

(No Model.)

J. ROBERTSON.
APPARATUS FOR FORMING METAL ARTICLES.

No. 524,505.

Patented Aug. 14, 1894.

FIG. 1.

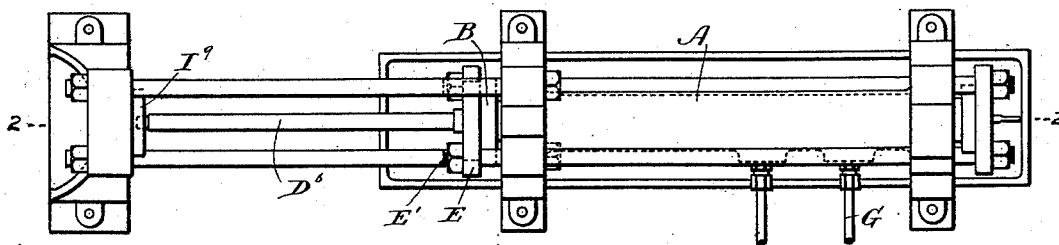


FIG. 2.

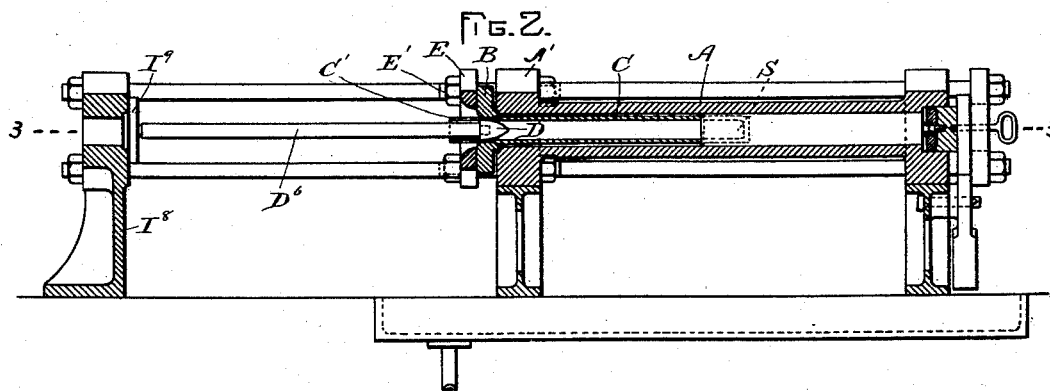
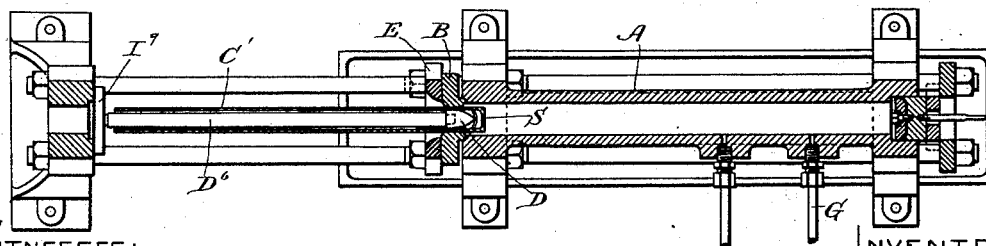


FIG. 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR FORMING METAL ARTICLES.

SPECIFICATION forming part of Letters Patent No. 524,505, dated August 14, 1894.

Original application filed September 30, 1893, Serial No. 486,869. Divided and this application filed February 19, 1894. Serial No. 500,725. (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 is a division of my application for Letters Patent of the United States filed September 30, 1893, Serial No. 486,869. Said application describes certain improvements in the manufacture of metal rods, bars, tubes, tubular articles, plates, and wires, by a drawing operation, a new method being involved, namely, compressing and forming a metal article by confining a blank or partially formed mass of metal at the entrance to a drawing die, and forcing a liquid against said metal under sufficient pressure to push it through the die, and thus impart to the cross-section of the metal the form of the die, the liquid pressure acting to force the metal forward without involving any injury to the completed article or any part thereof by the force used in driving the metal through the die.

The present invention has for its object to provide an organized apparatus for carrying said method into practice, comprising a container having a liquid inlet and an outlet formed as a drawing die, and a fixed mandrel arranged to co-operate with the die in shaping a tubular article from a blank forced through the die, the fixed mandrel being found advantageous for certain reasons, one of which is the utilization of the stem rod of the mandrel as a support for the completed tube after the latter has been ejected through the drawing die, while another is the fact that the mandrel, while supported outside of the container, enables a piston piece to be used in the container to receive the liquid pressure and transmit the same to the blank in forcing the latter through the drawing die. The employment of the piston and of the fixed mandrel enables the apparatus to be used for the production of lap-welded iron tubes in a cold state, as I will now proceed to describe.

Of the accompanying drawings forming a

part of this specification, Figure 1 represents a top plan view of a tube forming apparatus embodying my invention. Fig. 2 represents a section on line 2—2 of Fig. 1. Fig. 3 represents a section on line 3—3 of Fig. 2, a completed tube being shown in Fig. 3, after it has passed through the drawing die.

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

In the drawings, A represents a container or receptacle, of strong construction, adapted to sustain the high pressure of a liquid introduced into it, as hereinafter described. The container is of elongated form, and its interior cavity or chamber is formed to correspond to the general shape of the blank or mass of metal to be drawn. The container has at one end a discharge opening, through which the metal passes. At said opening is located a drawing-die B, which is or may be a plate of suitable metal, such as hardened steel, having an orifice, the walls of which are shaped to give the desired form to a mass of metal forced through the die, as usual in the operation of drawing dies. The die constitutes, in effect, the outlet of the container, it being secured to the container in such manner that when liquid pressure is maintained within the container the only outlet will be through the die.

In the simplest form of apparatus embodying my invention, the die is or may be secured to the container by means of a head or plate E, which is secured by bolts E' to a flange A' formed on one end of the container. The plate E is thus removably attached, so that the die may be at any time removed and another one substituted for it, the die being placed loosely between the flange A' and plate E.

G represents a pipe, communicating with the interior of the container and adapted to conduct a liquid into the same. Said pipe is preferably connected with a hydraulic accumulator loaded to give a sufficiently high degree of pressure to the liquid to cause the latter to push a blank or mass of metal inserted in the container through the die B. There may be two of these pipes as indicated in the drawings.

C represents a tubular blank, which is of

suitable size to be placed in the container, the cross-section of said blank being greater than that of the opening in the die B, so that when the blank is forced through the die by the liquid pressure within the container, the exterior of the blank will be reduced and the entire blank will be elongated into a tube C'.

D represents a fixed mandrel which is formed to closely fit the interior of the tube blank, or made slightly larger than the interior of said blank, in order that the blank may be enlarged internally by the mandrel while it is being reduced externally by the drawing die. Said mandrel is supported by a stem rod D⁶ located outside of the container, one end of said stem rod being engaged with a supporting piece I⁹, which is affixed to a standard or bracket I⁸ at a suitable distance from the die B.

It will be seen that when the blank is in the position shown in Fig. 2, and liquid under a high pressure is introduced into the container, the pressure of said liquid acting upon the blank will force the latter through the drawing die and over the mandrel, the result being that the metal is drawn and elongated into a tube C', which at the end of the operation is left upon the stem rod D⁶ as shown in Fig. 3.

S represents a removable piston, which is placed in the container against the rear end of the blank, and is of a diameter preferably about equal to that of the blank, the rear end of said piston being closed and constituting a head of considerable area, against which the pressure of the liquid is exerted. The piston S enables the drawing operation to be performed with the propelling liquid at a much lower pressure than would otherwise be possible. This arrangement is particularly adapted to the production of lap-welded iron tubes in a cold state. The cross-sectional area of an ordinary lap-welded iron boiler-tube three and one-half inches ($3\frac{1}{2}$ "') in diameter is usually

equal to two (2) square inches. By using the propelling liquid at a pressure of sixteen (16) tons to the square inch, a drawing force or pressure is exerted on the blank of thirty-two (32) tons, which with the forced lubrication caused by the impelling liquid is sufficient to cold-draw lap-welded iron tubes, a result which I believe has not been accomplished heretofore.

I claim—

1. A container, having a liquid-inlet, and an outlet formed as a drawing-die, combined with a fixed mandrel entering the die and supported by a fixed stem-rod outside the container arranged to co-operate with said die in shaping a tubular article from a blank forced through the die.

2. A container, having a liquid-inlet, and an outlet formed as a drawing-die, combined with a fixed mandrel entering the die and having a fixed stem-rod located outside of and in line with the center of the container, so that a tube formed by the movement of a blank from the container through the die will be deposited on the stem-rod, said stem-rod being immovably supported at its outer end.

3. A container, having a liquid-inlet, and an outlet formed as a drawing-die, combined with a fixed mandrel entering the die and having a stem-rod located outside of and immovably supported in line with the center of the container, and a piston-piece adapted to bear on the rear end of the blank and to enter the die and thereby force the completed tube through the die and onto the stem-rod.

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.