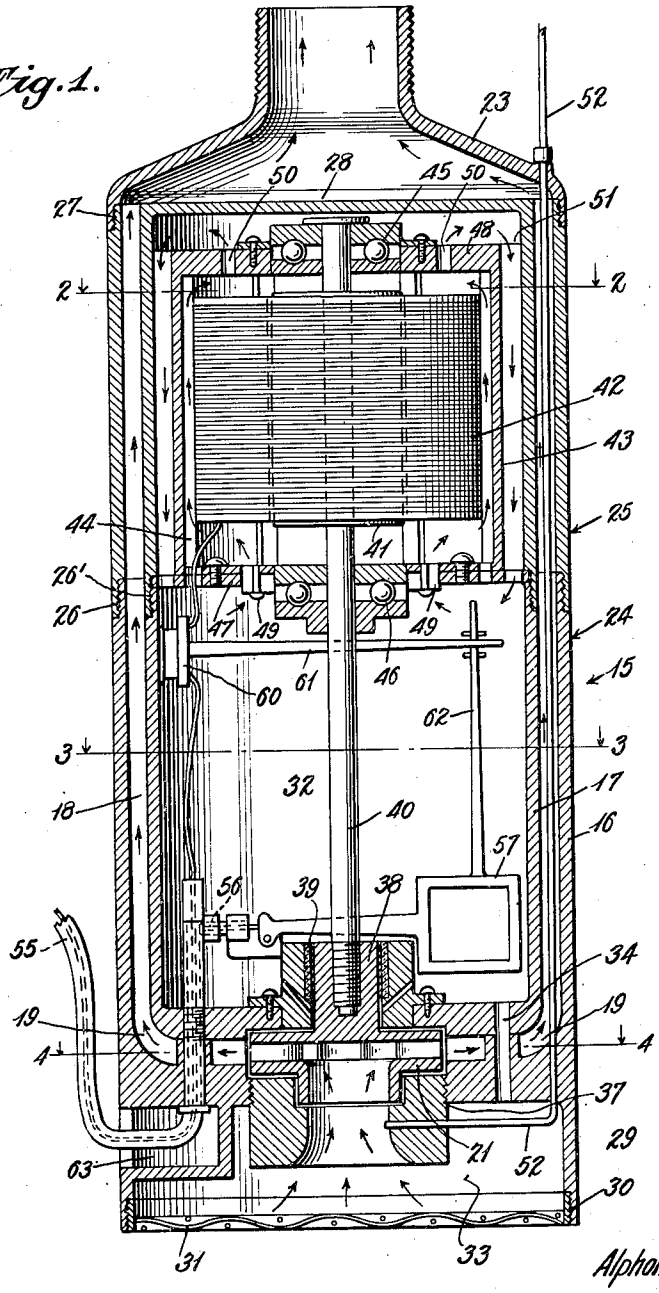
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ROTARY PUMP

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Fig. 1.




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Fig. 2.

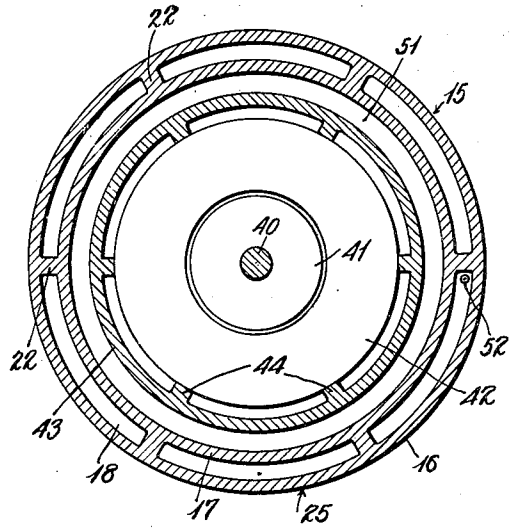



Fig. 3.

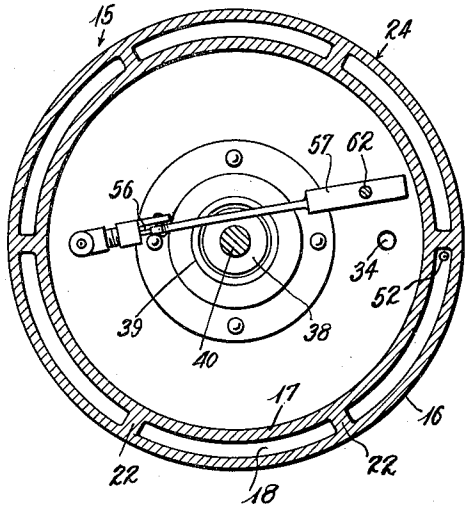



Fig. 4.

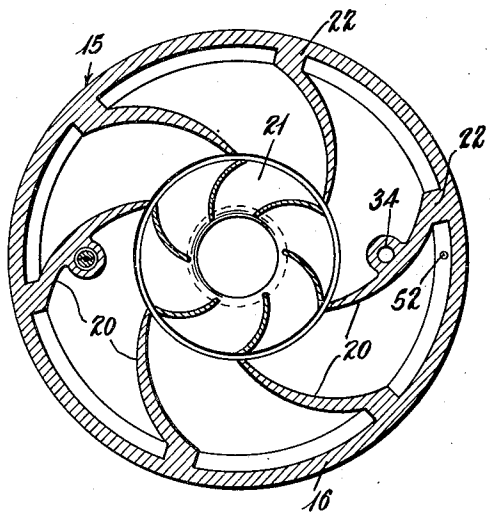
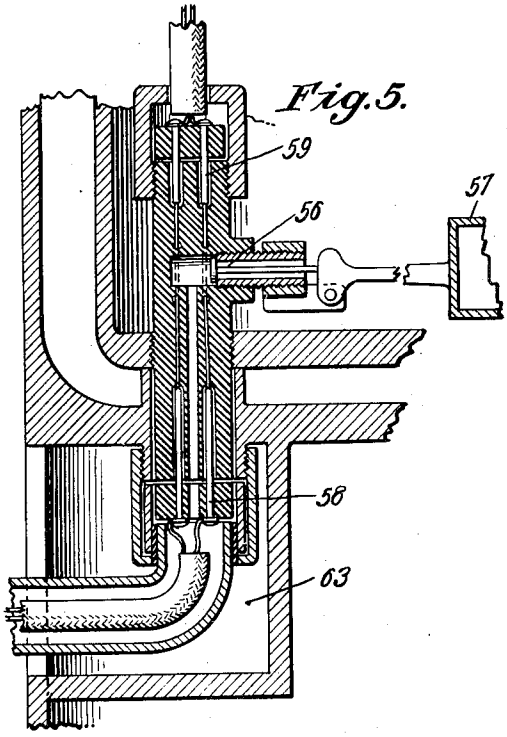



Fig. 5.




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Fig. 6.

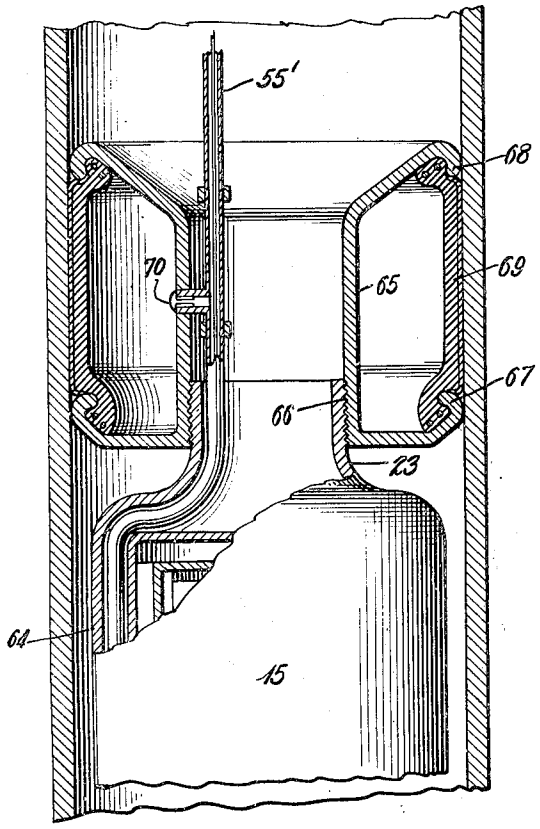



Fig. 7.

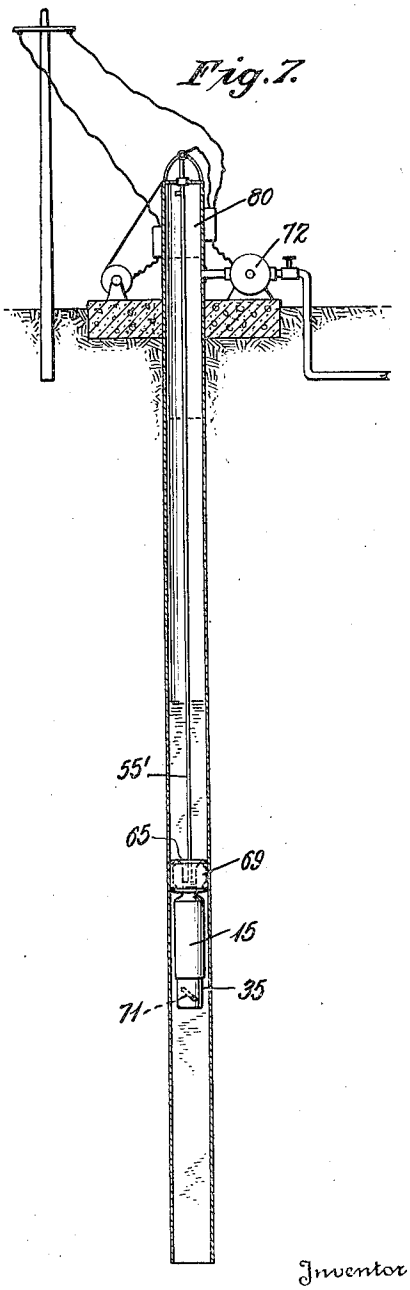
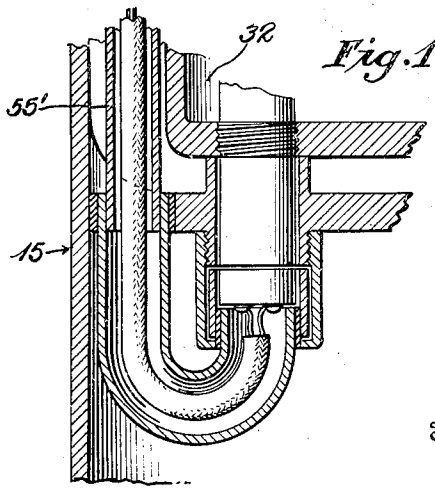



Fig. 13.




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Fig. 8.

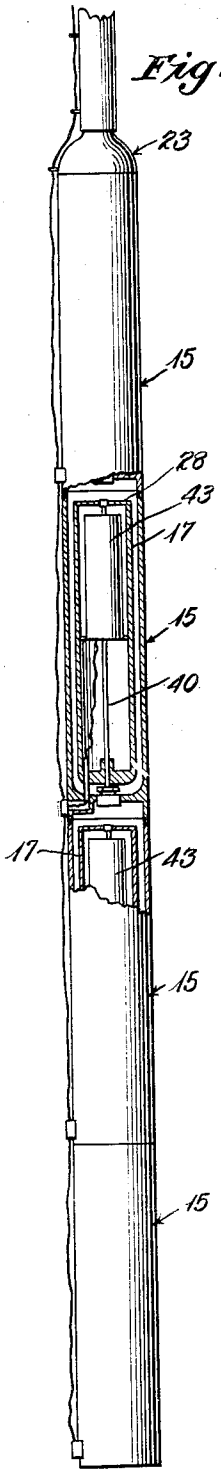



Fig. 9.

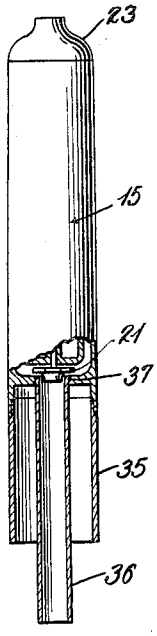



Fig. 10.

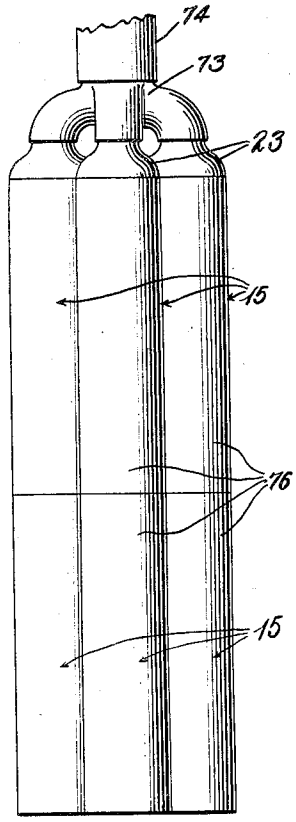



Fig. 12.

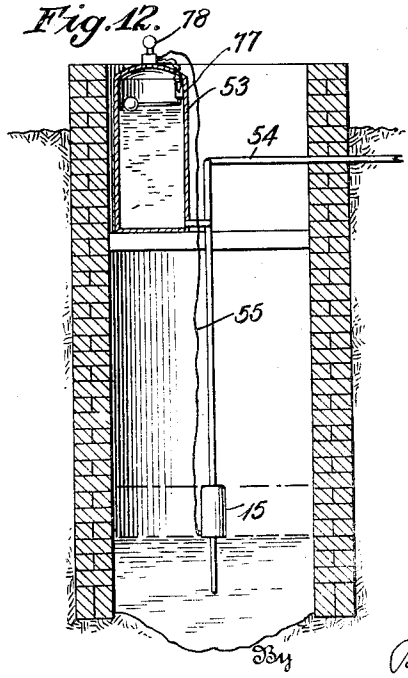
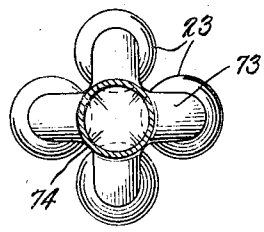



Fig. 11.




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# UNITED STATES PATENT OFFICE

2,039,698

## ROTARY PUMP

Alphonse O. Beauchemin, New York, N. Y.

Application May 8, 1934, Serial No. 724,585

5 Claims. (Cl. 103—87)

The invention relates to pumps and has as an object the provision of a pump which provides as an integral unit the pump structure enclosing the motor therein.

Further objects of the invention are to provide a submersible pump; a submersible pump having automatic means to prevent water from coming into contact with the motor; a submersible pump so designed as to prevent condensation of water upon the motor unit from the air surrounding the motor; to provide a pump which may be used in vertical position in a well, or as a boos. er pump in horizontal position in a pipe line; to provide a pump embodying means to compress air for the expelling of water from the motor chamber, and for other purposes; to provide a pump having an air trap or diving bell arrangement to house the motor, which diving bell is extensible for greater safety against water reaching the motor; to provide novel sealing means whereby the well casing may be used as a delivery conduit from the pump; to provide an air chamber or bell with circulation of air about the motor; to provide a motor chamber within the diving bell structure and spaced therefrom to keep the motor chamber wall out of contact with the diving bell structure; to provide a pump which may be run in submerged position indefinitely without attention; to provide a pump which may be connected in multiple series or in parallel, or both, for increase of head or of capacity, or both.

Further objects of the invention will appear from the following description when read in connection with the accompanying drawings showing an illustrative embodiment of the invention, and wherein:—

Fig. 1 is a central vertical section of the pump and motor unit;

Figs. 2, 3, and 4 are horizontal sections on the corresponding section lines of Fig. 1;

Fig. 5 is a detail vertical section corresponding to a portion of Fig. 1 drawn to an enlarged scale;

Fig. 6 is a central vertical section of the upper portion of the pump showing a sealing means;

Fig. 7 is a diagrammatic vertical section of the pump and sealing means of Fig. 6 in place in a well casing;

Fig. 8 is a side elevation partly broken away of a series arrangement of a plurality of pumps of the invention;

Fig. 9 is a side elevation partly broken away of an extension of the lower air chamber;

Fig. 10 is a side elevation, and Fig. 11 is a plan view of a parallel arrangement of four pumps;

Fig. 12 is a vertical section partly in side elevation showing a pump submerged in a well with the compressed air tank connected to the pump; and

Fig. 13 is a section corresponding to Fig. 5 showing a different form of air and wire conduit.

It is well understood in the art of centrifugal pumps that every pump of the nature illustrated herein must have a diffusing hub for change of the direction of the water from the horizontal direction where it leaves the impeller to a vertical direction for delivery from the pump. In former submersible pumps of which I am aware, the hub of the pump has always been made in accordance with conventional practice and the motor has been enclosed in a chamber separate from the hub. The result has been that such former structures have been too unwieldy and heavy for successful use or economical production. In accordance with the present invention the motor is enclosed in an air bell integral with the hub itself of the pump.

As shown in Figs. 1 to 5 inclusive, the casing of the pump is illustrated at 15 comprising the wall 16 of the bowl of the pump and the wall 17 of the hub, said walls spaced to provide the annular or cylindrical channel 18 curving inwardly as at 19 and formed with diffusion vanes 20, as shown in Fig. 4, to receive water from the impeller 21. The vanes 20 are shown as joining vanes 22 extending upwardly in channel 18, to the lower end of delivery nozzle 23.

For convenience in assembly, the lower portion 26 of the bowl 15 is made separate from the upper portion 25 thereof, the two portions being joined together as by a screwthreaded joint 26 and the nozzle 23 is screwed upon the upper end of the portion 25 of the bowl, as at 27. The upper and lower portions of the hub walls 17 are likewise divided, as at 26'.

To form a compressed air bell, the upper end of the walls 17 are shown as formed integral with a diaphragm 28, thus hermetically sealing an air space in the interior of the hub.

The lower end of the section 24 of the bowl is also shown as extending downwardly into a skirt 29 shown as interiorly screwthreaded at 30, into which screwthreads there is shown inserted a non-clogging screen 31. There is thus provided an upper air chamber 32 and a lower air chamber 33 which are shown as placed in communication by means of a channel 34. It results that when the pump is submerged, air will be compressed in the lower air chamber 33 and

through the medium of the channel 34 in the upper air chamber 32.

If the pump is to be submerged to a considerable depth, the screen 31 may be removed and an extension 35, Fig. 9, of the skirt 29 may be screwed into threads 30, in which event a pipe 36 is screwed upon the intake nozzle 37 of the pump to extend below the extension 35 of the skirt.

The impeller of the pump shown at 21 is of a usual form and comprises a hub 38 and has a bearing 39 in the lower portion of the hub, as shown in Fig. 1. To drive the impeller, there is shown a motor shaft 40 connected with a rotor 41 of a motor diagrammatically shown as of the squirrel cage type having a stator 42 mounted in a casing 43 and spaced therefrom by ribs 44 shown in Fig. 2.

Antifriction bearings 45, 46 are shown in which the shaft 40 revolves. The motor casing 43 comprises a supporting disc 47 which may be mounted in the threaded joint 26 between the upper and lower portions of the hub. The motor casing is shown as upwardly closed by means of a disc 48 which may be integral with the side walls of the casing, air circulation openings 49, 50 being shown for circulation of air within the motor casing to the space within the compressed air bell enclosed by the upper head 28, other openings 51 being provided for circulation between the motor casing and the bell.

To compress air by pumping action, there is shown an air intake pipe 52 which may be passed down one of the chambers 18 and through the intake nozzle 37 opening into a zone of rarefaction caused by the action of the impeller, which pipe 52 may extend to the atmosphere and through which air will be drawn to mix with the water. The water and air may, as indicated in Figure 12, be delivered to a tank 53 wherein the air will separate from the water and gather in the upper portion of the tank. The water will be expelled from the tank 53 by air pressure through a pipe 54 which may connect with the house system or other place of use.

To expel water from the chamber 32 within the compressed air bell, a pipe 55 is shown connecting with the upper portion of the tank 53 and passing through the lower portions of the bowl and hub into the chamber 32, admission of air from the compressed air tank being controlled by means of a valve 56 controlled by a float 57.

As shown the compressed air pipe 55 is utilized also as a conduit for wiring to the motor through the connectors 58, 59 illustrated in Fig. 5. Should the compressed air supply fail, it is desirable to cut off current from the motor upon rise of the water in pipe 32 and for this purpose a conventional cut-out switch 60 is shown diagrammatically in Fig. 1 controlled by a lever 61 and a rod 62 connected with the float 57. Should water still continue to rise and the cut-out switch 60 fail to act, a short circuit will result at the switch 60 which may be protected by a fuse, not shown, at the surface.

As shown in Fig. 13, the chamber 63 illustrated in Fig. 5 may be omitted and the pipe 55 may be carried through the lower portion of the hub and into one of the channels in the hub between vanes 22. This form of wiring is desirable when the sealing means shown in Fig. 6 is used for the purpose of utilizing the wall casing 64 as a delivery pipe.

The sealing means is shown as comprising an annular channel shaped casting 65 screwed at 66 upon the delivery nozzle 23 of the pump, the flanges of the casting 65 being formed as shown at 67, 68, to receive beads upon the edges of flexible annular member 69 of the nature of pneumatic tire structure.

To inflate the sealing means whereby to cause the annular member 69 to seal with the wall of the well casing, the compressed air pipe 55' is shown as communicating at 70 with the interior of the sealing means thereby placing air pressure from the tank 53 in the interior of said sealing means.

With this structure as shown in Figure 7, the pump may be lowered into the water in the well casing and compressed air turned into the sealing means and the pump started. Should the pump be stopped, water cannot escape downwardly about the pump and a check valve 71, Fig. 7, may be provided at the bottom of the skirt 35 or at the bottom of the skirt 29, Fig. 1, not shown. In the structure of Fig. 7 the upper end of the well casing may be closed to provide the compressed air chamber 30.

In Figure 7, there is diagrammatically illustrated a booster pump 72 placed in the outlet from the well, which may be a second pump of the nature of that shown herein to force the liquid away from the well to a point of use.

A plurality of pumps may be connected in series by unscrewing the nozzle 23 from the pump to be added and the screen ring 31 from the lower portion of the skirt 29, whereupon the added pump will fit into the threads 30, and with connection of the wires to the added pumps each in parallel with the pump above, any number of pumps may be connected in series, four pumps being shown so connected in Figure 8. This will provide a head of substantially 90% of the corresponding multiple of a single pump.

If it be desired to connect the pumps in parallel, a casting 73 may be connected to the delivery pipe 74, each of the outlets of the casting being connected to a nozzle 23 of the separate pumps.

The casting shown in Figures 10 and 11 is a four-way casting but it will be seen that a three-way or a two-way casting may be equally well utilized. The two, three, or four pumps thus connected in parallel may also be a series multiple pump as indicated at 76, Fig. 10.

A defect in former attempts to provide submersible pumps has been that the motor is housed directly in the compressed air bell and is therefore cooled by the water upon the outside of the wall of the bell. It resulted from this structure that when the pump is stopped, the stator of the motor cooled more rapidly than the air within the bell and the moisture from the air condensed upon the motor, which condensation upon again starting the motor, caused short circuits.

In the structure shown, the heat of the motor causes a circulation of air through the openings 49 about the motor, through openings 50 to the space within the air bell, and then downwardly through the openings 51. When the motor is stopped, the air within the motor casing 43 is warmed by the heat of the motor causing the circulation to continue, and the moisture from the air is deposited in drops upon the interior surface of the air bell away from the motor where it may drop down into the compressed air space 32, thus keeping the motor dry at all times.

In horizontal use, as for instance, when used as a booster pump in a pipe line, the opening 34

will be plugged, the float 57 and cut-out 60 will be omitted, and leakage will be provided about the passage of pipe 55 to the interior. The device will be placed with the portion at the left in Fig. 1 downward. Liquid leaking into chamber 32 will not reach the motor unless it rises to an opening 49 or 50, at which time air would become compressed in the chamber. However any liquid leaking in will drain out through the space about pipe 55 assisted by eduction of liquid flowing past the pump in the pipe line. Also, if desired a slow leak of compressed air may be provided from pipe 55 into the interior, to expel liquid.

The fact that the wires are run to the motor in the compressed air pipe 55 or 55' prevents leakage of water into contact with the wires.

In the compression tank 53 there is shown a float switch 77 for control of the motor by the water level in the tank. A safety valve 78 is shown on the compression tank to limit the air pressure in the tank to the desired amount. The air induction pipe 52 may be provided with a control valve, not shown, to adjust the intake of air to be compressed.

Minor changes may be made in the physical embodiment of the invention within the scope of the appended claims without departing from the spirit thereof.

I claim:

1. A rotary pump comprising, in combination: a hollow diffusing hub and bowl formed with an impeller chamber and radial flow passage in an inlet end wall thereof and with a longitudinal flow passage along its side wall; means hermetically closing the hollow of the hub at its outlet end; an impeller in said chamber; a motor housing in said hub spaced from said side wall and from said hermetically closed end; a motor mounted in said housing in spaced relation with the walls thereof; drive connections between said motor and impeller; and means to provide circulation of air through said housing and end and side spacings.

2. A rotary pump comprising, in combination: a hollow diffusing hub and bowl having an inlet and an outlet; a hermetic closure for the interior of said hub at its outlet end; a diaphragm within said hub intermediate its ends, dividing the interior into upper and lower air trap chambers; said diaphragm being formed with a passage placing said chambers in communication and with an impeller chamber and a radial flow passage in communication with the outlet; means to conduct liquid from said radial flow passage to the outlet end of the hub and bowl; an impeller in said impeller chamber; a motor housed in the upper chamber; means to drive said impeller from said motor and an intake nozzle secured at the inlet opening of the impeller chamber and projecting into said lower air trap to provide the air trap character thereof.

3. A rotary pump comprising, in combination: a rotary impeller; an upwardly closed submersible chamber; a motor mounted in said chamber and connected to drive said impeller; an air eduction pipe leading to the atmosphere and opening in the zone of rarefaction of said impeller; means to receive water mixed with compressed air from the pump and to store the air under pressure; means to deliver compressed air from said storage means to the interior of said chamber to expel water therefrom; a float in said chamber; wires leading to said motor; means controlled by said float to control admission of air to said chamber; and a cut-out connected in said wires and controlled by said float to break connection to said motor upon undue rise of water level in said chamber.

4. A rotary pump comprising, in combination: a hollow diffusing hub and bowl structure having an inlet and an outlet and formed with spaced closure walls at its inlet end and spaced concentric side walls; diffusion vanes between said spaced closure walls, said vanes extending longitudinally between said concentric walls to the outlet end of said bowl, said spaced closure walls formed with a central impeller chamber, said chamber communicating with the inlet and the spaces between said vanes and said closure walls having an opening to the interior of the hub closed from the passage between said spaced closure walls; a hermetic closure for the outlet end of the interior of the inner concentric wall; a motor mounted in the upper portion of said interior in spaced relation to the inner surface of the interior side wall; an impeller mounted in said chamber connected to be driven by said motor.

5. A series-parallel, submersible combination of pumps comprising in combination: a plurality of pumps each comprising a hollow diffusing hub and bowl of uniform and the same external diameters, each having an outlet and an inlet end formed with male and female screw connections respectively; the upper multiple connected pumps each having an outlet nozzle engaging said outlet end screw connections; a fitting having a plurality of inlets connected respectively to said outlet nozzles, and an outlet to connect with a common delivery conduit; a second pump connected at its outlet-end-screw-threads to the inlet-end-screw-threads of each of said outlet nozzle-provided pumps to provide said series parallel arrangement; each of said hubs and bowls having a closure at its inlet end formed with an impeller chamber and radial flow passages; the walls of each hub and bowl formed with longitudinal passages leading to the outlet end thereof and communicating with said radial flow passages; the outlet end of each hub, interiorly of said longitudinal passages being hermetically closed; an impeller in each impeller chamber; and a motor in each hermetically closed interior connected to drive the respective impellers.

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