

C. M. WALES.
HOLLOW AXLE.
APPLICATION FILED OCT. 28, 1908.

1,010,004.

Patented Nov. 28, 1911.

Fig. 1.

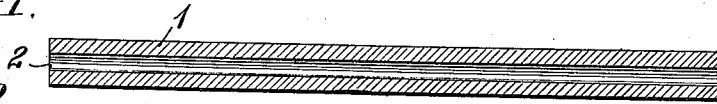


Fig. 2.

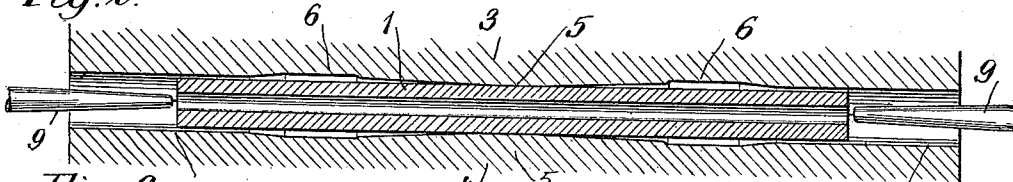


Fig. 3.

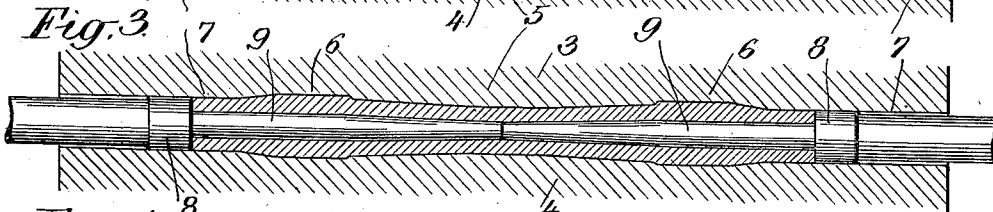


Fig. 4.

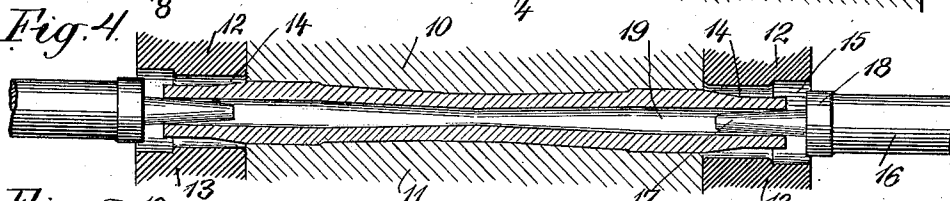


Fig. 5.

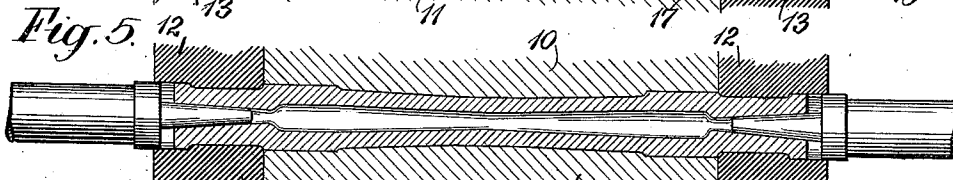


Fig. 6.

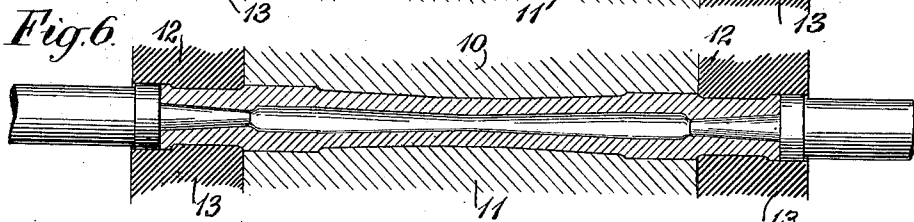


Fig. 7.

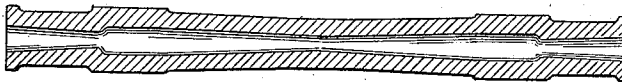


Fig. 8.

WITNESSES:



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HOLLOW AXLE.

1,010,004.

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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 Hollow Axles, of which the following is a specification.

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

The object of my invention is to provide a method and apparatus for the economical manufacture of railroad car axles in which both the distribution of the metal and the effect of its manipulation in the process of manufacture shall produce an axle of great strength and uniformity.

My invention consists in the method and apparatus hereinafter described and particularly pointed out in the claims.

In the drawings accompanying and forming part of this specification, Figure 1 represents a section of a hollow cylindrical billet; Fig. 2 represents in section the said billet and the dies and a portion of the mandrels, at the commencement of the first operation of my method; Fig. 3 represents the same at the end of the first operation; Fig. 4 represents the billet and apparatus in section at the commencement of the second operation; and Figs. 5 and 6 represent respectively the next succeeding and final stages. Figs. 7 and 8 represent respectively a cross section and a side view of the completed axle.

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

Numerals 1 represents a billet out of which the axle is to be made by my improved method and apparatus. 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 of material which are generally 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 first step in the method consists in expanding the billet before described and illustrated in Fig. 1, and slightly shortening the same so that its external surface shall gradually increase in diameter in both directions from the central portion to the wheel seats and at the same time giving the opening or hole in the center of the axle a gradually increasing diameter from the center, making it substantially parallel to the external taper between the central portion and the wheel seats. The preferred form of apparatus for accomplishing this step consists of a pair of dies 3 and 4 which make when closed a chamber in the form of a surface of revolution having its least diameter at the central portion 5 where the diameter is substantially equal to the diameter of the billet 1 and increasing gradually from the central portion 5 to the wheel seat forming enlargements 6 and decreasing outside of said wheel seat forming portions in a short taper to cylindrical portions 7 which project beyond the ends of the billet and form a guide for the shouldered head 8 of the mandrels 9. The mandrels 9 project beyond the shoulders 8 a length approximately equal to one-half the length of the billet after it has been transformed by this expanding and upsetting operation and the diameter of the straight cylindrical portion of the mandrel 9 is such as will expand the billet to approximately the diameter of the end of the die chamber, or of the shoulder 8 of the mandrel. The length of the tapered portion of the mandrel is approximately half the length of the mandrel from its end to the shoulder 8. The apparatus above described and the first operation performed therewith leave the axle forging complete between the outer extremities of the wheel seats. The wheel seats themselves of course must subsequently be turned as usual to the requisite exact diameter.

After removing the axle from dies 3 and 4 and reheating the ends, the next step in my improved method consists in forming journals on the ends of the axle by bringing external pressure to bear upon said ends, during which I prefer to simultaneously limit the closing of the openings in the ends by inserting taper mandrels, and finally the last step consists in forming collars at the outer ends of the journals 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 openings in the ends while the exterior of the journals is confined and prevented from expanding. The preferred form of apparatus which I employ to carry out that part of my method which relates to the forming of the journals upon the axle as it is partially formed in the dies 3 and 4, consists of the following: 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 9, 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 and the shoulders 18 are then forced inwardly, thus 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.

Having thus described my invention what I claim is:

1. In an apparatus for forming hollow axles, the combination with dies adapted to receive a hollow billet and forming when closed a chamber whose walls are in the form of a surface of revolution having its least diameter at the center longitudinally

thereof and of gradually increasing diameter from said center to wheel seat forming enlargements therein and having straight cylindrical portions outside of said wheel seat forming portions, of mandrels of a length equal to substantially one-half the length of the axle adapted to be forced from either end into the chamber formed by the closing of said dies; the diameters of the ends of said mandrels being substantially the same as the diameter of the opening of said hollow billet and tapering a distance from the end substantially equal to the distance from the center of the axle to the wheel seat, to a diameter adapted to expand the ends of the hollow billet to the approximate diameter of the straight cylindrical ends of the die chamber.

2. In an apparatus for forming hollow axles, the combination with dies adapted to receive a hollow billet and forming when closed a chamber whose walls are in the form of a surface of revolution having its least diameter at the center longitudinally thereof and of gradually increasing diameter from said center to wheel seat forming enlargements therein and having extensions outside of and of less diameter than said wheel seat forming portions, of mandrels of a length equal to substantially one-half the length of the axle adapted to be forced from either end into the chamber formed by the closing of said dies; the diameters of the ends of said mandrels being substantially the same as the diameter of the opening in said hollow billet and tapering to a diameter greater than said opening to a point substantially midway of their length.

3. In an apparatus for forming hollow axles, the combination with holding dies adapted to hold a partially formed axle between the wheel seats, of laterally movable journal forming dies adapted to close down upon the projecting ends and a movable taper mandrel adapted to be forced into the end of said axle after said laterally movable dies have been closed.

4. In an apparatus for forming hollow axles, the combination with holding dies adapted to hold a partially formed hollow axle intermediate the wheel seats thereof, laterally movable dies adapted to close in upon the ends of said partially formed axle and a taper mandrel having a shoulder secured thereto adapted to be forced into and against respectively the end of said hollow axle.

5. In an apparatus for forming hollow axles, the combination with dies adapted to receive a hollow billet and to form when closed a surface of revolution having its central portion of approximately the same diameter as the diameter of said hollow billet, wheel seat forming portions of greater diameter and journal forming portions of

less diameter than said wheel seat forming portions, of tapered mandrels adapted to reach from either end to approximately the center of said dies, the diameters of the ends of said mandrels being substantially the same as the opening in said hollow billet and tapered to a diameter greater than said opening, holding dies adapted to receive said billet as it is transformed by said first named dies, tapered mandrels adapted to enter the ends of said billet, having shoulders secured thereto adapted to engage the ends of said billet, projecting beyond said shoulders a length substantially equal to the length of the journals.

6. In an apparatus for forming hollow axles, the combination with dies adapted to receive a hollow billet and forming when closed a chamber whose walls are in the form of a surface of revolution having its least diameter at the center longitudinally thereof and of gradually increasing diameter from said central portion to wheel seat forming enlargements therein and having portions of less diameter than said wheel seat forming portions outside of said wheel seat

forming portions, of mandrels slightly less than half the original length of the billet, the diameters of the ends of said mandrels being substantially the same as the diameter of the opening in said hollow billet and tapering to a greater diameter than said opening and having shoulders secured thereto adapted to engage the ends of said billet, holding dies adapted to hold said billet between the outer extremities of the wheel seats as formed in said first named dies, journal forming dies adapted to close down upon the ends of said billet projecting beyond the ends of said holding dies, and tapered shouldered mandrels adapted to be forced into and against the ends of said billet to produce a thickening of the walls of the axle where the journal joins the wheel seat.

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

CHARLES M. WALES.

Witnesses:

F. MURRAY HILL,
ERNEST MILLER.