No. 698,531. Patented Apr. 29, 1902.

S. MICHAILOFF.

CASTING SOLID OR HOLLOW CIRCULAR BODIES.

(Application filed Mar. 16, 1901.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

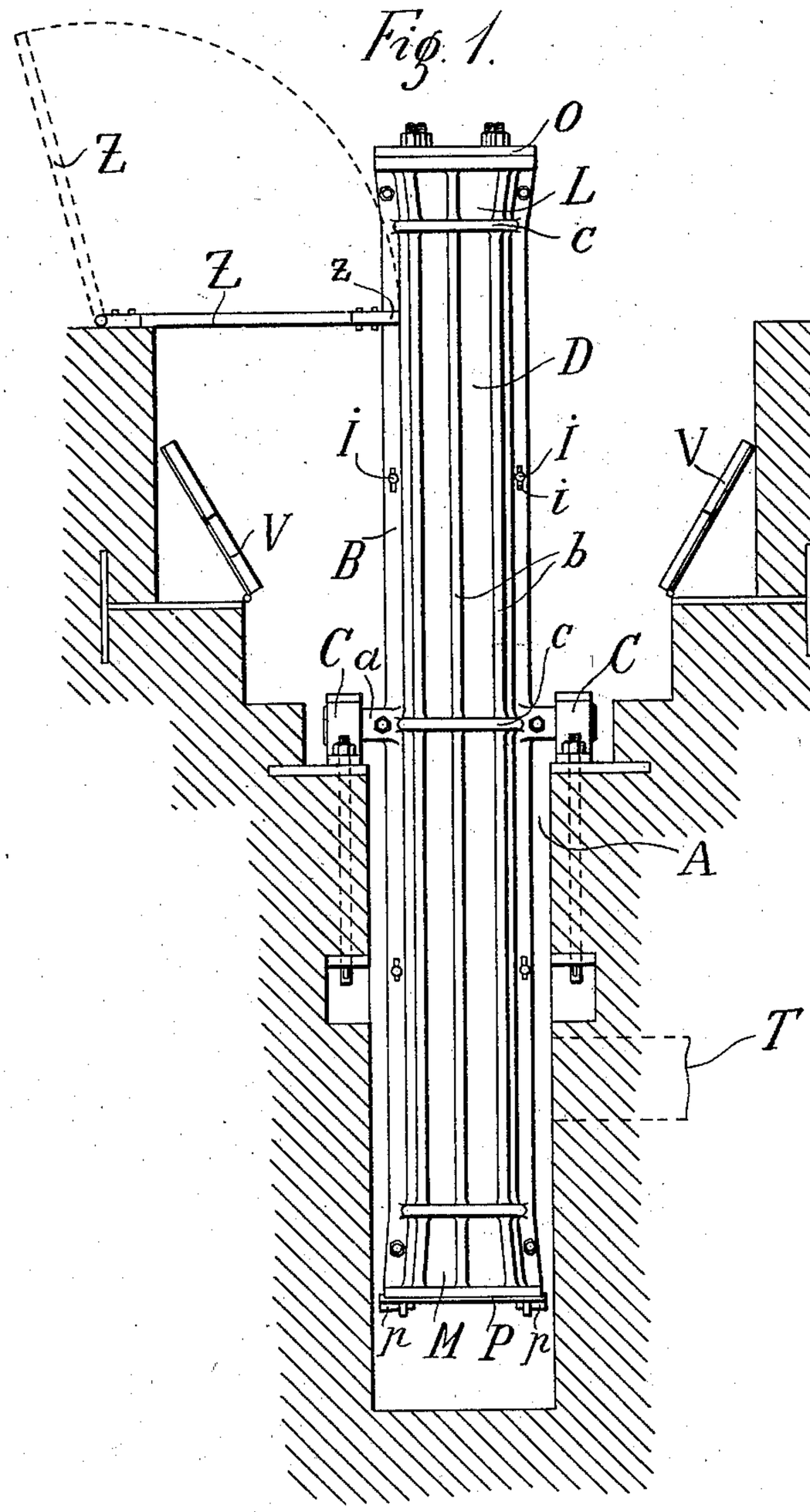
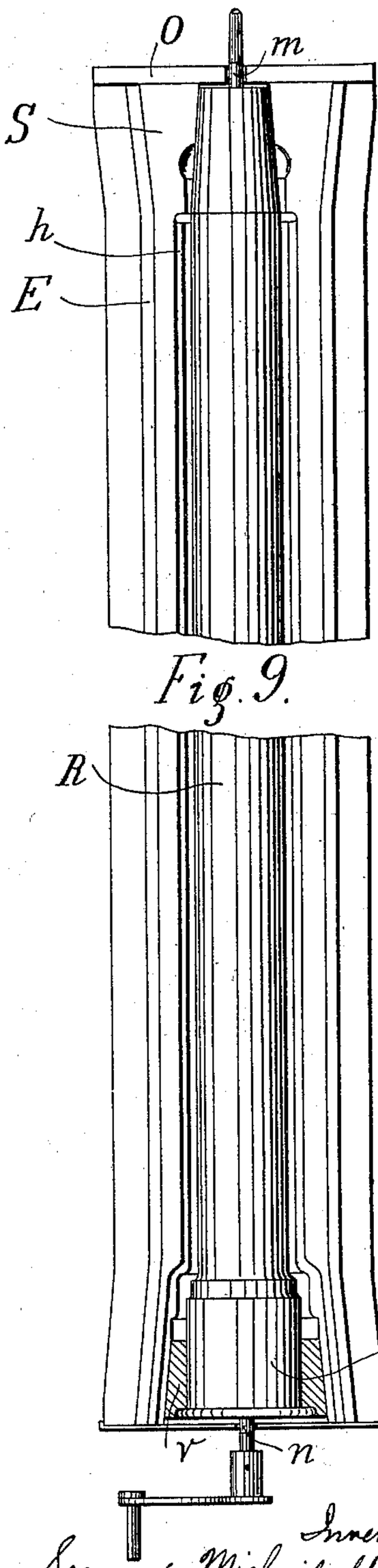


Fig. 9.



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(No Model.) 3 Sheets—Sheet 2.

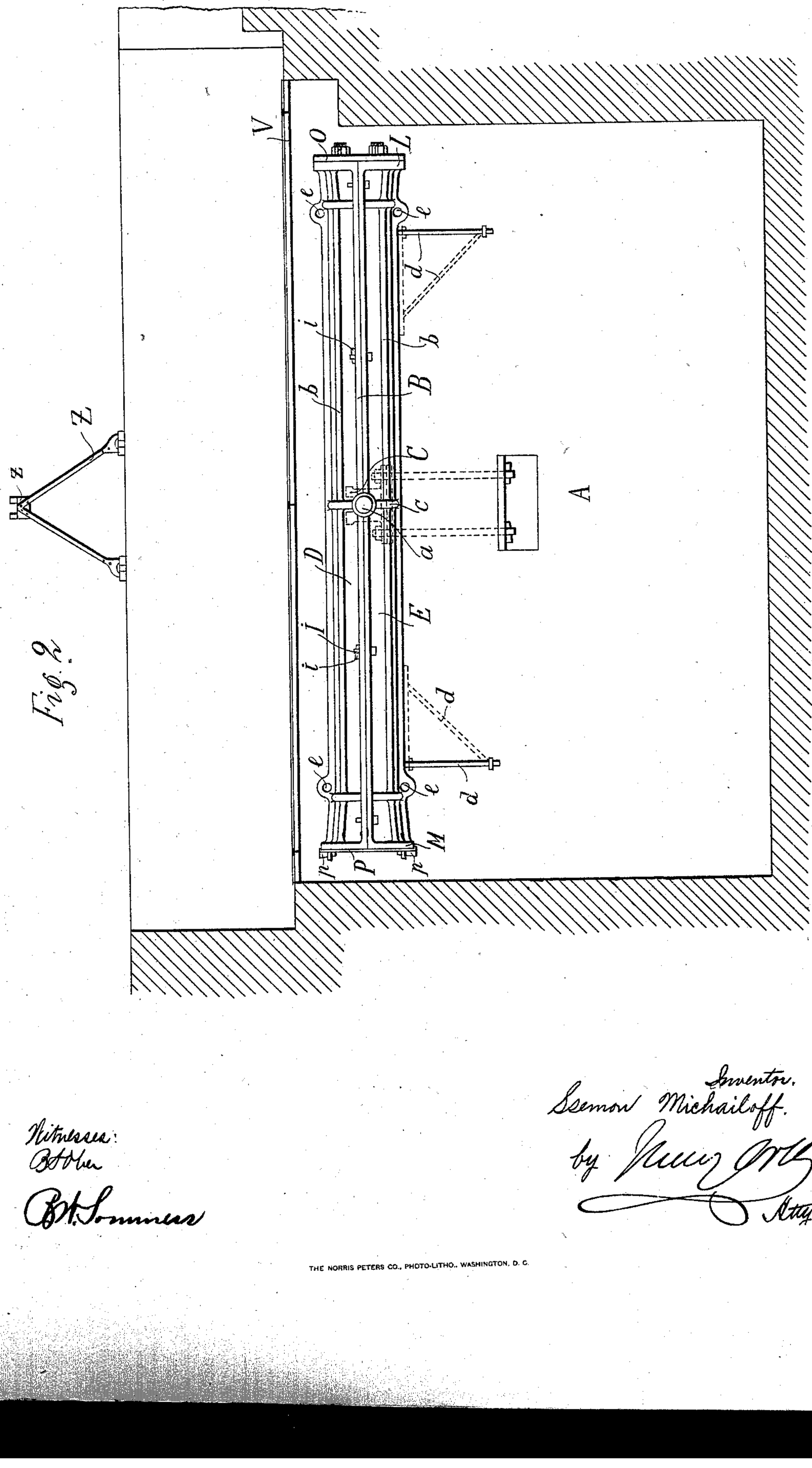

Fig. 2.

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No. 698,531. Patented Apr. 29, 1902.

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Fig. 3.

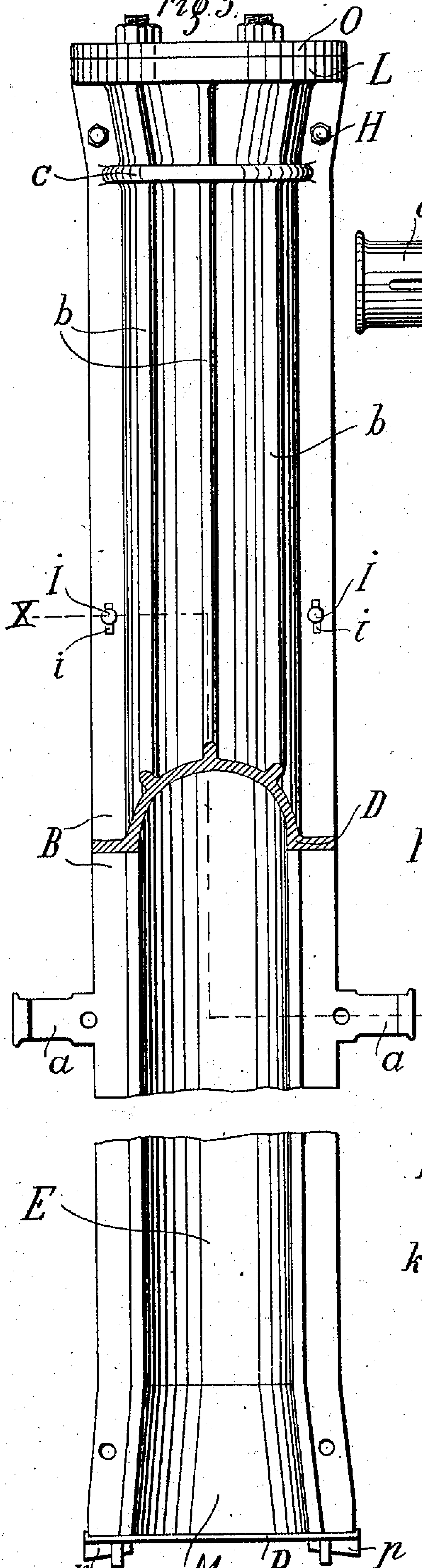


Fig. 4.

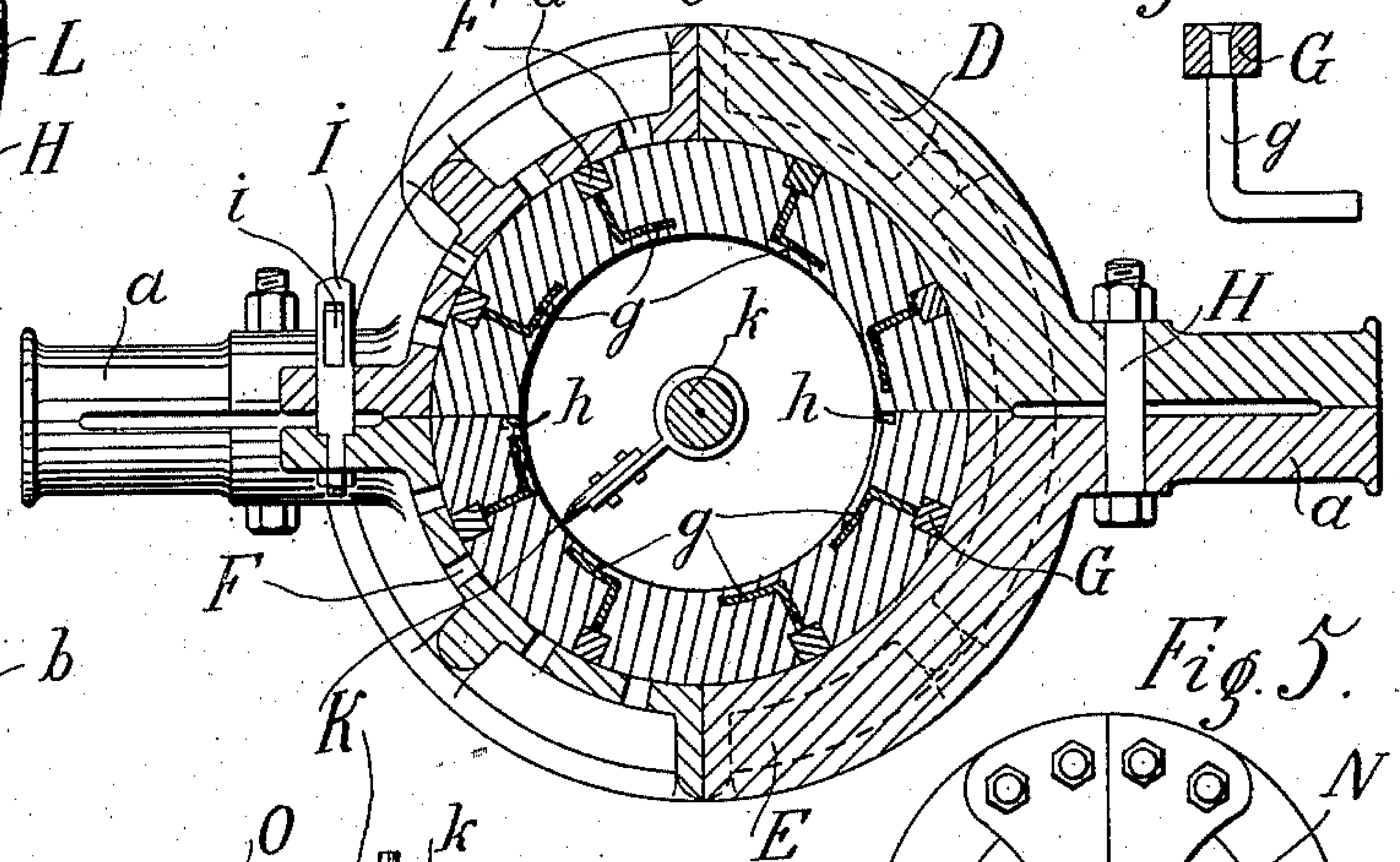
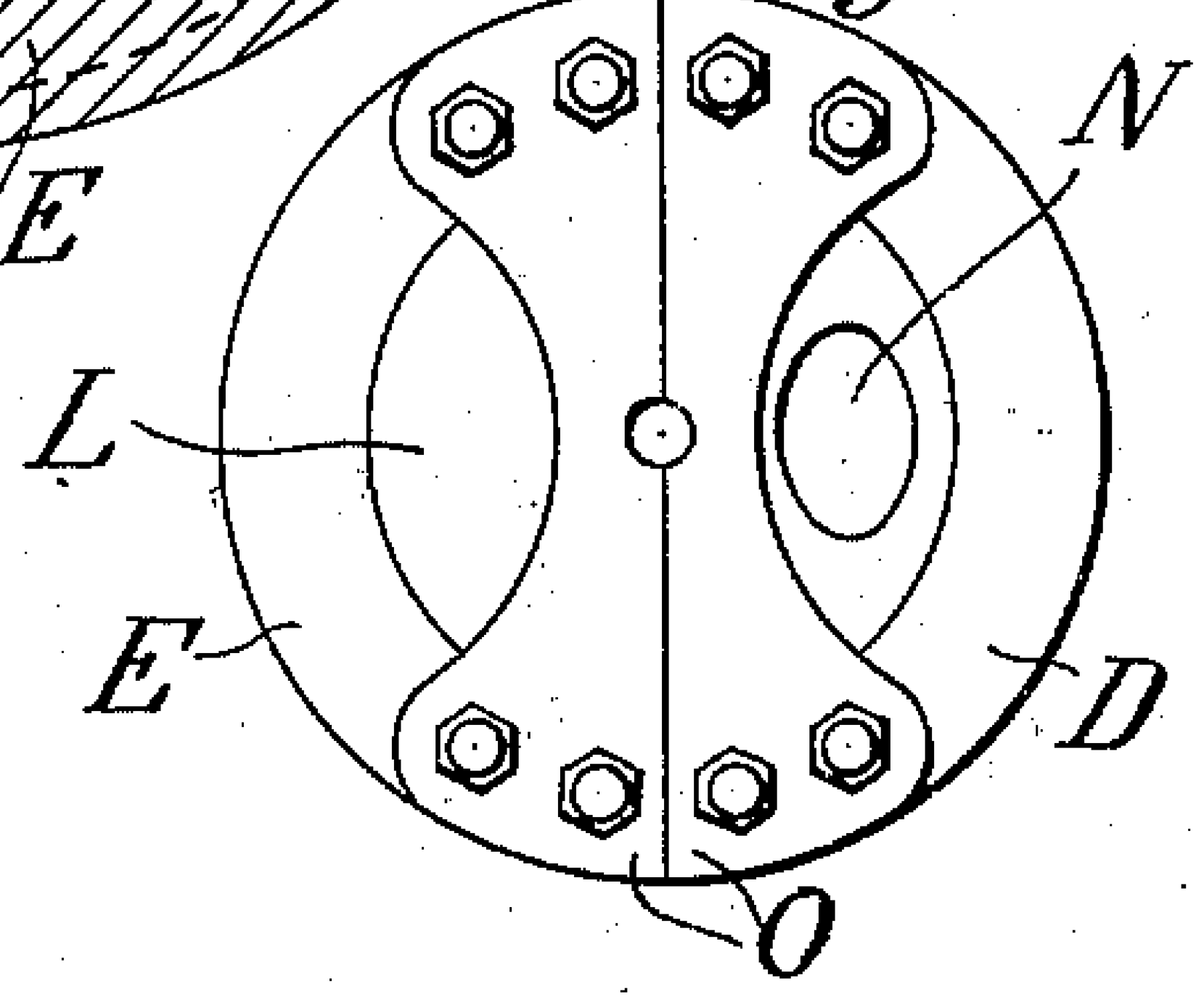


Fig. 10.

Fig. 5.



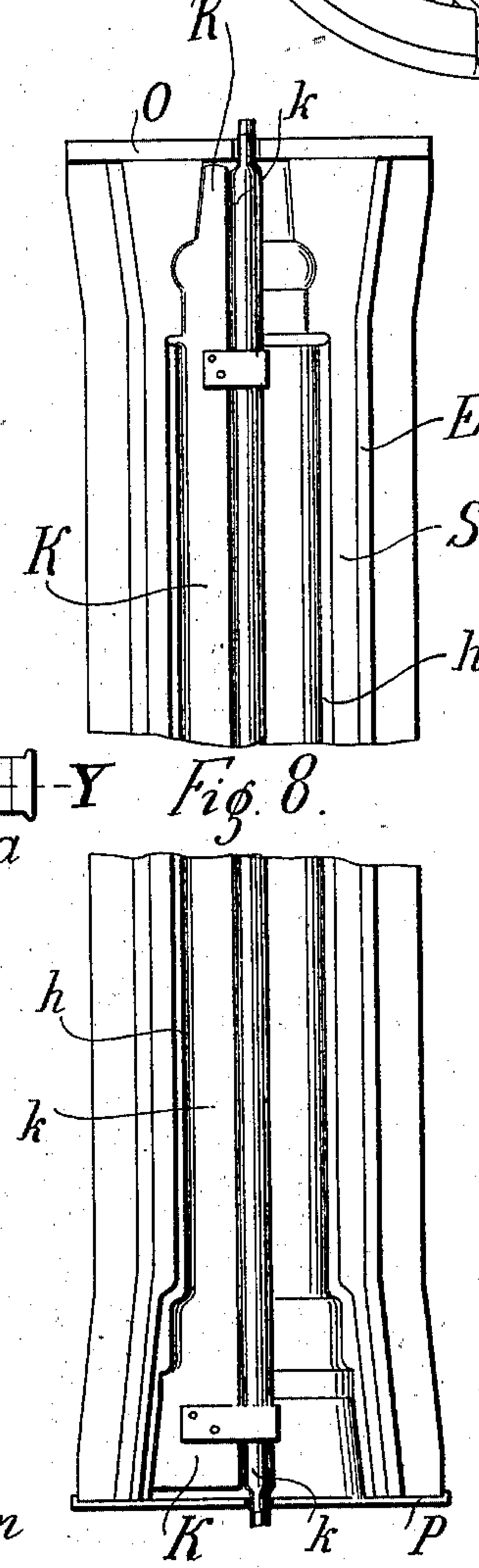


Fig. 8.

Fig. 6.

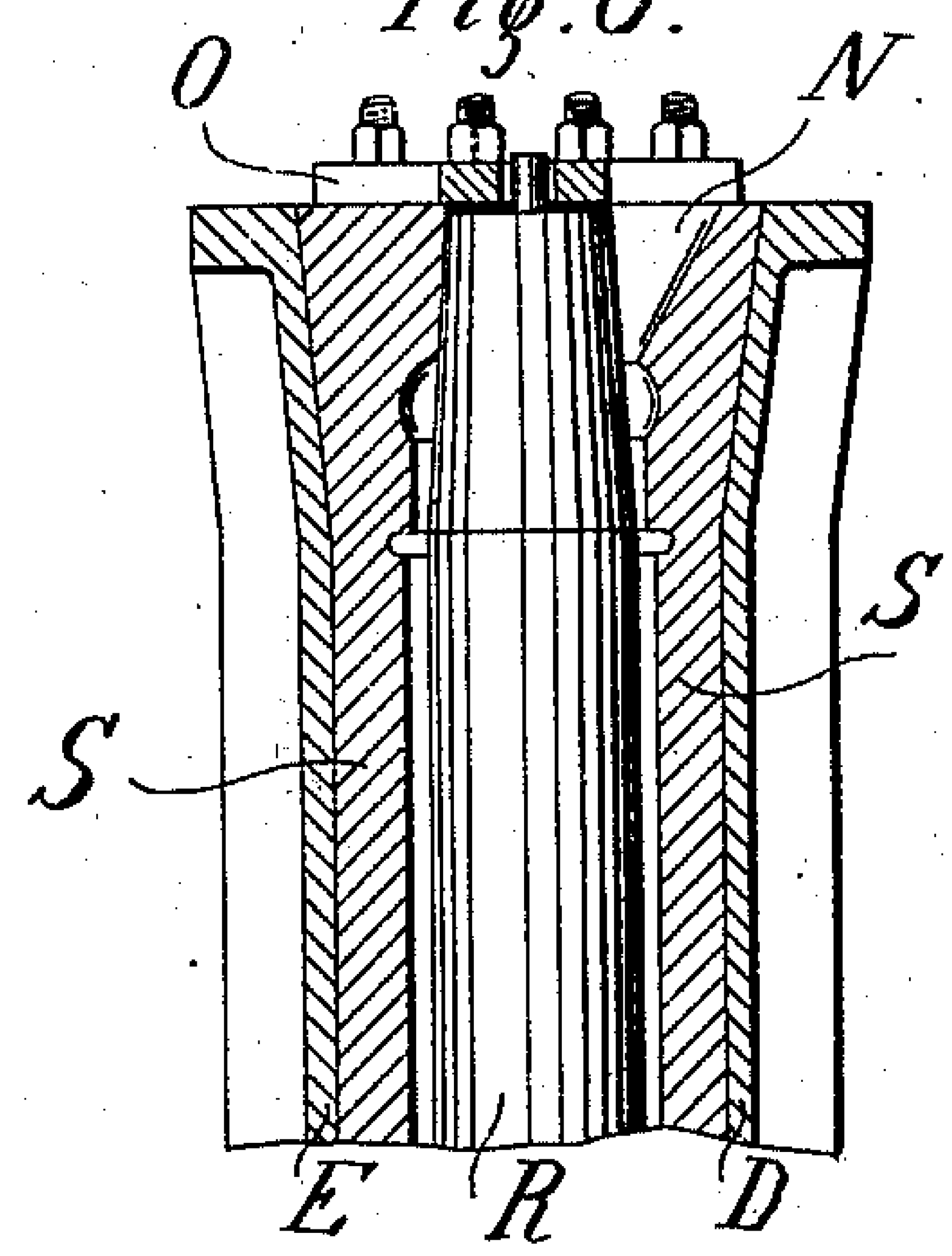
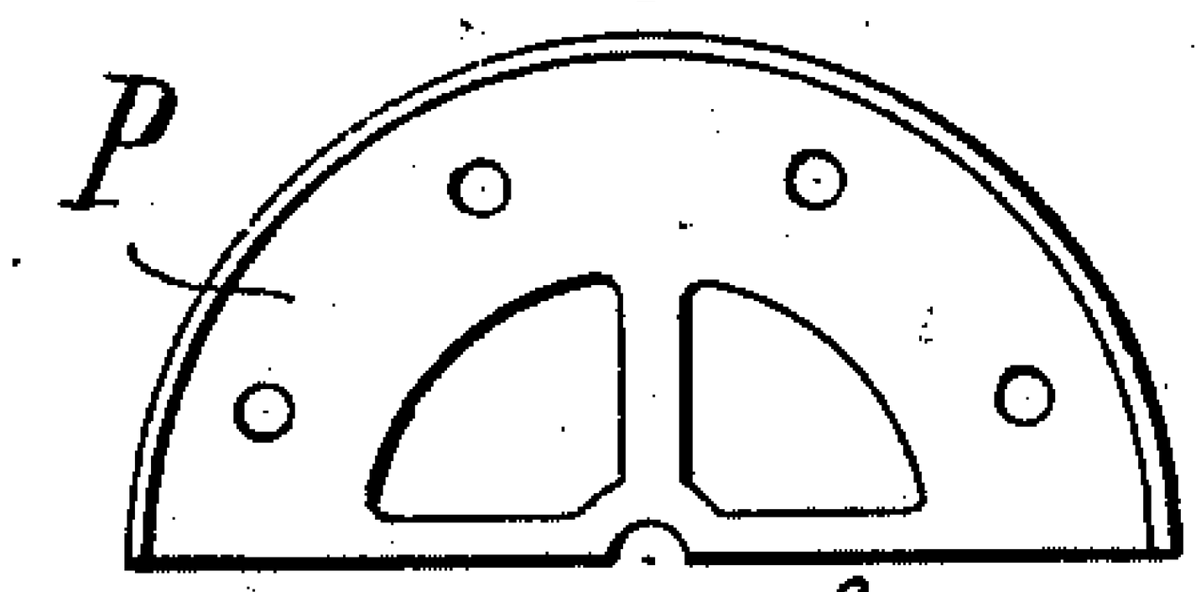


Fig. 7.



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Ssemon Michailoff, Inventor,
by [signature] Atty.

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UNITED STATES PATENT OFFICE.

SSEMON MICHAILOFF, OF ODESSA, RUSSIA.

CASTING SOLID OR HOLLOW CIRCULAR BODIES.

SPECIFICATION forming part of Letters Patent No. 698,531, dated April 29, 1902.

Application filed March 16, 1901. Serial No. 51,530. (No model.)

To all whom it may concern:

Be it known that I, SSEMON MICHAILOFF, a subject of the Emperor of Russia, residing at Khoutorskaya oulitza, Nos. 48 and 50, Odessa, Russia, have invented certain new and useful Improvements in the Casting of Solid and Hollow Circular Bodies, of which the following is a full, exact, and clear description.

The usual means used in the manufacture of cast-iron articles, especially pipes and similar circular hollow bodies, have many faults, which not only increase the expense of casting very much, but also render the production of good castings difficult, if not impossible. In casting pipes, for example, if molding is done by means of a pattern the latter must be frequently conveyed to and from the molding-box, since a new mold has to be made for each pipe to be cast. The molding-box is very heavy and with the necessary accessories occupies a great deal of room. The socket ends of the pipes are molded from special patterns. Consequently there are many joints and many casting-seams, which must be subsequently broken, chipped, or filed off. Even when molds composed of several rings made by pressing the material in molding-flasks are used each mold serves only once. In order to remove from the finished pipe-casting the molding-sand adhering thereto, it must first be allowed to cool. It follows, therefore, that the pipe must be reheated specially to receive a coat of tar or the like to protect it from rust. Moreover, a large quantity of refuse goods are obtained, since a new mold is required for each pipe, and it is impossible to produce pipes having a thickness of wall the same for all the pipes and uniform throughout each, especially as the proper (concentric) setting together of the molds for the pipe and its socket which are made by means of separate patterns is almost unattainable and only happens by accident in spite of the use of various accessories. The casting is often a failure because the mold prepared in the usual manner with the pattern in boxes does not sustain the pressure of the molten metal and the gases generated in casting and is consequently destroyed.

This invention has for objects to obviate the before-mentioned disadvantages, to simplify and accelerate the casting of solid and hollow cast-iron bodies in general and for pipes in particular, to reduce the cost considerably, and to lower the percentage of refuse goods to at most five per cent. These objects are attained by, first, substituting for composing molds of several pressed rings or molding with patterns in a molding-box molding the entire pipe—*i. e.*, the pipe and socket—at one operation in a cast-iron flask adapted to be rotated about a transverse axis and to be secured in any desired position; second, using a special material for the inmost layer of the mold, whereby a very durable mold is made, which after having been once dried lasts during about three months of uninterrupted work; third, drying the mold in the casting-pit; fourth, closing the joints of the parts of the mold in such a way that no casting-seams can be formed and chipping or filing the casting is obviated, so that the casting when taken from the mold in a glowing condition can be coated with the protecting layer of tar without further treatment.

The apparatus hereinafter described in detail enables at least as many cast-iron pipes to be produced in a single flask as have hitherto been made during the same time by means of ten separate devices for the ordinary flask-casting and possesses also the hitherto-unattained and important advantage that the hollow articles can be chilled in the interior as much as desired.

One example of apparatus for carrying out the invention and adapted for the manufacture of cast-iron pipes is shown in the accompanying drawings, in which—

Figures 1 and 2 are a cross-section and a longitudinal section, respectively, of the casting-pit, the flask being shown in Fig. 1 secured in the vertical position to receive the molten metal, while in Fig. 2 it is shown held in a horizontal position by supports pivoted to the wall of the casting-pit. Fig. 3 is a sectional elevation of the flask, one-half being partially broken away. Fig. 4 is a cross-section corresponding to the line X Y of Fig. 3. Figs. 5 and 6 are respectively an end elevation and a part-longitudinal section of the inlet end of the flask. Fig. 7 is a view of a cover for the conical enlargement of the opposite end of the flask. Fig. 8 is a plan of one-half of the flask, with the rotary former-

board for producing the mold of the pipe. Fig. 9 is a sectional elevation of the half shown in Fig. 8 with the core inserted. Fig. 10 is a plan of a tie-bar for securing the mold in the flask.

The casting-pit A, Figs. 1 and 2, which is built of brick, is of such size that the cylindrical flask B can be freely rotated on trunnions *a a* in bearings C. The flask comprises two comparatively thin hollow half-cylinders D and E, which are strengthened by longitudinal webs *b* and transverse webs *c* and are secured together by means of bolts H. In Fig. 3 the half D is shown partially broken away, so that in the right-hand portion of this figure the half E of the flask appears in plan. The flask is provided with uniformly-distributed vent-holes F, Fig. 4, which, however, are not shown in Fig. 3 for the sake of simplicity and clearness. Bars G, which extend from one end of the flask to the other and are secured to the half-cylinders D and E by bolts, (not shown,) are furnished with tie-bars *g*, Fig. 10, which are riveted or otherwise rigidly connected to them and are arranged at suitable distances apart for the purpose of securing the material of the mold to the half-cylinders and holding the mold together and imparting rigidity thereto.

The operation of casting pipes is as follows: The flask B is secured in a horizontal position with the half E upward—for example, by means of supports *d d*. The supports *d d* are hinged to the brick walls and are shown by full lines in Fig. 2 in the operative position and by dotted lines turned against the wall. The bolts H and the keys *i* of the guide-bolts I, Fig. 4, are slackened and removed, the half E of the flask is lifted off and laid on one side of the pit, and the molding of the half D, which remains in position, is then begun. This is effected by gradually filling the spaces bounded by bars G and their right-angled tie-bars *g* with a pasty material consisting of the ordinary materials used in dry sand and loam molding mixed in the usual manner with water and, it may be, with some boiled oil. This material can be applied in two or more layers, each layer being dried before another is applied. When three layers are used, the following operation is preferred: A mixture of lean clay and fine chopped straw is stirred with water to form a stiff paste and is spread in a suitable thickness (about half the thickness of the wall of the mold) on the wall of the flask and is then dried or fired. A second layer follows, and for this purpose refractory clay, sand, and horse-droppings are taken in about equal proportions and are stirred with water and boiled oil to form a plastic mass. The remaining portions of the tie-bars are covered with this material, and the mold is then dried in the usual manner by hot air or furnace-gases, which may be produced in the casting-pit itself. In applying the second layer the shape of the article to be cast is molded roughly either by the eye or with the aid of a former-board. After the second layer has been dried a third comparatively thin (three to four millimeters) layer of a sticky pasty material is applied, which is prepared by grinding about forty per cent. of terra-cotta powder, fifteen per cent. of burnt crucible graphite, ten per cent. of fatty clay, fifteen per cent. of washed sand, (river sand,) five per cent. of charcoal, and fifteen per cent. of cow-dung with water and boiled linseed-oil taken in the proportion of three to one. The excess of the third layer is removed by rotating the former-board K, Figs. 4 and 8, and in this manner the half of the mold for the complete pipe and its socket is made. The shaft *k* of the former-board is located in this case in central semicircular notches of half-plates O and P, which are secured, so as to be capable of being easily detached, to the enlarged ends of the flask by means of bolts and nuts or keys *p*. The shape of the enlarged ends L and M of the flask varies with the shape of the sockets of the pipe. In one of these enlarged ends L the runner N, Figs. 5 and 6, is made in the usual manner. Without drying the inmost (third) layer of the mold the half D of the flask is laid on the other side of the pit, and the molding of the half E, which, like the half D, is secured in the casing-pit in a horizontal position, is then proceeded with. The shaping of the second half of the mold is carried out in the manner described, with the sole exception that the small grooves *h*, Figs. 4, 8, and 9, preferably dovetailed, are left along the inner edges of the half-mold. After the shaping of the second half has been completed transverse bars or supports are laid thereupon, and upon these supports the half D of the flask is laid with the half-mold upward, and the iron doors V are then closed. The drying or firing of the two halves of the mold is then effected at the same time by heated air or furnace-gases, which can be generated in the casting-pit itself by means of a coal-pan placed in a suitable depression in the pit and be gradually led away through the passage T, Fig. 1. The third (inmost) layer of the mold forms after drying a crust as hard as stone, which adheres firmly to the main portion of the material and is therefore extraordinarily durable in spite of its very slight thickness. Moreover, as the crust does not adhere to the molten or solidifying metal a mold is produced which can be used several hundred times with very slight repairs to the inmost layer by applying to the injured parts fresh material, which is at once dried by the heat of the mold. As soon as the mold has been sufficiently dried the iron doors are opened, the half-mold contained in the half D of the flask is painted over with a coat of graphite, is lifted off the half E and turned over, and is held above the half E while the latter is being painted with graphite. When the graphite is dry, the trapezium-shaped or dovetail grooves *h h* are filled with the plas-

tic material of the third layer of the mold, the half D of the flask is placed on the guide-bolts I of the half E, and is then lowered quickly, so that when the surfaces of the joints strike together the excess of filling material is squeezed out of the grooves in the mold and a perfect joint is obtained. The two halves D and E of the flask are secured together by means of the bolts H and the keys *i* of the guide-bolts I, the flask is placed in an inclined position, the supports *d d* having been previously turned out of the working position, and the excess of jointing material, which exudes from the mold and has become somewhat dried in the meantime, is removed by means of a cylindrical scraper or the like. When this has been effected, the two half-plates O are bolted to the runner end L of the flask, the flask is rotated to bring the runner underneath, and is fixed in this vertical position by means of the fork *z* of the hinged support Z. Thereupon the core R, which is made of the usual materials in the usual manner, is inserted into the mold, and on its thicker end there is previously placed a loam stopper of a conical form corresponding to the bore of the mold and only slightly dried, so that it remains plastic and while forming a joint between the mold and the core closes the flask at the end which is directed downwardly during the casting operation. During the insertion of the core into the mold it is guided by the conical lower portion of the latter in such a way that the conical journal *m* of the core-shaft engages in the central opening of the end plates O. As soon as the lower conical end of the core has reached the end plates O or is jammed in the conical lower portion of the mold a layer of stiff clay is placed on the upper surface of the core around the mouths of the vent-holes, so that the core is secured by the end plates P, that are fixed by keys *p* in its proper position, so that it can move neither axially nor radially. The mold is then rotated to bring the runner N to the top and is secured in this vertical position by means of the support Z *z*, whereupon casting is effected in the usual manner. As soon as the cast-iron solidifies the apparatus is again rotated to bring the runner underneath, the end plates P are removed, the core is withdrawn, and the internal surface of the pipe is freed from adhering molding-sand by means of wire brushes or the like. During these operations the contraction of the metal continues and the pipe is chilled in the interior, so that injurious internal strains in the pipe-wall can be obviated, as the exposure of the external surface can be delayed more or less, as desired. At the proper time the flask with the finished pipe is fixed in the horizontal position, Fig. 2, the bolts are slackened, one half of the flask is removed, and the still glowing pipe is lifted out of the other half of the flask. As the surface of the pipe comes out of the mold quite free from molding-sand and without any casting-seams, &c., it can be at once coated with tar without further treatment as soon as the redness disappears.

The casting process hereinbefore described enables from four to twelve pipes to be cast in one mold daily if the cores are kept in stock, the mold lasting for about three months of uninterrupted work without repairs of any consequence or requiring much time. Before each casting operation the grooves *h h* of the one half of the mold must always be filled with fresh material, and, if necessary, small repairs to the mold can be undertaken.

This process, which has been described specially with reference to pipe-casting, can also be used for solid castings. In this case only the core and its centering arrangement are omitted.

Having now fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A flask composed of two sections, a trunnion on each section, internal longitudinal bars secured in each section, mold-retaining tie-bars having free ends conforming to the molding-surface secured to each longitudinal bar, an end plate at each end of each section provided with a half-bearing, two end plates coöperating to form an end bearing, and a core or other rod held in the bearings thus formed, substantially as described.

2. A flask composed of two sections, internal longitudinal bars secured in each section, mold-retaining tie-bars having free bent ends conforming to and proximate the surface of the mold, end plates at each end of each section provided with a half-bearing and one of the end plates of each section provided with a cut-away portion for the runner-opening, and a core or other rod adapted to be held in the bearings formed by the coöperation of the end plates, substantially as described.

3. The combination with a casting-pit, a bearing on each side thereof and hinged covers for closing the same, of a pipe-flask composed of two longitudinal sections, a half-trunnion on each side of each section, end plates one of which is provided with a core-bearing, means for supporting the flask in a vertical position in the pit, and brackets vertically hinged to a wall of the pit and arranged to be swung laterally under the ends of the flask after it has been rotated to maintain it in horizontal position, substantially as described.

4. The combination with a casting-pit, of a pipe-flask comprising two longitudinal sections having vents, means to rotatably support said flask in the pit, internal bars in each section and tie-bars secured to said bars to hold the mold in the flask, and end plates on each end of each section and provided with bearings to support a core and to center a former-board during the lining of the flask, substantially as described.

5. The combination with a casting-pit, and

a flask rotatable in the casting-pit and comprising two halves, each provided with longitudinal bars G and tie-bars *g*, an end plate on each half of the flask provided with a half-bearing coöperating when the flask is set up to form a central bearing at each end; of a shaft extending through the flask and the central bearings at the ends, a former-board rigidly connected to the shaft and means for rotating the shaft and former-board, substantially as described.

6. The combination with a casting-pit, of a flask rotatable therein comprising two halves, provided with lines of vents, longitudinal bars secured to the flask between the lines of vents, and tie-bars secured at one end to the longitudinal bars and having free ends bent at an angle and conforming to the molding-surface, an end plate on each end of each half-flask provided with a half-bearing coöperating when set up, to form a central bearing to centrally support a suitable core.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

SSEMON MICHAILOFF.

Witnesses:
PAUL ZARITSKI,
V. DIDEKKO.