The present invention relates to improvements in a pressure sensitive pump of the type illustrated in my copending application, Serial No. 851,749, filed November 9, 1959, now Patent No. 3,093,083 and entitled "Switch and Pumping Unit for Sensor, Barrier and the Like." The present application is a continuation-in-part of that application.

It is an object of the present invention to provide a pump insertable in a domestic or industrial floor riser or like upright liquid-receiving casing, this pump unit having an integral teflon or similar lining and not to require floor impeller housing to discharge liquid from the riser to an external disposal point. Such might be the exterior of the building or by return to the usual sewer system. The liquid intake to the impeller housing is through a vertically elongated tubular intake extension to a passage in the housing positioned in the riser, and one aspect of the invention deals with improved provisions for most rapidly and efficiently priming the impeller housing with liquid and ridding it of air upon commencement of pump operation.

This involves the expulsion of air from the impeller housing during priming through a venting or bleeder passage or port opening to the housing in a definite, predetermined location in relation to the height of the housing, to the axis of the impeller therein and/or to the outer circumference of the impeller itself, and to the housing's discharge opening. More specifically, the port is located on the top wall of the housing and in a zero pressure zone radially outwardly of the impeller axis and eye of the housing at which the pressure condition within the latter changes from positive to negative. The port is also predeterminedly located angularly relative to the discharge opening of the housing.

As clearly shown, that though the full explanation is not clear, the results are a rapidity of venting of air from the housing to prime the latter, and a continuing high pumping efficiency due to the bitted prime, which cannot be attained as well with the venting or priming port located in any other position on the impeller housing.

This invention further contemplates the provision, since the venting or the pressure change-over position, means of prevent this port from becoming an air intake through which air would otherwise be sucked to the housing to destroy the prime of the pump.

Indeed, in accordance with one embodiment of the means provided for this purpose, the vent or bleed port may become a liquid intake port for the housing after priming. In accordance with another embodiment, a check valve is provided to prevent any possible back siphon to the housing when the port is exposed to negative or zero pressure.

More specifically, in accordance with the first of two illustrated embodiments of the invention, a passage leading from the bleeder port in question is communicated downwardly through a tube or conduit to a zone adjacent a low level intake opening for the pump in the riser or other liquid accumulating casing being pumped, i.e., beneath the lowest expected liquid level. This insures against the entry of air to the passage and back to the impeller housing, although the tube and passage may permit two liquid intake inasmuch as they open at all times beneath the level of liquid in the riser. In accordance with the alternative embodiment, the passage and/or tube may terminate above the liquid level in the riser, but a simple and inexpensive check valve is disposed in this line which permits an outflow of air in priming, yet instantaneously closes the line to prevent back sucking of air into the impeller housing when its vacuum zone reaches radially outwardly to the port at which said line is opened to the housing interior.

A further object is to provide a pump unit having improved means for the purpose of fixedly yet vertically adjustably mounting the pump unit to a riser or like casing adjacent the top thereof. In accordance with the invention, such mounting means takes the form of an expanding plug engageable with the interior of the casing or riser adjacent its top, and manipulated entirely from above the floor to expand into gripping engagement with the riser. Such plug is provided with a flange resting upon said riser top to further vertically locate and sustain the pump unit in regard to the position of its intake in the riser.

It is another object of the invention to provide an improved plug of this description and for this purpose.

A still further object of the invention is to provide a rapid priming pump unit of the sort described which, in addition to features mentioned above, carries a pressure responsive unit on the bottom intake end of the pump, below the level of liquid from the riser; and in this respect closely resembling the structure shown in my copending application identified above. In its illustrative form, this pressure responsive device includes a diaphragm housing piloted on the lower end of an elongated pump intake member in the riser, with a switch in the interior of said last named housing to control the pump motor. A diaphragm seals this interior and is responsive to increasing hydrostatic pressure in the riser to close the switch, the diaphragm being downwardly exposed to liquid in which the pump intake is exposed in the riser. Since in accordance with the invention the intake to the pump is also a directly downwardly facing one, the result is that any induced upward component of flow force of the liquid in being pumped is effective upon the diaphragm in the most forcible, direct upward direction to maintain the switch in an upright hydrodynamic or kinetic action until the riser is pumped out as desired, and as determined by the setting of the switch.

Yet another object is to incorporate features of the above sort in a pump unit of a dual impeller type including, in addition to a main, an auxiliary impeller and its housing, a priming and secondary impeller disposed in a housing in the riser which opens upwardly through a tubular extension to the eye of the first named housing. Thus, a downwardly opening intake mouth of the secondary impeller housing serves as the actual intake means of the pump riser unit as a whole. It initially pumps alone to prime the main impeller housing and then, with the latter filled with water, assists the main impeller in the continued pumping; and in doing this it decreases the vacuum at the intake of the upper impeller. To this extent the action of the priming and secondary pump also is a factor in the location of the venting port in its radial relation to the axis of the main impeller. That is, lacking the action of the secondary impeller in this respect, the bleeder or vent port would be located closer in to the axis, because of greater vacuum at the impeller eye. For these reasons the lower pump structure is referred to jointly as well as in the alternative as "secondary" and "primary."

The pressure responsive device of the pump unit is piloted on the priming impeller housing as in my prior application, and a common motor driven shaft drives both impellers. Generally considered, it is a primary object of the invention to provide a pump unit which may have specific
features as described, but is more importantly characterized by a priming, air venting or bleeding passage leading from a port to the main impeller housing located at a predetermined radial distance relative to the housing’s side wall and/or to the impeller radius, also being located predetermined in a circumferential sense relative to the discharge outlet of the impeller housing, and, furthermore, on the top wall of the housing in order to obtain most rapid and efficient priming and continuous pumping.

Thus, for some purposes, such, for example, as the draining of the bilge of a boat, it may be desirable to mount the pressure responsive diaphragm unit separately in a line adapted to be dropped into the bilge, with the remainder of the pump unit disposed at a different elevation. However, other structural features of the pump unit, as referred to above, remain the same and offer the same advantages.

The foregoing as well as other objects will become more apparent as this description proceeds, especially when considered in connection with the accompanying drawings illustrating the invention, wherein:

FIG. 1 is a fragmentary elevational view of a pressure responsive pump unit in accordance with the invention.

FIG. 2 is a view in vertical sectional view through the unit, as along the line 2—2 of FIG. 3, further illustrating component structural means and arrangements of the pump unit and its mounting plug, as applied to a conventional riser, illustrated in dot-dash line;

FIG. 3 is a somewhat schematic view in horizontal section, as along the line 3—3 of FIG. 2, showing the positional relation of the bleed or air vent port to the housing; and

FIGS. 4 and 5 are similar fragmentary views in vertical cross section (FIG. 4 being sectioned on line 4—4 of FIG. 6) of alternative arrangements providing an air bleed or priming line to the impeller housing, in communication with a bleed passage and port opening to the housing at a predetermined location relative to the latter and the impeller which is depicted in FIGS. 2 and 3.

The pump unit of the invention, generally designated 10, is a dual impeller, self-priming one adapted to be mounted to the usual basement floor riser 11, or other known liquid accumulating receptacle or casing, by means of an improved expanding plug unit 12, hereinafter described in detail. The riser 11 may communicate with a city sewer system through the usual trap, and in many domestic installations will receive seepage or drainage water from the drain line of a tile system surrounding the building, as illustrated in my cited application referred to above.

The reference numeral 13 generally designates an above-door pump of the unit 10, including an impeller housing 14 encasing a centrifugal impeller 15 which is adjustably secured by a set screw to a drive shaft 18. Housing 14 includes an upper part 19 having a tubular top boss 20 through which the shaft 18 extends; and a suitable spring urged seal unit 21 is disposed within a downwardly opening counterbore 22 of boss 20 to bear downwardly upon a sealing sleeve 23 above the impeller 15 and having an O-ring sealed connection to the shaft 18, thus to afford a liquid tight seal for housing 14 from above. Impeller shaft 18 carries and drives further thrust sleeve 25 rotating upon the top of an “Oiltite” bearing in housing boss 20. A suitable felt lubricating ring 25 rests on the top of boss 20.

An appropriate coupling 26 connects the upper end of impeller shaft 18 with the shaft 28 of a suitable electric motor 29, which motor is secured by a set screw 30 to an end of the tubular sleeve 31 telescoped downwardly over and fixed to the housing boss 20.

The impeller housing 14 is completed by a centrally apertured bottom plate 33 having a tubular, downwardly extending axial boss 34, into which is threaded the upper end of a tubular take out 35 for the pump suction 10.

Extension 25 is a vertically elongated one, having its lower end threaded into the top of a bottom tubular priming impeller housing 37 which is of generally conical cross section, including an upwardly and inwardly tapering upper portion 38 merging downwardly with a downwardly and inwardly tapering lower portion 39. Impeller shaft 18 extends centrally downwardly through secondary impeller housing 37, and adjacent the lower end thereof the shaft has a centrifugal secondary impeller 40 secured thereto, as by a set screw 41.

Housing 37 is completed by a centrally apertured bottom intake plate 42 telescoped upwardly therein and held in place by screws 42 (FIG. 1). Plate 42 has a downwardly exposed intake mouth 43 through which liquid is pumped upwardly into the eye of priming impeller 40. The upwardly convergent conical shape of housing 37 at 38 provides a restrictive action to increase the upward velocity of the liquid column elevated by impeller 40.

The intake plate 42 of priming impeller housing 37 is formed to provide an integral tubular, downwardly extending boss or sleeve portion 45, which receives a bushing 46 in which the lower end of shaft 18 is jour-nelled. Boss 45 also serves as an internal boss from which a bottom pressure sensitive device, generally designated 47, is fixedly mounted. Thus, the pressure responsive device 47 includes a housing 48 providing a hollow, upwardly extending boss portion 49 telescoped upon the pilot boss or sleeve 45 and suitably held in fixed relation thereto. Beneath this pilot mounting, the device 47 also provides an integral switch housing portion 50 affording a chamber 51 within which a normally open motor control switch 52 is fixedly mounted.

A control diaphragm 53 extends across the bottom of housing chamber 51, being liquid-tight clamped in place by an apertured lower housing part 54 secured from beneath by screws 55 (FIG. 1) to the housing portion 50.

The part 54 has a tubular central mouth 56 (FIG. 2) opening downwardly, hence exposed to liquid in the riser 11 well beneath the intake mouth 43 of impeller housing 37. Thus, any component of hydrodynamic or kinetic force induced in the liquid by the upward intake to housing 37 serves the purpose of maintaining the diaphragm upwardly in closing relation to switch 52 until the riser is pumped down to a desired level at which the diaphragm permits switch 52 to open. Of course, initial closure of the switch takes place under action of the diaphragm 53 by hydrostatic pressure of riser liquid in which the secondary housing 37 is immersed, again at the desired level for which the switch 52 is set.

An electrical conduit or cable 57 extends through a liquid-tight fitting 58 to bring electrical leads 59 within the switch chamber 51, where they are suitably wired to switch 52. The cable 57 is such as to serve also as an air line to communicate switch chamber 51 with atmospheric pressure above the floor level. In order to accommodate the cable 57 in the radial sense and permit its insertion along with housing 37 into a riser 11 of limited diameter only a trifile greater than that of the housing (see FIG. 2), and also to similarly accommodate a bleed or vent tube to be described (which is utilized in accordance with one of the embodiments of the invention), the wall of priming impeller housing 37 is recessed inwardly at 37 to provide a vertical external groove 60 in this portion, in which cable 57 and the mentioned bleed tube are disposed, being secured therein by a suitable bend 64 encircling housing 37.

The electrical cable 57 extends upwardly and opens into a suitable compartment 63 mounted on the impeller housing part 33, as do further electrical cables 64, 64' which are connected respectively to a master switch means (not shown) and to the motor 29, thereby affording a
manual master control through which motor 29 can also be energized. As indicated above, the invention essentially contemplates improved means for bleeding or venting air from the interior of the above-floor impeller housing 14 as the pump comes into operation, i.e., upon energization of motor 29 through switch 52 under the hydrostatic pressure of a predetermined liquid level in the riser 11, and the consequent rapid elevation of a column of water through tubular extension 35 into the housing of upper pump 13. Thus the upper part 19 of impeller housing 14 is provided with a radially extending passage 66 in its top wall, which passage opens downwardly through a bleeder port 67 to the housing interior. The passage 66 is connected exteriorly of housing 14 with a bleeder tube 68 which, in accordance with one embodiment of the invention, specially shown in FIG. 4 and in solid line in FIG. 2, is an open tube or flow conduit brought downwardly from the housing 14 to a terminal, downwardly opening mouth at 69 (FIGS. 1 and 2) which is approximately at the level of the intake mouth 43 to the priming impeller housing 37. The mouth 69 will therefore always be beneath the minimum expected liquid level in riser 11.

The reference numeral 70 designates the discharge mouth or opening of the housing 14, which is successively connected by any suitable discharge line (not shown) to the exterior of the building, or to an existing sewer line downstream of a trap.

As before illustrated in FIGS. 1 and 3, the housing port 67 of the air bleeder passage 66-68 is located at a critical zone of pressure change-over in housing 14, as later described in detail, at which venting of that housing of all air has been found to most efficiently take place. For one thing the port 67 should be relatively close to the housing's discharge opening 70; and I have had best performance with the bleeder port disposed about 90° from a radial line through the center of the discharge mouth 70, in the angular direction opposite that in which the impeller 15 rotates. As mentioned above, the port 67 also opens downwardly to the housing interior from its top wall, in this way the body of liquid rising in the housing can best drive the lighter air into the passage 66 at the commencement and through the duration of priming.

Further, the port 67 is predeterminedly located in the radial sense in the space between the axis of impeller 15 and the upright side wall of the upper part 19 of housing 14, as well as predeterminedly radially relative to the discharge port 70. The object is to reduce the distance from the maximum vacuum at the impeller axis, and the housing eye through boss 34, through lessening vacuum values to a positive pressure increasing in value as the radial distance increases.

Thus, as indicated in FIG. 3, the port 67 is positioned at a zero pressure point O at which vacuum V changes to positive pressure P. The exact position, dimensionwise, of the port 67 will vary in accordance with a number of factors, such as the design of impeller 15 and/or the housing 14, the speed of operation of the pump, and the like. However, for a typical centrifugal housing design in the cross section of FIG. 3, the center line of bleeder port 67 will lie about two-fifths of the radial distance from the impeller axis outwardly to the upright wall of housing 14, the dimension being taken along the 90° radial line of housing passage 66 in relation to discharge opening 70. Further in relation to a typical design, the center line of port 67 will lie about nine-sixteenthths of the radial dimension of impeller 15 from its axis to its outer periphery of the impeller.

The typical dimension relationships are shown with reasonable accuracy in FIGS. 2 and 3 and, although the reason is not in all respects clear, I have found that these result in the most efficient venting of air from the impeller housing, as pump operation commences, and maintenance of a full prime as it continues. The impeller 40 rapidly elevates a column of liquid from priming housing 37 to the eye of impeller housing 14, this column trapping and compressing air and positively driving it out through port 67, passage 66 and bleeder tube 68 to the mouth of the latter in adjacent seat of the priming intake mouth 43. In no other zone of location of the port in the housing is the action so quick and effective. As intake side vacuum reaches the port 67, a reverse sucking of air into the housing through tube 68 is prevented, since its mouth 69 is below the lowest water level in the riser 11.

However, the invention also contemplates an alternative anti-siphon embodiment in regard to the air bleeder tube, as illustrated in FIG. 5 of the drawings, which makes it unnecessary to bring the tube all the way down to a below water terminus, yet still insures against possible back sucking of air into housing 14 when the bleeder port 67 is exposed to a minus pressure condition.

Thus, in FIG. 4 of the drawings the open tube 68 is shown as being connected to housing part 19 by means of a nipple or tubular fitting 71 threadedly received at one end in the housing bleeder passage 66 and at its other end threadedly received in a standard cup-like connector 72 surrounding the top of the tube 68. However, in a second adaptation of FIG. 5 it is unnecessary to bring the bleeder tube (specially designated 69' in FIGS. 1, 2 and 5) all the way down into the riser. It may be terminated, as illustrated in dotted line in FIGS. 1 and 2, just within the top of riser 11, thus reducing the cost of the unit 10 chargeable to the material of the tubing.

In order to make this possible, the tube 69' is communicated with bleeder passage 66, as shown in FIG. 5, through coupling components 71, 72 like those of FIG. 4, but with a small poppet-type shutoff valve element 74 of light weight plastic material interposed between the lower end of tube 69' and the bore of nipple element 71. This valve 74 is adapted to seat upwardly, as indicated in dotted line, across the bore of nipple 71 the instant that a vacuum condition arises in housing port 67 and passage 66, thereby preventing any reverse siphon of air into the housing 14, in the same way that the insertion of the lower end of the tube 68 in the riser liquid prevents this effect when an unvalved tube is employed, per the first embodiment. The enlarged lower valve end of element 74 is notched or serrated about its periphery at 76 so that in its lower, solid line position (FIG. 5) a downward flow from the valve and to the tube 69' is permitted. Valve element 74 is preferably guided for its vertical movement by a reduced diameter stem part 77 extending upwardly with adequate side clearance into the bore of fitting 71.

While the open tubing 68 of the embodiment of FIG. 4, as immersed at its bottom in the riser liquid, affords an anti-siphon bleeder outlet line, and may indeed become a relatively small capacity liquid intake line to impeller housing 14 in pumping; the valve structure illustrated in FIG. 5 positively prevents upward flow of fluid, either liquid or air, into housing 14 as the vacuum area of the housing enlarges radially outwardly to a point of transition to positive pressure, in the manner indicated in FIG. 3.

A further improvement in accordance with the invention resides in the mounting plug unit 12, which is best illustrated in FIG. 2 of the drawings. It includes an upper annular mounting plate or disk 79 of circular shape in a diameter adapting it to rest about its periphery upon the top of the riser 11. Plate 79 is provided with a central aperture 89 receiving the tubular extension 35 of pump unit 13, this aperture also being formed to provide an enlarged bay portion 81 through which the electrical cable 57 and the bleeder tube 68 or 69' are brought downwardly into the interior of the riser. Plate 79 is formed with an integral, axially extending semi-flange or boss 82, through which one or more set screws 83 threadedly extend radially into clamping engagement with tubular ex-
Thus, the pump unit may be adjusted vertically and angularly relative to the plug 12 and its top plate 79, hence relative to riser 11, and may be clamped in adjusted position to determine as desired the elevation of the priming impeller housing 37 and pressure sensitive device 47 in riser 11.

An expansible annular sealing sleeve 85 of rubber or like resiliently deformable material constitutes a further component of the mounting plug unit 12. Its tubular extension 35 concentrically, being disposed between the top plate 79 and a further centrally apertured backing plate or disk 86 beneath the plate 79; and plug unit 12 is completed by a plurality of elongated bolts or studs 87 passed through an enlargement 82 of the boss 82 of plate 79 and threaded into bottom boss formations 88 on the backing plate 86. Thus, as the bolts or studs 87 are taken up, the bottom plate 86 is elevated and, since the annular resilient sleeve 85 substantially overlaps the plates 79 and 86, this will have the effect of bulging or bowing the sleeve radially outwardly, as indicated in dotted line in FIG. 2. It thus takes expansive clamping engagement with the interior of the riser, so as to firmly mount the pump unit to the latter, with the plate 79 resting on the riser top.

The use of a plurality of individual retaining bolts or studs 87 makes it possible to axially compress and radially expand the sleeve 85 to grip the riser, without the need for disturbing a desired angular positioning of the plug unit 12 relative to the pump unit 13 and its external bleeder tube 68 or 68' and its electrical cable 57, both extending through the plug plate bay 81, and the angular relationship of the pump and plug assembly relative to the riser 11.

The invention affords improvements in a self-priming, dual impeller pump for a floor riser or like liquid accumulating or flow casing, featuring novel air bleeding means for the impeller housings which makes possible an extremely rapid priming of that housing by most effectively voiding air from the latter as the air is driven thereinto by a rapidly rising column of water elevated from the lower or intake housing. These improvements of course deal with the positioning of the air bleed port 67 relative to upper housing 14, i.e., vertically and circumferentially in regard to its position relative to the impeller; to the upright housing wall; and to the housing discharge opening, all as described in detail above.

The degree of vacuum at the intake eye of upper housing 14 will be of a certain value when secondary pumping is performed by impeller 40. Thus in this dual pump combination, the bleeder or vent port 67 will be located in the manner shown in FIG. 3 and described above. Lacking the secondary impeller 40, the degree of vacuum at the intake of housing 14 will be greater, hence the port 67 will be located more inwardly towards the axis of upper impeller 15, though otherwise in about the same relation to the discharge opening 70 which is discussed above. Accordingly, it is seen that the design of the unit will vary in accordance with the presence or absence of the secondary pump unit; but in any event the housing bleeder port 67 will follow the rule of being located in a circumferential zone radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive; and preferably in a circumferential relation to the housing discharge port 70 which has been described above.

Coupled with these considerations are improved anti-siphon means of one sort or another perfecting the action of the pump unit after it is primed, as illustrated alternatively in FIGS. 4 and 5, in each case considered with FIG. 2.

Finally the invention contemplates and provides improved plug means for the mounting of the pump unit to an upright riser or other liquid accumulating or flow casing in such manner that the intake of the pump, and a pressure sensitive device in predetermined positional relation to the pump intake, may be vertically adjusted as desired in relation to the riser.

What I claim as my invention is:

1. A self-priming liquid pump unit, comprising a pump housing, an impeller mounted to rotate therein, said housing having a discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, a port opening to the housing interior, said port being located in a circumferential zone of substantially neutral pressure radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive, and passage means communicating with said port through which air is unidirectionally discharged from the interior of said housing in priming at the commencement of pumping.

2. A self-priming liquid pump unit, comprising a pump housing, an impeller mounted to rotate therein, said housing having a lateral discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, a port opening downwardly to the housing interior, said port being located in a circumferential zone of substantially neutral pressure radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive, and passage means communicating with said port through which air is unidirectionally discharged from the interior of said housing in priming at the commencement of pumping.

3. A self-priming liquid pump unit, comprising a pump housing, an impeller mounted to rotate therein, said housing having a lateral discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, a port opening downwardly to the housing interior, said port being located in a circumferential zone of substantially neutral pressure radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive, and passage means communicating with said port through which air is unidirectionally discharged from the interior of said housing in priming at the commencement of pumping.

4. A self-priming liquid pump unit, comprising a pump housing, an impeller mounted to rotate therein, said housing having a lateral discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, a port opening downwardly to the housing interior, said port being located in a circumferential zone of substantially neutral pressure radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive, and passage means communicating with said port through which air is unidirectionally discharged from the interior of said housing in priming at the commencement of pumping.

5. A pump unit, comprising a pump housing, an impeller mounted to rotate therein, said housing having a discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, and a port opening to the housing interior, said port being located in a circumferential zone of substantially neutral pressure radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive, and means to prevent a back siphon of air to said housing when the housing pressure in the zone of said port drops below a predetermined value.

6. A pump unit for the pumping from above of a floor...
riser or like upright casing, comprising a pump housing, an impeller mounted to rotate therein, said housing having a discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, and a port opening to the housing interior, said port being located in a circumferential zone radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive, means to mount said pump unit on said riser for an upward flow of liquid from the latter to said intake eye, means providing an intake opening to said housing intake eye which is located at a substantial distance below said eye when the pump unit is so mounted, and means to prevent a back siphon of air to said housing when the housing pressure in the zone of said port drops below a predetermined value, including a passage communicating with said port and having a check valve therein to prevent reverse flow in the passage and port.

7. A pump unit, comprising a pump housing, an impeller mounted to rotate therein, said housing having a discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, and a port opening in the housing interior, said port being located in a circumferential zone of substantially neutral pressure radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive, and means to prevent a back siphon of air to said housing when the housing pressure in the zone of said port drops below a predetermined value, including a passage communicating with said port and having a check valve therein to prevent reverse flow in the passage and port.

8. A pump unit, comprising a pump housing, an impeller mounted to rotate therein, said housing having a lateral discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, and a port opening downwardly to the housing interior, said port being located in a circumferential zone of substantially neutral pressure radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive, said port being also angularly located approximately 90° from said discharge opening, in the rotative direction from which the impeller approaches said discharge opening, and means to prevent a back siphon of air to said housing when the housing pressure in the zone of said port drops below a predetermined value.

9. A pump unit for the pumping from above of a floor riser or like upright casing, comprising a pump housing, an impeller mounted to rotate therein, said housing having a lateral discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, and a port opening downwardly to the housing interior, said port being located in a circumferential zone radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive, said port being also angularly located approximately 90° from said discharge opening, in the rotative direction from which the impeller approaches said discharge opening, means to mount said pump unit on said riser for an upward flow of liquid from the latter to said intake eye, means providing an intake opening to said housing intake eye which is located at a substantial distance below said eye when the pump unit is so mounted, and means to prevent a back siphon of air to said housing when the housing pressure in the zone of said port drops below a predetermined value, including a passage communicating with said port and a point in said riser adjacent said intake opening and beneath the liquid level in said riser.

10. A pump unit, comprising a pump housing, an impeller mounted to rotate therein, said housing having a lateral discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, and a port opening downwardly to the housing interior, said port being located in a circumferential zone of substantially neutral pressure radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive, said port being also angularly located approximately 90° from said discharge opening, in the rotative direction from which the impeller approaches said discharge opening, and means to prevent a back siphon of air to said housing when the housing pressure in the zone of said port drops below a predetermined value, including a passage communicating with said port and having a check valve therein to prevent reverse flow in the passage and port.

11. A self-priming liquid pump unit, comprising a pump housing, an impeller mounted to rotate therein, said housing having a discharge opening, an intake eye opening to the interior of the housing, and a port opening to the housing interior, said port being located in a circumferential zone of substantially neutral pressure radially outwardly of the impeller axis at which the pressure condition within the housing during pumping changes from negative to positive.

12. The pump unit of claim 11, and further comprising means connected with said port for preventing a back siphon of air to said housing at a pressure in said neutral zone below a predetermined value.

13. The pump unit of claim 11, and further comprising means connected with said port for preventing a back siphon of air to said housing at a pressure in said neutral zone below a predetermined value, said last named means comprising a conduit extending from said port to a point below the level of liquid being pumped.

14. The pump unit of claim 11, and further comprising means connected with said port for preventing a back siphon of air to said housing at a pressure in said neutral zone below a predetermined value, said last named means comprising a check valve operatively connected to said port.

15. The pump unit of claim 11, in which said port is also angularly located approximately 90° away from said discharge opening in the direction of rotation of said impeller.

16. In combination with the pumping unit of claim 11, a priming impeller unit driven with said first named impeller to discharge liquid to said intake eye.

17. A self-priming liquid pump unit, comprising a pump housing, an impeller mounted to rotate therein, said housing having a lateral discharge opening, an intake eye opening to the interior of the housing coaxially of the rotative axis of the impeller, and a port opening downwardly to the housing interior, said port being located in a circumferential zone of substantially neutral pressure radially outwardly of the intake eye opening and impeller axis at which the pressure condition within the housing during pumping changes from negative to positive.

18. The pump unit of claim 17, and further comprising means connected with said port for preventing a back siphon of air to said housing at a pressure in said neutral zone below a predetermined value.

19. The pump unit of claim 17, and further comprising means connected with said port for preventing a back siphon of air to said housing at a pressure in said neutral zone below a predetermined value, said last named means comprising a conduit extending from said port to a point below the level of liquid being pumped.

20. The pump unit of claim 17, and further comprising means connected with said port for preventing a back siphon of air to said housing at a pressure in said neutral zone below a predetermined value, said last named means comprising a check valve operatively connected to said port.
21. The pump unit of claim 17, in which said port is also angularly located approximately 90° away from said discharge opening in the direction of rotation of said impeller.

22. In combination with the pumping unit of claim 17, a priming impeller unit driven with said first named impeller to discharge liquid to said intake eye.

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LAURENCE V. EFNER, Primary Examiner.