April 7, 1931. J. H. WAGENHORST 1,799,712

METHOD OF MAKING WIRE SPOKED WHEELS

Filed May 1, 1930 3 Sheets-Sheet 1

Fig. 1.

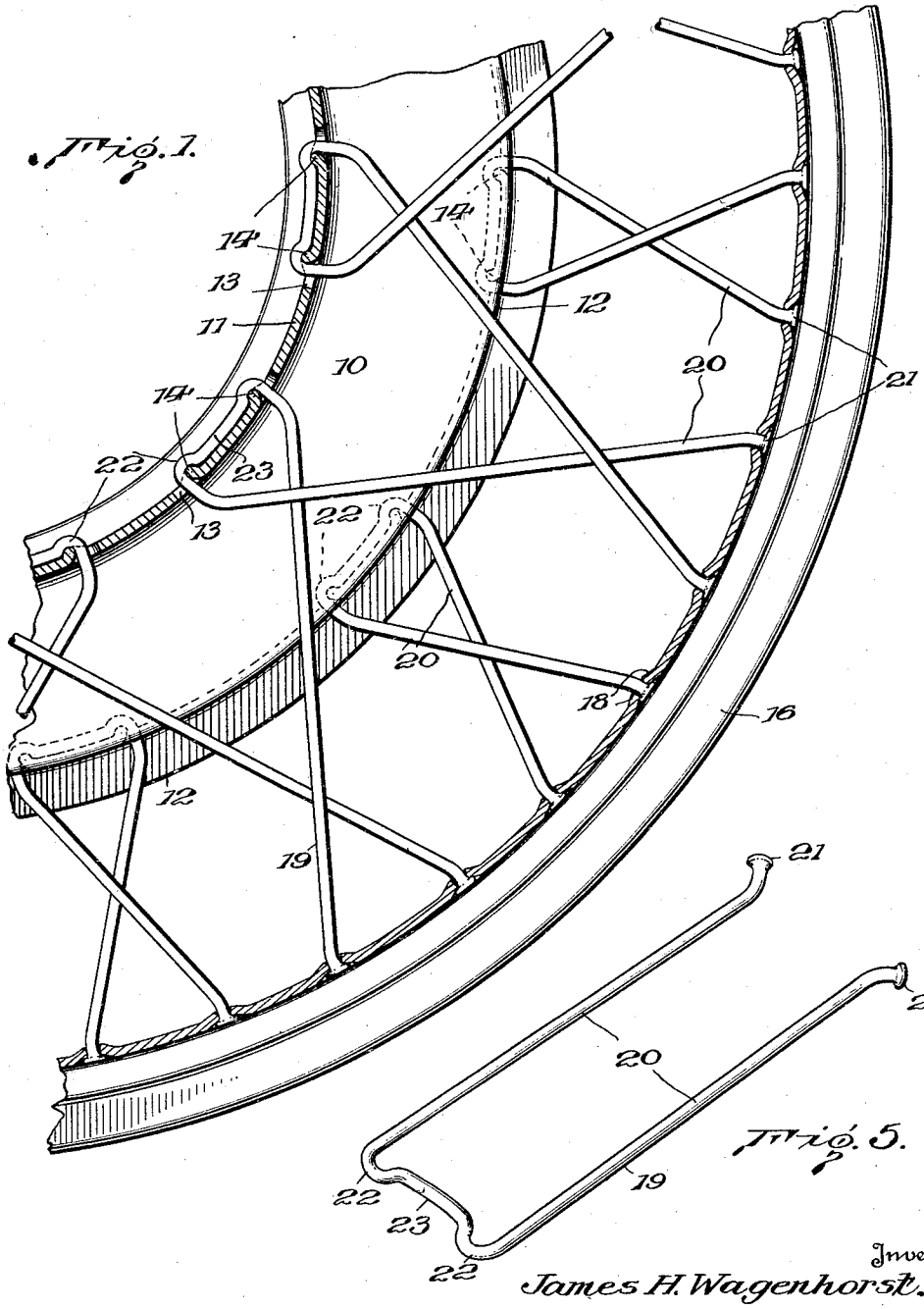


Fig. 5.

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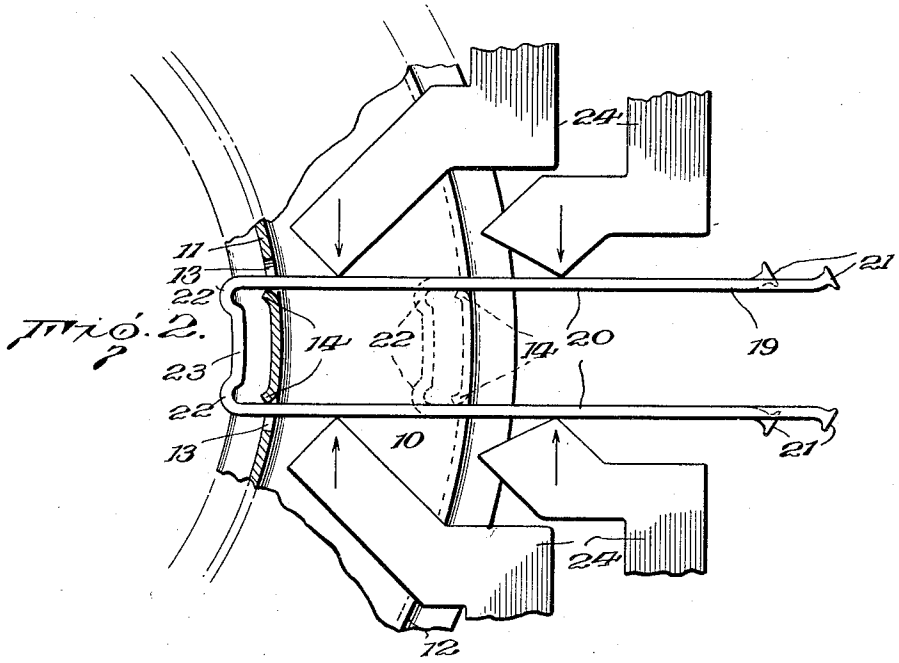


Fig. 2.

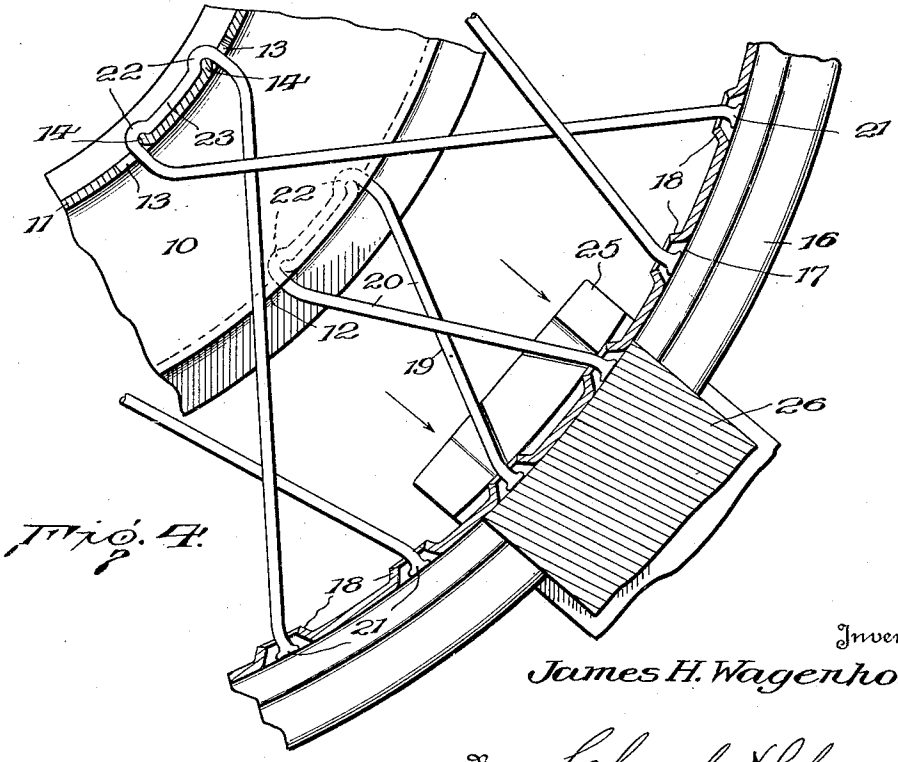


Fig. 4.

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Fig. 3.

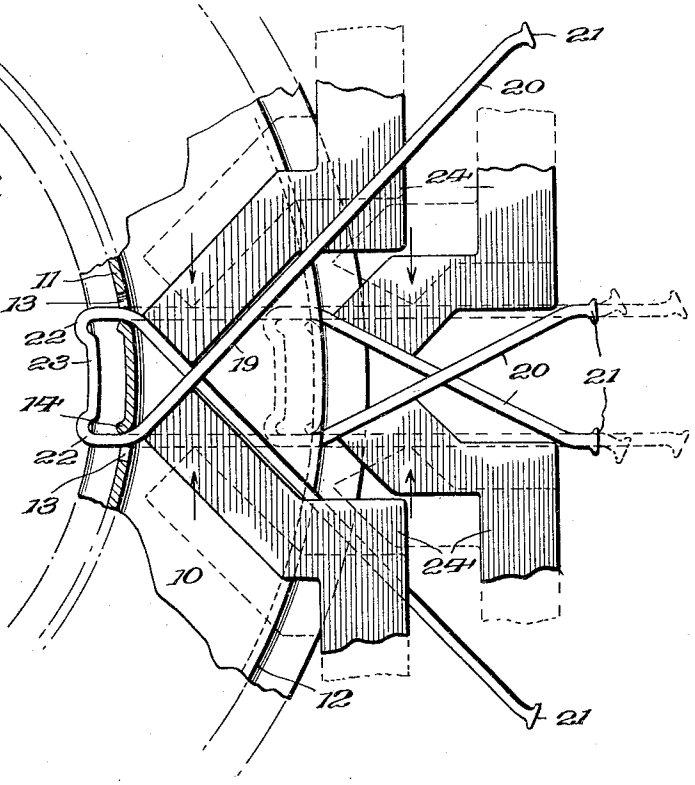


Fig. 7.

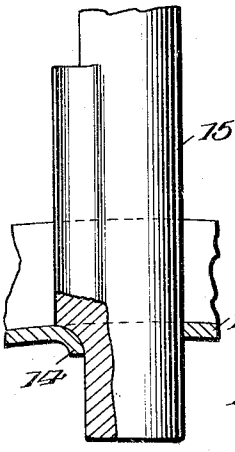


Fig. 6.

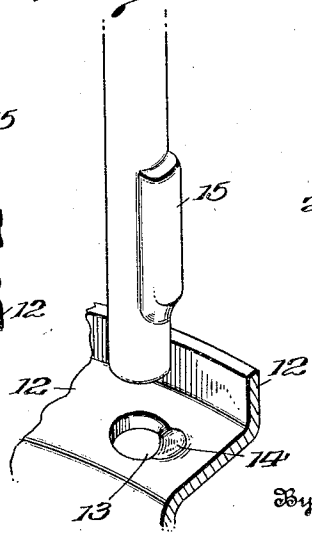
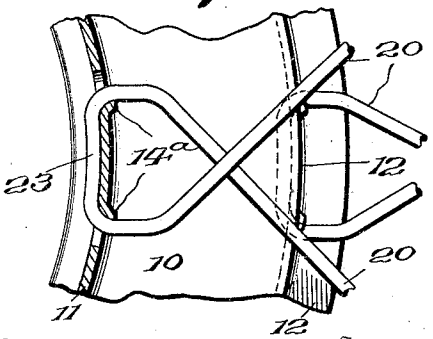


Fig. 8.



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UNITED STATES PATENT OFFICE

JAMES H. WAGENHORST, OF DETROIT, MICHIGAN

METHOD OF MAKING WIRE-SPOKED WHEELS

Application filed May 1, 1930. Serial No. 448,966.

My invention relates to an improved method of making wire-spoked wheels, and has to do, more particularly, with an improved method for making wire-spoked wheels of the demountable type customarily employed on automobiles.

The object of my invention is to provide a method by which stronger wire-spoked wheels may be made more cheaply and efficiently than by methods heretofore known and used.

A further object of my invention is to provide a method of making wire-spoked wheels which will permit of the use of duplex spokes of high carbon steel which have been previously heat treated and tempered so as to fit them for the tension strains to which they will be subjected in use.

A further object of my invention is to provide a method of making wire-spoked wheels in which spokes of duplex form may be quickly and easily assembled with hub and rim members.

A further object of my invention is to provide a method of making cross-spoked wheels in which the spoke anchoring and tensioning operation is greatly facilitated and a more resilient spoke construction is effected.

Further objects and objects relating to details and economies of manufacture will definitely appear from the detailed description to follow. In one instance, I accomplish the objects of my invention by the means described in the following specification. My invention is clearly defined and pointed out in the appended claims. My method is illustrated diagrammatically in the accompanying drawings, forming a part of this specification, in which:

Figure 1 is a sectional view through a portion of an assembled wheel and hub showing the arrangement of the duplex spokes;

Fig. 2 is a similar sectional view through a portion of the hub showing the retracted position of the spokes prior to cross bending;

Fig. 3 is a sectional view through a portion of the hub and rim showing the relative position of the retracted spokes after being cross bent;

Fig. 4 is a similar sectional view showing the spokes with their intermediate portions seated in the hub and their outer ends inserted through the spoke holes in the rim, and showing the anchoring and tensioning dies mounted about one of the spoke holes of the rim;

Fig. 5 is a perspective view of one of the spokes;

Fig. 6 is a fragmentary perspective view of a portion of the hub showing the lipped spoke hole and the punching tool employed for its formation;

Fig. 7 is a fragmentary sectional view of a similar portion of the hub, showing a portion of the punching tool in the process of forming the lipped spoke hole; and

Fig. 8 is a fragmentary sectional view of another form of my invention showing a somewhat modified spoke and hub construction.

In the drawings, the same reference numerals refer to the same parts throughout the several views.

For many years, wire wheels were made using spokes having heads on the inner ends thereof and screw threaded outer ends which received nipples screwed on the spokes to anchor and tension them. The spokes were assembled by passing them through the spoke holes in the hub until their outer ends projected into the spoke holes in the rim, and then applying the nipples from the outer side of the rim and screwing them on the outer ends of the spokes. This method of construction permitted the use of spokes of high carbon steel, which had been suitably heat treated, but was very slow and expensive because each spoke had to be independently tensioned by screwing up the nipple threaded on the outer end thereof. This meant that the tensioning of a wire wheel was a matter of repeated trial and adjustment which had to be done by expensive manual labor. In recent years, many wire wheels have been constructed in which the screw threaded nipples were eliminated and the outer ends of the spokes were upset, after assembly of the wheel, to form heads engaging the outer face of the rim to anchor the spokes in position. This required that the spokes be made of low carbon steel and

that they be not heat treated or tempered before assembly, because they had to be soft enough to permit upsetting to form heads. Consequently, wheels so constructed are not as strong as they ought to be, since the spokes are not of the sort best fitted for taking the tension strains imposed upon them in service. In my copending application, Serial No. 427,350, filed February 10, 1930, I have disclosed a method of making wire-spoked wheels by which the advantages of both types are attained. Briefly, the method therein disclosed consists in employing spokes of heat treated high carbon steel which are pre-formed with heads at both ends, each spoke having a large and a smaller head. The hub and rim members are provided with spoke holes which are of a size intermediate the large and small spoke heads, so that the spokes can be assembled by passing them, small head first, through the spoke holes in hub and rim. In preferred practice, the spokes are passed first through the hub and are brought to final position with their large heads seated in the hub and their small heads extended through the spoke holes in the rim. The holes in the rim are surrounded by a flange of excess metal, which is subsequently depressed into the hole and against the heads of the spokes to anchor and tension them. In the method employed for anchoring and tensioning the spokes, the present case is similar to my above mentioned application.

In general, my present invention consists in forming spaced spoke holes in a hub member, and also forming duplex spokes, each having a pair of substantially parallel spoke legs joined at their inner ends by an intermediate portion and terminated at their outer ends in enlargements to form the spoke heads. The spoke legs are then passed outwardly through the spoke holes in the hub, but are not fully extended therethrough. In this retracted position, the spoke legs are bent into suitable crossed relation with each other. A rim member, having countersunk spoke holes bounded by inwardly extending flanges, is then placed about the hub and retracted spokes, the holes of the rim being in alinement with the ends of the cross-bent spoke legs. The spokes are then forced outwardly, the heads passing through the spoke holes of the rim and the intermediate portions of the duplex spoke members straddling and seating against the interior of the hub intermediate the spoke holes. In this extended position, the metal of the flanges surrounding the spoke holes of the rim is forced outwardly against the heads, contracting the spoke holes and anchoring and tensioning the spoke inserted therein.

Referring to the drawing, and more particularly to Figs. 2 and 3, I provide a hub 10 with portions 11 and 12, in which spoke holes 13 and inwardly extending lips 14 are formed. The arrangement of the lips is such that the holes are paired, the lips being formed in the hub material intermediate the paired holes. The holes and lips may be formed in a single operation by the use of a shouldered punch 15 of the type disclosed in Figs. 6 and 7. I also provide a rim 16 with countersunk holes 17 bounded by inwardly extending flanges 18. The rim is made of low carbon steel, so that the flanges 18 can be easily deformed or refashioned by means of dies. I also form a plurality of spoke members 19, as in Fig. 5, each being of duplex form having a pair of substantially parallel spoke legs 20 terminating in enlarged heads 21, which are slightly smaller in size than the spoke holes in hub and rim. As is shown, the spoke legs are preferably bent adjacent the heads to provide for better seating and greater resiliency when assembled in a wheel. The inner end of the duplex spoke member is provided with bight portions 22 which are joined by the intermediate portion 23, which parts are of such dimensions as to be snugly seatable against the inner surface of the hub intermediate the spoke holes.

The assembly operations are shown at Figs. 2, 3, and 4, and are as follows. A hub 10, of the type described, having spoke holes and lips, is provided. The legs of the duplex spoke members are passed outwardly through the spoke holes of the hub, the legs of each duplex spoke member extending through a pair of holes. The spoke legs are not initially extended through the holes for their entire length, but are held somewhat retracted, as shown at Fig. 2. For insuring uniform location of the bend in the several spokes, it is preferable to provide some sort of backing element or form to which the intermediate portion 23 of the spokes may be retracted. I then cross-bend the legs of the spokes against the lip portions 14 of the hub, by means of bending dies 24. As is obvious, one, a pair, one series, or the entire set of the spokes may be bent in one operation, this being dependent purely upon the design of the bending apparatus employed. After the bending has been accomplished, and with the spokes still in retracted position, the rim 16 is placed about the hub and the spokes are extended until the heads pass through the spoke holes of the rim, as shown in Fig. 4. In this position, the bight portions 22 and the intermediate portions 23 of the spokes will be seated and engaged with the lips 14 and the inner surface of the hub intermediate the pairs of lips. I then press outwardly the metal of the rim flanges 18 surrounding the spoke holes 17, into engagement with the spoke heads 21, thus anchoring and tensioning the spokes at the same time. This may be accomplished by suitable dies 25 engaging

the inner face of the rim, which dies may be pressed outwardly against the spoke hole flanges of the rim by a suitable mechanism, not shown, acting in the direction of the arrows shown in Fig. 4. During this operation, a block 26 is preferably applied to the outer face of the rim, so as to hold it true to circumferential shape and size and prevent it from being distorted by the pressure applied through dies 25. The rim should be held under slight compression during the process of forcing the metal of the rim against the spoke heads so that, when the block 26 is released, the rim will tend to expand slightly. Of course, the rim should not be compressed beyond its elastic limit, but should be compressed slightly within the elastic limit, so as to get a better tensioning effect when it expands, after the spokes have been anchored in place and the fixture which engages the outer face of the rim has been removed. The dies 25 exert pressure radially outward to press the metal 18 of the rim against the heads of the spokes, forming depressions in which they are seated and anchored, and also putting the spokes under tension. This is also an important feature, since in a wire-spoked wheel the spokes act in tension and should be initially tensioned in the assembly of the wheel.

At Fig. 8 I have shown a similar but somewhat modified form of hub and spoke, embodying features of my invention. In this form, the hub lips 14*a* extend outwardly and the spoke member is made without bight portions, thus somewhat simplifying the spoke construction. However, the additional resiliency imparted to a wheel by reason of the bight construction, in general, justifies the slight additional expense involved in its manufacture. Further, the bights and inturned lips afford improved anchorage at the hub and a generally sturdier construction.

It will be observed that I have provided an improved method by which wire-spoked wheels of greater strength and resiliency may be made quickly and easily. By the use of my duplex spokes, the number of parts to be assembled is reduced to substantially one-half the number formerly involved, and a stronger and simpler spoke-anchorage is provided at the hub. By forming the spokes with bight portions, a wheel of much greater resiliency is made possible and, through the coaction of the bights with lips formed adjacent the spoke holes of the hub, a superior bearing for the inner end of the spoke is provided. The lip construction also facilitates the bending of the spoke leg directly in the spoke hole without injury to either spoke or hub By cross bending the spokes while partially retracted, assembly with the holes of the rim is made possible. Further, by finally locating the bends at a point well away from the hub, a wheel of improved resiliency and strength is obtained and wearing strains are not placed directly upon the edges of the spoke holes. While all these advantages are inherent to my preferred embodiment disclosed, it is obvious that my invention is not limited solely thereto. My inventive concept may be variously embodied in numerous forms having several or all of the advantageous features enumerated. In this connection, it should be noted that, while the lips adjacent the hub spoke holes are of great advantage, the ininvention is not essentially so limited. Similarly, the bending of the spokes into cross form is not a vital limitation, since the spoke legs could be bent apart to take the torsional strains, or in certain types of wheels, could be extended directly to the rim. Likewise, as in the modified form shown, the bight portions, though of advantage in respect to spoke anchorage and resiliency, may be omitted for the sake of cheaper construction. Similarly, other methods and means of anchoring and tensioning the spokes may be substituted for those disclosed. I am also aware that numerous other variations from the disclosed embodiment may be made, without departing from the spirit of my invention. I, therefore, claim my invention broadly, as indicated by the appended claims.

What I claim is:

1. The method of making a wire-spoked wheel which comprises forming spoke holes in hub and rim members, passing the legs of duplex spoke members, having enlarged heads, radially outwardly through the spoke holes in the hub member, and outwardly through spoke holes in the rim member, and pressing the metal of the rim surrounding the spoke holes into contact with the heads to anchor and tension said spokes.

2. The method of making a wire-spoked wheel which comprises forming spoke holes in hub and rim members, passing the legs of duplex spoke members, having enlarged heads, radially outwardly through the spoke holes in the hub member, crossing the said legs, passing the heads through the spoke holes in the rim member, and pressing the metal of the rim surrounding the spoke holes into contact with the heads to anchor and tension said spokes.

3. The method of making a wire-spoked wheel, comprising the formation of spoke holes in hub and rim members, assembling therewith duplex spoke members, each having substantially parallel spoke legs terminating at their outer ends in enlarged heads, by passing the legs of the spoke members outwardly through the spoke holes in the hub member, bending each leg at a point near, but spaced from its inner end, then inserting the heads through spoke holes in the rim, and pressing the metal of the rim surrounding the spoke holes into contact with

the heads to anchor and tension said spokes.

4. The method of making a wire-spoked wheel, comprising the formation of spoke holes in hub and rim members, assembling therewith duplex spoke members, each having substantially parallel spoke legs terminating at their outer ends in enlarged heads, by passing the said legs outwardly through the spoke holes in the hub member, bending each spoke leg at a point near, but spaced from, its inner end to effect crossing of the legs of each spoke member, inserting the heads through spoke holes in the rim, and pressing the metal of the rim surrounding the spoke holes into contact with the heads to anchor and tension said spokes.

5. The method of making a wire-spoked wheel, comprising the formation of spoke holes in hub and rim members, assembling therewith duplex spoke members, each having substantially parallel spoke legs terminating at their outer ends in enlarged heads, by passing the major portion of each spoke leg outwardly through a spoke hole in the hub member, bending each spoke leg in its spoke hole, extending the spokes into final position with their intermediate portions seated on the hub and their heads extended through the spoke holes in the rim, and pressing the metal of the rim surrounding the spoke holes into contact with the heads to anchor and tension the spokes.

6. The method of making a wire-spoked wheel, comprising the formation of spoke holes in hub and rim members, assembling therewith duplex spoke members, each having substantially parallel spoke legs terminating at their outer ends in enlarged heads, by passing the major portion of each spoke leg outwardly through a spoke hole in the hub member, bending each spoke in its spoke hole to effect crossing of the legs, extending the spokes into final position with their intermediate portions seated against the hub, and their heads extended through the spoke holes in the rim, and pressing the metal of the rim surrounding the spoke holes into contact with the heads to anchor and tension the spokes.

7. The method of making a wire-spoked wheel which comprises forming a plurality of pairs of holes in a hub member, forming an inwardly extending lip adjacent each hole, said lips being located intermediate the holes of each pair, forming duplex spoke members, the spoke legs of which are joined at their inner ends by an intermediate portion, passing the legs of each spoke member through a pair of holes, seating the intermediate portions of the spoke members against the lips and portions of the hub intermediate the lips, and anchoring the terminal portions of the spokes to a rim member.

8. The method of making a wire-spoked wheel which comprises forming a plurality of pairs of spoke holes in a hub member, forming a lip adjacent each hole, located intermediate the holes of a pair, assembling therewith duplex spoke members, each having a pair of substantially parallel spoke legs joined at their inner ends by an intermediate portion, by passing the major portion of each spoke leg outwardly through a spoke hole in the hub member, bending each spoke leg against the lip of its spoke hole, extending the spokes into final position with their intermediate portions seated against the lips and the hub portions intermediate the lips, and anchoring the terminal portions of the spokes to a rim member.

9. The method of making a wire-spoked wheel which comprises forming a plurality of pairs of spoke holes in a hub member, forming an inwardly extending lip adjacent each hole located intermediate the holes of a pair, assembling therewith duplex spoke members, each having a pair of substantially parallel spoke legs joined at their inner ends by an intermediate portion, by passing the major portion of each spoke leg outwardly through a spoke hole in the hub member, bending each spoke leg against the lip of its spoke hole, extending the spokes into final position with their intermediate portions seated against the lips and the hub portions intermedate the lips, and anchoring the terminal portions of the spokes to a rim member.

10. The method of making a wire-spoked wheel which comprises forming a plurality of pairs of spoke holes in a hub member, forming an inwardly extending lip adjacent each hole, located intermediate the holes of a pair, assembling therewith duplex spoke members, each having a pair of substantially parallel spoke legs joined at their inner ends by an intermediate reversely bent portion, by passing the major portion of each spoke leg outwardly through a spoke hole in the hub member, bending each spoke leg against the lip of its spoke hole, extending the spokes into final position with their intermediate portions seated between and engaged with pairs of lips, and anchoring the terminal portions of the spokes to a rim member.

11. The method of making a wire-spoked wheel which comprises forming spoke holes in a rim member, forming a plurality of pairs of spoke holes in a hub member, forming an inwardly-extending lip adjacent each hole thereof located intermediate the holes of a pair, assembling with the hub duplex spoke members, each having substantially parallel spoke legs terminating at their outer ends in enlarged heads and joined at their inner ends by an intermediate reversely bent portion, by passing the major portion of each spoke leg outwardly through a spoke hole in the hub member, bending each spoke leg against the lip of its spoke hole, extending the spokes into

final position with their intermediate portions seated between and engaged with pairs of lips, and pressing the metal of the rim surrounding the spoke holes into contact with the heads to anchor and tension the spokes.

12. The method of making a wire-spoked wheel which comprises forming a plurality of pairs of spoke holes in a hub member, forming a lip adjacent each hole located intermediate the holes of a pair, assembling therewith duplex spoke members, each having a pair of substantially parallel spoke legs joined at their inner ends by an intermediate portion, by passing the major portion of each spoke leg outwardly through a spoke hole in the hub member, bending each spoke leg against the lip of its spoke hole to effect crossing of each pair of spoke legs, extending the spoke legs into final position with the intermediate portions seated against the lips and hub portions intermediate the lips, and anchoring the terminal portions of the spokes to a rim member.

13. The method of making a wire-spoked wheel which comprises forming a plurality of pairs of spoke holes in a hub member, forming an inwardly extending lip adjacent each hole located intermediate the holes of a pair, assembling therewith duplex spoke members, each having a pair of substantially parallel spoke legs formed at their inner ends with bight portions connected by an intermediate portion, by passing the major portion of each spoke leg outwardly through a spoke hole in the hub member, bending each spoke leg against the lip of its spoke hole, extending the spokes into final position with the bight portions engaging the lips and the intermediate portions seated against the adjacent hub portion intermediate the lips, and anchoring the terminal portions of the spokes to a rim member.

14. The method of making wire-spoked wheels comprising the formation of duplex spoke members, each having a pair of spoke legs with heads at the outer ends thereof and an intermediate portion connecting the inner ends thereof, forming spoke holes in hub and rim members, passing the legs of said spoke members outwardly through the spoke holes in hub and rim, and pressing the metal of the rim surrounding the spoke holes therein against said heads to anchor and tension said spoke members.

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