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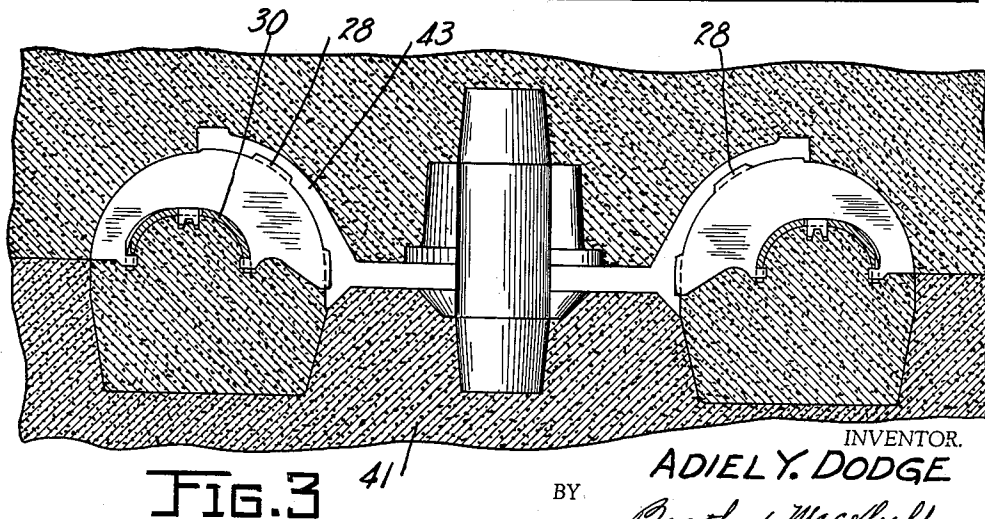
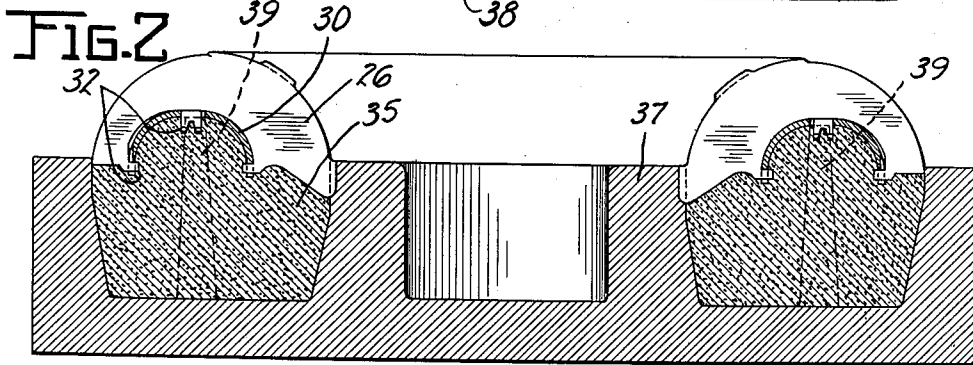
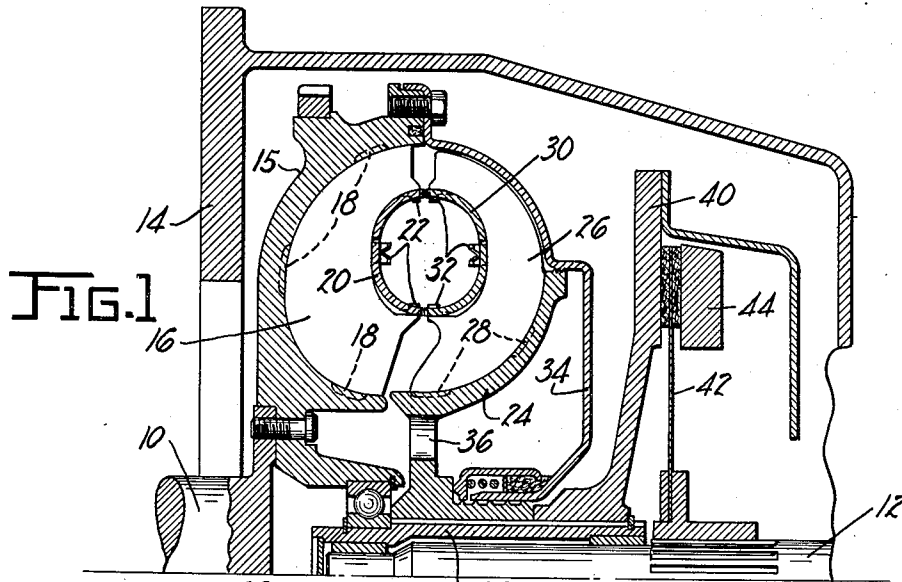
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2,294,837

METHOD AND APPARATUS FOR CASTING FLUID TRANSMISSION MEMBERS

Filed Aug. 26, 1939

2 Sheets-Sheet 1



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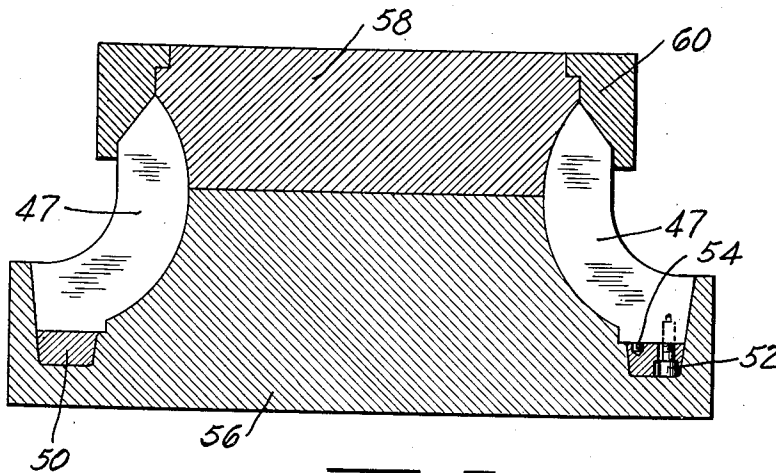
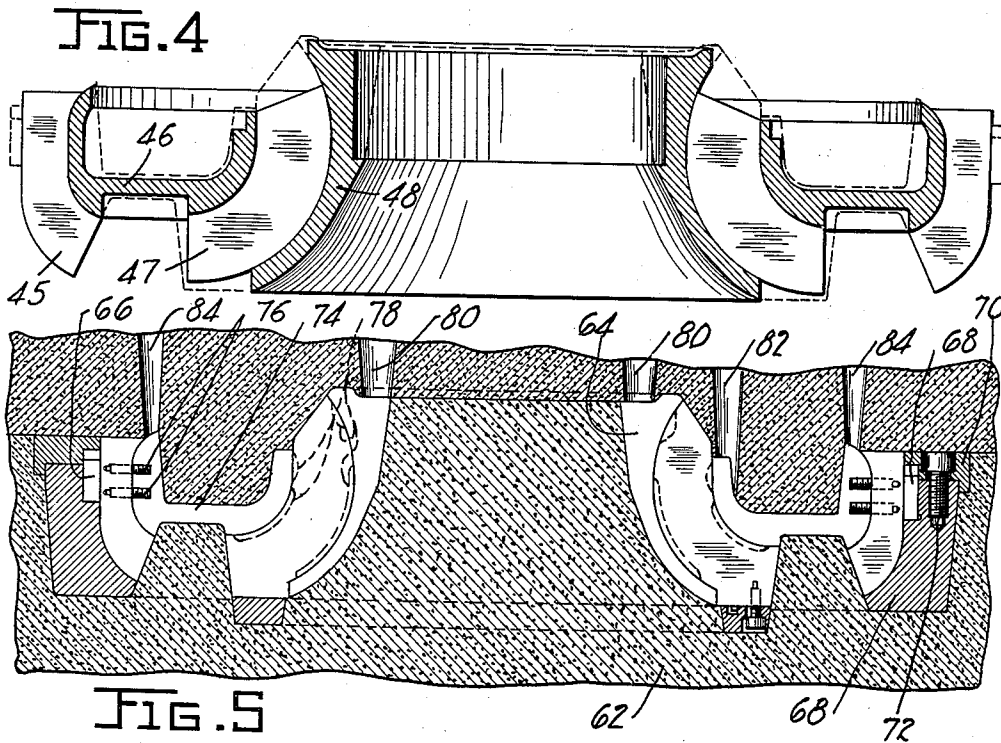
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METHOD AND APPARATUS FOR CASTING FLUID TRANSMISSION MEMBERS

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METHOD AND APPARATUS FOR CASTING
FLUID TRANSMISSION MEMBERS

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Application August 26, 1939, Serial No. 292,014

6 Claims. (Cl. 22-203)

This invention relates to method and apparatus for casting fluid transmission members and more particularly to the manufacture of vaned elements for use in fluid clutches or torque converters.

In the manufacture of vaned elements used in fluid torque transmissions it has been proposed to form the vanes separately by stamping, die-casting or the like, and to secure the vanes separately to preformed hubs or supporting structures. This process is tedious and expensive and is difficult to carry out so as to have all of the vanes located accurately.

It is one of the objects of the present invention to provide a method of casting vaned elements of this type. Preferably the vanes are preformed and the desired supporting structure is cast onto the vanes so as to secure them firmly in place.

Another object of the invention is to provide apparatus for use in carrying out the method so as to locate the vanes accurately.

Still another object of the invention is to provide a vaned fluid transmission member in which the vanes are securely held in place by cast metal engaging and adhering thereto.

The above and other objects, advantages and novel features of the invention will be apparent from the following description when read in connection with the accompanying drawings, in which:

Figure 1 is a partial section of a hydraulic clutch constructed according to the invention;

Figures 2 and 3 are partial sections illustrating steps in the manufacture of the clutch of Figure 1;

Figure 4 is a section of a vaned member for use in a hydraulic torque converter; and

Figures 5 and 6 are sectional views illustrating steps in the manufacture of the member of Figure 4.

The clutch of Figure 1 is shown connecting a driving shaft 10 with a driven shaft 12 and includes a casing 15 carrying a set of curved vanes 16, the unit being enclosed in a stationary housing 14. The casing 15 is formed of cast metal such as iron and engages and adheres to the convex edges of the vanes 16. As shown, the vanes 16 are formed with projections 18 imbedded in the cast casing 15 to anchor the vanes rigidly to the casing.

The inner concave edges of the vanes 16 are closed and connected by an annular sheet metal core member 20. The vanes are connected to the core member by means of spaced inwardly-projecting lugs 22 on the vanes projecting through

slots in the core member, the lugs and slots being so proportioned that the core member and vanes may have a limited amount of relative radial movement.

5 The hydraulic clutch includes a vaned driven member or rotor comprising a cast hub member 24 engaging and adhering to the convex edges of a series of vanes 26. The vanes 26 are shown provided with lugs 28 imbedded in the hub 24 and have their inner concave edges closed and connected by a sheet metal core member 30. The vanes and core member are connected by lugs 32 and slots as above described in connection with vanes 16. The hydraulic clutch is completed by a stamped casing member 34 secured to the casing 15 and sealing against the hub member 24. This casing member provides a liquid reservoir communicating with the vane circuit through an opening 36 in the hub 24 and at the same time closes the vane circuit against the escape of liquid. The hub 24 is keyed to a sleeve 38 surrounding the driven shaft and which carries a clutch disc 40. A clutch plate 42 keyed to the driven shaft 12 may be pressed into driving engagement with the clutch disc by a pressor ring 44 operated through any desired type of clutch mechanism not shown.

Figures 2 and 3 illustrate the method of making a vaned rotor, it being understood that the impeller may be made by a similar method. As shown in Figure 2, the vanes 26 are first connected to the core member 30 by snapping the lugs 32 through the slots in the core member. The assembly may then be pressed down into loose core sand indicated at 35 in a cavity in a block 37 until the core member 30 engages stops 39 in the cavity. The spaces between the vanes are then packed with core sand after which the sand is baked, 26, 30, 35 and 37 being placed in an air oven.

The assembly of vanes and the core member 30 with the core sand packed thereon, is then placed in a cavity in a mold 41 as indicated in Figure 3. It will be noted that this mold provides a space 43 adjacent the convex edges of the vanes shaped substantially as the hub member 24. This cavity is then poured full of molten metal such as iron, which is allowed to cool with the lugs 28 imbedded therein so that the vanes are firmly secured to the cast metal. After cooling, the parts are removed from the mold and any desired machining or finishing operations are performed thereon to complete the hub 24.

In originally connecting the vanes 26 to the core member 30 the vanes are pulled to their radially

outward position as shown in Figure 2 with the clearance between the vanes and core member at the outer side of the core member. When the hub 24 is cast any shrinkage of the cast metal tends to pull the vanes radially inward, this motion being permitted due to the provision of clearance between the vanes and core member. When the metal has finally cooled the vanes will be pulled into the point where the clearance between them and the core member is at the inner edge of the core member, as seen in Figure 1.

Figure 4 illustrates a vaned rotor member for a hydraulic torque converter of the type more particularly described and claimed in my copending application Serial No. 57,520 filed January 4, 1936. This rotor comprises an outer set of vanes 45 and an inner set of vanes 47 connected by a core member 46. The vanes 47 are supported by a hub member 48 and the two sets of vanes are spaced apart to receive a set of stator vanes between them.

In making this rotor member the vanes 47 are first secured to a ring member 50 by means of screws 52 fitting through enlarged holes in the ring and screwed into the outer edges of the vanes. The vanes are also provided with guide pins 54 fitting into radial slots in the ring 50 to hold the vanes against turning. When the vanes are assembled on the ring 50 the assembly is placed in a fixture as shown in Figure 6, and which comprises a base portion 56 having a cavity to receive the ring 50 and the lower half of the vanes. The upper half of the vanes is inclosed by a head member 58 and a ring 60 so as to leave exposed only the outer concave edges of the vanes. The spaces between the vanes are then packed with core sand leaving the vane edges exposed and the core sand is baked. The assembly of vanes and ring member is then removed from the fixture and placed in a mold 62, as shown in Figure 5, to leave a cavity 64 adjacent the inner convex edges of the vanes corresponding in shape to the hub 48.

The vanes 45 are provided initially with radially projecting lugs 66 formed with tapered upper edges. These lugs are clamped in a two-part supporting fixture having a lower part 68 receiving the lower portions of the lugs 66 and an upper ring 70 secured to the part 68 by screws 72 and clamping against the lugs 68. This fixture secures the vanes 45 firmly in place. Due to the fact that the upper edges of the lugs are tapered or sharpened and engage the plane surface of the upper ring, the stress will be highly concentrated at the points of engagement, so that either the ring or the lugs may be deformed slightly to accommodate any irregularity in the exact dimensions of the lugs to provide a substantially uniform gripping action.

After the vanes 45 have been properly secured to the fixture the spaces between them are packed with core sand and baked. The fixture with the vanes assembled thereon is placed in the mold 62 so as to leave an annular cavity 74 exposed to the concave edges of both sets of vanes 45 and 47 and corresponding in shape to the core member 46.

Figure 5 also illustrates two alternative methods of anchoring the cast metal to the vanes, which may be used in place of the lugs on the vanes as illustrated in Figures 1 to 3. As shown, screws 76 are provided in the vanes 45 projecting into the cavity 74 so as to be surrounded by the cast metal. The vanes 47 are shown formed in their edges with cavities 78 to receive cast metal

thereby anchoring the vanes to the castings. It will be understood that any of these methods may be employed alternatively.

With both sets of vanes and their accompanying fixtures in place in the mold as shown in Figure 5, the mold is ready for pouring. It will be noted the separate sprues 80 and 82 are provided for the cavities 64 and 74 respectively. Risers 84 may also be provided if desired. According to one important feature of the invention, molten metal is first poured through the sprue 80 into the cavity 64 and is thereafter poured through the sprue 82 into the cavity 74. Due to this sequence of pouring shrinkage of metal cast into the cavity 64 tends to draw the vanes 47 radially inwardly. This shrinkage occurs before the shrinkage of metal poured into the cavity 74 so that as the latter metal shrinks its action will tend to press the vanes 47 firmly into contact with the previously cast metal thereby insuring tight engagement with the vanes 47. It will be noted that motion of the vanes during shrinkage is permitted due to the loose fit of the screws 52 and pins 54 in the corresponding openings in ring 50 and due to the fact that lugs 66 will slip radially in the fixture 68 without causing angular displacement of the vanes.

After the metal is cooled it is removed from the mold and finished by any desired machining operations. As shown in Figure 4, the parts illustrated in dotted lines are preferably removed by machining operations to provide finished surfaces where necessary and to remove excess metal.

While several embodiments of the invention have been shown and described in detail it will be understood they are for the purpose of illustration only and are not to be taken as a definition of the limits of the invention reference being had for this purpose to the appended claims.

What is claimed is:

1. The method of casting double vaned fluid transmission members which comprises securing sets of vanes to two annular supporting members of different diameters, packing the spaces between the vanes of each set with sand, placing the sets of vanes and the supporting members in a mold providing a cavity exposed to edge portions of both sets of vanes and a second cavity exposed to the radial inner edge of the inner set of vanes, and pouring molten metal into both of said cavities.

2. The method of casting double vaned fluid transmission members which comprises securing sets of vanes to two annular supporting members of different diameters, packing the spaces between the vanes of each set with sand, placing the sets of vanes and the supporting members in a mold providing a cavity exposed to edge portions of both sets of vanes and a second cavity exposed to the radial inner edge of the inner set of vanes, pouring molten metal into said last named cavity and thereafter pouring molten metal into the first named cavity.

3. The method of casting double vaned fluid transmission members which comprises loosely securing sets of vanes to two annular supporting members of different diameters, so as to permit radial movement of the vanes relative to the supporting members, packing the spaces between the vanes of each set with sand, placing the sets of vanes and the supporting members in a mold providing a cavity exposed to edge portions of both sets of vanes and a second cavity exposed to the radial inner edge of the inner set of vanes,

pouring molten metal into said last named cavity, and thereafter pouring molten metal into the first named cavity so that shrinkage of the metal will hold the vanes tightly.

4. In apparatus for casting fluid transmission members including a series of curved vanes, an annular supporting ring formed with a series of openings therethrough and with a series of openings in one surface thereof, fastening means extending through the first series of openings and connected to the vanes to hold them on the supporting ring, and guide pins carried by the vanes and extending into the second series of openings to hold the vanes in alinement on the ring.

5. The method of casting a vaned element for a hydrodynamic power transmitter of the type having a closed toroidal passage formed by curved vanes, comprising securing the edges of a series of vane members having concave and convex inner and outer edges in annular array to an annular supporting member of less diameter than the vane annulus by fastenings extending at an angle to the plane of the supporting member, and so constructed and arranged that the vanes can move radially of the supporting member, packing the spaces between the vanes with sand while leaving exposed a portion of the vane edges op-

posite the edges which are attached to the supporting member, placing the packed vanes and the supporting member in a mold cavity, pouring molten metal in the cavity and against the exposed edges of the vanes, and allowing the molten metal to set, the vanes moving radially relative to the supporting member to follow shrinkage of the metal during setting.

6. In apparatus for casting fluid transmission members including an annular series of vanes, the combination of radially projecting lugs secured to the vanes and projecting radially therefrom and each being tapered to a sharp end at one of its ends lying in a plane perpendicular to the plane of the annular series of vanes, a two-part annular supporting member having plane facing surfaces engaging opposite ends of the lugs to hold the lugs and vanes in position while permitting radial movement thereof, and means for drawing the two parts of the supporting member together against the ends of the lugs, one of the plane surfaces engaging the sharpened ends of the lugs to concentrate the stress therebetween so that the material may be deformed to grip the several lugs substantially uniformly between the supporting members.

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