April 25, 1961 F. N. ZIMMERMANN ET AL 2,981,196

CONDENSATE PUMP AND CONTROL MEANS

Filed April 27, 1959 3 Sheets-Sheet 1

Fig. 1.

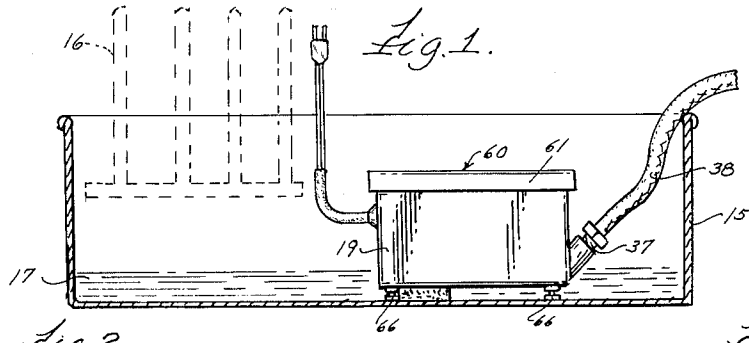


Fig. 2.

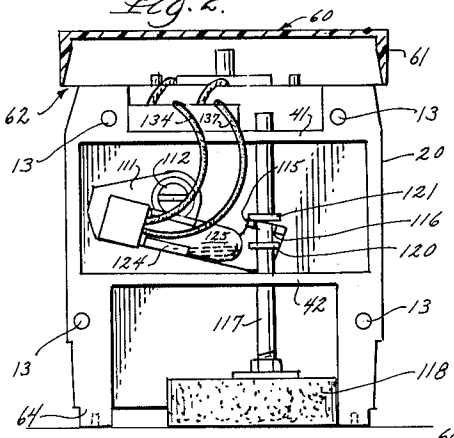
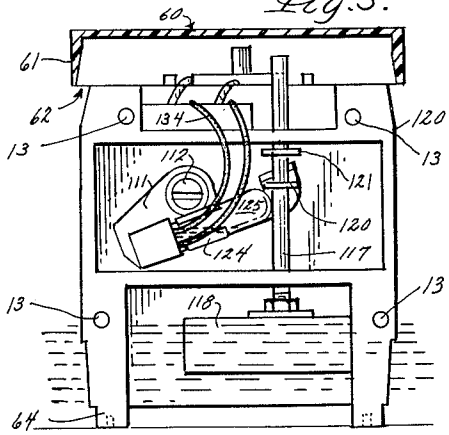


Fig. 3.



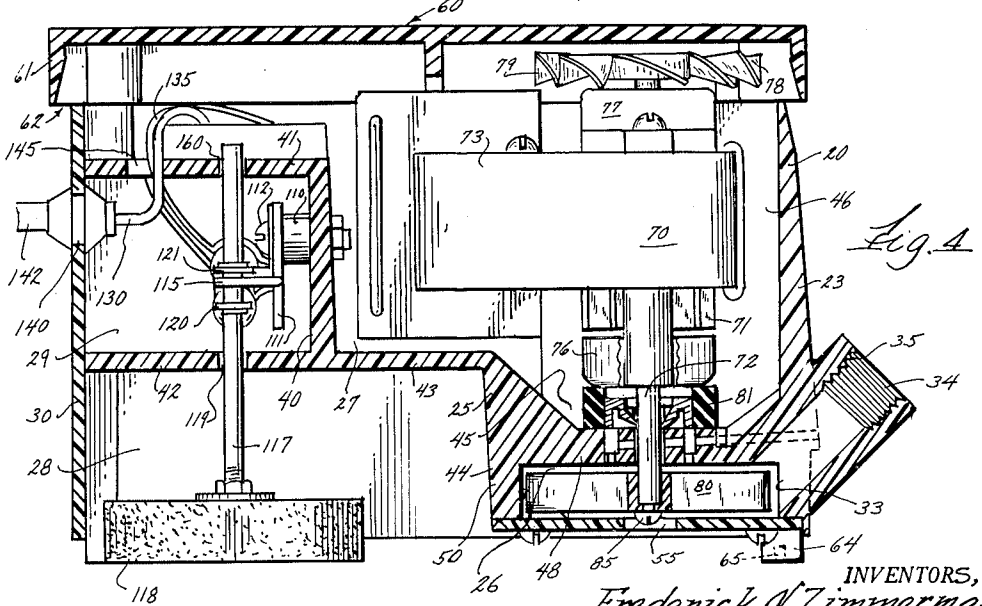


Fig. 4.

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CONDENSATE PUMP AND CONTROL MEANS

Filed April 27, 1959 3 Sheets-Sheet 2

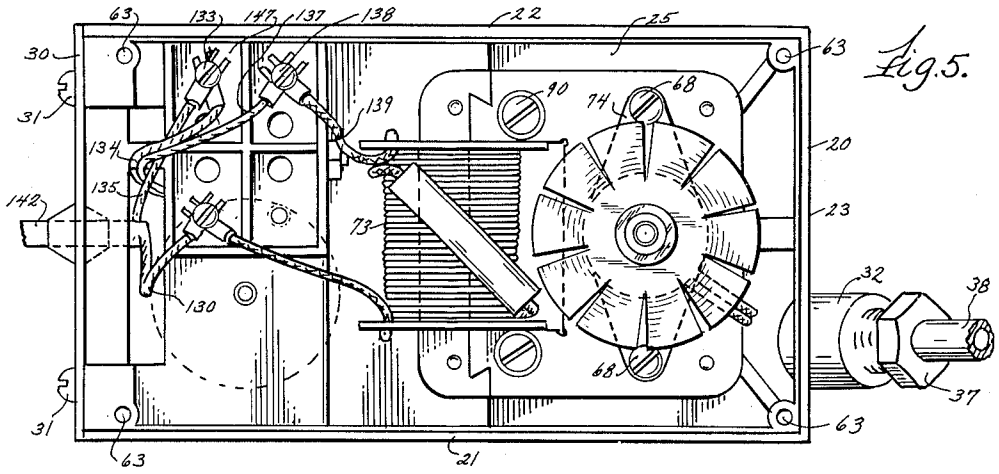


Fig. 5.

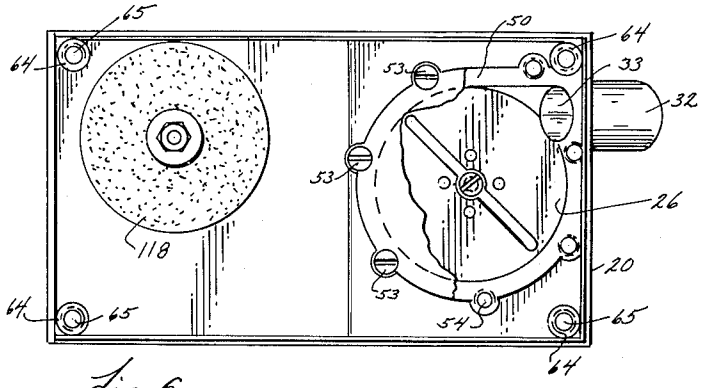


Fig. 6.

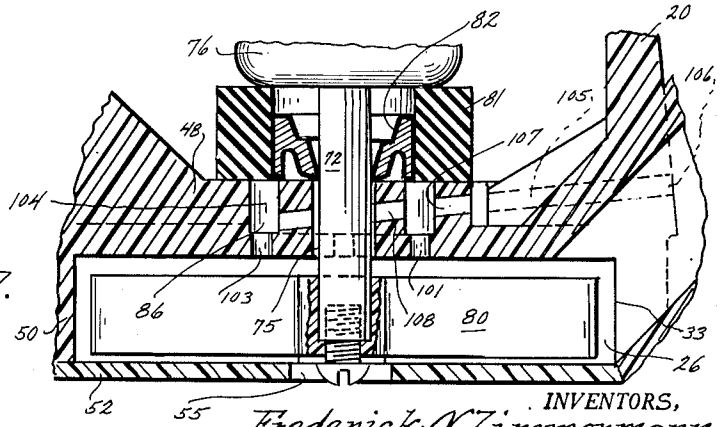


Fig. 7.

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CONDENSATE PUMP AND CONTROL MEANS

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Fig. 8.

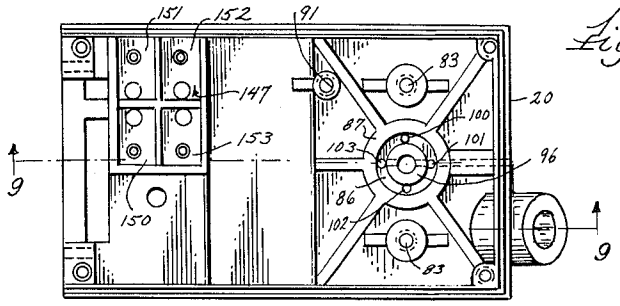
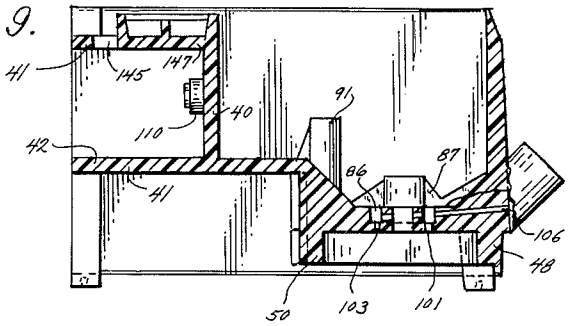


Fig. 9.



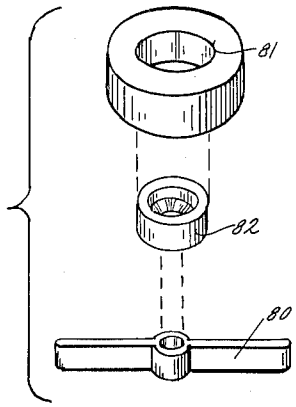


Fig. 10.

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United States Patent Office 2,981,196
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2,981,196

CONDENSATE PUMP AND CONTROL MEANS

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Filed Apr. 27, 1959, Ser. No. 809,263

4 Claims. (Cl. 103—26)

The present invention pertains to a novel pump and control means designed particularly for draining purposes, but also capable of service for the general purposes of elevating water and other liquids.

It is among the objects of this invention to provide an electrically driven pump with electric motor, the hydraulic pumping elements, and the float control mechanism embraced in the same housing, the lower portion of the housing constructed in such a manner that it can be submerged in water such as found in a drip pan beneath an air conditioning apparatus, or the like, whereby the pump will run for a period of time at high efficiency, without trouble or care until the drip pan, or the like, is substantially dry.

In our U.S. Patent 2,829,598, issued April 8, 1958, we described and claimed a "Condensate Pump and Controls" where the float control mechanism was enclosed within a separate enclosure. The present invention relates to a different type housing for enclosing all the units and effected by cooling means, for accomplishing new and novel results.

Accordingly, this invention relates to a pump of the referred to class, a construction and arrangement which is more efficient than corresponding pumps now in use.

A particular object of this invention is to provide an efficient combination unitary housing and cover assembled in spaced relation therewith, allowing air to be circulated in and around the motor within the housing by a fan assembled upon the upper end of the motor shaft.

Another object of this invention is to provide in a portable pump having a centrifugal impeller, means whereby the friction load of the fluid is materially reduced with reference to pumps of the same general type.

Another object of this invention is to provide, a portable pump housing with a pump mounted with its pump shaft arranged vertically, and embodying a fan cooling means at its upper end to draw air inwardly and outwardly over the motor so as to cool and prevent fluid from accumulating on or near the motor, and with an impeller on its lower end having radially and horizontally disposed blades to raise the water into the impeller chamber and thence upwardly and outwardly through the outlet pipe.

Another object of this invention is to provide a portable pumping unit comprising a plastic pump housing, with motor, pump and float control means assembled therein where the parts are closely coupled and in which the whole of the instrumentality is of low height and small mass, whereby it will fit conveniently into very tight drip pan locations and providing adjustable legs for positioning in drip pans having an irregular shape and angularly arranged floors.

Another object of this invention improve upon the condensate pumps of earlier inventions where the pump housings are partially submerged under water and the pump runs continuously, when there is water in the pan, or when the pan is substantially dry, running twenty-four (24) hours a day, or until manually stopped. Said

earlier type pump thereby functions for hours when it is not necessary, since an average pump will maintain a drip pan substantially dry seventy percent of the time. This novel pump is automatically controlled, does not run continuously unless necessary and being air cooled will run for a greater period of time without repair.

Another object of the invention is to provide a pump construction and method of pumping water and other liquids, wherein both the driving motor, and pump impeller may be correctly centered in vertical alignment within the pump housing constructed of plastic material and wherein the impeller may be properly borne and suspended within the pump chamber and supported both axially and radially with such accuracy by the unitary plastic housing to obviate outboard bearings, universal joints or loose couplings between the motor and impeller.

Another object of this invention is to provide a portable pump of the class described with a more efficient seal for preventing fluid being forced and/or from seeping into the motor chamber; the lower motor thrust bearing casing resting upon an annular resilient seal sleeving the upper portion of the impeller shaft.

And still another object of this invention is to provide a portable rotary pump handling a substantial volume of water and having a natural tendency to create a circular motion of the body of water in which the pump is partially submerged, mixing air with water, and including air-bleed passageways to effectively prevent, check, or relieve air locks within the entire impeller cavity. By the present invention, air-bleed passageways are provided within a partition separating the interior of the pump housing into an impeller cavity on one side thereof and a motor chamber on the other side thereof; the small air-bleed passageways and larger channels forming a manifold type channel between the low pressure areas of the impeller cavity and the exterior of the pump housing, which effectively relieves, checks, or prevents the formation of an air lock within the impeller cavity and annular bore about the impeller shaft.

Accordingly, a primary object of this invention is to provide a novel condensate pump free of air locks and with a control float means, all arranged within a unitary pump housing with end plate and cover and adapted to run intermittently as desired to empty a sump, a drip pan, or the like, to substantial dryness.

An additional object of the present invention is to provide a method of making, assembling and cooling a portable pump for carrying out some, or all, of the preceding objects and more particularly to provide a method of locating a planetary air-bleed system, locating and aligning the motor and impeller parts of a pump with respect to their respective working chambers and cooperating parts, housing, float mechanism, and instrumentalities.

Other objects include providing method and means for making an efficient, compact, longlived, rugged rotary pump economically and effectively.

Other objects and features of the invention will be set forth more fully hereinafter.

The full nature of the invention will be understood from the accompanying drawings and the following description.

In the drawings:

Figure 1 is a fragmentary view in side elevation, partially broken away and in section, illustrating the portable condensate pumping unit and control means of this invention in operative relation to a drip pan beneath an evaporator, or an air conditioning apparatus shown in phantom by dotted lines, from which liquid is to be pumped when it accumulates in the pan to an undesirable depth;

Figure 2 is an end view of the condensate pump hous-

ing shown in Figure 1, with the end cover plate removed;

Figure 3 is an end view similar to Figure 2 with the float and switch mechanism shown in raised position;

Figure 4 is a side elevational view of the pump shown in Figures 1, 2 and 3, with parts broken away and parts shown in section;

Figure 5 is a top plan view of the condensate pump shown in Figures 1, 2, 3 and 4 with the cover removed and parts broken away;

Figure 6 is a bottom plan view of the condensate pump shown in the other figures, showing the float upon the float shaft, and showing the cover of the impeller chamber broken away to show the impeller assembled upon the impeller shaft within the impeller chamber;

Figure 7 is an enlarged fragmentary view as shown in Figure 4, showing the motor bearing housing resting upon the annular resilient seal about the impeller shaft, and further showing the air-bleed manifold system in the pump;

Figure 8 is a top plan view of the pump housing without the cover or end plate assembled therewith, and all cooperating parts of the pump removed therefrom;

Figure 9 is a sectional view of the pump housing taken substantially on line 9—9 of Figure 8; and

Figure 10 is an exploded view in perspective of two annular sealing means and the impeller as used and arranged with the pump of this invention.

Referring to the drawings, the reference numeral **15** designates a suitable, conventional illustrated drip pan, or reservoir, or the like, beneath the evaporator **16** shown dotted, in which a small quantity of liquid **17** is shown; as more liquid is collected it is to be removed from the drip pan **15** by the condensate pump, or unit **19**, when partially immersed in said liquid and float raised thereby.

Referring to Figures 2 through 7, wherein details of the construction of the pumping unit **19** are illustrated, the pumping unit consists of a pump housing **20** constructed from a suitable plastic, embodying a front wall **21**, a rear wall **22**, one end wall **23**, an integrally connected inner wall **25** arranged transversely and between said front, rear and end walls dividing said housing **20** into an impeller chamber **26**, a motor chamber **27**, a float chamber **28** and switch control chamber **29**. A plastic end plate **30** is secured to the end of said housing opposite said wall **23** by screws **31** in threaded bores **13**, shown by Figure **5**. An integral cylindrical hub portion **32** is formed with said end wall **23** and extends angularly and upwardly therefrom. Said hub portion **32** being bored out to form an interior opening **33** leading into the impeller cavity **26**, and forming an exterior opening **34**. The opening **34** is provided with threads **35** to receive a pipe fitting **37** adapted to retain a suitable hose, iron pipe, or copper tubing **38**.

The integral plastic wall **25** embodies a vertical partition **40** intermediate the ends of said housing **20**, a horizontal top shelf member **41** and horizontal bottom shelf member **42** extending longitudinally therefrom toward the open end of said housing, a horizontal shelf **43** extending longitudinally toward the closed end of said housing, said shelf **43** being substantially mid-way between the upper and lower edge portions of said housing, said shelf **43** formed with a depending wall **44** forming with the front, rear, and end walls a sump **45** and lower most portion of the motor chamber **46**, the upper portion of said chamber **46** enclosed by front wall **21**, rear wall **22**, end wall **23** and partition **40**. The bottom end of said depending wall **44** turns and extends horizontally and longitudinally towards the closed end of the housing forming the base wall **48**, said wall **48** being a common wall forming the base of said sump **45** of motor chamber **46** and forming the top wall of the impeller chamber **26**. An annular wall **50** is integrally formed with and depending from said wall **48** and forming the circular side wall of said impeller chamber **26**. Said impeller chamber **26** is closed by a bottom plate **52** to form the enclosed impeller cavity. Said plate **52** is secured to the bottom of said wall **50** by thread screws **53** extending into threaded bores **54**; shown by Figure 6. Said plate **52** is provided with a central opening **55** for the entry of liquid **17** into the impeller chamber **26**; shown by Figures 4 and 7. The upper portion of said housing **20** is covered by a rectangular shaped cover **60** with depending walls **61**, said cover is larger than the rectangular upper portion of said housing so that the depending walls **61** extend outwardly from the vertical walls of said housing providing air space **62**; clearly shown by Figure 4. The corner portions of said cover **60** are provided with vertical counter sunk openings through which thread screws extend and secure the cover to threaded bores **63** in the upper corner portions of said housing, shown by Figure 5. The lower portion of said housing **20** is formed with cylindrical vertical leg member **64** arranged in the corner portions thereof. Said members **64** embody threaded bored openings **65** to receive adjustable bolts, the heads **66** of said bolts supporting the entire pump **19** in the drip pan **15** whereby the bolt heads **66** elevate the bottom plate **52** a desired distance above the bottom of said drip pan **15**.

Referring to Figures 4, 5 and 7, the motor chamber **27** is shown enclosing an electric motor **70** having a rotor **71** rotatable on a vertical axis and driving shaft **72**. It will be noted that the motor has the field coils **73** mounted to one side of the rotor **71**, and above shelf **43**. Said base wall **48** is provided with a cylindrical opening **75** to loosely receive the lower end portion of shaft **72**, allowing the lower end of the shaft to extend into the impeller cavity **26**. The impeller **80** is attached to the lower end of said shaft **72** by screw **85**, and driven thereby, is disposed in the impeller chamber, or cavity **26**. An annular washer, or grommet **81**, with cylindrical opening is assembled with a rubber covered shaft seal **82** and positioned upon said shaft **72**, whereby the grommet **81** and seal **82** rest upon the upper surface of wall **48** about the opening **75**. The bearing cap **76** of motor **70**, shown in Figure 4, rests upon the top annular surface of said grommet **81**, said grommet **81** and said seal **82** sealing the opening **75** around shaft **72** between the sump **45** in motor chamber **46** and said impeller cavity **26**, preventing any liquid from entering said motor chamber. The upper end of the driving shaft **72** extends through bearing cap **77** and has a fan **78** secured to the free end thereof by a suitable means. The blades **79** of the fan **78** are in the form of vertically disposed curved vanes extending horizontally outwardly from said shaft **72** to circulate the air within the motor chamber **46**; cool air being drawn in and forced outwardly between the closure **60** and top of the chamber walls through opening **62**. The bearing caps **76** and **77** are secured to a spider type bracket **74** secured to the casing of the motor and is secured as by bolts **68**, the threaded lower ends of the bolts **68** extending into threaded bores **83** arranged in base wall **48**. A screw **90** extends through the motor casing and is secured in threaded bore **91** in base wall **48**, shown in Figures 5, 8 and 9.

The base wall **48** is provided with plastic reinforcing ribs and a circular hub portion **87** with an annular groove, or channel **86**, shown in Figure 8. It will be observed that the wall **48** below said channel **86** is provided with four small vertical air-bleed passageways **100**, **101**, **102**, **103**. The grommet **81** and shaft seal close the upper portion of said channel **86**, forming a circular cavity **104**. An air bleed channel **105** extends from an opening **106** in the outside of said pump housing **20** straight through said base wall **48** to said channel **86**, said air bleed channel **105** is arranged centrally and longitudinally of the housing and in a plane arranged five degrees from the horizontal. The hub portion **96** formed by cylindrical opening **75** and channel **86** is provided with air bleed channel **108**; said channel **108** being in alignment with channel **106** and formed by the same drilling operation,

the drill entering the side wall **23** forming opening **106**, extending through wall **48** forming opening **107** in wall of channel **86**, and extending through the hub portion **96** forming the two air bleed channels **108** in the hub portion **96**. These air bleed channels **105** and **108** form direct communication with the circular channel **86** and cylindrical opening **75** about shaft **72**, whereby all air in pockets about the shaft in the impeller chamber **26**, or areas thereabout, is completely removed, the air being forced out of opening **106**.

The pump control unit is substantially enclosed in chambers **28** and **29**, closed by plastic plate **30** secured thereto by screws **31**. A plastic hub **110** is formed on the vertical partition **40** and extending horizontally into said switch control chamber **29**. A switch arm **111** is pivotally mounted upon said hub **110** by pivot bolt **112** screwed into said hub **110**. Said arm **111** is composed of a vertical body portion **113**, an intermediate extending vertical arm portion **114** and a horizontal free end portion **115**, said free end **115** having an aperture **116** therein to allow a vertical float rod **117** to pass freely therethrough; said rod **117** having an annular float **118** secured at the lower free end thereof. Said rod **117** extends vertically and is guided through opening **119** in shelf **42** and opening **160** in shelf **41**. The float **118** is generally a hollow metal float, however in this particular instance the float **118** is an annular disc of "Styrafoam," the guide rod **117** suitably secured therethrough. Intermediate the ends of said rod **117** are properly spaced two retaining rings, a lower ring **120** and an upper ring **121**. Said rings may be referred to as float stops secured to said rod **117**, whereby the free end **115** of the arm **111** alternately engages said rings during the travel of said rod upwardly and downwardly. The float is intended to ride upon the surface of the liquid body of water in the drip pan **15**. The intermediate portion **114** of arm **111** is provided with a clip **124** to carry a mercury switch **125**. In the normal lower position of the float, as shown by Figure 2, the mercury switch **125** is arranged to be in open position. As soon as the liquid level in the drip pan **15** rises above the specified height, the float **118** rises with such liquid and the rod **117** moves upwardly causing ring **120** to engage the free end **115** of arm **111**, said arm will tilt about the pivot bolt **112** causing the mercury in the switch to close the contacts therein and the motor circuit, thus establishing pump operation. When the float rod **117** drops due to lowering of the float, the ring **121** contacts the upper surface of arm end **115**, tilting said arm **11** downwardly, causing the mercury to open the contacts and the motor circuit. In this way the action is automatic, the float and the mercury switch closing and alternately opening the circuit to the motor **70** and as a consequence maintaining a substantially dry condition in the drip pan **15**. The electric current circuit is clearly shown by Figures 2, 3 and 5, line **130** is secured to the terminal block **128** by screw **129** where it is joined by line **131** connected to the motor **70**; line **135** is secured to the terminal block **147** by screw **133** where it is joined by line **134** connected to the mercury switch **125**; return line **137** leading from the mercury switch is secured to the terminal block by screw **138** where it is joined by a line **139** connected to the motor **70**. The flexible cord **142** embodying lines **130** and **135** extend through an opening **140** in the plastic end plate **30** into chamber **29**. The lines **130**, **135**, **134** and **137** extend from chamber **29** through a transverse rectangular shaped opening **145** in shelf **41**, to the various connections as described above. The terminal block **147** is an integral part of shelf **41** and is divided into four separate compartments **150**, **151**, **152** and **153** by suitable vertical ribs. The compartments separate the metallic connections on the ends of the electric current carrying line preventing short circuit of the same.

The impeller cavity **26** is closed except for openings **33** and **55**. Water enters the impeller cavity **26** through opening **55** and is forced outwardly through the opening **33** and through hose **38**. The float control chamber **28** is entirely open at its lower portion so that the float is free to drop to substantially drip pan floor level when placed therein. In assembly the float control mechanism, the float rod **117** is inserted from the base of the unit, said rod is passed through aperture **119** in shelf **42**, ring **120** is placed upon said rod **117**, said rod is then passed through aperture **116** in free arm end **115**, ring **121** is then placed upon the rod **117**, and the upper end of rod **117** is then passed through opening **160** in shelf **41**; the proper positioning of rings **120** and **121** regulates the proper functioning of said mercury switch and in turn the proper operation of the pump. The shaft seal **82** is a substantially rigid member, it can be made of metal and covered with rubber to resiliently sleeve the shaft **72**. The pressure of the thrust bearing cap upon the grommet **81** presses the grommet tightly upon the upper surface of wall **48** and into tight engagement with the shaft seal **82**; thereby closing the upper open portion of channel **86** making it a closed air-bleed cavity. The air bleed channels **105** and **108** extending from the area about said shaft **72** to the exterior in a slight upwardly and outwardly manner prevents air-locks any place between the impeller chamber **26** and exterior opening **106**.

The terms and expressions which have been herein employed are used as terms of description and not limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described. It is recognized that various modifications are possible within the scope of the invention claimed.

Having thus described this invention, what we claim as new and desire to secure by Letters Patent is:

1. A portable electric water condensate pump, comprising: a unitary supporting housing and a housing cover, said housing being of rectangular configuration in a horizontal plane, said housing having a pumping chamber, a motor chamber, a float chamber, a switch chamber therein; said housing having a closure assembled therewith and spaced slightly therefrom forming an air passageway, said pumping chamber provided with a liquid inlet and a liquid outlet; the base portion of said housing adapted to be immersed, at least in part, in a supply of liquid to be pumped; said housing cover being wider and longer than said supporting housing, said motor chamber being open to the atmosphere effected by the perimeter of the housing cover being spaced at a distance from the entire peripheral edge portion of said supporting housing, a motor with a lower bearing cap supported within said motor chamber, a vertical shaft assembled with said motor, said motor for driving said vertical shaft extending vertically through the body of the housing and connected to the motor; a fan mounted on the upper end of said shaft and rotatable therewith to circulate the air within the motor chamber; an impeller mounted on the lower end of said shaft and rotatable therewith in said pumping chamber; said pumping chamber having an upper wall; a manifold-type air bleed passage including an annular channel arranged within said upper wall; an annular grommet and a shaft seal assembled upon said shaft above and in contact with the upper surface of said upper wall, said lower bearing cap resting upon the top annular surface of said grommet exerting pressure on said grommet and sealing the open upper portion of said annular channel, the proximal end of said air-bleed passage in communication with said pumping chamber; the distal end of said air-bleed passage open to the atmosphere, allowing entrapped air within the pumping chamber to escape; said motor chamber and said pumping chamber in one end of said housing; said float chamber and said switch chamber arranged one above the other in the opposite end of said housing, a first shelf horizontally formed between said float chamber and said switch chamber, said

float chamber arranged below said switch chamber and open at its bottom end and substantially closed at its upper end by said shelf; a supporting arm bracket pivotally attached to a vertical wall of said housing and confined within said switch chamber; a movable float and associated guide rod in said float chamber; said guide rod extending upwardly through an opening in said first shelf and through an opening in a second shelf which substantially closing the upper end of said switch chamber, a terminal block integrally formed with the upper surface of said second shelf, a circuit embodying a normally open switch connected to said terminal block and from there to said motor; said switch supported by said arm bracket; means upon said rod for controlling the action of said arm; said switch closed when said float and said rod are elevated incident to rising liquid in the float chamber as said rod elevates one end of said arm supporting said switch, and said switch opening when the float and rod lower incident to declining level of liquid in the float chamber; whereby water is pumped out of said pump chamber by said impeller and air is circulated within said motor housing by said fan when said switch closes said circuit.

2. A portable electric condensate pump according to claim 1 wherein said manifold-type air-bleed passage comprises an annular channel; a plurality of vertical air-bleed passages connecting said annular channel with the pumping chamber; and a longitudinal air-bleed passage joining said annular channel with the annular space about the vertical shaft in the upper wall of said pumping chamber with the atmosphere.

3. In a device of the kind described for use with a drip pan for collecting and holding a body of water concentrate; a portable pump for discharging water concentrate from any drip pan in order to obtain a substantially dry condition within said pan; said pump comprising a housing and housing cover, said housing having a pumping chamber, a motor chamber, a switch chamber and a float chamber; said motor chamber being located above said pumping chamber and arranged in one end of said housing; said switch chamber arranged above said float chamber at the opposite end of said housing; said float chamber open at its lower end and substantially closed by a shelf at its upper end which forms the base of said switch chamber; a second shelf substantially closing said switch chamber at its upper end; a motor supported within said motor chamber, a vertical impeller shaft depending from said motor, said motor for driving said vertical impeller shaft extending downwardly therefrom and extending into said pump chamber; said housing cover being wider and longer than said supporting housing, said motor chamber being open to the atmosphere effected by the perimeter of the housing cover being spaced at a distance from the entire top peripheral edge portion of said supporting housing, an impeller mounted on the lower end of said shaft and rotatable therewith in said pumping chamber; a movable float and vertical supporting rod arranged within said float chamber, vertically aligned openings in said shelves, said rod extending upwardly through said vertically aligned opening in the first and second shelf; stop means assembled upon said rod within said switch chamber for controlling an arm-type lever pivotally mounted upon an integral hub formed on the transverse vertical wall of said switch chamber; a circuit embodying normally open mercury switch connected to said motor; said switch supported upon said arm-type lever; one end of said arm-type lever and said switch being moved upwardly to close the switch when said float and rod are elevated incident to rising liquid in said reservoir and surrounding the base of said housing, said switch again becoming open when the float and rod lower incident to the declining level of liquid around said housing; and a fan connected to the upper end of said impeller shaft and rotatable therewith above said motor in said motor chamber; whereby the air is circulated and the motor cooled by said air when said switch is closed in said circuit.

4. A portable electric water condensate pump comprising, in combination, a one piece supporting housing having detachably secured therewith one housing end wall and a housing cover, said housing having an integral, substantially rectangular transverse bottom wall located a distance above the lower extremities thereof, said detachable housing end wall being of rectangular configuration, said detachable housing cover being wider and longer than said supporting housing and rectangular in shape with depending flanges spaced at a distance from the top peripheral edges of said supporting housing and said detachable end wall to provide an air passage space therearound, said supporting housing having a pumping chamber located in the closed end portion thereof and arranged beneath said transverse bottom wall thereof, a motor chamber located within the closed end portion of said supporting housing above the bottom wall and directly above said pumping chamber, said pumping chamber having an integral vertical cylindrical side wall with a detachable circular bottom cover having a central aperture providing a water condensate inlet, a water condensate outlet formed in one side of said cylindrical side wall, the base portion of said housing adapted to be immersed, at least in part, in a supply of water condensate to be pumped, a motor supported within said motor chamber, a vertical impeller shaft depending from said motor and extending downwardly therefrom and into said pump chamber through an opening in said bottom wall, an impeller mounted on the lower end of said shaft in said pumping chamber and rotatably driven by said motor, a float chamber located in the opposite end of said supporting housing from the end embodying said pumping chamber and arranged below said bottom wall thereof, an integral vertical partition formed with said bottom wall and arranged intermediate the ends of said supporting housing, an integral top shelf member horizontally formed with the upper portion of said vertical partition forming a switch chamber C-shaped in longitudinal cross-section and closed by said detachable end wall and the side walls of said housing, said switch chamber located directly above said float chamber and having apertures centrally arranged in said top shelf and the bottom wall embodied therewith and said apertures vertically aligned with each other, a float and guide rod within said float chamber with the upper end portion of said rod extending through said apertures and through said switch chamber, the vertically aligned openings permitting vertical movement of said float and rod, a normally open mercury switch pivotally connected by means of an arm to said vertical partition of said switch chamber, said switch combined with a circuit connected with said motor, said mercury switch closed automatically when the float raises incident to rising water condensate in the float chamber for controlling the action of said motor and impeller, and said switch opening automatically when the float lowers incident to declining water condensate in the float chamber.

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