(No Model.)

J. ROBERTSON.

APPARATUS FOR FORMING METAL ARTICLES.

No. 524,509. Patented Aug. 14, 1894.

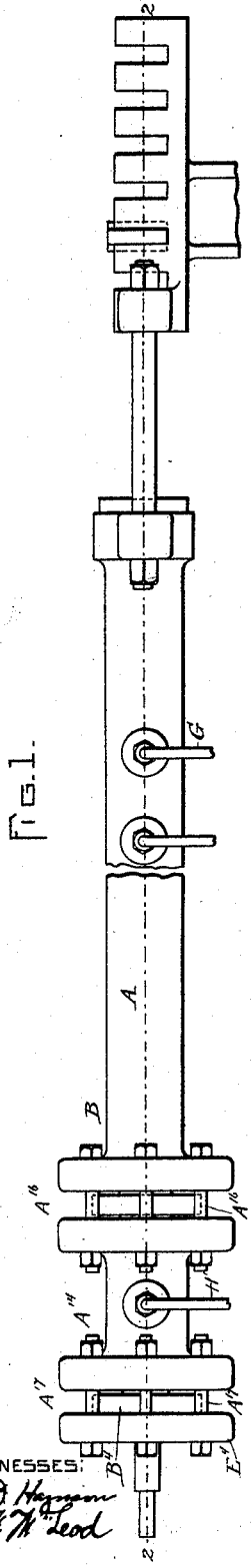

Fig. 1.

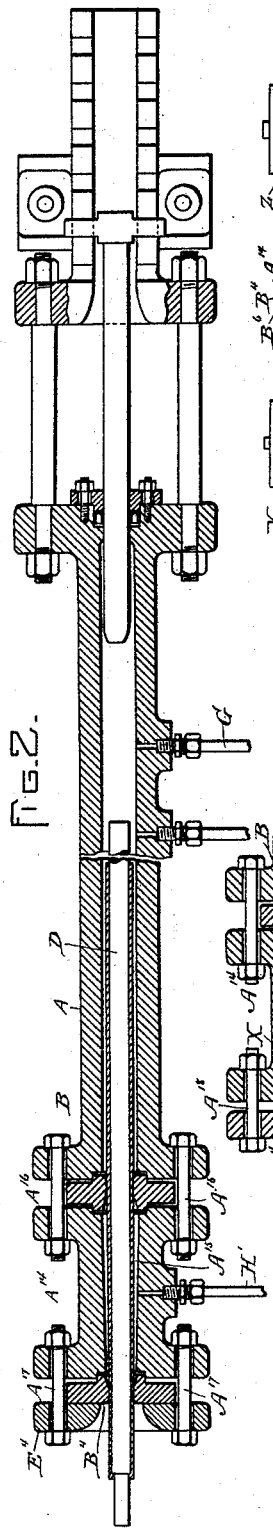

Fig. 2.

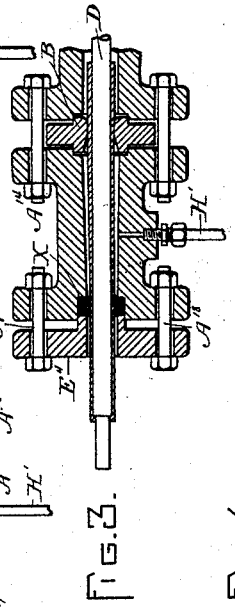

Fig. 3.

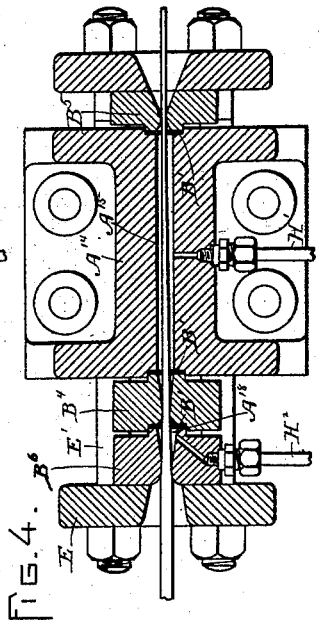

Fig. 4.

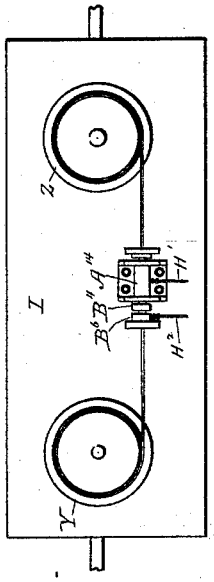

Fig. 5.

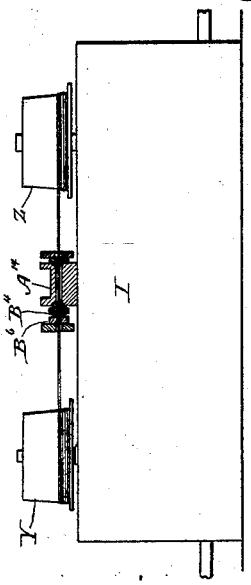

Fig. 6.

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UNITED STATES PATENT OFFICE.

JAMES ROBERTSON, OF MANCHESTER, ENGLAND.

APPARATUS FOR FORMING METAL ARTICLES.

SPECIFICATION forming part of Letters Patent No. 524,509, dated August 14, 1894.

Application filed February 19, 1894. Serial No. 500,729. (No model.) Patented in England October 14, 1893, No. 19,356.

To all whom it may concern:

Be it known that I, JAMES ROBERTSON, of Manchester, England, have invented certain new and useful Improvements in Apparatus for the Manufacture of Metal Tubes, Tubular and Hollow Articles, Rods, Bars, Wires and Plates, (for which I have obtained British Letters Patent No. 19,356, dated October 14, 1893,) of which the following is a specification.

This invention has for its object to provide a simple and effective apparatus for compressing or drawing elongated metal articles and particularly metal rods or wires of considerable length.

The invention consists in a metal drawing apparatus comprising a chamber having a liquid inlet and two curbs of different sizes, the larger one constituting an inlet and the other an outlet passage for a metal blank passing through said chamber, the said curbs fitting the metal closely and confining the liquid in said clamber around the portion of the metal contained therein.

The invention also consists in the combination of a hydraulic drawing apparatus constructed as above indicated, means for supplying the said chamber with liquid under pressure, and means for moving a metal article or blank through said chamber, all of which I will now proceed to describe.

Of the accompanying drawings, forming part of this specification,—Figure 1 represents a side elevation of a metal-drawing or forming apparatus embodying my invention. Fig. 2 represents a section on line 2—2 of Fig. 1. Fig. 3 represents a sectional view of a hydraulic metal drawing apparatus of a somewhat different construction from that shown in Fig. 2. Fig. 4 represents a sectional view of a hydraulic metal drawing apparatus, showing other variations. Figs. 5 and 6 represent views on a smaller scale, showing the hydraulic drawing apparatus illustrated in Fig. 4, and in connection therewith means for moving a wire through said apparatus.

The same letters of reference indicate the same parts in all the figures.

Referring first to Figs. 1 and 2, A represents a container which is a stout metal cylinder provided with an inlet pipe G through which a liquid under high pressure may be admitted, and with an outlet B hereinafter denominated a curb, and formed to act as a drawing die, adapted to reduce and elongate a metal blank ejected from the container by the pressure of the liquid admitted through the pipe G, said container and drawing die or curb forming parts of an apparatus described in connection with the improved method of forming metal articles by forcing them under liquid pressure through the said die, all as described in my application for Letters Patent of the United States, filed September 30, 1893, Serial No. 486,869. In Figs. 1 and 2, I show in connection with the said container, drawing die or curb, and means for applying liquid pressure to a blank within the container, an additional drawing apparatus which in its simplest form comprises a chamber or casing A^{14} connected with the container A by means of bolts A^{16} and provided with an internal chamber A^{15} which is in alignment with the cavity of the container, so that the blank ejected from the container will pass through said chamber.

H′ represents a pipe which admits liquid under a high pressure into the chamber A^{15}. At the opposite ends of said chamber are two curbs which tightly fit the metal article passing through said chamber, one of said curbs being larger than the other, the larger curb being at the receiving and the smaller at the discharging end of the chamber A^{15}, so that while the larger curb fits the cross-section of the metal entering the chamber, the smaller curb will fit the reduced cross-section formed by the liquid pressure within the chamber. The larger curb is in the present case the drawing die or curb B above described. The smaller curb B^4 is of the same general construction as the die or curb B, and is secured to the casing A^{14} by means of a plate or holder E^4 secured by bolts A^{17} to the casing A^{14}.

Liquid introduced into the chamber A^{15} through the pipe H′ has a pressure above the resistance of a metal article contained therein to crushing action. Said liquid is therefore caused to compress and form a metal article passed through said chamber. I find that a liquid confined under high pressure around a blank in this way constitutes a hydraulic die which has a greater tendency than an ordinary rigid die to improve the uniformity of thickness or gage of a tube subjected to

its action, while supported internally by a mandrel. There is not much drawing or pressing effect obtainable from the liquid unless it is used at a pressure about one-half greater than is required to partially crush the metal passing through the chamber. Take, for example, the most prominent metal to be dealt with in drawing tubes, which is steel, the crushing weight of which is, say, twenty (20) tons to the square inch, while the pressure of the liquid in the chamber should in this case be about thirty (30) tons to the square inch.

In the operation of the apparatus shown in Figs. 1 and 2, the pressure of the liquid being, as already stated, about thirty tons to the square inch, there is no expenditure of the compressing liquid beyond what may leak through the curbs or into the pores of the metal of the blank or of the chamber itself, the blank or object being drawn acting in connection with the curbs B and B^4 to tightly close the ends of the chamber, so that the expenditure of the compressing liquid is small, the office of the compressing liquid being to compress or diminish in diameter and thickness as well as to lubricate and treat the article being formed with little or no frictional resistance to the endwise motion of said article. In the construction now being considered, a tubular article is being formed, a mandrel D being employed. Said mandrel, when made of small diameter, should be of cast steel; but when made of larger diameter may be made of cast iron.

In Fig. 3 I show a modification in which instead of employing a metal curb B^4 I make said curb as a stuffing-box, which may be composed of a number of leather washers X confined in a cavity formed in the casing A^{14} by means of a plate E^4 and bolts A^{18}. The curb thus formed will within a small range of diameter accommodate itself to any reduction of diameter that may be effected by the compressing liquid, without allowing the latter to leak around the portion emerging from the rear curb.

The improved drawing apparatus may be used advantageously for the drawing of soft steel wire, say of four inches (4″) in diameter. Said wire may be reduced about one-sixteenth (1-16) part in its diameter by one passage through the apparatus.

In Figs. 5 and 6 I show an apparatus adapted particularly for the drawing of wire of comparatively small diameter, the wire being drawn through the apparatus by means of a reel Z from the supplying-reel Y, as shown in Figs. 5 and 6. The apparatus is composed in this case of a casing A^{14} having a chamber A^{15} and a liquid inlet H′ and the curbs B^4 B^5, the relative arrangement of said parts being substantially the same as already shown in Figs. 2 and 3. In this case, however, I employ a second drawing apparatus, which acts on the wire before it reaches the main apparatus already described. Said second apparatus is composed in part of the curb B^4, and in part of an additional and larger curb B^6, which is clamped against the curb B^4 by means of a holder E, and bolts E′ connecting the latter to the casing A^{14}. The curb B^6 is internally enlarged to form a chamber A^{18} in line with the chamber A^{15} in the main apparatus. The curb B^6 is also provided with a liquid inlet H^2. The joints between the curbs B^6 and B^4, the curb B^4 and the casing A^{14}, and the casing A^{14} and the curb B^5 are made water-tight by means of packings B′. The first curb B^6 is adapted to take only a sufficiently tight hold of the wire to clean it and reduce it a little, and to make the entrance to the space A^{18} water-tight. The next curb B^4 is adapted to reduce the diameter of the wire to a greater degree. The main reduction of the diameter of the wire, and the main drawing action is accomplished in the elongated space A^{15} of the main apparatus, which is suited for a pressure of about forty (40) tons to the square inch. The curb B^5 also slightly reduces the diameter of the wire. The liquid required in the liquid spaces A^{15} and A^{18} may be conveniently supplied from a small liquid accumulator loaded to the requisite pressure, the pressure being regulated by a suitable stop-cock.

The reels Y and Z shown in Fig. 6 may be mounted upon a wire drawing bench I, one being located at one side and the other at the opposite side of a hydraulic drawing apparatus such as that last described, affixed to said bench.

The inlet pipe shown in Figs. 1 and 2 beside the pipe G may be used to admit liquid under a relatively low pressure into the container for the purpose of filling the container with liquid before admitting the liquid under operative blank-forcing pressure through the pipe G.

I claim—

1. A hydraulic drawing apparatus comprising a chamber having a liquid inlet and two curbs of different sizes, the larger one constituting an inlet and the other an outlet passage for the metal, said curbs fitting the metal closely and confining the liquid in said chamber around the portion of the metal contained therein.

2. A hydraulic drawing apparatus comprising a chamber having a liquid inlet, a curb at one end of said chamber constituting an inlet for the metal blank and formed to fit the same liquid-tight, and a curb of smaller cross-sectional area at the opposite end of the chamber formed to fit the metal as formed or reduced by liquid pressure in said chamber.

3. A hydraulic drawing apparatus comprising a chamber having a liquid inlet, a rigid drawing die or curb at one end of said chamber formed to tightly fit and slightly reduce the metal blank to be drawn, and a curb formed as a stuffing-box at the other end of said chamber formed to tightly fit without fur-

ther reducing the metal as formed or reduced by liquid pressure within the chamber.

4. A hydraulic drawing apparatus comprising a series of three or more dies or curbs of successively reduced cross-sectional area, and a corresponding series of liquid-receiving chambers adapted to receive a liquid under high pressure, said liquid being confined in said chambers by the said dies or curbs.

5. In a hydraulic drawing apparatus, the combination of a container having a liquid inlet, two dies or curbs secured to one end of said container, said dies or curbs being separated by a liquid chamber and having different cross-sectional areas, and a smaller die or curb secured to the opposite end of the container.

6. A hydraulic drawing apparatus comprising a chamber having two curbs of different sizes, one constituting an inlet and the other an outlet passage for metal, means for supplying said chamber with liquid under pressure, and means for moving a metal article through said chamber.

7. A hydraulic drawing apparatus comprising a chamber having two curbs of different sizes, and means for introducing liquid under crushing or reducing pressure into said chamber, combined with a container arranged in alignment with said chamber and curbs, the larger of said curbs constituting the outlet for said container, and means for introducing a liquid under pressure into said container and thereby forcing a metal article therefrom through the hydraulic drawing apparatus.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 27th day of December, A. D. 1893.

JAMES ROBERTSON.

Witnesses:
ARTHUR C. HALL,
JOHN W. THOMAS.