T. D. WEST.

MOLD FOR CASTING CHILLED CAR WHEELS OR OTHER CIRCULAR OBJECTS.

APPLICATION FILED SEPT. 10, 1910.

981,904. Patented Jan. 17, 1911.

5 SHEETS—SHEET 1.

Fig. 1.

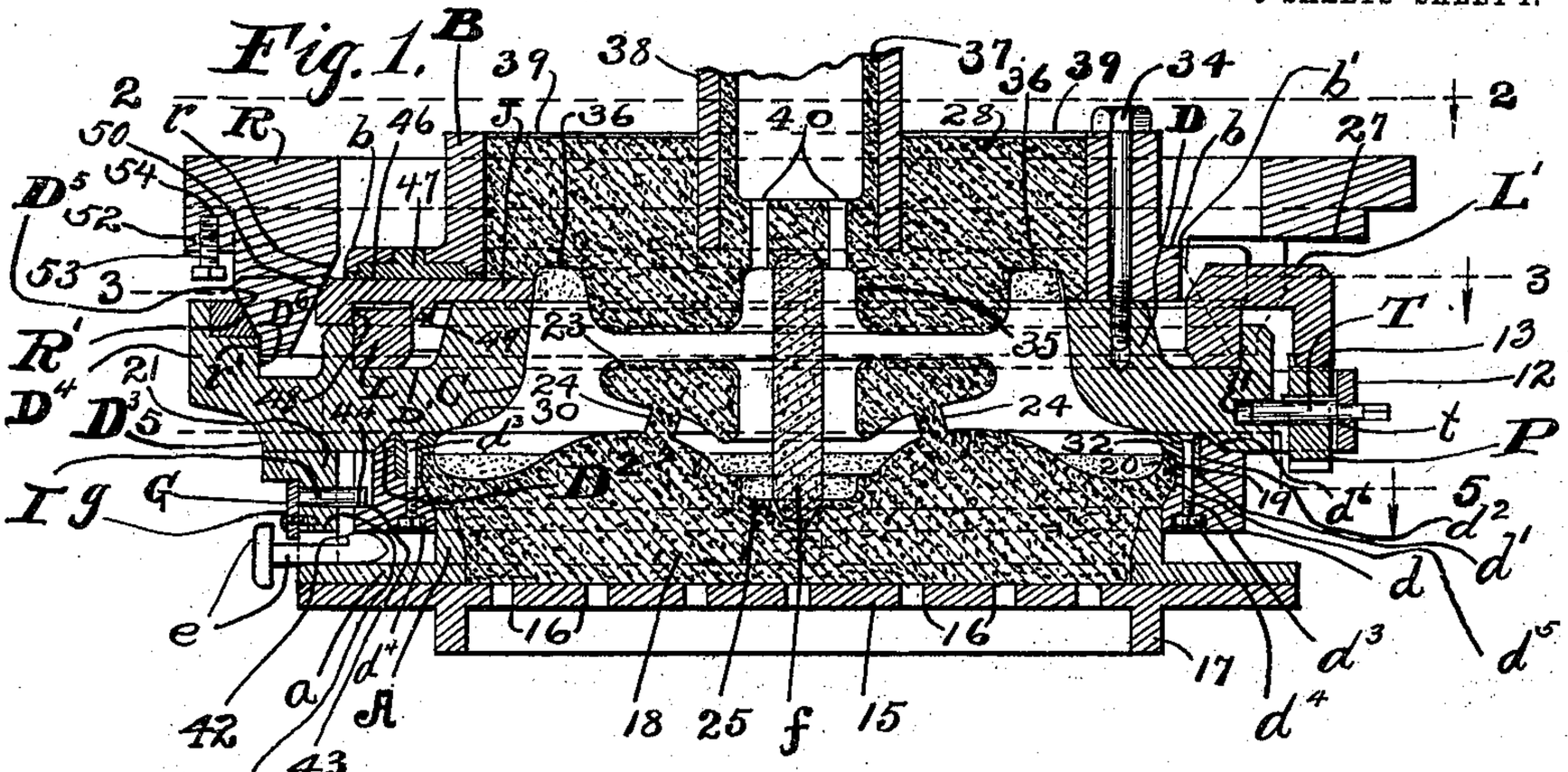
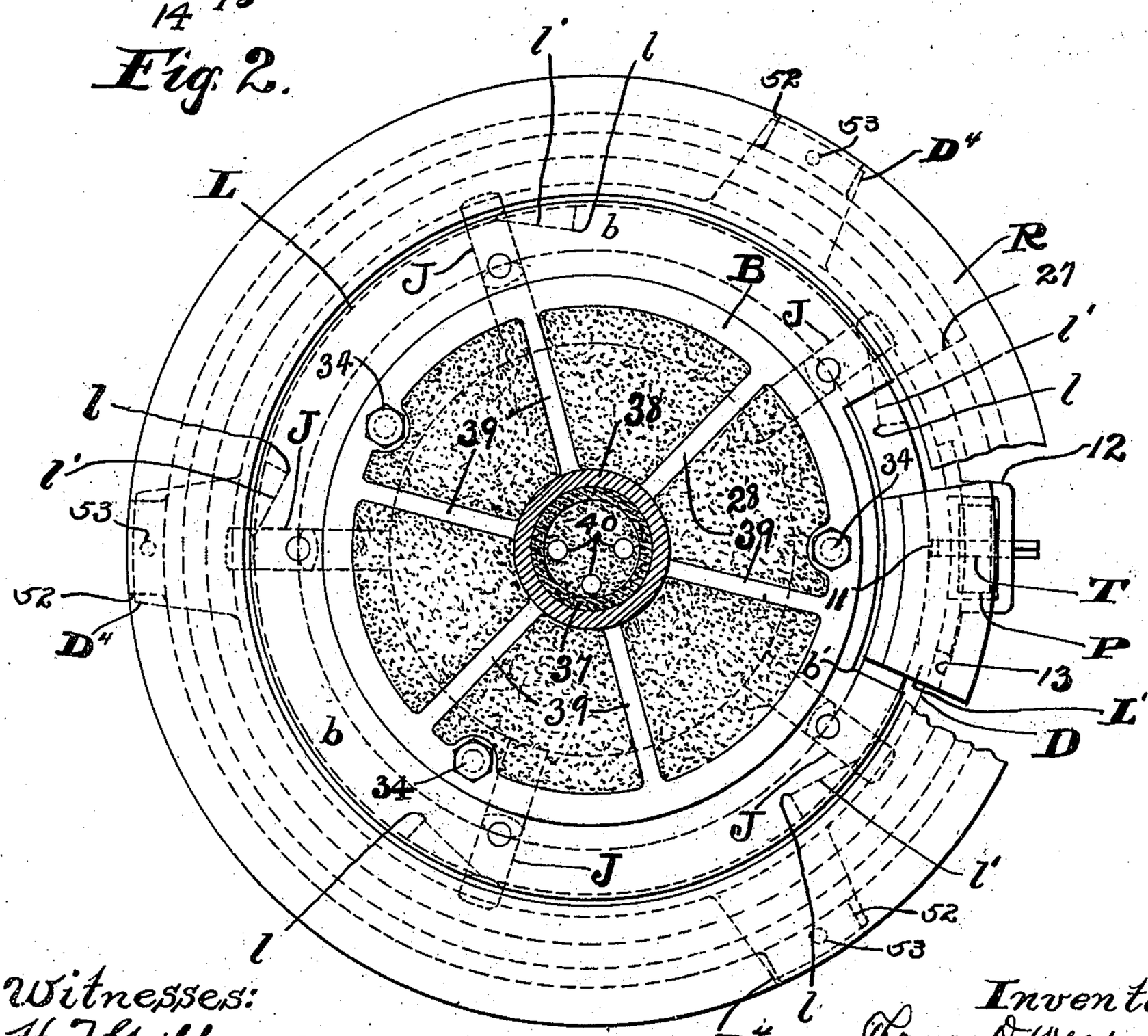


Fig. 2.



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5 SHEETS—SHEET 2.

Fig. 3.

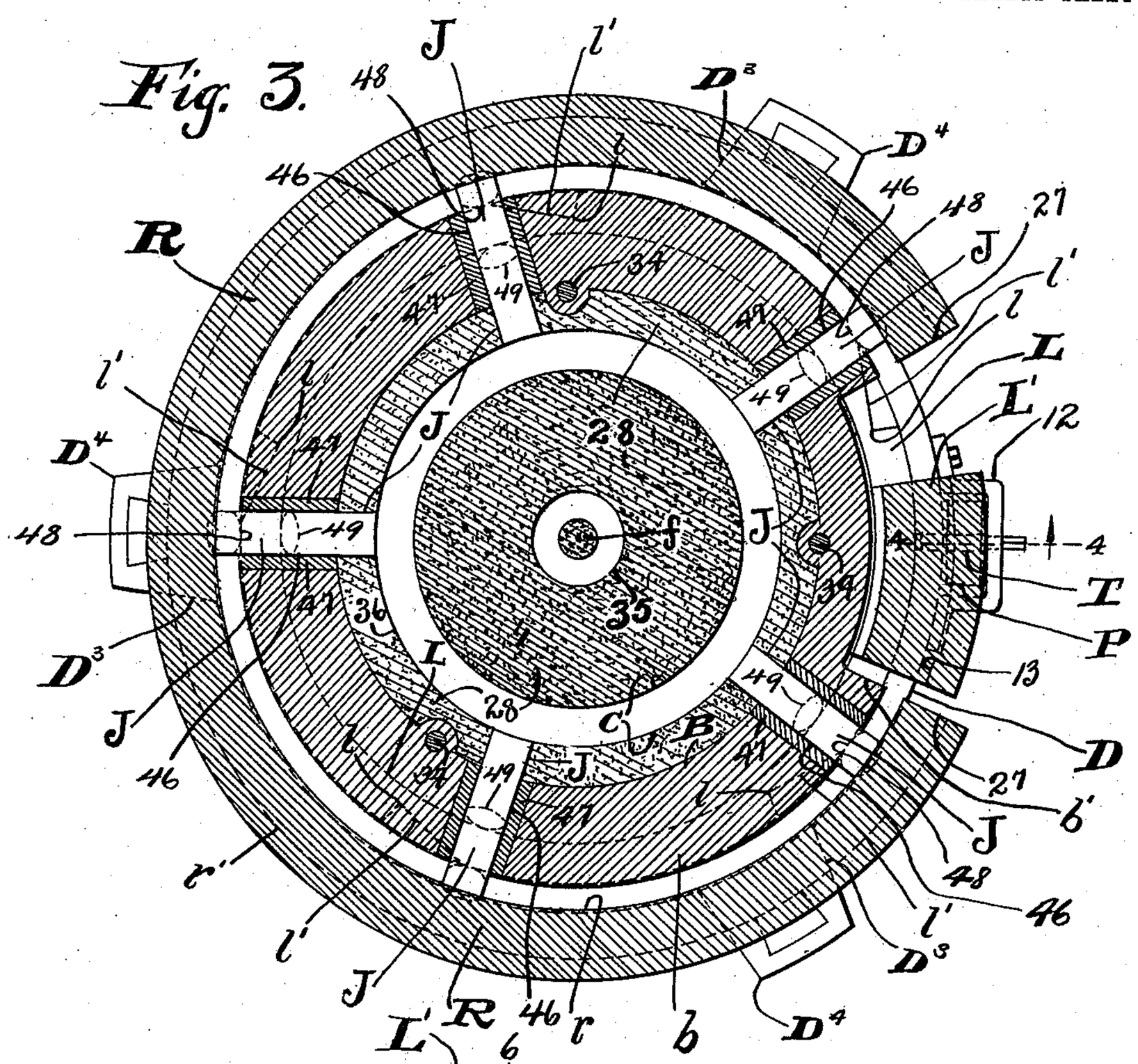
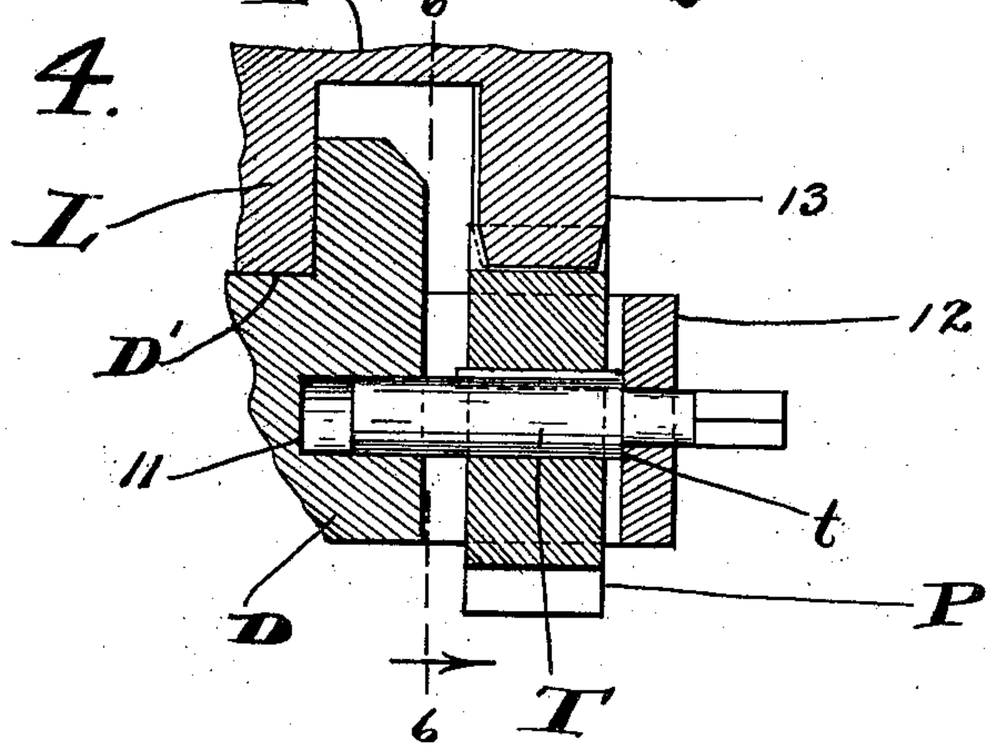


Fig. 4.



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5 SHEETS—SHEET 3.

Fig. 5.

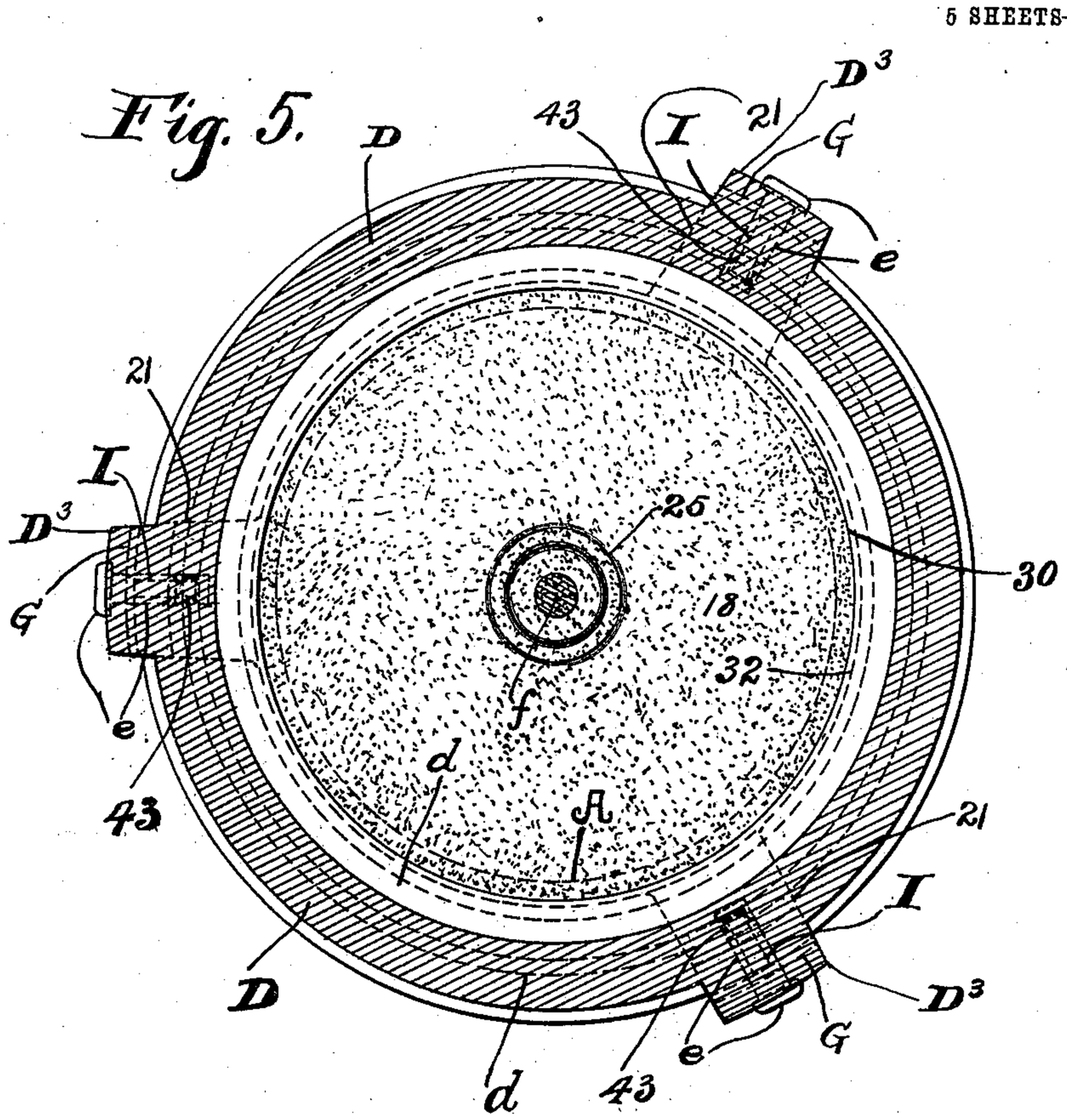
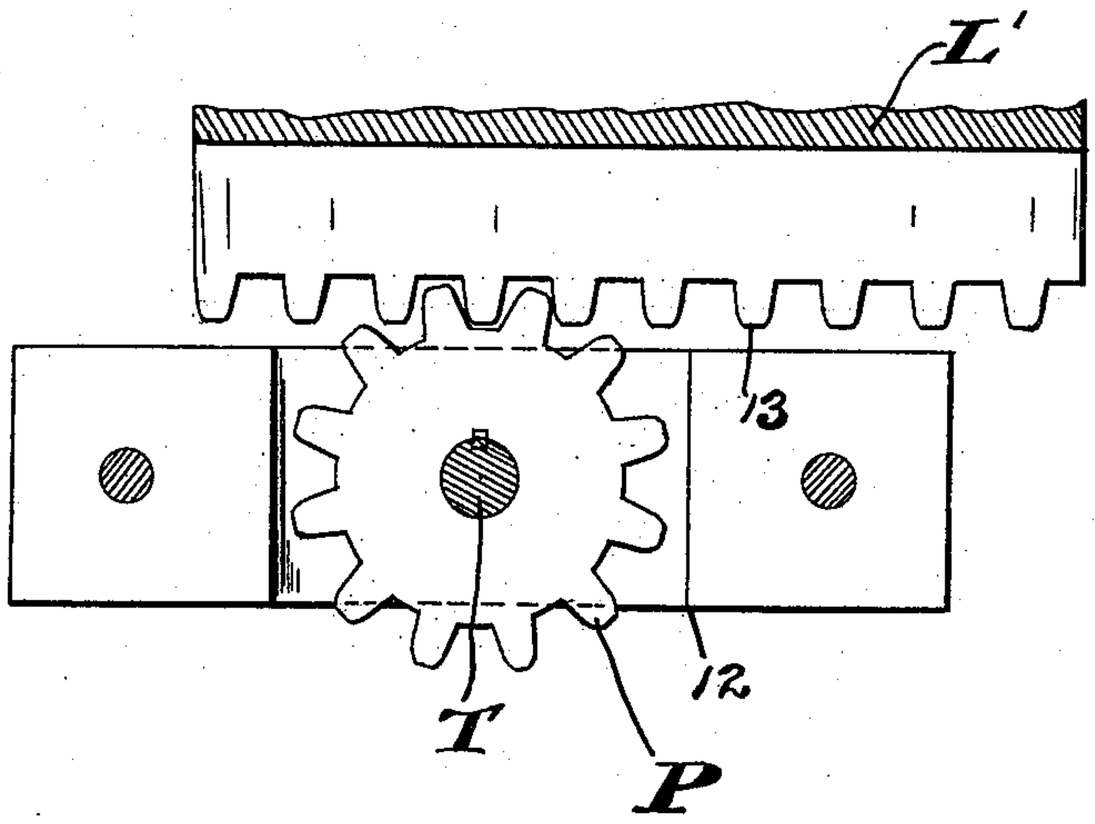


Fig. 6.



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5 SHEETS—SHEET 4.

Fig. 7.

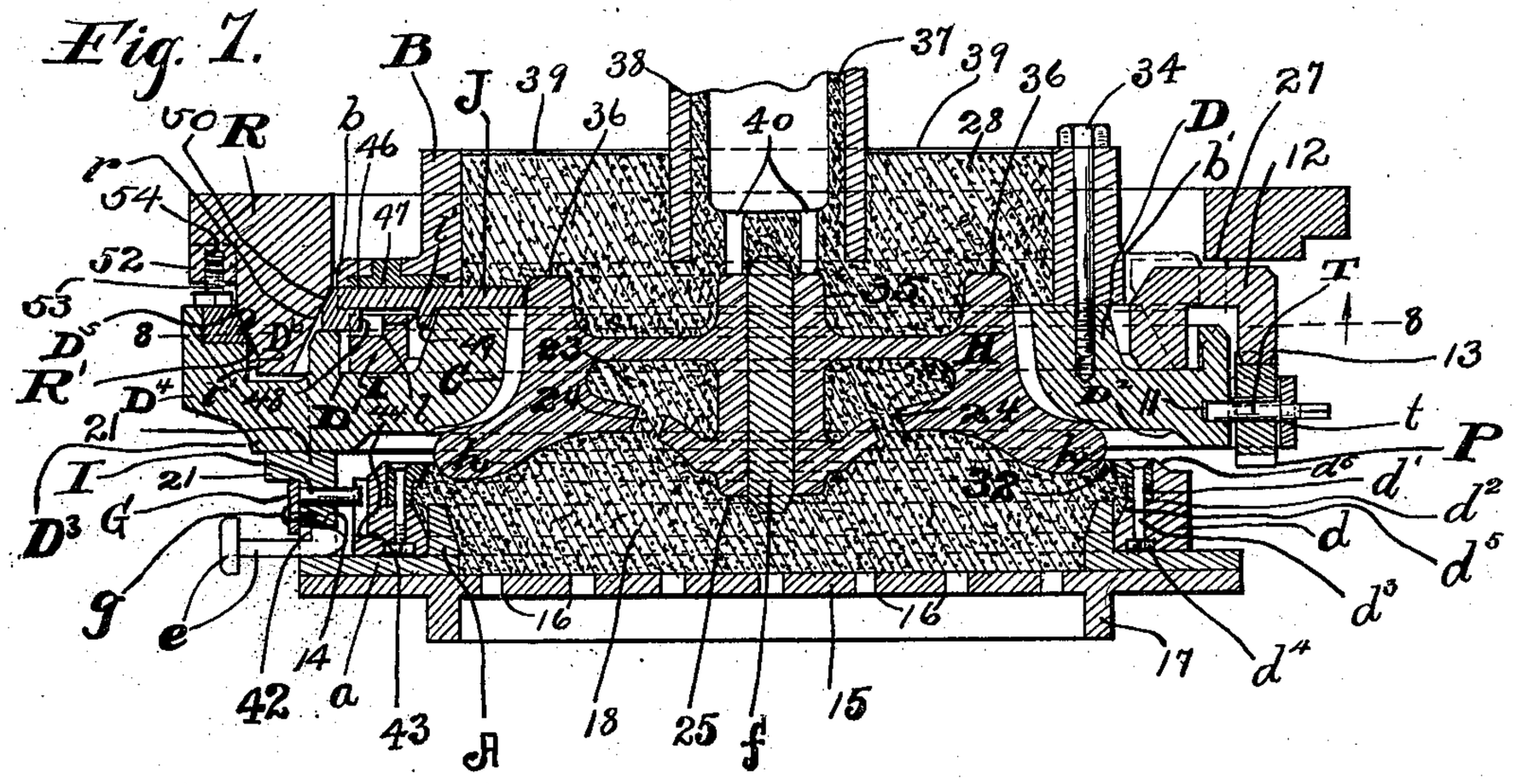
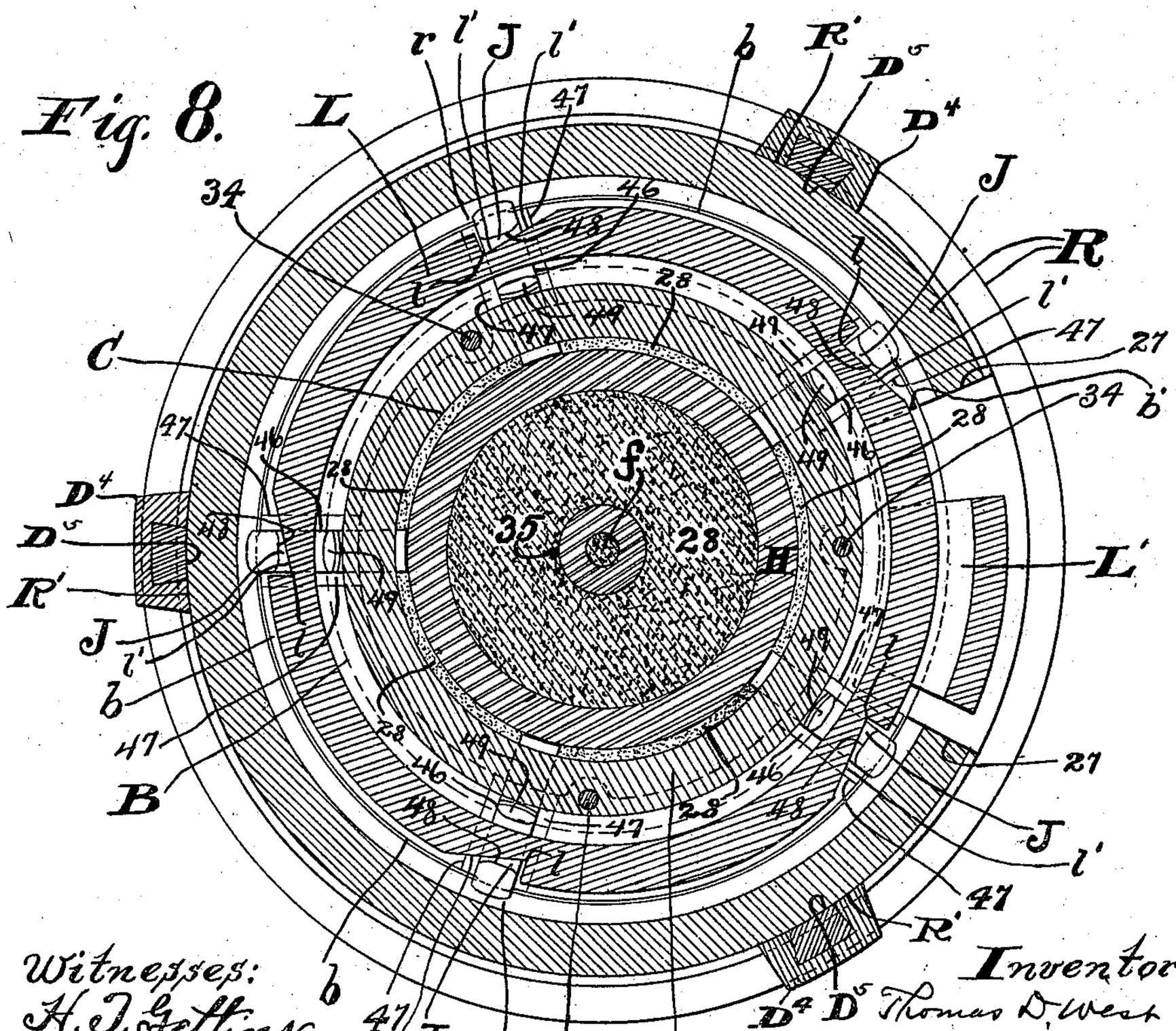


Fig. 8.



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APPLICATION FILED SEPT. 10, 1910.

981,904. **Patented Jan. 17, 1911.**

5 SHEETS—SHEET 5.

Fig. 9

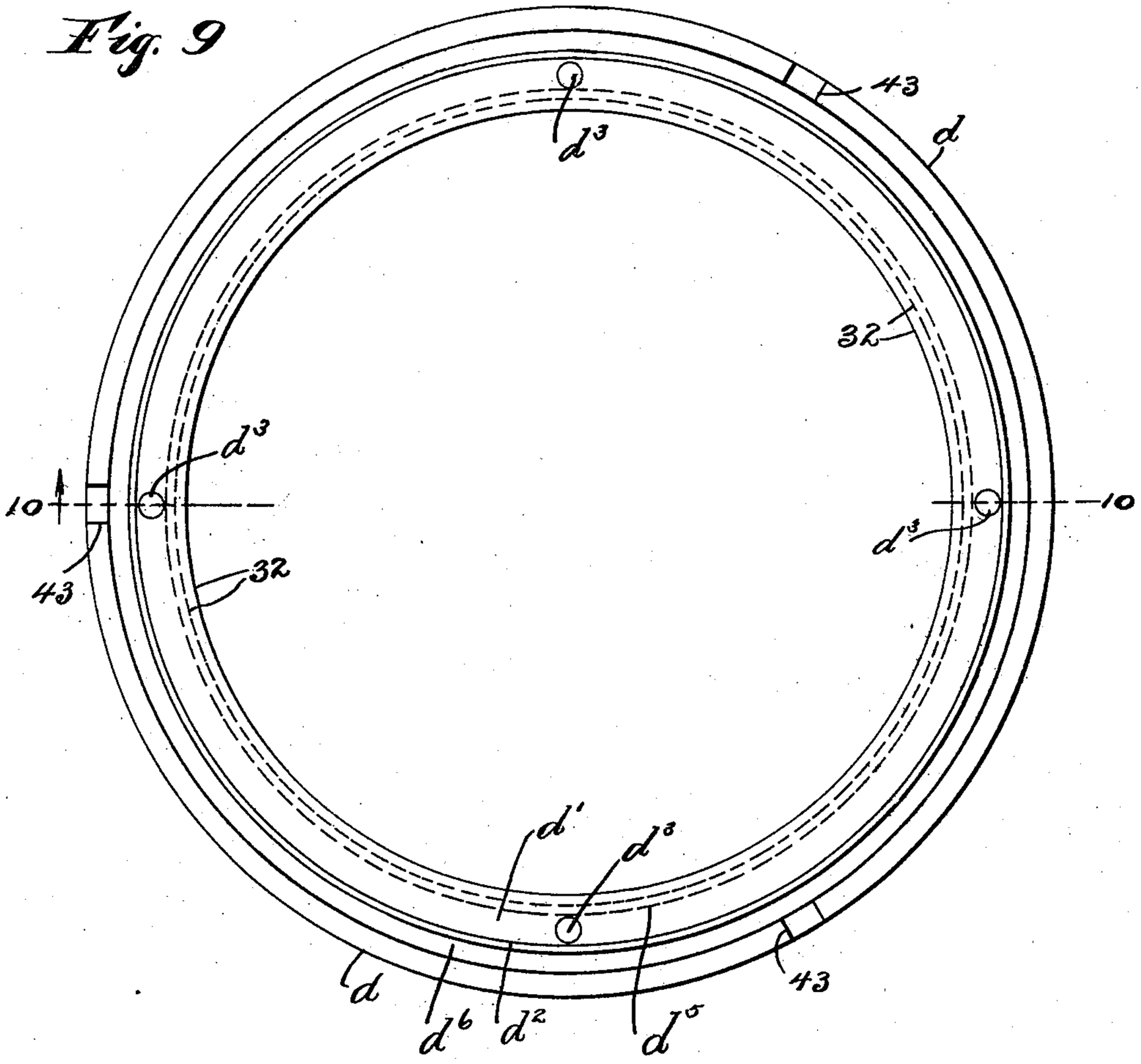
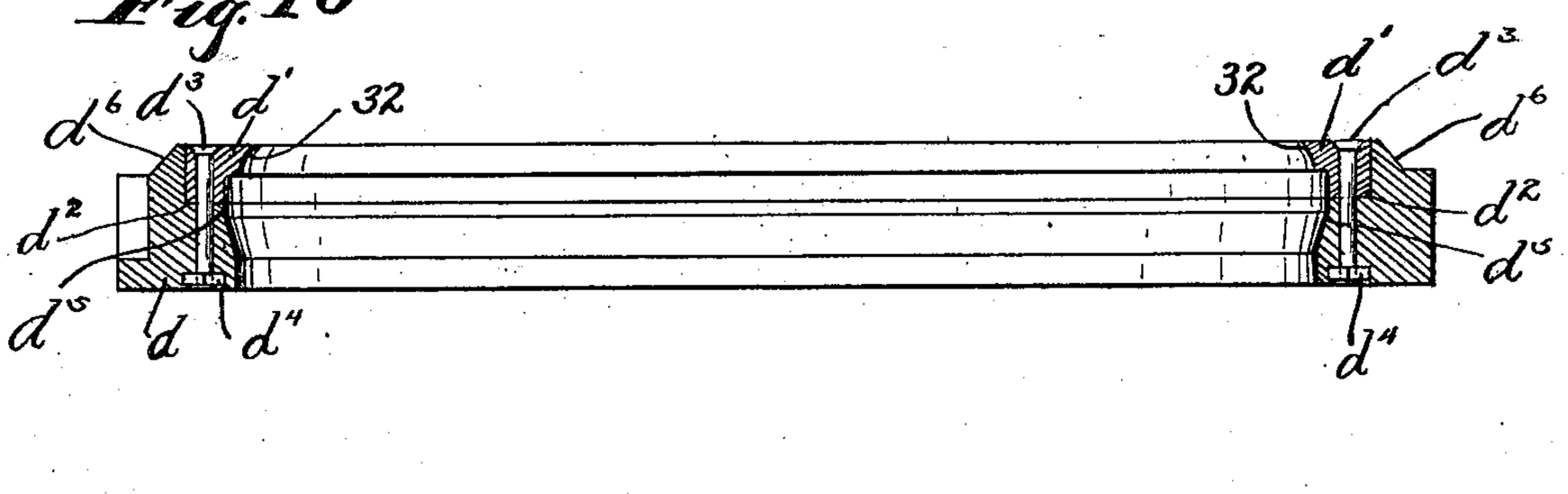


Fig. 10



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UNITED STATES PATENT OFFICE.

THOMAS D. WEST, OF CLEVELAND, OHIO.

MOLD FOR CASTING CHILLED CAR-WHEELS OR OTHER CIRCULAR OBJECTS.

981,904. Specification of Letters Patent. Patented Jan. 17, 1911.

Application filed September 10, 1910. Serial No. 581,444.

To all whom it may concern:

Be it known that I, THOMAS D. WEST, a citizen of the United States of America, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Molds for Casting Chilled Car-Wheels or other Circular Objects; and I hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

This invention relates to an improved mold for casting a chilled-car-wheel or other circular object provided at one end thereof with a circumferentially extending flange having a rounded periphery, and this invention pertains more especially to a mold comprising the following:—a substantially vertically arranged annular chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported movable casting-centering members which are spaced circumferentially of the chill and normally in position to move into the said chamber; means whereby the said casting-centering members are locked in their outer position, which locking means is capable of being rendered inoperative to permit the movement of the casting-centering members into the said chamber, and means employed in actuating the casting-centering members into the said chamber when the said casting-centering members are free to move inwardly upon rendering the aforesaid locking means inoperative.

One object of this invention is to improve the construction of mold disclosed and claimed in United States Letters Patent No. 918,236, granted to me April 13, 1909.

Another object is to utilize the lateral and outward expansion of the chill by heat in controlling the operation of casting-centering means and more especially in controlling the operation of means employed in actuating the aforesaid casting-centering members into the chamber of the mold and automatically operating during the said expansion of the chill upon rendering the hereinbefore mentioned locking means inoperative.

Another object is to employ a weight so arranged relative to the aforesaid casting-centering members that the latter, when they are free to move inwardly, are actuated inwardly by the weight during the descent of the weight, and to have the said descent controlled by the lateral and outward expansion of the chill by heat.

Another object is to accurately and readily center the said weight relative to the chill during the assemblage of the parts and to insure the maintenance of an accurate centering of the weight relative to the chill during the lateral and outward expansion of the chill by heat.

Another object is to arrest the descent of the weight preparatory to the completion of the contraction of the casting while the latter is in the mold and before the casting-centering members actuated by the weight during the descent of the weight can tightly engage or press against the casting at their inner ends so that the said casting-centering members will not bind against the casting and consequently do not interfere with the removability of the casting from the mold with facility.

Another object is to have the weight not only supported from the chill in the lowermost position of the weight but to provide desirable bearings for the weight in the said position of the weight.

Another object is to inexpensively afford a level bearing to the weight in the lowermost position of the weight.

Another object is not only to employ a locking ring for locking the aforesaid casting-centering members in their outer position, and to have the said ring engage an annular recess formed in the upper side of the chill and spaced from and extending circumferentially of the chamber of the mold, but to have the outer side wall of the said recess concentric relative to the said chamber and instrumental in centering the said ring relative to the said chamber during the assemblage of the parts.

Another object is not only to have the said locking ring and the aforesaid casting-centering members relatively contoured so that the latter are locked in their outer position by the said ring or free to move inwardly according as the said ring has been shifted to the extent required in the one or the other direction, but to prevent any binding between the said ring and the chill during the expansion of the chill by heat.

Another object is to provide means whereby the said locking ring may be operated with facility.

Another object of this invention is not only to utilize the drag of the mold and the chill in forming the flange of the casting to be produced, but to have the chill comprise an annular vertically shiftable section which is not only capable of assisting in centering the casting at the rounded periphery of the said flange but has an internal laterally inwardly and downwardly facing sloping surface arranged to form the upper portion of the said periphery and is provided internally and below the said surface with an annular recess into which the sand-body of the drag is extended and contoured so as to form the lower portion of the said periphery without interfering with the descent of the said chill-section during the contraction of the casting.

Another object is to permit the formation of the internal upper portion of the said shiftable chill-section of steel or other metal while the lower portion of the said chill-section is of cast-iron, and also to permit of a renewal of the aforesaid internal sloping surface of the said chill-section without requiring a renewal of the lower portion of the said chill-section.

With this object in view, and to the end of attaining any advantages hereinafter appearing, this invention consists in certain features of construction, and combinations of parts, hereinafter described, pointed out in the claims, and illustrated in the accompanying drawings.

In the said drawings, Figure 1 is a central vertical section of my improved mold ready to be poured. Portions are broken away in this figure to show certain features of the construction. Fig. 2 is a horizontal section on line 2—2, Fig. 1, looking downwardly. Fig. 3 is a horizontal section on line 3—3, Fig. 1, looking downwardly. Fig. 4 is a vertical section in detail, the section being taken along the line 4—4, Fig. 3, looking in the direction indicated by the arrow. Fig. 5 is a horizontal section on line 5—5, Fig. 1, looking downwardly. Fig. 6 is a vertical section on line 6—6, Fig. 4, looking outwardly. Fig. 7 is a central vertical section of the mold showing a car-wheel cast within and by the mold. Fig. 8 is a horizontal section on line 8—8, Fig. 7, looking upwardly. Fig. 9 is a top plan of the shiftable chill-section. Fig. 10 is a central vertical section on line 10—10, Fig. 9. Figs. 4, 6, 9 and 10 are drawn on a larger scale than Figs. 1, 2, 3, 5, 7 and 8.

My improved mold consists in the main of an upper mold-part or cope, a lower mold-part or drag and a central mold-part or chill.

I would here remark that an annular chill employed as the central part of a mold for casting chilled car-wheels or other circular objects expands substantially the maximum extent in a few minutes after the mold has been filled with molten metal, and one object of my present invention, as will hereinafter appear, is to utilize this expansion, which is gradual and uniform, in controlling the automatic operation of appliances that are instrumental in insuring the production of a chilled car-wheel or other circular object having a peripheral chilled crust or shell which is uniform in thickness circumferentially of the said circular object and exactly concentric relative to the axis or center of the said circular object.

Referring to Figs. 1, 5 and 7 of the drawings, A indicates an annular metal shell or casing which forms a portion of the lower mold-part or drag and is concentric relative to the center of the mold. The casing A is arranged vertically and rests upon a horizontally arranged metal plate 15 which is suitably secured to the said casing and forms the bottom of the drag, which bottom is provided with vent-holes 16 and a vertically downwardly projecting annular flange 17 serving to elevate the bottom above the floor or support upon which the mold is to be mounted. The drag is suitably rammed with sand, and the body of packed sand 18 of the drag fills the chamber formed within the casing A and preferably extends over and covers the upper end of the said casing. The top of the sand-body 18 of the drag has the contour required to form the bottom of the casting.

B (see Figs. 1, 2, 3 and 7) indicates an annular metal shell or casing which forms a portion of the upper mold-part or cope and is concentric relative to the center of the mold. The casing B is arranged vertically and supported as will hereinafter appear. The cope is suitably rammed with sand, and the body of packed sand 28 of the cope substantially fills the chamber formed within the casing B. The bottom of the sand-body 28 of the cope has the contour required to form the top of the casting. The cope and the drag are spaced vertically. That is, the cope is arranged a suitable distance above the drag to form a chamber C between them which chamber is enlarged diametrically and annularly at its lower end, as at 30 (see Figs. 1 and 5).

The central mold-part or chill is annular and arranged vertically and centered relative to the drag and the cope, being instrumental in forming the surrounding wall of the chamber C. The said chill comprises a substantially vertically arranged stationary annular body or section D of cast-iron or other metal. The chill-section D is arranged concentrically relative to the center of the mold. The chill also comprises a substantially vertically arranged vertically or endwise shiftable metal section which consists preferably of a ring *d'* made of steel or

other metal and mounted in a cast-iron ring *d*. The said shiftable chill-section is arranged under and concentric relative to the stationary chill-section D. The said shiftable or lower chill-section (see Figs. 1, 5 and 7) surrounds the drag and is normally in its upper position and capable of being lowered as will hereinafter appear, being locked or held in its upper position by suitably supported movable bars *e*. The said shiftable chill-section, in its upper and normal position, is instrumental in forming the surrounding wall of the lower end of the chamber C. The said shiftable chill-section is shown detached in Figs. 9 and 10. The ring *d* of the shiftable chill-section forms the lower portion of the said chill-section and is provided at its upper end and internally with an annular recess, d^2, as shown in Figs. 9 and 10, and the ring *d'* of the said chill-section engages the said recess and rests on the bottom of the recess. The ring *d'* forms the upper inner portion of the shiftable chill-section. The ring *d'* is secured to the ring *d* preferably removably by suitably applied bolts d^3 and nuts d^4 (see Figs. 9 and 10).

The flange of the car-wheel or flanged circular object to be cast in the mold is formed next above the outer portion of the drag, and the upper portion of the shiftable chill-section projects far enough above the drag in the upper position of the said chill-section to form the upper portion of the rounded periphery of the said flange. The shiftable chill-section is provided internally of its upper end with a downwardly and laterally inwardly facing sloping annular surface 32 which is shown formed internally of the ring *d'* of the said chill-section and, in the upper position of the said chill-section, participates in the formation of the upper portion of the surrounding wall of the diametrically enlarged lower end of the chamber C and in casting forms the upper portion of the desired rounded periphery of the flange of the car-wheel or flanged circular object being cast. The shiftable chill-section slidably or loosely embraces the casing A of the drag and is guided during its endwise movement by the said casing which is externally circular and concentric relative to the center of the mold so that the said chill-section is always centered accurately relative to the center of the mold and its sloping surface 32 kept concentric relative to the center of the chamber C during the descent of the said chill-section. The shiftable chill-section is provided internally and next below its sloping surface 32 with an annular recess d^5 arranged centrally between the top and bottom of the said chill-section, and the body of packed sand 18 of the drag is extended laterally and outwardly and upwardly into and fills the recess d^5 in the said chill-section, as at 19, Fig. 1, and the sand-filling 19 in the said recess has preferably an upwardly and laterally inwardly facing annular internal surface 20 which (see Fig. 1) forms the lower portion of the surrounding wall of the diametrically enlarged lower end of the chamber C and in casting forms the lower portion of the desired rounded periphery of the flange of the car-wheel or flanged circular object being cast without chilling the said lower portion of the said flange. As shown in Figs. 9 and 10 the recess d^5 is formed partially in the ring *d* and partially in the ring *d'* of the shiftable chill-section, and the top wall of the said recess is formed by the ring *d'* of the said chill-section. The formation of the shiftable section of two rings *d* and *d'*, as shown, not only permits of the formation of the internal upper portion of the said chill-section of steel or other metal while the lower portion of the said chill-section is of cast-iron, but also permits of a renewal of the internal sloping surface 32 of the said chill-section without requiring a renewal of the lower portion or ring *d* of the said chill-section.

I would here remark that the sectional construction of the shiftable chill-section and the extension of the sand-body of the drag into the said chill-section so that the said sand-body has the portion thereof which forms the outline of the lower portion of the flange of the casting supported by the said chill-section without interfering with the said chill-section in assisting the centering of the casting at the said flange during the contraction of the casting constitute meritorious features of my present invention.

The periphery or tread of the wheel or circular object to be cast between the flanged end of the said wheel or object and the opposite end of the object is formed in the main by the internal surface of the stationary chill-section D which is arranged concentrically relative to the sloping surface 32 of the shiftable chill-section. Obviously therefore the stationary chill-section D is instrumental in forming the surrounding wall of the chamber C between the shiftable chill-section at the lower or diametrically larger end of the said chamber and the upper end of the chamber and is smaller in internal diameter between the diametrical enlargement 30 of the lower end of the said chamber and the upper end of the chamber than the shiftable chill-section but has the bore formed therein flaring downwardly toward the said shiftable chill-section and substantially meeting the upper extremity of the internal sloping surface 32 of the said shiftable chill-section in the upper position of the said shiftable chill-section.

The stationary chill-section is supported from the drag, and preferably the drag-casing A is provided at its lower end and ex-

ternally and below the range of movement of the shiftable chill-section with a laterally and outwardly projecting annular flange *a* which is provided at its upper side and next to its periphery with upwardly projecting lugs 21 upon which the stationary chill-section D is mounted.

The stationary chill-section D is shown centered relative to the drag and shiftable chill-section (see Fig. 1) by means of a downwardly and laterally inwardly facing annular shoulder D^2 formed on the said stationary chill-section at the bottom of the stationary chill-section and overlapping an upwardly and laterally outwardly facing sloping shoulder d^6 which is formed on the shiftable chill-section at the top of the latter, as shown more clearly in Figs. 9 and 10.

The cope-casing B is enough larger in internal diameter than the stationary chill-section D at the upper end of the latter to cause the said chill-section to be covered by the sand-body 28 of the cope around the bore in the said chill-section, as shown in Figs. 1 and 7.

The cope-casing B (see Figs. 1, 3, 7 and 8) is provided at its lower end and externally with a laterally and outwardly projecting annular flange *b* which extends circumferentially of the cope-casing, and the said casing is provided in its lower end with recesses 46 which are spaced circumferentially of the cope-casing and extend laterally through the cope-casing from the internal surface of the cope-casing to the circumferentially extending edge of the flange *b*. Each recess 46 is engaged by a metal bar J which extends through the said recess, and the cope-casing B, including its flange *b*, is provided with Babbitt or other suitable metal 47 arranged to largely form the top and side walls of the recesses 46 and thereby form desirable bearings for the shiftable bars J engaging the said recesses.

The cope-casing B rests on the stationary chill-section D and is secured to the latter preferably removably by bolts or screws 34 applied in any approved manner (see Figs. 1, 2, 3 and 7).

The sand body 28 of the cope is provided in its under side and centrally with a circular cavity 35 which is arranged in line vertically and corresponds in dimensions with a circular cavity 25 formed in and centrally of the top of the sand-body 18 of the drag. The sand-body 28 of the cope is provided in its under side and next the internal surface of the stationary chill-section D with an annular recess 36 which is arranged concentrically relative to the said chill-section and consequently circumferentially relative to the center of the chamber C and forms an upward annular enlargement of the said chamber.

The cope and the drag of the mold illustrated are rammed to more especially fit them for casting a car-wheel which has a hub provided with a central bore extending therethrough, and consequently a baked sand-core *f* is arranged vertically and centrally of the chamber C and extends through the said chamber and through the cavities 25 and 35 from within the bottom of the cavity 25 into the top wall of the cavity 35. To form an annular chamber within and centrally of the casting an annular sand-core 23 which has an internal diameter substantially corresponding with the diameter of the cavities 25 and 35 is arranged centrally of the chamber C and concentrically relative to the core *f* and connected, as at 24, at a plurality of points with and supported from the sand-body 18 of the drag, and further supported or held down when pouring the mold by chaplets not shown. The top wall of the cope-cavity 35 forms the bottom of a circular pouring basin which has the surrounding wall 37 of its chamber built up of sand and inclosed by a metal casing 38 which is connected with the cope-casing B by webs 39 which are spaced circumferentially of the said basin and embedded in and instrumental in supporting the sand-body 28 of the cope. The pouring basin is formed centrally of the sand-body 28 of the cope and has its bottom provided with gates or perforations 40 which establish communication between the said basin and the cope-cavity 35. The molten metal employed in pouring the mold is supplied to the pouring basin, thence flows through the gates or perforations 40 in the bottom of the said basin and through the cope-cavity 35 into the chamber C and fills every unoccupied portion of the said chamber. During the cooling of the molten metal with which the mold has been poured the casting formed in the mold contracts horizontally or diametrically and becomes smaller in external diameter during the cooling process and thereby frees the stationary chill-section D.

By the descent of the shiftable or lower chill-section during the horizontal contraction of the casting the internal sloping surface 32 of the said chill-section will remain in contact with and hug the upper portion of the rounded peripheral surface of the flange of the casting during the said contraction of the casting until the said chill-section has lowered far enough to free the casting and thereby assists the production of a circumferentially chilled circular object which has its chill uniform in thickness circumferentially of and throughout that portion of the body required to be chilled, and has all of its outer circumferentially extending or peripheral surfaces con-

centric relative to the axis or center of the object. As already indicated, the shiftable chill-section is locked or supported in its upper position by movable bars *e*, but as soon as a sufficient crust or shell is formed on the casting after the pouring of the mold the said bars are shifted outwardly from under the said chill-section to render the said chill-section, so far as the said bars are concerned, free to descend by gravity, and the said chill-section, when rendered free to descend, will by its weight break away or press downward the projecting portion 19 of the sand-body 18 of the drag and of course lower by gravity as fast as the casting contracts horizontally during the cooling of the casting. The bars *e* are arranged substantially radially and spaced circumferentially of the mold below the shiftable chill-section. The bars *e* rest upon the flange *a* of the drag-casing A and are shiftable endwise. The bars *e* project under and hold and lock the shiftable chill-section in its upper position, or are removed from under the said chill-section according as the bars are at the one or the other extremity of their range of movement. Each bar *e* is provided near its inner end and on top with an outwardly facing shoulder 42, as shown in Figs. 1 and 7, and a plate G which is attached, preferably removably by means of any suitable number of screws *g*, to the outer side of a lug 21 of the flange *a* is arranged to cooperate with the said shoulder in forming a stop for limiting outward movement of the bar and prevent accidental detachment of the bar from the mold, and the said lug 21 is slotted, as at 14, to accommodate the location of the said bar. In Fig. 7 a bar *e* is shown in its outer and inoperative position and consequently removed from under the shiftable chill-section and the said chill-section in this figure is shown lowered far enough to free the flange *h* of the casting H shown formed in the mold.

Means for preventing detachment of the shiftable chill-section from the drag-casing A when the drag is turned down side up, either preparatory to the assemblage of the parts of the mold or after the separation of the stationary chill-section D and connected cope and the casting from the drag, are provided and preferably comprise pins I spaced circumferentially of the mold. Each pin I extends loosely through a lug 21 a suitable distance above the adjacent bar *e* into a recess 43 formed in the outer side of the shiftable chill-section and extending vertically downwardly from the upper extremity of the said chill-section, which recess has its bottom forming an upwardly facing shoulder 44 which is overlapped by the said pin. It will be observed therefore that the shiftable chill-section is provided at its outer side with upwardly facing shoulders 44 spaced circumferentially of the said chill-section and overlapped by suitably supported pins I which are preferably withdrawable endwise from over the said shoulders to detach the said chill-section if desired from the drag, and that the extension of the recesses 43 to the upper extremity of the said chill-section accommodates the location of the pins I and avoids interference by the said pins with the descent of the said chill-section upon rendering the latter free to lower.

Means employed in centering the casting at its upper end and keeping the casting accurately centered relative to the center of the mold during the cooling and horizontal contraction of the casting while in the mold comprise the endwise movable bars J mounted on the stationary chill-section D and placed substantially radially and spaced circumferentially of the chill. The casting-centering bars J engage and extend through the recesses 46 formed in the lower end of the cope, as already hereinbefore indicated, and correspond in length and have their inner ends equidistant from a point centrally of the chamber C. The bars J in their outer position, as shown in Figs. 1 and 3, have their inner ends arranged flush with the upper internal surface of the chill-section D and are arranged to enter the recess or upward enlargement 36 of the chamber C and are locked in their outer position by a ring L (see Fig. 1) which is arranged concentrically relative to and shiftable circumferentially of the chill and preferably centered and normally held in place by the inwardly facing outer side wall of an annular recess D′ which is formed in the upper side of the chill and spaced from and arranged concentrically relative to and extending circumferentially of the chamber C. More especially important is the arrangement of the outer side wall of the recess D′ concentrically relative to the chamber C so that the locking ring L, when in position locking the bars J in their outer position, is accurately centered externally relative to the said chamber. The centering of the said ring relative to the said chamber by the outer side wall of the recess D′ during the assemblage of the parts constitutes a not unimportant feature of my present invention. The ring L rests on the bottom of the recess D′ and is spaced at its internal surface from the inner side wall of the said recess so that lateral and outward expansion of the chill by heat cannot interfere with the circumferential shiftability of the said ring. The spacing of the ring L at its internal surface from the inner side wall of the recess D′, positively preventing binding between the said ring and the chill during the expansion

of the chill by heat, obviously constitutes an important feature of my present invention. Each bar J extends across the recess D and has bearing on the chill at both sides of the said recess.

By the construction hereinbefore described it will be observed that each bar or casting-centering member J extends laterally and outwardly from the chill and is normally in position to move into the chamber C, and I would here remark that each bar or casting-centering member J (see Figs. 1, 3, 7 and 8) is provided at its under side and a suitable distance from its inner ends with an inwardly facing shoulder 48 which is flush with the outer wall of the recess D′ in the outer position of the said casting-centering member, as shown in Fig. 1.

Preferably each bar J (see Figs. 1, 3, 7 and 8) is provided at its under side with a lug 49 which projects downwardly between the side walls of the recess D′ and is arranged in suitable proximity to the inner side wall of the said recess in the inner position of the bar, and the said lug and the shoulder 48 of the said bar overlap the internal surface and circumferential surface respectively of the locking ring L and facilitate the proper positioning of the bar relative to the said ring. I would here remark that the locking ring L has such contour and arrangement relative to the shoulders 48 of the bars J that the circumferential surface of the said ring is overlapped by the said shoulders in the outer position of the bars and in position locking the bars in their outer position, or the said ring frees the said bars to permit them to move inwardly, according as the ring has been shifted circumferentially to the extent required in the one or the other direction.

Another feature of my present invention consists in the provision of the ring L (see Figs. 2, 3, 7 and 8) at its circumferential surface with recesses *l* which are spaced circumferentially of the ring and gradually increased in depth radially of the ring in one and the same direction circumferentially of the ring, which recesses are arranged to receive the shoulders 48 of the bars J and permit the bars to move inwardly upon actuating the ring to bring its recesses opposite the said shoulders.

By the construction hereinbefore described it will be observed that to render the locking ring L inoperative, so far as locking the bars J in their outer position is concerned, when the said ring is in its bar-locking position, all that is required is to shift the said ring circumferentially in the direction required to bring its recesses *l* opposite the shoulders 48 of the bars J and thereby permit inward movement of the said bars. Of course, the inward movement of the bars J can be limited by the depth of the said recesses, whereas the outward movement of the said bars is preferably limited by the lugs 49 of the bars coming in contact with the internal surface of the ring L.

Means for actuating the bars J simultaneously inwardly upon rendering the bar-locking means inoperative (see Figs. 1, 2, 3, 7 and 8) preferably comprise a vertically shiftable weight R which extends circumferentially of the cope and chill and is arranged vertically and concentrically relative to the chill. The weight R is therefore arranged concentrically relative to the chamber C and at its lower end overlaps the outer ends of the bars J. Preferably each bar J is provided at its outer end with an upwardly and laterally outwardly facing sloping surface 50, and the weight R extends circumferentially of the chill at the outer ends of the said bars and is provided internally with a downwardly and laterally inwardly facing sloping surface *r* which extends circumferentially of the cope and chill and engages the sloping surfaces 50 of the said bars.

The weight R is provided externally with a downwardly and laterally outwardly facing sloping surface R′ which extends circumferentially of the weight, and the stationary chill-section D extends under and affords bearing, as will hereinafter appear, to the last-mentioned surface but is spaced below the weight far enough from the lower end of the weight in the upper position of the weight to permit the weight to descend when the weight is permitted to descend and thereby actuate the bars J inwardly. Preferably the chill-section D is provided with arms D^3 which are spaced circumferentially of the chill and project laterally and outwardly below the weight and have upwardly projecting lugs D^4 provided with upwardly and laterally inwardly facing sloping seats D^5 affording bearing to the outer sloping surface R′ of the weight. The provision of the weight with the outer sloping surface R′, and the seats D^5 formed on the chill for the said surface, constitute important features of my present invention. The arms D^3 are spaced under the weight far enough from the lower end of the weight in the upper position of the weight to permit the weight to descend and thereby actuate the aforesaid bars inwardly when the chill-section D expands laterally and outwardly by heat and the said bars are free to move inwardly.

I would here remark that preferably the weight R is not only provided externally with the sloping surface R′ but also has an outer surface *r′* extending circumferentially of the weight and vertically downwardly from the lower end of the said sloping surface, and the lug D^4 of each arm D^3 of the chill-section D has a surface D^6 which ex-

tends downwardly from the lower end of the sloping surface D^5 of the said lug and normally affords lateral bearing or guidance to the vertical surface r' of the weight and participates in centering the weight relative to the chill during the assemblage of the parts and constitute a meritorious feature of my present invention.

It will be observed that my improved mold not only comprises movable casting-centering members J spaced circumferentially of the chill and arranged normally in position to move into the chamber and means whereby the casting-centering members are locked in their outer position, which locking means are capable of being rendered inoperative to permit the movement of the casting-centering members into the chamber, but also comprises means employed in actuating the casting-centering members into the chamber and having the operation thereof controlled by the lateral and outward expansion of the stationary chill-section by heat, said means for actuating the casting-centering members inwardly automatically operating during the said expansion of the chill upon rendering the aforesaid locking means inoperative so far as concerns the inward actuation of the said casting-centering members. The utilization of the lateral and outward expansion of the chill by heat in controlling the operation of the casting-centering means, and more especially in controlling the operation of the means employed in actuating the casting-centering members J into the chamber of the mold and automatically operating during the said expansion of the chill upon rendering the locking ring L inoperative, constitute an exceedingly valuable feature of my present invention.

The weight R is supported from the bars J and from the seats D^5 of the chill and held in its upper position while the said bars are locked in their outer position, and the degree of slant of the sloping surfaces r and R' of the weight, the sloping surfaces 50 of the bars J and the sloping surfaces D^5 of the chill is such that the weight, when the bars are unlocked and the stationary chill-section D expands laterally and outwardly by heat, descends by gravity to actuate the bars inwardly uniformly and simultaneously so as to assist the casting to be accurately centered relative to the chill.

Preferably the weight R is provided externally with lugs 52 which are spaced circumferentially of the weight and arranged over the different lugs D^4 respectively of the stationary chill-section D. Each lug 52 is provided with a vertically arranged set-screw 53 which is screwed into a correspondingly screw-threaded hole 54 extending vertically upwardly from the lower end of the lug. The set-screws 53 of the weight R engage and have bearing on the lugs D^4 of the stationary chill-section D in the lowermost position of the weight and consequently form vertically adjustable stops serving to limit the descent of the weight and consequently limiting the inward actuation of the casting-centering bars J by the weight, and a not unimportant feature of my present invention consists in such a relative arrangement of the parts that the said stops operate to interrupt the inward actuation of the casting-centering bars by the weight preparatory to the completion of the contraction of the casting while the latter is in the mold and before the said bars can tightly engage or press against the casting at their inner ends so that the said bars do not bind against the casting and consequently do not interfere with the removability of the casting from the mold with facility.

I would here remark that the set-screws or vertically adjustable stops 53 also constitute a meritorious feature of my present invention in that they provide desirable bearings for the weight in the lowermost position of the weight, and that a proper manipulation of the said set-screws or stops upon the assemblage of the parts insures a level bearing to the weight in the said position of the weight.

In practice, lateral and outward expansion of the chill loosens the lugs D^4 of the arms D^3 of the chill-section D at the vertical surface r' of the weight so that the vertical surfaces D^6 of the said lugs cease to accurately center and guide the weight relative to the chill. The provision of the outer sloping surface R' of the weight and the sloping seats D^5 of the chill are obviously invaluable therefore to insure the maintenance of an accurate centering of the weight relative to the chill when the said vertical surfaces of the chill and weight can not longer be relied upon during the lateral and outward expansion of the chill by heat in retaining the ring R concentric relative to the chill.

The side wall l' of each recess l in the locking ring L slopes so as to face laterally and outwardly and in the direction in which the said ring is shifted circumferentially in actuating the ring from its bar-locking into its bar-unlocking position so that in shifting the said ring in the opposite direction from its bar-unlocking into its bar-locking position the walls l' of the recesses l exert pressure against the shoulders 48 of the bars J and actuate the said bars from their inner into their outer position.

Another feature of my present invention consists in the provision of means whereby the locking ring L may be shifted circumferentially with facility, which means preferably comprise a horizontally arranged shaft T which has bearing in the stationary chill-section D, being loose within a hole 11 which is formed in the said chill-section at

one side of the chill and extends inwardly from the exterior of the chill a suitable distance. The shaft T projects laterally of and outwardly from the chill a suitable distance and is provided externally with a shoulder *t* which faces in the direction of the outer extremity of the shaft and is spaced from the chill and from the said extremity of the shaft. The shaft T is intergeared, as will hereinafter appear, with the aforesaid locking member between the last-mentioned shoulder and the shaft, and a bracket, 12, which is rigid with or supported from the stationary chill-section D, overlaps the said shoulder and affords bearing to the shaft between the said shoulder and the outer extremity of the shaft. A pinion P is operatively mounted on the shaft between the shoulder *t* and the chill, and a rack 13 meshes with the pinion and extends circumferentially of the chill and is rigid with an arm L′ formed on and projecting laterally of and outwardly from the ring L. The shaft T is rotated in any approved manner, as, for instance, by proper manipulation of a wrench or other device applied to the outer end of the shaft. The weight R is slotted or cut away, as at 27 to accommodate the location and operation of the rack, and the flange *b* of the cope-casing is slotted or cut away, as at *b*′, for the same purpose.

Although I have hereinbefore described a portion of the chill (the section composed of the rings *d* and *d*′) as shiftable and utilized not only as a part of the chill but in centering the casting, I would have it understood that an accurate centering of the casting can in most cases be effectually accomplished and maintained by the use only of the casting-centering bars J.

What I claim is:—

1. In a mold of the character indicated, a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, which chamber is diametrically enlarged at its lower end, said chill comprising a substantially vertically arranged stationary annular section and a vertically shiftable annular section arranged under and concentric relative to the stationary section, the shiftable chill-section being normally in its upper position and provided internally of its upper end with a downwardly and laterally inwardly facing annular sloping surface which participates in the formation of the surrounding wall of the diametrically enlarged end of the chamber, said shiftable chill-section being also provided internally and between its lower end and the said sloping surface with an annular recess which is filled with packed sand which participates in the formation of the last-mentioned wall.

2. In a mold of the character indicated, a lower mold-part or drag having a body of packed sand forming the top of the drag; an upper mold-part or cope arranged above and spaced from the drag to form a molten-metal-receiving chamber between the drag and the cope, which chamber has a diametrical enlargement at its lower end, and an annular chill comprising a substantially vertically arranged stationary annular section instrumental in forming the surrounding wall of the chamber between the aforesaid enlargement and the upper end of the chamber, said chill also comprising a vertically shiftable annular section arranged under and concentric relative to the stationary chill-section, the shiftable chill-section being normally in its upper position and provided internally of its upper end with a downwardly and laterally inwardly facing annular sloping surface which participates in the formation of the surrounding wall of the aforesaid diametrical enlargement of the chamber, and the aforesaid body of sand having an extension entering the shiftable chill-section below and meeting the said sloping surface of the said chill-section, said extension of the said body of sand forming the lower portion of the surrounding wall of the aforesaid enlargement of the chamber and being supported from the shiftable chill-section.

3. In a mold of the character indicated, a lower mold-part or drag; an upper mold-part or cope arranged above and spaced from the drag to form a chamber between the drag and the cope, which chamber has an inlet for the passage of molten metal to the chamber, and a chill instrumental in forming the surrounding wall of the said chamber and comprising a substantially vertically arranged endwise shiftable annular section provided with a circumferentially extending sloping surface which participates in the formation of the aforesaid wall, said shiftable chill-section being composed of two rings which are secured together, and the said sloping surface being formed wholly on one of the said rings.

4. In a mold of the character indicated, a lower mold-part or drag; an upper mold-part or cope arranged above and spaced from the drag to form a chamber between the drag and the cope, which chamber has an inlet for the passage of molten metal to the chamber, and a chill instrumental in forming the surrounding wall of the said chamber and comprising a substantially vertically arranged endwise shiftable annular section comprising the following:—a metal ring forming the lower portion of the said chill-section and another metal ring forming the inner portion of the upper end of the said chill-section and secured to the first-mentioned ring and provided inter-

nally of its upper end with a downwardly and laterally inwardly facing circumferentially extending sloping surface which participates in the formation of the aforesaid wall.

5. In a mold of the character indicated, a lower mold-part or drag; an upper mold-part or cope arranged above and spaced from the drag to form a chamber between the drag and the cope, which chamber has an inlet for the passage of molten metal to the chamber, and a chill instrumental in forming the surrounding wall of the said chamber and comprising a substantially vertically arranged endwise shiftable annular section comprising the following:—a metal ring forming the lower portion of the said chill-section and provided at its upper end and internally with an annular recess, another metal ring engaging the said recess and resting on the bottom of the recess and provided internally of its upper end with a downwardly and laterally inwardly facing circumferentially extending sloping surface which participates in the formation of the aforesaid wall.

6. In a mold of the character indicated, the combination, with a substantially vertically arranged annular chill instrumental in forming the surrounding wall of the molten-metal receiving chamber of the mold, and means whereby the lateral and outward expansion of the chill by heat is utilized in centering the casting formed in the said chamber.

7. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, of casting-centering means having the operation thereof controlled by the lateral and outward expansion of the chill by heat.

8. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, and suitably supported movable casting-centering members which are spaced circumferentially of the chill and normally in position to move into the chamber, of means instrumental in actuating the casting-centering members into the chamber and having the operation thereof controlled by the lateral and outward expansion of the chill by heat.

9. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported movable casting-centering members which are spaced circumferentially of the chill and normally in position to move into the chamber, and means whereby the casting-centering members are locked in their outer position, said locking means being capable of being rendered inoperative to permit the movement of the casting-centering members into the chamber, of means employed in actuating the said casting-centering members into the chamber and having the operation thereof controlled by the lateral and outward expansion of the chill by heat, said means for actuating the said casting-centering members automatically operating during the said expansion of the chill upon rendering the aforesaid locking means inoperative.

10. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, and suitably supported movable casting-centering members which are spaced circumferentially of the chill and normally in position to move into the chamber, of a weight having the descent thereof controlled by the lateral and outward expansion of the chill by heat, said weight being arranged to actuate the aforesaid casting-centering members inwardly during the said expansion of the chill by heat.

11. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, and suitably supported movable casting-centering members spaced circumferentially of the chill and normally in position to move into the chamber, of a weight extending circumferentially of the chill and having the descent thereof controlled by the lateral and outward expansion of the chill by heat, said weight being arranged to actuate the aforesaid casting-centering members inwardly during the said expansion of the chill, and means arranged to arrest the descent of the weight preparatory to the completion of the contraction of the casting while the casting is in the mold.

12. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, suitably supported movable casting-centering members which are spaced circumferentially of the chill and normally in position to move into the chamber, and a weight arranged to descend and actuate the aforesaid casting-centering members inwardly during the lateral and outward expansion of the chill, of adjustable stops for limiting the descent of the weight.

13. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming

the surrounding wall of the molten-metal-receiving chamber of the mold, suitably supported movable casting-centering members which are spaced circumferentially of the chill and normally in position to move into the chamber, and a weight arranged to descend and actuate the aforesaid casting-centering members inwardly during the lateral and outward expansion of the chill by heat, of suitably applied set-screws arranged to limit the descent of the weight.

14. In a mold of the character indicated, a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported movable casting-centering members spaced circumferentially of the chill and normally in position to move into the chamber, and a weight extending circumferentially of the chill and arranged to actuate the aforesaid casting-centering members inwardly during its descent, which weight is provided externally with a downwardly and laterally outwardly facing sloping surface which extends circumferentially of the weight, the chill extending under the weight and affording bearing to the said surface, said chill being spaced below the weight far enough from the lower end of the weight in the upper position of the weight to permit the weight to descend and thereby actuate the casting-centering members inwardly when the chill expands laterally and outwardly by heat and the said casting-centering members are free to move inwardly.

15. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported casting-centering bars spaced circumferentially of the chill and normally in position to move into the chamber, and a weight extending circumferentially of the chill and arranged to actuate the said bars inwardly during its descent, which weight is provided externally with a downwardly and laterally outwardly facing sloping surface which extends circumferentially of the weight, of seats on the chill for the said sloping surface, which seats are spaced circumferentially of the weight and arranged to permit the weight, when the weight is in its upper position, to descend when the chill expands laterally and outwardly by heat and the aforesaid bars are free to move inwardly.

16. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported casting-centering bars spaced circumferentially of the chill and normally in position to move into the chamber, and a weight extending circumferentially of the chill and arranged to actuate the said bars inwardly during its descent, which weight is provided externally with a downwardly and laterally outwardly facing sloping surface which extends circumferentially of the weight, of arms rigid with the chill and spaced circumferentially of the chill, which arms project laterally and outwardly below the weight and have each an upwardly projecting lug provided with a seat for the aforesaid surface of the weight, said arms being spaced under the weight far enough from the lower end of the weight in the upper position of the weight to permit the weight to descend and thereby actuate the aforesaid bars inwardly when the chill expands laterally and outwardly by heat and the said bars are free to move inwardly.

17. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported casting-centering bars spaced circumferentially of the chill and normally in position to move into the chamber, and a weight extending circumferentially of the chill and arranged to actuate the said bars inwardly during its descent, which weight is provided externally with a downwardly and laterally outwardly facing sloping surface extending circumferentially of the weight, of arms formed on and spaced circumferentially of the chill, which arms project laterally and outwardly below the weight and have upwardly projecting lugs provided with upwardly and laterally inwardly facing sloping seats affording bearing to the aforesaid sloping surface of the weight, said arms being spaced under the weight far enough from the lower end of the weight in the upper position of the weight to permit the weight to descend when the chill expands laterally and outwardly by heat and the said bars are free to move inwardly.

18. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported casting-centering bars spaced circumferentially of the chill and normally in position to move into the chamber, and a weight extending circumferentially of the chill and arranged to actuate the said bars inwardly during its descent, which weight is provided externally with a set of lugs which are spaced circumferentially of the weight and have seats affording bearing to the aforesaid sloping surface of the weight and arranged to permit the weight, when the latter is in its upper position, to descend

when the chill expands laterally and outwardly by heat and the said bars are free to move inwardly, the lugs of one of the aforesaid sets of lugs being provided with vertically adjustable members arranged to engage the lugs of the other of the said sets of lugs in the lowermost position of the weight.

19. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported casting-centering bars spaced circumferentially of the chill and normally in position to move into the chamber; means whereby the said bars are locked in their outer position, said bar-locking means being capable of being rendered inoperative so far as concerns movement of the bars into the chamber, and a weight extending circumferentially of the chill and arranged to actuate the said bars inwardly during its descent, of upwardly and laterally inwardly facing sloping seats spaced circumferentially of the weight, which seats are borne by the chill and afford bearing to the weight, the weight being free to descend when the chill expands laterally and outwardly by heat and the aforesaid bar-locking means are rendered inoperative.

20. In a mold of the character indicated, a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, which chill is provided with upwardly and laterally inwardly facing sloping bearings spaced circumferentially of the chill and substantially equidistantly from the said chamber; suitably supported endwise movable casting-centering bars spaced circumferentially of the chill and normally in position to move into the chamber; a weight seated on the said bearings and extending circumferentially of the chill, which weight is arranged to actuate the said bars inwardly during its descent and is provided externally with a downwardly and laterally outwardly facing sloping surface extending circumferentially of the chill and arranged to seat on the aforesaid bearings, the parts being arranged to permit the weight, when the weight is in its upper position, to descend when the chill expands laterally and outwardly by heat and the aforesaid bars are free to move inwardly.

21. In a mold of the character indicated, a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported endwise movable casting-centering bars spaced circumferentially of the chill and normally in position to move into the said chamber, and a weight extending circumferentially of the chill and arranged to actuate the said bars inwardly during its descent, which weight is provided externally with a downwardly and laterally outwardly facing sloping surface extending circumferentially of the weight, and also has an outer surface extending circumferentially of the weight and vertically downwardly from the said sloping surface, the chill normally affording a lateral guide to the second-mentioned surface and affording bearing to the first-mentioned surface during the descent of the weight and being contoured to permit the weight, when the weight is in its upper position, to descend when the chill expands laterally and outwardly by heat and the aforesaid bars are free to move inwardly.

22. In a mold of the character indicated, a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, which chill is provided with upwardly and laterally inwardly facing sloping surfaces spaced circumferentially of the chill and a suitable distance from the said chamber, said chill also having surfaces which extend vertically downwardly from the lower ends of the said sloping surfaces, and suitably supported endwise movable casting-centering bars spaced circumferentially of the chill and normally in position to move into the said chamber; a weight extending circumferentially of the chill and arranged to actuate the said bars inwardly during its descent, which weight overlaps the aforesaid sloping surfaces and normally has lateral bearing at its lower end against the second-mentioned surfaces, said weight, when in its upper position, being free to descend when the chill expands laterally and outwardly by heat and the aforesaid bars are free to move inwardly.

23. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, and endwise movable casting-centering bars placed substantially radially of the upper end and spaced circumferentially of the chill and normally arranged to move into the said chamber, which bars are provided at their under sides with shoulders which face in the direction of and are spaced outwardly from the inner ends of the bars, of a suitably supported ring supported from and extending and shiftable circumferentially of the chill and centered externally relative to the chill by a portion of the chill, said ring having such contour and arrangement relative to the aforesaid shoulders that the circumferential surface of the ring is overlapped by the shoulders in the outer position of the casting-centering bars and locks the latter in their outer position, or the ring frees the said bars to permit them to move inwardly,

according as the ring has been shifted to the extent required in the one or the other direction.

24. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, which chill is provided in its upper side with a recess which is spaced from and extends circumferentially of the said chamber and has its outer side wall arranged concentrically relative to the chamber; endwise movable casting-centering bars placed substantially radially of the upper end and spaced circumferentially of the chill and normally arranged to move into the said chamber, which bars extend across the aforesaid recess and have bearing on the chill at both sides of the recess and are provided at their under side with shoulders which face in the direction of and are spaced outwardly from the inner ends of the bars, of a ring engaging the said recess and centered by the outer side wall of the recess relative to the aforesaid chamber during the assemblage of the parts, which ring extends circumferentially of and is spaced from the inner side wall of the said recess and supported from and shiftable circumferentially of the chill, said ring having such contour and arrangement relative to the aforesaid shoulders that the circumferential surface of the ring is overlapped by the shoulders in the outer position of the casting-centering bars and locks the latter in their outer position, or the ring frees the said bars to permit them to move inwardly, according as the ring has been shifted to the extent required in the one or the other direction.

25. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, which chill is provided in its upper side with a recess which is spaced from and extends circumferentially of the said chamber and has its outer side wall arranged concentrically relative to the chamber, of endwise movable casting-centering bars mounted on and placed substantially radially of the upper end and spaced circumferentially of the chill and normally arranged to move into the said chamber, which bars extend across the aforesaid recess and have bearing on the chill at both sides of the recess and are provided at their under side with lugs which project downwardly between the side walls of the recess and are arranged in suitable proximity to the inner side wall of the recess in the inner position of the bars, said bars being also provided at their under side with shoulders which face in the direction of the inner ends of the bars and are spaced outwardly from the aforesaid lugs, and a ring engaging the said recess and centered by the outer side wall of the recess relative to the aforesaid chamber during the assemblage of the parts, which ring extends circumferentially of and is spaced from the inner side wall of the said recess and supported from and shiftable circumferentially of the chill, said ring having such contour and arrangement relative to the aforesaid shoulders that the circumferential surface of the ring is overlapped by the shoulders in the outer position of the casting-centering bars and locks the latter in their outer position, or the ring frees the said bars to permit them to move inwardly, according as the ring has been shifted to the extent required in the one or the other direction.

26. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported endwise movable casting-centering bars placed substantially radially and spaced circumferentially of the chill and normally arranged to move into the said chamber, which bars are provided with shoulders which face in the direction of and are spaced outwardly from the inner ends of the bars, of a ring supported from and extending and shiftable circumferentially of the chill and centered externally relative to the chill, which ring has its circumferential surface overlapped by the aforesaid shoulders and is provided at the said surface with recesses which are spaced circumferentially of the ring and gradually increased in depth radially of the ring in one and the same direction circumferentially of the ring, which recesses are arranged to receive the said shoulders and permit the bars to move inwardly upon actuating the ring to bring its recesses opposite the said shoulders.

27. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, suitably supported movable casting-centering members spaced circumferentially of the chill and normally arranged to move into the chamber, and means instrumental in locking the said casting-centering members in their outer position, of a suitably supported pinion, and means whereby the aforesaid locking means are rendered inoperative or operative according as the said pinion is rotated the extent required in the one or the other direction.

28. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, and suitably

supported movable casting-centering members spaced circumferentially of the chill and normally arranged to move into the said chamber, of a suitably supported pinion, and means whereby the casting-centering members are actuated simultaneously from their inner into their outer position during the rotation of the pinion in the direction and to the extent required.

29. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported movable casting-centering members spaced circumferentially of the chill, said casting-centering members being normally in position to move into the said chamber and provided a suitable distance from their inner ends with inwardly facing shoulders, and a locking member arranged externally and extending and shiftable circumferentially of the said chamber and contoured to overlap the aforesaid shoulders in the outer position of the casting-centering members and thereby lock the latter in the said position upon shifting the said locking member circumferentially to the extent required in the one direction, or to permit the said casting-centering members to move from their outer into their inner position during the shifting of the said locking member circumferentially the extent required in the opposite direction, of a suitably supported rotary member operatively connected with and employed in actuating the said locking member, the latter being shifted circumferentially in the one direction or the other according as the said locking-member-actuating rotary member is rotated in the one or the other direction.

30. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold, and suitably supported movable casting-centering members spaced circumferentially of the chill and normally in position to move into the said chamber, of a rotary member supported from the chill at one side of the chill, and means whereby the casting-centering members are actuated from their inner into their outer position during the rotation of the said rotary member in the direction and to the extent required.

31. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported movable casting-centering members spaced circumferentially of the chill and normally in position to move into the said chamber and provided a suitable distance from their inner ends with inwardly facing shoulders, and a suitably supported locking member arranged externally and extending and shiftable circumferentially of the said chamber, which locking member is contoured to overlap the aforesaid shoulders in the outer position of the casting-centering members and thereby lock the latter in the said position upon shifting the said locking member circumferentially to the extent required in one direction, or to permit the said casting-centering members to move from their outer into their inner position during the shifting of the said locking member circumferentially to the extent required in the opposite direction, of a suitably supported rotary member intergeared with and instrumental in actuating the said locking member.

32. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported movable casting-centering members spaced circumferentially of the chill and normally in position to move into the said chamber and provided a suitable distance from their inner ends with inwardly facing shoulders, and a suitably supported locking member arranged externally and extending and shiftable circumferentially of the said chamber, which locking member is contoured to overlap the aforesaid shoulders in the outer position of the casting-centering members and thereby lock the latter in the said position upon shifting the said locking member circumferentially to the extent required in one direction, or to permit the said casting-centering members to move from their outer into their inner position during the shifting of the said locking member circumferentially to the extent required in the opposite direction, of a rack extending circumferentially of the chill and rigid with the said locking member, and a suitably supported and suitably operated pinion meshing with the said rack.

33. In a mold of the character indicated, the combination, with a substantially vertically arranged chill instrumental in forming the surrounding wall of the molten-metal-receiving chamber of the mold; suitably supported movable-casting-centering members spaced circumferentially of the chill and normally in position to move into the chamber and provided a suitable distance from their inner ends with inwardly facing shoulders, and a suitably supported locking member arranged externally and extending and shiftable circumferentially of the chamber, which locking member is contoured to overlap the aforesaid shoulders in the outer position of the casting-centering members and thereby lock the latter in the said position upon shifting the said locking member

circumferentially to the extent required in one direction, or to permit the said casting-centering members to move from their outer into their inner position during the shifting of the said locking member circumferentially to the extent required in the opposite direction, of a suitably supported pinion arranged at one side of and having its axis substantially radially relative to the chill, and a rack arranged at the top of and meshing with the pinion, which rack extends circumferentially of the chill and is rigid with the aforesaid locking member.

In testimony whereof, I sign the foregoing specification, in the presence of two witnesses.

THOMAS D. WEST.

Witnesses:
C. H. DORER,
B. C. BROWN.