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Schröder et al.

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[54] **METHOD FOR PRODUCING RIMS**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **29/159.1,** 72/87

[51] **Int. Cl.** **B21h 1/10,** B21k 1/38

[58] **Field of Search** ..... 29/159.1, 159 R, 159.02, 29/159.03; 72/80, 81, 82, 86, 87

[56] **References Cited**

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Attorney, Agent, or Firm—Fitch, Even, Tabin & Luedeka

[57] **ABSTRACT**

A method is disclosed for producing slant shoulder rims for tires including the steps of: forming a metal strip into a ring and welding a longitudinal seam to complete the ring. Then thickening the cross-sectional thickness of one end of the ring by upsetting one edge of the ring with axially advancing spinning roll followed by the step of drawing a snap groove in the thickened end of the ring by radially advancing spinning rolls to form the groove indentation therein. Spinning rolls are used to bend back the outer wall of the snap ring groove. A draw spinning step forms a rim base with a profile of constant strength. A wheel flange is erected into an upright position by a spinning operation on the other end of a ring. During the erecting of the wheel flange the ring is clamped within an internal chuck while one or more spinning rolls having the surfaces for forming the wheel flange are advanced to complete the spinning operation. The outer edge of the wheel flange is severed after being erected.

5 Claims, 7 Drawing Figures

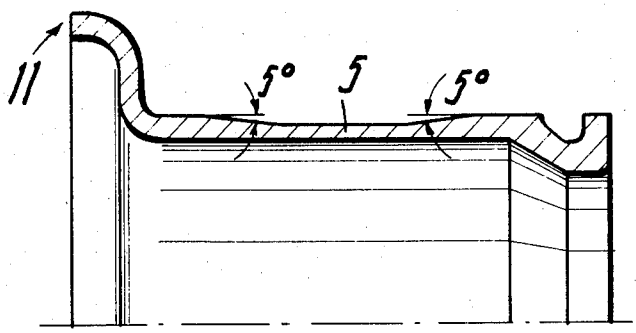


Fig. 1

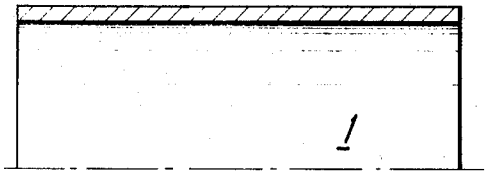


Fig. 2

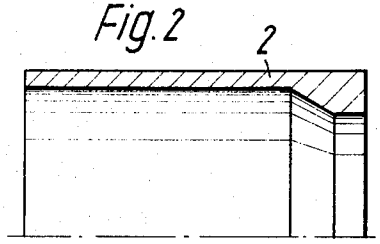


Fig. 2a

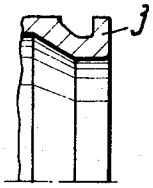
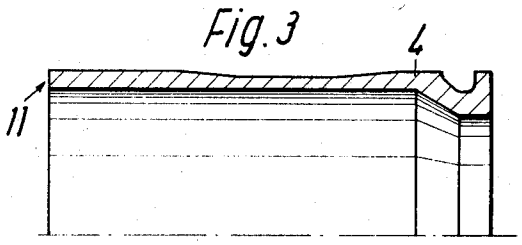


Fig. 3



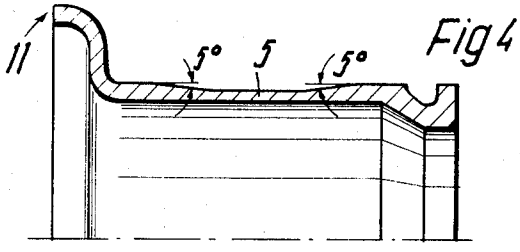


Fig 4

Fig. 5

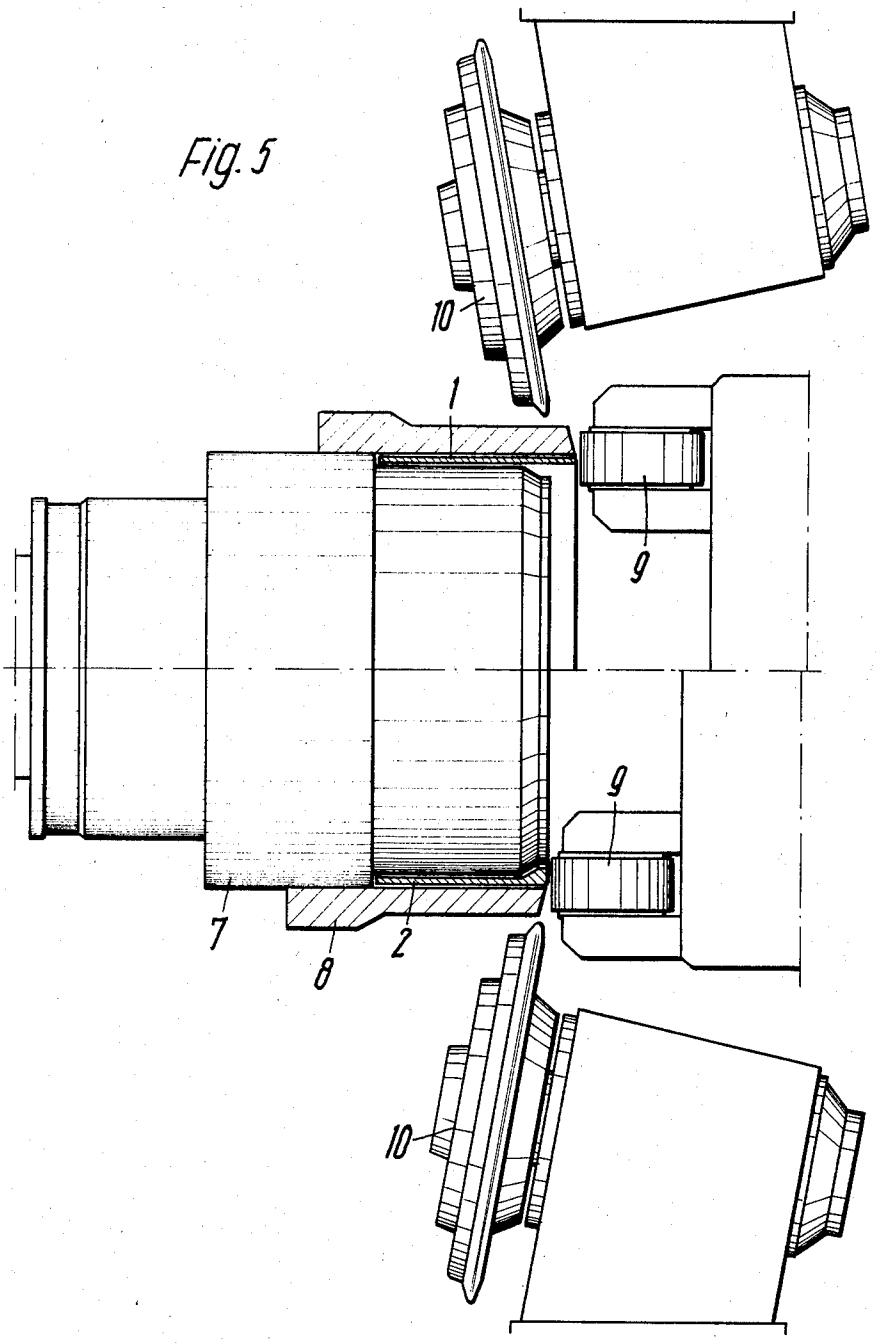
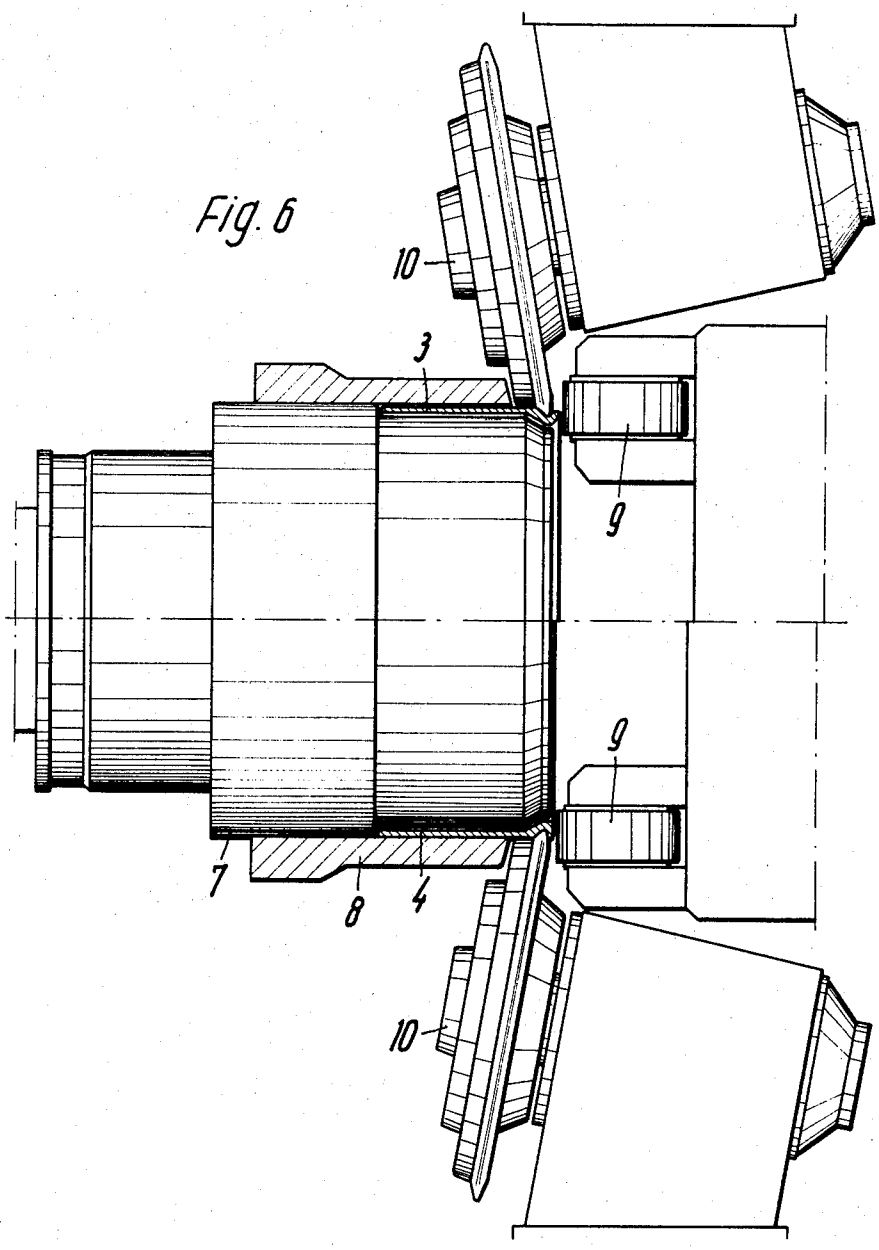


Fig. 6



METHOD FOR PRODUCING RIMS

The present invention relates to a method of producing slant shoulder rims, so-called special rims; special rim produced in accordance with such method, and an apparatus for carrying out such method.

It is already known (German Pat. No. 1,152,086) to produce, by starting from profiled rings, special rims having a snap ring groove and a wheel flange formed on the opposite side of the ring. However, it is disadvantageous in this known method that the method must start from a profiled ring, such a great number of most varied profile shapes must be kept on store, and that the thickness reduction of the rim base results in an elongation of the rim base having the wheel flange already formed thereon with the result that either the depth of the rim at a given wall thickness of the rim base cannot be adjusted precisely, or the wall thickness of the rim base cannot be adjusted when the depth of the rim is set precisely. Accordingly, in the conventional method it is not possible to produce special rims by starting from materials of different wall thicknesses, wherein both wall thickness of the rim base and the depth of the rim can be adjusted very precisely.

Furthermore, the conventional method does not permit shaping the rim base as a body of constant strength or as a special rim base having slants for guiding the tire.

Accordingly, it is the object of the present invention to provide a method for producing improved rims and for overcoming the abovementioned disadvantages.

Further, it is an object of the invention to provide a method for producing a special rim which in the areas of high stress, i.e., in the region of the wheel flange and particularly in the region of the snap ring groove, has an adjustable great wall thickness and which in the region of the rim base is formed as a body of constant strength or as a base having slant shoulders, whereby both the wall thickness and the depth or opening and the shape and edge of the wheel flange should be formed with minimum tolerances.

The method according to the invention should be easy to perform and merely by using spinning machines, whereby the special rims according to the invention should be adapted to be produced with but two steps of operation. In particular, the method according to the invention should lend itself to the fully automatic mass production of articles of minimum tolerances with a minimum of machine operation.

Finally, the apparatus according to the invention should be of simple construction, provide for trouble-free operation, and as far as possible correspond to standard machines.

With respect to the special rim, according to the invention the above object is solved in that the special rim has such a wall thickness which is greater in the region of the snap ring groove, and smaller in the region of the rim base, than that of the wheel flange. In the region of the rim base, the wall thickness should correspond to that of a body of constant strength. Advantageously and according to the invention, the method of producing the above-outlined special rims is characterized in that a ring is formed from a sheet metal or metal plate strip, the ring is welded along its longitudinal seam, one end of said ring is then thickened and has the profile of the snap ring groove drawn in at this location, whereupon the rim base is reduced in thickness, and,

finally, the wheel flange is erected, i.e. brought into an upright position by means of a spinning operation within an internal chuck.

An advantageous feature of the invention consists in that in order to draw in the snap ring groove, the edge of the workpiece ring is upset by a spinning operation with axial advance, whereupon the indentation of the groove is formed by a spinning operation with radial advance, whereby advantageously the outer wall of the groove is bent back after the drawing in of the profile of the snap ring groove.

According to another embodiment of the invention, it is possible that after the formation of the snap ring groove, the rim base is formed as a profile of constant strength by a draw spinning operation, whereupon the rim ring is clamped within an internal chuck and the wheel flange is erected by means of one or more rolls the surface shape of which corresponds to that of the wheel flange to be erected.

In order to obtain minimum tolerances at the edge of the wheel flange, the edge may be cut off after the erection of the wheel flange.

Furthermore, the apparatus according to the invention is advantageously characterized by a spinning machine having an external chuck for clamping the annular workpiece, a sleeve of said external chuck adapted to be moved beyond the end of said external chuck against a force, at least one cylindrical upsetting roll having a wide cylindrical surface, and at least one spinning roll for drawing in the snap ring groove.

In order to form the profile of constant strength, the apparatus according to the invention, further, comprises at least a pair of draw spinning rollers which also can be radially adjusted or advanced in continuous manner.

In the following an exemplary embodiment of the invention is explained in greater detail by referring to the drawings, wherein:

FIG. 1 shows the starting material bent into the shape of a ring and welded at the longitudinal edge thereof;

FIG. 2 shows the ring according to FIG. 1 with an upset end;

FIG. 2 a shows the snap ring groove drawn into the upset end;

FIG. 3 shows the ring including the drawn in snap ring groove after the reducing of the rim base as a body of constant strength;

FIG. 4 shows the finished special rim including the erected wheel flange;

FIG. 5 is a schematical view of the spinning machine for upsetting the ring end; and

FIG. 6 is a schematical view of the spinning machine of FIG. 5 for the drawing in of the snap ring groove and for the erecting of the outer wall of the snap ring groove.

As shown in FIG. 1, the method according to the invention starts with the rolling of an elongate sheet metal or metal plate strip to form a ring, and the welding of the longitudinal seam. In the subsequent method steps, the material of the weld seam is integrated into the material of the remainder of the ring in such a manner that the weld seam does no longer weaken the ring and an integral body is formed. However, in a modified embodiment of the invention, the method may as well start from a seamless drawn pipe section.

As shown in FIG. 2, in a first operation, one end of the rim ring is thickened; advantageously, such thickening may be performed in a spinning machine such as shown in the schematical view of FIG. 5. However, this thickened portion may be formed on the workpiece also by forging, hammering, cold or hot upsetting or swaging in a press.

According to FIG. 2*a*, the snap ring groove is then drawn by a spin rolling operation into the material of the thickened portion, whereby the outer wall 3 must be erected, i.e. brought to an upright position after the drawing in of the groove.

In another operation, according to FIG. 3, the rim base is stretched into a body of constant strength having slant shoulders with an inclination of 5° each, and the wheel flange is erected in a third operation as shown in FIG. 4. The erection of the wheel flange is known from applicant's prior German Pat. application P 20 53 005, reference being made to the disclosure of this prior application so that a detailed explanation of the erection of the wheel flange within an interior chuck can be dispensed with at this point.

As a final operation which is required in the production of rims having precise external dimensions only and which is not shown in the drawings, the edge 11 of the finished special rim may now be cut off.

The production of the intermediate shape according to FIG. 3 can be seen from the schematical view of FIG. 5. The ring 1 is clamped onto an external chuck the outer end of which is formed complementary to the subsequently formed configuration of the thickened portion 2 of the snap ring groove.

A guide ring or a sleeve 8 is placed onto the external chuck which ring is forcefully urged in outward direction towards the end of the chuck. Now, when the spin rolls 9 which must have a wide cylindrical surface, are advanced towards the external chuck, they push the guide ring 8 in rearward direction, and the material of the ring 1 can now flow only inwardly into the space between the external chuck 7 and the guide ring 8.

As shown in FIG. 6, the guide ring 8 is then withdrawn still further such that the spin rolls 10 may be advanced laterally into the region of the thickened portion 2. The spin rolls 10 have a roll profile or cross-sectional shape which is complementary to the profile of the snap ring groove. Then, the spin rolls 10 form the snap ring groove in conventional manner, whereby the outer wall 3 is again bent out to a certain degree. Therefore, during or after the forming of the snap ring groove the axial spin rolls 9 are advanced again so that they bend the outer wall 3 back into its desired shape.

In the manner described above, a snap ring groove of this kind can be formed which is subject to minimum tolerances and the wall thickness of which may be thickened as desired, so that the desired strength values may be brought about in consideration of the notch stresses due to the production of the snap ring groove. Thus, in comparison with special rims produced in accordance with conventional methods, it becomes possible either to use a material of lower quality or, otherwise, to reduce the wall thickness of the rim on the whole.

After the forming of the snap ring groove, the rim ring according to FIG. 2 is clamped onto another chuck, whereupon the rim base joining the snap ring groove is formed by draw spinning into a body of constant strength having slant shoulders 4 of any desired inclination, preferably inclinations of 5°.

Again, in this method step the wall thickness of the rim base 5 may be adjusted in the same manner as the wall thickness of the shoulders 4, independent of the wall thickness of the starting material. Depending on the material reduction which has taken place in the region of the rim base, the edge 11 of the final wheel flange will now have moved into a position remote from the snap ring groove.

As mentioned above, the wheel flange is now erected in a further operation, whereby the material removed from the region of the rim base now forms the edge 11. Normally, the special rim may be put into use in this condition; however, if it is desired to maintain precise weight tolerances of the complete special rim, the edge 11 may be cut off to conform to the designed shape. Evidently, any desired width of the special rim may be provided with any desired distribution of the wall thickness, without the material displaced from the region of the rim base resulting in an undesirable increase of the wall thickness at other places or even causing variation of the rim width.

Apparently, it is thus possible with the method according to the invention to provide special rims with optimum utilization of material and, hence, minimum weight, which rims in advantageous manner provide minimum non-cushioned masses in the truck while at the same time ensuring an optimum guidance of the tire.

The method according to the invention can be carried out by using for the most part customary draw spinning machines, whereby a guide ring 8 being slidable by spring force is placed onto an external chuck, which guide ring defines with the external chuck 7 a gap for receiving the rim ring 1. The subsequent operations may be performed by draw spinning machines of conventional construction, too.

Additionally, the method of the invention offers the further advantage that the wall thickness in the region of the wheel flange likewise can be precisely adjusted by drawing the starting material which is present in the annular shape as shown in FIG. 1, to the desired thickness of the wheel flange prior to the further processing. In view of the fact that the wall thickness of the snap ring groove and of the wheel flange is adjusted in the course of the subsequent operations, this first drawing operation will have no influence on the wall thickness of the snap ring groove and of the wheel flange. Accordingly, with the method of the invention it becomes possible for the first time to adjust all portions of a special rim independently from each other with respect to their wall thicknesses, without having to take into consideration the tolerances of the starting material.

What we claim is:

1. A method of producing a slant shoulder rim comprising the steps of:

forming a metal strip into a ring, welding the strip along a longitudinal seam when forming said ring, thickening the cross-sectional thickness of one end of said ring, forming a profile and drawing a snap ring groove in the thickened end of said ring and thereby reducing the thickness thereof, and erecting a wheel flange into an upright position by a spinning operation using an internal chuck.

2. The method according to claim 1 in which the step of thickening said one end of said ring includes the further steps of:

upsetting the edge of said one end of said ring by a spinning operation with an axial advance of a spin roll means and in which the step of drawing said snap ring groove comprises the further step of:

spinning with a radial advance of a spin roll means to form the indentation of said groove profile.

3. The method according to claim 2 in which the step of drawing the snap ring groove includes the further step of: bending back an outer wall of said snap ring groove after the spinning with the radial advance to form the indentation.

4. The method according to claim 1 including the further step of: after the drawing of the snap ring groove, draw spinning the ring to form a rim base with a profile of constant strength and the step of erecting said wheel flange comprises the further steps of clamping the ring within an internal chuck and using one or more spin rolls having the surface shape corresponding to that of the wheel flange.

5. The method according to claim 1 including the further step of: cutting off the outer edge of wheel flange after erecting the same.

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