Aug. 15, 1967 R. A. THON 3,335,668

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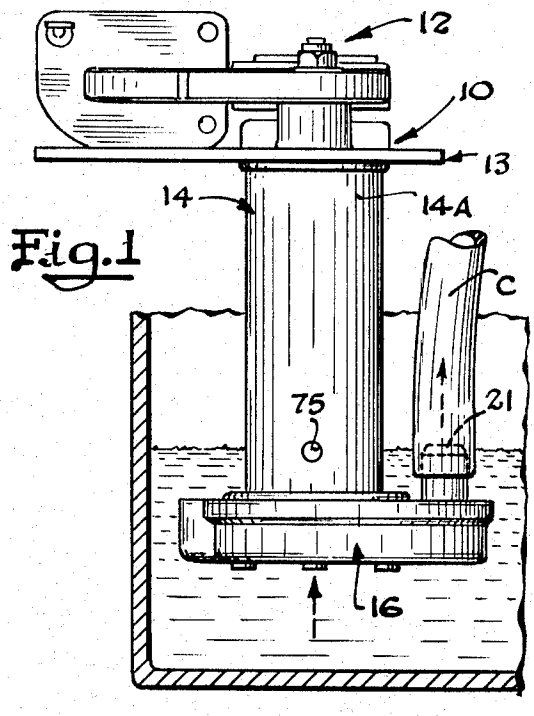


Fig.1

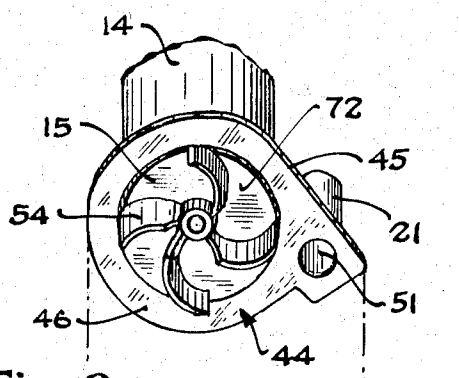
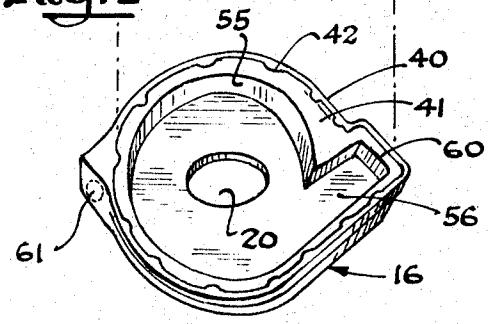


Fig.2



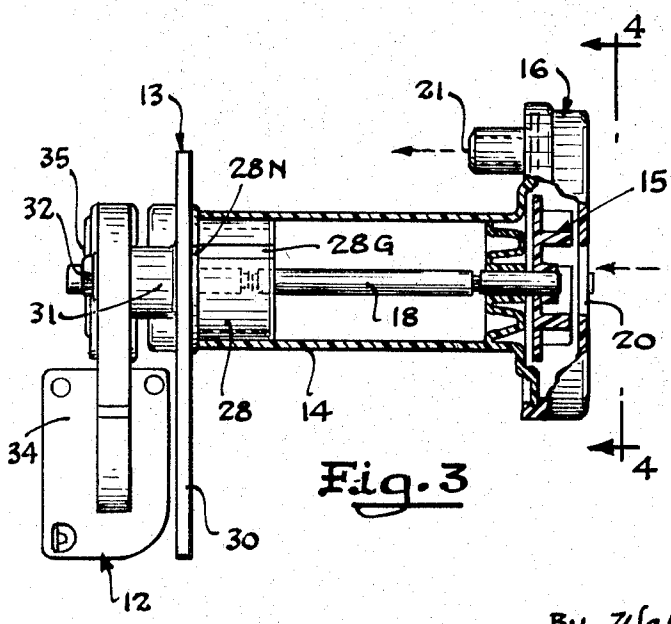
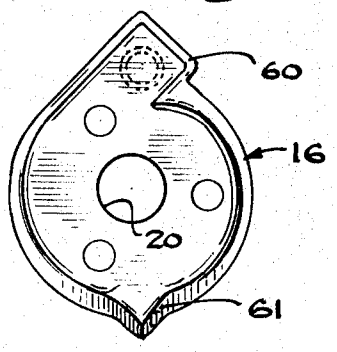


Fig.3

Fig.4



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Fig.5

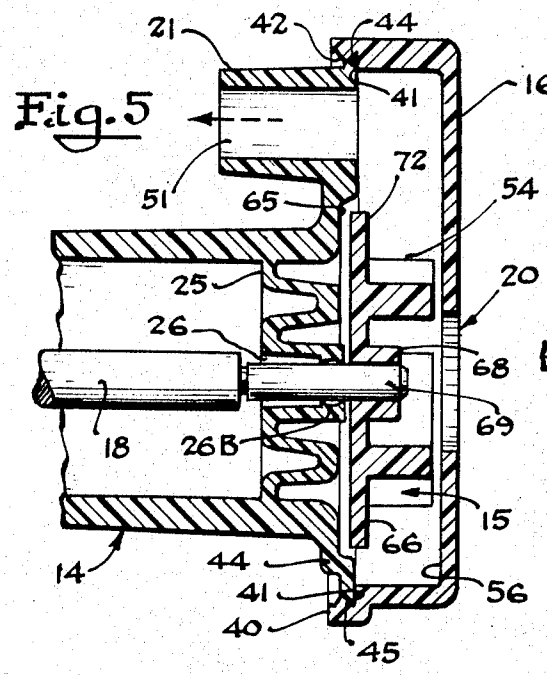


Fig.10

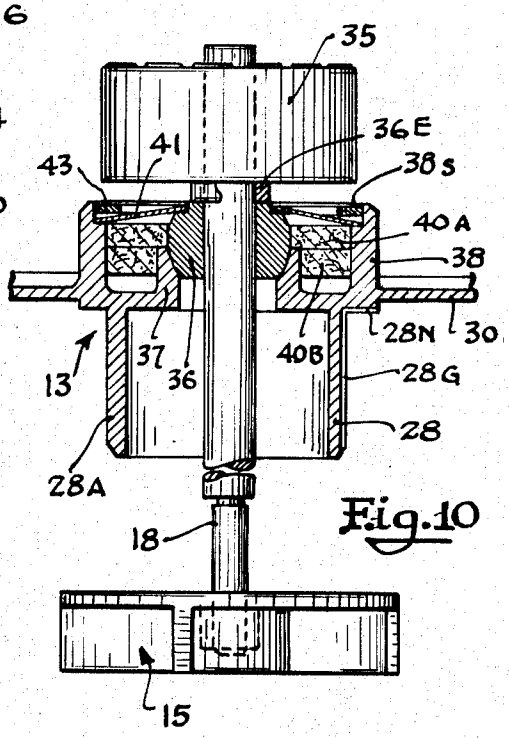


Fig.6

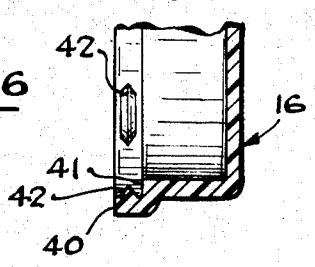


Fig.7

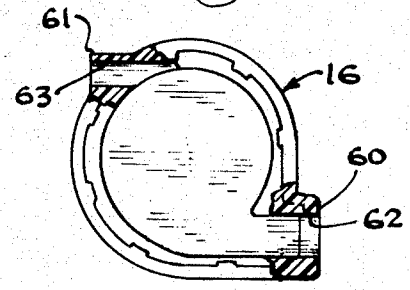


Fig.9

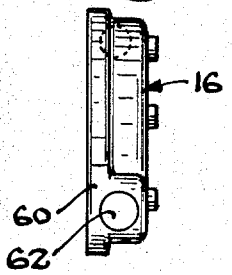


Fig.8

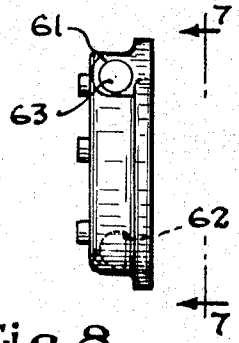
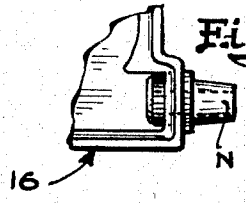


Fig.7A



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6 Claims. (Cl. 103—103)

This invention relates to centrifugal pumps and the construction thereof.

In numerous applications, such as liquid electrostatic duplicating machines, humidifiers, advertising displays, office machines and photographic developing machines, a relatively small centrifugal pump of low cost and relatively reliable performance could be used to advantage, especially if so constructed as to be readily adapted to different envvironments represented by such diverse applications. Cost factors reduced by the present invention relate to the elimination of sealed bearings and/or shaft seals, the manner of protecting an electric motor from the fluid being pumped, and the elimination of fasteners such as screws and rivets. Other important factors contributing to the cost of a pump are the number of components comprising the pump, and the labor employed in assembling the components to complete the pump. Accordingly, the primary object of the present invention is to produce a reliable, low cost, centrifugal pump characterized by molded plastic parts, few in number, and readily assembled without the necessity of fasteners.

A more specific object of the invention is to construct a low cost centrifugal pump with molded plastic components characterized by a column or tube having one end adapted to be press fitted on a motor support and with the other end thereof formed to include a bearing for an impeller shaft; a one piece impeller being adapted to be secured to said shaft, and a pump housing or cover being adapted to be snap-fitted to said column and immersed in a fluid.

The pump of the present invention is adapted to be related to a motor for disposition above a liquid. The impeller shaft is connected at one end to the motor rotor, and another object of the present invention is to support the rotor by the same bearings which support the impeller shaft.

Another object of the invention is a low cost pump having a molded plastic column which extends from a motor support to an impeller housing, said column being easily dimensioned to fit the many different environments where the pump may be employed, and having an integrally formed bearing for an impeller drive shaft and a separate, snap-fitted impeller cover which may be modified for directing flow of a liquid.

Other specific objects of the invention are to provide flexibility in pumps by having a molded attaching column which can be cut to various lengths and by having a pump housing which can be readily assembled and ported in alternative fashions.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show preferred embodiments of the preesnt invention and the principles thereof and what is now considered to be the best mode contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention.

In the drawings:

FIG. 1 is an elevational view of a pump constructed in accordance with the preferred embodiment of the invention;

FIG. 2 is a perspective view of the distal end of the pump with the pump cover removed;

FIG. 3 is a partial sectional view of the pump construction of FIG. 1;

FIG. 4 is a view taken along the lines 4—4 of FIG. 3, in the direction of the arrows and showing the pump cover;

FIG. 5 is an enlarged fragmentary sectional view of the distal end of the pump;

FIG. 6 is a fragmentary sectional view of the pump cover;

FIGS. 7, 8 and 9 are illustrations of an alternative porting of the pump housing;

FIG. 7A is a fragmentary view illustrating a nozzle; and

FIG. 10 is an enlarged sectional view at the base plate of the motor.

Referring now to the drawings and more particularly to FIGS. 1 and 3, there is illustrated a centrifugal pump **10** constructed in accordance with the preferred embodiment of the invention. In its preferred form, the pump **10** includes a motor assembly **12**, a motor support base **13**, a column **14**, a rotatable impeller **15** and a pump housing defined in part by a separable cover **16**. As best seen in FIG. 3, the motor assembly **12** drives a drive shaft **18** which is disposed internally of and coaxially with the hollow column **14**, the lower end of the drive shaft **18** being fixed to the impeller **15** to rotate the impeller **15** within the pump housing. The cover **16** of the pump housing is of a convolution shape having a central inlet port **20** through which fluid enters for movement by the impeller **15** to an outlet port **21**.

The present invention is characterized by its low cost of manufacture due to relatively few, inexpensive, and uncomplicated parts, and its readily assembled nature without the requirement for the usual screw or rivet type fasteners. In accomplishing the low cost production, it is preferred that the column **14** be a molded plastic one piece element of Delrin, nylon or like plastic and including a wall or center plate **25**, FIG. 5, formed with a central aperture **26**. The aperture **26** is enlarged to enable the shaft **18** to be easily extended therethrough and supported by a bearing **26B** that is part of the center plate **25** at the distal end of the tube **14**. Shaft **18** extends through a hollow boss **28**, FIG. 3, which is part of the motor support base **13**.

Thus, the boss **28** is preferably an integral portion of a generally rectangular base plate **30**, serving as a motor support, and which is preferably formed from a die cast part which affords the entire base **13**. A pair of projecting spacers **31** extend from the plate **30**, FIG. 3, to receive threaded studs **32** to fasten the stator portion **34** of the motor means **12** to the support plate **30**. A central rotor **35**, FIGS. 3 and 10, is coaxial with the drive shaft **18** and is secured thereto for rotating the shaft **18** and attached impeller **5**. It will also be observed that shaft **18** is coaxial within the sleeve or tube **14**. Referring now to FIG. 10, the rotor **35** is engageable with a spacer **36E** resting on a porous bronze self-centering bearing **36** which in turn is supported on the conical seat of a boss **37**.

The boss **37** is formed within the base **13** of which the support **30** is an integral part of an entire die casting. An annular wall **38** surrounds and is spaced from the boss **37**, the space between being packed with oil-impregnated felt rings **40A** and **40B**. The bearing is resiliently retained by a spring **41**, and the spring in turn is retained by a washer **43**. The free end of the wall **38** is swedged at **38S** to confine the parts described above as located within the base **13**.

The bearing 36 thus holds the rotor 35 against axial thrust while also serving as a rotary bearing support for the rotor and shaft 18.

To facilitate the assembly of the pump, the internal bore in the upper portion 14A, FIG. 1, of the column is configured to have a tight press fit with the outer peripheral surface 28A, FIG. 10, of the boss 28. In its preferred construction, the cover 16 of the pump housing is snap-fitted to the opposite or distal end of the column 14 thereby again eliminating the need for screw type fasteners, as will be explained in more detail below. Alternatively, the pump housing cover 16 could be press-fitted on the end of column 14, but this makes more difficult the removal of the housing 16 from the column 14 for servicing.

As can best be understood from FIG. 2, the pump housing cover 16 is provided with peripheral ledges or flanges 40 extending at right angles beyond a base or shoulder portion 41. The flange 40 is provided with a series of spaced lugs or projections 42 extending radially toward the interior of the cover 16. The distal end of the column 14 is formed with a flat attaching plate or portion 44, FIGS. 2 and 5. The peripheral edge 45 of the plate 44 is configured to snap fit within the confines of the flange 40 with the flat bottom surface 46 of the column plate 44 fitted flush against the right-angled shoulder 41 of cover housing 16. This ararngement produces an acceptable seal between the cover 16 and the tube 14, and since no separate metal fasteners are used to connect the tube to the motor support or to the cover 16, there are no metal parts that can become corroded.

In an assembly operation, the housing 16 is snap-fitted onto the attaching plate 44 of the column 14 by forcing the lugs 42 over the peripheral edge 45 of the base 44, thereby locking the housing 16 against accidental removal. During the snap fitting operation, the lugs 42 flex the flange 40 to permit the peripheral edge 45 of the plate 44 to move therepast whereupon the flange 40 returns the lugs 42 to overlie a portion of the peripheral edge 45 of the base plate 44 on the column 14 as shown in FIG. 5.

As can best be understood from FIG. 5, it is preferred that the outlet port 21 be formed in a boss integral with the attaching plate 44, FIG. 5, and having a hollow bore 51 through which fluid may exit the pump 10. Preferably, the outer peripheral surface of the outlet port 21 is tapered so as to easily fit a discharge conduit C, FIG. 1, connected to the pump 10.

As the fluid enters the pump housing 16 through the central aperture 20 in the cover 16, the revolving impeller blades 54 of the impeller 15 force the fluid in a path defined by a convolute internal wall 55, FIG. 2, within the cover 16 and toward an outlet cavity 56 therein which is disposed directly opposite the outlet bore 51, FIG. 2. Thus, the fluid enters the inlet port 20 at the center of the housing cover 16 and is moved by the impeller 15 through the bore 51 to exit the pump. Alternatively, the pump housing 16 may include either a single or double outlet by forming openings in one or both of a pair of bosses 60 and 61, FIGS. 2 and 4, which are integral with the member 16. Thus, as can be seen in FIGS. 7, 8 and 9, the respective bosses 60 and 61 may be apertured as at 62 and 63 to provide either a single or double outlet for the fluid being pumped. A nozzle as N, FIG. 7A, having a knurled outer surface, can be easily pressed into such a port to receive a conduit. Manifestly, the bore 51 of the outlet 21 may be plugged when an outlet is provided through a boss 60 or 61.

Adaptation of the pump to a particular use may be easily accomplished by appropriately dimensioning the length of the tube 14. The tube can be turned on boss 28 to port from the outlet in any desired direction.

Preferably, the impeller 15 is an integral one piece element molded of a plastic such as Delrin, nylon or the like having an integral and separate hub portion 68, FIG. 5, through which extends an end 69 of the drive shaft 18. The impeller hub is press-fitted to the end 69 of the shaft 18 which extends beyond the bearing 26B toward the cover 16. The integrally molded vanes 54 project outwardly from an integral circular plate 72 disposed adjacent an annular surface 65 on the underside of the base 44 of the column 14.

As seen in FIG. 5, the impeller 15 is free to rotate intermediate the end wall 56 of the pump housing 16 and the interior surface 65 of the attaching base 44 of the column 14. Advantageously, the rotor 35 is supported by the same bearings 36 and 26B which support shaft 18 for rotation, thereby minimizing the number of parts.

To avoid liquid rising in the tube 14 to the motor assembly, a suitable vent opening 75, FIG. 1, is provided in the tubular column 14 in conjunction with a groove 28G and communicating notch 28N formed in the boss 28.

In its preferred commercial form, the motor 12 is a $\frac{1}{200}$ horsepower motor, capable of delivering one gallon per minute at a 24 inch head of pressure. However, the present invention is not to be construed as limited to these dimensions and operating characteristics inasmuch as the principles of the present invention are applicable to other sizes of pumps. Also, the configurations and proportions of the enclosure for the impeller afforded by the cover 16 and the column end plate 44 may be varied from that described in the illustrated embodiment of the invention.

For servicing a pump constructed in accordance with the preferred embodiment of the invention, the pump housing cover 16 may be readily removed by applying a force to pull the pump housing cover to release the snap fit of the cover relative to the column 14.

It will be seen from the foregoing that the present pump embodies a great deal of flexibility in adaptation to various uses, due principally to the use of the column 14, easily dimensioned, and which is itself at one end press-fitted to a boss as 28 on the motor support. In turn, the pump housing or cover 16 is snap fitted to the opposite end of the tube 14, to encase the impeller, and to this extent separate fasteners are eliminated. Resultantly, this assembly can be easily rotated on the support 28 to direct the outlet port of the pump in any desired direction. A relatively inexpensive but nevertheless reliable seal is effected between the cover and the periphery of the end plate 44 of the tube 14, and the motor is safeguarded against contamination of liquid being pumped by venting the interior of the tube 14 in the manner described. The rotor is supported by the bearing means 36 and 26B which support the impeller shaft 18, characterized in one regard by the coaxial relationship between the tube 14, shaft 18 and the axis of the rotor.

Hence, while I have illustrated and described preferred embodiments of my invention, it is to be understood that these are capable of variation and modification.

I claim:

1. In a submersible centrifugal pump adapted to be driven by the rotor of a non-submersible motor: a motor support means having a boss projecting therefrom, a tube press fitted at one end on said boss and having an attaching plate affording part of a pump housing at the other end, a pump housing cover snap fitted to said attaching plate and configured to afford a pump housing therewith, an impeller shaft extending to said pump housing, and an impeller secured to said shaft within the pump housing.

2. A pump according to claim 1 wherein the impeller shaft is coaxially arranged within said tube, said attaching plate being formed with a bearing supporting said shaft, said motor support means having another bearing for said shaft, and a rotor secured to said impeller shaft and coaxial therewith whereby the rotor and shaft are both supported by the same bearings.

3. A pump according to claim 1 wherein said cover includes lugs having a snap-fit relation to an edge of said attaching plate, and wherein the attaching plate and cover have engaged peripheral surfaces affording a pump housing seal without the need for interposing a separate seal.

4. In a submersible centrifugal pump adapted to be driven by the rotor of a non-submersible motor: a motor support means having a boss projecting from one side thereof and supporting a bearing, a plastic tube press-fitted at one end on said boss and having at the other end an integral attaching plate affording part of a pump housing, a separable plastic cover snap-fitted to the other end of said tube to complete the pump housing, said attaching plate also being formed with a bearing, an impeller shaft coaxial within said tube and supported for rotation in said bearings, a rotor on the other side of said motor support means and being secured to one end of said impeller shaft, a plastic impeller affixed to the other end of said impeller shaft and being located within said pump housing, vent means for venting the interior of said tube, and said pump housing being formed with inlet and outlet ports for the fluid to be pumped.

5. A pump according to claim 4 wherein said cover includes lugs having a snap-fit relation to an edge of said attaching plate, and wherein the attaching plate and cover

have engaged peripheral surfaces affording a pump housing seal without the need for interposing a separate seal.

6. A pump according to claim 5 wherein said cover is formed with a pair of bosses which can be alternatively selected for the outlet port.

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