(No Model.) 3 Sheets—Sheet 1.

J. A. POTTER.

APPARATUS FOR SHAPING STEEL.

No. 498,304. Patented May 30, 1893.

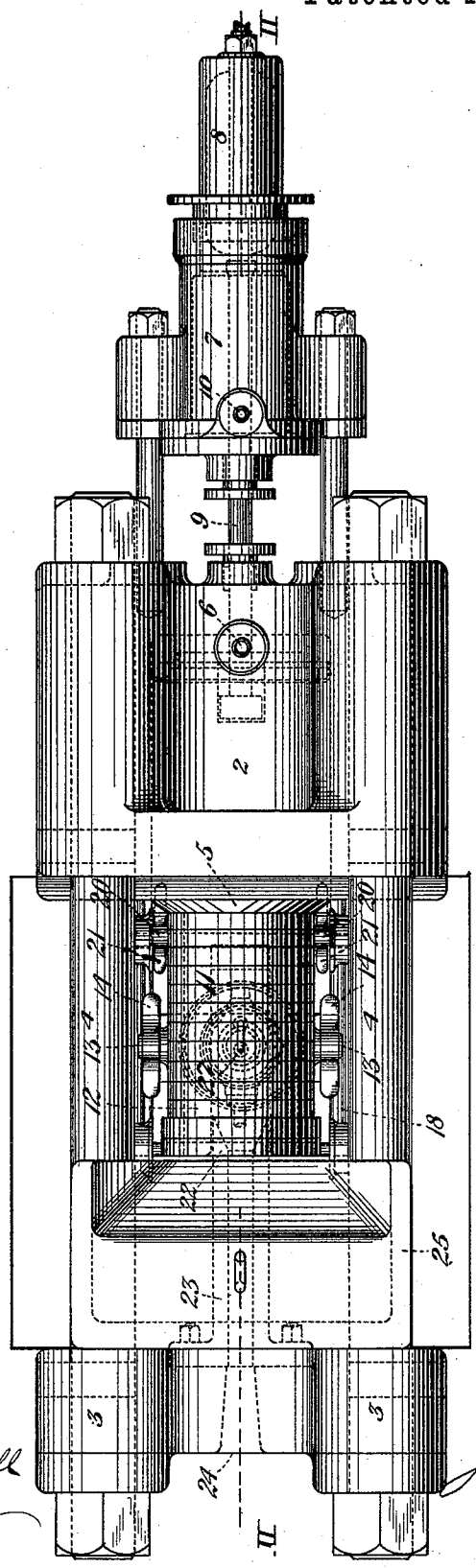

Fig. 1.

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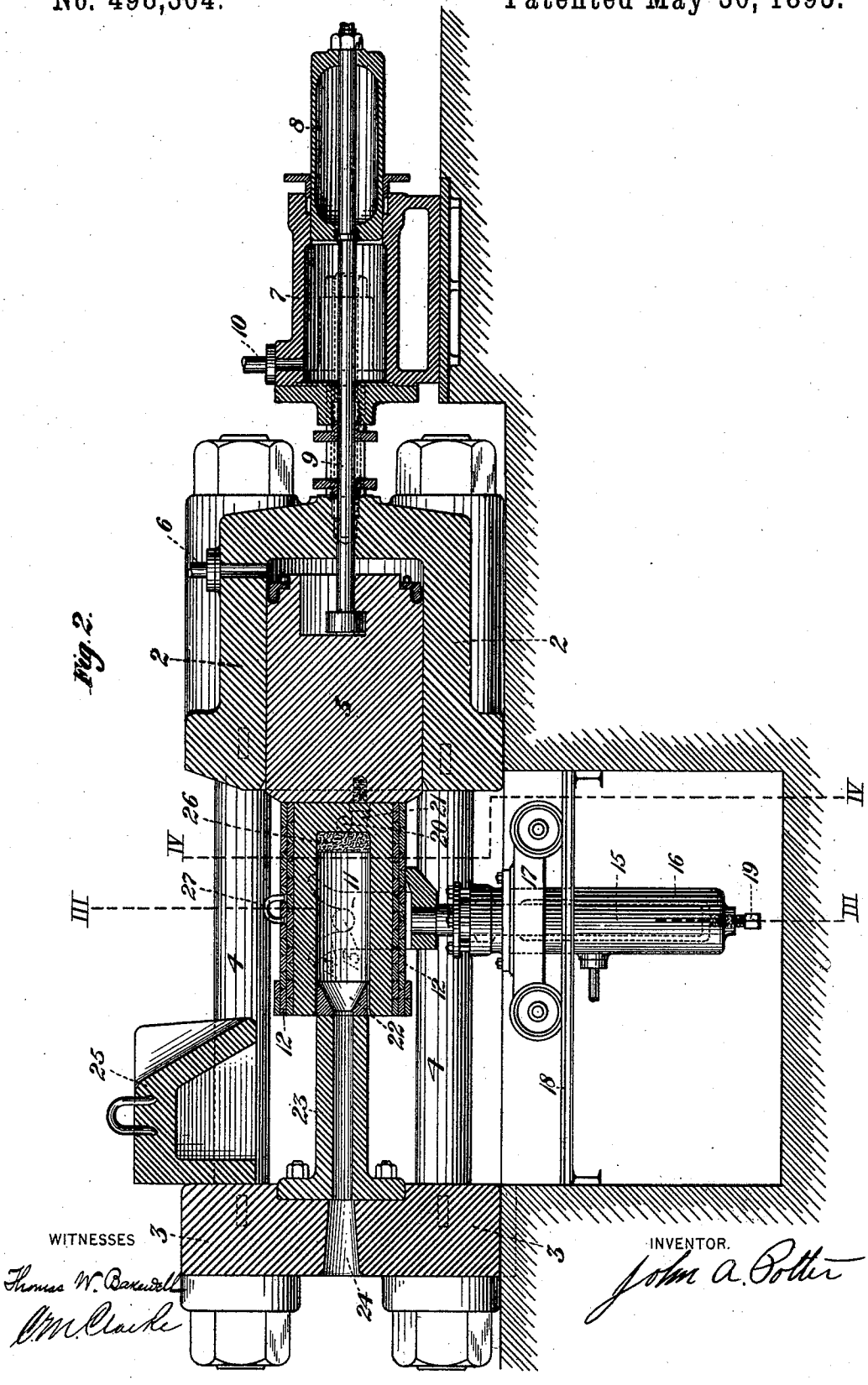

Fig. 2.

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Fig. 4.

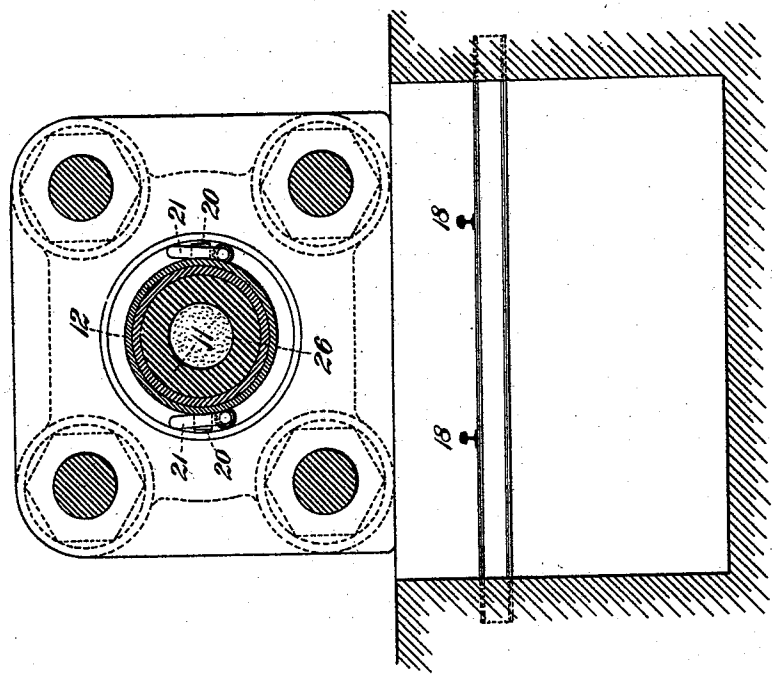
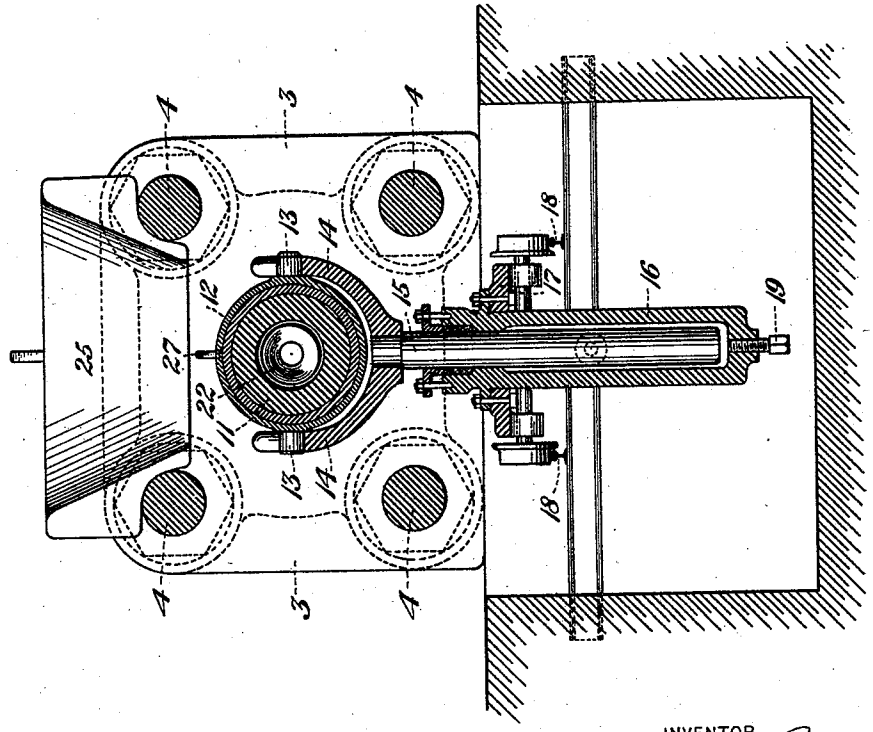


Fig. 5.



WITNESSES

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UNITED STATES PATENT OFFICE.

JOHN A. POTTER, OF MUNHALL, PENNSYLVANIA.

APPARATUS FOR SHAPING STEEL.

SPECIFICATION forming part of Letters Patent No. 498,304, dated May 30, 1893.

Application filed March 26, 1891. Serial No. 386 514. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. POTTER, of Munhall, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Apparatus for Shaping Steel, of which the following is a full, clear, and exact description.

My invention is designed to afford efficient means by which steel can be reduced directly into the form of bars or rods of suitable cross-section, by forcing it while in a plastic state through a die. In the use of my improvement I take steel while molten and pour it into a mold-cylinder from which, after it has partly solidified but while still plastic, it is ejected through the die. I thus avoid the labor, waste and expense of casting the steel into ingots, reheating and rolling them to merchantable shapes.

I shall now describe my invention with reference to the accompanying drawings, in which—

Figure 1 is a plan view of my improved machine. Fig. 2 is a vertical section on the line II—II of Fig. 1. Figs. 3 and 4 are vertical cross-sections on the lines III—III and IV—IV of Fig. 2, respectively.

In the drawings, 2 represents the motive cylinder, which consists of a strong casting and is preferably connected with an end block 3 by tie-rods or bolts 4.

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 to actuate the plunger. The cylinder 2 is single acting, and for the purpose of retracting its plunger I employ a smaller counterbalancing cylinder 7, having a plunger 8 provided with a rod 9, which passes through the cylinder 2 and is flexibly coupled to the plunger 5, as shown in Fig. 2.

10 is a pipe by which water is admitted to the cylinder 7.

11 is the cylinder for containing the steel 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, (Fig. 3) in which it is supported by the fitting of the trunnions in forked portions of the cradle. 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.

Fig. 2 shows the parts of the apparatus in operative position. The mold-cylinder 11 then rests on the cradle 14, its rear end fits against the end of the plunger 5, and it is connected therewith by pins 20 on the cylinder which fit on hooks 21 projecting from the plunger. Fitting in the end of the mold-cylinder is a hollow die 22, flaring internally and made of proper diameter and shape to effect the reduction of the metal to the dimensions required. In advance of the die 22 is a hollow guide-cylinder 23, which is secured to the end block 3 in line with the axis of the mold cylinder 11, and registers with a passage 24 in the end-block. The bore of the guide-cylinder 23 is of somewhat larger diameter than the largest portion of the die. It bears against the die and serves thereto the function of a stationary resistance post or plunger. I shall use in the claims the word plunger to designate this part, whether constructed in the manner illustrated, or in some other manner adapted to act by affording resistance to the die, whether the same be a merely passive resistance, or whether it be adapted to move to force the die into the mold-cylinder. Above the guide-cylinder 23 is a guide block 25, having an inclined face adapted to guide the mold-cylinder into position as hereinafter explained.

The operation of the apparatus is as follows:—Before setting the mold-cylinder in the machine and while it is in an upright position, I place in its rear end a small charge of refractory clay 26, and I then pour into the cylinder above the clay a charge of molten steel and place in the end above the steel the annular die 22. Then when the steel has so far solidified as to permit the mold-cylinder to be placed on its side without bleeding, I suspend it from a crane by means of lugs 27 and lower it into position on the cradle 14, as shown in Fig. 2, the block 25 serving to guide it into place. Before depositing the mold-

cylinder in the cradle, the latter may be raised by elevating the plunger 15, and may then be lowered into the position shown in Fig. 2 by exhausting the water from the cylinder 16. The parts are then in the position shown in Fig. 2, the mold-cylinder being connected with the plunger 5, and the guide-cylinder 23 being in register with the annular die 22. When the metal in the mold-cylinder has solidified somewhat, but while it is yet hot and plastic, water is admitted to the cylinder 2, the effect of which is to project the plunger 5 and to advance the mold-cylinder 11, carrying with it the truck 17 and cylinder 16. As the mold-cylinder advances it passes over the guide-cylinder 23, and the pressure thereby exerted upon the metal contained in the mold-cylinder displaces the same and causes it to flow through the die 22 and through the guide-cylinder 23. The die shapes the metal to the form of a bar of cross-section corresponding to that of the opening of the die whether it be round, square or of other shape. As it emerges from the opening 24, the bar thus produced will be received on a suitable support or table. When the rear end of the mold-cylinder reaches the annular die, the body of clay 26 is forced thereinto and displaces the plug of metal at the mouth of the die, thereby ejecting the metal entirely into the guide-cylinder. This is important because otherwise the metal would solidify in the die and would be very difficult to remove. When the metal has been entirely displaced from the mold-cylinder, the plunger 5 is retracted, thereby restoring the parts to the position shown in Fig. 2. Then by admitting water into the cylinder 16, the cradle 14 is elevated and the mold-cylinder is lifted above the apparatus and may be removed by the crane.

The machine thus constitutes an efficient means for shaping steel rapidly and without the labor incident to the usual method of casting a steel ingot and subsequently reducing it by rolling. By varying the cross-sectional shape of the forming-die, bars of a variety of shapes may be produced, and, if desired, instead of having but one opening in the die, there may be several such openings adapted to produce several bars of steel at once.

The advantages of my invention will be appreciated by those skilled in the art. By moving the mold-cylinder over the die instead of forcing the metal by a plunger through the mold-cylinder and into the die, I am enabled to displace the steel without excessive friction, and I thereby increase the efficiency of the apparatus and diminish the power necessary to be employed. The use of the body of refractory material as an agent for rejecting the residue of metal from the mold-cylinder is of advantage for the reasons above indicated, and the general construction of the apparatus is also remarkably good. By using jointed connections between the rod 9 and plunger 5, and between the mold-cylinder and cradle, and between the mold-cylinder and the plunger, the mechanism operates without the danger of binding and breaking which, by reason of inequality of construction or expansion by heat, would otherwise be present.

Various modifications of construction of the apparatus within the scope of the invention as stated in the claims will suggest themselves to those skilled in the art. Instead of charging molten steel into the mold cylinder, I may insert therein re-heated steel blooms, though this is not so desirable.

I claim as my invention and desire to secure by Letters Patent—

1. In apparatus for shaping steel, a mold-cylinder adapted to receive a charge of steel, an apertured die, means for forcing the metal through the die, and a compressible refractory charge located in the bottom of the mold-cavity; substantially as and for the purposes described.

2. In apparatus for shaping steel, a mold-cylinder adapted to receive a charge of steel, a die having a mouth tapering to substantially the size of the mold aperture movable within the mold-cylinder, a cradle for upholding the mold-cylinder, a cylinder and plunger carrying the cradle and movable across the end of the die and means for forcing the cylinder over the die; substantially as and for the purposes described.

3. In apparatus for shaping steel, a mold-cylinder adapted to receive a charge of steel, an apertured die movable within the mold-cylinder, a cradle for upholding the mold-cylinder a cylinder and plunger for elevating the cradle, a truck by which said cylinder and plunger are carried; and means for forcing the cylinder over the die, substantially as and for the purposes described.

4. In apparatus for shaping steel, a mold cylinder adapted to receive a charge of steel, an apertured die movable within the mold-cylinder, a cradle for upholding the mold-cylinder, a cylinder and plunger for elevating the cradle, and guide 25; located above the die, and means for forcing the cylinder over the die substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 23d day of March, A. D. 1891.

JOHN A. POTTER.

Witnesses:

A. C. DINKEY,

W. H. CORBETT.