April 1, 1941. R. T. CORNELIUS 2,236,621

MOTOR PUMP UNIT

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Fig. 1

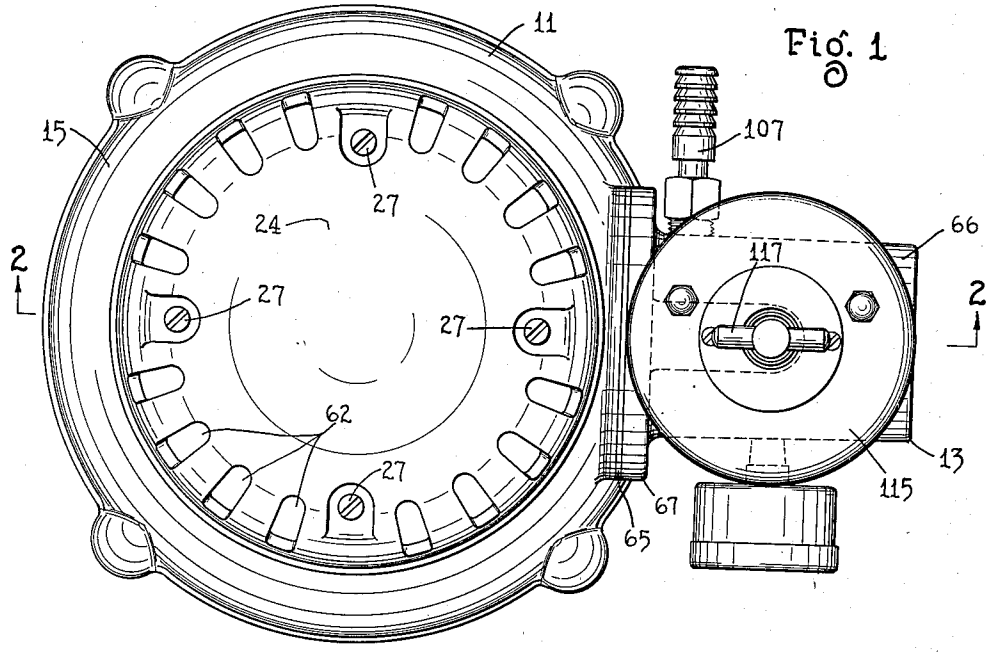
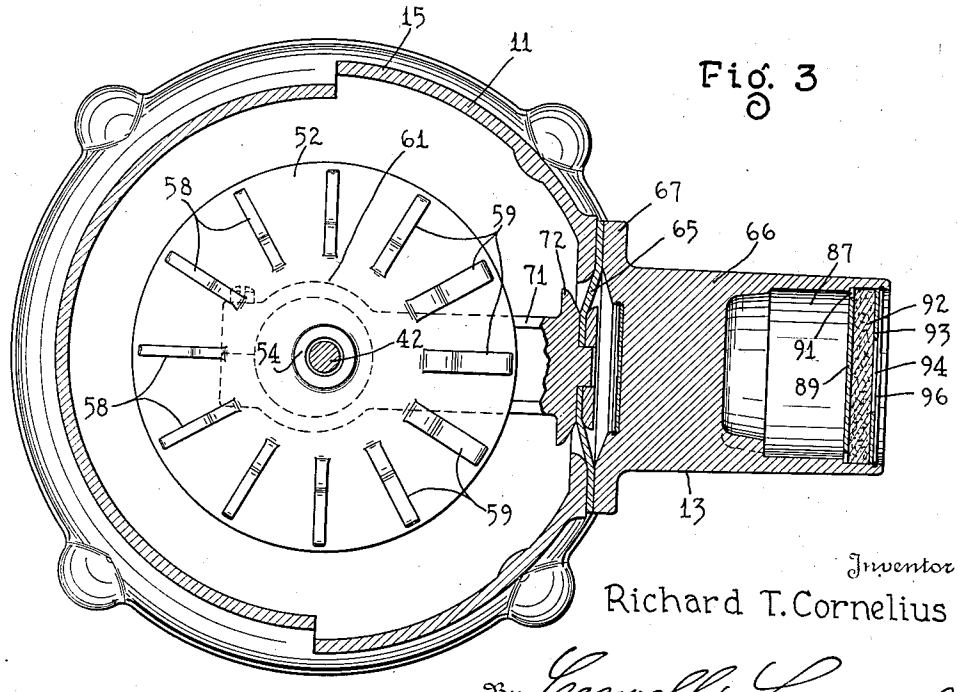


Fig. 3



Inventor

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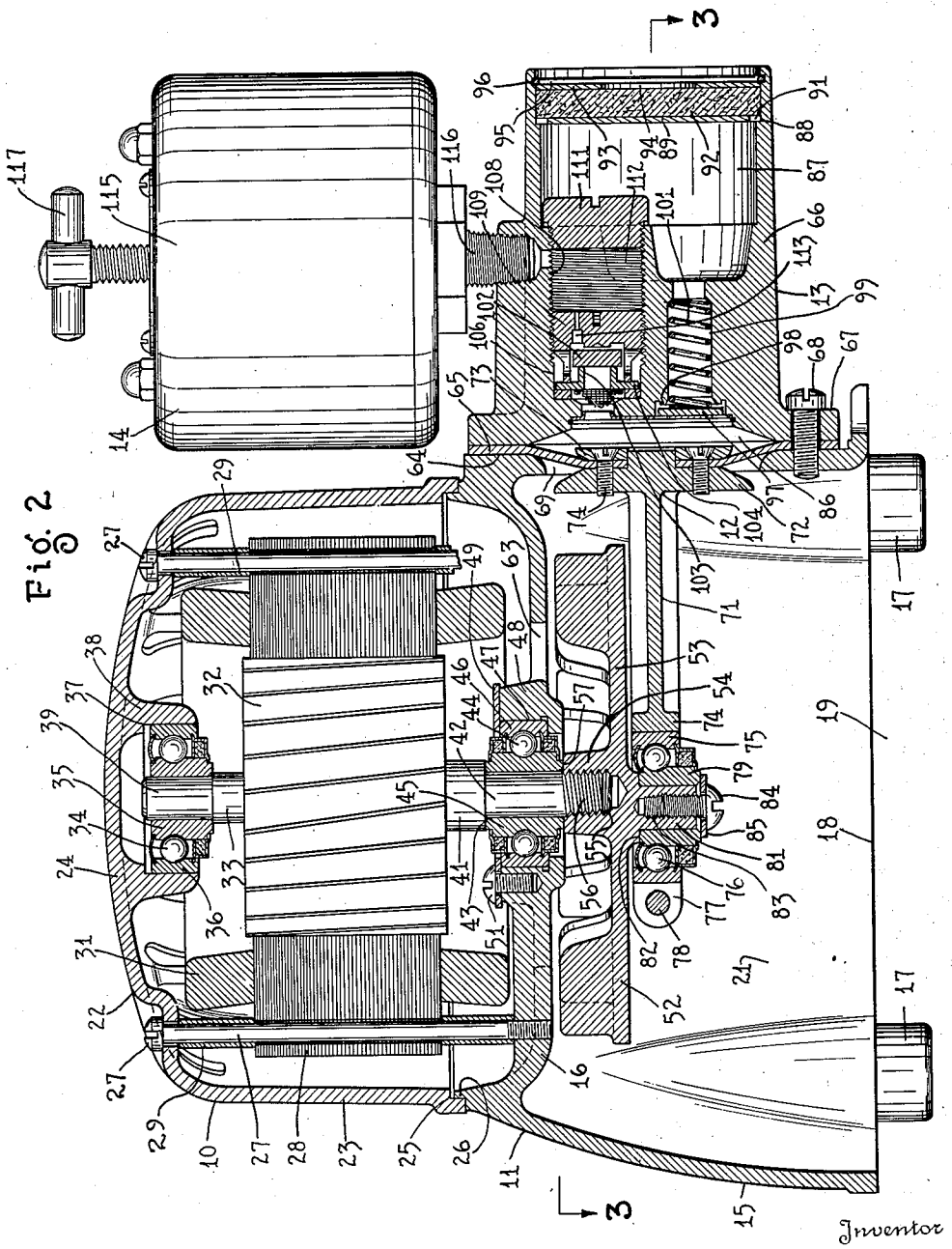
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Fig. 2



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2,236,621

MOTOR PUMP UNIT

Richard T. Cornelius, Minneapolis, Minn.

Application April 17, 1939, Serial No. 268,278

10 Claims. (Cl. 230—211)

My invention relates to motor pump units and has for an object to provide an exceedingly simple and compact construction by means of which compressed air may be readily procured.

Another object of the invention resides in utilizing a fan for cooling the motor and pump and in directly connecting the crank for operating the pump to the fan.

Another object of the invention resides in utilizing a ball bearing for the end of the motor shaft driving the pump and in utilizing the fan in securing the bearing to the motor shaft.

A still further object of the invention resides in utilizing the fan for drawing air through the motor to cool the same and discharging the air against the pump to cool the pump.

A feature of the invention resides in providing a hollow base for the motor pump unit open at the lowermost portion thereof and in arranging the operating mechanism for the pump within the base.

Another object of the invention resides in constructing the motor pump unit so as to completely avoid the use of pipes, tubes or fittings for connecting the compression chamber with the control device and outlet of the motor pump unit.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and described.

In the drawings:

Fig. 1 is a plan view of a motor pump unit illustrating an embodiment of my invention.

Fig. 2 is an elevational sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a plan sectional view taken on line 3—3 of Fig. 2.

My invention comprises a motor 10 of the vertical shaft type which is mounted on a base 11. Within the said base is provided a pump 12 which includes a valve mechanism 13 attached to the base 11. Associated with the valve mechanism 13 is a control device 14 by means of which the pressure procured by the pump 12 may be regulated. These various parts will now be described in detail.

The base 11 consists of a skirt 15 which is open at the bottom and is closed at the top through a horizontally extending wall 16. The base 11 has secured to the lowermost portion thereof four feet 17, which are preferably constructed of rubber or some suitable material by means of which the motor pump unit is supported and which serve to hold the lower edge 18 of the base 11 above the surface on which the unit rests. By means of the feet 17 passageways 19 are provided whereby air may be drawn from the exterior and into the chamber 21, formed within the base 11.

The motor 10 consists of a housing 22 having a cylindrical wall 23 and an end wall 24 connected therewith. The wall 23 is provided with an annular groove 25. A lip 26, formed on the upper edge of the skirt 15 of base 11 is seated within the groove 25 and holds the housing 22 centered with respect to the base 11. The housing 22 is attached to the base 11 by means of screws 27 which extend through the wall 24 of said housing and are threaded into the wall 16 of base 11.

Within the housing 22 is mounted the core 28 of motor 10 which is supported within said housing on the screws 27 and which is held in position within said housing by means of spacers 29 mounted on the screws 27. This core carries the usual windings 31 which have not been shown in detail and which form no particular feature of the invention. Rotatably mounted within the core 28 is a rotor 32 which is mounted on a shaft 33. This shaft is journalled at its upper end by means of a ball bearing 34 having an inner race 35 and an outer race 36. Race 36 is received within a socket 37, formed on a boss 38 cast integral with the wall 24 of housing 22 and projecting inwardly into the said housing. The race 35 fits upon the extreme end 39 of the shaft 33. The race 36 fits sufficiently free with respect to the socket 37 with which it is associated so that the bearing may float longitudinally.

The lower end of the shaft 33 is supported in a similar manner. This end of the shaft is formed with an enlarged portion 41 which is reduced as indicated at 42 to form a shoulder 43 at such locality. The portion 42 of shaft 33 has mounted on it a ball bearing 44 which comprises an inner race 45 and an outer race 46. The race 46 is received within a socket 47 formed in a boss 48, cast in the wall 16 of base 11. This race is securely clamped in position within said socket by means of an annular plate 49 which is held attached to the boss 48 by means of screws 51. The inner race 45 of ball bearing 44 butts against the shoulder 43 and is held in position against said shoulder by means of a feature of the invention to be presently more fully described.

Within the chamber 21 in base 11 is provided a fan or blower rotor 52 which is constructed

with a disc 53 having a hub 54 at the center of the same. The hub 54 is threaded, as designated at 55, to receive the threaded end 56 of the shaft 33. The hub 54 is constructed with a shoulder 57 which is adapted to engage against the outer end of the race 45. When the boss 54 is screwed upon the threaded end 56 of shaft 33, the said boss firmly clamps the race 45 of bearing 44 in position upon said shaft and at the same time rigidly holds the fan 52 mounted on the said shaft. The fan 52 has a number of blades 58 and 59 formed on the same which are arranged near the outer periphery of the fan and which serve to circulate air. The portion of the fan, adjacent the hub 54 is constructed without blades to provide a central chamber 61 free from blades. The wall 24 of housing 22 is constructed with a plurality of annularly disposed ventilation openings 62 which are arranged in proximity to the windings 31 on the core 28. The wall 16 of base 11 is constructed with a number of openings 63 which are arranged in close proximity to the hub 48 and which communicate with the chamber 61. It will readily be comprehended that, as the motor 10 operates, the fan 52 functions to draw air in through the openings 62 past the windings 31, along the core 28 and through the openings 63 into the chamber 61. In this chamber the air is thrown by centrifugal force outwardly where the same follows along the inner surfaces of the wall 16 and skirt 15 of base 11 and is finally discharged from the compartment 21 through the passageways 19 afforded between the edge 18 of the skirt 15 and the surface on which the motor pump unit rests.

On one side of the base 11 is formed a face 64 which has an opening 69 through it. Overlying this face is a diaphragm 65 which forms part of the pump 12. This diaphragm is clamped in position by means of a case 66 which has a flange 67 projecting outwardly therefrom and which overlies the marginal portion of said diaphragm. A number of screws 68 extend through the said flange and diaphragm and clamp the diaphragm in position. For reciprocating the diaphragm 65 a connecting rod 71 is employed which is constructed at one end with a conical shaped head 72. This head fits adjacent the diaphragm 65 on one side thereof. The other side of said diaphragm is provided with a plate 73. Screws 74 extend jointly through said plate and diaphragm and are threaded into the head 72. By means of this construction the connecting rod 71 is rigidly secured to the diaphragm. The opening 69 is of suitable dimension to receive the head 72 and permits of reciprocating the diaphragm. The connecting rod 71 is constructed at its other end with a boss 74 which is bored to receive the outer race 75 of a ball bearing 76. The end of the boss 74 is split as indicated at 77 and a bolt 78 extending through the same clamps the said boss securely upon the race 75 holding the ball bearing 76 rigidly attached to the connecting rod. The inner race 79, of the ball bearing 76, is mounted on a stub shaft 81 issuing outwardly from the disc 53 of fan 52. This stub shaft is cast integral with said disc and is constructed to provide a shoulder 82 encircling the same where the said shaft issues from the fan 52. The stub shaft 81 is threaded as designated at 83 to receive a screw 84. A washer 85 encircles said screw and bears up the outer end of the race 79 of bearing 76. When the screw 84 is tightened the race 79 of bearing 78 is rigidly clamped in position. It will thus be readily comprehended that the connecting rod 71 is reciprocated as the shaft 33 rotates. For the purpose of counter balancing the weight of the rotating portion of the connecting rod 71 and the stub shaft 81 and bearing 76 the blades 59 are constructed somewhat thicker than the blades 58 which increases the weight of fan 52 on the side thereof opposite the stub shaft 81.

All of the bearings 34, 44 and 76 may be of the sealed type being packed with lubricant and requiring no attention until worn out. If desired, however, any other type of bearing may be employed. By constructing the stub shaft 81 integral with fan 52, lost motion between the various moving parts of the motor pump unit is reduced to a minimum.

The case 66 is part of valve mechanism 13 and is counter-sunk at the end of the same opposite the diaphragm 65 to provide a chamber 86 into which the diaphragm is moved as the connecting rod 71 is reciprocated. This constitutes the compression chamber of the pump into and from which the air is drawn and forced. At the outer end of the case 66 is provided a chamber 87 which is open to the exterior. Encircling this chamber near the outer end thereof is a shoulder 88. A plate 89 is seated against this shoulder which plate is constructed to provide openings 91, near its periphery, which conduct air from the exterior and into the chamber 87. A pad 92 of filter material overlies the plate 89. An outer plate 93 overlies the pad 92 and is formed with an opening 94 at the center of the same. This plate is held in place by means of a ring 95 which is received in a groove 96 in the case 66 near the outer end of the same. By means of this construction air enters through the hole 94, is filtered through the pad 92 and finally enters into the chamber 87 through the openings 91.

The inlet valve of the pump is designated by the reference numeral 97 and is adapted to be seated against a seat 98 encircling a passageway 99 extending between the chamber 86 and the chamber 87. An unloader spring 101 normally holds the valve 97 open until the speed of the motor 10 is sufficient to efficiently operate the pump.

The outlet valve of the pump is designated by the reference numeral 102. This valve is adapted to be seated against a seat 103, formed on a member 104, mounted in a bore 106 in the case 66. This bore communicates with the chamber 86 and also with the passageway in a hose connection 107 tapped into the case 66 and shown in Fig. 1. The bore 106 is threaded as indicated at 108. A plug 109 is screwed into the threads 108 and holds the member 104 in place. This plug also forms a stop for limiting movement of the valve 102. The end of the bore 106 is closed by a cap 111 which is screwed into the threads 108. The cap 111 is spaced from the plug 109 to provide a chamber 112 within said bore intermediate the ends thereof. A hole 113 drilled through the said plug brings the interior of the valve chamber into communication with the chamber 112.

The control device 114 may be constructed in any suitable manner such as is well known in the art and the details of construction thereof will hence not be described in this application. This device includes a case 115 which is provided with a nipple 116 which is screwed into the case 66. This nipple brings the mechanism of the device 14 into communication with the cham-

ber 112. The device 14 includes a pressure regulating valve and an electrical switch operated thereby by means of which the motor 10 may be energized and de-energized depending upon the pressure within the chamber 112. The pressure desired may be varied through an adjusting screw 117.

The operation of the device is as follows: When the motor switch is first operated, and atmospheric pressure occurs in chamber 112 the switch in the control device 14 is closed and the motor becomes energized. The shaft 33 then rotates and fan 52 and connecting rod 71 are operated. As the stub shaft 81 rotates, diaphragm 65 is reciprocated and the pump 12 set into action. Due to the fact that the valve 97 is normally open, the air is drawn into and out of the passageway 99 without pumping. As soon as the motor reaches a sufficiently high speed, the velocity of the air traveling past the said valve is sufficient to close the valve and pumping then continues. The air drawn into the chamber 86 is discharged past the valve 102 and enters the chamber 112. At the same time the air pumped is forced through the passageway of the hose connection 107. When the pressure in chamber 112 reaches a predetermined amount, the switch operated by the control device 14 cuts off and the motor 10 stops. During operation of the motor the fan 52 draws air through the openings 62 in the end wall 24 of housing 23, causes the said air to travel past the core 28 and windings 21 and discharges the same through the openings 63 in the wall 16 and into the chamber 61 in fan 52. Fan 52 by centrifugal force throws the air outwardly. Part of the air is directed against the head 72 of pump 12 and also against diaphragm 65 thereof. This air, as well as cooling the motor, removes part of the heat from the diaphragm and thus keeps the same cooled. The air, on leaving the fan 52, follows along the inner surface of the wall 16 and skirt 15 of base 11 and is discharged through the opening 19. As the air rises, the same follows along the exterior of the skirt 15 and around the case 66 and further tends to cool all of the parts of the motor pump unit.

The advantages of my invention are manifest. An extremely simple and practical construction is provided for the compressing of air. The single fan employed serves to conduct through the motor pump unit the air necessary for cooling all of the parts associated therewith. This fan, in addition, forms a single member for rigidly securing and holding the parts attached to one another so as to minimize the lost motion between the moving parts of the motor pump unit. By constructing the stub shaft integral with the fan a rather small degree of eccentricity can be procured and no lost motion between the said shaft and the hub of the fan is produced. Due to the fact that the hub of the fan butts against the inner race of the bearing for journalling the motor shaft, relative movement between the bearing and shaft is prevented. By the arranging of parts shown it becomes unnecessary to employ tubing or to provide pipe connections externally of the device or to provide ducts exposed externally of the device. By means of the arrangement shown the base for the pump serves as a housing for containing the moving parts of the invention which are readily accessible and are protected thereby.

Changes in the specific form of my invention, as herein disclosed, may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In a motor pump unit, a driven shaft, a disc secured to said shaft, blades issuing from said disc and integral therewith, a stub shaft formed on the opposite side of the disc and integral therewith, said stub shaft being eccentric relative to said driven shaft, and a connecting rod pivoted to said stub shaft and operating the pump, said blades on the side of said disc opposite said stub shaft being heavier than the blades on the side of said disc on which the stub shaft is disposed.

2. In a motor pump unit, a driven shaft, a disc secured to the end of said shaft, blades issuing from said disc and disposed inwardly of the end of the shaft, a stub shaft formed on the opposite side of said disc and a connecting rod pivoted to said stub shaft and operating the pump.

3. In a motor pump unit, a base including a skirt provided with a discharge opening at the lowermost portion thereof and a wall extending across said skirt at the uppermost portion thereof, a motor secured to the upper portion of said base and having a driven shaft extending through said wall, a fan secured to the protruding end of said shaft and disposed adjacent said wall, said fan causing circulation of air along said wall and downwardly along said skirt and out of the discharge opening thereof, a pump mechanism carried by said base and means driven by said fan for operating said pump mechanism.

4. In a motor pump unit, a base including a skirt and a wall extending across said skirt at the uppermost portion thereof, a motor secured to the upper portion of said base and having a driven shaft extending through said wall, a fan secured to the protruding end of said shaft and disposed adjacent said wall, said wall having an opening therein directed to said fan, said motor having air passageways therethrough communicating with said opening, said base having a discharge opening at the lowermost portion thereof, said fan being adapted to draw air through the motor passageways from the opening in said wall and to discharge same downwardly along said skirt and through the discharge opening.

5. In a motor pump unit, a base including a skirt and a wall extending across said skirt at the uppermost portion thereof, a motor secured to the upper portion of said base and having a driven shaft extending through said wall, a fan secured to the protruding end of said shaft and disposed adjacent said wall, a pump mechanism attached to said base adjacent the periphery of said fan, said fan being adapted to throw air by centrifugal force against said pump mechanism to cool the same.

6. In a motor pump unit, a base including a skirt and a wall extending across said skirt at the uppermost portion thereof, a motor secured to the upper portion of said base and having a driven shaft extending through said wall, a pump mechanism secured to said skirt and extending outwardly therefrom, means driven by said shaft for operating said pump mechanism, said means being disposed within said base, said pump mechanism having a case formed with an inlet chamber and a pressure chamber, valve means for connecting said inlet chamber with said pressure chamber, a passageway extending between said

pressure chamber and inlet chamber, an outlet valve controlling the flow of air out of said pressure chamber and into said passageway, a plug in said passageway for holding the valve in position, a cap at the end of said passageway spaced from said plug to form a chamber therebetween, said plug having a hole therein communicating with said chamber and a control device attached to said case and communicating with said chamber.

7. In a motor pump unit, a base including a skirt and a wall extending across said skirt at the uppermost portion thereof, a motor secured to the upper portion of said base and having a driven shaft extending through said wall, a fan secured to the protruding end of said shaft and disposed adjacent said wall, said wall having an opening therein directed to said fan, said base having a discharge opening at the lowermost portion thereof, said fan being adapted to draw air through the opening in said wall and to discharge the same downwardly along said skirt and through the discharge opening.

8. In a motor pump unit, a base including a skirt and a wall extending across said skirt at the uppermost portion thereof, a motor secured to the upper portion of said base and having a driven shaft extending through said wall, a fan secured to the protruding end of said shaft and disposed adjacent said wall, said wall having an opening therein directed to said fan, a pump mechanism attached to said skirt adjacent the periphery of said fan, said base having a discharge opening at the lowermost portion thereof, said fan being adapted to draw air through the opening in said wall and to discharge the same downwardly along said skirt and past said pump mechanism and through the discharge opening.

9. In a motor pump unit, a motor shaft, a disc secured to said shaft, blades issuing from said disc on one side thereof and forming a fan, a stub shaft issuing from the opposite side of the disc and eccentric relative to said shaft, and a connecting rod pivoted to said stub shaft and operating the pump, said blades on the side of said disc opposite said stub shaft being heavier than the blades on the side of said disc on which the stub shaft is disposed.

10. In a motor pump unit, a base having a compartment therein, a motor secured to said base and having a motor shaft extending through the base and into said compartment, a fan secured to the protruding end of said shaft and disposed within said compartment, a pump mechanism attached to said base adjacent the periphery of the fan, said fan being adapted to circulate the air within the compartment and throw the air by centrifugal force against said pump mechanism to cool the same.

RICHARD T. CORNELIUS.