(No Model.) 3 Sheets—Sheet 1.

F. H. DANIELS.

APPARATUS FOR CASTING INGOTS, BARS, &c.

No. 359,349. Patented Mar. 15, 1887.

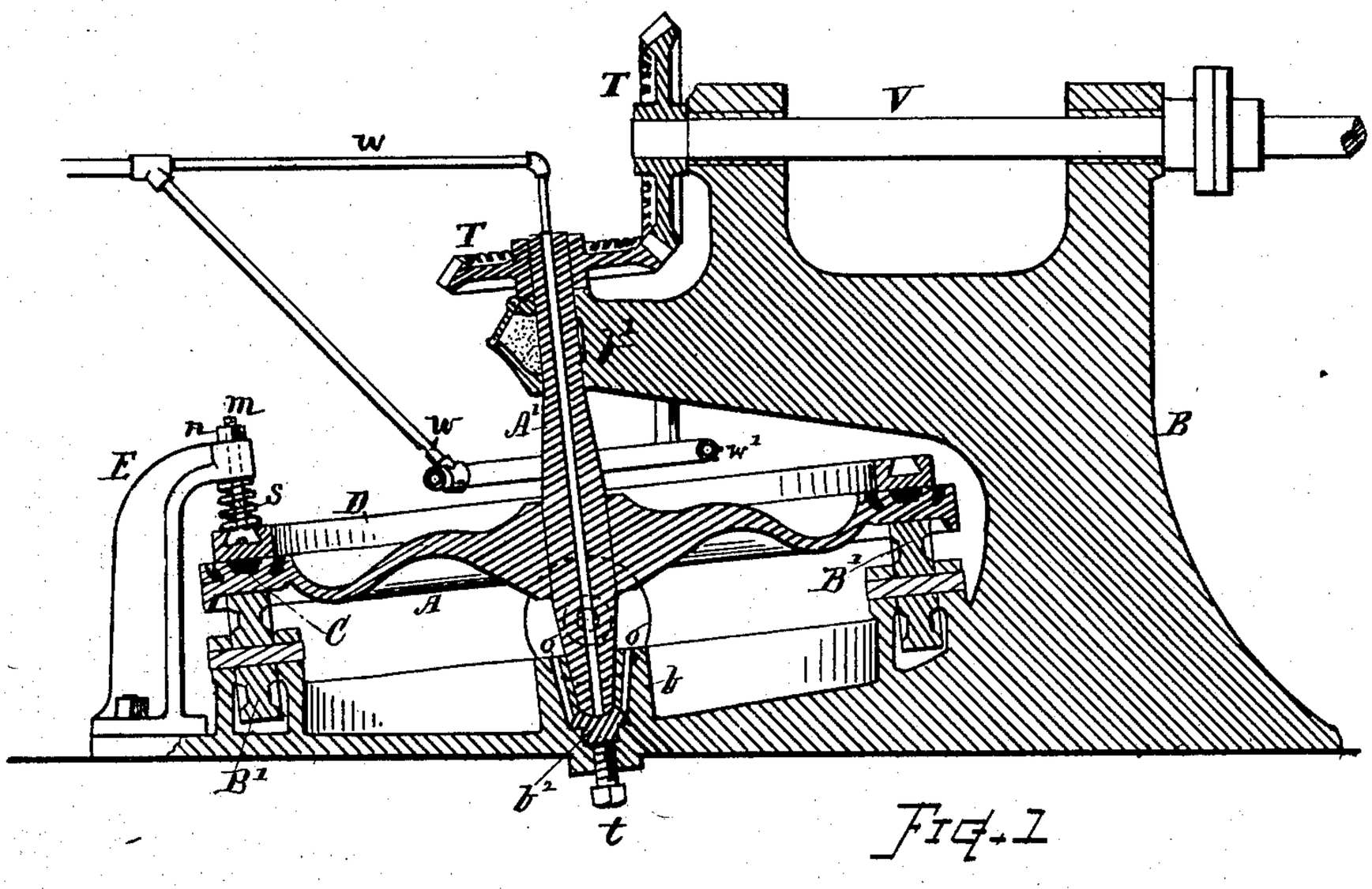
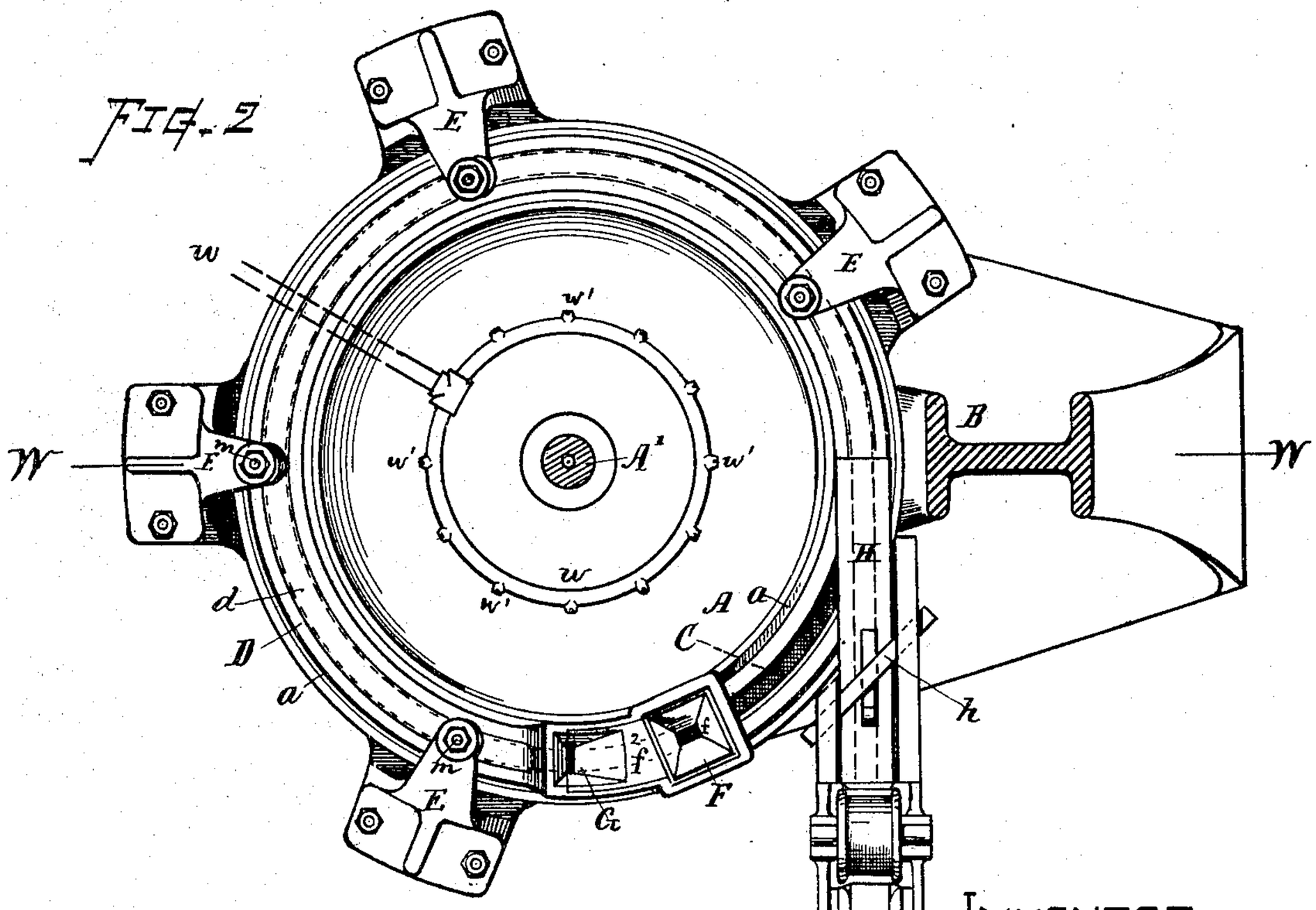


FIG. 1



WITNESSES

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(No Model.) 3 Sheets—Sheet 2.

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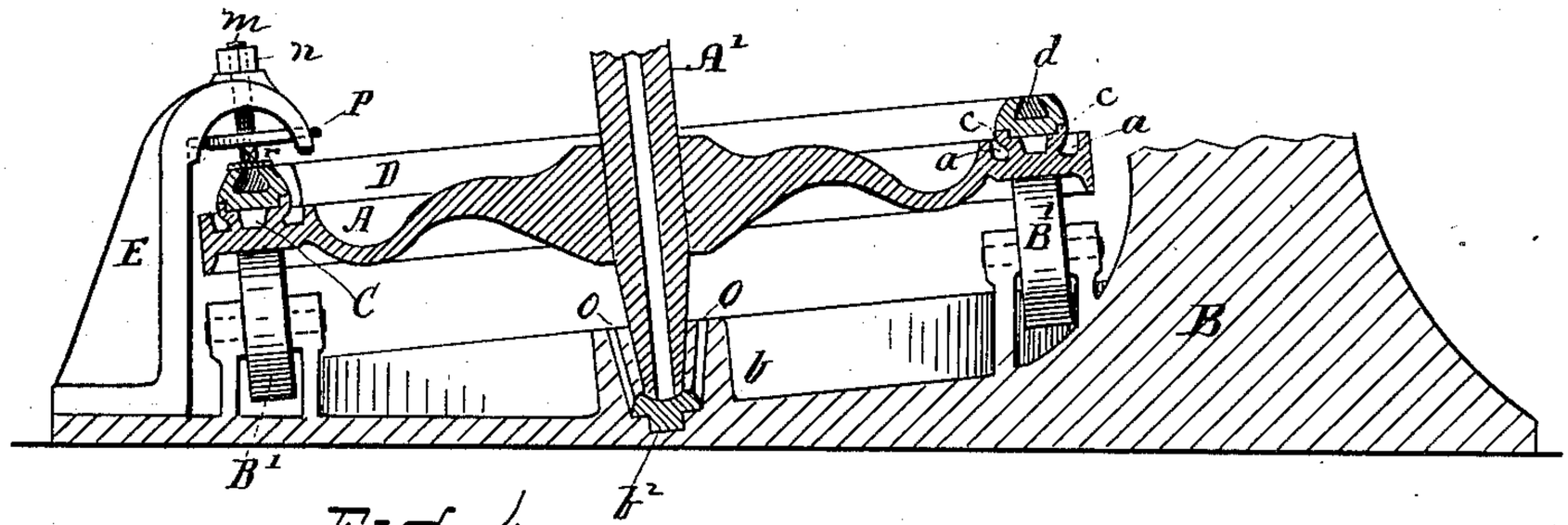

FIG. 4

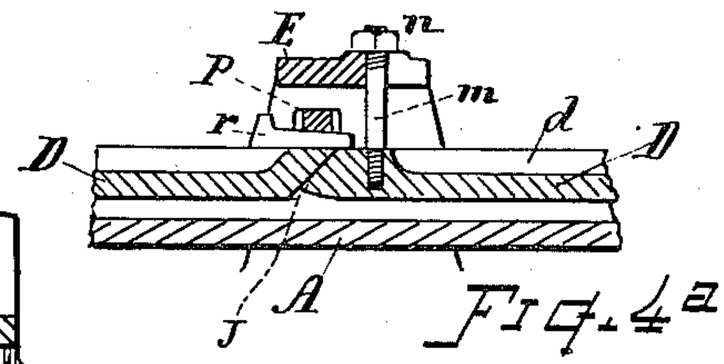

FIG. 4a

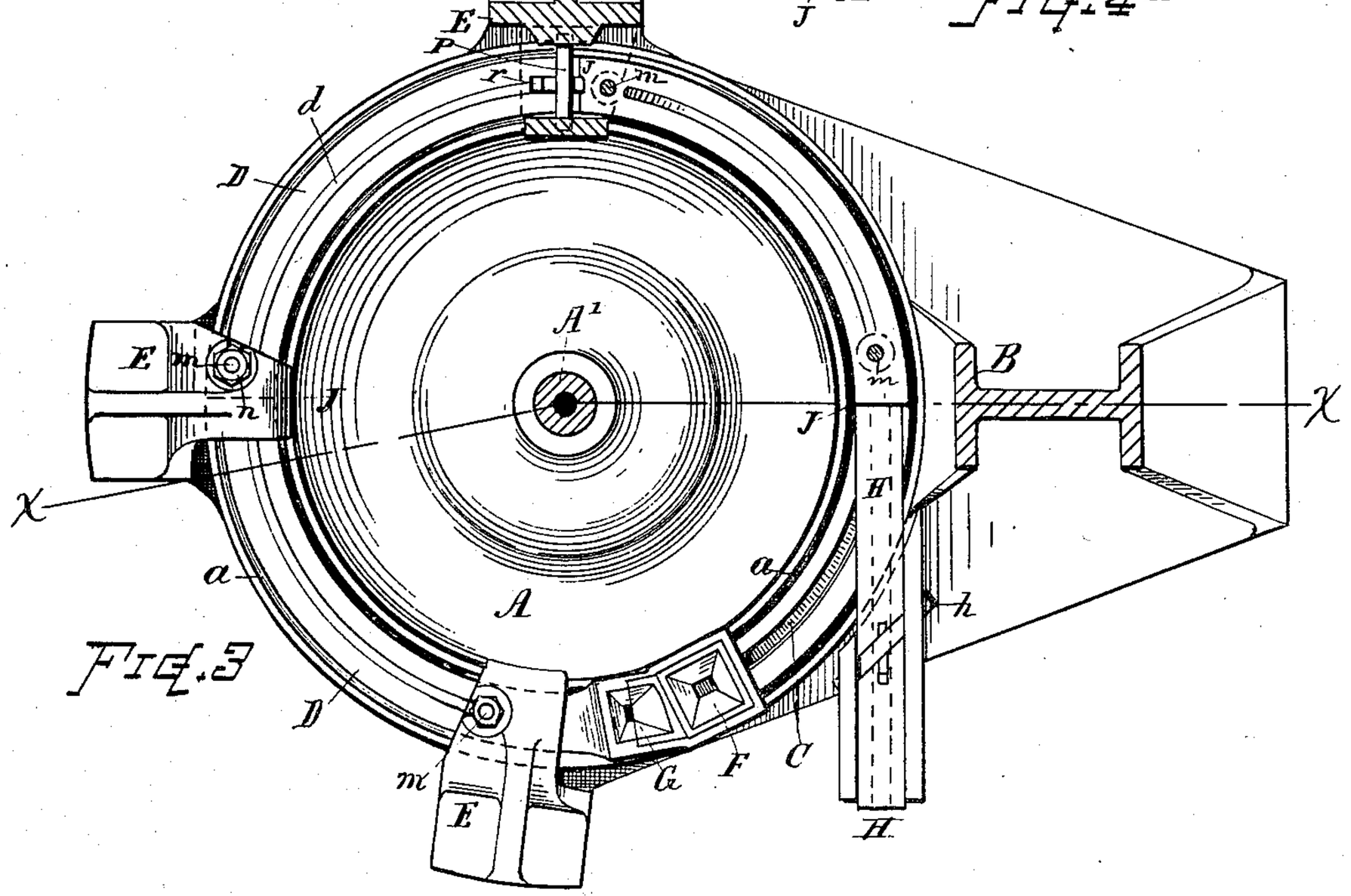

FIG. 3

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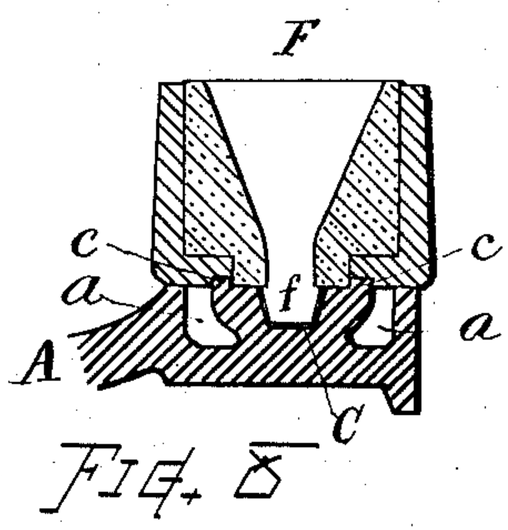

FIG. 5

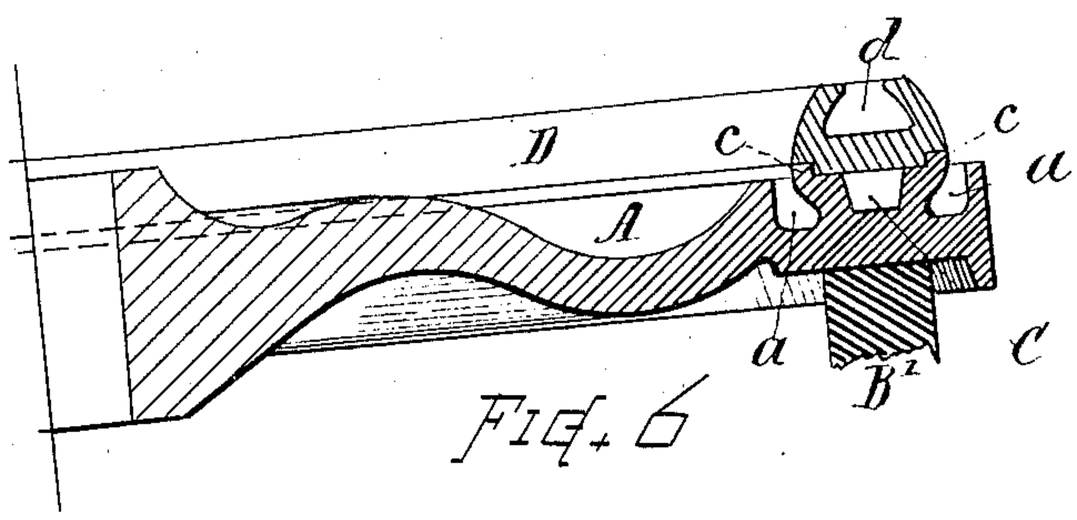

FIG. 6

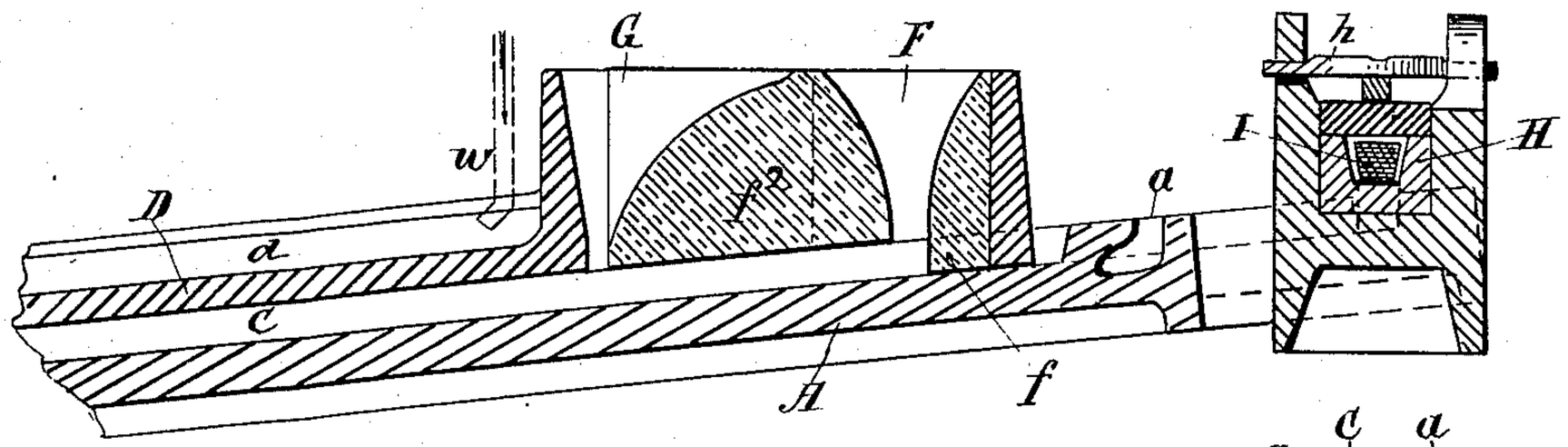

FIG. 7

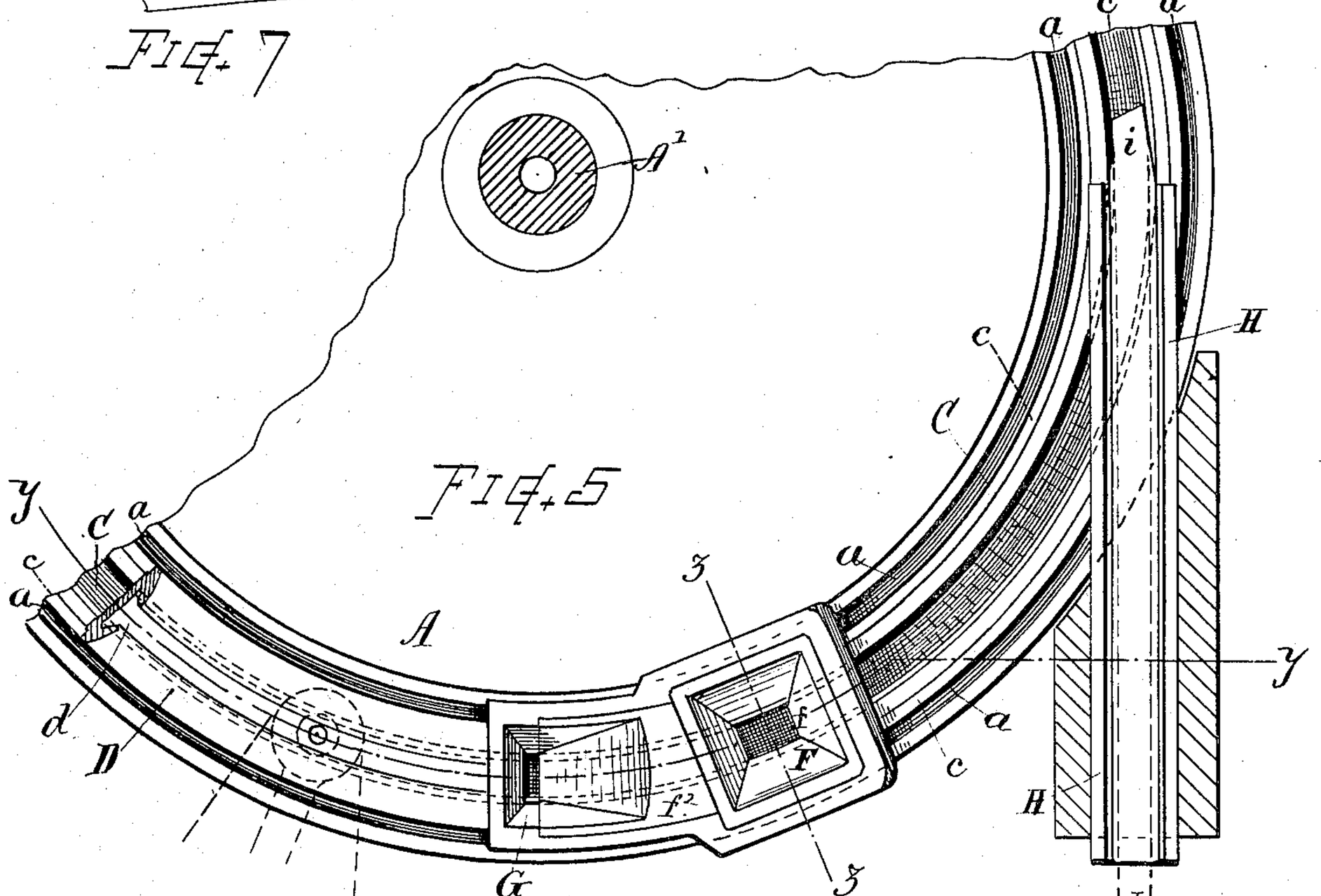

FIG. 5

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UNITED STATES PATENT OFFICE.

FRED H. DANIELS, OF WORCESTER, MASSACHUSETTS.

APPARATUS FOR CASTING INGOTS, BARS, &c.

SPECIFICATION forming part of Letters Patent No. 359,349, dated March 15, 1887.

Application filed June 14, 1886. Serial No. 205,086. (No model.)

To all whom it may concern:

Be it known that I, FRED H. DANIELS, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Mechanism for Producing Ingots, Bars, or Rods from Fluid Metal, of which the following, together with the accompanying drawings, is a specification sufficiently full, clear, and exact to enable persons skilled in the art to which this invention appertains to make and use the same.

The objects of my present invention are to provide an apparatus for producing bars or ingots by continuous process from molten or fluid metal, wherein the forming-mold, arranged as a circular groove or grooves upon the side of a revoluble wheel, plate, table, or carrier disposed in a horizontal or inclined position, is provided with an adjustable cap or top and means for supporting the same in proper relation thereto; also, to provide practical and efficient devices for introducing the fluid metal to the matrix and retaining it from backward flow in the matrix-groove; also, to afford facilities in an ingot-forming mill for feeding a material or substance into the matrix upon the surface of the ingot, for lubricating the same in its contact with the cover or non-movable portion of the mold; also, to provide means for limiting the pressure of the cover upon the face of the mold to any required adjustment, and to afford facilities for giving a yielding pressure of the cover when required; also, to provide facilities for cooling the mold in a rapid and convenient manner; also, to provide practical and efficient means for effecting the discharge of the contiguous ingot or bar from the forming-mold and delivering it in a comparatively straight condition for subsequent treatment; also, to provide relief devices whereby the annular cover of the mold can automatically give way in case of obstruction or abnormal strains. These objects I attain by mechanism the nature, construction, and operation of which are illustrated in the drawings and explained in the following description, the subject-matter claimed being hereinafter definitely specified.

In the drawings, Figure 1 is a vertical section of the mill in the direction of the line *w w* in Fig. 2, showing my improved apparatus for producing continuous bars or ingots from fluid metal. Fig. 2 is a plan view of the same with the top portion removed to better reveal the parts beneath. Fig. 3 is a plan view showing a modification in the construction and manner of securing the circular cover. Fig. 4 is a vertical sectional view of the same at line *x x* in Fig. 3. Fig. 4ª is a vertical sectional view longitudinally through the mold and the cover-sustaining joint. Fig. 5 is a plan view of a portion of the forming-wheel, showing the feeding-funnels and discharging-guide. Fig. 6 is a section through one side of the wheel and mold-cover. Fig. 7 is a vertical section through the mold-feeding funnels and discharging-guide on the line *y y* in Fig. 5. Fig. 8 is a transverse vertical section through the mold at line *z z* in Fig. 5.

In reference to parts, A denotes the matrix wheel or carrier, which consists of a circular rim, plate, or table mounted and revoluble on a central axis or spindle, A′, and supported by a step-bearing, *b*, and top bearing, *b′*, on the frame B, in an upright or preferably slightly-inclined position, as indicated, so that the wheel or plate A will revolve in a plane somewhat diagonal to the horizontal. If preferred, the wheel may be set in a horizontal plane.

The mold or matrix for receiving the fluid or molten metal is formed as an annular groove, C, (one or more,) in or upon the top side of the wheel A and near the circumference thereof. At either side of the matrix, preferably parallel therewith, and extending into the rim of the wheel in the manner shown, I form annular ways or grooves *a a*, to receive water or other cooling-fluid for cooling the mold and metal contained therein.

The wheel A may be some eight feet (more or less) in diameter, and its peripheral rim supported by means of anti-frictional rolls or wheels B′, as shown in Figs. 1 and 4.

In connection with the revoluble wheel A, I provide a circular cover, D, that fits over this groove and completes the mold for confining the metal therein. The circle or curvature of the cover D is lateral in relation to the plane of the mold, so that the bottom face of said cover will stand in a plane perpendicular, or substantially so, to the axis about which the wheel or mold-carrier revolves, and the radius

of curvature of said cover corresponds with that of the rim of the wheel, so that the top surface of the wheel-rim and bottom surface of the cover will match together. Said cover D extends about three-fourths of the distance around the circle of the mold, more or less, and is retained in proper relation to the groove C by means of interlocking flanges *c c* or other suitable means. Said cover D is non-rotatable, and is held in place by supporters E, located at suitable intervals around the outside rim of the wheel. The cover can be formed in a single piece, as in Figs. 1 and 2, or it may be formed in a number of independently-removable sections, as in Figs. 3 and 4.

The top of the cover is preferably constructed with a groove or recess, as at *d*, for retaining the water or cooling-fluid for reducing the temperature of the mold. At the front end of the cover is a hopper or funnel, F, for receiving the fluid metal and conducting it into the groove or matrix C. Said funnel is made of fire-clay or other refractory substance set in a metal frame. The end piece of the funnel F extends down into the groove C and forms a barrier, as at *f*, (see Figs. 7 and 8,) to prevent the fluid metal from escaping in that direction.

Adjacent to the funnel F, I provide a second funnel, G, leading down through the cover D, for the purpose of introducing to the mold pulverized graphite or other suitable substance for lubricating the surfaces, which slide upon each other as the wheel and ingot move forward along the non-movable cover D.

The fire brick or block f^2, in the present instance, is made to form one side of both the funnels F and G, and also the top of the mold C at the position between said funnels.

H indicates the discharging-guide, which is disposed in relation to the wheel A in a manner to direct the produced ingot or bar in a straight line out upon a suitable roller-bed or receiving-platform at K, (only a portion of which is shown,) where it can be cut up or guided to a furnace or to reducing-rolls, or cared for in any desired manner. The bottom of the guide H is furnished with a laterally-curved extension or plow, *i*, that fits down into the groove C and serves to lift the ingot or bar I therefrom and cause it to run out through the conducting portion of the guide, which is fitted to serve for counteracting and overcoming the curvature of the bar, so as to deliver it in a comparatively straight condition. The guide H is supported in a suitable frame, B^2, and is retained by a relief-bar, *h*, and wedge, and a plate, T, as indicated.

The devices for retaining the cover D of the mold are adapted to force the cover down with a slightly yielding pressure, and screw-studs *m* or equivalent devices are arranged in connection with the cover and standards E, whereby the pressure or degree of closeness of the cover D upon the side of wheel A can be limited and adjusted.

In Fig. 1 I have shown a spring, *s*, for pressing down the cover D, with the stud *m* passing through the spring for limiting its action in accordance with the position of the nut *n* on the stud.

In Figs. 3, 4, and 4ª I have illustrated my method of arranging a cover made in several sections, either of which can be removed independently of the others when required. In this the adjacent ends of the cover-sections are formed with an incline-joint surface at J, so that the first or leading section overlies and holds down the section that follows it, and the screw-stud *m* is secured to the latter or underlying section back of the inclined joint J, so that the lifting action of the stud will hold up both parts. The overlying section is held down by means of a breaking-bar, P, and wedge *r*, the top of the supporter being made overhanging, so as to give a bearing for the inner end of the breaking-bar, as illustrated. The opening for the screw-stud *m* in the supporter or bracket is slotted in from the edge, so that the stud can be released without turning off the nut.

When it is desired to remove a section of the cover, it is simply necessary to knock out the wedge *r*, remove the bar P, and then lift off the section. It can then as readily be replaced by reversing such operation.

The bar P is made of a strength to withstand normal strains, but to break and relieve the mechanism by allowing a section to be thrown off in case of choking or any derangement that gives abnormal pressure upon the cover D.

Rotative action is imparted to the wheel in the direction indicated for continuously advancing the mold C by means of the gears T T′ and shaft V, to which power may be applied in any well-known manner. In the present instance the driving-gearing is located above the wheel; but it may in some cases be more convenient to locate the gears below the wheel, or in some other relation from that shown, and any suitable arrangement of gears may be employed for giving equivalent action to the mechanism.

The central shaft, A′, of the wheel is preferably formed hollow, or with a tubular cavity leading down to the step-block b^2, and the bearing *b* around the block is provided with passages, as at *o*. Water being supplied to the top of the spindle, it follows down through the hollow, works out through the bearing-surface, and escapes through the passages *o*, thus keeping the bearings well lubricated and cooled.

The wheels or rolls B′ beneath the rim of the matrix-wheel A prevent the rim of said wheel from springing downward away from the cover D, thereby preventing the formation of fins by reason of the metal flowing into the joint between the top of the wheel and the under surface of the cover.

The step-bearing b^2 beneath the end of the spindle A′ is preferably made adjustable by means of the set-screw *t*, or otherwise, so that the center or axis of the wheel can be raised

or depressed to cause the periphery to properly bear upon and run truly in conjunction with the rim-supporting rolls B'.

Water is supplied for cooling the mold and ingot by means of suitably-arranged pipes *w w*, having branches or openings *w'* for distributing it over the wheel, as in Figs. 1 and 2; or, if preferred, said pipes may be placed for delivering it into the channels *a* and *d*, as in Fig. 7, or in other sufficient manner.

The matrix or groove C and the water-ways or cooling-grooves *a a* can, if desired, be formed in a separate rim or circle, to be supported upon and attached to the circumference of wheel A, in lieu of forming said grooves directly within the integral metal of said wheel. The action is, however, the same in either case, and such construction does not change the nature of the invention.

In the operation of my improved ingot-forming mechanism, the metal, which may be melted and prepared in any suitable kind of furnace or converter, is, by means of a suitable ladle or conduit, poured in fluid condition, into the funnel F, and from thence runs into the mold or groove C, where it becomes congealed or solidified.

The wheel A, as it is revolved, carries forward the solidified ingot, and continuously presents more of the mold for receiving further supply of the fluid metal, and the congealed portion of the ingot or bar is carried forward to the delivery-guide H and ejected upon the roller table or platform G, the action being continuous so long as the matrix-wheel A is revolved and the supply of fluid metal in the funnel F is maintained.

The speed at which the matrix-wheel A is revolved is conditioned on the rapidity with which the metal can be properly congealed or cooled to a degree that will permit of its being discharged and retain its proper shape.

By arranging the matrix-wheel to revolve in an inclined position on an upright axis, substantially as herein shown and described, and having the matrix-groove with a laterally-curved cover on the top side thereof, I am enabled to support the produced ingot within the mold for a longer distance than can be practically done by a wheel set on a horizontal axis with a groove in its face and a segmental cover for the mold. It also permits of the metal being entered into the mold more sluggishly, and insures the filling of the matrix in a better manner, while the inclination can be rendered such as to cause the metal to flow in it and take position with as little agitation as possible.

What I claim as of my invention, and desire to secure by Letters Patent, is—

1. In mechanism for producing ingots or bars from fluid metal, the matrix-wheel having an annular mold or groove in the side thereof, disposed to rotate horizontally in a plane somewhat inclined from the horizontal, combined with a circular cover fitted upon the side of said wheel, and means for confining and adjusting said cover in relation to the matrix or groove, substantially as set forth.

2. In mechanism for producing ingots or bars from fluid metal, a matrix-wheel having an annular matrix or groove located in the side thereof, disposed to rotate about an upright or inclined axis, in combination with a circular cover formed of a series of independently-removable sections, and means for retaining said cover in position, substantially as and for the purpose set forth.

3. In mechanism for producing bars or ingots from fluid metal, the combination, with the matrix-wheel provided with the annular forming mold or groove, of the laterally-curved cover provided with a hopper or funnel, as at F, for receiving the fluid metal and directing it into the forming groove or matrix, substantially as set forth.

4. In mechanism for producing bars or ingots from fluid metal, the combination, with the traveling forming-mold, its cover, and the funnel whereby the fluid metal is conducted into said mold, of the second or auxiliary funnel, through which a lubricating substance can be introduced to the surface of the metal within the mold, substantially as set forth.

5. In a mechanism for producing bars or ingots from fluid metal, the annular guiding-flanges *c*, in combination with the matrix-wheel A, having the annular groove C in its side, and a cover, D, having grooves that interlock or engage with said flanges, substantially as and for the purpose set forth.

6. The combination, substantially as described, of the rotatable wheel having the matrix-groove C in the side thereof, the laterally-circular cover having the funnel for the entrance of the fluid metal, and devices for forcing said cover down upon the mold with a yielding pressure, for the purpose set forth.

7. The combination, substantially as described, of the rotatable wheel having the matrix-groove C in the side thereof, the circular cover having the funnel F for conducting the fluid metal into the groove, devices for forcing said cover down upon the side of the wheel, and screw-studs, as at *m*, adapted to adjust and limit the pressure of said cover upon the mold, for the purposes set forth.

8. The combination, substantially as described, of the rotatable wheel having the matrix-groove C in the side thereof, the laterally-circular cover D, provided with fastening devices for retaining it in position, the feed-funnels F for conducting fluid metal into the said groove, and discharging-guide H, having a plowing-point, *i*, running in said groove, substantially as and for the purposes set forth.

9. The revoluble matrix-wheel provided with an annular groove or mold, as at C, and having adjacent thereto annular cooling-grooves *a*, substantially as and for the purpose set forth.

10. The cover D, formed in a series of sections, in combination with the matrix-wheel A, supporters E, with the breaking-bars P,

wedges *r*, and screw-studs *m*, substantially as and for the purpose set forth.

11. The combination, with the rotatable wheel A, having the groove or matrix C, of the supporting-wheels B′, the cover D, supporters E, and cover pressure devices connected therewith, as and for the purposes set forth.

12. In a mechanism for making ingots or bars from fluid metal, the combination, with a wheel or carrier having the groove or matrix formed in the side of its rim, and mounted to revolve upon a central upright spindle, A′, and a series of supporting-wheels located beneath its periphery, of an adjusting-step, b^2, on which the lower end of said spindle is supported, substantially as and for the purpose set forth.

13. The combination of the cover-sections, having overlying ends at J, the screw-stud *m*, the supporter or bracket E, slotted for said stud, the pressure-bar P, and wedge *r*, substantially as and for the purpose set forth.

14. The combination, substantially as described, of the matrix-wheel, its axis or spindle, having a hollow or opening extending therethrough, and the step-bearing *b*, provided with passages *o*, substantially as and for the purposes set forth.

Witness my hand this 11th day of June, A. D. 1886.

FRED H. DANIELS.

Witnesses:
CHAS. H. BURLEIGH,
ELLA P. BLENUS.