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[54] **MOTOR-PUMP**
8 Claims, 9 Drawing Figs.

[52] **U.S. Cl.**..... **222/333,**
239/226, 417/356

[51] **Int. Cl.**..... **G01f 11/06,**
G01f 11/30

[50] **Field of Search**..... **239/220,**
226; 103/3, 87 (AX), 87 (AH), 87 (E); 222/333;
134/115, 186, 188, 176, 191; 417/902, 356

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ABSTRACT: A motor-pump for use in an apparatus such as a dishwasher. The motor-pump is adapted to be submersible in the sump of a dishwasher tub. The motor-pump has an extremely low profile permitting such installation without interference to the normal dishwasher apparatus components. The motor-pump means includes means for delivering the water for draining the dishwasher as an incident of the reverse rotation of the motor.

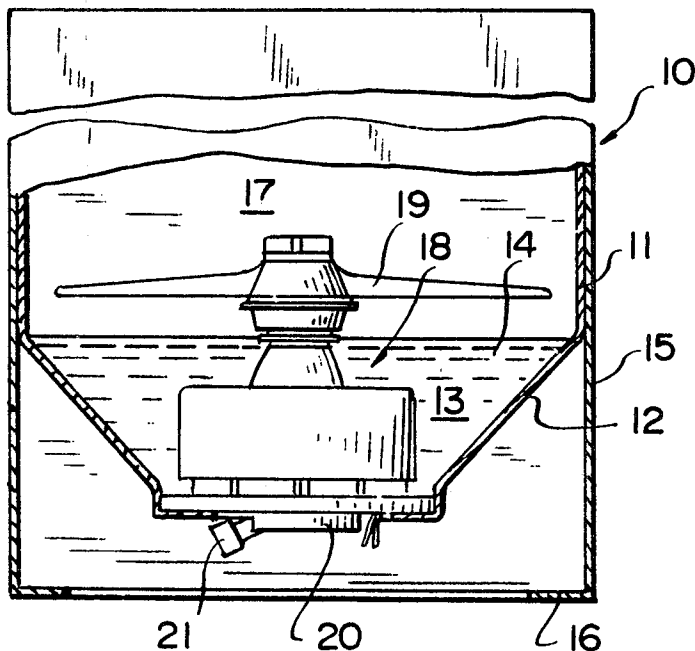


FIG. 1

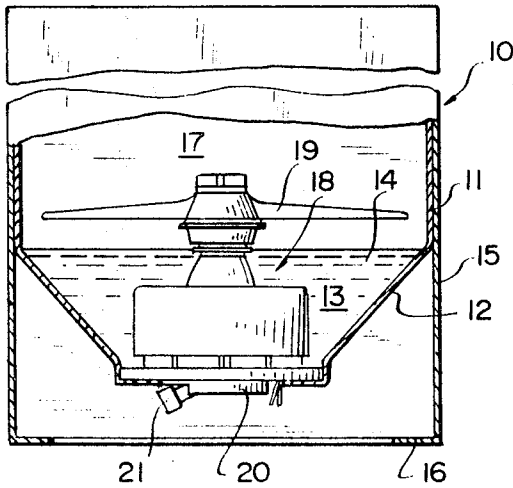


FIG. 4

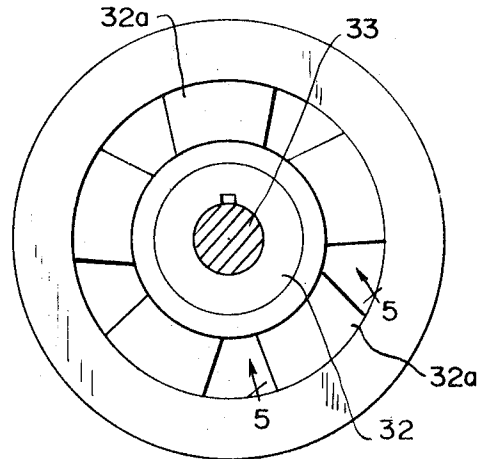


FIG. 5

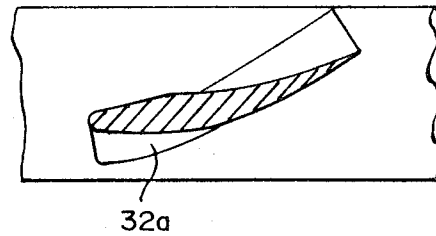


FIG. 6

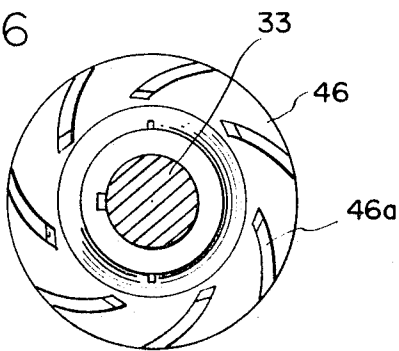


FIG. 7

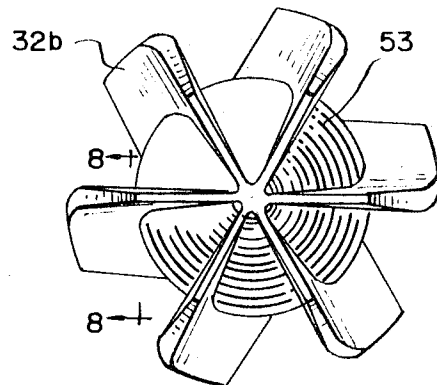
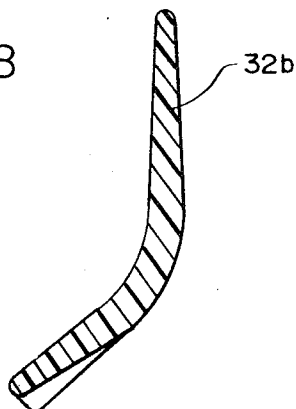


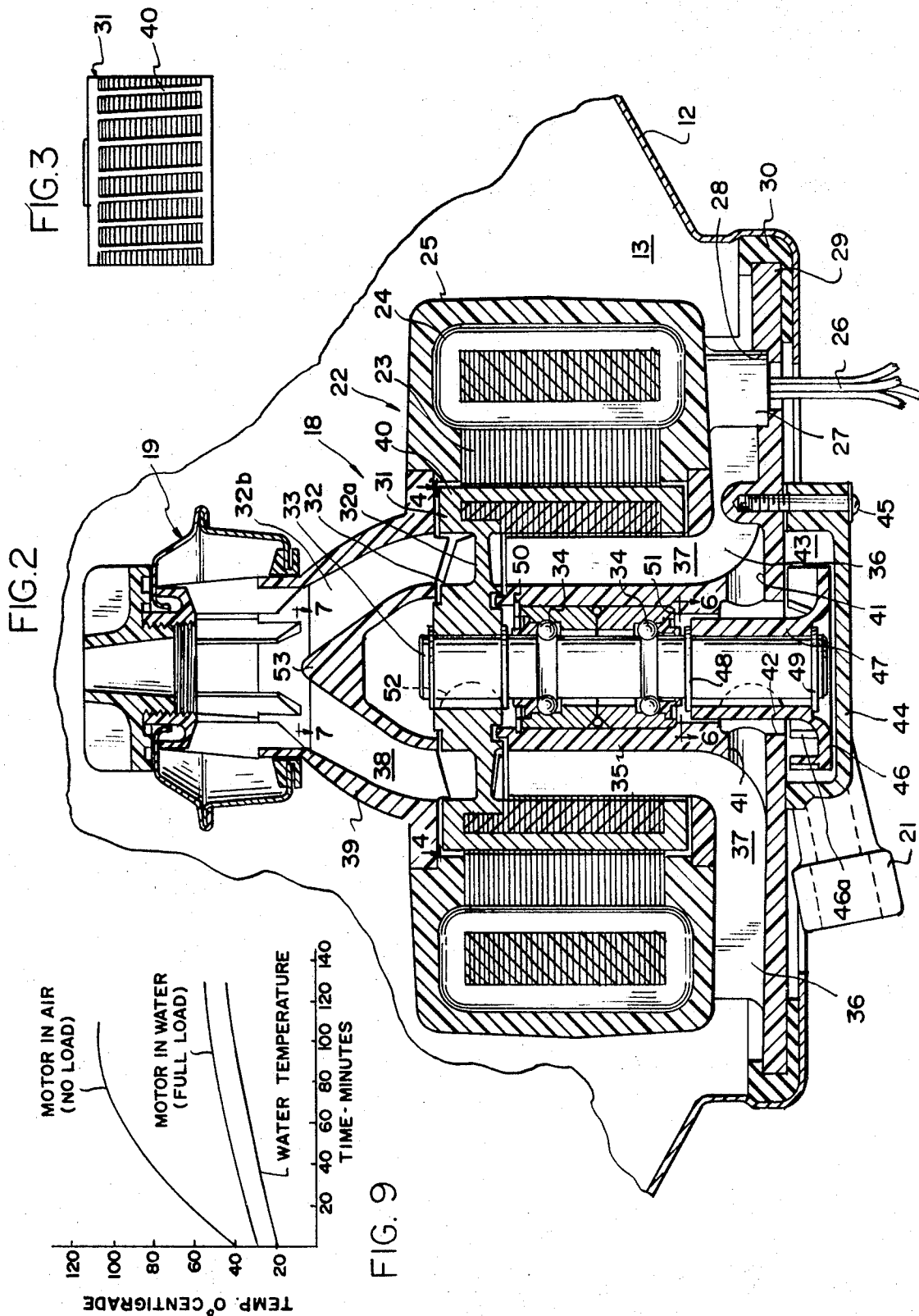
FIG. 8



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MOTOR-PUMP

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electric motors and, in particular, to pump motors such as for use with dishwashers, and the like.

2. Description of the Prior Art

In conventional dishwasher installations, pump motors are provided subjacent the bottom of the tub with means for delivering the pump water upwardly through the tube bottom and to the means for dispersing the liquid in the apparatus. Such an arrangement requires that the tub bottom be spaced above the bottom of the dishwasher thereby substantially decreasing the useful tub capacity. Further, the conventional dishwasher motors have a relatively large axial dimension thereby aggravating the problem by requiring a relatively large spacing of the tub bottom above the bottom of the appliance.

Another problem of the prior art motor is the utilization of separate pump elements which, when mounted on the motor, further increase the axial dimension of the assembly. Another disadvantage of the known dishwasher pump motors is the relatively expensive construction thereof resulting from the conventional toothwound two pole stator structure.

SUMMARY OF THE INVENTION

The present invention comprehends an improved pump motor for use in appliances such as dishwashers eliminating the disadvantages of the above discussed prior art structures in a novel and simple manner. Thus, the present invention comprehends a pump motor utilizing a yoke wound stator having an improved low profile. The pump may be formed integrally with the motor within an upper housing portion thereof for further minimized axial extent. The motor is extremely simple and economical of construction, having effectively minimum stator coil wire, while yet may be of the desirable two pole, single phase type. The motor is further adapted for submersed use in the sump of the dishwasher tub thereby permitting the tub to extend substantially to the bottom of the dishwasher providing improved capacity of the tub and optimum efficiency of use of the space within the dishwasher appliance.

More specifically, the invention comprehends a motor-pump means for use in a dishwasher having a tub provided with a bottom wall defining a sump space, including a motor stator encapsulated in a dielectric disposed in the sump space, bearing means disposed coaxially of a stator, integral rotor means including a shaft portion journaled in the bearing means, a motor rotor disposed coaxially intermediate the shaft and the stator for electrical coaction with the stator to rotate the rotor means about the axis of the shaft portion, and impeller means for pumping dishwasher fluid as a result of the rotation.

Further, more specifically, the invention comprehends such a motor-pump means wherein the bearing means is disposed coaxially radially inwardly of the stator.

Still further, more specifically, the invention comprehends such a motor-pump means wherein the impeller means mechanically interconnects the rotor and shaft. The impeller may be provided at one end of the rotor and the rotor may carry a second impeller means for use in draining the tub such as upon reverse rotation of the motor.

Yet further, the invention comprehends the provision of such a motor-pump means wherein the impeller is arranged to pump dishwasher fluid through the motor during normal dishwashing operation thereby cooling the motor while heating the dishwasher fluid to facilitate the dishwashing operation.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a fragmentary front elevation of a dishwasher apparatus provided with a pump motor embodying the invention;

FIG. 2 is a diametric section of the pump motor installed in the sump portion of the dishwasher;

FIG. 3 is a side elevation of the motor rotor;

FIG. 4 is a horizontal section taken substantially along the line 4-4 of FIG. 2;

FIG. 5 is a section taken substantially along line 5-5 of FIG. 4;

FIG. 6 is a horizontal section taken along line 6-6 of FIG. 2;

FIG. 7 is a plan view of the discharge vanes;

FIG. 8 is a transverse section of an impellor blade taken substantially along the line 8-8 of FIG. 7; and

FIG. 9 is a graph of test results based on operating the pump motor in the sump portion of the dishwasher.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the exemplary embodiment of the invention as disclosed in the drawing, a dishwasher apparatus, generally designated 10, is shown to include a tub 11 having a bottom wall 12 defining a sump 13 receiving a body of dishwashing liquid 14. The tub is mounted in a suitable outer cabinet 15 having a bottom 16. The tub 11 further defines an upper dishwashing space 17 into which the dishwashing liquid is delivered by motor-pump means comprising a pump motor, generally designated 18, embodying the invention. The dishwashing liquid may be sprayed into chamber 17 by means of a spray arm 19 carried at the upper end of the pump motor 18. As shown in FIG. 1, the pump motor 18 is submerged in the dishwashing liquid 14 in sump 13. The bottom wall further defines a lowermost well portion having a drain outlet 21 extending downwardly therefrom for delivering spent dishwashing liquid to a drain (not shown).

Referring now to FIG. 2, the pump motor 18 includes a stator 22 and an annular stator core 23 having a toroidal yoke wound coil 24 arranged for linking the stator yoke flux. The stator 22 may be encapsulated by suitable means, such as plastic body 25, herein comprising a molded epoxy resin encapsulation. Suitable electrical leads 26 are brought to the stator coil 24 through a bushing 27 extending downwardly from the stator 22 and through an opening 28 in a bottom plate 29 of the pump motor 18. The plate 29 may be sealingly carried on the tub bottom wall 12 by means of an annular gasket 30 embracing the periphery of the plate, as shown in FIG. 2.

The rotor 31 may comprise a squirrel cage rotor having formed integrally therewith an upper impellor portion 32 carried on a shaft 33 rotatably journaled by means of bearings 34 in a tubular support portion 35 comprising an upward extension of plate 29. The plate 29 further defines a plurality of, herein 6, equiangularly spaced vanes 36, which support the motor, as shown in FIG. 2, and which define therebetween flow passages 37 opening at their lower ends to the sump 13 and at their upper ends to a chamber 38 within a bonnet 39 for directing the liquid pumped by the impellor 32 to the spray arm 19. The impellor vanes 32a, herein five, are indicated in section in FIG. 2 and are also shown in plan in FIG. 4. FIG. 5 shows a sectional end view of one of the vanes 32a. Above the impellor vanes 32a are six discharge guide vanes 32b for directing the flow of liquid to the spray arm 19. FIGS. 7 and 8 illustrate details of the discharge guide vanes 32b. Rotor 31 and the impellor 32 may be formed of a suitable material such as aluminum, with the rotor bars 40 embedded in conventional laminated iron and with the bars 40 being of conventional construction formed of a suitable material such as aluminum or copper. As shown in FIG. 2, the plate 29 and up-standing support portion 35 may be integrally formed as of a suitable plastic material.

The lower end of the support portion 35 may be provided with radial passages 41 communicating through a center opening 42 in the plate 29, with a subjacent drain pump chamber 43 defined by a well cap 44 secured to the bottom plate 29 as by screws 45. An impellor 46 is secured to the lower end of the shaft 33 and is arranged for pumping liquid outwardly through the drain outlet 21 when the motor is operated in an opposite

direction of rotation from the normal direction in which the liquid is circulated by the impellor 32 through the spray arm 19. In FIG. 2 the spray arm 19 has been rotated 90° from the position shown in FIG. 1 to illustrate assembly details. The impellor 46 includes a tubular mounting portion 47 retained on shaft 33 between a pair of collars 48 and 49. The impellor 46 is provided with equally spaced radial vanes 46a (herein seven — see FIGS. 2 and 6) for pumping liquid outwardly from the sump 13. The bearings 34 are retained in the support portion 35 by means of a snap ring 50 and a shoulder portion 51 of the support 35. The impellor 32 may be rotatably fixed to the shaft by suitable means such as a conventional key. As shown in FIG. 2, the impellor 32 is secured on the shaft to be spaced slightly below bonnet 39, which may include a center deflector portion 53. As illustrated, the bonnet 39 may be formed of a suitable material such as molded plastic.

Thus, pump motor 18 has an extremely low profile, as shown in FIG. 2, as a result of the yoke wound stator construction and the cooperatively associated circulation impellor 32 and drain impellor 46 carried on the motor shaft 33. Thus, the pump motor 18 is simple and economical of construction while yet providing the highly desirable feature of submersible installation in the dishwasher tub sump 13 whereby the overall height of the dishwasher may be effectively minimized. The stator winding 24 is effectively insulated from the dishwashing liquid by the plastic encapsulation 25. If desired, the bushing 27 may be integrally formed as a part of the enclosure 25. The wires of winding 24 may be suitably insulated with Formvar or equivalent insulation.

The stator core 23 may be formed of conventional laminated iron and dipped in epoxy resin to provide a thin insulating coating on the surface thereof. The rotor 31 may also be dipped in epoxy resin to inhibit corrosion.

One highly desirable feature of the pump motor 18 is the simplified construction of the rotor and impellor wherein the stator core rotor portion 31 is mechanically connected to the shaft 33 through the impellor portion 32. By providing the flow passages 37 radially within the rotor portion 31 and outwardly adjacent the bearings 34, improved liquid cooling of the motor and heating of the washing liquid is effected as a result of the normal pumping of the dishwashing liquid by the impellor 32. FIG. 9 illustrates the cooling effect of the washing liquid on the motor (approximately 50° centigrade after 1 hour). The difference between the motor and washing liquid temperature is approximately 11° C. This utilization of the motor heat facilitates washing action and drying of the dishwasher load.

It will be recognized that if desired the rate of washing liquid temperature rise could be further increased by reducing the winding wire size and turns so that the motor operates at a higher temperature. In such event the motor heat, circulated by the impellor, could be used for drying during the dry cycle instead of using the conventional resistance heating element.

Further economy in the pump motor 18 construction is obtained by use of the yoke wound motor where the motor comprises a two pole motor, as such a stator winding arrangement effectively eliminates the costly end turns of the conventional

two pole, single phase induction motor. Thus, not only does the wound yoke stator construction provide an improved low profile but further provides substantially improved economy in the motor construction by requiring minimum utilization of comparatively scarce copper wire material.

While we have shown and described one embodiment of our invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

We claim:

1. A dishwasher, comprising: a tub provided with a bottom wall defining a liquid receiving sump space; a motor having a stator encapsulated in a dielectric disposed substantially entirely in said sump space for submerged contact by water in said space; bearing means disposed coaxially of said stator; an integral rotor means including a rotary shaft portion journaled in said bearing means and a motor rotor disposed coaxially intermediate said shaft and said stator for electrical coaction with said stator to rotate said rotor means about the axis of said shaft portion; and an impeller for circulating dishwasher fluid as a result of said rotation.

2. The dishwasher of claim 1 wherein said impeller extends between and mechanically interconnects said motor rotor and said shaft.

3. The dishwasher of claim 2 wherein said impeller, rotor means and shaft are coaxial, said motor rotor has an inner, annular tubular space coaxial with said shaft, and said impeller extends across one end of said space in said interconnecting of the motor rotor to the shaft.

4. The dishwasher of claim 3 wherein said impeller is an integral extension of the motor rotor and is attached to said shaft, and thereby supporting the motor rotor on the shaft.

5. The dishwasher of claim 3 wherein said motor rotor is a squirrel cage rotor with the impeller located at one end thereof.

6. The dishwasher of claim 3 wherein there are provided a plurality of spaced vanes in said tubular space dividing the space into a plurality of flow passages each opening at one end to said sump space and at the opposite end to said impeller for simultaneously circulating said fluid, heating said fluid from the heat of the motor and cooling said motor.

7. The dishwasher of claim 6 wherein said motor stator comprises a yoke-wound stator.

8. The dishwasher of claim 3 wherein said impeller is an integral extension of the motor rotor and is attached to said shaft and thereby supporting the motor rotor on the shaft, said motor rotor is a squirrel cage rotor with the impeller located at one end thereof, and there are provided a plurality of spaced vanes in said tubular spaced dividing the space into a plurality of flow passages each opening at one end to said sump space and at the opposite end to said impeller for simultaneously circulating said fluid, heating said fluid from the heat of the motor and cooling said motor.

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