United States Patent [19]

Rule

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[54] **PUMP APPARATUS AND HOUSING THEREFOR**

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[52] **U.S. Cl.** **415/201,** 417/360, 417/411, 417/424

[51] **Int. Cl.**.....**F01d 1/02,** F04b 17/00, F04b 35/04

[58] **Field of Search** 415/200, 201; 417/360, 411

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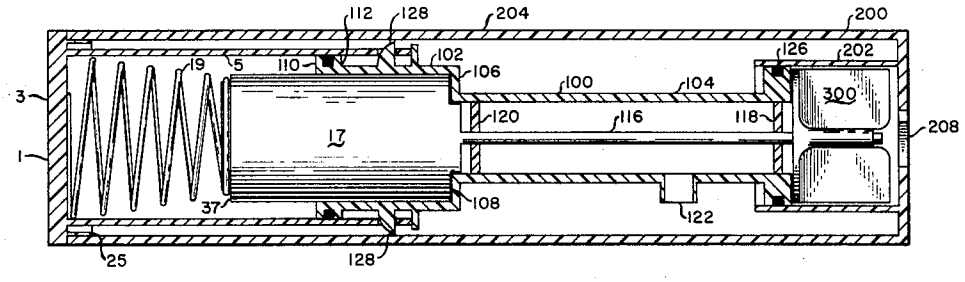
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[57] **ABSTRACT**

There is described an impeller pump assembly and particularly an impeller pump housing characterized by simple and rapid assembly and disassembly thereof.

13 Claims, 2 Drawing Figures



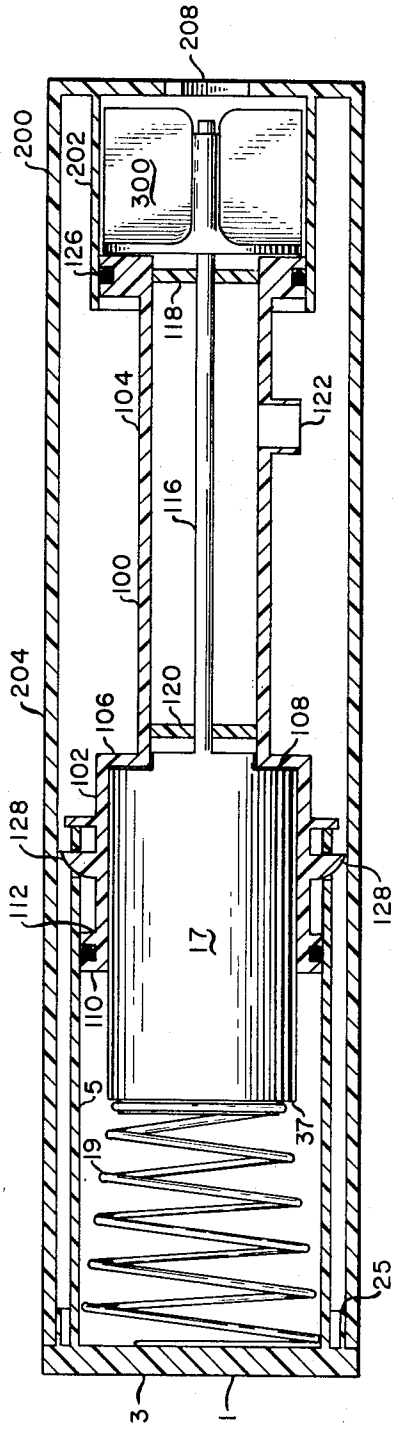
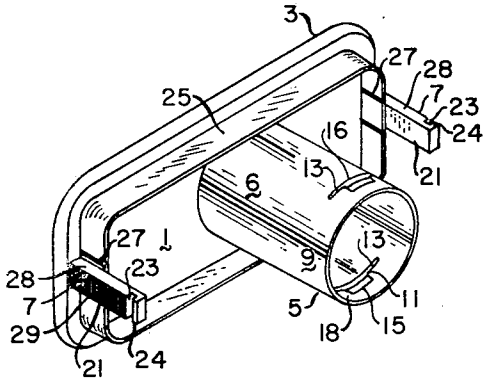
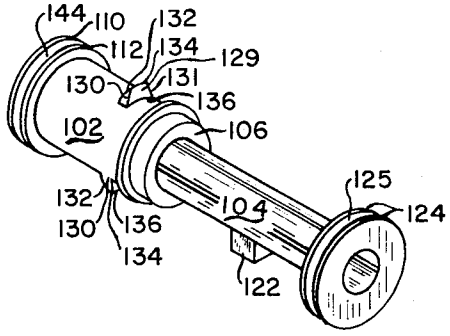

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FIG. 1


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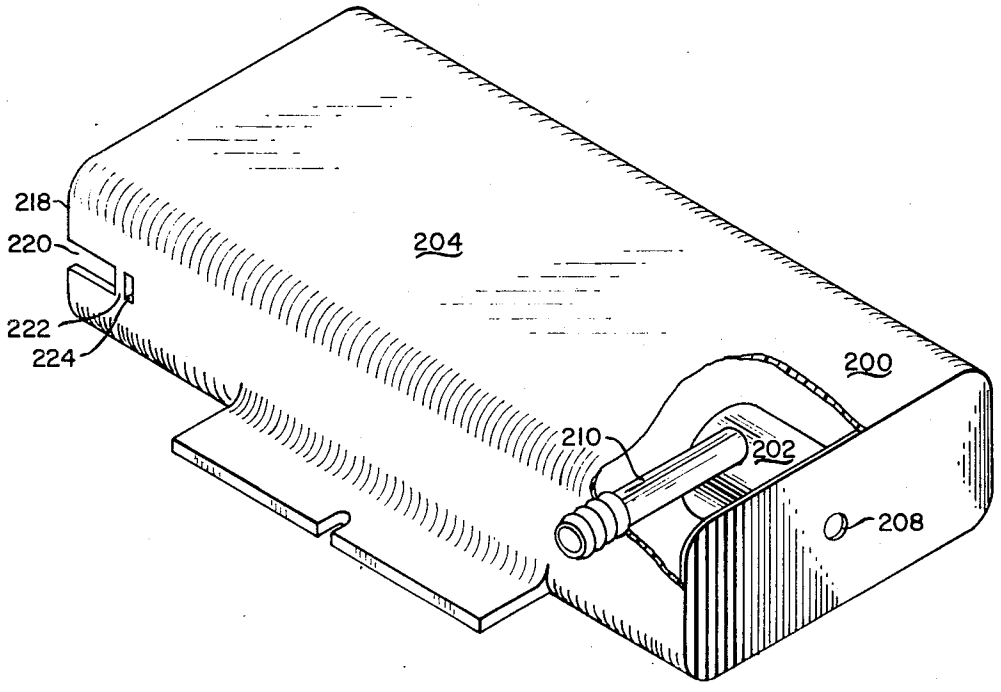

218
220
204
222
224
200
210
202
208

FIG. 2

PUMP APPARATUS AND HOUSING THEREFOR

OBJECTS OF THE INVENTION

It is a principal object of the invention to provide a novel impeller pump housing assembly.

It is another object of the invention to provide a novel impeller pump assembly which provides a prime feature of facile assembly and disassembly of the overall pump apparatus.

It is another object of the invention to provide a novel impeller pump assembly characterized by the feature of facile assembly and disassembly while retaining the desirable characteristic of security of assembly.

It is another object of the invention to provide a compact impeller pump.

Other objects and advantages of the present invention will in part be obvious and will in part appear hereinafter.

GENERAL DESCRIPTION OF THE INVENTION

The impeller pump assembly of the present invention generally comprises at least three sections:

1. a rear end wall comprising a forwardly extending rear casing and having associated therewith locking members which cooperate with an external pump enclosure and an internal front casing;

2. a front casing having associated therewith locking members which cooperate with locking members of said end wall; and

3. a pump housing constituting a general external enclosure for the pump apparatus and comprising a front partition, said partition having integral therewith a rearwardly extending impeller chamber, and said housing comprising locking means adapted to cooperate with the locking members of said rear end wall.

THE DRAWINGS

A better understanding of the assembly of the present invention and various preferred embodiments thereof can be had by reference to the drawings in which:

FIG. 1 is a longitudinal, partly sectional, schematic view of an assembled pump comprising one embodiment of the invention; and

FIG. 2 is a schematic, perspective, partly sectional, disassembled view of the three sections of the pump apparatus of FIG. 1 showing various features thereof in greater detail.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIGS. 1 and 2, wherein like numbers refer to like elements, rear end wall 1 comprises endplate 3 and tubular rear casing 5 extending forwardly from and perpendicularly to said endplate 3. Additionally, at least two inwardly depressible locking arms 7 extend forwardly from about the periphery of said endplate 3. In detail, rear casing 5 comprises a resilient tubular structure 6 which is outwardly biasable at the forwardmost section 9 thereof, and which forwardmost section 9 bears at least two circumferentially oriented step-shaped slots 11. Each of slots 11 comprises a relatively deeply slotted center section 15 and relatively shallow slotted sections 13 extending laterally from at least one and preferably both sides of said slotted center section 15. Each said slotted center section 15 and its associated coextensive lateral slotted section(s) 13 have a common and continuous rearmost edge 16. Said lateral slotted sections 13 are of considerable importance in that said sections 13 can normally provide substantially all of the outwardly biasable nature required of forwardmost section 9. The functions of these features will be discussed in more detail hereinafter.

In the assembled state, a portion of motor 17 resides within the confines of rear casing 5. Desirably, there is further provided a resilient thrusting means, such as spring 19, located within rear casing 5 and which thrusting means is supported at one end thereof against endplate 3, and at the other end against the rearward end 37 of motor 17. As will become more clear in the description hereinbelow, the presence of said biasing or thrusting means aids in the assembly of the pump mechanism and serves to improve the security of the linkages achieved between the interlocking members of rear casing 5 and forward casing 100.

Each locking arm 7 generally comprises a forwardly extending, inwardly depressible member 21 bearing thereon a substantially perimetrically oriented locking slot 23 located at the free end and on the outer aspect thereof. The forwardmost boundary of locking slot 23 is defined near the terminus of arm 21 by a laterally extending locking projection 24. In order to maximize the inwardly depressible character of arms 21, it is preferred that (a) end wall 1 comprise an integral flange 25 of substantial resiliency extending forwardly from the perimeter of endplate 3, and (b) said arms 21 be affixed to or integral with said flange 25. Further flexibility can be achieved by providing flange 25 with slot or slots 27 adjacent the sides 28 of members 21. Additionally, said slots 27 are substantially parallel with respect to the longitudinal axes of members 21. As mentioned previously, members 21 are intended to be manually depressible in an inward direction. Accordingly, it is normally desirable that the outermost aspect 29 of each member 21 be etched, grooved, checkered or otherwise treated so as to provide a slip-resistant surface thereto.

Forward casing 100 comprises a rear tubular member 102 and narrower forward tubular member 104. As shown clearly in FIG. 1, shoulder 106 formed at the junction of said tubular members 102 and 104 forms a convenient anchor point against which there butts front shoulder 108 of motor 17. Additionally, rear tubular member 102 is equipped with flanges 110 and 112 spaced from one another so as to form channel 114 therebetween. An O ring of suitable dimensions is positioned within said channel 114 and, in cooperation with interior wall 31 of casing 5, seals the motor casing.

An important feature of rear tubular member 102 resides in the provision thereon of locking studs 128, each stud extending from the outer surface of member 102 and positioned between flange 112 and shoulder 106. Each stud 128 comprises a front surface 129 which extends substantially perpendicularly from the surface of member 102. The rear surface 132 of each stud 128, however, is radiused or angled rearwardly from its apex 134 towards the surface of member 102.

In assembling the pump, spring 19 is placed in casing 5, the back 37 of motor 17 is placed against the free end of spring 19 and forward casing 100 is slipped over

motor shaft 116. Next, locking studs 128 are aligned with the slotted center sections 15 of slots 11 and end wall 1 and casing 100 then forced together. The radiused or angled rear surfaces 132 of studs 128 bias edge 18 and/or section 9 of tubular structure 6 outwardly, thereby allowing studs 128 to slip into locking engagement with center sections 15 of slots 11. Obviously, therefore, the width of each stud 128 at its base 136 should be equal to or, preferably, slightly less than the width of the slotted center section 15 corresponding thereto.

Conversely, in the disassembly procedure, it is important that the thickness of base 136 of each stud 128 be greater than the slot depth of each lateral slotted section 13 corresponding thereto. It is a further important feature of studs 128 that at least one, and preferably each of its sides 130 and 131 be radiused, beveled or otherwise angled towards apex 134. When said sides are so radiused or angled, the disassembly of casing 5 from casing 100 is accomplished simply by twisting end wall 1 relative to casing 100. Normally, when a thrusting means such as spring 19 is employed between motor 17 and endplate 3, the biasing force of said thrusting means will be sufficient to cause end wall 1 to pull away from casing 100 when studs 128 are brought out of locking engagement with slotted center sections 15.

Forward tubular member 104 of forward casing 100 defines generally a casing for motor shaft 116. Said member 104 is provided with at least one shaft seal. However, as indicated, it is preferred that at least two shaft seals be positioned at each extremity of member 104. A desirable feature to be employed in the design and construction of tubular member 104 when horizontal mounting of the pump is contemplated resides in the provision of downwardly positioned aperture 122, which allows liquid which may work its way through front shaft seal 118 and into casing 104 to be eliminated by gravity. When, as preferred, an aperture means is employed, a convenient expedient which avoids accidental assembly so as to position aperture 122 at the top rather than properly at the bottom resides in pairing the dimensions of each slot 1 with its corresponding stud 128. By this expedient only the correct position of casing 100 relative to end wall 1 will allow interlocking of the corresponding slots and studs.

At the forwardmost end of tubular member 104, there is provided another spaced apart, double flange system 124 adapted to form a seat 125 for O ring 126 and thereby provide a seal between member 104 and tubular impeller chamber 202.

After assembly of end wall 1, motor 17 and casing 100 as described hereinabove, impeller 300 can then be affixed to the end of shaft 116. A particularly preferred method and linkage of impeller 300 to shaft 116 is described in my copending application Ser. No. 108,775, filed Jan. 2, 1972. However, other means conventionally employed in the art to affix rotating members to drive shafts are also acceptable. Once the impeller has been affixed to shaft 116, the encased subassembly thus far described in detail is fitted to and locked into housing 200.

Housing 200 comprises a general pump enclosure 204 extending rearwardly from a partition 206. Said partition 206 comprises (1) impeller chamber 202 extending rearwardly therefrom and (2) inlet aperture 208 adapted to conduct liquid through said partition and into said impeller chamber 202. Impeller chamber 202 is further equipped with tangentially located outlet pipe 210.

A particularly important feature of the construction of housing 200 resides in the locking structure thereon which structure cooperates with locking studs 7 of end wall 1. Near the rear edge 218 of cover 204, there are provided cut-outs 220 adapted to receive manually depressible arms 21 of locking studs 7. Associated with each such cut-out 220, there is provided a bridge 222 and aperture 224 which features cooperate with locking slot 23 and projection 24 of the corresponding stud 7 to provide a locking relationship therewith. Thus, projection 24 of stud 7 extends outwardly into aperture 224 to secure the locking of end wall 1 to cover 204 and to provide, for practical purposes, a fail-safe locking system therebetween. Said locking feature serves to even further improve the integrity of the assembled pump apparatus.

In assembling housing 200 to the subassembly comprising end wall 1, casing 100, fully encased motor 17 and mounted impeller 300, it is merely necessary to depress members 21 inwardly so as to provide clearance of locking projections 24 and the interior of cover 204. This having been accomplished, and after positioning projections 24 within cover 204 so that bridges 222 and apertures 224 are substantially registered with their respective slots 23 and projections 24, members 21 are released. Due to their resilience, members 21 will urge the various locking members of this construction into engagement with one another, thereby effecting completion of the construction of the pump. Disassembly of course, is simply and rapidly achieved by reversing the order of the above assembly steps.

Obviously, any material of construction may be employed which can be formed or fabricated into the essential parts of the apparatus of the invention and which material of construction is further capable of withstanding the intended and obvious working environments encountered in impeller pump applications. However, it should be noted that end wall 1, casing 100 and housing 200 are especially adapted to fabrication from solid thermoplastic polymeric material such as polyamides, polyolefins, polystyrene, polycarbonates, polyacetals, etc. The so-called "impact" resistant polymers based on acrylonitrile-butadiene-styrene copolymers have been found to be particularly suitable. Further, it should be borne in mind that the relatively complex shapes of the essential elements of the invention can ordinarily be readily formed by standard thermoplastic forming methods, particularly by injection molding techniques.

What is claimed is:

1. An impeller pump housing assembly comprising:

A. a rear end wall defining an end closure of the housing and comprising an endplate, a rear tubular casing extending forwardly from said endplate and at least two resiliently inwardly biasable arm members extending forwardly from the perimeter of said endplate, said arm members having engaging means near the free ends thereof;

B. front tubular casing means having a front portion and a rear portion, said rear portion having means to engage said rear tubular casing in fluid-tight relationship and said front portion having means to engage a tubular impeller chamber in substantially fluid-tight relationship; and

C. housing means comprising

i. a partition,

ii. enclosure means integral with and extending rearwardly from said partition, said enclosure means having toward the rear margin thereof corresponding means to engage said engaging means of said arm members of (A) in interlocking relationship therewith,

iii. a tubular impeller chamber extending rearwardly from said partition and adapted to engage said front portion of said front tubular casing,

iv. an aperture through said partition in open communication with said impeller chamber and defining an inlet thereinto, and

v. tangential outlet means adapted to conduct fluid from said impeller chamber to the exterior of said enclosure means.

2. The pump housing of claim 1 wherein said front tubular casing comprises a front portion of abruptly smaller diameter than said rear portion, thereby forming a shoulder at the junction therebetween.

3. The pump housing of claim 1 wherein said front portion of said front tubular casing is provided with front and rear shaft seals in spaced apart relationship and downwardly oriented aperture means positioned between said seals and in open communication with the bore of said front portion of said front casing.

4. The pump housing of claim 1 wherein said means to engage said rear portion of said front casing with said rear casing includes

A. at least two circumferentially oriented slots located near the forward margins of said rear casing, each of said slots comprising a relatively deeply slotted center section and at least one relatively narrowly slotted lateral section coextensive with said slotted center section and having a common and continuous rear margin therewith, and

B. stud means projecting from the tubular surface of said rear portion of said front casing, said stud means being adapted to correspond to and engage in locking relationship with the center sections of said slots.

5. The pump housing of claim 4 wherein the front surface of each said stud means is substantially perpendicular to said tubular surface and wherein the rear surface of each said stud means is beveled or radiused rearwardly from its apex.

6. The pump housing of claim 4 wherein the sides of each of said stud means are angled or radiused towards the apex of the stud.

7. The pump housing of claim 4 wherein each said circumferential slot comprises a relatively narrow slotted lateral section extending from each side of said relatively more deeply slotted center section.

8. The pump housing of claim 1 wherein said fluid-tight relationships between said rear casing, front casing and impeller chamber are provided by

A. paired spaced apart flange means located on the rear portion of said front casing and defining therebetween a seat for an O ring, and an O ring in said seat adapted to bear against the interior of said rear casing in fluid-tight relationship; and

B. paired spaced apart flange means located on the front portion of said front casing and defining therebetween a seat for an O ring, and an O ring in said seat adapted to bear against the interior of said impeller chamber in fluid-tight relationship.

9. The pump housing of claim 1 wherein said endplate has a resilient flange extending forwardly from the perimeter thereof and said arm members are attached to said flange.

10. The pump housing of claim 9 wherein said flange is provided with slots adjacent the sides of said arm members and parallel therewith.

11. The pump housing of claim 1 wherein said engaging means of each of said arm members includes a perimetrically oriented slot on the outer aspect of said arm and an outwardly oriented projection located substantially immediately forward of said slot and wherein each said corresponding engaging means of said enclosure means includes perimetrically oriented bridge means adapted to receive said slot of said arm member and aperture means located substantially immediately forward of said bridge means and adapted to receive said projection of said arm member.

12. An impeller pump comprising the pump housing of claim 1 and containing therein:

A. a motor within said rear casing and said rear portion of said front casing;

B. a shaft in operative communication with said motor and extending through said front casing into said impeller chamber;

C. at least one shaft seal associated with said shaft and said front casing; and

D. an impeller affixed to said shaft within said impeller chamber.

13. An impeller pump comprising the pump housing of claim 2 and containing therein:

A. a motor within said rear casing and said rear portion of said front casing;

B. resilient biasing means within said rear casing adapted to urge said motor into abutting relationship with said shoulder of said front casing;

C. a shaft in operative communication with said motor and extending through said front casing into said impeller chamber;

D. at least one shaft seal associated with said shaft and said front casing; and

E. an impeller affixed to said shaft within said impeller chamber.

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