No. 653,428. Patented July 10, 1900.

C. M. WALES.

MANDREL.

(Application filed Sept. 27, 1899.)

(No Model.)

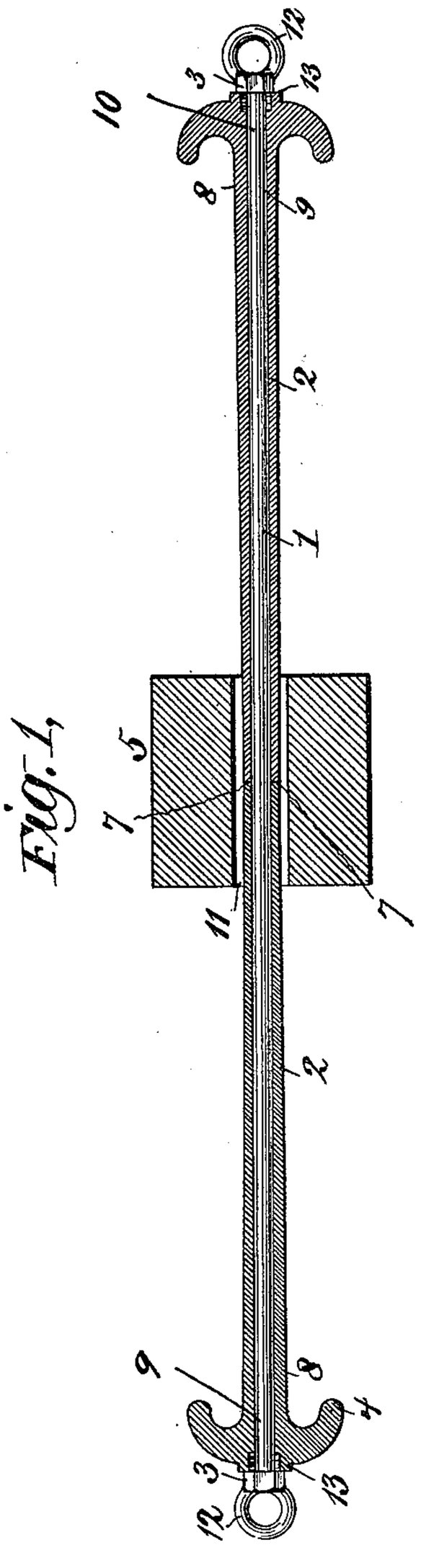

Fig. 1.

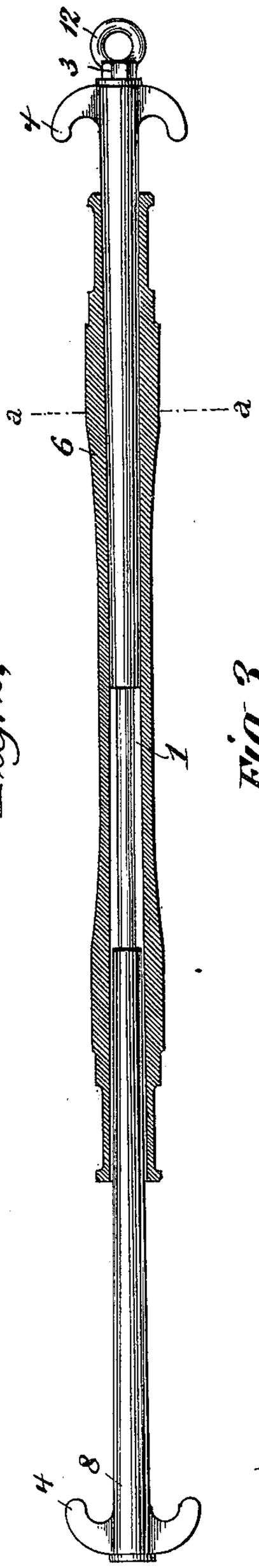

Fig. 2.

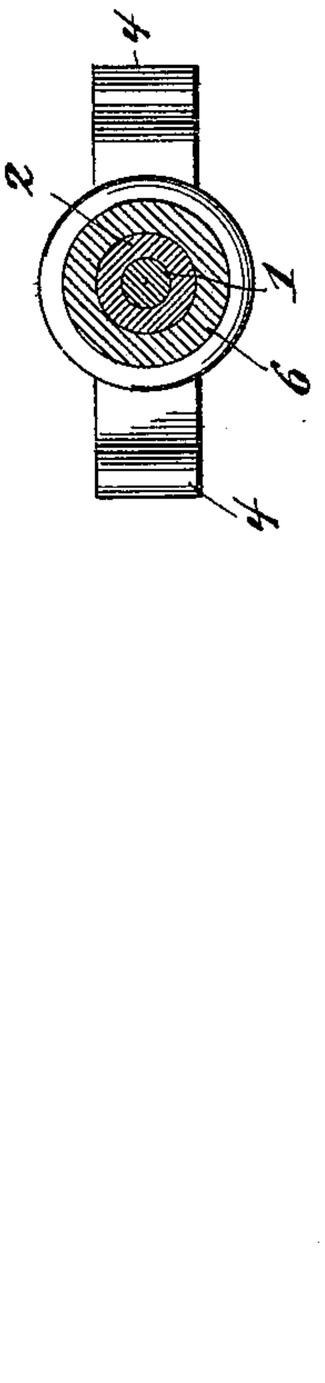

Fig. 3.

WITNESSES:

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MANDREL.

SPECIFICATION forming part of Letters Patent No. 653,428, dated July 10, 1900.

Application filed September 27, 1899. Serial No. 731,847. (No model.)

To all whom it may concern:

Be it known that I, CHARLES MARSHALL WALES, a citizen of the United States of America, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Mandrels, of which the following is a specification.

My invention relates to mandrels for making hollow shafts, and has for its object to provide a mandrel on which an ingot may be forged into a hollow shaft from which the mandrel may be quickly and conveniently withdrawn, and it is especially adapted for the production of relatively-small hollow shafts, particularly car-axles and the like.

My invention consists in making a hollow shell or tubular mandrel, in providing means for reinforcing the walls of said mandrel by means of a rod adapted to be received within it, and in providing means for holding said rod and mandrel in position during the process of forging, and means for releasing and moving said rod prior to the removal of the hollow mandrel when the forging is completed, and finally for removing the mandrel.

In the drawings accompanying and forming part of this specification, Figure 1 represents a longitudinal section through a mandrel, showing an ingot in place on the mandrel ready for the commencement of the forging operation. Fig. 2 represents a forging completed on the mandrel with one of the parts of the mandrel partially removed. Fig. 3 shows a section on the line *a a*, Fig. 2.

Similar characters of reference designate like parts in all of the figures.

Numeral 1 is a rod located within the hollow shell.

2 2 represent the parts of the shell or tubular mandrel, which in the preferred form is made in two parts having an external taper with the smaller ends 7 7 at or near the center.

3 3 represent nuts on the ends of the rod 1, which are provided with the rings 12 12 for the purpose of withdrawing the rod 1.

4 4 represent hooks or lugs on the outer ends of the shells 2 2.

5 represents an ingot ready to be forged.

6 represents a completed forging.

7 7 represent the smaller ends of the shells, and 8 8 represent the larger ends.

13 13 represent chambers in the ends of the shells for the insertion of suitable nozzles or water connections for the introduction of water into the interior of the shell.

In forging hollow shafts upon a mandrel the mandrel is apt to become heated and soft and adhere to the walls of the hollow shaft. These difficulties increase very rapidly as the size of the shaft and especially the hole in the shaft are diminished. They also increase greatly when the size of the hole in the shaft is small relatively to the length of the shaft.

By making the mandrel in two parts the power required to withdraw these parts becomes only half what it would be if the mandrel were made in one piece, and by giving them a slight taper their removal is further facilitated. By making the mandrel hollow I not only provide means for holding the two pieces rigidly together during the process of forging, but also provide a means for introducing a stream of water into the interior of the mandrel when the rod 1 is removed, thereby tending to contract and harden the mandrel. At the same time when the rod 1 is in place in the shell 2 the mandrel has practically as great power to resist compression as a solid mandrel. I prefer to make the hole in the mandrel and the rod 1 slightly tapered, so that the rod may be more easily withdrawn after it has been started.

In the preferred form of my mandrel herein shown the inner ends 7 7 of the shells are smaller in diameter than the outer ends 8 8, and one end, as 9, of the rod 1 is slightly smaller in diameter than the other end 10, the rod 1 having a uniform taper between its ends and the internal bore of the shells being made to correspond to this taper. It is not necessary in all cases to have the rod tapered, but in certain classes of work it is preferable.

The operation of forging with my improved mandrel is as follows: A hole 11 is made in the ingot somewhat greater in diameter than the external diameter of the mandrel. The ingot is then brought to the proper heat and placed on the mandrel, which is previously

made ready by the removal of one of the nuts 3 and shells 2. The shell is then replaced and firmly secured, after which the forging is carried on to the desired extent, when the nut 3 is again removed and hooks are attached to the lugs 4 4 and the mandrel is withdrawn. In some cases it may be desirable to withdraw the rod previous to withdrawing the shells 2 2 and force through the shells a stream of water to cool, contract, and harden the same.

My improved mandrel is especially designed for use in connection with hydraulic presses; but it of course may be used with any form of press or hammer, such as the ordinary steam-hammer, which is suitable for forging shafts, and with any form of dies.

Having thus described my invention, what I claim is—

1. In a mandrel for forging hollow shafts the combination with two hollow members having a central bore, of a rod within said bore, and means whereby said two hollow members may be held together upon said rod while the shaft is being forged and removed separately from the completed forging.

2. In a mandrel for forging hollow shafts the combination with two hollow members having a central bore and an external taper, of a rod within said bore, and means whereby said two hollow members may be held together upon said rod while the shaft is being forged and removed separately from the completed forging.

3. A mandrel for forging hollow shafts consisting of a hollow shell in combination with a removable center adapted to be inserted in the hollow shell while the shaft is being forged and to be removed therefrom prior to the removal of the hollow shell from the hollow shaft.

4. A mandrel for forging hollow shafts consisting of a hollow shell having an internal taper, in combination with a removable center for said hollow shell having a taper to correspond with the internal taper of said shell, whereby said removable center may be inserted in said hollow shell to reinforce it during the process of forging and be withdrawn therefrom to permit the introduction of water to cool and contract the shell to facilitate its removal from the hollow shaft.

5. A mandrel for forging hollow shafts consisting of a hollow shell in combination with a removable center, and means whereby said removable center may be secured in said hollow shell during the process of forging and removed therefrom prior to the removal of the hollow shell from the hollow shaft.

6. A mandrel for forging hollow shafts consisting of a hollow shell having an external and an internal taper in combination with a removable center for said hollow shell having a taper to correspond with the internal taper of said shell.

7. In a mandrel for forging hollow shafts the combination with the tubular shell of a rod adapted to be held within the tubular shell during the process of forging, and means whereby said rod may be withdrawn to introduce a stream of water previous to the withdrawal of the tubular shell.

Signed by me at New York, N. Y., this 26th day of September, 1899.

CHARLES MARSHALL WALES.

Witnesses:

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C. F. CARRINGTON.