Nov. 18, 1924. 1,515,953

S. JUNGHANS

CENTRIFUGAL CASTING APPARATUS

Filed April 28. 1923 2 Sheets-Sheet 1

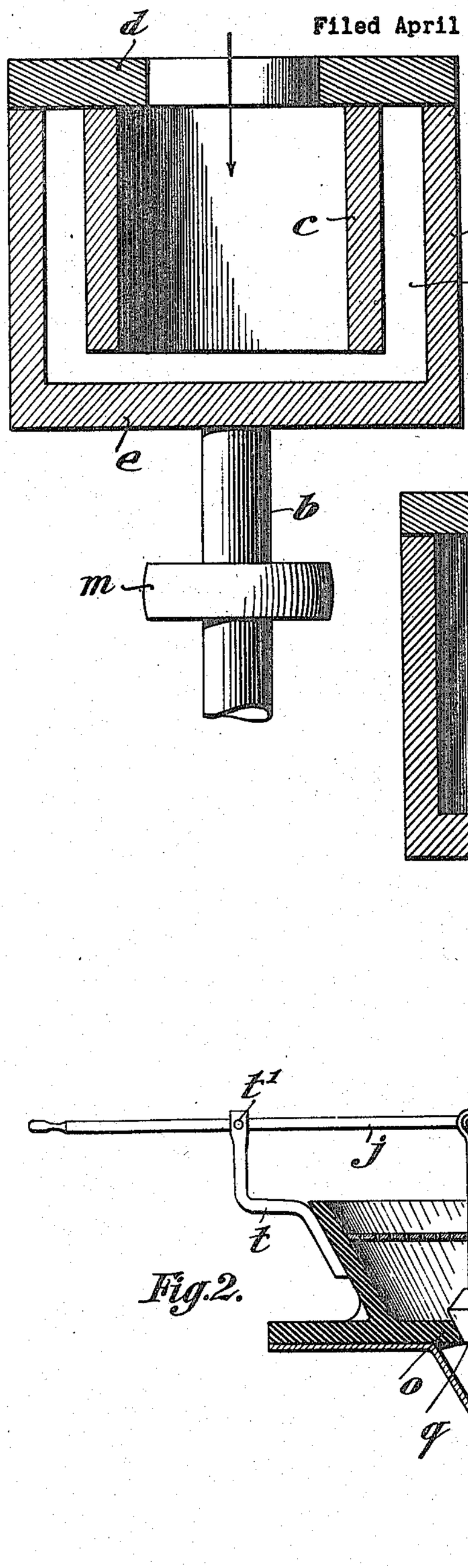

Fig. 1.

Fig. 2.

Fig. 3.

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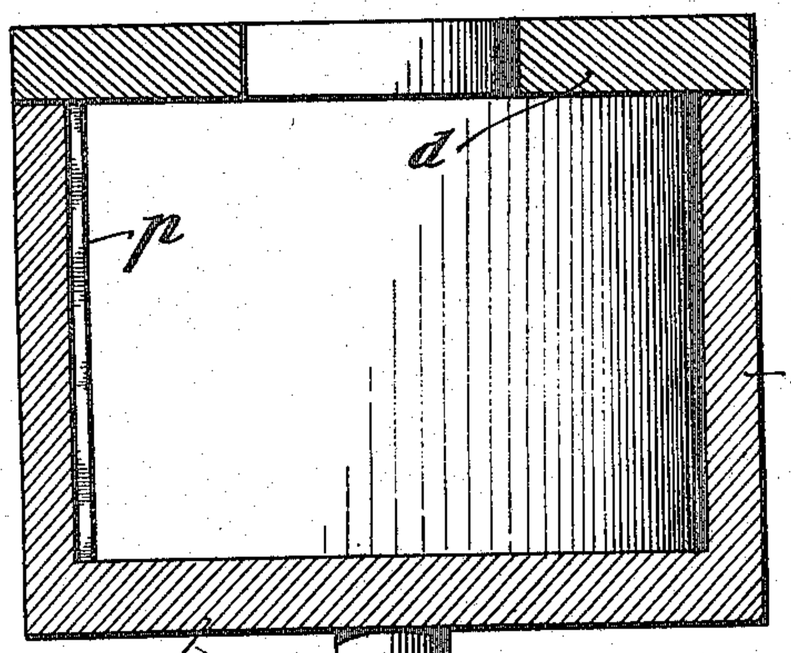


Fig. 4.

Fig. 5.

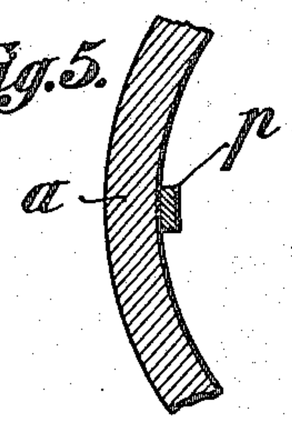


Fig. 6.

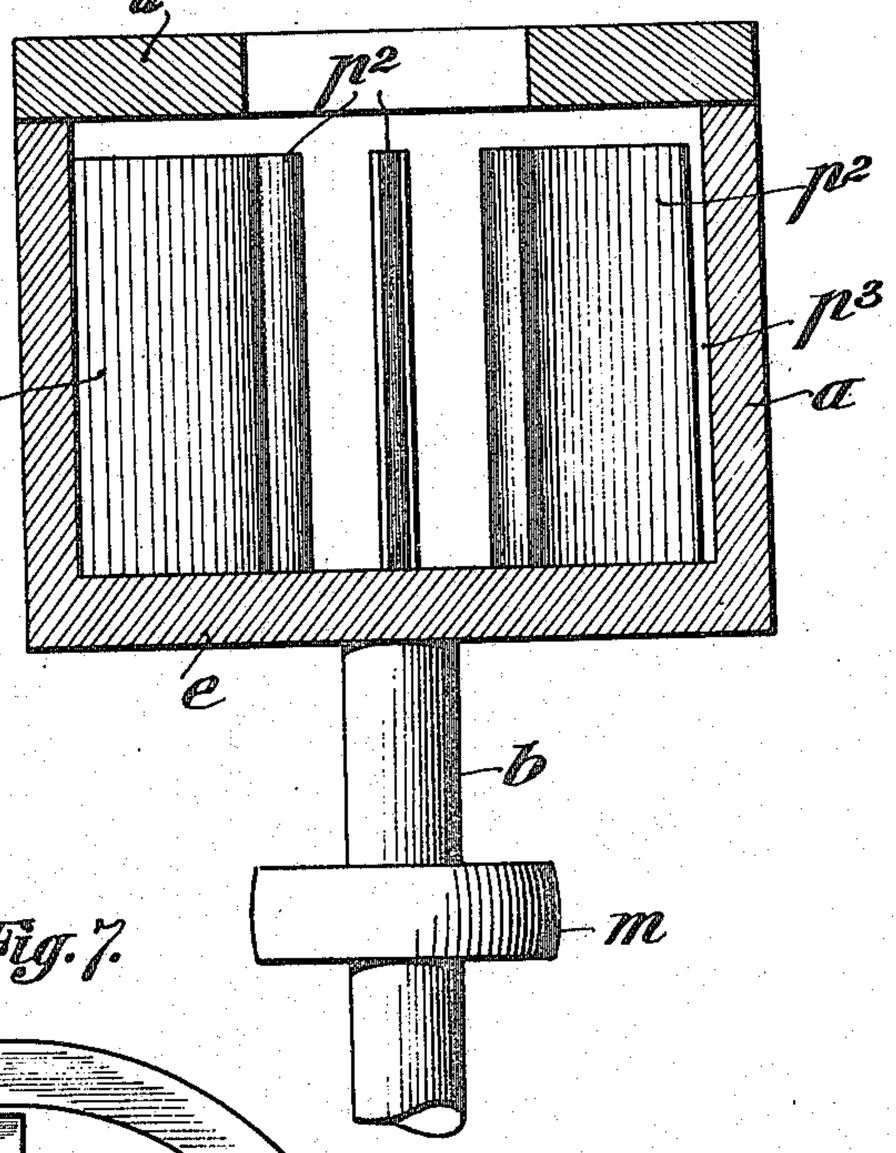
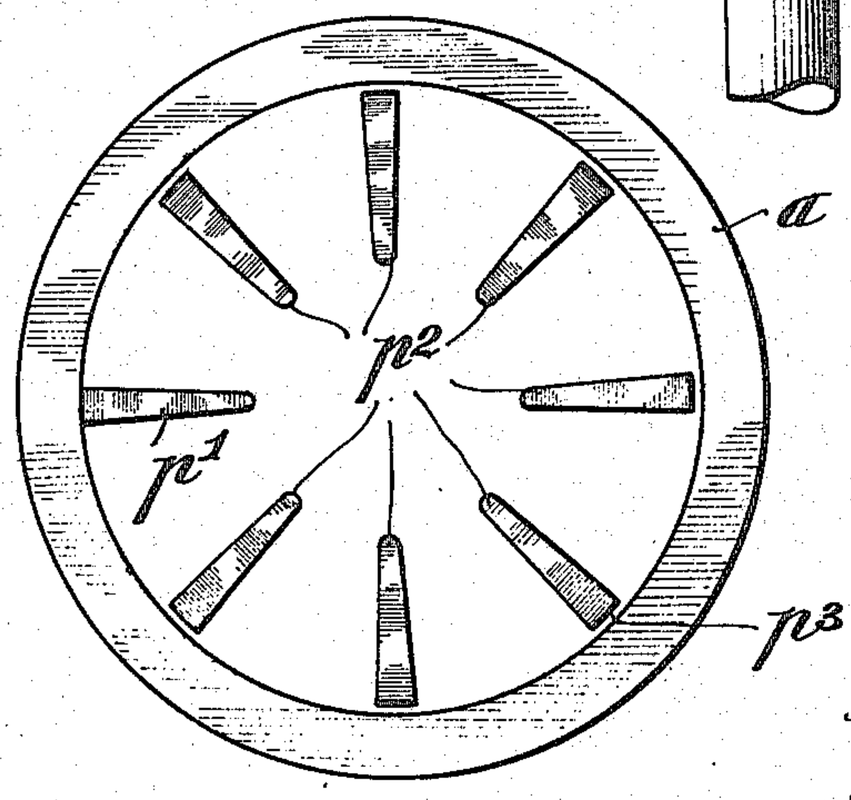


Fig. 7.



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Patented Nov. 18, 1924. 1,515,953

UNITED STATES PATENT OFFICE.

SIEGFRIED JUNGHANS, OF VILLINGEN, GERMANY.

CENTRIFUGAL CASTING APPARATUS.

Application filed April 28, 1923. Serial No. 635,344.

To all whom it may concern:

Be it known that I, SIEGFRIED JUNGHANS, a citizen of the German Republic, residing at Villingen, Germany, have invented certain new and useful Improvements in Centrifugal Casting Apparatus, of which the following is a specification.

My invention relates to improvements in the process of and moulds for producing metallic bodies by centrifugal casting.

The main object of my invention is to provide improvements in the process of producing centrifugal castings of great density and free of pores or flaws. To this end the principal feature of the invention resides in that the molten metal or alloy is forced, by centrifugal action, to rise in the mould from the bottom thereof to the top, a particular means being provided within the mould for backing and guiding the ascending liquid metal or alloy and for co-operating with the wall of the mould to give the casting the desired shape.

In this way the liquid metal or alloy can be maintained under pressure within the mould, without employing any further auxiliary means. In carrying out my improved process, for example in a cylindrical mould having an inner co-axial or cylindrical backing and guiding wall, it is preferable not to pour the molten metal into the said mould until the latter has attained its full running speed.

A further object of my invention is to provide, in lieu of the said cylindrical inner backing and guiding wall, suitable means of a different type for raising or guiding the molten metal or alloy in an upward direction in the mould, and such means may be arranged and disposed in the mould to radially extend therein towards the circumferential wall thereof. In particular the radially disposed member or members may comprise simple ribs or plates or vertically arranged rollers, and if desired, such members may be mounted in the mould in a manner whereby a certain resiliency is afforded in order to accommodate the pressure due to the shrinking of the metal or alloy on cooling.

My invention is especially intended for use in making rings or short tubes which are to be cut along axial lines and rolled out to form sheets or plates of a desired thickness. The method of centrifugal casting is of particular advantage in the manufacture of such rings or short tubes, for the reason that rings and tubes having relatively thin walls can be produced thereby and the thus produced rings and tubes will be free from all pores and flaws and can be quickly rolled out.

The cutting of the rings or short tubes is usually done by an operation of its own. In order to avoid this operation and to thereby shorten the whole of the process and reduce the cost, I provide in some cases a rib on the inner surface of the mould extending preferably lengthwise or vertically therein and projecting radially from the said surface to such an extent as to ensure the production of a casting in the shape of an open or slit ring or tube. The provision of a rib of this type further ensures the advantage of greater density of the casting owing to the fact that the resistance opposed by the rib to the quick moving metal produces an increase of the inner pressure of the molten metal in the mould.

It is known in the art of centrifugal casting that when the mould has a high running speed at the time of pouring the molten metal or alloy, the latter will be thrown towards the side wall of the mould in the form of a very steep spiral. Hence the fed metal accumulates mainly at one place in the mould so that accidents can occur due to the unequal load at the high running speed. To obviate this disadvantage the hereinbefore mentioned rib is enlarged to form a kind of stationary vane extending radially a certain length towards the centre of the cylindrical mould and in some cases even near the centre or axis thereof, if required by particular circumstances. The thus enlarged rib or vane may be associated with a number of similar auxiliary vanes disposed a certain distance apart from each other in radial positions and located preferably in a symmetrical relationship on the bottom of the mould and a certain distance remote from the side wall of the latter so as to allow the molten metal or alloy to pass around on the inner surface of the wall without being impeded by said auxiliary vanes.

In this manner an even distribution of the molten metal or alloy over the inner surface of the side wall of the mould is ensured, even though the metal or alloy is poured into the mould while the latter is running at full speed, without any liability to dangerous accidents.

The structure embodying the novel features of my invention is hereinafter more fully described and illustrated in the accompanying drawing, in which—

Figure 1 is a vertical sectional view of a mould for casting a ring or short tube in accordance with my invention;

Figure 2 is a vertical sectional view of a valve-controlled funnel for pouring the molten metal or alloy at one time into the mould;

Figure 3 is a view similar to Figure 1 showing a modified construction of the mould,

Figure 4 is a similar sectional view illustrating a further modification of the mould;

Figure 5 is a partial horizontal section thereof;

Figure 6 is a view similar to Figure 1 showing a third embodiment of my invention and

Figure 7 is a plan thereto.

The mould shown in Figure 1 is, from a general aspect, constructed so as to have the usual shape of modern moulds for centrifugal action. To this end the cylindrical mould or receptacle *a* is rigidly connected with a vertical shaft supported in bearings, not shown, and provided with a driving pulley *m*. The inner cylindrical face of the side wall of the mould diametrically corresponds to the perimeter or outer face of the ring or short tube to be cast in the mould, and mounted in the mould co-axially therewith is a cylindrical hollow body *c*. The said body *c* is rigidly attached to the cover *d* so as to be freely suspended, with the inner or lower end projecting vertically towards the bottom *e* of the mould, but remaining a certain distance therefrom, thus forming an annular free space *n* corresponding in width to the thickness of the ring or short tube to be cast. The distance between the inner end of the inserted cylinder or body *c* and the bottom *e* of the mould is determined in accordance with the requirements of the case that is to say, it must always be sufficiently wide to allow the entire charge to rise in the annular space *n*.

It goes without saying that both the inner face of the side wall of the mould *a* and the outer face of the suspended cylinder *c* may be given any desired shape or contour, so that besides rings or short tubes other articles of different shape can be produced in the mould by centrifugal action. If required the inner cylinder *c* may be made of a plurality of parts detachably united so as to afford a means for readily removing the cast article from the mould, as will be easily understood by those skilled in the art.

Figure 2 illustrates a device for pouring the molten metal or alloy into the mould in a manner which is particularly suitable in connection with my improved casting process. The device comprises an upper conical portion or vat *f* and a lower conical portion *g*, the two portions constituting a kind of a funnel with an intermediate, horizontal partition *o* forming the bottom of the vat *f*. The conical portion *g* has a tubular extension *h* of sufficient length to terminate freely near the bottom *e* of the mould provided that the pouring device is placed on the mould shown in Fig. 1. The bottom *o* of the vat *f* is provided with an opening or a plurality of openings for the molten metal or alloy to pass therethrough. In the embodiment shown two such openings *q* are provided. The openings *q* are of conical shape to thus form the seats of two conical valves *i* each having a stem *r* pivotally connected at *s* in any appropriate manner to a controlling lever *j* which is supported in a bracket *t* firmly attached to the wall of the vat *f*. By manually turning the lever about its pivot t^1 the two valves *i* can be lifted from their seats simultaneously so that the charge of molten metal or alloy in the vat *f* will be caused to flow out from the tubular extension *h* to the bottom of the mould.

The cross-sectional areas of the conical portion *g* and of the tubular extension *h* are so adjusted that the molten metal or alloy flowing down from the vat *f* can collect in the conical portion *g* in order to flow out of the end of the tubular extension *g* into the mould as one continuous charge. Coarse impurities of the molten charge poured into the vat *f* are retained by a perforated straining plate *k* preferably consisting of refractory material and which is mounted in the upper part of the vat for the purpose, that impurities, slag and the like subsequently have sufficient time to rise in the molten mass and separate at the surface thereof, since the valves *i* are not opened, until the whole of the charge of molten metal or alloy has been poured into the vat *f*.

The operation for casting a short tube or ring as above exemplified is as follows:—

The mould is imparted a particular running speed corresponding to the solidifying or melting temperature of the casting metal or alloy and to the size of the ring or short tube to be cast. As soon as this speed is attained the molten metal is poured into the vat *f* of the superposed feeding device and caused to flow out therefrom as one complete charge onto the central portion of the bottom *e* of the mould. As the whole of the

charge thus supplied to the mould is thrown against the side wall thereof, it immediately rises in the space *n* between the said wall and the inserted backing cylinder *c*, owing to centrifugal action, thus forming a ring or short tube which will solidify by gradually cooling.

In the mould the whole of the molten mass or charge undergoes an approximately uniform pressure due to centrifugal action and the resistance opposed by the wall of the mould, and since the charge can be made to contain just as much molten metal or alloy as required to completely fill the annular space *n* there will be no dead-head nor waste and the articles can be removed from the mould in a perfectly finished condition, that is to say, they will have smooth inner and outer surfaces.

In the embodiment of my invention shown in Figure 3 a vertical roller *l* is provided within the mould *a* in lieu of the cylinder *c* of Figure 1. The roller *l* is carried by two radial arms l^1 supported by a central or axial standard l^2, and may be mounted resiliently in any suitable manner. The roller may be stationary or adapted to rotate. Preferably provision will be made for adjusting the roller with relation to the side wall of the mould, that is to say, for adjusting the distance therebetween so that articles such as rings or short tubes may be made having walls of any desired thickness.

Instead of a single roller a plurality of rollers or equivalent confining members, such as ledges or bars and the like may be employed. In any case a retaining and confining member of the stated kind will act, during the rotation of the mould, to evenly distribute the ascending molten metal, so that a ring or short tube having a wall of uniform thickness in the whole of its length will be produced.

In the modification illustrated in Figs. 4 and 5 the mould likewise comprises a cylindrical vessel or drum *a* rigidly connected with a vertical shaft *b* having a pulley *m* for driving it. On the inner cylindrical face of the mould *a* a vertical rib *p* is provided, said rib extending from the bottom to the top or cover of the mould in Figure 4. In some cases a rib of a shorter length will be sufficient, the required length of the rib depending merely upon the length of the short tube or the like to be cast in the mould. The rib may be firmly attached to or made integral with the side wall of the mould *a* or it may be mounted in the mould so as to be removable and exchangeable.

The advantage of the rib *p* resides in that, e. g. in case of casting a hollow ingot or short tube, the latter will have a slit or joint, so that on cooling a ready contraction will take place and the ingot or tube can be easily removed from the mould, and further that the thus obtained ingot or tube need not be cut in order to be transformed into a plate of any desired thickness by rolling or in any other suitable way.

In the embodiment of my invention shown in Figures 6 and 7 the rib p^1 on the inner face of the side wall of the cylindrical mould is radially enlarged to form a kind of a stationary vane. Similar radial vanes p^2 are provided in the mould at a certain distance apart from each other in a symmetrical configuration or order. These vanes p^2, however, are not connected with the side wall of the mould, but they are positioned a certain distance remote therefrom so as to afford a clearance or passage between the wall and the outer vertical edge of the rib, so that the molten metal or alloy may evenly distribute itself over the whole of the inner circumference of the mould *a*.

The vane p^1 is constructed so that it will at least be as high as the ring or short tube to be cast in the mould, since the purpose of this vane is to produce a longitudinal slit in the cast article over the whole of the length or height of the latter, whereas the other vanes p^2 may be, if desired of a less height.

From the foregoing description it will be seen that simple and efficient means are herein provided for accomplishing the objects of my invention, but while the elements or members shown and described are well adapted to serve the purpose for which they are intended, it is to be understood, that the invention is not limited to the precise construction set forth, but includes within its purview such changes as may be made within the scope of the appended claims.

What I claim is:—

1. The mould comprising a cylindrical hollow receptacle, a cover, a vertical rib connected with the inner face of the side wall of said receptacle and extending radially toward the centre of the receptacle to form a kind of a vane, and a plurality of similar radial vanes positioned a distance apart from each other and a distance remote from the said inner face of the receptacle, essentially as and for the purpose set forth.

2. A mould for centrifugal casting comprising a hollow receptacle; and means in said receptacle spaced from the wall for evenly distributing the metal to be cast and means for providing a longitudinal slit in the casting.

3. A mould for centrifugal casting comprising a hollow receptacle; a cover for said receptacle having a central opening therein through which the casting metal is adapted to be poured; and means in said receptacle spaced from the wall of said receptacle for

evenly distributing the metal to be cast and means for providing a longitudinal slit in the casting.

4. A mould for centrifugal casting comprising a hollow receptacle; and a plurality of radially arranged vanes mounted in the mould and spaced from the wall of said receptacle for evenly distributing the metal to be cast.

5. A mould for centrifugal casting comprising a hollow receptacle; and a plurality of radially arranged vanes mounted perpendicularly on the bottom of the mould to provide a space between the side wall of said receptacle and the vanes for evenly distributing the metal to be cast.

6. A mould for centrifugal casting comprising a hollow receptacle; a plurality of radially arranged vanes mounted perpendicularly on the bottom of the mould to provide a space between the side wall of said receptacle and the vanes for evenly distributing the metal to be cast; and a rib mounted perpendicularly on the bottom of the mould and on the side of the receptacle for providing a longitudinal slit in the casting.

7. A mould for centrifugal casting comprising a hollow receptacle; a plurality of radially arranged vanes mounted perpendicularly on the bottom of the mould to provide a space between the side wall of said receptacle and the vanes for evenly distributing the metal to be cast; a rib mounted perpendicularly on the bottom of the mould and on the side of the receptacle for providing a longitudinal slit in the casting; and means for rotating said receptacle.

8. A mould for centrifugal casting comprising a receptacle having a bottom and wall portions; and a plurality of radially arranged vanes mounted on the bottom portion in said receptacle and spaced from the wall for evenly distributing the metal to be cast.

In testimony whereof I affix my signature.

SIEGFRIED JUNGHANS.