Dec. 23, 1947. G. A. RUBISSOW 2,433,065

GYROCASTING APPARATUS

Filed June 24, 1944 3 Sheets-Sheet 1

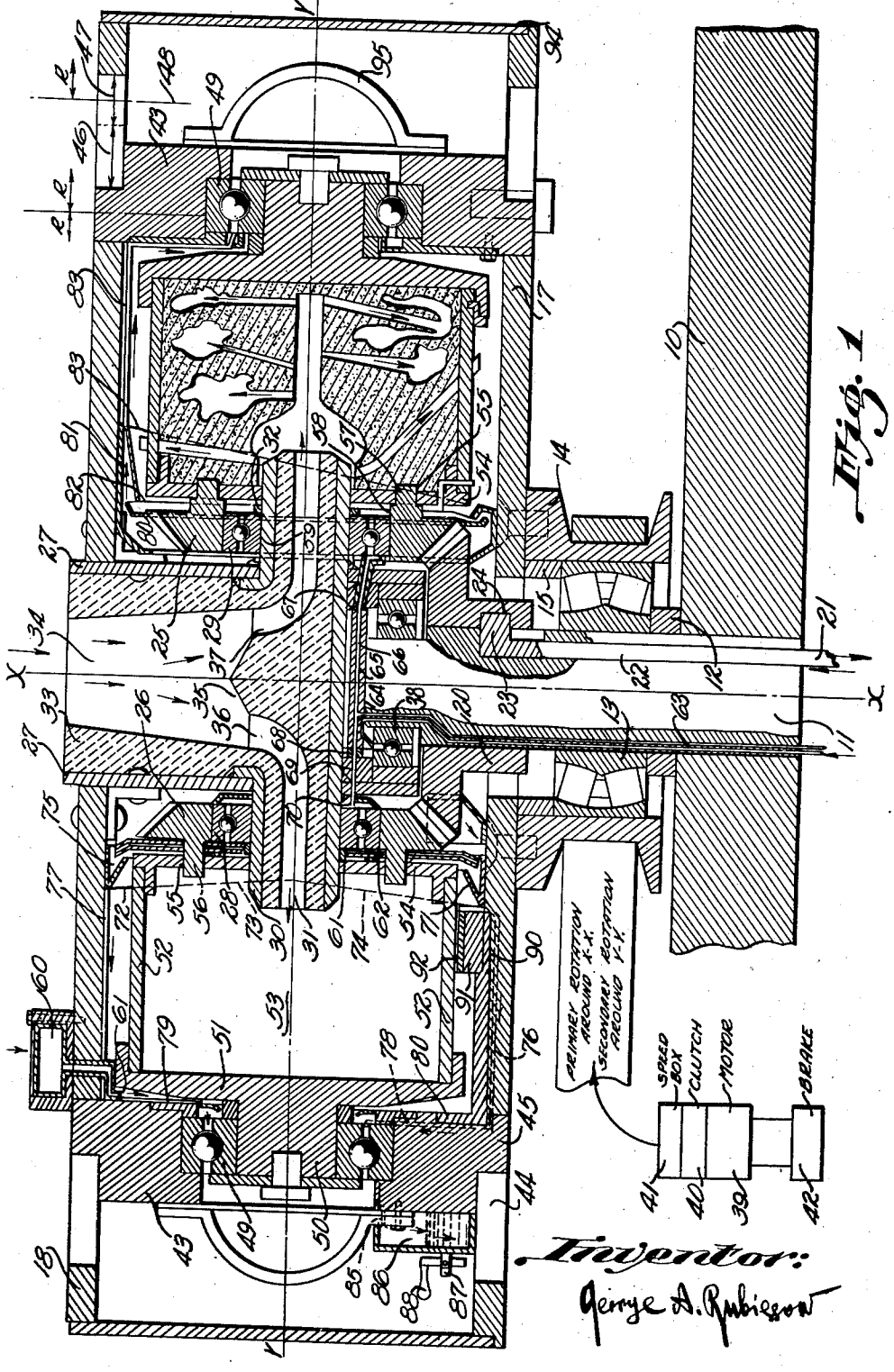

Fig. 1

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Fig. 2.

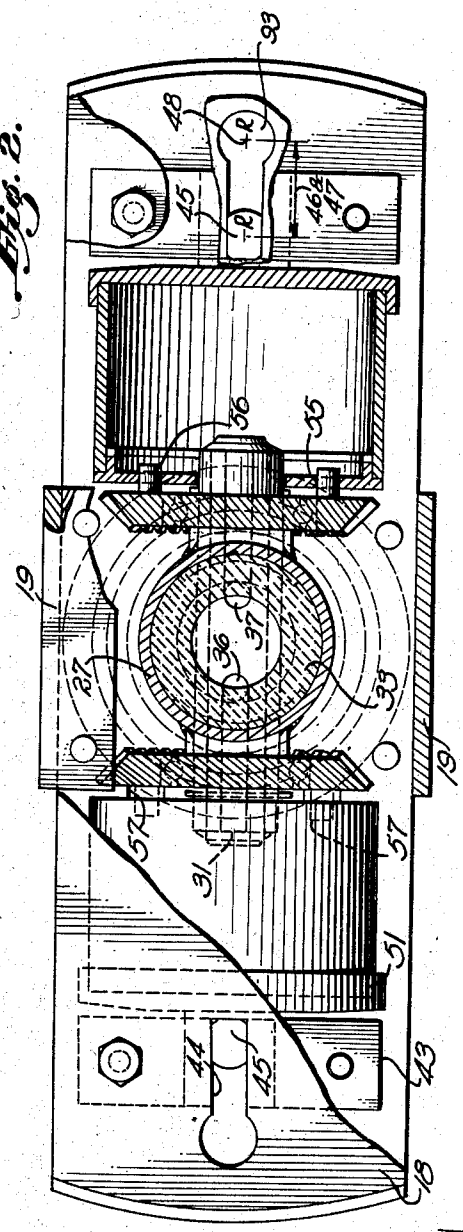

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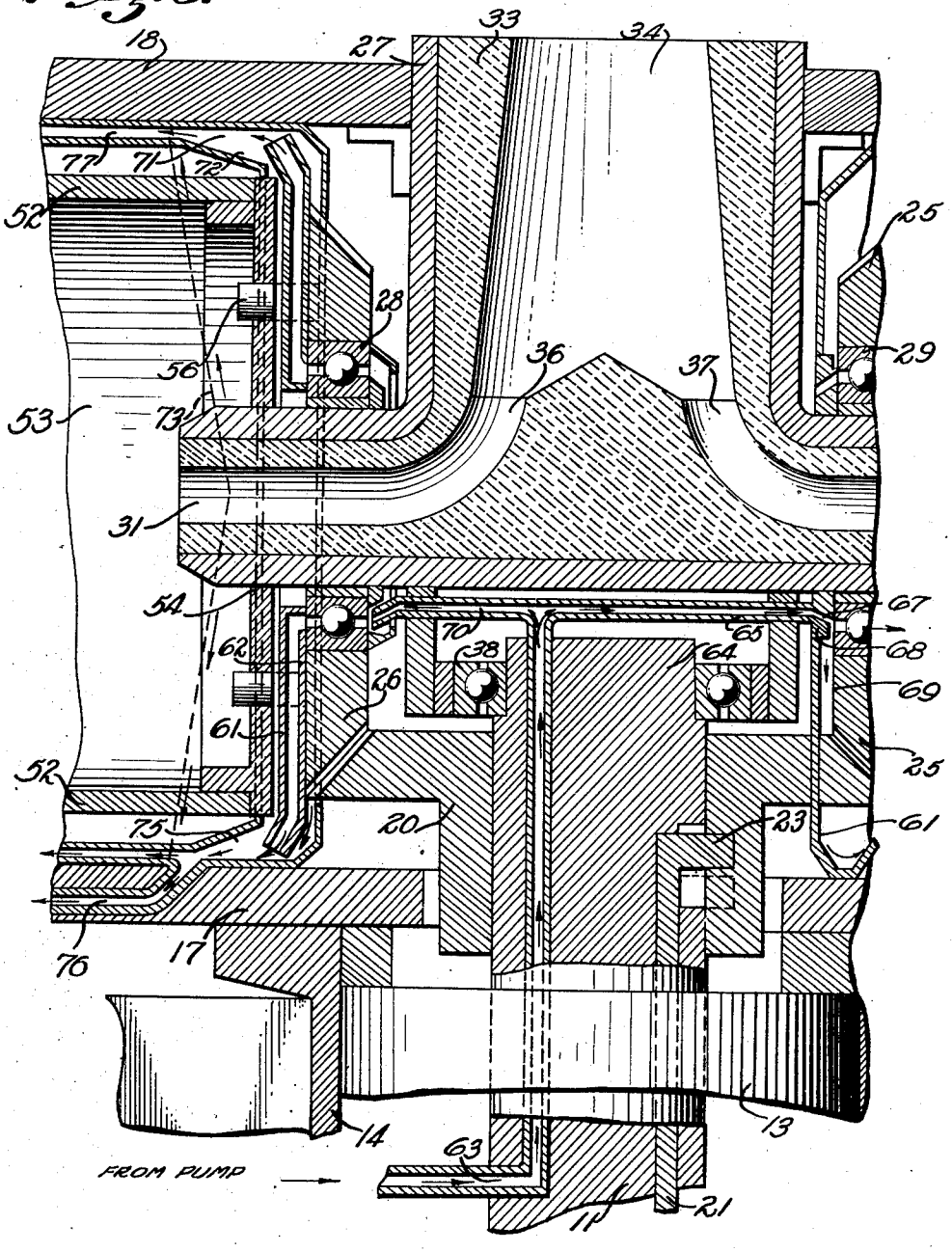
Fig. 3.



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Patented Dec. 23, 1947

2,433,065

UNITED STATES PATENT OFFICE

2,433,065

GYROCASTING APPARATUS

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Application June 24, 1944, Serial No. 541,953

14 Claims. (Cl. 18—26)

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This application is a continuation in part of the United States Patent application, Serial #525,028, filed March 4, 1944, for Centrifugal casting apparatus and method.

This invention relates to various types of centrifugal casting or treatment apparatuses and methods for casting various materials or treatment of the same under the influence of two simultaneously-acting centrifugal forces, and may be used in combination with the improvements and methods patented in the United States Patents 2,208,230; 2,222,266; and 2,325,019.

These apparatuses may be used in combination with molds for casting therein of various machine parts, precision parts, all types of ingots, all types of objects produced by casting of fusible materials.

A preferred embodiment of the present invention will be hereinafter described and illustrated on the accompanying drawing, given merely by way of example, and in which:

Figure 1 is a cross-sectional side view with parts broken out of one embodiment of the apparatus.

Figure 2 is a plan view partly in cross-section of Fig. 1.

Figure 3 is an enlarged figure of the portion of the apparatus shown in Figure 1.

One embodiment of this invention comprises a base 10, a non-rotating shaft 11 mounted on said base, a collar 12 mounted around said shaft on said base, a bearing 13 the inner part of which rests on said collar 12 and the outer part of which is connected to a pulley 14 (which may also be a gear, if a gear is used for power transmission).

Another ring 15 if desired may be interposed between the outer part of the bearing 13 and the bottom plate 17 of the frame of the apparatus. The upper plate 18 should preferably be rigidly interconnected to the bottom plate by means of bars or plates 19 shown on Figure 2.

A non-rotating gear 20 may be mounted either rigidly on the shaft 11 or mounted thereon so that it can slide, i. e. move up and down along the longitudinal axis X—X for which purpose a member 21, for instance, comprising a key-supporting bar 21, provided with a key 23, operatively engaging a groove or recess 24 provided in a non-rotating gear 20. The bar 21 may be mounted slidably in a respective groove 22 provided in said main shaft 11, which shaft is a non-rotating one, and serves as a support for the bearing 13, the frame 17 as well as a support for the non-rotating gear 20 mounted either rigidly or slidably and non-rotatably on said main shaft

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11. The key 23 is shown in its top position in which the gear 20 operatively engages the gears 26—27, which are thus accordingly rotated. When the key 23 is pulled downwardly it forces the non-rotating gear 20, mounted slidably on the shaft 11 also to slide downwardly and thus it disengages from the gears 26—27. By pushing the bar 21 to and fro, the gear 20 may be disconnected from gears 25, 26, which are rotatably mounted on respective bearings 28, 29, the inner parts of bearings being either rigidly or slidably mounted on the outer walls 30 of the rotating pouring gate 27, which may be provided with one, two or more exit orifices 31.

When the inner part of each of the bearings, according to this invention, is mounted slidably, a stop-ring 32 may be rigidly mounted on wall 30 with a reasonable clearance provided between the bearing and the ring in order to permit that the bearing together with the gear 25, 26 may slightly slide.

The rotating pouring gate 27 may be made of refractory material or of reinforced refractory material, or its walls may be made of metal and the interior thereof made of refractory material 33. The rotating gate may have an entrance orifice 34 flaring towards the bottom 35 in which bottom one or more openings 36, 37 may be provided. These openings form the entrances into channels which emerge into exit orifices 31.

The rotating gate 27 may be mounted on a bearing 38, the inner side of which may be mounted rigidly or mounted slidably on the shaft 11 and the outer side also may be either mounted rigidly or mounted slidably on the walls of the rotating gate.

The slidable mounting is advisable to permit this bearing to work more effectively for radial load while the bearing 13 works for both thrust and radial loads.

The frame 17 rotates around axis X—X by means of a motor 39, eventually through the intermediary of a clutch 40 and, if desired, of a speed box 41, provided with a brake, 42. This is shown diagrammatically.

When the frame 17—18 the gears 25, 26, rotate around X—X axis, they engage gear 20 and roll due to the fact that the rotating gate 27 is rigidly mounted to the frame 17, 18.

Between the bottom and upper plates of the frame, an end-plate 43 is mounted for each exit orifice. Said end-plates may be either rigid with the frame or mounted as shown on Figures 1 and 2—i. e. slidable in a groove 44—and having a key member 45 shaped for instance, as shown on

Figures 1 and 2, viz: having a part of its contour coincide with the radius R. The groove 44 may guide the key 45 for a desired distance shown by arrow 46 without rotation. The groove 44 may furthermore acquire a circular form by the radius R so that when moved for an additional distance 47 the key will be in position to rotate in the circle so formed, thus enabling the end-plate to be rotated around the axis 48—48.

The end-plate may carry a bearing 49, the outer surface of which rests on said end-plate while the inner surface thereof is connected to a shaft 50 rigidly mounted on a support 51 on which casing 52 of the mold 53 is also mounted.

The top of the casing 52 is interconnected with another support 54 keyed or otherwise affixed thereto, and provided with one or more grooves or openings 55 in which keying member or teeth 56 are mounted. They may be slidably mounted if desired and form an integral part of the gear 26 or be separate unit 57 shown on Figure 1 as mounted on gear 25. Such unit may be of any shape—i. e. square or circular. It will be found advisable to make it circular and provide it with a recess of a larger diameter than that part which enters into the hole 55. This will permit the recess to become a shoulder 58 which, due to centrifugal force, will press against the support 54 when the gear 25 slides along the surface 59 due to the clearance provided between the ring 32, and the gear 25.

This latter improvement is of great importance because it enables bearing 29 to work almost always on a radial load, and to establish perfect contact between gear 25 and the support 54 which enables the mold to rotate around the axis Y—Y while the frame 17, 18 is rotated around the axis X—X.

Another important embodiment of this invention provides lubricating means which may be either a lubricating box 60 mounted rigidly on the plate 18 and having a channel, the cross-section of which should be well-controlled and interconnected by contact or otherwise with a channel 60—A leading to bearing 49.

Another lubricating system may comprise the provision of one or more shields 61, 62 mounted rigidly on the gear 26. The oil is introduced through a channel or tube 63 provided in the shaft 11 and conducted to the upper part 64 of the shaft, where a member 65 may be provided having a collar channel 66 tightly engaging the collar channel 67 mounted in a rotating collar 68 rigid with the wall 69 of the rotating gate 27. Another channel 70 leading to bearing 28 may be provided, through which the oil may pass to lubricate this bearing. It will thereafter emerge on the shield 61 or 62, or in between them, according to the design, and thereafter be thrown on to another shield 71. The shield 71 may be so formed that its contour 72, 73, 74 will be inclined towards the bottom and end-plates 17, 18, so that when the oil is assembled in a groove 75 it will automatically lead to the channel 76 and 77 which may be connected accordingly to channels 78 and 79 to oil the bearing 49.

The interconnection between the channels 79 and 77 and 78 and 76 may be made either by tight contact or by bayonet or screws or other pressure-contacting means. Spring effect may be used therefor, also, to increase the tightness.

On Figure 1 is also shown another type of oiling system, which although similar in general to that described above, differs in that the oil is fed to the top. For this purpose, the gear

25 may be provided with a shield 80 or a plurality of shields similar to 62 and 63. The collector collar 81 may have the shape shown on Figure 1, i. e. its open edge 82 may be perpendicular to the axis Y—Y while the channel forming part 83 may incline from bottom to top thus urging all the oil towards the top exclusively by the centrifugal force around the axis X—X. The oil will then emerge through channel 83 and feed the bearing 84 by means of suitable interconnections.

If desired, the oil after passing through bearing 49 (or respectively, 84) may be re-channeled through channel 85 into a storage room 86 which may eventually be provided with an outlet 87 and a vane 88.

The initial feeding of oil through the channel of 63 or a plurality of similar channels may be made at any desired pressure.

Any type of mold may be used in combination with this apparatus—permanent, semi-permanent or non-permanent.

The apparatus described has a non-rotating shaft 11. However, it is obvious that the shaft 11 may be made rigid with the rotating gate 27 and rotatably mounted in a base 10 and provided with a pulley or gear rigidly affixed to the shaft 11, so that the shaft may be simply rotated around a bearing through the intermediary of which it will then be mounted in the base 10.

Obviously the frame 17, 18 will then form one rigid member with the shaft 11 while the gear 20 is rigidly affixed on the base so that it does not rotate.

This arrangement is self-explanatory for everyone skilled in the art.

The end-plate 43 may be provided with a holder 89 which is rigidly affixed thereon, and so designed that it will slide in a groove 90 provided in the bottom plate 17. A part of this holder may be provided with a recess 91 and if desired made of or lined with babbitt, 92 for instance. A small clearance should preferably be provided between the recess 91 or the lining 92 and the casing 52 in order to avoid any contact during the rotation of the mold.

When the mold is removed, the end-plate and the holder slide; the recess 91 prevents the casing of the mold from falling and the key-member 45 moves to the circular groove 93, Figure 2. The end-plate may thereafter be turned around the axis 48 until the casing of mold may be removed manually or otherwise.

For better handling of the end-plate, a handle 95 may be provided. The bottom and top plates 17, 18, may additionally be interconnected one with the other, or provided with a guard 94.

Having now ascertained and particularly described the nature of this invention and the manner in which it is to be performed, I declare that what I claim is:

1. An apparatus as set forth in claim 6 wherein means are provided to supply lubricating oil through lubricating conduits mounted in said apparatus at least one lubricating shield is rigidly mounted on said rotatable gear and rotatable therewith, and channeling means being mounted on said frame to receive the lubricating oil emerging due to the action of centrifugal force from said shield, lubricating channels being provided to interconnect said channeling means with the bearings to be oiled.

2. An apparatus as set forth in claim 6 wherein means are provided to supply lubricating oil through lubricating conduits mounted in said

apparatus at least one lubricating shield is rigidly provided on each said rotatable gear and rotatable therewith, channeling means being mounted on said frame to receive the lubricating oil emerging due to the action of centrifugal force from said shield, a main lubricating channel being provided in said main shaft leading to a first collar-groove provided near the top of said main shaft, said collar-groove being rigid with said shaft, a second collar-groove tightly mounted around said first collar-groove and rigid with respect to said frame and rotatble therewith, an exit channel interconnecting said second collar-groove and leading to at least one of said bearings.

3. An apparatus as set forth in claim 6 wherein means are provided to supply lubricating oil through lubricating conduits mounted in said apparatus said main shaft is provided with a lubricating groove in which a lubricating tube is mounted, the entrance orifice of said tube being connected with oil pumping means provided therefor, the exit orifice of said tube emerging into a non-rotatable collar-groove mounted on said main shaft and registering a rotatable collar-groove mounted rigidly in respect to said frame and rotatable therewith, a lubricating channel interconnecting said rotatable collar-groove with at least one of said bearings, a lubricating shield mounted on each said rotatable gear, channeling means being mounted on said frame, the bottom surface of which flares upwards in respect to the said entrance orifice of said rotatable gate, a second lubricating channel leading from the top of said bottom surface of said channeling means to said third bearing provided in said end-plate.

4. An apparatus as set forth in claim 6 wherein said end-plate is provided with an oil storage chamber rigidly mounted in respect thereto, oil-conducting means being provided to distribute the oil from said storage chamber to one or more of said bearings for their lubrication.

5. An apparatus as set forth in claim 10, wherein said frame is provided with a lubricating tank rigidly mounted thereon and rotatable therewith, around said main shaft, oil distributing channels leading from said tank, being provided for lubrication of at least one of said bearings.

6. A gyrocasing apparatus of the character herein referred to comprising a base, a main shaft mounted rigidly on said base, a frame interconnected through the intermediary of a first bearing with said main shaft, means to rotate said frame around said main shaft, said frame comprising at least one mold-casing with a mold having a main gate placed therein and a rotatable pouring gate rigidly affixed to said frame and rotatable coaxially with said main shaft, said rotatable pouring gate having on its top an entrance orifice flaring towards the bottom of said gate, exit orifices being provided in said bottom, one exit orifice per each of said mold, said exit orifice comprising a channel which runs into said main gate, a gate casing mounted around said channel, said gate casing being provided with a second bearing mounted thereon, said second bearing having an outer bearing ring operatively interconnected with a rotatable gear mounted thereon, a non-rotating gear being mounted on said main shaft and coaxially therewith and being operatively interconnected with said rotatable gear, one end-plate per each mold mounted on said frame through the intermediary of a key-member and guide-grooves in which said key-member slides and rotates, locking means provided to interlock said end-plate with said frame, a third bearing provided in said end-plate, having an inner part rigidly mounted on said mold-casing said third bearing being mounted on a mold-shaft-support-member provided on that part of said mold-casing which is closer to said end-plate, a second support-member being mounted on that part of said mold-casing which is closer to said rotatable gear said second support-member being provided with means operatively interconnecting it with said rotatable gear.

7. An apparatus as set forth in claim 6 wherein said non-rotatable gear mounted on said main shaft is provided with first means enabling it to slide to and fro on said main shaft and with means to operate said first means, whereby said non-rotatable gear may be disengaged from said rotating gear.

8. An apparatus as set forth in claim 6 wherein said second bearing is mounted slidingly on said gate casing.

9. An apparatus as set forth in claim 6 wherein said second bearing is mounted slidably on said gate casing and said mold-casing is a cylinder, one side of which cylinder is in contact with a circular flange provided on a circular cover, provided on said mold having a circular opening in it, in which said cover is provided, said second support-member.

10. A gyrocasting apparatus having at least one mold-casing with a mold having an entrance orifice simultaneously rotatable around two axes of rotation, the first axis of rotation and a second axis of rotation, said axes being at an angle one to another, said apparatus comprising a frame, a non-rotatable main shaft on which said frame is rotatably mounted said non-rotatable main shaft being concentric with said first axis of rotation, a means to rotate said frame around said non-rotatable main shaft, a non-rotatable gear coaxial with said non-rotatable main shaft and mounted non-rotatably in respect to said frame, at least one rotatable gear per each said mold-casing mounted in a plane perpendicular to said second axis of rotation, and able to freely rotate about it, a pouring gate rigid with said frame and rotatable therewith, and having an entrance opening on the top thereof concentric to said first axis of rotation, said entrance opening flaring downward to the bottom of said pouring gate, at least one exit orifice per each said mold being provided in said bottom of said pouring gate, an exit channel leading from each of said exit orifices into the respective entrance orifice of each said mold, said exit channel passing through an opening provided in said rotating gear and coaxial with said second axis of rotation, while also coaxial with said exit channel and with said entrance orifice, first bearing means coaxial with said second axis of rotation provided around said exit channel for mounting thereon of said rotatable gear, a second bearing means provided in said frame and also mounted coaxially with said second axis of rotation, said mold-casing being mounted rotatably between said first and second bearing means interlocking means being provided to interlock said rotating gear with said mold-casing.

11. An apparatus as set forth in claim 10 wherein means are provided to engage and disengage said non-rotation gear with each of said rotating gear.

12. An apparatus as set forth in claim 10 wherein, said non-rotatable gear mounted on said main shaft is provided with first means enabling

it to slide to-and-fro on said main shaft and with second means to operate said first means, whereby said non-rotatable gear may be disengaged from said rotating gear.

13. An apparatus as set forth in claim 10 wherein, said second bearing is mounted slidably in respect to its own axis of rotation.

14. An apparatus as set forth in claim 10 wherein, said second bearing is mounted slidably in respect to its own axis of rotation and wherein said mold casing is a cylinder, one side of which cylinder is in contact with a circular flange provided on a circular cover provided on said mold casing.

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