May 17, 1949. E. O. NORRIS 2,470,319

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Fig. 1.

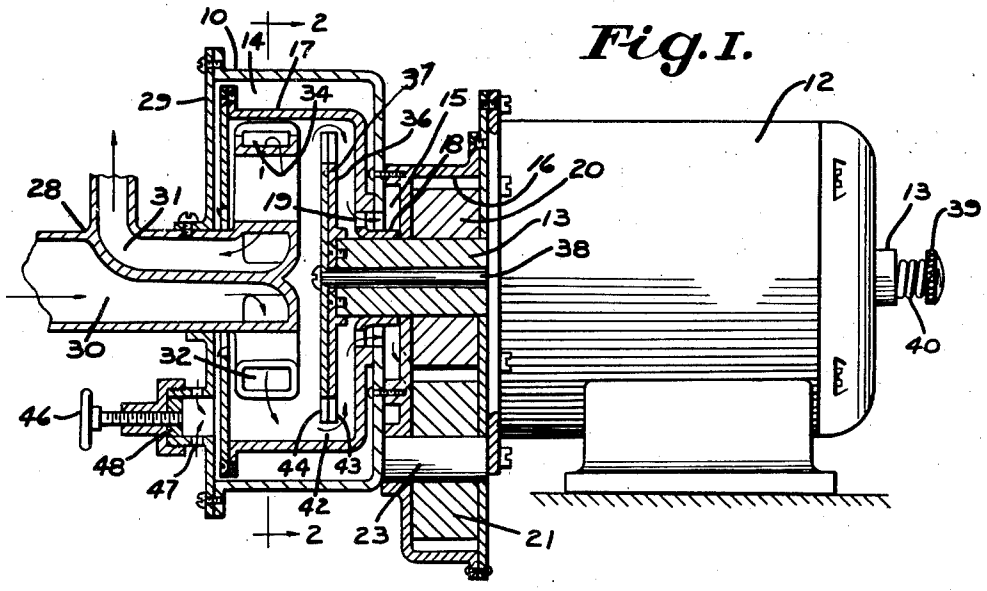
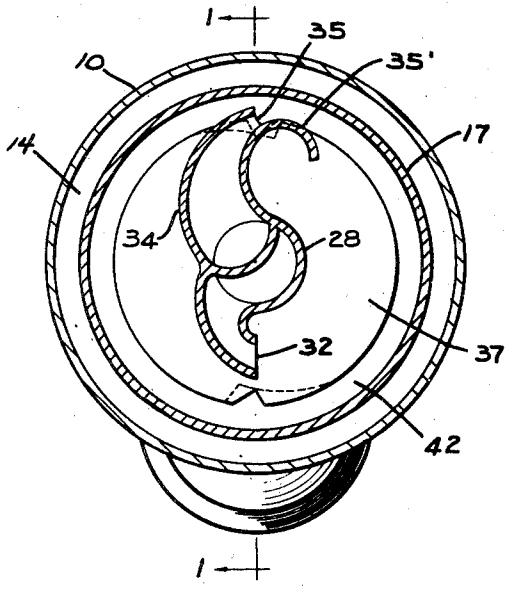


Fig. 2.



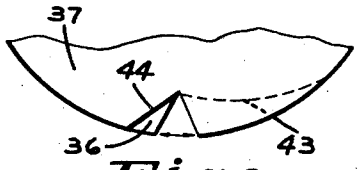


Fig. 3.

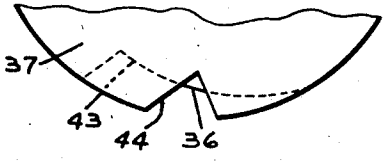


Fig. 4.

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Fig. 5.

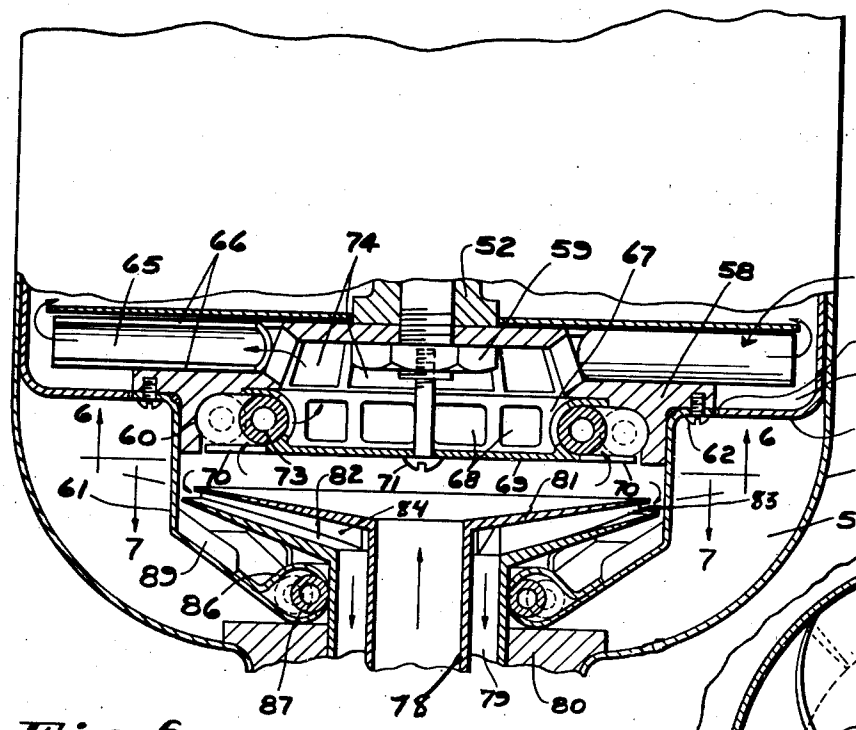
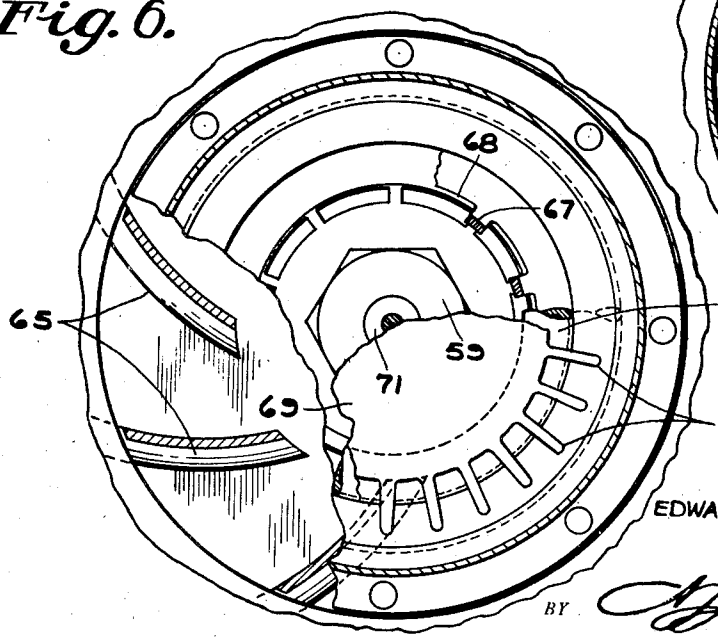


Fig. 6.



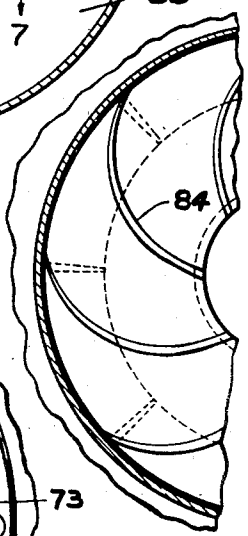


Fig. 7.

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16 Claims. (Cl. 103—113)

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This invention relates to combination suction and pressure pumps of the type employing a suction device for drawing in liquid and air, and centrifugal means for separating and discharging the liquid under pressure, and it is an object of the invention to provide a novel and improved device of this type.

Another object of the invention is to provide a pump of the foregoing type having a novel separating means to prevent liquid from entering the suction mechanism of the pump.

Another object is to provide a pump of the type specified which is self-regulating and does not require priming or the use of a packing gland.

Another object is to provide a simple and efficient pump which will give a suction lift over a greater height than that normally expected from the effect of barometric pressure alone.

Still another object is to provide a pump of the above type which will lift a solid stream of liquid, or a mixture of liquid and air, and will remove practically every drop of liquid from a carboy or other container and not leave a film on the bottom as in the case of an ordinary suction pump.

Another object is to provide a combination suction and pressure pump having novel and improved details of construction and features of operation.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

Although the novel features which are characteristic of this invention are set forth more in detail in the claims appended hereto, the nature and scope of the invention may be better understood by referring to the following description, taken in connection with the accompanying drawings forming a part thereof, in which certain specific embodiments have been set forth for purposes of illustration.

In the drawings:

Fig. 1 is a longitudinal sectional view of a fluid pump embodying the present invention;

Fig. 2 is a transverse section taken on line 2—2 of Fig. 1;

Figs. 3 and 4 are fragmentary plan views illustrating the adjustment of the cut-off plates or shutters controlling the pressure of the pump;

Fig. 5 is a longitudinal sectional view illustrating a modification of the invention;

Fig. 6 is a transverse section taken on line 6—6 of Fig. 5 but progressively broken away to show the construction of the parts; and

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Fig. 7 is a partial section taken on the line 7—7 of Fig. 5.

In the following description certain specific terms are used for convenience in referring to the various details of the invention. These terms, however, are to be interpreted as broadly as the state of the art will permit.

In the drawings, Fig. 1 shows a combination suction and pressure pump comprising a stationary housing 10 secured to an electric motor 12 having a rotary shaft 13.

The housing 10, which may be a metal casting, comprises an outer chamber 14, an intermediate or suction chamber 15, and an inner gear pump chamber 16.

The chamber 14 contains a rotary cylindrical case 17 having an axial hub 18 secured to motor shaft 13 and having orifices 19 adjacent said hub communicating with the intermediate or suction chamber 15.

The chamber 16 contains a gear pump comprising a gear 20 secured to the motor shaft 13, and an idler gear 21 which is secured to a stub shaft 23 rotatably mounted in chamber 16 and meshes with gear 20, as illustrated in Fig. 1. This gear pump, which may be of conventional design, pumps air from the suction chamber 15, and this air, after passing through the motor 12 and cooling same, is discharged to the atmosphere.

A unitary pipe casting 28 secured to the outer plate 29 of housing 10 is divided internally into an inlet passage 30 for air and liquid, and an outlet passage 31 for the liquid which is being pumped. The inlet passage 30 extends within the rotary case 17 in housing 10 and terminates in a spout 32 which is curved to direct the incoming liquid and air into the rotary case 17 in the same direction as said case is rotating, as indicated by the arrows in Figs. 1 and 2, to increase the pump efficiency. The outlet passage 31 likewise extends within the rotary case 17 and terminates in a curved scoop 34 having its mouth 35 positioned adjacent the cylindrical wall of the case 17 so as to scoop up the rotating film of liquid which lines said cylindrical wall as hereinafter more fully described. The scoop 34 is provided with a lip 35' to direct the liquid into the mouth 35.

A pair of flat circular suction cut-off plates or shutters 36 and 37 are carried by the rotary shaft 13 of motor 12 within the rotary case 17; the inner plate 36 being fixed to the shaft 13, and the outer plate 37 being secured to a rod 38 which extends axially through the shaft 13 and ter-

minates in a knurled knob 39 beyond the end plate 26 of the motor. A coil spring 40 compressed between knob 39 and the end of shaft 13 urges rod 38 toward the right, as viewed in Fig. 1, and thus holds plate 37 in frictional engagement with plate 36. When the motor 12 is at rest, however, the knob 39 may be pushed in against the pressure of spring 40 and turned to rotate the plate 37 with respect to the plate 36. The diameter of the plates 36 and 37 is somewhat less than the diameter of the rotary cylindrical case 17, thus forming a restricted annular peripheral passage 42 between the plates and wall of the case, and it is through this peripheral passage 42 that air is drawn by the gear pump during the operation of the device.

In order to adjust the effective height of the opening 42, the plates 36 and 37 are provided with diametrically opposed peripheral notches 43 and 44, respectively. In the embodiment illustrated in Figs. 3 and 4, the notches 43 in plate 36 are considerably longer than the acute angled notches in plate 37, so that by rotating plate 37 with respect to plate 36 (by turning the knurled knob 39) the flare of the overlapping notches 43 and 44 and the height of the radial openings formed by said notches may be varied to any desired degree.

Air for controlling the suction may be admitted to the chamber 14 and thence to the interior of rotary case 17 through a valve 46 containing ports 47 controlled by valve plunger 48. By adjusting the plunger 48 the volume of air admitted through ports 47 may be varied as desired. As is hereinafter more fully described, the valve 46 performs the same function as the adjustable notches 43 and 44 in the plates or shutters 36 and 37, namely, the control of the thickness of the layer of liquid which is carried around the cylindrical wall of the rotary case 17 during the operation of the device. However, the valve 46 may be actuated freely while the pump is operating, whereas the knurled knob 39 controlling the axial adjustment of plate 37 rotates with the motor shaft 13 and therefore cannot be manipulated while the motor is running.

In operation, the outer end of the pipe casting 28 leading to the inlet passage 30 is connected to a hose placed in the liquid to be pumped, and the motor 12 is set in operation thus rotating the motor shaft 13, the gears 20 and 21, the cut-off plates or shutters 36 and 37, and the cylindrical case 17. The suction created by the gear pump thereupon draws the liquid through inlet passage 30 and spout 32 into the rotary case 17. The rotating liquid lines the inner cylindrical wall of the case 17 and is ejected, by pressure due to velocity, through the scoop 34 and outlet passage 31; while the air in casing 17 is drawn through the peripheral opening 42, orifices 19 and suction chamber 15 by the gear pump and is discharged to the atmosphere. The layer of liquid lining the cylindrical wall of rotary case 17 continues to rise toward the center of the case until it touches the periphery of the cut-off plate 37 (or until it closes the openings formed by the notches 43 and 44 in plates 36 and 37, if plate 37 was previously adjusted to provide such openings) whereupon the suction is cut off and no more liquid is pumped through inlet passage 30 until the level of the liquid in case 17 is reduced to the point where the peripheral passage 42 (or the openings formed by notches 43 and 44) is uncovered.

Now, assuming that there were no notches such as 43 and 44 in the cut-off plates 36 and 37, but that the valve 46 were adjusted to open its ports 47 either partially or completely, the operation would be as follows: the layer of liquid lining the cylindrical wall of rotary case 17 would continue to rise toward the center of the case until it reduced the peripheral passage 42 between the walls of case 17 and plates 36 and 37 to the area of the effective opening in valve ports 47, at which time air would be drawn into the casing only through the ports 47, and no air or liquid would be drawn into the casing through inlet passage 30. When the level of the liquid in casing 17 is again reduced to the point where the liquid-free area of the peripheral passage 42 is greater than the effective area of valve ports 47, suction will again be applied to spout 32 and inlet passage 30 and liquid will be drawn into the casing 17.

Precisely the same considerations apply when both the valve 46 and the notches 43 and 44 of plates 36 and 37 are employed as control means, though in such case the factor determining the suction cut-off point will be the effective area between the liquid and the notches, rather than the effective area between the liquid and the periphery of plates 36 and 37. The ports 47 also serve to relieve the load on the suction device when pumping liquid at low suction heads.

Figs. 5 and 6 illustrate a modification of the invention which is useful for a wide variety of purposes, such as for a combination suction and pressure pump for floor scrubbers. This pump comprises a stationary housing 50 secured to and enclosing an electric motor having a rotary shaft 52. A stationary wall 53 having a circular central opening 54 divides the housing 50 into an outer chamber 55 and an inner suction chamber 56.

A rotary casting or carriage 58 is secured to the motor shaft 52 within the suction chamber 56 by a nut 59, and this casting 58 has an annular flange 60 which extends into the outer chamber 55 and supports a rotary case 61 which is secured to said castings 58 by screws 62. A single or multiple stage rotary air suction fan 64 is secured to the casting 58 within the suction chamber 56, this fan, in the embodiment illustrated, comprising a circular series of fan blades 65 supported between a pair of plates or discs 66. Nested within the annular flange 60 of casting 58 is an annular flange or collar 67 having a circumferential series of air inlet openings 68 and an outer wall or cover plate 69 which has a series of fingers 70 disposed about its periphery. The collar 67 and cover plate 69 are secured to the shaft 52 by an axial screw 71.

The outer periphery of the collar 67, which contains the air inlet orifices 68, is curved like the rim of a bicycle wheel and forms a seat for an annular elastic flexible tube or tube 73 having a specific gravity less than that of the liquid to be pumped. When the motor is not operating, and the casting 58 and associated parts including collar 67 are at rest, the elastic tube 73 snugly engages the periphery of collar 67 and seals the air inlet orifices 68, thereby preventing liquid in the rotary casing 61 from leaking into the suction fan 64. However, when the casting 58 and associated parts including collar 67 are rotating, the centrifugal force acting on the tube 73 stretches said tube and thus uncovers the air inlet orifices 68. This permits the air in rotary case 61 to be sucked inwardly through the air inlet orifices 68 and thence through orifices 74 on the inner hub of casting 58, to the fan blades 65. This air, after

passing through the motor and cooling same, is discharged through louvers not shown in the motor housing.

A pair of stationary concentric inlet and outlet pipes 78 and 79, respectively, extend axially through the outer end plate 80 of housing 50 and terminate within the rotary case 61 in a pair of stationary dished plates or cones 81 and 82 which are spaced slightly apart as shown in Fig. 5. The cones 81 and 82 together form a restricted space or annulus 83 for the discharge of the liquid which enters the rotary case 61 through inlet pipe 78, and to facilitate such action the periphery of cone 82 extends almost to the cylindrical wall of rotary casing 61 while the periphery of cone 81 is spaced somewhat from said cylindrical wall to more readily admit the liquid to the annulus 83 for discharge through the pipe 79.

In operation, the air and liquid inlet pipe 78 is placed in communication with the liquid to be pumped, for example, said pipe 78 may be connected to the nozzle of a floor scrubbing machine. The motor 51 is then set in operation thus rotating the motor shaft 52, the casting 58, the case 61 and the fan 64. The rotation of the case 61 throws the tube 73 outwardly and opens air passages 68 and permits suction created by the fan 64 to draw liquid through inlet pipe 78 into the rotary case 61. The rotating liquid lines the inner cylindrical wall of the case 61 and flows outwardly through the annulus 83 into the outlet pipe 79 which may lead to any suitable discharge point, while the air in case 61 is drawn through the orifices 68 and 74 to suction chamber 56 by the fan 64.

The rotating mass of liquid in the case 61 develops a high centrifugal force. The friction of the liquid entering the restricted stationary annulus 83 retards the rotation of the liquid in the annulus, which reduces the centrifugal force acting on the liquid in the annulus and develops a pressure differential between the liquid in the casing which is under high centrifugal force and the liquid in the annulus which is under low centrifugal force. This pressure differential is equivalent to a static head and develops the pressure necessary to drive the liquid out through the pipe 79. If desired, vanes 84 may be provided on the sloping face of the cone 82 to assist in stopping the rotation of the liquid in the annulus 83, such vanes preferably being of spiral form to direct the liquid toward the outlet pipe 79.

As stated above, the elastic hollow tube or tore 73 snugly engages the periphery of collar 67 and seals the air inlet orifices 68 when the pump is at rest, which prevents any liquid remaining in the rotary casing 61 from getting into the suction fan 64. When the casing 61 and associated parts are rotating, on the other hand, the centrifugal force stretches the flexible tube 73 and uncovers the orifices 68, thereby permitting the fan 64 to draw air from the casing 61. However, if a substantial excess of liquid accumulates in the rotary casing 61, such liquid will exert pressure on the flexible tube 73 and will float said tube back to its central position in sealing contact with the orifices 68, thereby cutting off the suction of fan 64 until the liquid layer in rotary casing 61 falls to the proper operating level.

Some liquid may leak past the outer periphery of cone 82 into the outer flared portion 85 of the rotary casing 61, and when the motor is stopped such liquid might seep into the outer chamber 55 of housing 50 unless prevented from doing so.

In order to prevent such seepage, a curved annular band 86 is secured to the inner surface of the flared wall 85 and an annular flexible tube or tore 87 is seated within said band in contact with the cylindrical wall of the outlet pipe 79, as shown in Fig. 5. When the pump is in operation, any liquid which may collect in the flared portion 85 of rotary casing 61 will be thrown outwardly by centrifugal force and propelled by vanes 89 toward the orifice 83. When the pump is idle, however, the flexible tube 87 will seal the space between the casing 61 and the outlet pipe 79 and effectively prevent the escape of any liquid which may be trapped in the outer flared portion 85 of the casing.

In the embodiment of Figs. 1 to 4 a positive displacement type of suction pump is shown and Figs. 5 and 6 shown a centrifugal blower. It is to be understood that these forms are only illustrative and that either type of pump may be used with either design.

The device may be used to lift a liquid over a substantial height because it does not require priming or require a solid column of liquid for its operation. Thus, a mixture of air and liquid, which may even consist of liquid drops dispersed in air, may be readily raised. Such an air liquid mixture may be raised a height greater than the barometric height of the liquid itself.

The device is particularly suited to transferring liquids, such as chemicals from carboys, because it does not require priming and will continue to suck an air liquid mixture until all drops which the nozzle engages are removed. In a floor scrubber the floor is dried in the same manner. It is also useful for priming a standard impeller type centrifugal liquid pump.

It is to be noted that no packing is required in the pressure side of the device as there are no joints or bearings subjected to liquid pressure.

The outlet pressure is dependent upon the speed of rotation of the housings and upon the thickness of the peripheral liquid layer. In Figs. 1 to 4 the knob 39 and the valve wheel 46 provide accurate means for adjusting the thickness of this layer.

When the discs 36 and 37 are set to provide a steep notch as in Fig. 3, the thickness of the layer is more sensitive to changes in setting of the valve 48 because a given rise in liquid produces a greater change in the area of the suction opening. On the other hand, by adjusting the discs as in Fig. 4, the depth of the notches and the resulting thickness of the liquid layer is varied as described.

Although certain specific embodiments have been shown and described herein for purposes of illustration, it will be evident to those skilled in the art that the invention is capable of various modifications and adaptations within the scope of the appended claims.

The invention claimed is:

1. A combination suction and pressure pump comprising a suction device, a rotary case having an air passage communicating with said suction device, means for admitting air and liquid to said case, means for discharging liquid from said case, and a suction cut-off plate in said case having its peripheral edge spaced from the inner peripheral surface of said case and forming therewith a restricted peripheral passage for air to said suction device.

2. A combination suction and pressure pump comprising a suction device, a rotary case having orifices communicating with said suction device,

means for admitting air and liquid to said case, means for discharging liquid from said case, a suction cut-off plate in said case having its peripheral edge spaced from the surface of said case and forming therewith a restricted opening for the passage of air to the orifices communicating with said suction device, and means for varying the effective depth of said restricted opening.

3. A combination suction and pressure pump comprising a suction device, a rotary case having orifices communicating with said suction device, an inlet passage for air and liquid and an outlet passage for liquid, discharge means in said case communicating with said outlet passage, a pair of suction cut-off plates in said case having their peripheral edges spaced from the surface of said case and forming therewith a restricted opening for the passage of air to the orifices communicating with said suction device, said cut-off plates being mounted in face to face contact and having apertures adjacent their respective peripheries to form openings of varying depths upon relative rotation of said plates, and means for rotating one of said cut-off plates with respect to the other to vary the maximum depth and consequent pressure of liquid in said case.

4. A combination suction and pressure pump comprising a rotatable shaft, a suction device actuated by said shaft, a rotary case carried by said shaft and having orifices communicating with said suction device, an inlet passage for air and liquid and an outlet passage for liquid, means in said case communicating with said outlet passage, a pair of suction cut-off plates carried by said shaft within said case and having their peripheral edges spaced from the surface of said case and forming therewith a restricted opening for the passage of air to the orifices communicating with said suction device, said cut-off plates being mounted in face-to-face contact and having notches adjacent their respective peripheries to form openings of varying depths upon relative rotation of said plates, and means for rotating one of said cut-off plates with respect to the other to vary the maximum depth and consequent pressure of liquid in said case.

5. A combination suction and pressure pump comprising a housing, a rotatable shaft in said housing, a suction pump in said housing actuated by said shaft, a rotary cylindrical case in said housing carried by said shaft and having orifices adjacent said shaft communicating with said pump, an inlet passage for air and liquid to said housing and an outlet passage for liquid therefrom, and a valve on said housing having adjustable air inlet means communicating with the interior of said case to control the effect of the suction upon said inlet passage.

6. A combination suction and pressure pump comprising an electric motor having a rotatable shaft, a housing secured to said motor, a gear pump in said housing actuated by said shaft and having means for sucking air from said housing and discharging same through said motor to cool the latter, a rotary cylindrical case carried by said shaft and having orifices adjacent said shaft communicating with said gear pump, an inlet passage for air and liquid and an outlet passage for liquid, a spout extending from said inlet passage into said rotary case and curved in the direction of rotation of said case, a curved scoop in said rotary case communicating with said outlet passage and having its mouth adjacent the cylindrical surface of said case to scoop up liquid therefrom, a pair of circular suction cut-off plates carried by said shaft within said rotary case and having their peripheral edges spaced slightly from the cylindrical surface of said case and forming therewith a restricted annular opening for the passage of air to the orifices communicating with said gear pump, said cut-off plates being mounted in face-to-face contact and having dissimilar notches adjacent their respective peripheries to form openings of varying depths upon relative rotation of said plates, means for rotating one of said cut-off plates axially with respect to the other to vary the maximum depth and consequent pressure of liquid in said rotary case, and a valve on said housing having adjustable air inlet means communicating with the interior of said rotary case to control the effect of the suction upon said inlet passage.

7. A combination suction and pressure pump comprising a housing containing an outer chamber and an inner suction chamber, a rotary carriage between said chambers, a suction device in said suction chamber, an annular collar on said carriage extending into said outer chamber and containing circumferential air inlet openings communicating with said suction chamber, an elastic ring on said collar sealing said air inlet openings and being deformable to uncover said openings under the action of centrifugal force upon rotation of said carriage, and a rotary cylindrical case in said outer chamber secured to and enclosing said carriage.

8. A combination suction and pressure pump comprising a housing containing a suction chamber, a rotary carriage having orifices leading to said suction chamber, means in said suction chamber for sucking air through said orifices, a rotary cylindrical case secured to and enclosing said carriage, a pair of stationary concentric liquid inlet and outlet pipes extending within said case, and spaced cones carried by the inner ends of said inlet and outlet pipes within said rotary case and forming between said cones a restricted annulus for the discharge of liquid through said outlet pipe, the outer one of said cones having its periphery close to the cylindrical surface of said rotary case and the inner one of said cones having its periphery spaced from said cylindrical surface to admit liquid to said annulus.

9. A combination suction and pressure pump comprising a housing containing an outer chamber and an inner suction chamber, a rotary carriage between said chambers having orifices leading to said suction chamber, a fan on said carriage within said suction chamber for sucking air through said orifices, an annular collar on said carriage extending into said outer chamber and containing a circumferential series of air inlet openings communicating with said orifices, an outer plate on said collar, an elastic annular tube on said collar sealing said air inlet openings and being deformable to uncover said openings under the action of centrifugal force upon rotation of said carriage, a rotary cylindrical case in said outer chamber secured to and enclosing said carriage and having a flared outer wall containing an axial opening, a pair of stationary concentric liquid inlet and outlet pipes extending within said axial opening, and sealing means between said outlet pipe and said rotary case.

10. A combination suction and pressure pump comprising a housing containing an outer chamber and an inner suction chamber, a rotary car-

riage between said chambers having orifices leading to said suction chamber, suction means on said carriage within said suction chamber for sucking air through said orifices, an annular flange on said carriage extending into said outer chamber, a collar on said carriage within said flange containing a circumferential series of air inlet openings communicating with said orifices, an outer plate on said collar, an elastic annular tube seated on said collar in position to seal said air inlet openings and being deformable to uncover said openings under the action of centrifugal force upon rotation of said carriage, a rotary cylindrical case in said outer chamber secured to and enclosing said carriage and having a flared outer wall containing an axial opening, a pair of stationary concentric, liquid inlet and outlet pipes extending within said axial opening, and an elastic annular tube surrounding the outer concentric outlet pipe adjacent the axial opening in said flared wall to seal said opening against leakage.

11. A combination suction and pressure pump comprising a housing containing an outer chamber and an inner suction chamber, a rotary carriage between said chambers having orifices leading to said suction chamber, suction means on said carriage within said suction chamber for sucking air through said orifices, a rotary cylindrical case in said outer chamber secured to and enclosing said carriage and having a flared outer wall containing an axial opening, a pair of stationary concentric liquid inlet and outlet pipes extending within said axial opening, spaced cones carried by the inner ends of said inlet and outlet pipes within said rotary case and forming between said cones a restricted annulus for the discharge of liquid through said outlet pipe, the outer one of said cones having its periphery close to the cylindrical surface of said rotary case and the inner one of said cones having its periphery spaced from said cylindrical surface to admit liquid to said annulus, and vanes on the flared wall of said rotary case for propelling liquid toward said annulus.

12. A combination suction and pressure pump comprising a housing containing an outer chamber and an inner suction chamber, a rotary carriage between said chambers having orifices leading to said suction chamber, suction means on said carriage within said suction chamber for sucking air through said orifices, an annular flange on said carriage extending into said outer chamber, a collar on said carriage within said flange containing a circumferential series of air inlet openings communicating with said orifices, an outer plate on said collar, an elastic annular tube seated on said collar in position to seal said air inlet openings and being deformable to uncover said openings under the action of centrifugal force upon rotation of said carriage, a rotary cylindrical case in said outer chamber secured to and enclosing said carriage and having a flared outer wall containing an axial opening, a pair of stationary concentric liquid inlet and outlet pipes extending within said axial opening, spaced cones carried by the inner ends of said inlet and outlet pipes within said rotary case and forming between said cones a restricted annulus for the discharge of liquid through said outlet pipe, the outer one of said cones having its periphery close to the cylindrical surface of said rotary case and the inner one of said cones having its periphery spaced from said cylindrical surface to admit liquid to said annulus, vanes on the flared wall of said rotary case for propelling liquid toward said annulus, and an elastic annular tube surrounding the outer concentric outlet pipe adjacent the axial opening in said flared wall to seal said opening against leakage.

13. A combination suction and pressure pump comprising an electric motor having a rotatable shaft, a housing secured to said motor and containing an outer chamber and an inner suction chamber, a rotary carriage secured to said shaft and having orifices adjacent said shaft leading to said suction chamber, a fan on said carriage within said suction chamber having means for sucking air through said orifices and discharging same through said motor to cool the latter, an annular flange on said carriage extending into said outer chamber, a collar on said carriage within said flange containing a circumferential series of air inlet openings communicating with the orifices leading to said suction chamber, an outer plate on said collar having peripheral vanes for propelling air into said inlet openings, an elastic annular tube seated on said collar in position to seal said air inlet openings and being deformable to uncover said openings under the action of centrifugal force upon rotation of said carriage, a rotary cylindrical case in said outer chamber secured to and enclosing said carriage and having a flared outer wall containing an axial opening, a pair of stationary concentric liquid inlet and outlet pipes extending within said axial opening, spaced cones carried by the inner ends of said inlet and outlet pipes within said rotary case and forming between said cones a restricted annulus for the discharge of liquid through said outlet pipe, the outer one of said cones having its periphery close to the cylindrical surface of said rotary case and the inner one of said cones having its periphery spaced from said cylindrical surface to admit liquid to said annulus, vanes on the flared wall of said rotary case for propelling liquid toward said annulus, and an elastic annular tube surrounding the outer concentric outlet pipe adjacent the axial opening in said flared wall to seal said opening against leakage.

14. A liquid pump comprising a rotary cylindrical case, an air suction device connected to draw air from the interior of said rotary case, an inlet duct for feeding liquid into said case due to the suction thereof, means rotating said case to cause the liquid to form a peripheral layer therein, means discharging liquid from the periphery of said case due to centrifugal force developed by the rotation thereof, and means in said case responsive to the depth of the peripheral layer of liquid therein to control the connection to said suction device in a manner to limit the liquid level.

15. A liquid pump comprising a rotary cylindrical case, an air suction device connected to draw air from the interior of said rotary case, an inlet duct for feeding liquid into said case due to the suction thereof, means rotating said case to cause the liquid to form a peripheral layer therein, means discharging liquid from the periphery of said case due to centrifugal force developed by the rotation thereof, and means in said case cooperating with the peripheral layer of liquid therein to cut off the connection to said suction device when the peripheral layer of liquid reaches a predetermined depth.

16. A liquid pump comprising a rotary cylindrical case, an air suction impeller connected to draw air from the interior of said rotary case for maintaining suction therein, an inlet duct for

feeding liquid into said case due to the suction thereof, means rotating said case to maintain a peripheral film of liquid therein, and a discharge duct positioned in said case to receive liquid from said peripheral film under a pressure due to the centrifugal force developed by the rotation thereof.

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