

[54] SELF-CONTAINED PUMPING UNIT

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[58] Field of Search 417/423, 424; 415/121, 53, 415/214, 211, 109, 115

[56] References Cited

UNITED STATES PATENTS

2,622,537	12/1952	Wortendyke	417/424
2,248,174	7/1941	Jacobsen	415/121
2,965,038	12/1960	Purder et al.	415/121 X

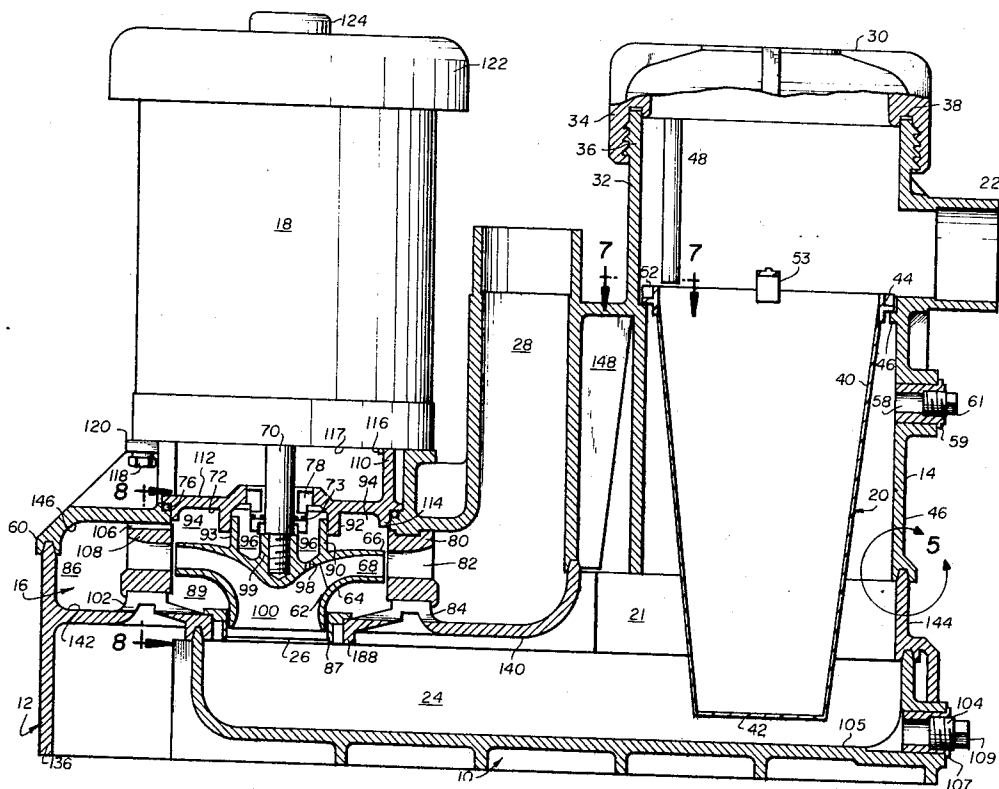
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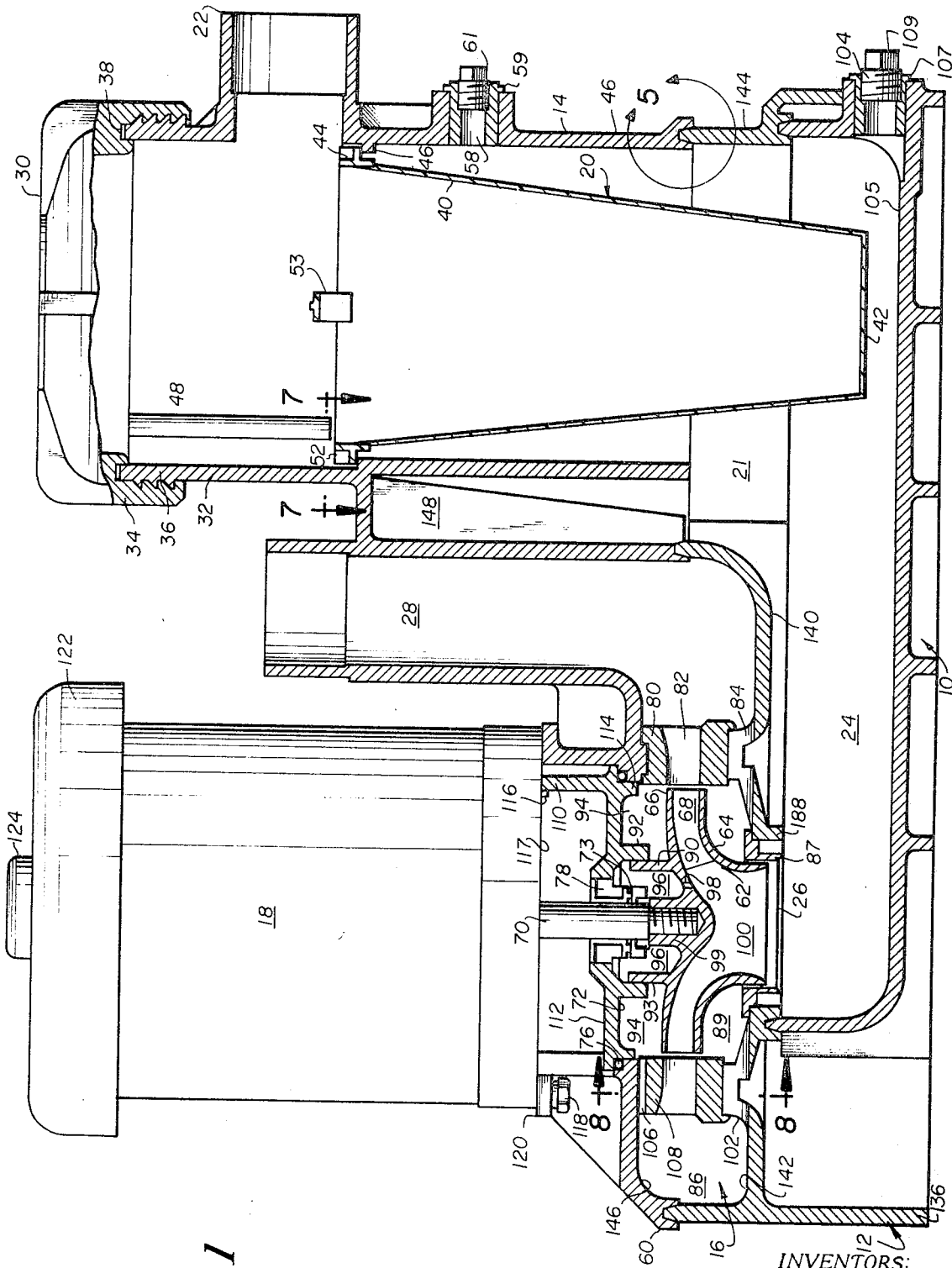
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ABSTRACT

A self-contained pumping unit, fabricated primarily from plastic materials, has pump apparatus and filter apparatus formed as integral parts of a single structure. The self-contained pumping unit includes a base member which communicates the pump apparatus to the filter apparatus. Additionally, the base member incorporates a mount for the pump drive motor and a pump discharge conduit. The relative positioning of the filter apparatus to the pump base member and other structural features of the unit provide the unit with self-venting, self-draining, and self-priming characteristics. The design of the pumping unit allows for the fabrication of the structure by modern plastic molding techniques, thereby allowing the use of noncorroding and chemically inactive materials in all the surfaces of the structure which are to be exposed to the liquid to be pumped. A special design is used to mate the individually molded parts of the pumping unit to form a single structure having high strength and rigidity.

29 Claims, 8 Drawing Figures





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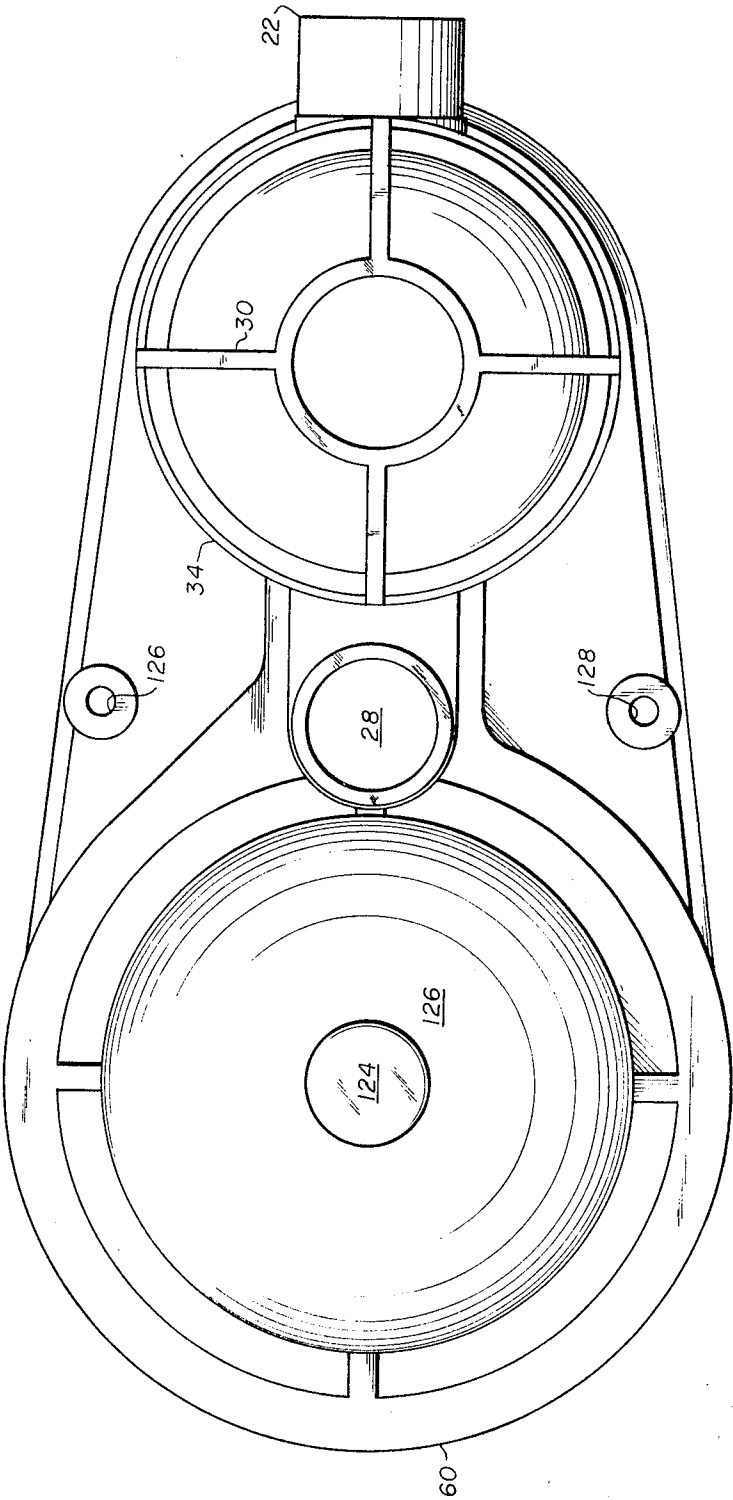


FIG. 2

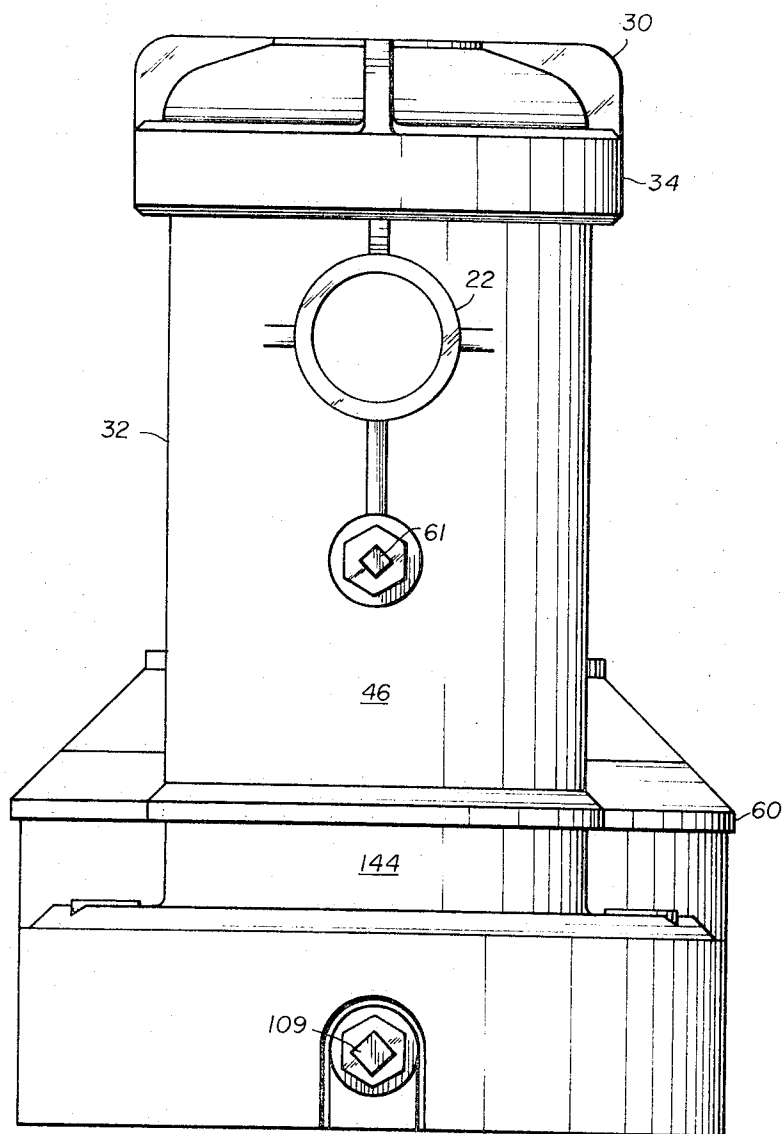
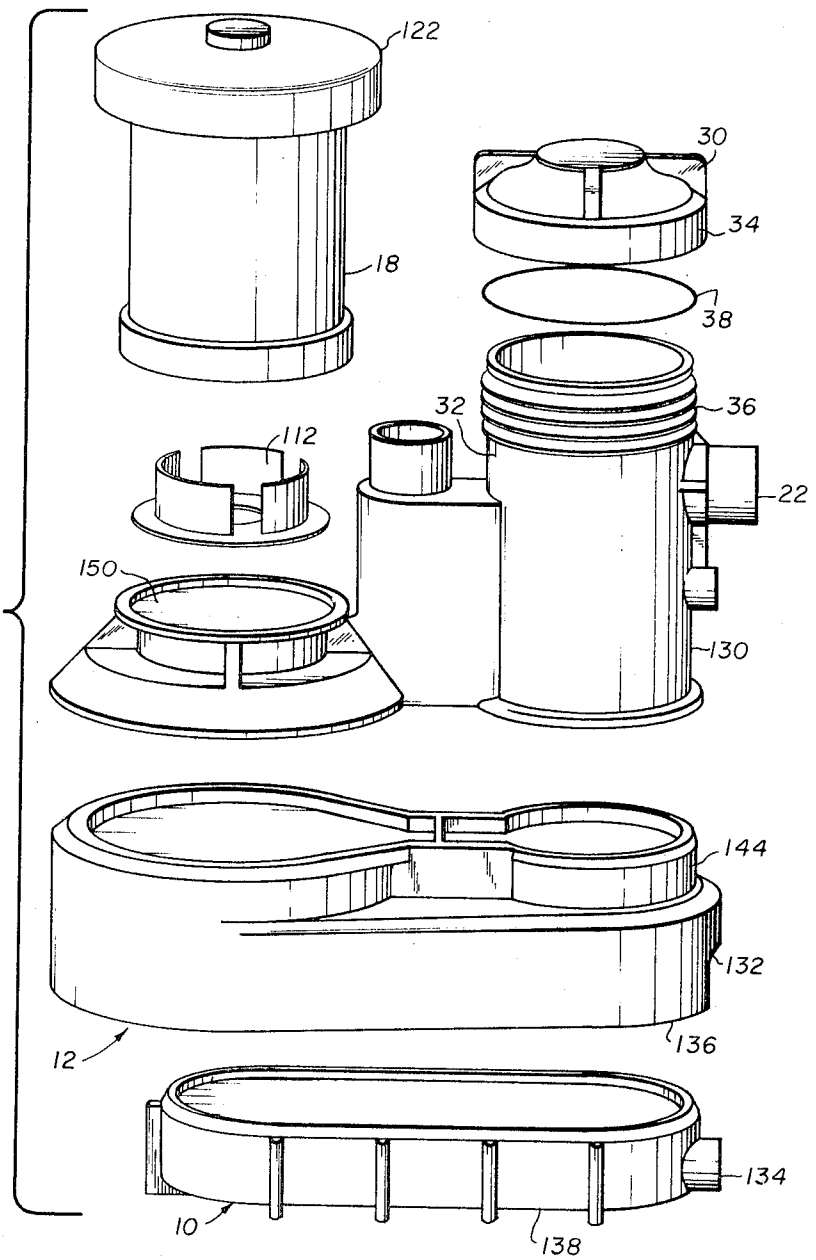


FIG. 3

FIG. 4



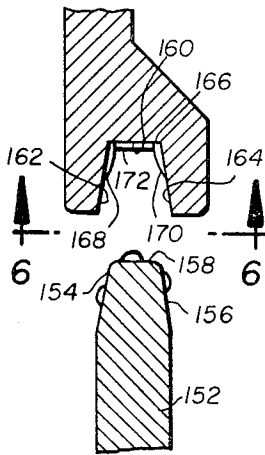


FIG. 5

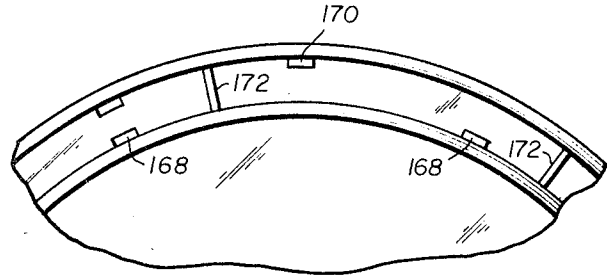


FIG. 6

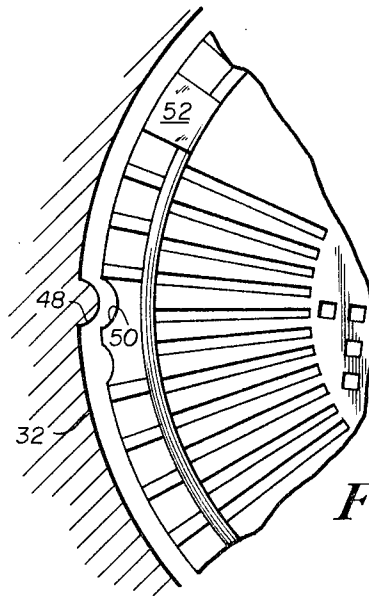


FIG. 7

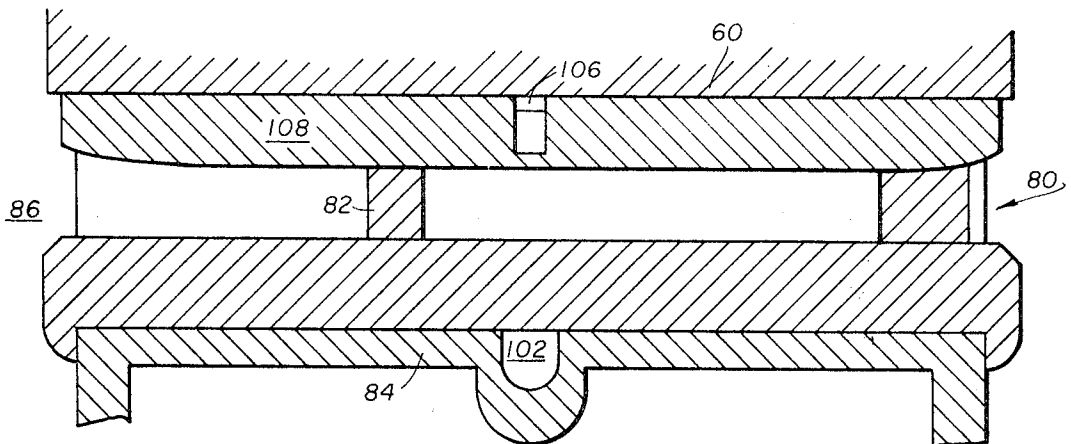


FIG. 8

SELF-CONTAINED PUMPING UNIT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to pumping apparatus in general and, in particular, to pump assemblies formed as a single self-contained pumping unit.

2. Description of Prior Art

In the pumping industry, it has long been sought to provide pumping assemblies which are relatively inexpensive, have good performance, possess high reliability, are easy to install into existing hydraulic circuits and offer ease of maintenance. These goals have long been sought, especially in the area of relatively low capacity pumps used for light service, such as swimming pool recirculating pumps.

SUMMARY OF THE INVENTION

The present invention satisfies these long sought requirements by setting forth a uniquely constructed, self-contained pumping unit. The pumping unit includes the pump, pump filter, piping connections to attach the pumping unit to existing hydraulic networks, and a motor mount to support and position an electric motor to drive the pump. The pumping unit is fabricated from relatively simple components which can be manufactured by means of inexpensive plastic-molding techniques. Special joining surfaces are formed on each of the component elements to facilitate the joining of the elements into a single integral structure. Several interchangeable elements are used in construction of the unit which allows standard parts to be used for different sizes of pumping units to be produced. Disassembly of various components of the unit allows for ease of servicing and maintenance of all-critical components. The construction material used for forming the units provides corrosion resistant surfaces to the liquid being pumped which surfaces are also resistant to accumulations of biological matter.

Accordingly, it is an object of this invention to provide a self-contained pumping unit in which the motor and running parts of the pumping unit can be easily removed for maintenance without unduly disrupting the entire hydraulic system in which the pump operates.

It is another object of the present invention to provide a self-contained pumping unit which is constructed and designed to impose minimum bearing loads on the pump bearings to insure extended service life of the pump components.

Another object of the present invention is to provide a self-contained pumping unit incorporating a diffuser type of pumping chamber to provide superior self-priming characteristics for the unit.

Still another object of the present invention is to provide a self-contained pumping unit designed to be primarily fabricated from structural foam materials.

It is a further object of the present invention to provide a self-contained pumping unit in which the system can be fabricated using plastic-molding techniques to insure inexpensive and accurate mass production.

Yet another object of the present invention is to provide a self-contained pumping unit which is designed to utilize a common pump casing with interchangeable pump components to provide a large range of pump sizes from standard parts.

A further object of the present invention is to provide a self-contained pumping unit fabricated from relatively inexpensive and durable materials which do not deteriorate in water or other liquids compatible with human contact and which will resist biological fouling.

It is another object of the present invention to provide a self-contained pumping unit having all electrical components of the pumping unit located above the level of the liquid pumped by the unit to minimize any electrical hazards during operation of the pumping unit.

It is another object of the present invention to provide a self-contained pumping unit which requires a minimum of suction lift for proper operation of the pump apparatus.

Yet another object of the present invention is to provide a self-contained pumping unit which is self-draining and self-venting.

Other objects and advantages will be apparent from the following description of an embodiment of the invention and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a side elevation, partially in section, of a self-contained pumping unit built in accordance with the teachings of the present invention.

FIG. 2 is a top view of FIG. 1.

FIG. 3 is an end view of FIG. 1.

FIG. 4 is an exploded view of the self-contained pumping unit shown in FIG. 1.

FIG. 5 is an enlarged exploded view of detail 5, circled in FIG. 1.

FIG. 6 is an enlarged view, in section, taken along lines 6—6 of FIG. 5.

FIG. 7 is an enlarged view taken along lines 7—7 of FIG. 1.

FIG. 8 is an enlarged view taken along lines 8—8 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The pumping unit described is particularly adapted for use as a swimming pool recirculating pumping unit, although it should be understood that this unit could be used for any of the wide applications possible for a small self-contained pumping unit.

Referring now to the drawings, a self-contained pumping unit, generally indicated at 10, consists of a base member 12, a filter housing generally indicated at 14, and a pump generally indicated at 16, driven by an electric motor 18.

Liquid to be pumped enters the pumping unit through inlet port 22 of filter housing 14 and is filtered by a filter means in the form of a leaf basket type of strainer 20 mounted in the housing. The liquid passes to the outlet section 21 at the bottom of filter housing 14 and enters passage means 24 which communicates the outlet of the filter means with the inlet 26 of pump means 16. Liquid discharge from pump means 16 is carried out of the pumping unit 10 through vertical discharge conduit 28 which is connected to the hydraulic network (not shown), in which the pumping unit operates.

Access to leaf basket 20 is provided by a cap 30 which is threadably connected to the top portion 32 of filter housing 14 by means of threaded sections 34 and 36, on cap 30 and upper portion 32 of the housing respectively. Removal of cap 30 allows for easy access to leaf basket 20, so that the basket can be easily removed for cleaning or replacement. A gasket 38 or other convenient sealing device is positioned between cover 30 and top portion 32 of filter housing 14 to seal the top of the housing.

The filter element is positioned and retained in the filter housing as explained below. Leaf basket 20 is of mesh construction and is generally shaped in the form of a truncated cone, having conical sides 40 and a flat mesh bottom 42. A mounting lip 44 located near the top of basket 20 coacts with the horizontal support flange 46 in housing 14 to support the leaf basket in the housing.

As shown in FIG. 7, a vertical guide rail 48 projects radially inward from the upper portion 32 of filter housing 14 and extends downward to a point above supporting flange 46 of filter housing 14. A guide groove 50 in mounting lip 44 of leaf basket 20 is shaped to coact with guide rail 48 so the basket can be raised out of, or lowered into, filter housing 14 when the groove and rail are aligned. When the leaf basket 20 is resting on support flange 46, mounting lip 44 of the leaf basket will be out of contact with guide rail 48, which ends above the upper portion of the mounting lip, and the basket 20 can then

be rotated until positioning shoulder 52 projecting upwards from mounting lip 44 comes in contact with guide rail 48. When guide groove 50 and guide rail 48 are out of alignment, the leaf basket 20 will be prevented from rising in filter housing 14 and will be adequately secured for operation of the pumping unit. A handle 53 extends from the top of the basket strainer to aid in installation and removal of the basket.

A pipe boss 58 is formed in the wall of filter housing 14 for installation of a threaded plastic insert 59. The insert is adapted to accept a pressure gauge or other suitable instrumentation to indicate the pressure of the liquid which has passed through the filter element. The pressure downstream of the filter element will indicate the condition of the filtering element and allow for proper servicing when the element is clogged or otherwise not functioning properly. When not in use, boss 58 is sealed with a pipe plug 61.

At the other end of the pumping unit 10 from the filter means is the pump means which will now be described. The pump means generally indicated at 16 consists of a vertically disposed centrifugal type pump having a pump casing generally indicated at 60 enclosing a horizontally rotating centrifugal impeller 62 having full front and rear shrouds, 64 and 66 respectively, and impeller vanes 68. Impeller 62 is mounted on motor shaft 70 which extends from electric motor 18 into pump casing 60 through a casing cover member 72 which seals a large opening 74 at the top of the casing. A seal assembly 73 is mounted on the casing cover 72 and shaft 70 to seal the pump casing from leakage along the drive shaft. A gasket 76, or other suitable sealing device, is interposed between casing cover 72 and the top of pump casing 60 to seal the connection between these two members.

The nonrotatable portion 78 of the seal assembly 73 is mounted in casing cover 72 and coacts with the rotatable portion 79 mounted on the motor shaft 70, to prevent leakage of liquid from the seal chamber behind the impeller.

A diffuser 80 having a plurality of vanes 82 is mounted on diffuser positioning means 84 extending from the bottom of pump casing 60. A collection chamber 86 is formed between the outer portion of the diffuser and the outer walls of the pump casing. The liquid traveling from centrifugal impeller 62 and diffuser 80 will collect at a relatively reduced velocity in chamber 86 before entering vertical discharge conduit 28.

Wear rings are provided for the front and rear faces of the centrifugal impeller 62. Front wear ring 87 is a replaceable wearing surface mounted in inlet orifice 88 of pump casing 60. Wear ring 87 coacts with front shroud 64 of impeller 62 to direct flow of liquid from passage 24 into pump inlet 26 and to restrict the flow to passage 24 from the impeller front discharge area 89 formed by front shroud 64, the lower part of diffuser 80 and diffuser mounting means 84. As can be readily seen from the drawings, the front shroud 64 of impeller 62 extends close to the passage 24 in base member 12 thereby reducing to a minimum the suction lift required to obtain the required inlet flow for proper operation of the pump.

The wear ring arrangement for the rear portion of the impeller consists of two coacting cylindrical sections. A rotating cylindrical section 90 extends upward from rear shroud 66 of impeller 62, and a stationary cylindrical section 92 extends downward from casing cover 72, into rear impeller area 93 formed by the rear shroud of the impeller and the casing cover.

The rotating and stationary sections partition the rear impeller area 93 into a rear shroud discharge chamber 94 and a seal chamber 96. Rear shroud discharge chamber 94 is formed by rear shroud 66 of impeller 62, diffuser 80, casing cover 72, and stationary cylindrical element 92, while seal chamber 96 is formed from the inner portion of rear shroud 66, rotating cylindrical element 90, casing cover 72, seal assembly 73, and impeller hub 99.

The rotating and stationary cylindrical sections are concentrically disposed and dimensioned to coact together to restrict the flow from rear shroud chamber 94 to seal chamber 96. Balancing holes 98 in rear shroud 66 of impeller 62 commu-

nicate seal chamber 96 with the inlet section 100 of impeller 62 so as to maintain the pressure in seal chamber 96 close to the pressure in the impeller inlet section 100.

The pumping unit is constructed to be self-draining, and the pump is designed to have superior self-venting and self-priming characteristics, as will now be explained.

The pump structure includes drain passages in the pump and the base member in addition to the usual drain path for the pumped liquid from the discharge column 28, back through collection chamber 86, diffuser 80, impeller 62, pump inlet 26 and then into passage 24. Referring to FIGS 1 and 8, a plurality of drain passages 102 are formed in the bottom of pump casing 60 which extend from collection chamber 86 through the diffuser positioning means 84 to the front shroud discharge area 89 and then to the inlet 26 of the pump to carry liquid from the collection chamber back to the pump inlet.

When the pumping unit is not operating, the liquid from pump inlet 26 will fall back to passage 24 and be drained through drain fitting 104 located at the lowermost point of depression 105 in passage 24 which is the lowest point in the entire flow circuit within the self-contained pumping unit. Any liquid in filter housing 14 will, of course, be drained through drain fitting 104, since depression 105 is located directly beneath leaf basket 20. Drain fitting 104 includes a threaded insert 107 similar to insert 59 previously described, and normally sealed by pipe plug 109.

The venting of gases in the pump is accomplished by a circulation pathway from the collection chamber through the rear shroud chamber and seal chamber back to the pump impeller. In the usual vertically disposed diffuser type centrifugal pump, gases which have entered the pump casing during periods of nonoperation as well as some of the gases which have separated from the liquid pumped tend to accumulate and remain in the upper portions of the rear impeller area.

However, in the present invention, as shown in FIG. 1, a circulation vent passage 106 formed in the top portion 108 of diffuser 80 communicates collection chamber 86 with rear shroud chamber 94 and inner seal chamber 96 to provide a pathway for liquid to carry off, or vent, accumulated gas from the rear shroud chamber. During pump operation, the gases in chamber 94 will be swept by the liquid passing from the impeller discharge and vent passage 106 through the partial seal provided by the stationary and rotating cylindrical sections to enter inner seal chamber 96. The gases will then be drawn through the balancing hole 98 in the rear shroud of the impeller and will be mixed with the liquid pumped into the vertical discharge conduit.

The repriming characteristics of the pump are produced by the drain structure, previously described, which functions as a self-priming means during periods of pump operation. In addition to draining liquid from the collection chamber when the pump is not in use, the drain pathway recirculates relatively gas-free liquid pumped by the pump impeller 62 when the pump is operating. The less dense liquid which has a high air content will tend to move to the top of collection chamber 86 and hence out the vertical passage 28. The relatively gas-free liquid, which tends to gravitate towards the bottom of collection chamber 86 because of its greater density, will pass back to the front shroud discharge area 89 through drain passages 102, and then on to the impeller inlet section 100. As this relatively gas-free liquid is repumped, it will pick up gas from the inlet passage 24 as well as some of the gas bubbles which have reentered the impeller through balancing holes 98, and will carry this entrained gas to the vertical discharge conduit 28. Since the liquid returned to the pump inlet is more air free than the liquid which flows through the diffuser, in time, sufficient air is thus passed out of the pumping unit to allow proper operation of the pump.

It should also be pointed out, that significant performance advantages for pump 16 are provided by the relative location of the pump impeller with relation to liquid inlet 22 and the filtering element in the form of the strainer-type leaf basket 20. Because the pump inlet 26 is located substantially below inlet

22 of filter housing 14, sufficient liquid is retained in the pumping unit after shut down of the pump to significantly enhance the self-priming performance of the pump. Additionally, as previously mentioned, the inlet portion 26 of the pump is located near the lowest point of the pumping unit. Therefore, very little suction lift is required to draw liquid from passage 24 into the pump inlet.

The pump is driven by drive motor 18 which is positioned with relation to pump casing 60 by means of positioning members 110. The positioning members extend upward from motor-mounting means 112 formed on the rear side of casing cover 72. An aligning shoulder 114 on casing cover 72 coacts with the walls of opening 74 on the top of pump casing 60 to position the casing cover and, therefore, the motor-mounting means, with relation to the pump casing. The positioning members 110 of motor-mounting means 112 coact with an aligning lip 116 on the face 117 of motor 18 adjacent the pump casing to fix the position of the motor with respect to the pump casing 60.

The single member forming the casing cover and motor mount is held in position by a plurality of bolts 118 which fasten motor 18 to bolting flange 120 in the upper part of the pump casing. Therefore, as can be seen in FIG. 1, it is possible to remove the entire motor, motor mount, and centrifugal impeller 62, from the pump casing without disturbing the pump casing or other parts of the self-contained pumping unit by merely removing the bolts securing electric motor 18 to bolting flange 120 of pump casing 60. Accordingly, ease of access to, and maintenance of the critical portions of the pumping unit can be easily accomplished with a minimum of difficulty.

While discussing the subject of maintenance, it should also be pointed out that the use of a multivaned diffuser rather than the standard volute in the centrifugal pump reduces the radial loads on the impeller and, therefore, reduces the bearing loads on the pump. Further, the fact that the electric motor 18 is mounted vertically above the impeller and is supported by motor mount 112 rather than by the drive shaft bearing structure, as is the case very often in horizontally mounted centrifugal pumps, further reduces the load upon the bearing structure of the pump. Accordingly, it can be seen that the present design provides for maximum service life of the critical parts of the pumping apparatus.

As shown in FIG. 2, the pumping unit is adapted to be secured by means of bolt holes 126 and 128 which bolt down base member 12 to any convenient mounting base.

It should also be pointed out that the vertical positioning of electric motor 18 above the pumping unit is an important safety feature in that it allows all of the electrical connections to be made above the level of the liquid which is being pumped. Therefore, the risk of motor flooding or electrical shock resulting from leaks of the shaft seal or other failures in the pumping unit is greatly reduced.

FABRICATION OF THE PUMPING UNIT

As shown in the exploded view of FIG. 4, the major components of the pumping unit are designed in such a manner that the entire unit can be fabricated from molded structural foam. The main assembly of the pumping unit consists of three major elements, and upper member 130, an intermediate or middle member 132 and a bottom member 134.

As can be seen, the middle member 132 provides the support surfaces 136 for the pumping unit. The bottom member 134 constitutes the bottom and side walls of channel 24 which connects the depression 105 at the bottom of filter housing 14 with the pump inlet 26.

Middle member 132 forms the top portion 140 of channel 24, the bottom portion 142 of pump casing 60 and the lower portion 144 of filter housing 14.

Upper member 130 includes the upper portion 32 and intermediate portion 46 of filter housing 14, vertical discharge conduit 28 and the upper portion 146 of pump casing 60. Additionally, a supporting rib 148 connecting filter housing 14 with

vertical discharge conduit 28 braces vertical discharge conduit 28. A receptacle 150 in upper member 130 is adapted to receive motor mount means 112. Bolting flange 120 is located at the top of receptacle 150 for securing motor 18 to the upper member.

Upper member 130, middle member 132 and bottom member 134 are joined together by a chemical fastening means, such as adhesives or epoxies. To facilitate the joining of these members into a single rigid structure, the mating surfaces of each of these members are formed in a tongue and groove configuration. As shown in FIG. 5, the tongue portion 152 is generally frustoconically shaped with tapered sidewalls 154 and 156 and a blunted end 158. The mating groove surface 160 corresponds generally to the shape of the tongue surface, having slanted sidewalls 162 and 164 and flat end surface 166.

Spacing nibs 168, 170 and 172 extend from sidewalls 162, 164 and end wall 166 respectively of the groove section. The nibs (FIG. 6) on the sides 168 and 170 may be staggered or located in the same plane, but the nibs 166 on the top surface must be staggered with relation to the nibs on the sidewalls. The nibs may, alternately, be placed on the tongue portion of the joint rather than in the groove. The spacing nibs act to center the tongue in the groove and to maintain a constant thickness film space for the chemical fastening means used to join the adjacent members of the pump unit structure. The spacing nibs are required for proper alignment of the tongue and groove surfaces because the tolerances between the two parts could cause close contact on one hand or excessive clearance on the other, either of which are not conducive to the maximum surface bonding strength.

It should be pointed out that the design of the pumping unit set forth herein allows for the use of structural foam plastic in fabricating the unit. The structural foam plastic offers definite advantages of cost savings in tooling and materials for the structural strength which it provides, and permits the commercial utilization of plastics in applications that were heretofore commercially unfeasible.

It should also be pointed out that the use of a separate diffuser mounted within the pump casing allows for several different size pumps to be assembled with the same basic pump casing by merely varying the size of the diffuser and impeller combination installed within the pump casing. Since the pumping unit is fabricated from structural foam plastic, the hydraulic passageways in the pumping unit will not corrode and are resistant to fouling by build up of biological organisms.

It will be understood that various changes in the details and materials and arrangements of parts which have been herein described and illustrated in order to explain the nature of the invention may be made by those skilled in the art within the principle and the scope and information as expressed in the appended claims.

We claim:

1. A pump unit comprising:
 - a base member;
 - filter means connected to said base member having an inlet and having an outlet in said base member;
 - pump means connected to said base member having a discharge and having an inlet in said base member;
 - drive means for said pump means supported at least partially by said base member; and
 - passage means in said base member communicating said outlet of said filter means with said inlet of said pump means;
- said base member is disposed in a generally horizontal plane;
- said outlet of said filter means is disposed below said inlet of said filter means;
- said pump means includes impeller means rotating in a plane substantially parallel to said base member; and
- said drive means are connected to said impeller means and disposed perpendicular to and above said plane of rotation of said impeller means.

2. The invention claimed in claim No. 1 wherein said filter means comprises:
 a filter housing having an outlet communicating with said base member;
 an inlet opening in said housing; and
 filter element means disposed between said inlet opening and said outlet opening and extending into said base member.

3. The invention claimed in claim No. 2, wherein:
 said filter housing includes:
 a generally horizontal mounting flange projecting inward from the walls of said filter housing; and
 a generally vertical guide rail projecting inward from the walls of said filter housing; and
 said filter element means includes:
 a mounting lip extending from said filter element means adapted to engage said mounting flange to support said filter element; and
 a guide groove in said mounting lip adapted to coact with said guide rail to allow removal of said filter element means from said filter housing when said guide groove and rail are in alignment and to prevent removal of said filter element means when said guide groove and rail are out of alignment.

4. The invention claimed in claim No. 2 wherein said inlet opening in said housing is disposed above said filter element means;
 and further comprising closure means in said filter housing including:
 a cover threadably connected to said filter housing at the upper portion thereof; and
 seal means coacting with said cover and said upper portion of said filter housing to seal said filter housing.

5. The invention claimed in claim No. 1 wherein said base member includes drain means communicating with said passage means.

6. The invention claimed in claim No. 5 wherein the lowest portion of said passage means is disposed proximate said filter housing outlet in said base member; and
 said drain means are disposed at the lowest portion of said passage means.

7. The invention claimed in claim No. 1 wherein said pump means include:
 a centrifugal flow impeller having an inlet section and an outlet section;
 a pump casing having an outlet section and a vertically disposed inlet; and
 diffuser means disposed between said outlet section of said centrifugal flow impeller and said outlet section of said pump casing.

8. The invention claimed in claim No. 7 wherein:
 said filter means include a filter housing connected to and extending above said base member;
 and further comprising:
 generally vertically disposed discharge conduit means connected to said outlet section of said pump casing and extending above said base member; and
 bracing means connecting said filter housing and said discharge conduit to support said generally vertical discharge conduit.

9. The invention claimed in claim No. 8 wherein:
 said filter housing has an inlet disposed above said base member; and
 said pump impeller is disposed to rotate below the level of said inlet in said filter housing and below the end of said vertically disposed discharge conduit, so that liquid to be pumped will tend to remain in said pump casing during periods of nonoperation to augment the self-priming characteristic of said pump means.

10. The invention claimed in claim No. 7 wherein:
 said centrifugal impeller has a front shroud and a rear shroud; and
 said front shroud extends proximate said passage means in said base member.

11. The invention claimed in claim 1 and further comprising:
 a pump casing having an inlet and an outlet;
 a diffuser disposed in said casing about said impeller means;
 said diffuser and said pump casing forming an annular collection chamber in said pump casing; and
 drain means communicating said collection chamber with midinlet of said pump casing.

12. The invention claimed in claim 11 wherein said pump casing is formed from at least two mating members disposed in vertical relation to each other and bonded together.

13. A pump unit comprising:
 a base member;
 filter means connected to said base member having an inlet and having an outlet in said base member;
 pump means connected to said base member having a discharge and having an inlet in said base member;
 drive means for said pump means supported at least partially by said base member; and
 passage means in said base member communicating said outlet of said filter means with said inlet of said pump means;
 wherein said base member comprises:
 a bottom member;
 an intermediate member adjacent said bottom member;
 an upper member adjacent said intermediate member;
 each of said member constructed to mate with said adjacent member to form a continuous structure; and
 fastening means operatively associated with said members, adapted to facilitate the alignment and chemical fastening of said adjacent members.

14. The invention claimed in claim No. 13 wherein said fastening means comprise mating tongue and groove surfaces on said adjacent members.

15. The invention claimed in claim No. 14 wherein said grooved surfaces include a plurality of positioning nibs extending into said groove, to position said tongued surface with relation to said grooved surface.

16. The invention claimed in claim No. 13 wherein said upper member and said intermediate member, in assembled position, comprise:
 a pump casing having an outlet section and a vertically disposed inlet; and
 a filter housing extending above said pump casing.

17. The invention claimed in claim No. 16 wherein said upper member comprises:
 a generally vertically disposed discharge conduit for said pump means; and
 support means connecting said discharge conduit to said filter housing.

18. The invention claimed in claim No. 13 wherein said pump means comprise:
 a pump casing formed from said upper and intermediate members in assembled position, said pump casing having an inlet and an outlet;
 a centrifugal impeller rotatively disposed in said pump casing;
 casing passage means in the top of said casing, said passage means large enough to remove said impeller from said casing;
 casing cover means for said casing passage means; and
 shaft means extending through said casing cover means and connected to said impeller to drive said impeller.

19. The invention claimed in claim No. 18 further comprising:
 a diffuser disposed in said casing about said centrifugal impeller;
 said diffuser and said pump casing forming an annular collection chamber in said pump casing; and
 drain means communicating said collection chamber with said inlet of said pump casing.

20. The invention claimed in claim No. 19 wherein said drain means communicating said collection chamber with said inlet of said pump comprises:

diffuser positioning means operatively associated with said diffuser and said intermediate member; and
 at least one drain passage between said diffuser and said intermediate member extending from said collection chamber to the inlet of said pump casing.
 21. The invention claimed in claim No. 20 wherein:
 said diffuser positioning means is formed in said intermediate member; and
 said drain passage is a groove in said intermediate member and extending through said diffuser positioning means.
 22. The invention claimed in claim No. 20 further comprising entrapped gas eliminating means comprising:
 a rear shroud on said impeller;
 a rear impeller chamber in said pump casing disposed between said rear shroud of said centrifugal impeller and said casing cover means;
 balancing passage means in said rear shroud of said centrifugal impeller communicating said rear impeller chamber with the inlet portion of said impeller; and
 vent passage means communicating the upper portion of said collection chamber with said rear impeller chamber so that liquid discharged into said collection chamber will circulate from said collection chamber to said rear impeller chamber to force gases in said collection and said rear impeller through said balancing passage means into said centrifugal impeller where the gases will be carried off with the liquid passing through said impeller.
 23. The invention claimed in claim No. 22 wherein said vent passage means are disposed between said diffuser and said upper member.
 24. The invention claimed in claim No. 23 wherein said vent passage means comprise a channel in the upper surface of said diffuser.
 25. The invention claimed in claim No. 22 further comprising:
 a cylindrical section extending from said rear shroud of said impeller into said rear impeller chamber to rotate in said rear impeller chamber;

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a stationary cylindrical section extending from said casing cover means into rear impeller chamber disposed concentrically with relation to said rotating cylindrical section to separate said rear impeller chamber into rear shroud discharging chamber and seal chamber; and
 said rotatable and said stationary cylindrical sections coacting to impede fluid flow between said rear shroud discharge chamber and said seal chamber.
 26. The invention claimed in claim No. 18 further comprising:
 motor means operatively connected to said shaft means to drive said impeller; and
 motor mounting means connecting said motor means to said base member to operatively support and position said motor to drive said pump means.
 27. The invention claimed in claim No. 26 wherein:
 said casing cover means include said motor mounting means;
 and further comprising positioning means on said pump casing and said casing cover, coacting to align said motor mounting means with relation to said pump casing.
 28. The invention claimed in claim No. 27 further comprising means to position said motor means, including:
 an aligning lip on the face of said motor means adjacent said pump casing; and
 positioning surface means extending from said motor mounting means to coact with said aligning lip to position said motor means with relation to said motor mounting means.
 29. The invention claimed in claim 22 wherein:
 said drain means include a front shroud discharge chamber adjacent said impeller and communicating said pump casing; and
 said front shroud chamber is adapted to pass relatively gas-free liquid from said collection chamber to said front shroud chamber and back into said impeller inlet to provide said pump with self-priming characteristics.
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