(No Model.) 2 Sheets—Sheet 1.

W. McELROY.

Method of and Apparatus for Casting Metals.

No. 238,515. Patented March 8, 1881.

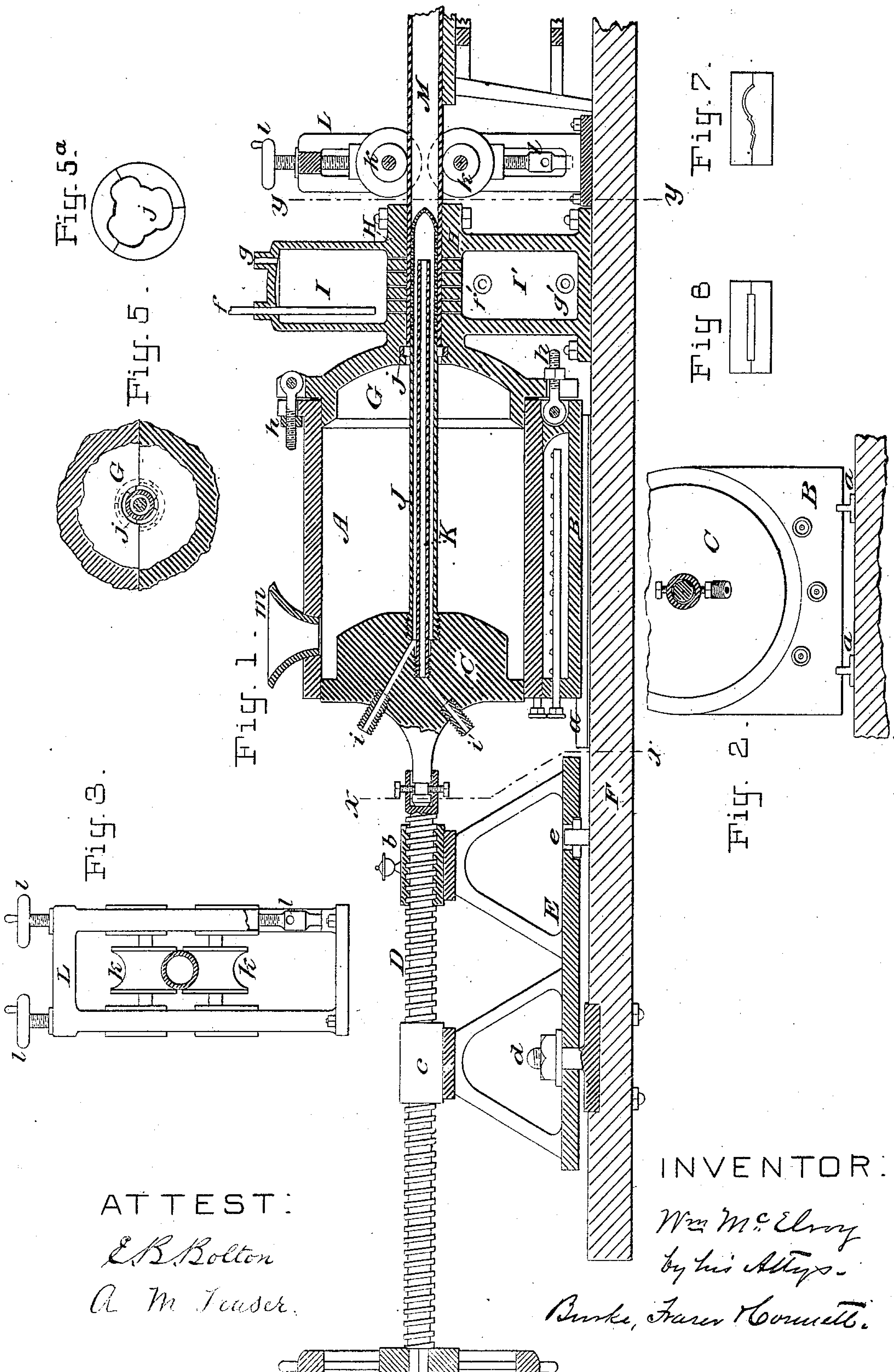

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Fig. 4.

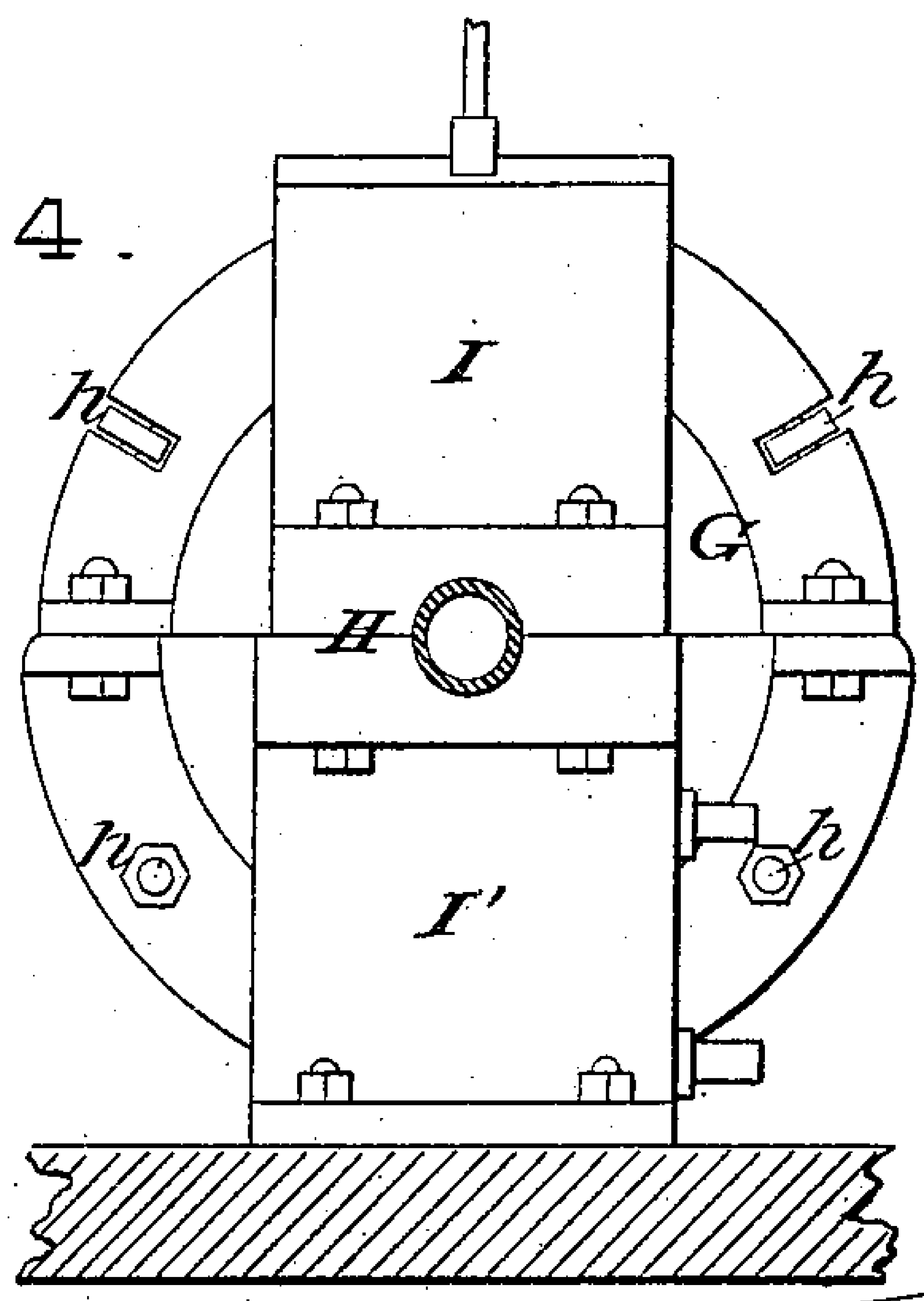


Fig. 8.

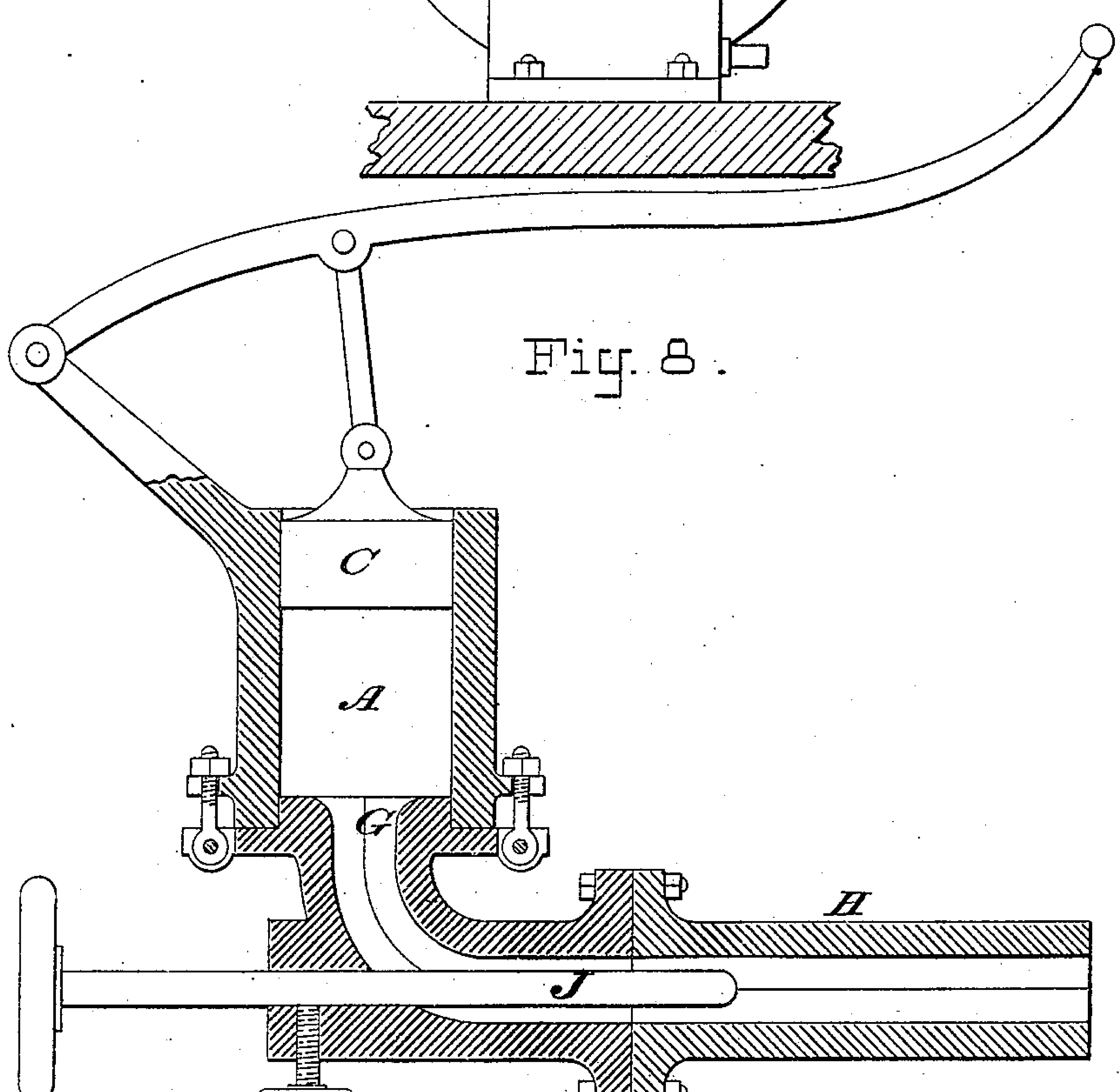
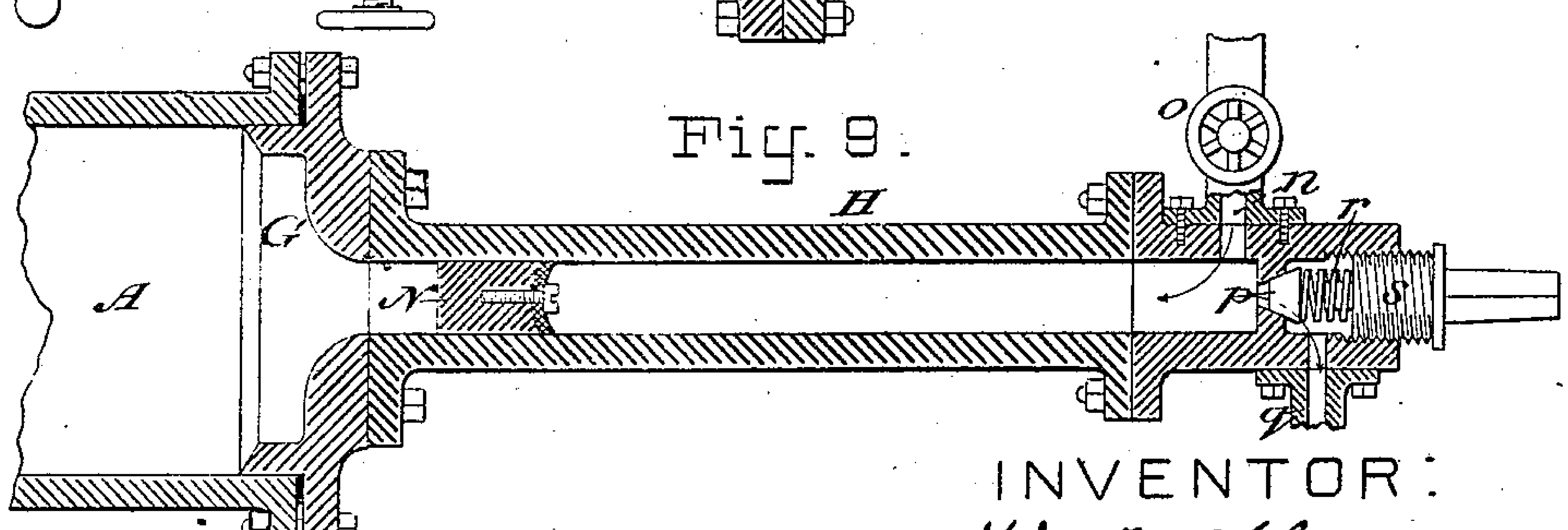


Fig. 9.



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UNITED STATES PATENT OFFICE.

WILLIAM McELROY, OF BROOKLYN, NEW YORK, ASSIGNOR OF TWO-THIRDS TO THOMAS McELROY AND MATTHEW McELROY, OF SAME PLACE.

METHOD OF AND APPARATUS FOR CASTING METALS.

SPECIFICATION forming part of Letters Patent No. 238,515, dated March 8, 1881.

Application filed October 4, 1880. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM McELROY, a citizen of the United States, residing in Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Methods of and Apparatus for Casting Metals, of which the following is a specification.

This invention relates, in part, to a method of casting continuous articles—such as piping, rods, moldings, &c.—from fluid molten metals through the medium of a cylinder or holder, a piston to force the molten metal through a mold or die, and the said mold or die.

My invention is intended for molding any metal which is solid at ordinary temperatures, as steel, iron, brass, and the softer metals, and is adapted to produce rods, pipes, moldings, or plates of almost any length, but having a uniform sectional contour.

I am aware that it is not new to force molten metal into molds and through dies to form both small articles and articles of continuous lengths, as pipes, &c. I am also aware that pipes and other continuous articles are formed by pressing soft non-molten metal through dies; and I am further aware that forcing apparatus consisting of a cylinder and piston has been employed in producing castings by these methods.

My invention consists in the specific features hereinafter set forth and claimed.

In carrying out my invention the apparatus will, of necessity, vary in some respects, according to the article to be cast—as, for example, the dies will be varied to suit the form of the article—and where hollow articles (as tubes or pipes) are to be cast a core will be required, as in making lead pipe in the ordinary way. In casting most articles, especially those of considerable weight, I employ a water-jacket over or forming a part of the mold or die, while for very thin or light articles this may be dispensed with.

In the drawings, which serve to illustrate my invention, Figure 1 is a longitudinal vertical mid-section of my apparatus arranged for casting large tubes. Fig. 2 is a partial end view of the cylinder, being a section taken on the line *x x* in Fig. 1. Fig. 3 is an elevation of the clamping guide-rolls, being a section taken on the line *y y*, Fig. 1, looking to the right; and Fig. 4 is an elevation of the cylinder, water-jacket, and die, being a section taken on the line *y y*, Fig. 1, looking to the left. Fig. 5 is a detail view, showing the guide for the core arranged in the head of the cylinder; and Fig. 5ª is a detached view of the same. Figs. 6 and 7 are end views of dies for making moldings and plates; and Figs. 8 and 9 are modifications, which will be more particularly referred to hereinafter.

Let A represent a cylinder or holder for the molten metal, provided with a heating-chamber, B, wherein may be burned gas, oil, or other combustibles. This device is employed to keep the metal hot. The cylinder and its heating-chamber are preferably mounted on ways *a a*, on which it may be moved longitudinally when desired.

C is a piston, which fits into the cylinder A, and to this piston is coupled a screw, D, arranged in the prolonged axis of the cylinder, and having a nut, *b*, and bearing *c*, both mounted on a bed, E. To enable the screw to draw back the piston as well as advance it, I prefer to employ the simple device shown in Fig. 1, which consists of a boss on the piston arranged to enter a socket in the end of the screw, and one or more set-screws arranged to pass through the shell of said socket and enter a groove in the boss, as clearly shown. The bed E is pivoted to the base or bed plate F by means of a pintle or stud, *d*, and may be provided with a track roller or wheel, *e*. This construction enables the operative to turn the screw around out of the way when it is uncoupled from the piston.

G is the cylinder-head, H the die or mold, and I I′ the water-jacket around the same. These several parts are shown as made in one piece; but each may be cast or made separately and then bolted together.

By reference to Fig. 4 it will be seen that the upper half of the head and die and the jacket I are made in one piece and the lower half of the head and die and the jacket I′ are in one piece, the two parts being bolted together and the line of the joint being horizontal. This construction is important, as in most cases it will be necessary to separate the two parts after the casting is completed to remove the "heel" or chilled metal still attached to the casting and inside of the cylinder. Therefore I deem it best where a water-jacket is employed to make it in two parts, as I and I', and supply them with separate inlet and outlet water-pipes *f f'* and *g g'*, respectively, as shown. To get the full benefit of the cold water I prefer to admit the water close to the die and allow it to escape at a distance therefrom, as shown.

The jacket I' being bolted firmly to the bed-plate F and the die and head being connected with the same, it will be seen that the said head is practically a fixture, while the cylinder A is adapted to be moved longitudinally to or from it, the attachment of the two being made by the bolts *h h*. For convenience and facility of operation the bolts may be hinged or pivoted in one of the parts, so as to be turned aside, the nut being employed to make the joint tight and hold the parts more firmly together.

J is a hollow core, closed at its free end, and preferably rounded at its tip. The butt of this core is fixed to the piston, and it contains an inner tube, K, which is open at its free end, and also attached to the piston. A water-inlet, *i*, connects through the piston with the rear end of the core, and a water-outlet, *i'*, connects with the inner tube, K. By means of this arrangement a circulation of cold water or other liquid may be kept up through the core during the operation of casting, when desired or when necessary. Where the castings are heavy the tip of the core beyond the cylinder-head may be perforated, as shown, to give the inclosed water or other liquid access to the casting in the die, and the die itself may be also perforated, to allow the water or other liquid in the jackets I I' to reach the casting. The core is guided in its passage through the head G by means of a guide-ring, *j*, (best shown in Figs. 1, 5, and 5[a],) which is made in segments and fitted into a groove cored out around the central opening in the head. This guide steadies the core, but permits the molten metal to pass freely.

Referring to Figs. 1 and 3, *k k* are compression and guide rolls, arranged to play in a frame, L, and provided with adjusting-screws *l l* at both top and bottom.

I plate, by preference, the inner face of the die and cylinder-head, the cylinder, and the core with platinum, to preserve them against the injurious effects of the heat from the molten metal.

Having thus far described my apparatus as arranged for casting a pipe or tube, I will now describe its operations.

The screw D is uncoupled from the piston and turned aside on the pintle *d*. The piston is removed and its inner face washed with a mixture of clay and plumbago, if desired. The cylinder and core are also, by preference, coated in the same way, and the piston again inserted and the screw D coupled on. A section of pipe, M, of the same size as that to be cast is now inserted between the rolls *k k* and into the die H until its end reaches the guide *j*, when the rolls are adjusted up to it until it is clamped fast. Cold water is now forced into the water-jackets and the core, and the cylinder heated by means of the combustibles in the chamber B. All being now ready, the molten metal is poured into the cylinder at the inlet *m* until the cylinder is nearly full, when the piston is run down upon it by means of the screw D, care being taken not to have the cylinder too full, or some portion of the metal may escape at the inlet *m* before the piston advances far enough to close or cut off said opening. When the piston has advanced far enough to exert the required force upon the metal to insure the solidity of the casting, the rolls *k k* may be slightly loosened until the molten metal will force the pipe M back, and then the piston may be gradually forced down to the head G. By the time the end of the tube being cast reaches the outer end of the die it will be sufficiently chilled to be rigid, and by the time it reaches the rolls the section M will not be required, and may be removed. The rationale of this process is, that the molten metal in the cylinder, being in a highly-heated and fluid condition, passes readily, under pressure, into the die, and therein assumes the form of the same. As it passes on through the die it becomes gradually cooled and hardens until it issues at the other end as a firm and solid casting. Being still hot, however, and liable to bend or warp, I employ the rolls *k* to serve both as a guide and check. This retardation tends to consolidate the metal and produce a better casting than that made in the usual way. The slight shrinkage in cooling allows the casting to pass freely through the dies. When the piston has been driven home the casting is cut off beyond the dies and the "heel" removed by separating the upper and lower halves of the die and cylinder-head, the latter having been first detached from the cylinder and the cylinder moved out of the way.

When the dies and core, or either, are perforated to admit the water to the casting, I prefer to force the water in under some pressure, when it serves as a lubricator as well as a refrigerant; or I may employ, in lieu of water, oil or oil mixed with plumbago or lamp-black for the purpose of lubrication.

In casting plates, rods, moldings, or other articles not of a tubular nature, the core J will, of course, be unnecessary.

In Figs. 6 and 7, respectively, I have shown dies for casting a plate and a molding of thin metal. In casting such articles the rolls *k k* and the section M will, of course, be made to correspond. These elements, as herein shown, are designed only for a pipe of a given size.

In casting very light articles from metals which melt at comparatively low temperatures no water-jacket may be needed over the die.

In Fig. 8 I have shown a modification of my apparatus in which the axis of the cylinder is arranged at an angle to the axis of the die and the core is not attached to the piston. In this case I have also substituted lever for screw power.

In Fig. 9 I have shown a means of casting rods or tubes of limited lengths according to my process. In this construction the retarding medium is a packed piston, N, which fits snugly in the die H.

In operating this device water or other liquid is forced into the die at the inlet *n* until the piston N is driven up to the junction of the die with the head G, and then the ingress is cut off by means of the valve *o*. When the metal is forced into the die the piston N is forced back and the fluid behind it driven out through a valve-opening closed by a valve, *p*, whence it eventually escapes at the outlet *q*. The desired compression on the metal of the casting is attained by means of a spring, *r*, behind the valve, and by having an adjustable screw-plug, *s*, behind the spring.

I am aware that in molding small articles according to this method a refractory plug driven before the advancing column of molten metal has been employed to retard its advance, and am also aware that an annular enlargement on the extremity of the advancing core has also been employed for the same purpose. Neither of these, however, is susceptible of being regulated. The plug may stick or may suddenly give way, while the core must advance as fast as the piston and the metal, and can exert no regulated retarding force, as in my device. Where a "sinking head" is employed in lieu of a piston the effect is the same. The pressure will vary with the head and fall with it.

Having thus described my invention, I claim—

1. The method of casting articles herein described, which consists in forcing molten metal through an open-ended die against a regulated yielding resistance, whereby the metal of the casting may be consolidated to the proper extent, substantially as set forth.

2. A mechanism for casting articles from molten metals, consisting of a forcing mechanism, an open-ended die connected therewith, through which the metal may be forced continuously, and a means for resisting the too rapid flow of the metal through the die, consisting of a piece of metal or other refractory material which fits the opening in the die, the outer or free end of which is clasped between griping-rolls, all combined and arranged substantially as set forth.

3. The combination of a cylinder to contain the molten metal, a piston and forcing mechanism to force it out, a water-jacket connected with said die, rolls *k k*, arranged to be adjusted to and from each other, and a retarding-piece, M, to be grasped by the roller *k*, all arranged substantially as set forth.

4. A mechanism for casting tubes or pipes from molten metal, provided with a metal-forcing mechanism, a tubular die, and a hollow core arranged to be traversed by a current of water, whereby it may be kept cool, substantially as set forth.

5. The combination, with the cylinder, piston, and die, of the tubular core J, the inner tube, K, the inlet *i*, and outlet *i'*, all arranged substantially as set forth.

6. The combination, with the cylinder, of the cylinder-head and die, made in halves and adapted to be separated for the removal of the casting therefrom, substantially as set forth.

7. The combination of the cylinder A, mounted on ways and arranged to be moved on same longitudinally, with the head G, made in halves and attached to the cylinder by bolts *h h*, and fixed to the die, the die H, made in two parts and fixed to the head G, the bed-plate F, the water-jacket I', fixed to the bed-plate and to the die, and the jacket I, mounted on the upper half of the die, all arranged substantially as set forth.

8. The bed E, mounted on the pintle *d*, and provided with a track-wheel, *e*, and bearings for the screw, in combination with the screw D, the cylinder A, and the piston C, all arranged substantially as set forth.

9. The combination, with a perforated die, of a water-jacket arranged to cover the perforations in said die, whereby the water or other liquid from the jacket may penetrate to the casting in the die, substantially as and for the purposes set forth.

10. The combination, with the forcing mechanism and the die, of the tubular core J, arranged to receive water at its butt and provided with perforations in its tip, substantially as and for the purposes set forth.

11. The combination of the forcing-screw and piston, the cylinder A, the refrigerator-core J, the head G, the guide *j*, the die H, the water-jackets I I', the frame L, the rolls *k k*, and the screws *l l*, all arranged substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM McELROY.

Witnesses:
HENRY CONNETT,
ARTHUR C. FRASER.