

[54] **MOTOR-DRIVEN PEDESTAL-MOUNTED PUMP ASSEMBLY AND METHOD FOR MANUFACTURING THE SAME**

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[58] Field of Search.....415/200, 201, 219, 131, 132; 417/359, 323, 68, 67; 308/244

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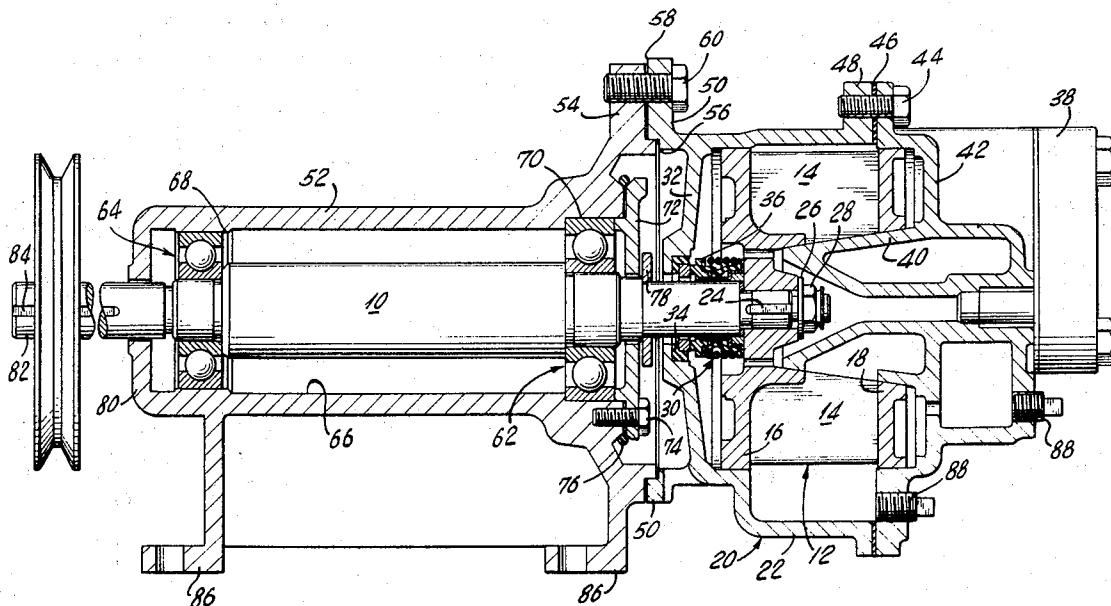
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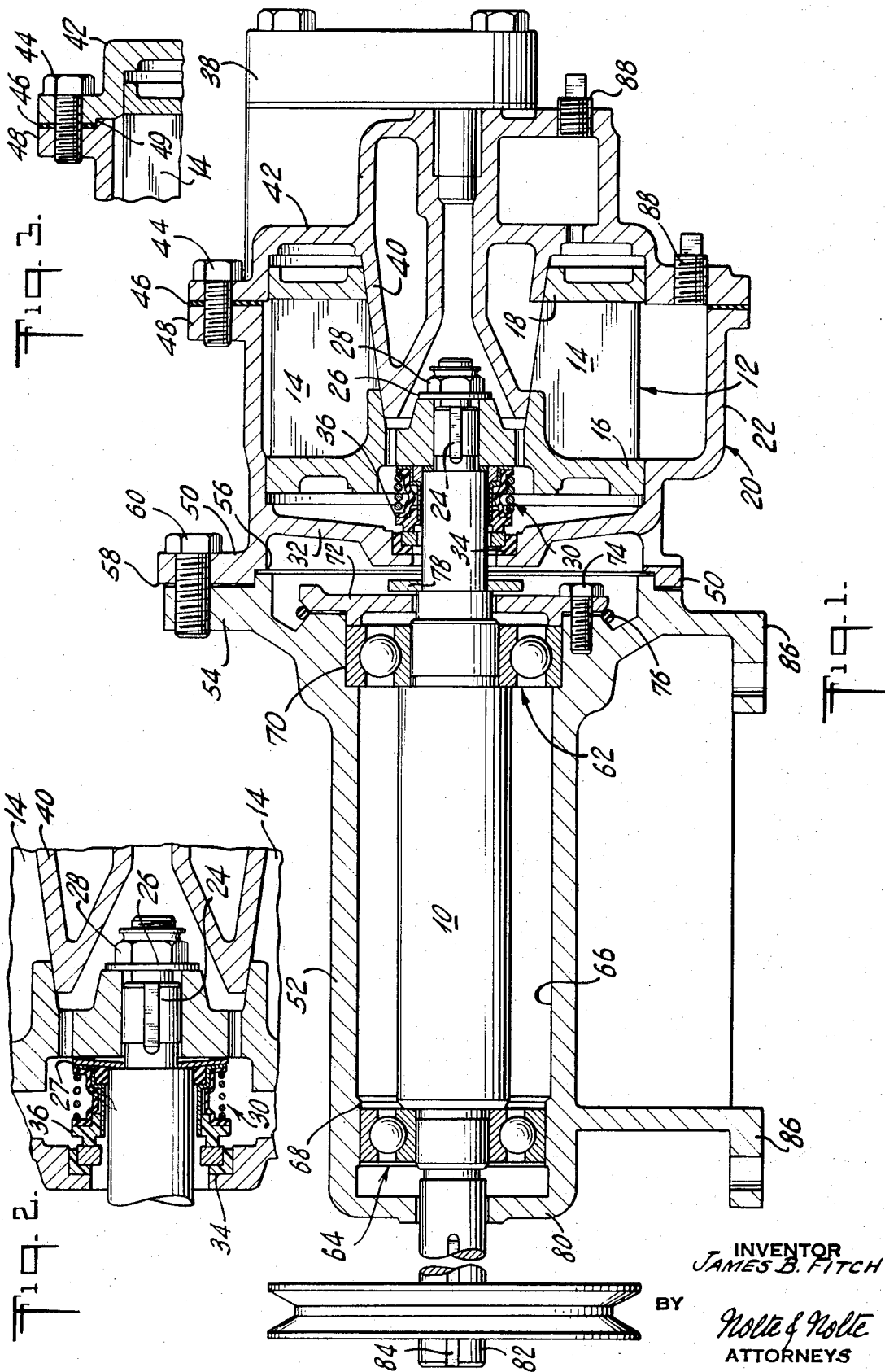
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[57] **ABSTRACT**

A motor driven pedestal pump assembly and a method for manufacturing same are disclosed. The assembly has a housing which may include one or two members. The housing supports the bearings and the elongated drive shaft and houses the pump rotor of the pump assembly. One of the housing members, which may be the sole member, has a bearing bore at one end and a mounting face at the other end. This housing member is hollow and is constructed so that the mounting face and the bearing bore can be machined from one end during a single set up.

10 Claims, 6 Drawing Figures

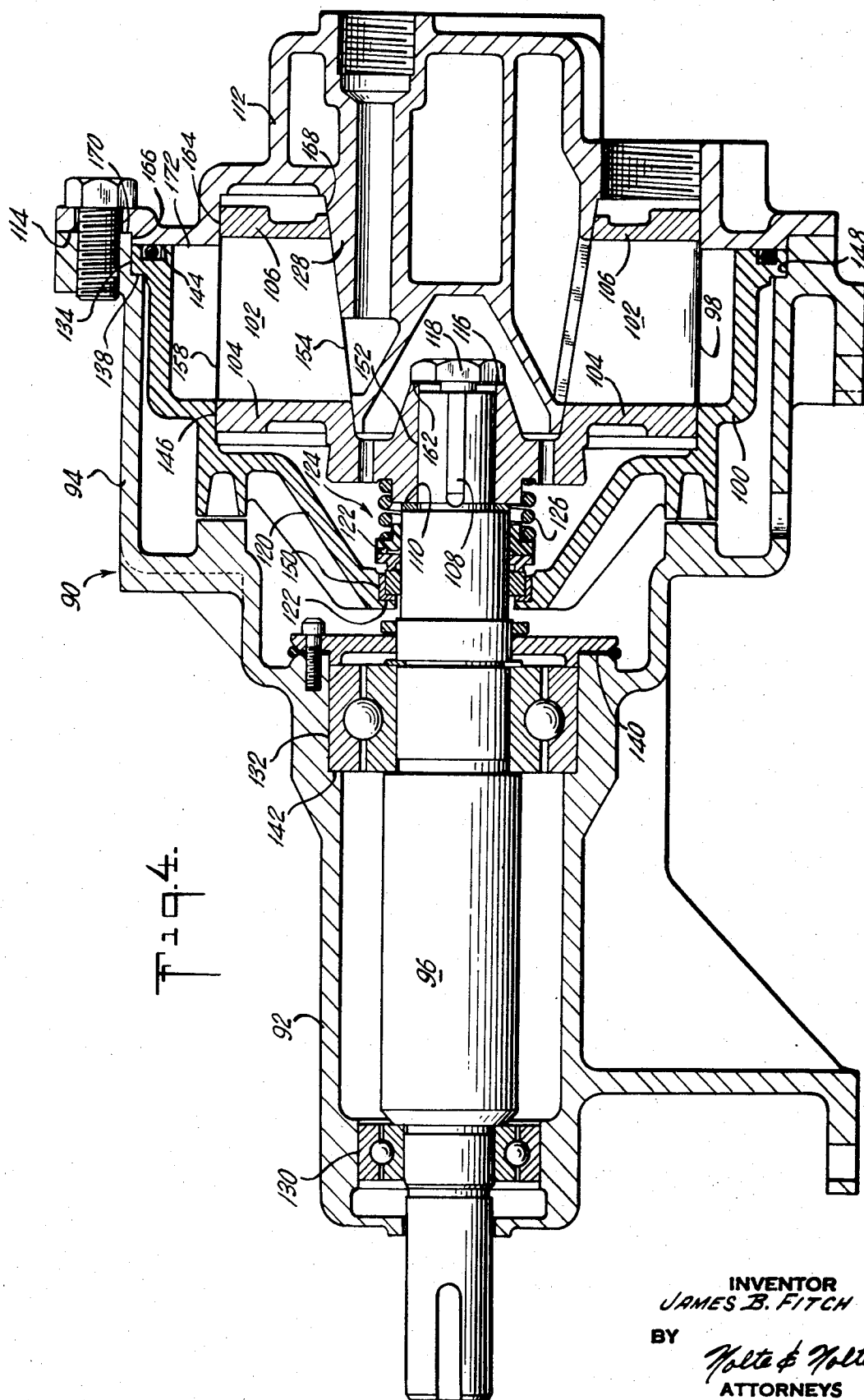




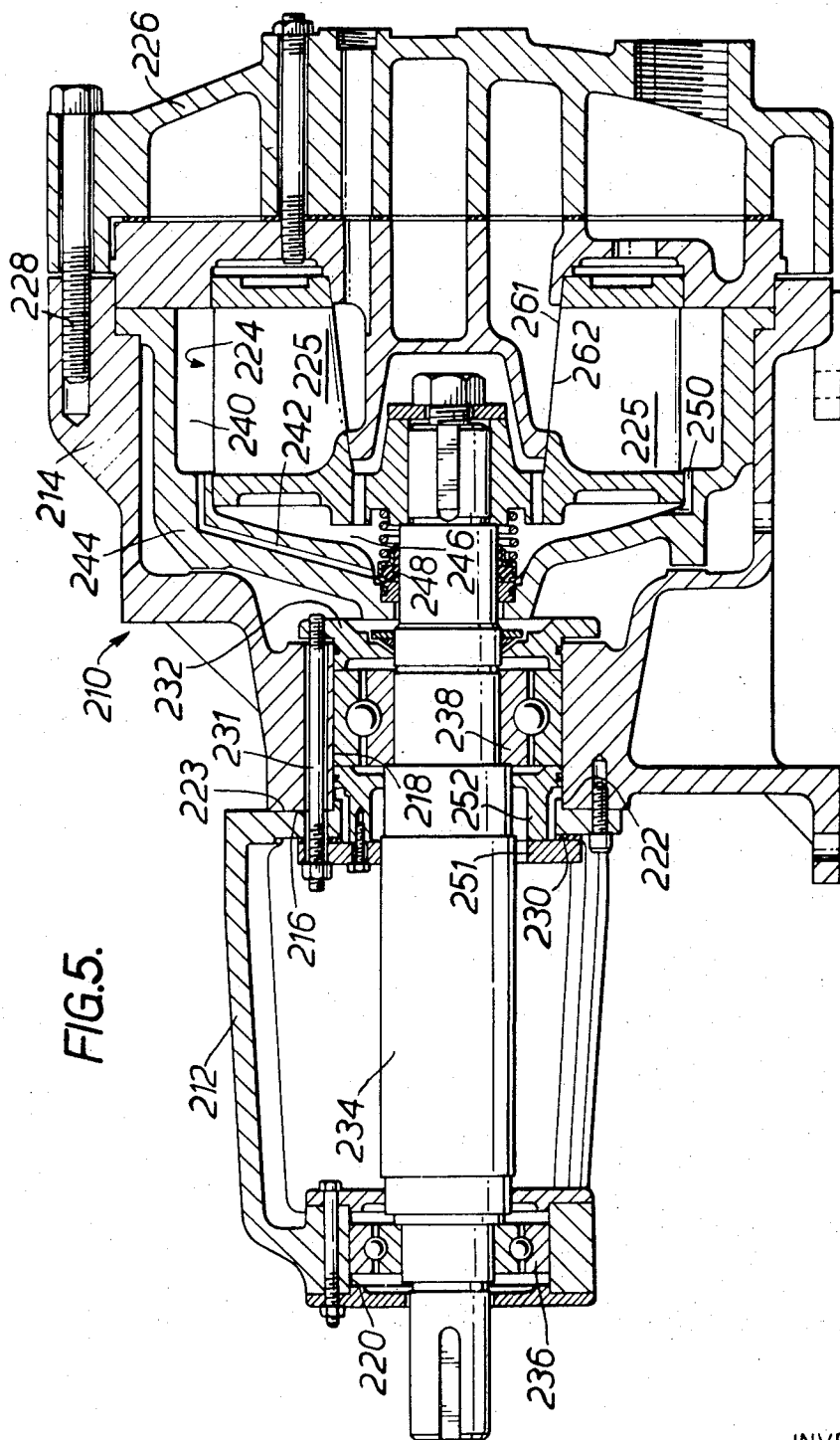
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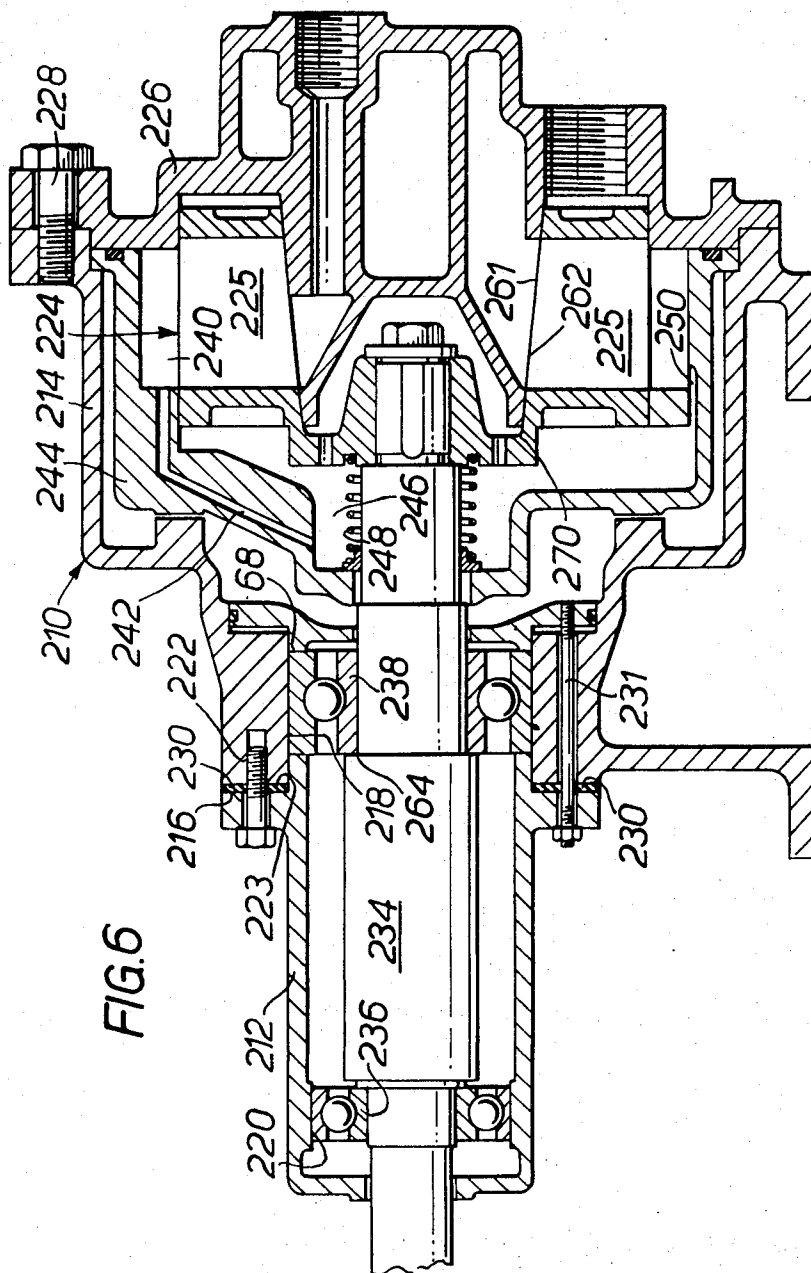


FIG. 6

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MOTOR-DRIVEN PEDESTAL-MOUNTED PUMP ASSEMBLY AND METHOD FOR MANUFACTURING THE SAME

This is a consolidation continuation application of a divided out portion of copending application Ser. No. 823,434, filed on May 9, 1969 and copending application Ser. No. 7,647 filed on Feb. 2, 1970 for a Motor-Driven Pedestal-Mounted Pump Assembly and Method for Manufacturing same, which in turn was a consolidation continuation of applications Ser. Nos. 744,347 and 768,254, filed respectively on July 12, 1968 and Oct. 17, 1968, and now abandoned.

While considerable advantages are indeed achieved by a separation of the pump and motor, there are also encountered with such a construction problems in connection with the transmission of the drive from the motor to the pump. It is necessary to support the drive shaft of the pump for rotary movement at a location where a suitable belt drive or the like can be transmitted from the motor to the drive shaft with the pump connected to the drive shaft to be driven thereby, and such arrangements require special mountings for the drive shaft itself and a connection between the pump and such a special mounting. At the present time the various units such as the one or more parts on which the drive shaft and the pump components are mounted are separately machined in a manner which will result, even if the machined surfaces are maintained within certain tolerances, in tolerance buildup in the sense that a tolerance at one component adds to the tolerance at another component so that the total tolerance becomes undesirably great. As a result, the efficiency with which a given assembly will operate and the length of time during which it enjoys a trouble-free operation depends to a very great extent on the skill with which the parts are assembled.

It is accordingly a primary object of the present invention to provide a construction of the above general type which will avoid the above drawbacks.

A more particular object of the present invention is to provide a construction of the above general type and method of manufacturing the same which will avoid tolerance buildup.

In particular, it is an object of the invention to provide a construction where reliance need not be made on the skill of the assembler in order to achieve a highly efficient assembly which will have a long life of trouble-free operation.

Furthermore, it is an object of the present invention to provide a construction capable of being adjusted whenever required to bring about the best possible operation.

It is a further object of the present invention to provide a bearing housing in which the axial position of the shaft is adjustable therein as required. This particular arrangement avoids the disassembly of the pump to make adjustments of the shaft.

The above and further objects and advantages are achieved by designing a housing for the pump and attached elongated drive shaft, which whether in one part or in two parts, will have all bearing bores and alignment faces machined during a single set up from one end of each of the parts.

The invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. 1 shows a circular lobe pump together with a drive shaft and pedestal body therefor, all in a longitudinal sectional elevation which is taken in a vertical plane which contains the axis of the drive shaft;

FIG. 2 is a fragmentary view, partly in section and partly in elevation of the rotor hub section of an alternate construction;

FIG. 3 is a fragmentary sectional view of an alternate detail of construction; and

FIG. 4 is a cross-sectional view of a second embodiment of the present invention showing a circular lobe pump together with an integral pedestal and pump body;

FIG. 5 is a sectional view of a third embodiment of the present invention showing a circular lobe pump with a split pedestal; and

FIG. 6 is a sectional view of an alternate construction of the third preferred embodiment.

The first embodiment illustrated in FIGS. 1, 2 and 3 includes an elongated drive shaft 10 which is fixed at its right end, as viewed in the drawing, to a pump rotor 12. As is well known this rotor 12 includes vanes 14 extending between and fixed to the end shroud rings 16 and 18. The spaces between the rotor vanes 14 at their inner ends, which are adjacent to the shaft axis, form the inlets and outlets for gas during suction and compression thereof as the liquid ring is circulated into and then radially inwardly from lobe 22. Shroud ring 16 is fixed directly to the right end (as shown in FIG. 1) of the shaft 10 for rotary movement therewith as by way of a key 24 which extends into aligned registering keyways of the hub of shroud ring 16 and the shaft 10. A lock washer 26 and a lock nut 28 maintain the rotor 12 at a predetermined axial position along the shaft 10. The inner surface portions of the shroud rings 16 and 18 form portions of a cone whose axes coincides with the axis of the shaft 10.

The pump housing 20 surrounds the rotor 12 in the manner shown in the drawing, and this pump housing 20 has a rear end wall 32 surrounding but spaced from the shaft 10 and carrying a stationary part 34 of the shaft seal with spring means 30, the rotary part 36 thereof being axially expandable and contractable and having a sliding surface of engagement with the stationary portion 34 of the shaft seal means, so that the spring means 30 urges the rotor 12 and the end wall 32 apart from each other.

Located between the hub of rotor 12 and a shoulder of shaft 10 is a shim 25 of the proper dimensions in order to position the rotor 12 in the pump housing 20. Another construction for positioning the rotor 12 in the pump housing 20 is seen in FIG. 2 in which a Belleville type of spring 27 is shown between the hub of the rotor 12 and a shoulder of shaft 10. As illustrated in FIG. 2, the nut 28 may be rotated in the proper direction to axially position the rotor hub with respect to the shaft shoulder and, therefore, position the rotor taper with respect to cone taper of the stationary pump cone body 40.

At its right end, as viewed in the drawing, the pump head 42 is provided with an assembly 38 which forms the inlets and outlet for the pump in a known manner which does not form part of the present invention and is, therefore, not further illustrated and described. The pump head also has an inwardly directed tubular por-

tion 40 forming at its exterior a close fitting to the cone surface as that generated by the inner tapered surfaces of the shroud rings 16 and 18 and blades 14, so that there is a precise fit between the stationary pump cone body 40 and the rotary cone structure formed by the hubs of the shroud rings 16 and 18. The cone body 40 forms part of a head portion 42 which is fixed, as by a plurality of bolts 44 with the interposition of a suitable gasket 46, to the right flange 48 of that part of the housing 20 which is fixed at its left end 50 to an elongated hollow pedestal body 52 of the present invention.

This elongated pedestal body 52 is machined perpendicular to its shaft at its right flanged end 54, so as to be provided, in conjunction with the end 50 of the pump housing, with a single circular rabbeted joint 56 which very precisely surrounds the axis of the shaft 10.

While it is possible to adjust the axial position of the rotor 12 with respect to the head-cone assembly 40, 42 by way of the adjustable lock-nut assembly 26, 28, it is also possible to make additional adjustments at the very same part of the structure by inserting suitable shims between the end 50 of the pump housing 20 and the flanged end 54 of the pedestal body 52 at the gap 58 indicated in the drawing. The pedestal body 52 and pump housing 20 are maintained releasably connected to each other by way of a plurality of bolts 60 threaded into tapped bores which pass through the flanged end 54 of the pedestal body 52 and passing through registering openings formed in the flanged end 50 of the pump housing 20.

Outwardly beyond the end wall 32 of the pump housing 20, the shaft 10 is supported for rotary movement by an inner ball bearing 62 and an outer ball bearing 64. Between these bearings the elongated, tubular, hollow, substantially rigid pedestal body 52 is formed with an interior cylindrical or irregular surface 66 which surrounds and is spaced from the shaft 10, and it will be noted that the seat 68 for the bearing 64 is formed on an inwardly directed annular projection of the pedestal body 52 and has a diameter somewhat smaller than the diameter of the inner surface portion 66, while the inner bearing 62 is carried by a seat 70 whose diameter is somewhat greater than that of the surface 66 and thus greater than that of the seat 68, and in fact it will be noted that the bearing 62 is larger than the bearing 64. Furthermore, it will be noted that the right machined end surface of the end flange 54 of body 52, where the rabbeted joint 56 is located, has a diameter even greater than that of the seat 70.

Between the inner bearing 62 and the end wall 32 of the pump housing 20 is a closure cap 72 maintained in position by bolts 74 and surrounded at its region which adjoins the pedestal body 52 by an O-ring 76. Furthermore, a slinger 78 is situated on the shaft 10 between the cap 72 and the end wall 32 of the pump housing.

The shaft 10 extends outwardly to the left, through an opening in the end wall 80 of the pedestal body 52, beyond the latter where the shaft 10 terminates in an end portion 82 formed with an elongated keyway 84 by means of which this part of the shaft can be fixed to a pulley driven by a belt which is in turn driven by a motor. The pulley, belt and motor are not illustrated. The pump shaft may also be directly coupled to an axial in-line motor shaft (not shown).

it is to be noted that, with the structure of the invention, because the bearing seat 70 is at least as great as, and in fact larger than, and coaxial with the bearing seat 68, while the rabbet joint 56 is in turn of a diameter greater than, while being coaxial with, the bearing seat 70, all of these surfaces can be machined from one and the same end of the pedestal body 52, namely the right end thereof, as viewed in the drawing. As a result of this feature it is possible, without disturbing the position of the pedestal body 52 on the machine tool during the machining of the bearing seats and rabbet joint, to machine all of the surfaces so that they have the greatest possible precision both with respect to the accuracy with which they surround the axis of the shaft as well as with respect to the perpendicular positioning of flat surfaces of the rabbet joint, for example, with respect to the axis of the shaft 10. Furthermore, without disturbing the machine setup of the pedestal 52 it is possible to fasten pump housing 20 and to proceed with the machining of the housing 20 at the surfaces at the joint between which the gasket 46 is located. It should be noted that even if the pump housing is not machined with the pedestal the significant machining operations of the pump parts are accomplished by one set-up each of the shaft, lobe, head and rotor.

The pedestal body is provided with feet 86 by which it can be mounted on a suitable support. Also, various features, such as drain plugs 88, are not further described in detail since they form no part of the invention.

FIG. 3 illustrates an alternate construction of the mounting of the right flange 48 of the housing 20 to the head 42 by means of a rabbet joint 49 therebetween. This construction additionally permits an assembly of the pump which is not dependent upon the skill of the assemblers.

A second embodiment of the present invention is illustrated in FIG. 4 in which an integral pedestal and pump body is referred to generally by the numeral 90 while the pedestal portion thereof is referred to by the numeral 92 and the pump housing portion thereof is referred to by the numeral 94. A drive shaft 96 is shown which is fixed at its right end in the drawing to a pump rotor 98. As seen in FIG. 4, the left is hand end of the shaft 96 is in the pedestal 92 in a well-known manner while the right hand end of the shaft 96 together with the attached rotor 98 is mounted in the pump housing 94. A lobe insert 100 is positioned within the pump housing 94 and surrounds the rotor 98.

It should be noted that a lobe insert 100, as shown, is fabricated of a material that is different from the material forming the integral pedestal pump housing. In addition, the lobe insert 100 provides a double wall construction for the integral pedestal pump housing which is effective in noise reduction. However, it should be understood that it is within the teachings of the present invention that the pedestal pump housing may be constructed without a lobe insert; also that the lobe insert does not add a joint between the pedestal and the pump head.

The rotor includes radial vanes 102 extending between and fixed to end shroud rings 104 and 106 in the well known manner. It should also be noted that the spaces between the rotor vanes 102 at the inner ends which are adjacent to the axes of the shaft 96 form both

the inlets and outlets for gas during suction and compression thereof as the liquid ring is circulated within the lobe 100 and moves radially outwardly into and then radially inward therefrom. The shroud ring 104 is fixed directly to the right end of the shaft 96 for rotary movement therewith by means of a key 108. The key 108 extends into aligned registering keyways of the hub of the shroud ring 104 and the shaft 96.

The shim 110 may be inserted in the device to adjust the rotor 98 axially with respect to the shaft 96, integral pedestal body 90 and especially head cone 112 thereof. An alternate adjusting method may take the form of the use of a shim not shown located in abutting relationship with the face 114.

As seen in FIG. 4 the lock washer 116 and lock nut 118 maintain rotor 98 at a predetermined axial position along the shaft 96. It should further be noted that the inner surface portions of the shroud ring 104 and 106 meet with the portions of the cone 120 of the head 112 adjacent thereto. The lobe 100 surrounds the rotor 98 as illustrated in the drawing and this lobe 100 has a rear end wall 120 which surrounds but is spaced from the shaft 96 and carries a stationary part 122 of the spring means 124. The rotary part 126 of the spring means is actually expandable and contactible and has a sliding surface of engagement with the stationary portion 122 of the spring means whereby the spring means urges the rotor 98 and the end wall 120 apart from each other. It is to be further noted that both the spring means 124 and rotary part 126 form a mechanical shaft seal at its right end. As seen in the drawing, the housing 94 has attached thereto a head 112 which forms the inlet and outlet of the pump, in a well known manner. The structure of the head 112 will be described more particularly hereinafter. The head 112 is provided with an inwardly directed tubular portion 128 having a conical exterior surface part which corresponds in shape to the inner tapered surfaces of the shroud rings 104 and 106 and radial vanes 102 whereby, these two mating surfaces are complimentary and form a precise fit between the stationary pump cone body 128 and the rotary cone structure formed by the hubs of the shroud rings 104 and 106 and radial vanes 102. Surrounding the lobe 100 is the integral pedestal bracket and pump housing 90 in the form of an elongated hollow body having bore diameters 130, 132 and 134 which are concentric and square with faces 114 and 138 thereof as well as with bearing cap mounting face 140 and bearing shoulder face 142. It should be noted that said diameters and faces are all machined at the same setup. In addition, the length from 114 to 142 is accomplished by direct dimensioning at the same setup. It will also be noted that the internal machined diameters of the bore of the pedestal bracket and pump housing 90 are progressively smaller from the open end to the closed portion thereof.

The lobe 100 is inserted within the pedestal bracket and pump housing 90 and is provided with a face 144 which is square with concentric diameters 146 and 148 and 150 respectively, as the lobe is similarly designed to be machined from one end at the same setup.

The rotor 102 fits within the lobe 100 and has the bores 152 and 154 and the outside diameter 158 of the rotor 102 located concentric and square with the faces 110 and 162 as the rotor is similarly designed to be machined from one end at the same setup.

The head 112 is conical in shape and has diameters 164, 166 as well as taper diameter 168 which are concentric and square with faces 170 and 172 as the head is similarly designed to be machined from one end and at the same setup.

It should be noted that all the foregoing diameters are precisely made possible since they are all machined from one and the same setup, and from the open end of the integral pedestal and pump body. Consequently, there is a minimum of tolerance buildup with respect to dimensions, concentricity and squareness. In addition, the rabbeted construction with one joint permits the rotor to be centered easily and accurately without depending upon the skill of the assembler.

A third preferred embodiment is illustrated in FIG. 5, wherein a double lobe compressor is shown. The present construction comprises a pedestal for the pump which is referred to generally by the numeral 210. The pedestal is constructed in two structural parts, 212 and 214 respectively. The aforementioned two-part construction is necessary as a practical matter of the manufacture of large pump units.

Each of the structural parts 212 and 214 of the pedestal 210 are so constructed that all alignment surfaces of each part are machined in one set-up in a machining fixture. In this connection, it should be noted that accurate assembly of the parts 212 and 214 is ensured by back-facing part 214 on surface 216, and by machining the bearing bore on surface 218. Thus, no extra diameter is involved in the foregoing operation.

The pedestal part 212 is the bracket and is machined in one set-up from the front end forming bearing bore 220, rabbet diameter 222 and mounting face 223 which are of extreme importance to the true alignment of bearing bore 220. The bearing bore 220, rabbet diameter 222 and mounting face 223 are thus all machined in one and the same set-up.

As seen in FIG. 5 of the drawings, a rotor 224 is located within the structural part 214 of the pedestal 210 and is provided with rotor vanes 225. A head 226 is secured to the forward end of the structural part 214 by means of threaded bolts 228 (only one shown in the drawing).

A shim 230 is positioned between the structural part 212 of the pedestal bracket and part of the bearing cap assembly 251. The selective use of shim 230 permits the external axial positioning of the rotor 224 by means of positioning bearing cap assembly 251, 252 and 232, bearing 238 and shaft 234, thereby adjusting the rotor travel and the internal running clearance at the cone such as rotor bore 262 and a stationary port member in the cone outer surface 261. Accordingly, the rotor can be moved axially without requiring the disassembly of the pump.

A motor (not shown) drives the pump through a shaft 234 supported in bearings 236 and 238.

The foregoing construction permits the accurate alignment of the bearing bores with the mounting face for stationary parts of the pump.

FIG. 6 is an alternate construction of the pump assembly of FIG. 5 in which like parts bear the same reference numerals. The construction shown therein is an alternate two-part pedestal construction in which the shim 230 is located between surface 216 of the pedestal part 212 and the mounting face 223 of the

structural part 214. When the shim 230 is changed the surfaces 264, 266, 268 of the bearing 238 and surface 270 of the rotor 224 all move axially in identical increments.

What is claimed is:

1. In a motor driven pump assembly, an elongated drive shaft, a pump rotor affixed to said shaft at one end thereof, a pump housing in the region of said one end thereof, an inner bearing supporting said shaft for rotary movement and located adjacent to said pump housing, an outer bearing also supporting said shaft for rotary movement and located at a substantial distance from said inner bearing along said shaft at said side of said inner bearing remote from said pump housing, and an elongated hollow pedestal body being provided with bores carrying said inner and outer bearings respectively therein and having one end of said pedestal body affixed to said pump housing, said hollow pedestal body having in its interior a pair of coaxial bearing seats on which said inner and outer bearings are respectively mounted, wherein the diameter of the bearing bore for the outer bearing is less than the diameter of the bearing bore for the inner bearing, and the end of said pedestal body remote from and beyond said outer bearing is provided with an opening through which said drive shaft extends, said pedestal body terminating at its end which is fixed to said pump housing in an outer flange formed with a single rabbeted joint of substantially annular configuration having a radius substantially greater than said seats of said inner bearing, and forming a connection with said pump housing which is concentric with the axis of said shaft, said bore of said pedestal body, a diameter of said inner bearing bore, a diameter of said outer bearing bore and a diameter of said rabbeted joint lying in planes parallel to the plane in which said flange lies, said flange including said single rabbeted joint and said bearing seats for said inner and outer bearings of the drive shaft being made simultaneously from said one end of said assembly in order to insure the precise alignment of said pump housing with the axis of rotation of said pump assembly.

2. The motor driven pump assembly according to claim 1, wherein said pedestal member further includes a second mounting face for said second bearing and a shoulder face for said second bearing, said second mounting face and said shoulder face lying in planes parallel to the plane in which said first mounting face lies, said bores and faces being machined during a single set up from said other end of said pedestal member.

3. The motor driven pump assembly according to claim 1, wherein said pump housing includes a coaxial shroud bore in which one of said rotor shrouds rotates and a head mounting face, a diameter of said shroud bore lying in a plane parallel to the plane in which said head mounting face lies, said shroud bore being machined during the same set up during which said head mounting face is machined.

4. The motor driven pump assembly according to claim 1 wherein the pump housing and rotor form a rotary pump with said rotor having a pair of end shroud rings formed with concentric central openings extending along and forming part of a cone whose axis coincides with that of said drive shaft, said housing having a coaxial tapered portion also forming part of the same cone and extending into and surrounded by said shroud

rings, said housing having an end wall situated between said rotor and pedestal body and surrounding and located closely adjacent to but spaced from said shaft.

5. The motor driven pump assembly according to claim 3, wherein said pump head is provided with a conical surface, said drive shaft is provided with a shoulder and said rotor is provided with a hub portion, further comprising a spring positioned between said rotor hub and drive shaft shoulder for yieldably adjusting said rotor axially with respect to said conical surface of said pump head by rotating and then locking the screw adjustment.

6. A motor driven pump assembly for mounting a pump having an elongated drive shaft, said assembly comprising a first part including a portion of a pedestal and second part including the remaining portion of said pedestal and a pump housing, said first part including a bearing seating surface at one end thereof and a mounting face at the other end thereof, said second part including a bearing seating surface and a pedestal mounting face at one end thereof and a second mounting face at the other end thereof, said first part mounting face lying in a plane parallel to a plane in which a diameter of said first part bearing surface lies and said second part pedestal mounting face lying in a plane parallel to planes in which a diameter of said second part bearing surface and said second mounting face lie, whereby when said first and second parts are interfitted there will be no tolerance buildup.

7. The motor driven pump assembly according to claim 6, wherein said first part further includes a coaxial rabbet diameter on said other end, said rabbet diameter lying in a plane parallel to the plane of said first part mounting face.

8. A motor driven pump assembly for mounting a pump having an elongated drive shaft, as claimed in claim 6 said pedestal including first and second bearing seating surfaces, said surfaces having substantially greater axial length than the bearing to be seated thereon, means for seating one of the bearings at a predetermined location on one of said seating surfaces and means for selectively changing said location.

9. The pedestal according to claim 8, wherein said means for selectively changing said location comprises shims having various widths.

10. A liquid ring pump assembly having an elongated drive shaft, a pump rotor affixed to an end of the drive shaft, housing means for housing said elongated drive shaft and said pump rotor a pump head mounted to said housing means, said rotor including an axial bore and said head including a port member extending into the bore and defining therewith running clearances to the closeness of which the pump efficiency is related, a pair of bearings carried by said housing means for rotatably supporting said elongated shaft, said housing means including a bearing bore at one end thereof for carrying one of said bearings and a substantially annular first mounting face at the other end thereof, said housing means further including a second bearing bore for the other of said bearings said second bearing bore including a shoulder face being disposed between the first bearing bore and said first mounting face, and a second mounting face for said second bearing, said housing means being hollow and having an inner diameter at least as large as the diameter of said first bearing bore,

said second bearing bore having a diameter at least as large as the diameter of said first bearing bore, and said first mounting face having an inner diameter at least as large as said second bearing bore diameter, said head including a mounting face cooperating with said first mounting face, said housing means further including a third coaxial bore having a diameter larger than said second bearing bore diameter, extending from said first mounting face towards said one end of said housing means to a third mounting face, and a lobe insert mounted to said housing means third mounting face, said lobe insert including a pump head mounting face

and an oppositely facing housing means mounting face at one end thereof and a coaxial shroud bore, said pump head mounting face and said housing means mounting face lying in planes parallel to the plane in which the diameter of said shroud bore lies, diameters of said first and second bores of said housing means lying in planes parallel to the planes in which the diameter of said first and second mounting faces lie and said bearing bores and mounting faces of said housing means being machinable during a single set-up from said other end of said housing means.

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