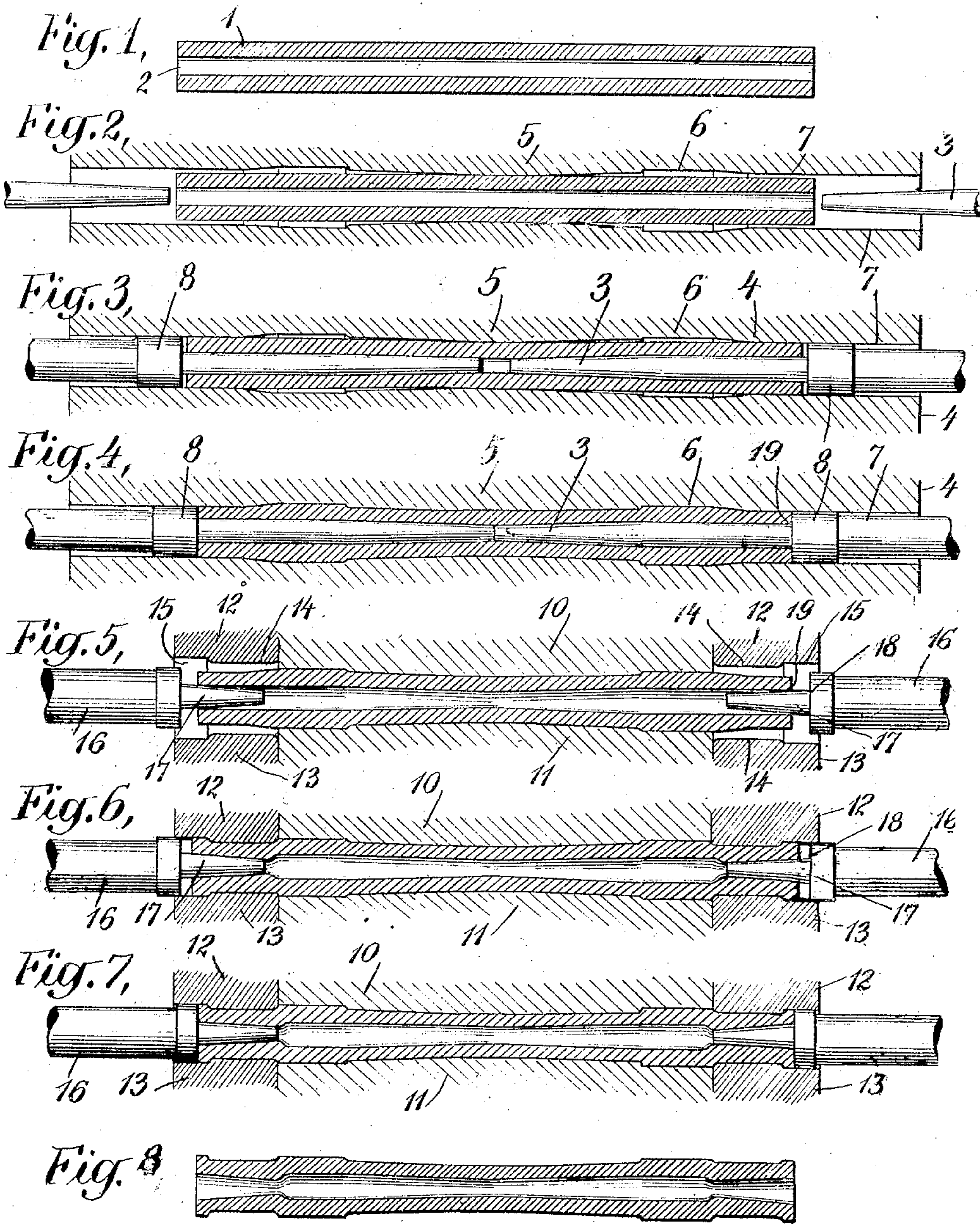


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METHOD OF MAKING HOLLOW CAR AXLES.
APPLICATION FILED MAY 16, 1910.

983,849.

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WITNESSES:

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Fig. 9,

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BY

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METHOD OF MAKING HOLLOW CAR-AXLES.

983,849.

Specification of Letters Patent.

Patented Feb. 7, 1911.

Original application filed October 28, 1908, Serial No. 459,819. Divided and this application filed May 16, 1910. Serial No. 561,738.

To all whom it may concern:

Be it known that I, CHARLES M. WALES, a citizen of the United States of America, and resident of the city, county, and State of New York, have invented certain new and useful Improvements in Methods of Making Hollow Car-Axles, of which the following is a specification.

My invention relates to a novel method for making hollow axles for railroad cars and the like.

The apparatus described herein in connection with my method, is described and claimed in my co-pending application Serial Number 459,819, filed October 28th, 1908, from which this application is divided.

The object of my invention is to provide an economical and effective method for making hollow car axles, by means of which, both on account of the distribution of the metal and the treatment it undergoes, superior strength, uniformity and economy of material are attained.

My invention consists in the various steps, severally and combined, which are herein-after described and pointed out in the claims.

In the drawings accompanying and forming a part of this specification, Figure 1 represents in section a billet of which the axle is to be formed; Fig. 2 a section through dies in which the billet is placed preparatory to performing the first step; Fig. 3 a similar section at the end of the first step; Fig. 4 the same at the end of the second step; Fig. 5 a section through a second set of dies in which a partially formed axle is placed preparatory to the third step; Fig. 6 represents a section corresponding to Fig. 5 after the third step has been performed; and Fig. 7 the same at the end of the fourth and last step. Figs. 8 and 9 represent, respectively a section and side view of the finished axle forging.

The reference characters are used in the same sense throughout the drawings and the specification.

Numeral 1 represents the billet out of which the axle is to be made by my improved method. It is preferably cylindrical in form and of a length somewhat greater than the finished axle and a diameter substantially equal to the diameter of the finished axle at its central portion. It has a straight cylindrical hole 2 formed

through it. This hole is preferably produced by drilling, because in this way small imperfections in the metal which are generally to be found at the center of the billet are removed and large imperfections which would impair the strength of the axle may be more readily discovered. My invention is not, however, limited to any particular method of forming the hole in the billet, and any other method such as piercing the billet while hot, by forcing a plunger through it, may be employed.

The preferred first step Figs. 2 and 3 in my improved method consists, after the billet has been properly heated, in transversely expanding the hollow billet progressively from its ends to points near the inner extremities of the wheel seats, by means of pressure exerted upon the interior of the billet. This I prefer to accomplish by simultaneously forcing into each end of the hollow billet the mandrels 3 having tapered ends adapted to enter the hole 2 and straight cylindrical portions back of said ends, said tapered ends being of a length about equal to half the distance between the inner extremities of the wheel seats, and said straight portions reaching in to a point near the inner extremities of the wheel seats. For this operation the billet may be held in any suitable manner which will prevent its buckling and permit its expanding as above described. I prefer, however, to place the billet in the matrix dies 4 which make when closed a chamber in the form of a surface of revolution having its least diameter at the central portion 5 substantially equal to the original diameter of the billet 1, and increasing gradually from the central portion to the enlarged portions 6 for the wheel seats of the axle, and then decreasing outside of said enlargements in short tapered portions to cylindrical portions 7, which project beyond the ends of the billet and form guides for the shouldered heads 8 of the mandrels 3, the purpose of which will be more fully hereinafter explained.

The second step Fig. 4 consists in still further expanding the billet or partially formed axle forging at the wheel seats by bringing pressure to bear on its ends, while at the same time maintaining the pressure upon its interior. This step I prefer to accomplish by means of the matrix dies and

arbors above described, in conjunction with shoulders 8, either secured to said arbors or operating independently.

The third step Figs. 5 and 6 consists in placing the partially formed axle in holding dies which are of such length as to permit so much of the ends of the axle as is required for the journals to project beyond the ends of the dies, and then partially forming the collars at the ends and reducing the external diameter between the collars and the wheel seats by causing external pressure to bear upon the cylindrical exterior of said projecting ends, during which I prefer to limit the closing of the openings in the ends by inserting therein taper mandrels.

The fourth and last step Figs. 6 and 7 consists in completing the formation of the collars at the ends of the axle and thickening the walls of the journals where they join the wheel seats, by bringing pressure to bear simultaneously against the ends of the journals and the opening in the ends, while the exterior of the journals is confined and prevented from expanding.

In carrying out the last two steps or operations, I provide holding dies 10 and 11 which are made to fit that part of the axle between the outer extremities of the wheel seats so that the ends of which the journals are to be formed project beyond the ends of said dies. At the ends of the dies 10 and 11, I arrange segmental transversely movable dies 12 and 13. These consist preferably of three or more segments adapted to be moved radially. Each segment is provided with a cylindrical portion 14 of proper curvature to form the journal proper and a cylindrical portion 15 of larger radius to permit the forming of the collar. I also provide a plunger 16 having a tapered mandrel 17 and a shoulder 18. The shoulder 18 is adapted to fit the cylindrical portion 15 of the segmental dies when the latter are closed. The ends of the mandrels 17 are of less diameter than the openings 19 left by the mandrels 17, while that part of the mandrel nearest the shoulder 18 is preferably of somewhat larger diameter than said opening, the shape of the mandrel being such as to give the required varying thickness to the walls of the journal between its junction with the wheel seat and its end. After the partially formed axle or billet has been placed in the holding dies, the tapered mandrels 17 are inserted to a point where the diameter of the mandrel will just about equal the diameter of the opening 19 in the end of the axle, the segmental dies 12 and 13 are then caused to close down upon the ends of the axle to shape the ends to the requisite diameter for the journals and to partially form the collars at the extreme ends of the axle. The mandrels 17 and the shoulders 18 are then forced inwardly, while the dies 12 and 13

are held rigidly, thus bringing pressure to bear simultaneously against the ends and the openings in the ends of the journals thereby compressing the metal of the ends of the journal, reducing the length of the axle and causing the metal in the chambered portions 15 of the dies 13 and 14 and the metal included in the space between the mandrels 17 and the journal forming portions 14 of the segmental dies to completely fill the space included between the segmental dies, the mandrel and the shoulder, and at the same time causing a thickening of the walls of the journal where it joins the wheel seat.

Having thus described my invention what I claim is:

1. The herein described method of forming journals on the ends of hollow axles which consists in holding the partially formed axle between the journals in holding dies, inserting taper mandrels in the openings of the ends of said axle to limit the reduction of the openings of said ends, causing journal forming dies to close upon the projecting ends of said axle and then forcing said taper mandrels and shoulders in connection therewith, inwardly while said journal forming dies are held rigidly against the exterior of said journals, to increase the thickness of material at the junction of the wheel seats and journals.

2. The herein described method of forming hollow axles which consists in placing a hollow billet in a matrix die having wheel seat enlargements joined by sections tapering from said wheel seat enlargements to a smaller diameter at the center, expanding said billet to a larger diameter progressively from its ends to points near the inner extremities of the wheel seats, by means of pressure exerted upon the interior of the billet, and still further expanding said billet at the wheel seats by pressure exerted against the ends of the billet.

3. The herein described method of forming hollow axles which consists in placing a hollow billet in a matrix die having wheel seat forming enlargements joined by sections tapering from said wheel seat enlargements to a smaller diameter at the center, and journal extensions beyond said wheel seat enlargements of less diameter than said wheel seat forming enlargements and greater diameter than said center, expanding said billet to substantially the diameter of said journal extensions progressively from its ends to points near the inner ends of the wheel seats, by means of pressure exerted upon the interior of the billet, and still further expanding said billet at the wheel seats by pressure exerted against the ends of the billet.

4. The method of making hollow axles which consists in forming a straight cy-

lindrical hole through a billet and expanding said billet to a larger diameter progressively from its ends to points near the inner extremities of the wheel seats by means of pressure exerted upon the interior of the billet.

5. The method of making hollow axles which consists in forming a hole longitudinally through the center of a billet, placing the hollow billet in a matrix die having wheel seat enlargements joined by sections tapering from said wheel seat enlargements to a smaller diameter at the center, and expanding said billet in said die to a larger diameter from its ends to points near the inner extremities of the wheel seats by means of pressure exerted upon the interior of the billet progressively from its ends to points near the inner extremities of the wheel seats.

6. The herein described method of producing hollow car axles which consists in placing a straight hollow cylindrical billet in dies, forcing a mandrel having a taper end and a straight portion back of said end into the opening in said billet to expand said billet into conformation with said dies, withdrawing said mandrels and placing said billet in holding dies which permit the ends thereof to project beyond the ends of said holding dies, causing journal forming dies to close down upon said projecting ends, and then forcing a taper mandrel into and a shoulder against the ends of said billet.

7. The herein described method of forming hollow axles which consists in forming a straight cylindrical hole through a straight cylindrical billet, placing said billet in dies having a diameter at the center substantially equal to the diameter of said billet and having wheel seat forming por-

tions of enlarged diameter and end forming portions of less diameter than said wheel seat forming portions and greater than the diameter at said center, forcing mandrels having taper ends and a straight portion back of said end, into said hollow billet, and forcing shoulders against the ends thereof to cause said billet to expand into conformation with said dies.

8. The herein described method for thickening the walls of the journals of a hollow axle where the journals join the wheel seats, which consists in confining the exterior of axles at the journals between dies and forcing into and against the ends of said journals shouldered taper mandrels having ends of less diameter than the openings in the journals.

9. The herein described method of forming hollow axles which consists in placing a straight cylindrical billet having a straight cylindrical hole therethrough in dies, expanding said billet to fill said dies by forcing tapered mandrels into the ends thereof and causing a thickening of the walls of said axle where the journals join the wheel seats by confining the exterior of said journals and forcing shouldered taper mandrels having ends of less diameter than the openings in the journals into and against the ends of said axle, whereby the opening in the said axle at the junction of the journal and the wheel seat is reduced and the thickness of the wall at this point is increased.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES M. WALES.

Witnesses:

FLORENCE J. WALSH,
ERNEST MILLER.