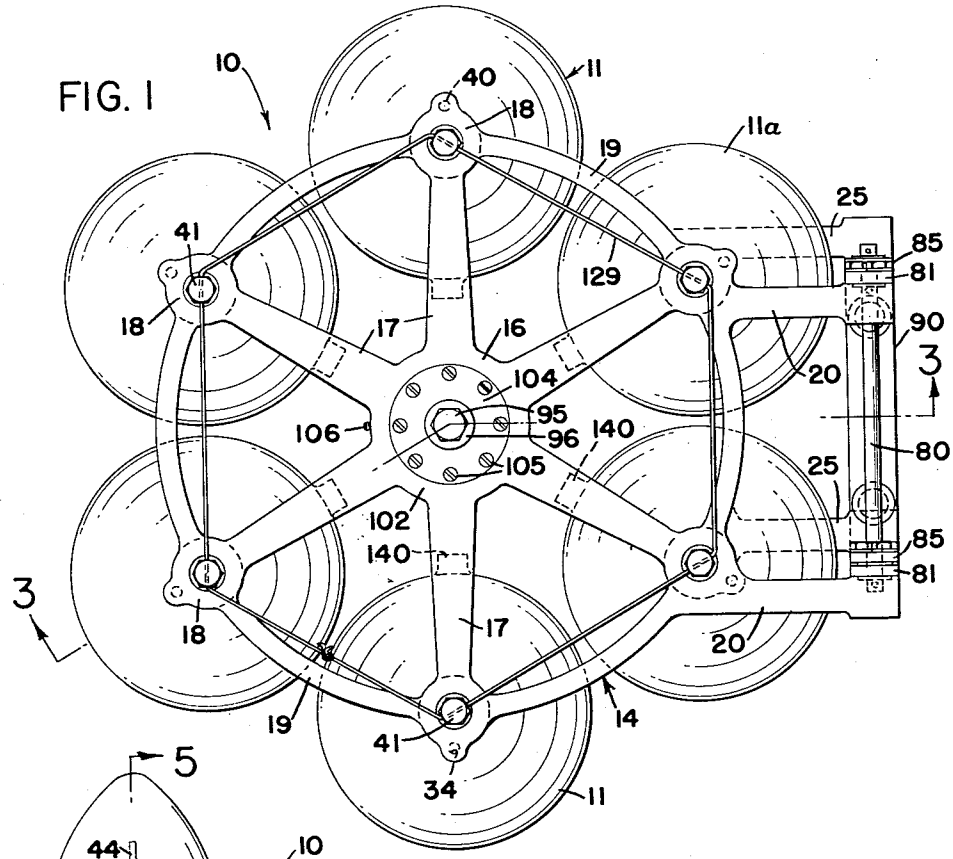
Sept. 19, 1961 G. T. PARSCH 3,000,056

MOLD CARRIERS FOR USE IN ROTATIONAL CASTING

Filed Feb. 26, 1958 3 Sheets-Sheet 1

FIG. 1



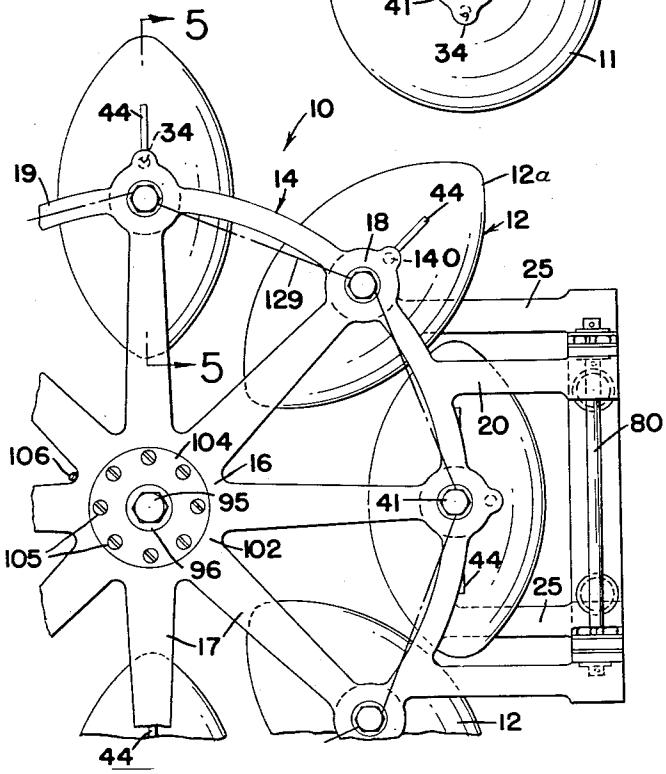


FIG. 2

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MOLD CARRIERS FOR USE IN ROTATIONAL CASTING

Filed Feb. 26, 1958 3 Sheets-Sheet 2

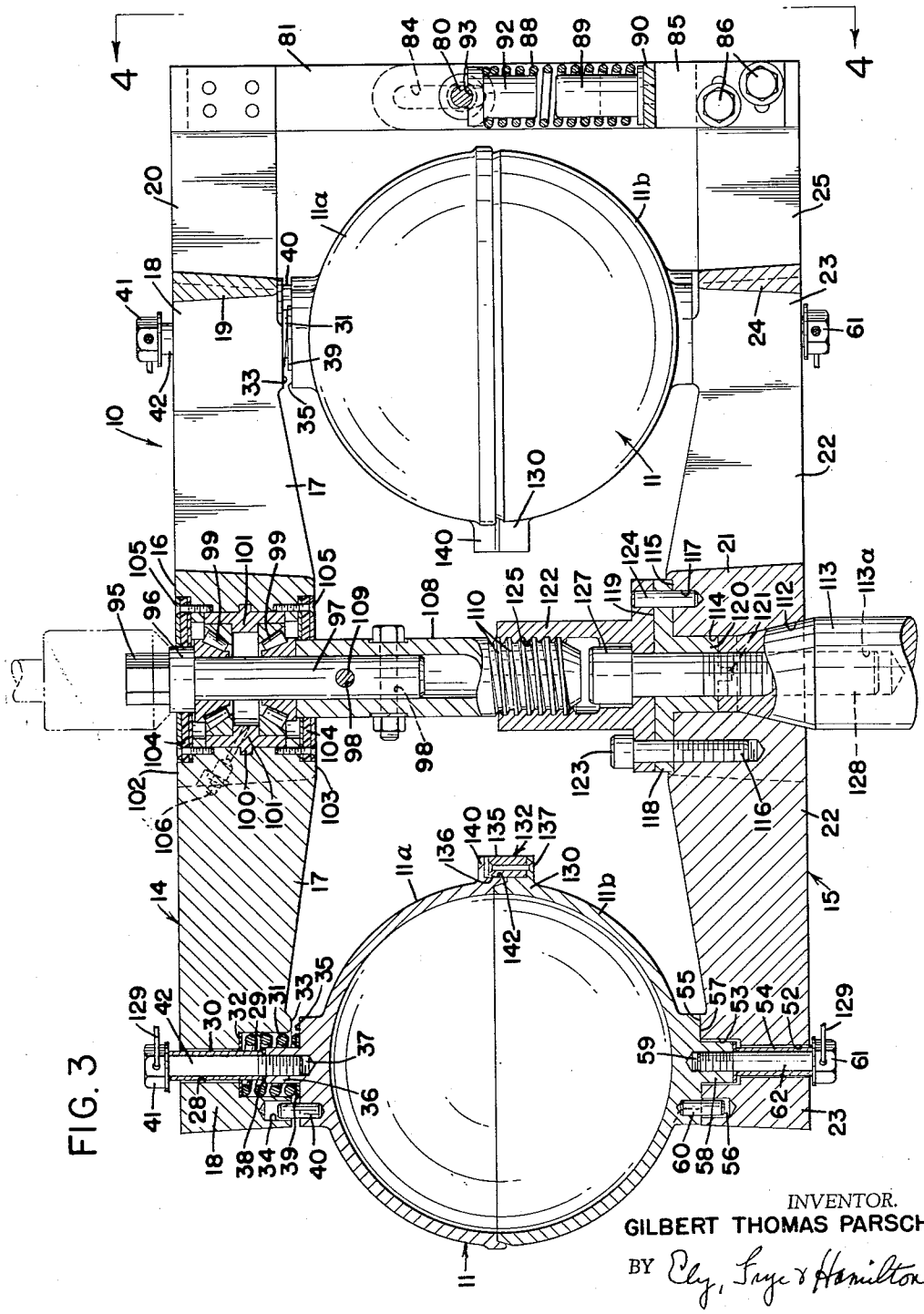


FIG. 3

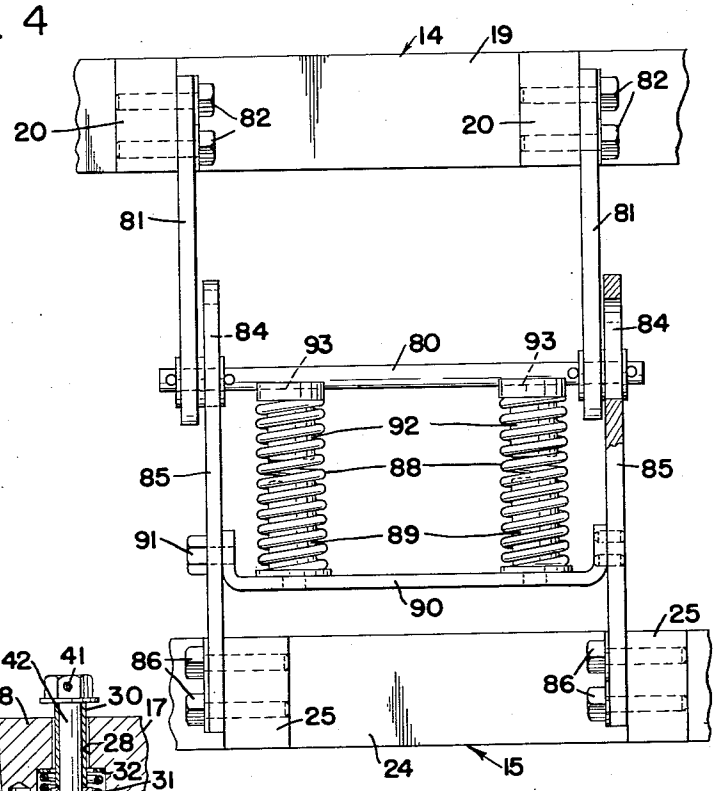
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MOLD CARRIERS FOR USE IN ROTATIONAL CASTING

Filed Feb. 26, 1958 3 Sheets-Sheet 3

FIG. 4



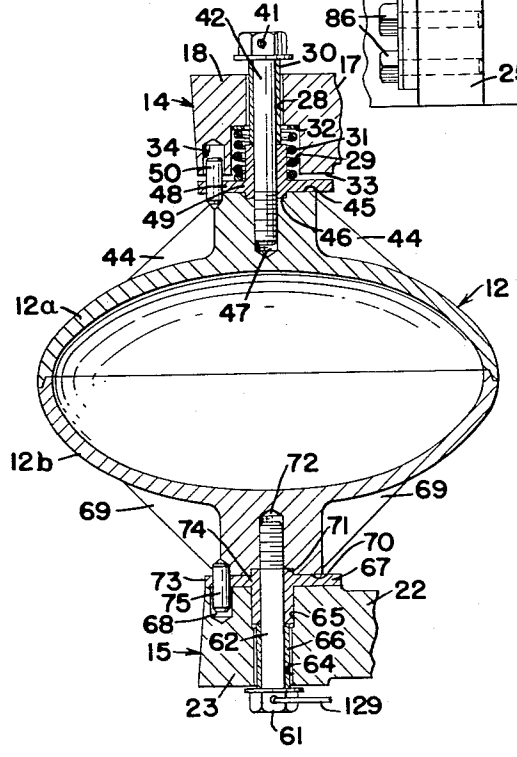


FIG. 5

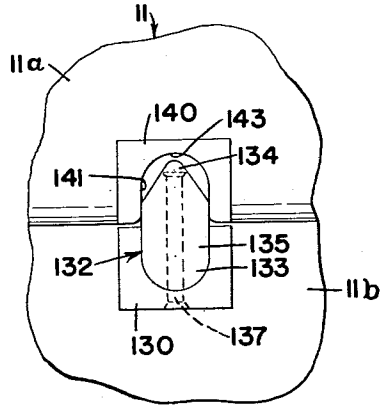


FIG. 6

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United States Patent Office 3,000,056 Patented Sept. 19, 1961

3,000,056

MOLD CARRIERS FOR USE IN ROTATIONAL CASTING

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Filed Feb. 26, 1958, Ser. No. 717,668
14 Claims. (Cl. 18—43)

The present invention relates to improvements in rotational casting apparatus. More particularly, the invention relates to an improved mold carrier or "spider" for use with rotational casting apparatus.

In a process of rotational casting to which the invention is especially adapted, there is provided a series of hollow sectional molds which are loaded with a charge of plastisol such as a vinyl-resin compounded with a plasticizer. Plastisols of this type are well known in the art and are available from a number of sources. When the molds are charged, the spider is closed and locked and immediately thereafter is rotated simultaneously upon different axes to distribute the plastisol evenly over the inner surface of each mold. After the material has been gelled and fused by the controlled application of heat, the rotation of the spider is stopped and the spider is cooled to a degree where the molds can be opened and the finished article removed, whereupon the molds are readied for repeating the cycle.

The apparatus of the invention is particularly intended for use with a casting machine having one or more radially extending arms. Each casting arm may include a pair of shafts, one within the other, which are driven at differential speeds to impart simultaneous rotation on divergent axes to the spider or mold carrier supported on the outer ends of the shafts. The rate of rotation of either shaft may be changed without changing the speed of the other shaft and thus the spider may be subjected to a variety of speed ratios with a resultant extreme application of centrifugal forces. A satisfactory spider or mold carrier should thus be light in weight yet constructed to resist deformation by the driving force of the casting machine. A satisfactory spider should be easily closed when cool yet easily opened when warm after emergence from a curing oven. Finally, a satisfactory spider must maintain the sectional molds closed and in proper alignment despite extreme application of centrifugal casting forces.

Accordingly, it is an object of the present invention to provide an improved mold carrier or spider for use with rotational casting apparatus.

It is a further object of the invention to provide an improved mold carrier or spider which is light in weight, which will resist deformation by the driving force of the casting machine, which will be easily opened and closed, which will resist the heat of a curing oven, and which will maintain the sectional molds closed and in correct alignment despite extreme applications of centrifugal casting forces.

These and other objects of the invention will be apparent in view of the following description of the invention taken in connection with the attached drawings.

In the drawings:

FIG. 1 is a plan view of a mold carrier or spider according to the invention adapted for carrying round or spherical molds;

FIG. 2 is a sectional plan view of a spider adapted for carrying oval molds;

FIG. 3 is an enlarged section taken substantially as indicated on line 3—3 of FIG. 1;

FIG. 4 is an end view taken substantially as indicated on line 4—4 of FIG. 3;

FIG. 5 is an enlarged section through an oval mold

taken substantially as indicated on line 5—5 of FIG. 2; and

FIG. 6 is an enlarged view of a mold half registering means for use with spherical sectional molds having continuous pattern molding surfaces.

A mold carrier or spider according to the invention includes a lower grid member adapted for attachment to a casting machine, an upper grid member yieldably hinged to the lower grid member, and coupling means extending axially between the grid members for locking the grids together in substantially parallel planes. A plurality of upper mold halves are resiliently mounted on the upper grid and a plurality of lower mold halves, aligned and mating with the upper mold halves, are movably mounted on the lower grid.

In the drawings, a mold carrier or spider according to the invention is indicated at **10**. In FIG. 1, the spider **10** is adapted for carrying a round or spherical mold **11** having a cavity such as could be used to manufacture a basketball or volley ball. In FIG. 2, the spider **10** is adapted for carrying an oval mold **12** having a cavity such as could be used to manufacture a football. The upper half (**11***a* or **12***a*) of each sectional mold is resiliently mounted on an upper grid member indicated at **14**. The lower half (**11***b* or **12***b*) of each mold is movably mounted on a lower grid member indicated at **15**.

Referring to FIG. 1, an upper grid member **14** has a central hub area **16**. Extending radially from the hub area is a plurality of regularly spaced spoke ribs **17**. Each spoke rib terminates in an upper mold half mounting boss **18**. Each mounting boss is laterally connected with adjacent bosses by a peripheral rib **19**. At one side of the grid **14**, two parallel hinge struts **20** extend outwardly from the rib **19**.

As best shown in FIG. 3, a lower grid member **15** preferably matches an upper grid member **14** and also has a central hub area **21**, a plurality of regularly spaced spoke ribs **22**, a lower mold half mounting boss **23** at the end of each spoke rib and a connecting peripheral rib **24**. The grid **15** also has two parallel hinge struts **25**, but offset in relation to the upper hinge struts **20**, extending outwardly from the rib **24**.

The grid members **14** and **15** are preferably cast from a stainless steel alloy or a ductile iron composition so as to be light in weight yet resistant to centrifugal forces and the heat of the curing oven.

Referring to FIG. 3, each upper grid mold mounting boss **18** has an upper small diameter sleeve bore **28** opening down into a larger diameter spring bore **29**. A preferably stainless steel spacer sleeve **30** is loosely fitted in bore **28** and extends a substantial distance downwardly into bore **29**. A strong (e.g. 300–600 p.s.i.) compression spring **31**, also preferably of stainless steel, is seated against a washer **32** in the upper end of bore **29**. The under surface **33** of the boss is machined flat and is drilled to provide a blind bore **34**. Referring briefly to FIG. 5, it will be observed that the mounting boss **18** of the spider adapted for carrying the oval molds **12** is similarly constructed.

The neck of each upper mold half **11***a* has a boss surface **35** which is substantially coextensive and in conformity with the under surface **33** of the mounting boss **18**. At the center of the upper surface **35** is a mounting stud **36** having a tapped bore **37**. On top of the stud **36** is placed a washer **38** for seating the lower end of the spacer sleeve **30**. Around the stud **36** is another washer **39** for seating the lower end of the compression spring **31**. Between the washer **39** and the edge of surface **35** is an aligning dowel **40** for insertion within the blind bore **34** in the under surface **33** of the mounting boss.

Each mold half **11***a* is attached to the mounting boss **18** by a cap screw having a hexhead **41** and a shank **42**

threaded into bore 37. The length of sleeve 30 is such that when the screw shank 42 is securely threaded into bore 37, the cap screw can "float" or move a slight distance longitudinally within bore 28. The extent of downward movement is limited by the screw head 41 and the extent of upward movement is limited by the mold surface 35. The compression spring 31 is always tending to move the screw head 41 into contact with the upper surface of the mounting boss 18 and the screw shank 42, and attached mold half 11*a*, away from the surface 33 of the mounting boss.

FIG. 3 shows the preferred normal position of the mold half 11*a* in relation to the mounting boss 18 when the spider 10 is closed. Rotation of the mold half about the axis of the screw shank 42 is prevented by the blind dowel 40. The mold half 11*a* is maintained in mating alignment with the lower mold half 11*b* by the strong compression spring 31. It has been found desirable that the spring 31 yield a pressure of approximately 20 pounds per lineal inch of periphery of the mating mold surfaces. As centrifugal casting forces or heat from the curing oven are applied to the spider, any significant distortion of the grid member 14 will be compensated or equalized by the resilient mounting of the upper mold half 11*a*.

Referring to FIG. 5, the neck of each upper mold half 12*a* is strengthened by longitudinal fins 44 and has an upper surface 45. The center of surface 45 has an annular recess 46 and a tapped bore 47. On top of the surface 45 is placed an annular member 48 having a hub 49 engaging the recess 46 and extending upwardly into the spring bore 29. Between the hub 49 and the edge of member 48 is an aligning dowel 50 for insertion within the blind bore 34 in the under surface 33 of the mounting boss.

Each mold half 12*a* is attached to the mounting boss in a manner similar to that described above for a mold half 11*a*, that is, by a resiliently mounted cap screw having a head 41 and a shank 42 threaded through hub 49 into bore 47.

Referring to FIG. 3, each lower grid mold mounting boss 23 has a lower small diameter sleeve bore 52 opening upwardly into a larger diameter stud bore 53. A preferably stainless steel sleeve 54 is loosely fitted in bore 52 and extends a slight distance upwardly into bore 53. The upper surface 55 of each mounting boss is machined flat and is drilled to provide a blind bore 56.

The neck of each lower mold half 11*b* has a boss surface 57 which is substantially coextensive and in conformity with the upper surface 55 of each mounting boss 23. At the center of the undersurface 57 is a mounting stud 58 having a diameter slightly less than the diameter of bore 53. The mounting stud also has a tapped bore 59. Between the stud 58 and the edge of surface 57 is an aligning dowel 60 for insertion within the blind bore 56 on the upper surface 55 of the mounting boss.

Each mold half 11*b* is attached to the mounting boss 23 by a cap screw having a hexhead 61 and a shank 62 threaded into bore 59. The length of sleeve 54 is such that when the screw shank 62 is securely threaded into bore 59, the lower end of stud 58 will be slightly above the lower end of the bore 53 so that slight longitudinal and lateral movement of the mold half is possible. Provision for such a slight movement permits the accurate alignment of the mating upper mold half 11*a* during closing of the spider, compensates or equalizes any distortion of the grid member 15, and lessens the possibility of injury to the mating mold surfaces during opening.

Referring to FIG. 5, each mounting boss 23 of the spider adapted for carrying the oval molds 12 also has a lower small diameter sleeve bore 64 opening upwardly into a larger diameter bore 65. A sleeve 66, similar to sleeve 54, is loosely fitted in bore 64 and extends a slight distance upwardly into bore 65. The upper surface 67 of each mounting boss is machined flat and is drilled to provide a blind bore 68.

The neck of each lower mold half 12*b* is strengthened by longitudinal fins 69 and has an under surface 70. The center of surface 70 has an annular recess 71 and a tapped bore 72. An annular member 73 having a hub 74 engaging recess 71 and extending downwardly into the bore 65 is located on the upper surface 67 of the mounting bore. Between the hub 74 and the edge of member 73 is an aligning dowel 75 for insertion within the blind bore 68 of the mounting boss.

Each mold half 12*b* is attached to the mounting boss 23 in a manner similar to that described above for a mold half 11*b*; that is, by a slightly movable cap screw having a head 61 and a shank 62 threaded through hub 74 into bore 72.

As best shown in FIG. 4, the means for yieldably hinging grid members 14 and 15 together includes a rod or pin 80. The hinge pin is carried between the lower ends of a pair of rectangular straps 81 extending downwardly from the upper grid member 14. Each strap 81 is preferably attached to the "right hand" side surface of a hinge strut 20, as by bolts 82, and may be doweled for accurate alignment.

The hinge pin 80 is movable within vertically elongate slots 84 in the upper ends of a second and preferably somewhat longer pair of rectangular straps 85 extending upwardly from the lower grid member 15. Each strap 85 is preferably attached to the "left hand" side surface of a hinge strut 25, as by bolts 86, and also may be doweled, if desired.

During opening of the spider 10, as described in detail below, the hinge pin 80 is moved upwardly within the elongate slots 84 by a resilient means such as a pair of coiled compression springs 88. The lower portion of each spring 88 is supported by a fixed position spring stud 89. The spring studs 89 are preferably spaced equidistant from the center line of the grid members 14 and 15 and extend upwardly from a cross-plate 90 extending between the straps 85 and attached thereto as by bolts 91. The upper portion of each spring 88 carries a spring plunger 92, which is preferably somewhat shorter than a spring stud 89. Each plunger 92 has a transverse groove 93 to maintain the upper surface thereof in abutting contact with the under surface of the hinge rod 80.

Referring to FIG. 3, the coupling means for locking the grid members 14 and 15 together in substantially parallel planes extends between the central hub areas 16 and 21 of the respective grids. The coupling means includes a shaft extending transversely through hub area 16 and having a hexhead 95, a collar 96 and an elongated body 97 with a pair of cross bores 98 at right angles to each other. The shaft body 97 is journaled preferably in a pair of upper and lower antifriction bearings 99.

When an upper grid member 14 is cast, the hub area 16 preferably has a transverse steel sleeve 100 inserted therein. The sleeve 100 is later machined to provide a shoulder seat 101 for the bearings 99. The upper surface 102 and the under surface 103 of the hub area 16 are also machined to provide annular grooves for insertion of upper and lower bearing seals 104. Each bearing seal 104 is of a grease and heat resistant material such as Teflon, suitably encased for attachment as by screws 105. The bore of the hub area 16 is lubricated by a heat-resistant grease inserted through a conventional fitting 106.

The shaft body 97 extends downwardly into a hollow coupling member 108. The upper end of member 108 preferably extends through the lower seal 104 and seats against the lower bearing 99. The shaft body 97 is rigidly connected to the member 108 as by bolts 109 extending through the cross-bores 98. The lower end of member 108 has exterior threads 110. The threads 110 are coarse and quick-acting (e.g. standard Acme, 4 threads per inch).

When the lower grid member 15 is cast, the hub area 21 preferably has a rough bore therethrough. The lower portion of the hub bore is then machined to provide a finished bore 112 for receiving the drive spindle 113 of a casting machine (not shown). Though the bore 112 is

shown as tapered, the hub area **21** could be adapted in any suitable manner for connection to a casting machine.

The upper portion of the rough bore is machined to provide a finished bore **114**. The upper surface of the hub area is also machined to provide a flat surface **115**, a series of tapped bores **116**, and if desired, dowel holes **117**. The drive connection between the grid **15** and the machine spindle **113** is provided by an annular plate **118** seated on surface **115**. The plate **118** has a flat upper surface **119**, a hub **120** fitting in bore **114**, and drive keys **121** for engagement with the drive spindle **113**.

The coupling means further includes a hollow stud **122** seated on the upper surface **119** of the drive plate and secured thereto as by bolts **123** inserted in bores **116**, and if desired, dowels **124** inserted through the drive plate into holes **117**. The upper portion of the bore of the coupling stud has interior threads **125**. The threads **125** should mesh quickly with the threads **110** of coupling member **108** and therefore are machined to provide a slight radial play (e.g. .010 inch). The lower portion of the coupling stud bore is preferably machined to receive an Allen-head bolt having a head **127** and shank **128** extending longitudinally of the coupling stud, through the drive plate hub **120**, into a threaded bore **113***a* in the drive spindle of the casting machine.

When each grid member has been assembled with its respective mold halves as described above, a stay wire **129** is preferably inserted through the hexheads (**41** or **61**) of each mold half mounting screw.

When the spider **10** is open, the hinge springs **88** are at maximum extension so that the hinge pin **80** is near the top of the elongate slots **84**. The upper grid member **14** may thus be readily lowered in position over the lower grid **15**. When the grids are closed, the threads **110** on the coupling member **108** will be ready for engagement with threads **125** of the coupling stud **122**. A suitable wrench (shown in dotted lines in FIG. 3) applied to the shaft head **95** will pull the upper grid **14** parallel to and in locked engagement with the lower grid **15**. The resilient mounting of the upper mold halves (**11***a* or **12***a*) and the movable mounting of the lower mold halves (**11***b* or **12***b*) enables the mold halves to mate and align without injury to the mold surface during coupling of the grid members.

During the casting operation, the drive forces of the casting machine are applied to the lower grid **15** through the plate **118**. Because the shank **97** of the upper grid coupling shaft is journaled in the bearings **99**, the drive forces of the casting machine are applied to the upper grid **14** through the resiliently mated and aligned mold halves. Thus, the drive force is applied to the upper grid at several points and distortion thereof will be compensated or equalized.

After the casting operation, the shaft head **95** is turned to disengage the coupling member **108** from the coupling stud **122**. As the threads **110** and **125** part, the upward movement of the grid **14** will be stabilized by extension of the hinge springs **88**. During the opening movement, compression of the upper mold half mounting springs **29** is released so that when the coupling members are fully disengaged, the upper mold halves are lifted opening the molds without injury to the mating surfaces and freeing the molded articles from the mold cavities.

Referring to FIG. 6, when the spherical molds **11** have continuous pattern surfaces, that is, patterns or textures extending from one mold half to the other without interruption, it has been found desirable to provide means to accurately and quickly align the mold halves as the spider **10** is being closed. In most uses, the upper and lower dowels **40** and **60** are sufficiently accurate. However, finely patterned molds benefit from a very accurate alignment.

Accordingly, a key lug **130** may be cast at one side of the mating flange of a lower mold half **11***b*. The key lug is machined to provide a seat for a registering pin or key **132**. In cross-section, the lower end **133** of the aligning key is preferably rounded and the upper end **134** is pointed or equally tapered on either side. Referring to FIG. 3, the outer surface **135** of the key **132** is substantially vertical but the inner surface **136** is inwardly tapered at a slight angle (e.g. 5°) from approximately the midpoint of the key. The key **132** is attached to the lug **130** by a pin or screw **137**.

A latch lug **140** may also be cast at one side of the mating lip of an upper mold half **11***a*. The latch lug is machined to provide a slot **141** having a vertical inner surface **142** (see FIG. 3) and an arcuate upper end **143**. When the mold halves **11***a* and **11***b* are brought together by closing of the spider **10**, the surface **142** will slide upon the key surface **136** and the slot end **143** will readily engage the pointed key end **134**. Thus, the mold halves may be quickly and accurately aligned.

What is claimed is:

1. A spider for use with a rotational casting machine comprising, a wheel-like lower mold carrying member having a hub area adapted for connection to said machine, an upper wheel-like mold carrying member resiliently and yieldably hinged to said lower member, and means extending between the hub areas of said members for coupling the members together in substantially parallel planes.

2. A spider for use with a rotational casting machine comprising, a wheel-like lower mold carrying member having a hub area adapted for connection to said machine, an upper wheel-like mold carrying member resiliently and yieldably hinged to said lower member, a shaft journaled transversely of the hub area of said upper member, and means extending between said hub areas and associated with said shaft for coupling the members together in substantially parallel planes.

3. A spider for use with a rotational casting machine comprising, opposed wheel-like mold carrying members resiliently and yieldably hinged together, one of said members having a hub area adapted for connection to said machine, the other of said members having a shaft journaled transversely of the hub area, and means extending between said hub areas and associated with said shaft for coupling the members together in substantially parallel planes.

4. A spider for use with a rotational casting machine comprising, a lower member, an upper member resiliently and yieldably hinged to said lower member, coupling means for locking said members together in substantially parallel planes, at least one mold section resiliently depending from said upper member and at least one mold section movably mounted on said lower member in alignment with a mold section on said upper member and defining a mold cavity when mated therewith.

5. A spider for use with a rotational casting machine comprising, a wheel-like lower member having a hub area adapted for connection to said machine, an upper wheel-like member resiliently and yieldably hinged to said lower member, a shaft journaled transversely of the hub area of said upper member, means extending between said hub areas and associated with said shaft for coupling the members together in substantially parallel planes, at least one mold section resiliently depending from said upper member and at least one mold section movably mounted on said lower member in alignment with a mold section on said upper member and defining a mold cavity when mated therewith.

6. In combination with a spider for use with a rotational casting machine, said spider including an upper member for carrying at least one depending mold section, a lower member for carrying at least one mold section in alignment with a mold section on said upper member and defining a mold cavity when mated therewith, hinge means resiliently and yieldably connecting said upper and lower members and coupling means for locking said upper and lower members together in substantially parallel planes, means for resiliently mounting a mold section

on said upper member; comprising, a cap screw having a shank extending movably through said member and attached to the mold section, spacer means maintaining said cap a predetermined distance from said mold section, and compression means extending between said member and mold section tending to move said cap into contact with said member.

7. In combination with a spider for use with a rotational casting machine, said spider including an upper member for carrying at least one depending mold section, a lower member for carrying at least one mold section in alignment with a mold section on said upper member and defining a mold cavity when mated therewith, hinge means resiliently and yieldably connecting said upper and lower members and coupling means for locking said upper and lower members together in substantially parallel planes, means for resiliently mounting a mold section on said upper member, said mold section having a neck portion, comprising, a cap screw having a shank extending movably through said member and attached to said neck portion, spacer means maintaining said cap a predetermined distance above said neck portion, and a coiled spring surrounding said shank and said neck portion and tending to move said mold section away from said upper member.

8. In combination with a spider for use with a rotational casting machine, said spider including a lower mold half carrying member, an upper mold half carrying member, and coupling means extending axially between said members, hinge means connecting said members comprising, a first pair of straps extending downwardly from the edge of said upper member, a second pair of straps extending upwardly from the edge of said lower member each having an elongate slot in the upper end thereof, a hinge pin carried between the lower ends of said first pair of straps and extending through said elongate slots, and compression means carried by said second pair of straps tending to move said hinge pin away from said lower member.

9. In combination with a spider for use with a rotational casting machine, said spider including a lower mold half carrying member, an upper mold half carrying member, and coupling means extending axially between said members, hinge means connecting said members comprising, a first pair of straps extending downwardly from the edge of said upper member, a second pair of straps extending upwardly from the edge of said lower member each having an elongate slot in the upper end thereof, a hinge pin carried between the lower ends of said first pair of straps and extending through said elongate slots, a plate extending between said second pair of straps, and coiled spring means on said plate tending to move said hinge pin away from said lower member.

10. In combination with a spider for use with a rotational casting machine, said spider including a lower mold half carrying member, an upper mold half carrying member, and coupling means extending axially between said members, hinge means connecting said members comprising, a first pair of straps extending downwardly from the edge of said upper member, a second pair of straps extending upwardly from the edge of said lower member each having an elongate slot in the upper end thereof, a hinge pin carried between the lower ends of said pair of straps and extending through said elongate slots, at least one upwardly directed stud supported between said second pair of straps, at least one plunger in abutting contact with said hinge pin and coiled spring means extending between a stud and plunger tending to move the hinge pin away from said lower member.

11. In combination with a spider for use with a rotational casting machine, said spider including a wheel-like lower mold carrying grid having a hub area adapted to be driven by said machine and a wheel-like upper mold carrying grid resiliently and yieldably hinged to said lower member, coupling means for said grids comprising, a shaft journaled transversely of the hub area of said upper grid and having exterior threads on the lower end thereof and a hollow stud attached to the hub area of said lower grid and having interior threads in the upper end thereof meshing with said exterior threads, said shaft being rotatably engaged with said stud to lock said grids together in substantially parallel planes.

12. In combination with a spider for use with a rotational casting machine, said spider including a wheel-like lower mold carrying grid having a hub area adapted to be driven by said machine and a wheel-like upper mold carrying grid resiliently and yieldably hinged to said lower member and having a hub area with a transverse bore, coupling means for said grids comprising, a shaft journaled in bearings seated in said bore, a member having exterior threads attached to the lower end of said shaft and a hollow stud attached to the hub area of said lower grid and having interior threads in the upper end thereof meshing with said exterior threads, said shaft being rotatable to mesh said threads locking said grids together in substantially parallel planes.

13. In combination with a spider for use with a rotational casting machine, said spider including opposed upper and lower members each carrying at least one mating mold half, means for registering said mold halves comprising, a registering key having a pointed upper end and a downwardly tapered inner facing surface, said key being located on the periphery of a lower member mold half, and a registering latch having an arcuate slot for engaging said pointed end and a vertical surface for engaging said tapered surface, said latch being located on the periphery of an upper member mold half.

14. In combination with a spider for use with a rotational casting machine, said spider including opposed upper and lower members each carrying at least one hemispherical mold half, means for registering said mold halves to define a mold cavity comprising, a registering key having a pointed upper end and a downwardly tapered inner facing surface, said key being located on the periphery of a lower member mold half, and a registering latch having an arcuate slot for engaging said pointed end and a vertical surface for engaging said tapered surface, said latch being located on the periphery of an upper member mold half.

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