

(No Model.)

2 Sheets—Sheet 1.

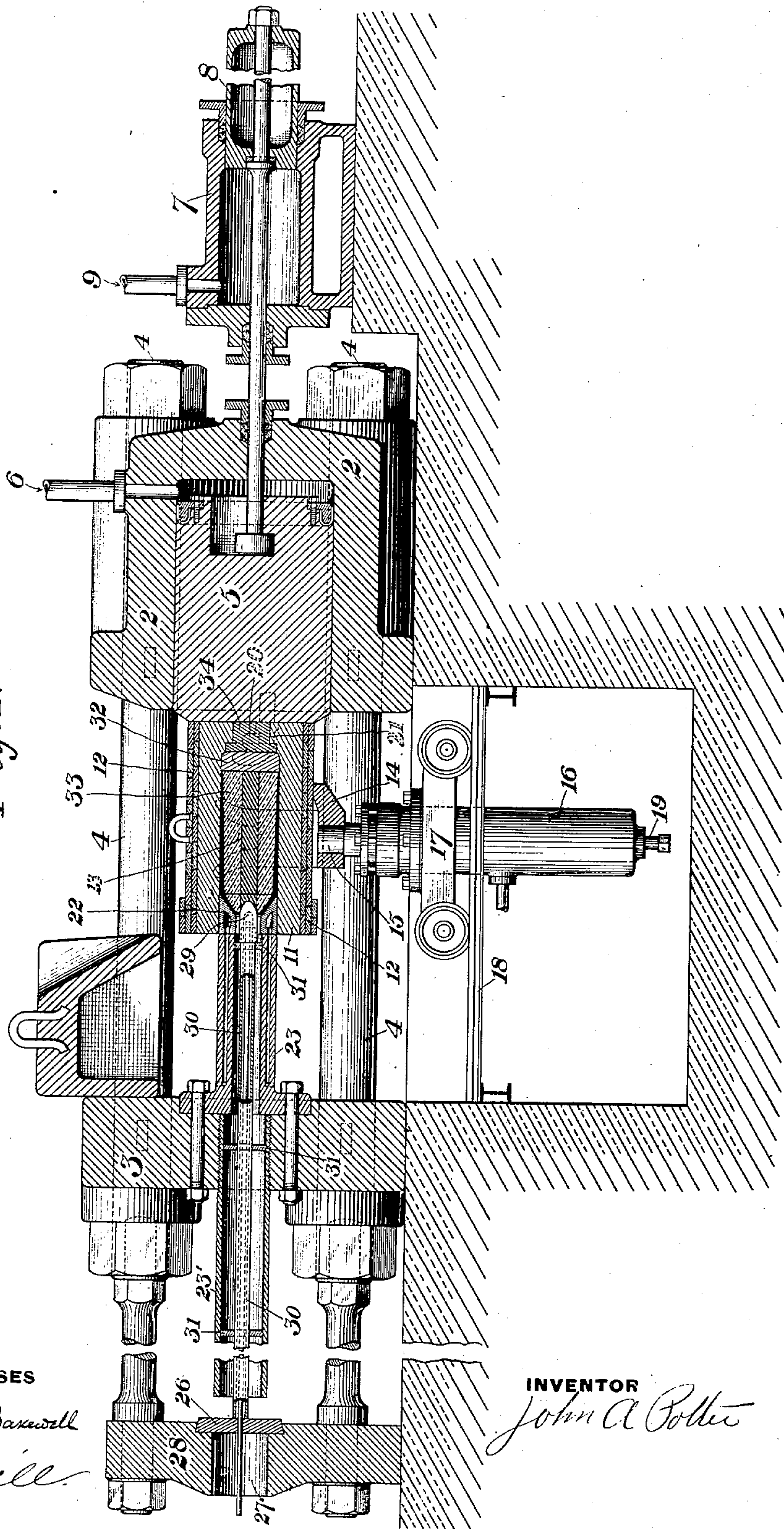
J. A. POTTER.

MANUFACTURE OF HOLLOW METAL ARTICLES.

No. 551,229.

Patented Dec. 10, 1895.

Fig. 1.



WITNESSES

Thomas W. Baxwell
H. L. Gill

INVENTOR

John A. Potter

(No Model.)

2 Sheets—Sheet 2.

J. A. POTTER.

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Fig. 2.

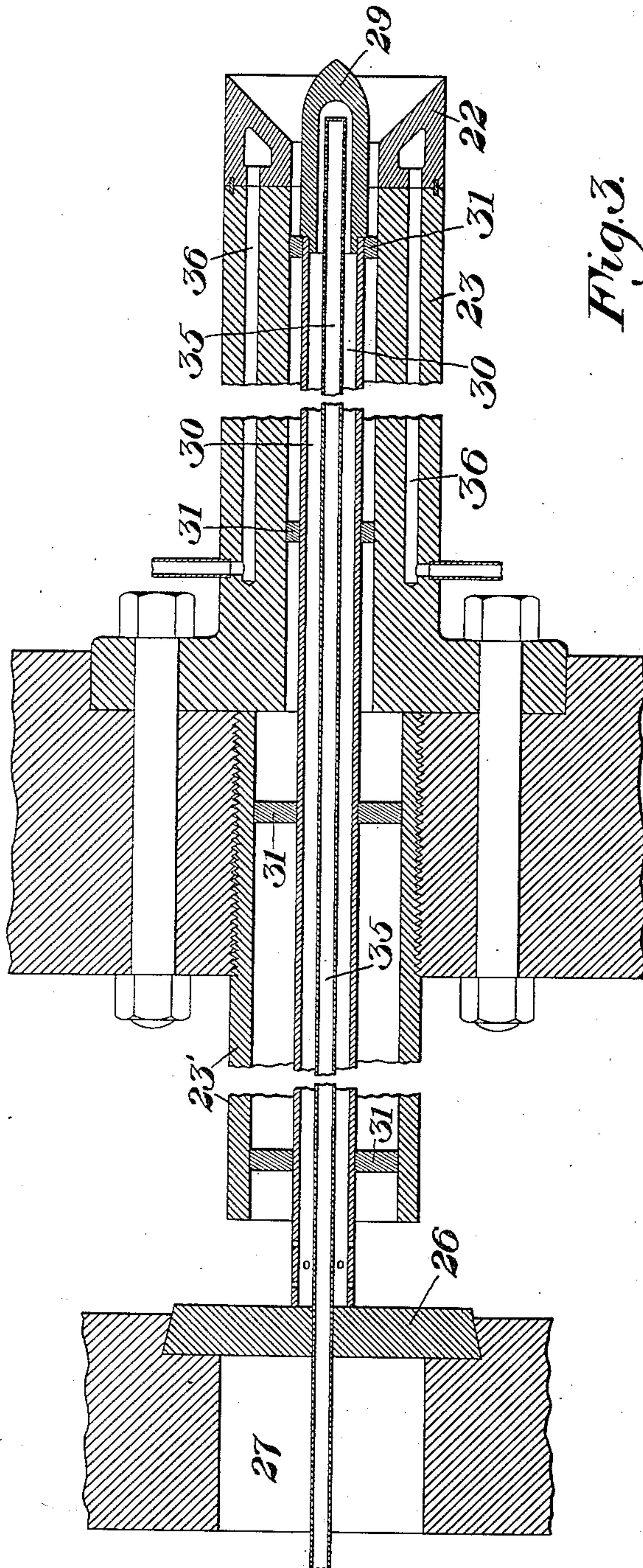
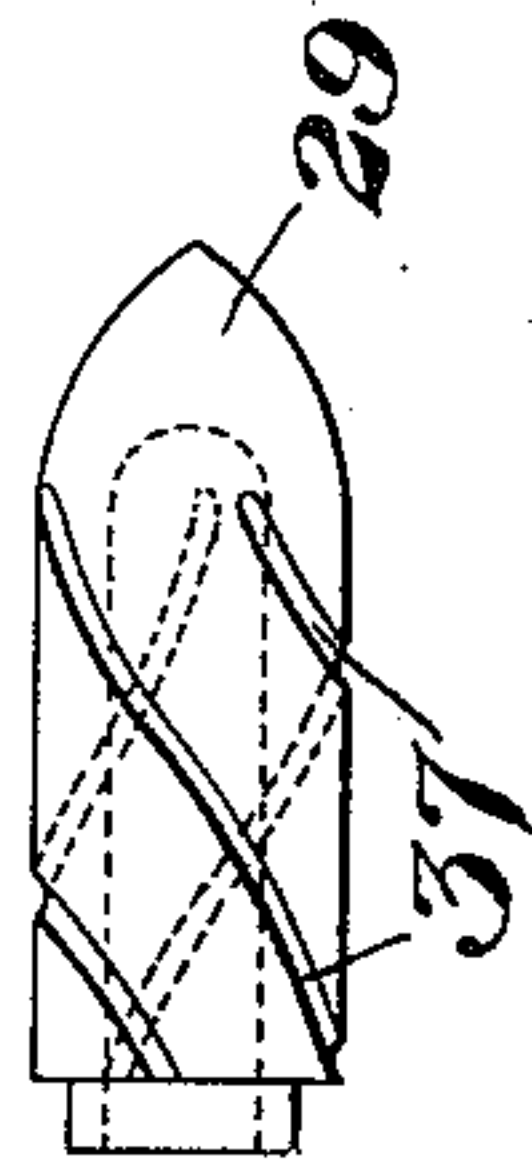


Fig. 3.



WITNESSES

Warren W. Swartz
S. S. Stoddard

INVENTOR

John A. Potter
by M. Baker and
his attys.

UNITED STATES PATENT OFFICE.

JOHN A. POTTER, OF PITTSBURG, PENNSYLVANIA.

MANUFACTURE OF HOLLOW METAL ARTICLES.

SPECIFICATION forming part of Letters Patent No. 551,229, dated December 10, 1895.

Application filed July 29, 1893. Serial No. 481,886. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. POTTER, of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in the Manufacture of Hollow Metal Articles, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 shows my improved apparatus in longitudinal vertical section. Fig. 2 is a detail sectional view of a modification, and Fig. 3 is a side elevation of another form of mandrel.

The object of my invention is to provide means for manufacturing hollow articles of steel or other metals by forcing the same through a shaping-die while in a plastic or reheated condition.

Various kinds and shapes of articles, such as pipes, axles, shafting, and other hollow articles, may be made in accordance with my invention, and the invention is not limited in its application in this respect.

The apparatus which I show is an improvement upon the apparatus described and claimed in my prior patent, No. 498,304, granted on May 30, 1893.

In the drawings, 2 represents the power-cylinder of a machine, which is made of a strong metal casting, and is preferably connected with an end block 3 by tie rods or bolts 4, which serve to brace the machine and to provide for the resistance of strain.

5 is the plunger of the cylinder 2, and 6 is a pipe by which water or other motive fluid is admitted to the cylinder for the purpose of projecting the plunger. The cylinder is single acting, and to retract the plunger I employ a smaller counteracting cylinder 7, whose piston or plunger 8 is connected with the plunger 5, so that when the fluid-supply is cut off from the pipe 6 the pressure of motive fluid from a pipe 9, acting on the piston 8, will serve to retract the plunger 5 and displace the water from the cylinder 2.

11 is the receptacle for containing the steel or other metal to be compressed and shaped. It consists of a hollow mold-like cylinder,

which may be encircled by strengthening-bands 12, of iron or steel, and which is open at the front end and closed at the rear end. At its opposite sides it has pins or trunnions 13, and it is adapted to sit in a cradle 14, in which it is supported by the fitting of the trunnions in suitable forks. The cradle is swiveled to and supported by the end of the upright plunger 15 of a cylinder 16, which is carried by a truck 17, movable on a track 18. The lower end of the cylinder 16 may be provided with an adjustable stop 19, which limits the extent of downward motion of the plunger 15.

The drawings show the parts of the apparatus in operative position. The mold-cylinder 11 then rests upon the cradle 14, its rear end fits against the end of the plunger 5, and it is connected therewith by pins 20, which fit on hooks 21 projecting from the plunger.

22 is a hollow die which fits in the forward end of the mold-cylinder. It flares internally and is made of proper diameter and shape to effect the reduction of metal to the required dimension.

23 is a hollow guide box or cylinder set in advance of the die 22 and secured to the end block 3 in line with the axis of the mold-cylinder, so that it shall register with a passage in the end block. The bore of the guide-cylinder is of somewhat larger diameter than the cavity of the die against which it bears and to which it serves the function of a stationary resistance plate or plunger. In using the word "plunger" to describe this part I intend to indicate that it may be constructed in the manner illustrated or in any other manner adapted to afford resistance to the die, whether the same be merely a passive resistance or whether it be adapted to force the die into the mold-cylinder. The guide box or cylinder 23 has an extension 23' of somewhat larger diameter screwed into or otherwise detachably secured to the end block 3, and opposite to the open outer end thereof is a gate or block 26, which fits removably over a window 27 in an end block or head 28.

29 is a mandrel, preferably of conical or tapering form, which, when the apparatus is

in action, fits centrally within the die, and has a rod or shank 30, which extends axially therefrom and abuts at its end against the gate 26, which is then slid into position over the window 27. The rod 30 is centered in position by means of guide-rings 31, which fit around the same within the guide-box 23 and 23', and are movable lengthwise within said box by the flowing metal after it has been ejected from the die, as hereinafter described.

As thus constructed, the operation of the apparatus is as follows: Before setting the mold-cylinder into the machine and while it is in an upright position, I place in its rear end the small charge 32 of refractory clay, which is intended to serve the purpose described in my prior patent, No. 498,304, and I then cast or place within the cylinder above the clay a hollow ingot 33. Then while the metal is highly heated, (either reheated or partially solidified from its original molten state,) but is sufficiently solid to permit the mold-cylinder to be placed on its side without bleeding, I suspend it from a crane and lower it into position upon the cradle 14, as shown in the drawings. Before placing the mold-cylinder in the cradle the latter may be raised by elevating the plunger 15, and may then be lowered by exhausting the water from the cylinder 16. The parts are then in the position shown in the drawings, the mold-cylinder being connected with the plunger 5 and the guide-cylinder 23 being in register with the annular die 22. The mandrel 29 is then placed in position within the die, as shown in the drawings and as above described. The metal within the mold-cylinder is preferably cast before it is placed therein and is made hollow, having a longitudinally-extending bore in its axis. For the purpose of preventing excessive wear on the mandrel and lubricating it in its action upon the metal, I prefer to place within the hole of the ingot a charge of black lead, soapstone, or other substance or mixture which is both refractory and lubricant in its properties, and which may be charged into the ingot before the mold-cylinder is placed in the apparatus. This lubricant material serves to retard the chilling of the inside of the ingot and prevents the ingot from cutting or sticking to the mandrel. Lubricant material may also be placed in the mold-cylinder around the sides of the ingot in the manner described in my patent application, Serial No. 481,272, filed July 24, 1893. The parts being in the position above described, water is admitted into the cylinder 2 and projects the plunger 5, which, bearing on the mold-cylinder, moves it forwardly over the die 22 and over the guide-cylinder 23. This subjects the metal in the mold-cylinder to powerful compression, and forces it through the die in the annular space around the mandrel 29, causing it in its passage to assume the form of a hollow cylinder which is delivered as it is formed into the guide-box 23 23', through

which it travels easily over the rod 30 because of the greater diameter of the guide-box than that of the die. As the end of the flowing metal reaches the rings 31, it pushes the rings along on the rod before it. The projection of the plunger 5 may be continued until the metal has been entirely ejected from the mold-cylinder, the residue remaining in the die being displaced by the refractory material at the inner end of the mold-cylinder, as explained in my prior patent above referred to. When the operation is thus completed, the plunger 5 is retracted by the counteracting cylinder 7, thereby pulling the mold-cylinder back from the guide-cylinder 23, and leaving the pipe or other hollow article resting in the latter cylinder. The gate 26 may then be moved back and the pipe withdrawn, stripping it from the rod 30 through the window 27. The mold may then be lifted by the cylinder 16, taken out from the machine, another mold-cylinder substituted, and the operations above described repeated in the manufacture of different articles.

In order to provide for the convenient removal of the die from the mold-cylinder after the latter has been taken from the apparatus, I prefer to provide the rear end of the mold-cylinder with a hole in which I fit a removable plug 34, this plug being movable inwardly so that on applying pressure thereto it will force the die out to the front end of the mold-cylinder.

For the purpose of water-cooling the mandrel, I may place a pipe 35 within the rod 30, as shown in Fig. 2, the water being conducted to the mandrel and then back through the rod 30 around the water-pipe. The die may also be cooled by suitable water-passages 36, as shown.

To manufacture hollow articles with non-circular surfaces or interiors, I may shape the mandrel and the die correspondingly. For example, by providing the mandrel with spiral grooves 37 as in Fig. 3 and setting it on the rod 30 so that it may rotate thereon, I may make a pipe or hollow metal article with an internal spiral. Other modifications will suggest themselves to those skilled in the art.

I claim—

1. In apparatus for the manufacture of hollow articles, a receptacle for the metal to be shaped, a die through which the metal is ejected from the receptacle, a core around which the metal is ejected, and a body of solid lubricating material within the receptacle; substantially as described.

2. An improvement in the art of making hollow articles, which consists in placing a hollow body of metal within a suitable receptacle, applying a lubricant within the cavity of the metal, and forcibly ejecting the metal through the die-cavity and over an external core; substantially as described.

3. In apparatus for the manufacture of hol-

low articles, a receptacle for the metal, a die
through which the metal is ejected from the
receptacle, a mandrel which projects into the
die toward the interior of the receptacle, a
5 guide-box or cylinder, and movable centering
supports for the mandrel contained therein;
substantially as described.

In testimony whereof I have hereunto set
my hand.

JOHN A. POTTER.

Witnesses:

W. B. CORWIN,

H. L. GILL.