No. 725,787. PATENTED APR. 21, 1903.

C. S. SMITH.

TUBULAR VEHICLE AXLE.

APPLICATION FILED MAY 21, 1898.

NO MODEL.

Fig. 1.

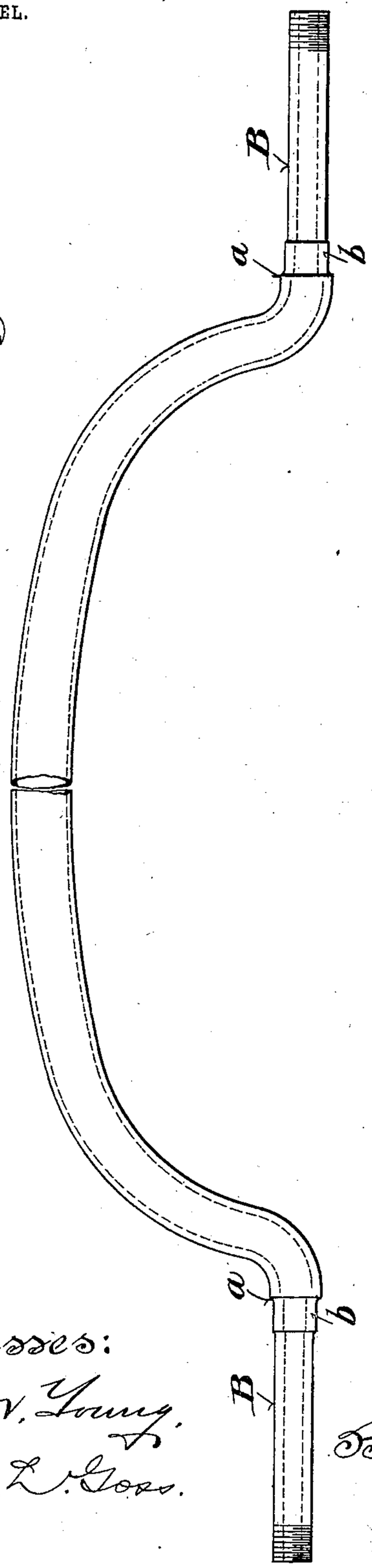
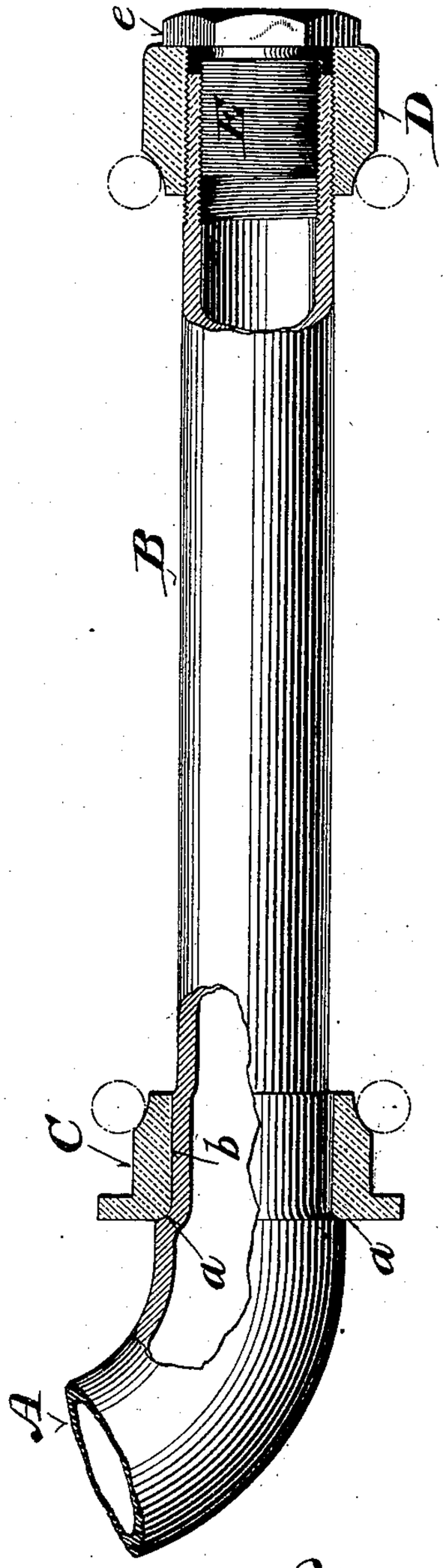



Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## TUBULAR VEHICLE-AXLE.

SPECIFICATION forming part of Letters Patent No. 725,787, dated April 21, 1903.

Application filed May 21, 1898. Serial No. 681,389. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES S. SMITH, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Tubular Vehicle-Axles, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The main object of my invention is to produce in one piece a tubular metallic vehicle-axle without joints or abrupt changes in the thickness of the metal between the spindles and body or axletree.

It consists in certain novel features of construction, as hereinafter particularly described, and pointed out in the claims.

In the accompanying drawings like letters designate the same parts in both figures.

Figure 1 is a side elevation of a tubular vehicle-axle embodying my invention; and Fig. 2 is a view on a greatly-enlarged scale, partly in elevation and partly in vertical longitudinal section, of one of the axle-spindles.

A designates the body of the axle or the axletree, and B B the spindles upon which the wheels are mounted and adapted to turn.

For the illustration of my invention I have shown an axle which is specially designed for use in connection with ball-bearings; but with little or no change in the essential features of construction constituting my invention it may be used with other kinds of bearings.

In the construction of the axle the body or axletree A and the spindles B are formed integrally with each other of metal tubing. I prefer for the purpose to use seamless tubing of the greatest diameter of the finished axle or whose diameter is the same from end to end and equal to the diameter of the larger middle portion of the body or axletree A. The diameter of the tubing is first gradually reduced from the middle to the ends by dies or other suitable means, thus condensing and increasing the thickness of the metal toward the ends. The body or axletree A is then arched or bent into the desired shape. The spindles B are reduced in diameter by forcing over them a die or dies of the proper shape and size to form shoulders *a* and cone-seats *b* next to the ends of the body A. The spindles are further slightly reduced in diameter outside of the cone-seats *b*, so as to permit the inside cones C to be readily slipped over the ends of the spindles into place upon said seats *b* against the shoulders *a*, to which they are fitted, as shown in Fig. 2. The outside cones D are adjustably fastened to the outer ends of the spindles in any suitable way. They may be threaded thereon, as shown in Fig. 2, so as to be adjusted toward and from the inside cones C by turning them, and they may be locked in place when adjusted by means of screws E, threaded inside of the spindles and having squared heads *e*, which project outwardly over and are adapted to bear against the outer ends of said cones.

Axles of this class have heretofore been made by welding solid spindles in the ends of a tubular axletree; but by this construction abrupt changes in the gage, thickness, or mass of metal are produced where the spindles join the body. These abrupt changes in the thickness or mass of the metal tend to interrupt vibrations and to produce crystallization, by which the axles become brittle and weak at those points.

Instead of constructing the spindles by compression they may be reduced in diameter by turning them down. This, however, reduces the thickness of the metal, making a more or less abrupt change in gage between the spindles and body to form the shoulders *a*, and to this extent interrupts vibration and weakens the axle at those points.

In place of tubing of the larger diameter of the finished axle and instead of reducing it by compression toward the ends tubing of a smaller diameter may be employed and expanded between the spindles to form the axletree. This may be done by placing the tubing in a mold or form of the desired shape and pumping wax or some suitable fluid or semifluid substance into the tubing under high pressure. I do not claim, however, in this application the process of making the axle, and do not wish to be understood as limiting my invention thereto or to the ball-

bearings and adjustable fastening for the outer bearings which I have shown and described in connection therewith.

In place of ordinary tubing of uniform gage or thickness taper gage tubing may be used, so that when it is expanded in the middle or contracted at the ends to produce the desired taper in the finished axle it will be brought to an approximately uniform or equal gage or thickness.

Instead of forming the shoulders *a* on the axle for the inside cones C to abut against said cones may be pinned or otherwise fastened in place and the axle may be formed without such shoulders.

I claim—

1. A metallic vehicle-axle consisting of an arched tubular body and spindles formed integrally therewith, the spindles being reduced in diameter forming shoulders next to the body without change in the gage or thickness of the metal at those points and the body diminishing in diameter and increasing in gage or thickness from the middle toward the ends, substantially as and for the purposes set forth.

2. A metallic axle consisting of tubular spindles and an arched tubular body or axletree diminishing in diameter from the middle toward the ends, the spindles being reduced in diameter next to the body to form seats and shoulders for the inside cones and further reduced outside of the cone-seats to permit the cones to be readily slipped into place over the outer ends of the spindles, substantially as and for the purposes set forth.

In witness whereof I hereto affix my signature in presence of two witnesses.

CHARLES S. SMITH.

Witnesses:

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L. A. MORRILL.