

June 28, 1932.

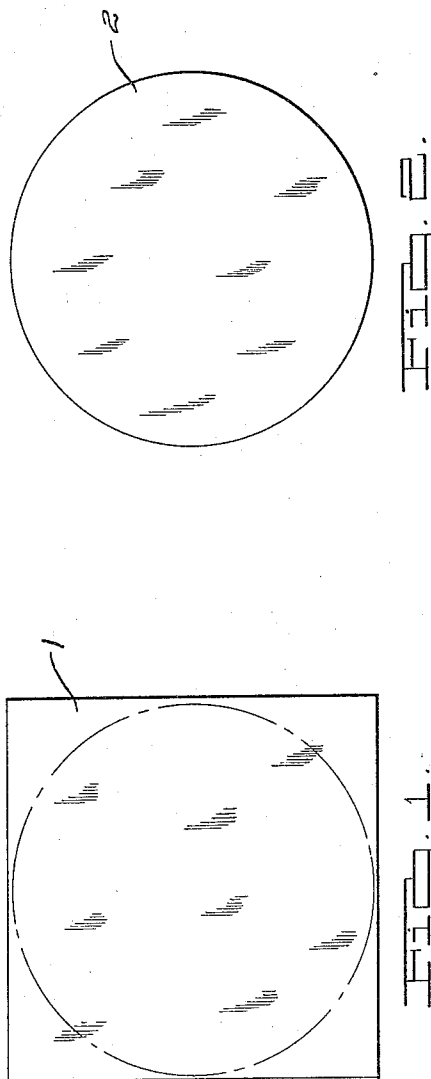
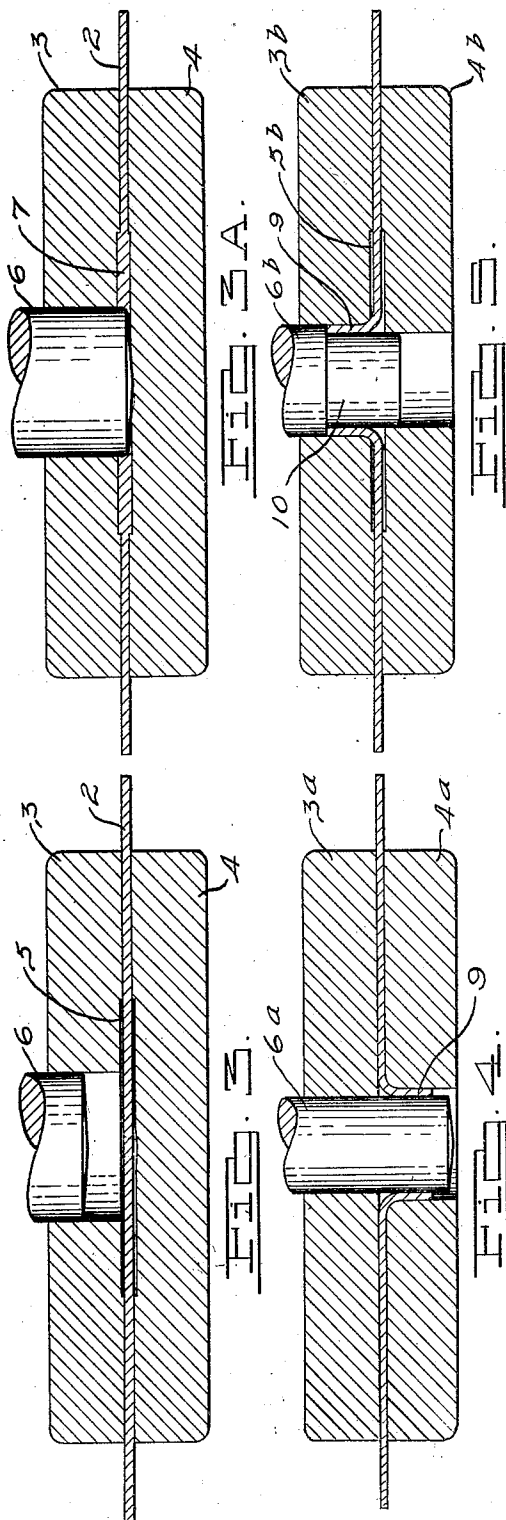
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1,865,185

METHOD OF MAKING DISK WHEELS

Filed March 19, 1930

2 Sheets-Sheet 1



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METHOD OF MAKING DISK WHEELS

Application filed March 19, 1930. Serial No. 437,176.

This invention has to do with a method of making a wheel. More particularly, the invention is concerned with the making of a wheel from metal stock in the form of a sheet with the resultant wheel being of the disk type.

The invention is directed to a method, or rather steps in a method, by means of which a disk wheel having portions or zones of different thicknesses is provided, and this is obtained although the sheet metal stock which is worked does not, of itself, have different thicknesses. It is appreciated that disk wheels having a relatively thick center portion or zone with the cross section of the disk decreasing as it approaches the rim or outer zone is prior art to this invention, but this has been accomplished by utilizing stock sufficiently thick so that the metal may be drawn or rolled to produce the thinner cross section in the outer wheel zone. This, of course, requires a considerable flow of metal, particularly as the periphery of the disk is approached.

In accordance with the present invention the rolling operation for thinning of the metal in the outer zone of the disk wheel is eliminated. In practicing the present invention it is preferred that the sheet material has an original thickness equal, or substantially equal to that desired in the major part of the wheel which is to be made therefrom which is thinner than other parts of the wheel; this will hereinafter be termed the "outer zone". In forming the wheel, the inner zone or part to be attached to a hub is thickened; this is accomplished by upsetting the metal, or in other words, flowing the metal to produce the thickened cross section area. This step is preferably accomplished while the metal is hot. Due to the fact that the metal is flowed or upset near the wheel axis or inner zone, the flow of metal required is materially less than the flow which would be required at the periphery, with the result that easier and cheaper manufacture, and setting up of less strains in the finished product.

In accordance with the present invention the metal in the outer zone is maintained uni-

form in thickness instead of a tapered formation in cross section; this is a major objective for a number of reasons:

(1) It is well known among engineers that a rectangular section (such as a section taken through a wheel spoke or a spoke-like member) increases in strength as the square of the thickness of the section. The present invention takes advantage of this principle in that as the outer portion of a spoke is approached the placement of metal is such that the sections are of relatively great thickness and of lesser breadth (the comparison being to a wheel of tapered cross section) and this makes the spokes lighter for the same strength than sections of relatively lesser thickness and greater breadth. Thus, the wheel of this invention has a lighter outer zone and therefore has less inertia and provides for minimum unsprung wheel weight, while still maintaining a strength equal to that of a wheel having spokes or spoked portions of diminishing thickness but of greater breadth.

(2) A material saving in the cost of manufacture is effected because of the cut-out portions of the blank are metal blanks of uniform thickness and have more value in the metal working art than blanks of tapering or varying thickness; blanks of uniform thickness may be used for making small articles whereas blanks of tapering thickness are practically waste and have a value only as junk. Thus, the fact that the so-called "scrap" can be used, which is due to the nature of the wheel, there is less waste and lowered manufacturing costs.

Fig. 1 is a view illustrating an original blank which may be employed in the manufacture of a disk wheel.

Fig. 2 represents a disk cut from the blank.

Figs. 3 and 3a are cross sectional views illustrating one manner in which the thickened inner zone of the disk can be made.

Figs. 4 and 5 are similar cross sectional views illustrating a modified manner of upsetting the metal to provide the thickened inner zone.

Figs. 6 and 7 are further similar views il-

lustrating another manner of upsetting the metal to provide the thickened inner zone.

Fig. 8 is a view in illustration of an operation for punching and forming the disk.

Fig. 9 is a plan view of a completed disk.

Fig. 10 is a sectional view of a completed disk taken substantially on line 10—10 of Fig. 9.

Fig. 11 is a sectional view taken through a completed wheel showing the rim attached to the disk.

Fig. 12 is a sectional view illustrating a slightly modified form of construction.

A piece of blank stock, illustrated at 1 in Fig. 1, may be employed for making the wheel, and while the blank stock shown in Fig. 1 is of square formation, this is not important as the disks to be worked, as illustrated at 2, may be cut from any shape blank. The cross section of this stock is substantially uniform, and the thickness of the stock is the thickness which is desired in the main portion or outer zone portion of a disk wheel to be manufactured therefrom. It may be desirable to have wheels of different weights, depending upon the use to which they are to be put, and in this regard, stock of varying thickness may be used and selected to make the proper wheels.

It is desirable to have the inner zone of the wheel, or the portion to be attached to a hub, stronger than the rest of the wheel for obvious reasons, and to accomplish this the inner zone of the disk 2 is thickened. This may be accomplished in one of a number of ways, some of which are shown herein.

One manner of thickening the center of the disk is to place the disk between dies or clamps 3 and 4 (Fig. 3) which are recessed to form central chamber 5. A plunger 6 may be utilized, preferably located centrally of the chamber 5, and the plunger is moved under pressure from a position approximating that shown in Fig. 3 to that shown in Fig. 3a, thus causing an upsetting of the metal and flowing of the metal outwardly from underneath the plunger into the recess 5. As clearly shown in Fig. 3a, this provides a thickened zone 7. This operation is to be carried out preferably while the metal, especially the metal in the thickened zone, is in a heated condition, and in this regard, various ways of heating the metal may be employed but the electrical inductance method is thought to be readily adapted to and preferred for this process.

Another way for effecting the thickened inner zone is by the use of clamps or dies 3a and 4a, and a punch 6a which first punches an aperture into the disk and flanges over the metal around the aperture as at 9. The disk may now be placed between clamps or die elements 3b and 4b properly recessed to form a chamber 5b and then by the use of a plunger 6b having a pilot 10 the metal forming the

flange 9 is caused to flow into the chamber 5b. This is also done while the metal is in a heated condition.

Another manner of thickening the metal is illustrated in Figs. 6 and 7 wherein the disk is placed between dies or clamps 3c and 4c, the clamp 4c having depressions 11, and by the use of a plunger or punch 12 having formations corresponding to the depressions 11, the metal is curved, as at 13. In the curving of the metal in this manner more metal is needed over what was present in its straight line position, and this additional metal is drawn from the central part, as illustrated at 14. Then by placing the disk thus formed between clamp elements 3d and 4d and by utilizing a punch 15 having a pilot 16 which cuts out the center part 14, the curved metal 13 is again straightened out and the excess metal which forms the curve is utilized to provide the thickened central zone.

The disk as yet still may remain in flat form, but it now may be shaped as by means of dies 20 and 21 which form the main part 2 of the disk at an angle to the inner zone 7, and which flange over the outer peripheral edge of the disk, as illustrated at 22. At this same time suitable punches 23 may be employed for punching apertures into the disk, the same being shown at 24. The inner zone, following this operation, is provided with apertures 25 for the reception of bolts for attachment of the disk to the hub and, preferably, these apertures are machined in, and also the central opening in the inner zone, as illustrated at 26, is preferably machined.

The wheel as an article is claimed in co-pending application Serial No. 437,175, filed March 19, 1930.

The disk per se is now in completed form, and following this, a suitable tire-retaining rim 27 is affixed thereto as by means of riveting the rim to the flange 22, as shown at 28. It is within the invention, of course, to weld the rim to the disk wheel. Also it is within the invention to place a demountable wheel rim on the disk, but in the present instance the rim shown is permanently attached thereto because the wheel as a whole is removably mounted upon a hub by bolts extending through apertures 25; this is a well known procedure, however, and needs no disclosure herein. Also it is to be pointed out that while the particular wheel shown herein has the outer zone extending angularly with respect to the inner zone, so that the inner zone is offset with respect to the rim, yet it is clearly within the invention to provide the entire disk wheel in a single plane, or the angular relation between the inner and outer zone may vary.

Accordingly, it will be noted that a disk wheel is provided which is made from stock having a thickness no greater than a relatively small thickness desired in the resultant

wheel, and wherein thickened portions of the disk are provided by upsetting the thin stock. This entirely eliminates a rolling action for the purpose of reducing the thickness of the wheel in its outer zone, in which case it is necessary to use stock having a thickness substantially equal to the thickest part desired in the resultant wheel.

While the outer zone portion of the present wheel is of uniform thickness, it is not necessary to have as much metal near the periphery of the outer zone portion as near the inner zone. Accordingly, the apertures 24 are provided, and their elongated shape is advantageous because spokelike parts are provided of tapering formation which lend a relatively great amount of metal near the inner part of the outer zone with a decreasing amount of metal as the spokes approach the wheel periphery. In doing this, a wheel of adequate strength is provided, yet there is an elimination of excess weight and metal; this is advantageous because it minimizes the unsprung weight of the vehicle, and reduces wheel inertia. Moreover, the apertures facilitate passage of air and thus aid in the dissipation of heat which may be generated either from an adjacent brake or the tire contacting with the roadway, or both.

As shown herein, the inner and outer zones of different thicknesses are separated or defined by a line at shoulders between the zones, but it is quite within the invention to provide a taper on the shoulders which result from the thickened part after the manner illustrated in Fig. 12. Both forms may be described, however, as a relatively sharp line of demarcation. Also, while the inner zone is shown as of circular formation, the particular shape is not essential and may vary, and in this regard the line of demarcation between the inner and outer zones may be of more or less scalloped formation swinging out to catch the apertures 25, and then swinging in between the apertures.

Claims:

1. The method of making a disk wheel having a relatively thick inner zone, a relatively thin outer zone, and wherein the amount of metal in the outer zone diminishes from a point near the inner zone toward the wheel periphery, which comprises taking a flat blank of stock having a thickness substantially equal to the thickness of the outer zone in the resultant wheel, upsetting the stock while in flat form to form the thickened inner zone leaving the outer zone portions substantially unaltered as to thickness, and providing apertures in the outer zone located in close proximity to the wheel periphery.

2. The method of making a disk wheel from sheet metal stock wherein the resultant wheel has portions thicker than the thickness of the stock which comprises, taking a substantially flat sheet metal blank having such

dimensions that the disk wheel may be cut therefrom and having a thickness less than that of the said portions of the resultant wheel, upsetting some of the metal of the blank to provide the said thickened portions of the resultant wheel while said blank is in substantially flat condition, and leaving other portions of the blank substantially unaltered as to thickness to form the thinner portions of the resultant wheel.

3. The method of making a disk wheel from a sheet metal blank wherein the resultant wheel has an inner zone thicker than the thickness of the blank, and an outer zone substantially of the same thickness as the blank which comprises, taking a substantially flat sheet metal blank having such dimensions that the disk wheel may be cut therefrom, providing a central hub aperture and flowing some of the metal afforded by the provision of the aperture radially outward into the inner zone of the wheel to provide said thickened inner zone of the resultant wheel, and leaving the outer portions of the blank substantially unaltered as to thickness to form the outer zone of the wheel.

4. The method of making a disk wheel from a sheet metal blank which comprises, taking a blank having such dimensions that a wheel forming disk may be cut therefrom, cutting the disk out of the blank, providing a central aperture in the blank, flowing some of the metal afforded by the provision of the aperture radially outward into an inner zone of the disk around said aperture to provide the inner zone with a thickness of stock greater than the thickness of the blank, leaving the metal of the disk from said inner zone to the outer periphery of the disk substantially unaltered as to thickness to provide an outer zone of a thickness less than that of the inner zone, and then shaping the disk by a press operation into concavo-convex disk wheel form.

In testimony whereof I affix my signature.

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