(No Model.)

J. ROBERTSON.

APPARATUS FOR THE MANUFACTURE OF METAL TUBES, RODS, &c.

No. 524,507. Patented Aug. 14, 1894.

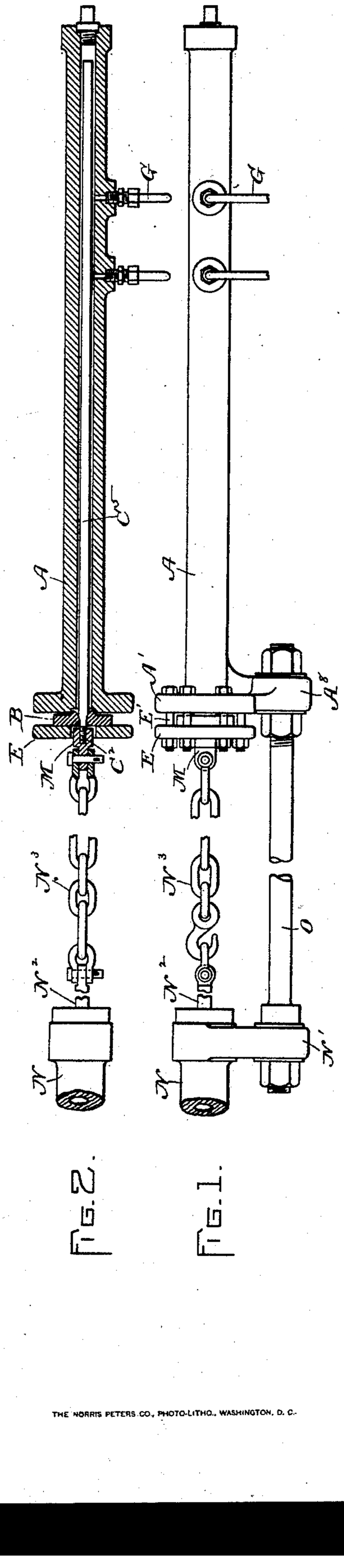

FIG. 2.

FIG. 1.

WITNESSES:
A. D. Harrison
W. F. McLeod

INVENTOR
J. Robertson
by Wright Brown Quinby & Otis
Attys

UNITED STATES PATENT OFFICE.

JAMES ROBERTSON, OF MANCHESTER, ENGLAND.

APPARATUS FOR THE MANUFACTURE OF METAL TUBES, RODS, &c.

SPECIFICATION forming part of Letters Patent No. 524,507, dated August 14, 1894.

Original application filed September 30, 1893, Serial No. 486,869. Divided and this application filed February 19, 1894. Serial No. 500,727. (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 to 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 comprising means for carrying into practice the above-mentioned method, and in addition external means for supplementing the forcing action of the liquid within the container, so that metals requiring the application of more force to move them through a drawing die than could be conveniently applied to either end alone may be drawn or formed by being passed through such a die.

The invention consists in confining a blank at one side of a drawing die of smaller cross-sectional area than the blank, pushing the metal through said die with the direct action of a liquid under pressure, and aiding the movement of the metal by a pulling force exerted in the same direction.

The invention also consists in the combination with a container having a liquid inlet and an outlet formed as a drawing die, of a draft or pulling mechanism outside of the container, and means for connecting the same with the metal being formed.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a side elevation of a portion of a forming apparatus provided with my improvement. Fig. 2 represents a sectional view of the same.

The same letters of reference indicate the same parts in both 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^5 represents a blank, which in this case

may be a solid rod of iron of greater cross-section than the opening in the die, said blank being forced through the die and reduced and elongated thereby, so that it is formed into a solid rod. The blank is forced through the die by the pressure of a liquid introduced under high pressure through the pipe G, aided by an external pulling force. In this case, if the die has an internal diameter of one and one-eighth inches ($1\frac{1}{8}''$), its cross-sectional area will be about one (1) square inch. The internal diameter of the container being one and one-half inches ($1\frac{1}{2}''$), and the diameter of the blank one and three-sixteenths inches ($1\frac{3}{16}''$), liquid pressure of about sixteen (16) tons to the square inch would be suitable, it being preferable to employ a pressure which will not exert a crushing force upon the metal. As the crushing resistance of wrought iron is about eighteen (18) tons to the square inch, a pressure of sixteen (16) tons would be suitable. It will be seen that the liquid surrounds the blank in the container, and is in direct contact with the blank up to the point where the latter touches the die, hence the liquid lubricates the die and the metal passing through it, and thus facilitates the passage and formation of the metal.

If desired, the die and blank may be greased before the operation. For more complete lubrication than can be furnished by the preliminary greasing and by the action of a liquid which is not oleaginous, the impelling liquid introduced through the pipe G may be oil, in which case the great pressure employed would cause the oil to penetrate the metal to some extent, thereby insuring very complete lubrication.

The force of the liquid is supplemented by an external pulling force, which may be exerted by means of a hydraulic piston-rod N^2, connected by a chain N^3 with the forward end of the rod C^5, said forward end being screw-threaded, as at C^2 (Fig. 2), and engaged with an internally-threaded socket M connected to the chain N^3. The hydraulic piston-rod works in a hydraulic cylinder, N, and may be actuated in the usual way to exert a pulling force upon the metal passing through the die. The hydraulic cylinder N is connected to the container by means of a stay-rod O, engaged with lugs N′ and A^8, formed respectively on the cylinder N and container A. By thus uniting two forces in drawing a metal blank through a drawing die, I am enabled to form solid rods of considerable diameter, which could not well be formed by force or pressure exerted at one point only.

I claim—

A container having a liquid inlet and an outlet formed as a drawing die, combined with a hydraulic cylinder, and a piston therefor arranged to pull in the direction of movement of a metal article through said die, and a connecting chain and screw coupling whereby said piston may be connected with said article, said piston being operatively independent of the means for pushing the blank from the container.

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.