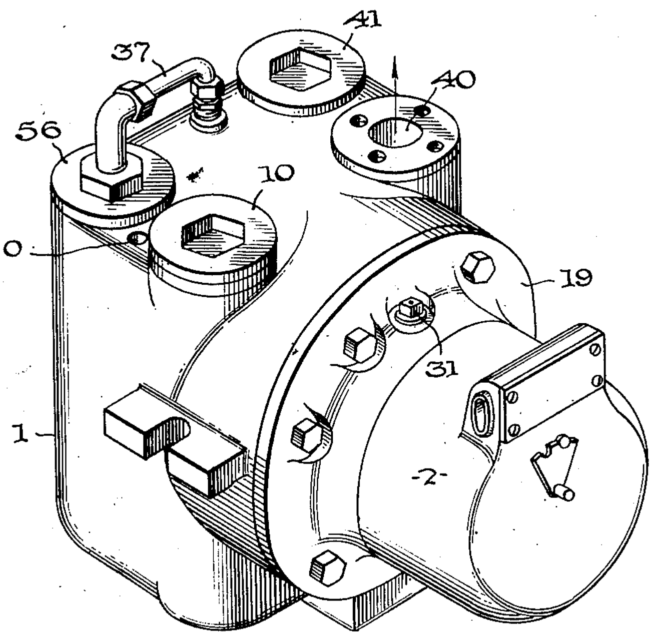
May 26, 1953 | B. WAGNER | 2,639,671

SELF-PRIMING CENTRIFUGAL PUMP UNIT
FOR LIQUID DISPENSING APPARATUS

Filed Oct. 11, 1949 | 6 Sheets-Sheet 1

Fig. 1.



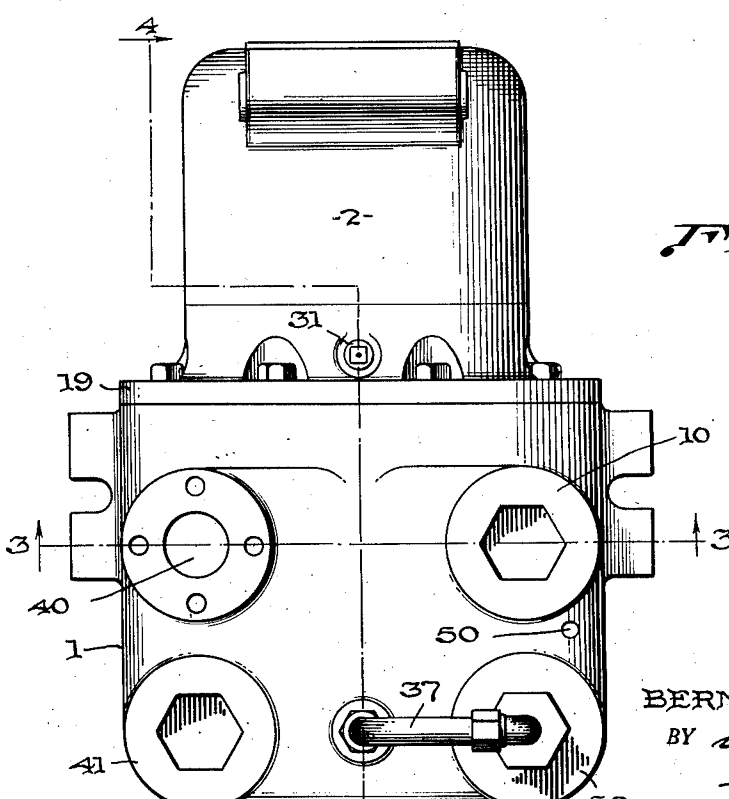


Fig. 2.

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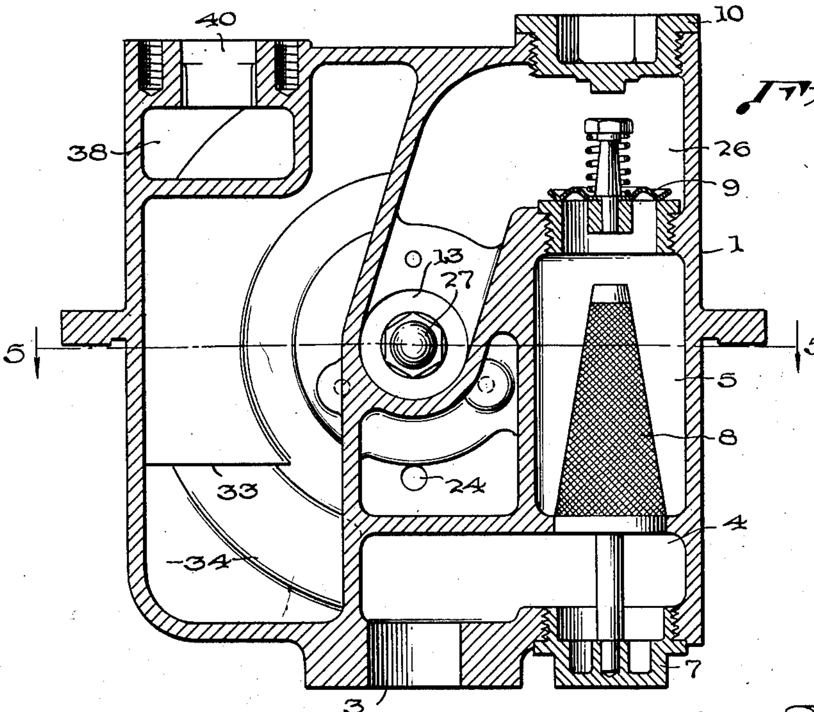

Fig. 3.

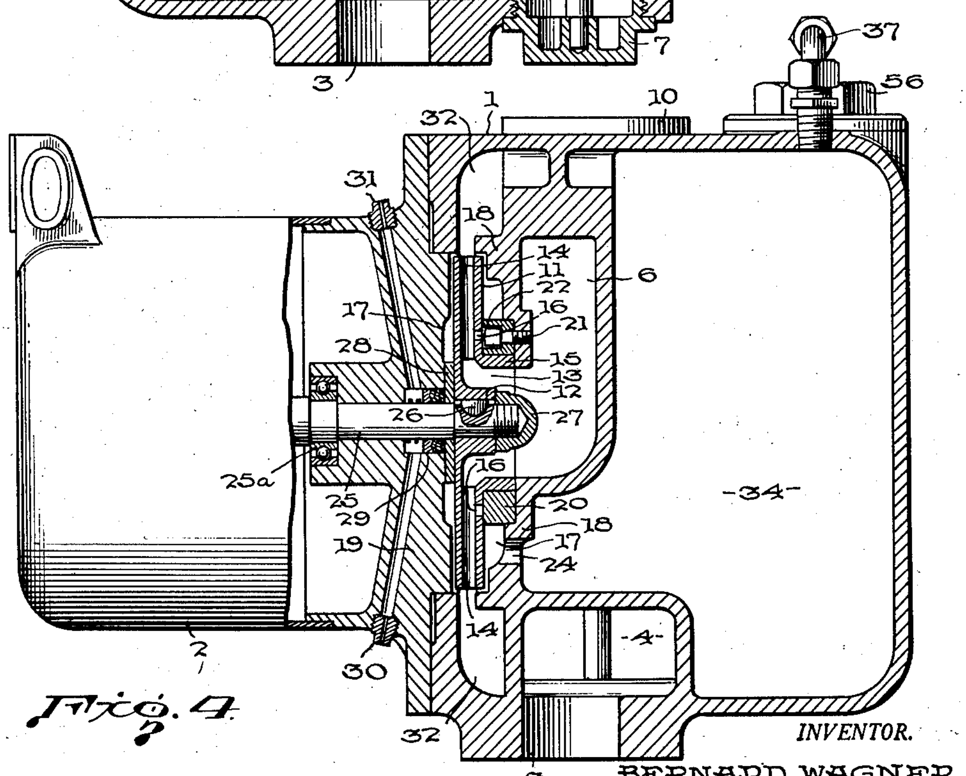

Fig. 4.

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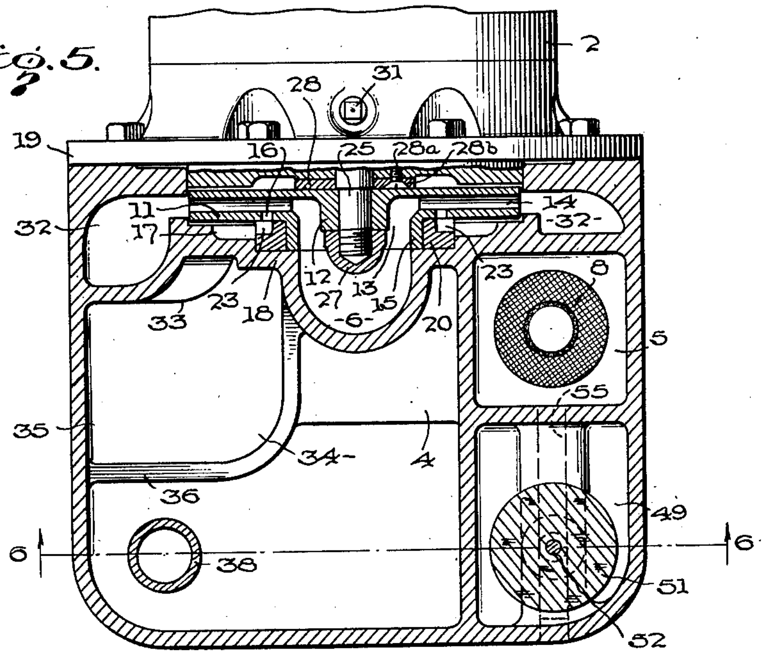
FIG. 5.



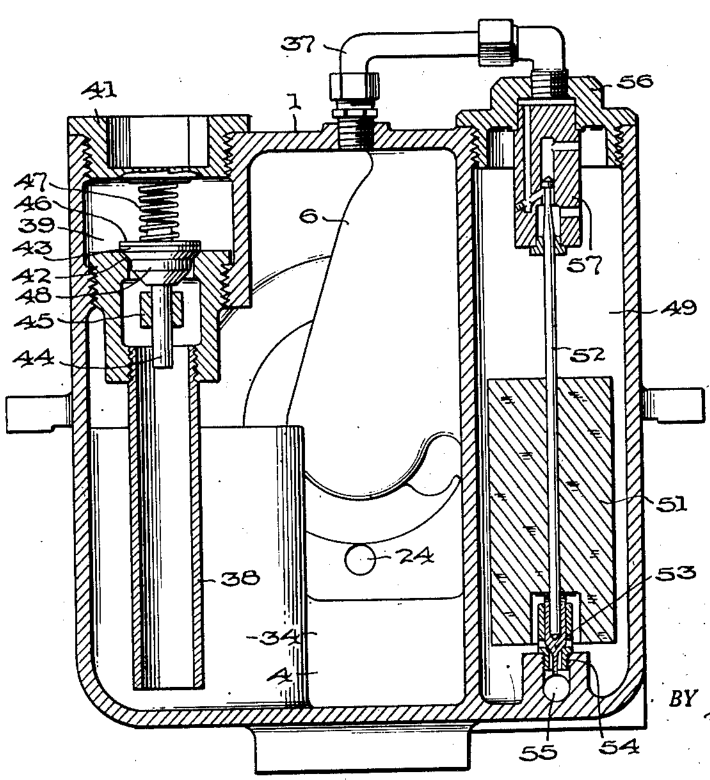


FIG. 6.

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Fig. 7.

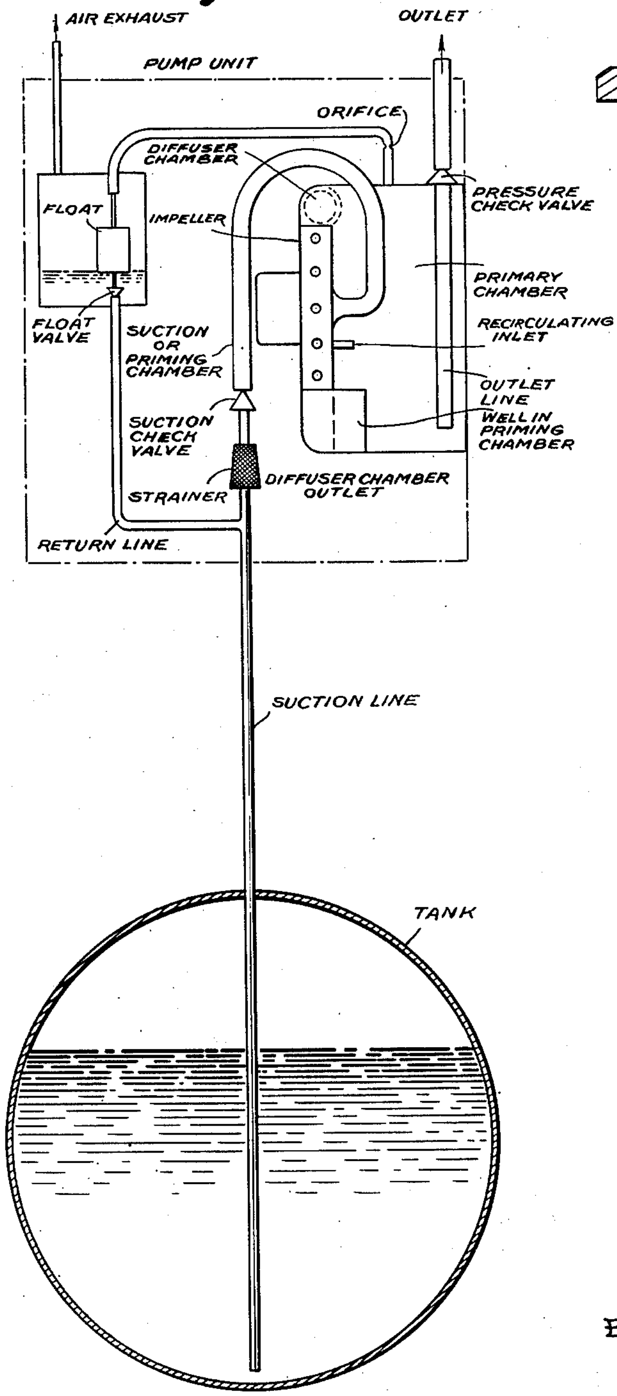

Fig. 8.

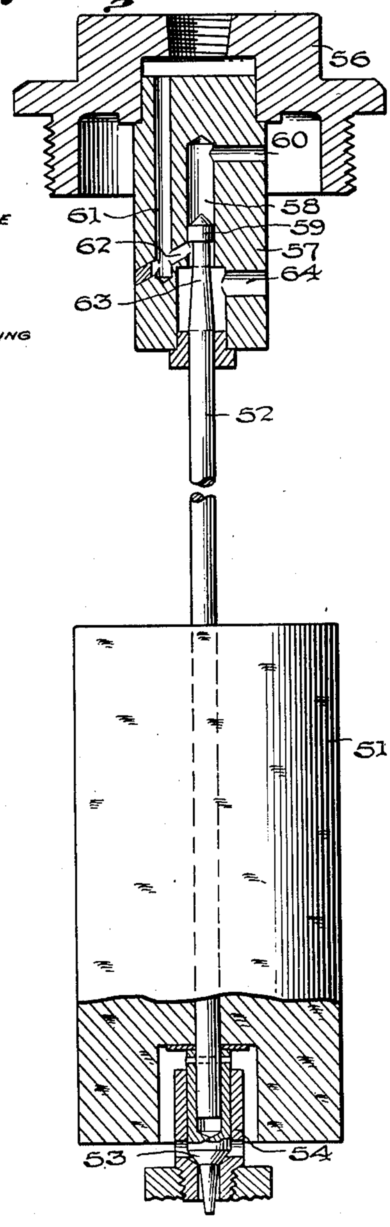

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Fig. 9.

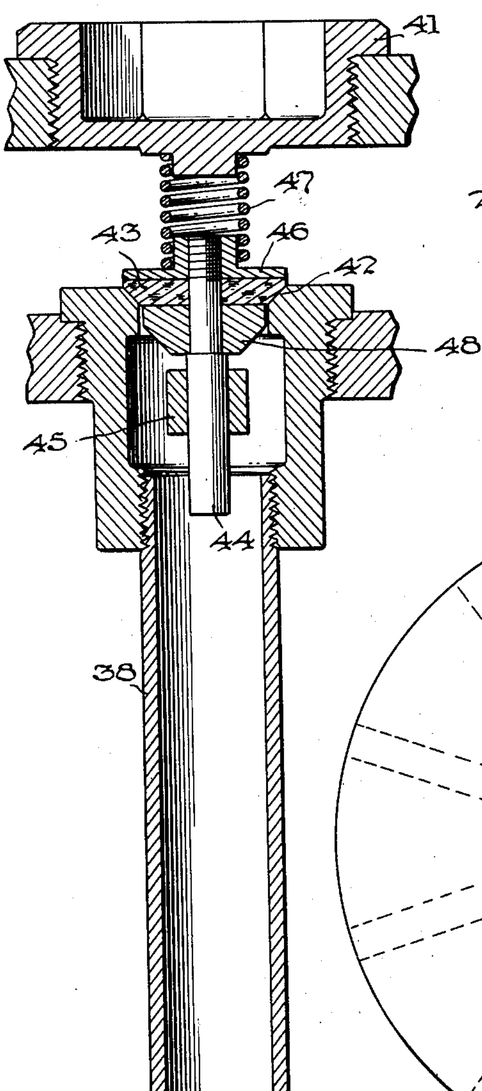

Fig. 11.

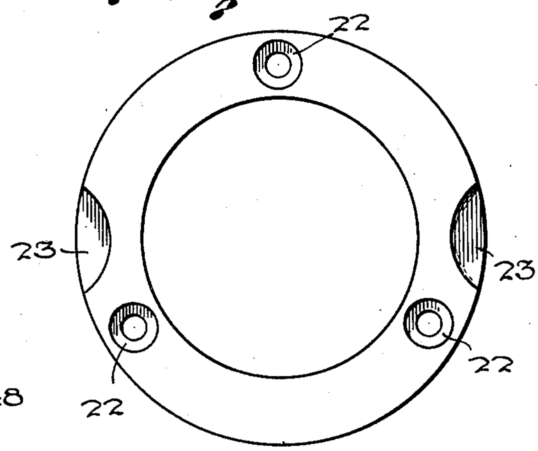

Fig. 10.

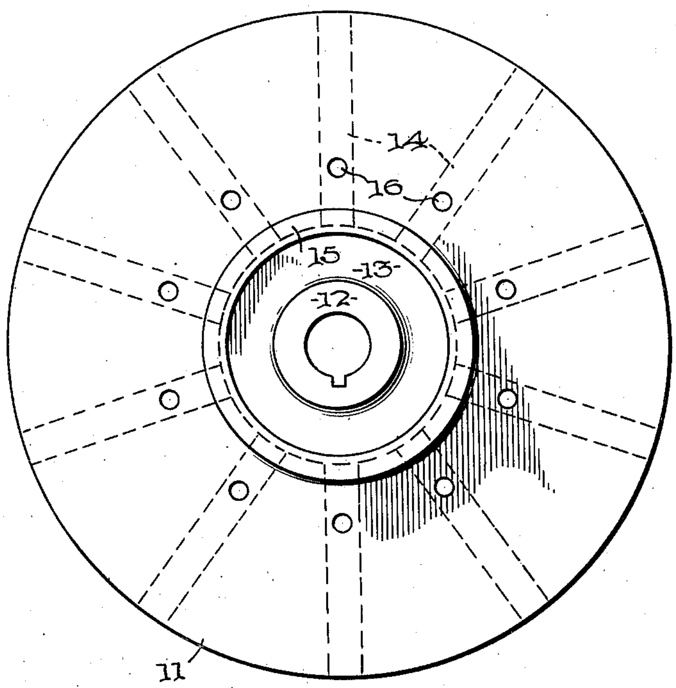

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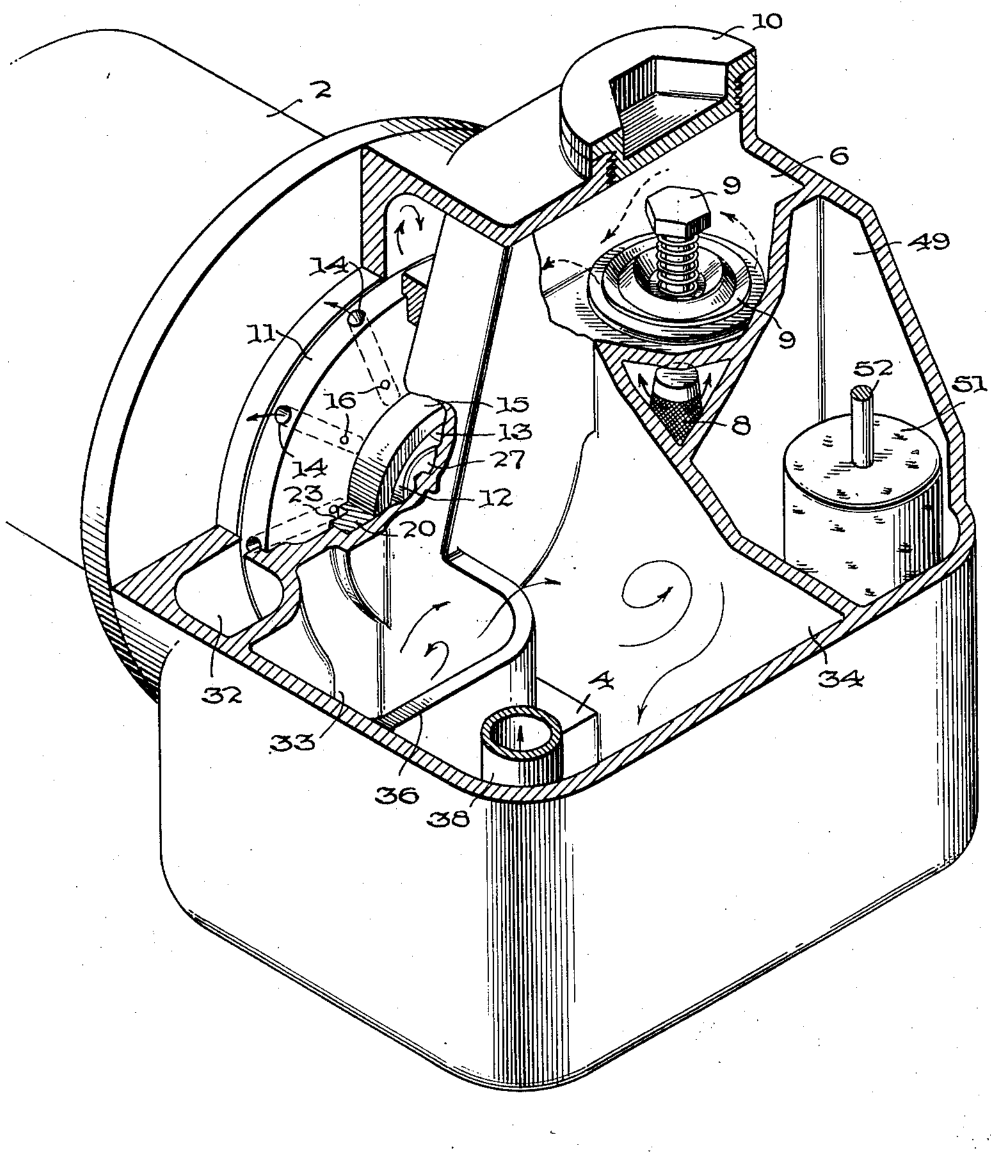
Fig. 12.



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Patented May 26, 1953

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UNITED STATES PATENT OFFICE

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SELF-PRIMING CENTRIFUGAL PUMP UNIT FOR LIQUID DISPENSING APPARATUS

Bernard Wagner, Crafton, Pa., assignor to Gulf Oil Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Application October 11, 1949, Serial No. 120,797

5 Claims. (Cl. 103—103)

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This invention relates to a self-priming centrifugal pump unit for liquid dispensing apparatus, and more particularly to a pump unit which is advantageously adapted to perform the pumping function in a gasoline dispensing system and to deliver the gasoline to a meter free from air and vapor.

The principal components of the usual gasoline dispensing system comprise an underground reservoir having a conduit containing a check valve leading therefrom to a pump, a motor to drive the pump, an air eliminator to separate air from the pumped gasoline, a meter through which the gasoline from the air eliminator is forced under pressure, a computer having a driven connection with the meter, and a dispensing hose connecting with the discharge from the meter and containing an outlet dispensing valve. It is customary practice in such dispensing systems to employ rotary positive displacement type pumps to perform the pumping operation. However, due to the positive action of these pumps and the high pressures which they are capable of building up, it is necessary to employ therewith a by-pass line from the outlet to the suction side of the pump to by-pass gasoline while the outlet valve in the dispensing hose is closed and the pump in operation. This characteristic of construction results from the common practice of operating the pump to develop pressure before the dispensing valve is opened and after it is closed following a dispensing operation. Were it not for the by-pass, if the dispensing valve were closed with the pump running, the pressure developed would either stop the pump or cause serious breakage. It is also necessary to include in the by-pass line a check valve which is designed to permit the by-pass of gasoline when the dispensing valve is closed and to cut off the by-pass flow when the dispensing valve is opened. The disadvantages of such an arrangement are many. From the economic standpoint, additional power is consumed to pump the gasoline through the by-pass and by-pass valve. Furthermore, such construction adds to the expense of any gasoline pump installation. In addition, failure of the by-pass valve will stall the motor or otherwise result in serious damage to the entire dispensing system.

It is therefore apparent why many attempts have been made to find a practical substitute for the rotary positive displacement pump in gasoline dispensing systems. The use of centrifugal type pumps has been proposed, since centrifugal pumps offer certain advantages over the rotary

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positive displacement type pump for such a purpose. Perhaps most significant is the fact that no by-pass connection need be employed with centrifugal pumps, due to the characteristic of centrifugal pump impellers which enables them to idle or slip while the dispensing valve is closed, without building up serious pressures on the discharge side of the pump. When such a condition exists in a centrifugal pump, that is, when the dispensing valve is closed, the power consumed by the pump is considerably less than that consumed when the dispensing valve is open and the pump is pumping under full load. Rotary positive displacement type pumps are not so advantageously adapted. Moreover, a centrifugal pump is one of the most economical and efficient types of devices for pumping purposes.

On the other hand, the use of centrifugal pumps in gasoline dispensing systems is complicated by the fact that ordinary centrifugal pumps fail to remain in a state of prime under all conditions of operation. Since the operation of a centrifugal pump depends upon the inertia of a liquid to develop the necessary pressure, it cannot pump if air enters the impeller causing air binding. Therefore, centrifugal pumps must be provided with some means for filling the suction line and the pump casing with liquid before the pump can discharge. Various means have been proposed to perform this function. For example, the use of a check valve in the suction line, or the use of a small auxiliary priming pump, as well as maintaining the impeller under a positive head by locating a discharge tank thereabove, have all been proposed. However, such arrangements have not proved to be completely successful or practical under all conditions. Clearly, they have not rendered centrifugal pumps suitable for use in gasoline dispensing systems wherein a highly volatile liquid must be handled by the pump. It has also been proposed to combine certain features of the rotary positive displacement type pump with features of the centrifugal type pump, but such devices have not been demonstrated to be a practical solution to the problem.

One of the most important objects of my invention, therefore, is to provide a self-priming centrifugal pump of such design as to render it practical for use in a gasoline dispensing system, thereby eliminating the necessity for employing the by-pass construction used with rotary positive displacement pumps and permitting the enjoyment of other advantages which attend the use of centrifugal pumps.

Another object of my invention is to provide a centrifugal pump having improved priming means incorporated therewith to eliminate the priming problem which in the past has restricted the broad application of centrifugal pumps.

A further object of my invention is to provide an improved centrifugal pump impeller designed to facilitate priming of the pump.

A still further object of my invention is to consolidate the necessary elements of a pump system with an improved centrifugal pump in a novel manner to achieve an integrated pumping unit having improved design and operational features, and occupying a minimum amount of space.

Another object of my invention is to provide an integrated pump unit of the character described wherein the component parts thereof are all readily accessible without disconnecting the unit from the dispensing system and wherein possible trouble can be quickly detected and isolated to the defective part, thereby reducing the time of shutdowns for servicing the pump.

A further object is to provide a pump unit of the character described wherein the individual parts thereof are simple and economical to manufacture, assemble, and maintain.

Another object is to provide in the outlet from the pump unit an improved outlet check valve designed to resist the shock of sudden pressures developed between the check valve and meter when the gasoline discharge valve is suddenly closed, thereby preventing damage to the meter and other portions of the dispensing system.

Still another object is to provide for adequate drainage and venting from the impeller drive shaft to prevent the hazard accompanied by the possible leakage of inflammable liquid and vapors along the drive shaft.

These and other objects are accomplished by my invention wherein I provide a pump unit containing within one compact housing an inlet conduit having a strainer and check valve therein, a centrifugal pump impeller, a discharge chamber thereabout, a primary air separation chamber, a liquid discharge conduit from the primary air separation chamber and an outlet check valve in the liquid discharge conduit, and a secondary air separation chamber having a float operated valve therein controlling a return conduit to the pump inlet conduit. The float valve aforesaid is the subject of my copending application, Serial No. 290,016. To facilitate priming the pump, the impeller, which is characterized by a central inlet eye and a plurality of passages radiating from the central inlet eye to the outer periphery of the impeller, is further provided with lateral passages connecting with the radiating passages; and a recirculating or priming passage is provided between the impeller chamber and the primary air separation chamber to permit the flow of priming liquid to the lateral passages in the impeller. This flow is so controlled that priming liquid is introduced to the radiating passages in the form of successive slugs of liquid which serve to entrap successive volumes of air therebetween and drive the air to the outer periphery of the impeller, thereby creating suction at the impeller inlet.

My invention may be best understood by reference to the accompanying drawings and the descriptive matter relating thereto wherein a preferred embodiment of my pump unit is specifically shown and described.

Referring to the drawings,

Fig. 1 is an isometric view of my pump unit showing the motor connected thereto;

Fig. 2 is a plan view of the pump unit and motor shown in Fig. 1;

Fig. 3 is a section in elevation taken along line **3—3** of Fig. 2;

Fig. 4 is a section in elevation taken along line **4—4** of Fig. 2;

Fig. 5 is a sectional view, looking down, taken along line **5—5** of Fig. 3;

Fig. 6 is a section in elevation taken along line **6—6** of Fig. 5;

Fig. 7 is a schematic representation showing the principal elements incorporated in my pump unit;

Fig. 8 is a section in elevation showing the detail of the float valve and mechanism associated therewith which also appears in Fig. 6;

Fig. 9 is a section in elevation showing the detail of the outlet check valve which also appears in Fig. 6;

Fig. 10 is a side view in elevation of the impeller which is shown in section in Figs. 4 and 5;

Fig. 11 is a side view in elevation of the wearing ring which is shown in section in Figs. 4 and 5; and

Fig. 12 is an isometric view of my pump unit, partly in section, showing the spatial relationship of the elements, chambers and conduits therein.

The general arrangement of elements which I have consolidated in my pump unit may be ascertained from the diagrammatic representations shown in Fig. 7. A more specific description of my invention, with reference to the other figures, follows.

Suction inlet conduit

Referring to Figs. 1, 2, 3 and 12, the pump unit housing is indicated generally at **1**, and the motor and motor bell housing which is bolted thereto is indicated generally at **2** and may be provided with conventional voltage regulator and electrical conduit connection box as shown. The base of the pump housing is provided with a suction inlet **3** which leads into portions **4**, **5** and **6** of a suction conduit delivering liquid to the impeller eye and formed by partitions within the housing. The base of housing **1** is provided with a removable closure **7** which is adapted to position a strainer **8** within portion **5** of the suction conduit to prevent any foreign matter from entering any further portion of the pump system. A suction check valve indicated generally at **9** and of any suitable type is positioned downstream of the strainer between portions **5** and **6** of the suction conduit and a removable closure **10** is provided in the top of housing **1** to permit insertion and servicing of valve **9**. From the check valve **9** at a high point in the housing the portion **6** of the suction conduit bends and extends downwardly to form an inlet connection with the impeller **11**.

Impeller and impeller chamber

The impeller **11**, shown in Figs. 4, 5, 10 and 12 is a disc-like cylindrical member which is provided with a collar **12** adapted to receive a drive shaft. An annular inlet passage **13** surrounding this collar extends into the impeller from one end face thereof and a plurality of radial passages **14** are provided to connect inlet eye **13** with the outer periphery of the impeller. The outer periphery of inlet **13** is provided with a bearing **15** extending outwardly from the end face of the impeller which carries bearing 15. Lateral passages 16, the purpose of which will hereinafter appear, are provided at points adjacent the bearing to connect radial passages 14 with the end face of the impeller carrying said bearing. The impeller 11 is situated within an impeller chamber 17 formed between a partition 18 within the housing 1 and the end plate 19 of the bell housing for motor 2. Bearing 15 of the impeller operates against a portion of partition 18 and a wearing ring 20, rigidly secured to partition 18 by means of bolts 21 countersunk within the wearing ring in counterbores 22. The wearing ring 20 is further provided, as shown in Figs. 5, 11 and 12, with arcuate passages 23 which communicate impeller chamber 17 with the region of lateral passages 16 in impeller 11. Partition 18 is provided with a recirculation passage 24 to communicate a source of priming liquid with impeller chamber 17 and thence through passages 23 in wearing ring 20 to passages 16 in the impeller.

As stated hereinabove, the impeller 11 is so constructed that priming liquid is introduced to the radial passages 14 in the form of successive slugs of liquid from the primary air separation chamber to entrap air from the suction inlet 6 and prime the pump. To accomplish this result, the size and number of the radial passages 14 and lateral passages 16, as well as the size and number of arcuate passages 23 may vary depending upon a number of considerations. The pump capacity will depend, within certain limits, primarily upon the size and number of the radial passages 14 and the speed of impeller rotation, although other factors obviously influence pump capacity. For any particular impeller capacity wherein the size and number of radial passages 14 have been chosen, having the impeller speed in mind, the size and number of both the arcuate passages 23 in wearing ring 20 and the lateral passages 16 in the impeller should be such that before a slug of liquid is discharged from any radial passage during priming, another slug of liquid is introduced so that a liquid seal is at all times maintained between the inlet and outlet of the impeller. Should this seal become broken, priming efficiency will be impaired. Thus, the size of the passage means, including arcuate passages 23 and lateral passages 16, for introducing priming liquid to radial passages 14 should be of sufficient magnitude to permit a liquid seal to be formed in each radial passage by a slug of liquid. For maximum priming efficiency it is desirable to space the successive slugs of liquid as far apart as possible without breaking the liquid seal and to entrap the largest possible volumes of air or vapor between successive slugs. The frequency of these slugs, in turn, is determined by the speed of impeller 11 and the number of passages directly conveying priming liquid to the region of lateral passages 16. For the embodiment specifically shown herein, two such passages 23 in wearing ring 20 are provided for this purpose. However, one or more may be employed depending upon the factors discussed. It is preferred to provide such passages as 23 in pairs to balance the forces acting upon impeller 11 during priming. Moreover, although passages 23 are shown disposed in the horizontal plane, the vertical plane or any other plane may be suitable as long as priming liquid is always in communication therewith.

It should be noted, in connection with impeller 11 that passages 14, although shown to be radial, may radiate from the inlet eye 13 to the outer periphery in other respects than that specifically shown. Passages 14 may intersect eye 13 tangentially and/or may be curved.

Impeller 11 is keyed to a shaft 25 which is driven by motor 2 and which is journaled in bearing 25*a*. Key 26 and lock nut 27 are provided for this purpose. A packing ring 28 is situated between impeller 11 and plate 19 and is rigidly secured to plate 19 by means of countersunk screws or rivets 28*a* within packing ring 28 in counterbores 28*b* to provide a working surface for a packing. A packing and packing gland resiliently urged against packing ring 28 by a spring, all of which are generally indicated at 29, are provided within end plate 19 to minimize fluid leakage along shaft 25. As an added precautionary measure should there occur leakage around packing 29 and along shaft 25, conduits, as shown, are provided from the motor side of the packing and terminating with ported vent plugs 30 and 31 to exhaust such leakage from the pump unit.

Impeller discharge chamber

An impeller discharge chamber 32, shown in Figs. 3, 4, 5 and 12, is provided within housing 1 and extends about the outer periphery of impeller 11 and communicates therewith. This impeller discharge chamber may take any convenient form such as that of a doughnut, but is preferably of the volute type. The purpose of this chamber is to gradually perform a transition from radial flow of liquid in the impeller to tangential flow as well as to initiate the separation of any air which may be entrapped within the liquid being pumped. An outlet 33 is provided in the impeller discharge chamber extending downwardly and discharging in the same direction into primary air separation chamber 34. Baffle means may be provided in conjunction with outlet 33 and extending within impeller discharge chamber 32 to facilitate direction of the liquid in the impeller discharge chamber toward the outlet 33.

Primary air separation chamber

The primary air separation chamber 34, shown in Figs. 3, 4, 5, 6 and 12, is a relatively large chamber compared to other portions of the pump unit and is separated from impeller chamber 17 by partition 18 and bounded by the suction inlet conduit 6 leading to the impeller eye 13. The purpose of the primary air separation chamber, as the name implies, is to separate the air and difficultly condensable vapor from the liquid which has been freshly pumped and discharged thereinto. This may be due to aeration or cavitation caused by the centrifugal pump or simply due to the presence of air or vapor on the inlet side of the pump. The immediate discharge from outlet 33 of impeller discharge chamber 32 passes into a well 35 formed by a baffle 36 within primary air separation chamber 34 to prevent saturation of all the liquid within chamber 34 with air. This well directs the saturated liquid to the top of chamber 34, where it releases the air and/or vapor, leaving the liquid outside of well 34 free of air and entrained vapor. Thus, the liquid available for priming through passage 24 and for discharge from the pump unit through conduit 33, described hereinafter, is maintained air and vapor-free. The level of liquid in chamber 34 will remain near the top of the chamber at all times unless there is a leak in the system. At the lowest level liquid could fall in chamber 34, there would still remain sufficient liquid to reprime the pump. Furthermore, a liquid seal is normally maintained over the outlet 33 of impeller discharge chamber 32 which helps prevent the impeller chamber from accumulating air when the pump is idle and facilitates priming. During repriming and normal operations the air and/or vapor separating from the liquid as it reaches the top of chamber 34 is forced into a restricted conduit 37. Conduit 37 may be an ordinary tubing containing an orifice therein. Recirculation passage 24 in partition 18 is preferably disposed below the central portion of the impeller to insure at all times an adequate source of priming liquid from the primary air separation chamber 34 to the impeller 11. A pump outlet conduit 38 extends downwardly into chamber 34 on the opposite side of baffle 36 from well 35 to receive air-free liquid from a point near the bottom of primary air separation chamber 34. This outlet conduit contains a check valve generally indicated at 39 disposed therein and extends laterally beneath the top of housing 1, terminating in outlet passage 40, to permit the placement of a removable closure 31 above valve 39 for installation and removal of the valve.

Outlet check valve

Outlet check valve 39, shown assembled in Fig. 6 and shown in detail in Fig. 9, is designed to resist the shock in the fluid column above the check valve when the outlet valve in the gasoline dispensing hose is closed following a dispensing operation. In many dispensing systems, when this dispensing valve is closed, the inertia of liquid in the system frequently tends to build up pressures on the outlet side of the check valve between pump and meter which tend to snap the valve upon its seat with such force that serious damage is apt to occur. Accordingly, valve 39 is so constructed and designed that it will resist initially any impact exerted thereupon as a result of sudden pressures developed thereabove. Basically, the valve consists of a valve seat 42 which is adapted for insertion within outlet conduit 38, a valve disc 43 cooperable therewith, preferably of a shock absorbent material such as cork, a valve stem 44 riding within a valve stem guide 45, a collar 46 on said valve stem and above valve disc 43, and a spring 47 operating against collar 46 for urging the valve disc toward the valve seat. Beneath valve disc 43, valve stem 44 is provided with a piston 48 reciprocable within the hollow cylindrical member forming valve seat 42 and having a loose fit therein, and the lower portion of piston 48 is provided with a taper. The effect of this construction is that any sudden downward motion of the valve toward its seat will tend to become retarded before disc 43 contacts seat 42, due to the action of piston 48 exerting pressure upon the liquid beneath. However, the slight clearance provided between piston 48 and the cylinder within which it operates permits leakage of liquid therebetween and ultimate closure of the valve as long as a sustained pressure above the valve exists, overbalancing the pressure therebeneath. Thus, the valve 39 is permitted to close when desired, but unnecessary shock during the closing operation is eliminated.

Secondary air separation chamber

The air which is permitted to bleed from primary air separation chamber 34 through restricted conduit 37 will invariably contain volatile

vapors and may also contain entrained liquid. To recover as much liquid as possible passing through conduit 37 and to facilitate further air separation, a secondary air separation chamber 49, shown in Figs. 5, 6 and 12, is provided within the pump unit. This air separation chamber is provided with an air vent 50 in the top thereof, shown in Figs. 1 and 2, a float 51 of any suitable buoyant material such as cork, and a float operated valve to control the liquid level therein. Float 51 is disposed upon a vertical rod 52 connecting at the base thereof with the needle portion 53 of a needle valve having a seat 54 situated in the base of chamber 49 and disposed about needle 53 in the form of a collar, as shown in detail in Fig. 8. This needle valve is in communication with a conduit 55 extending therefrom in the base of housing 1 to portion 4 of the suction inlet conduit to the pump unit. Thus, as the float 51 rises within the secondary air separation chamber in response to the liquid level therein, the needle valve is opened and liquid recirculates to the suction inlet. The portion of chamber 49 above the liquid level therein is under atmospheric pressure due to air vent 50 provided in the top thereof communicating with the atmosphere, as shown in Figs. 1 and 2. For this reason and for the reason that the conduit 55 is under suction, the needle valve may tend to stick to its seat, although the liquid level within chamber 49 has risen to a point which should cause the float 51 to open the valve. To insure that this condition will not occur, the pressure of fluid coming from conduit 37 is employed to assist opening of the valve, as shown in Figs. 6 and 8. For this purpose, the top of chamber 49 is provided with a removable closure 56 to which conduit 37 is connected. A cylinder 57 having a central bore 58 therein depends from removable closure 56, and rod 52, upon which float 51 is mounted, extends upwardly within bore 58 to form a small piston 59 operating within bore 58. The top of bore 58 is provided with a lateral passage 60 extending therefrom to the chamber 49 to permit elevation of piston 59 within bore 58 when a pressure is developed therebeneath. To develop this pressure, another passage 61 is provided within cylinder 57, extending from a point in communication with conduit 37 and directing at 62 a jet against the lower face of piston 59. Rod 52 is tapered at 63 immediately beneath piston 59 and passage 64 communicating with this portion of rod 52 is provided to permit fluid from conduit 37 and passages 61 and 62 to pass into chamber 49 except when piston 59 is fully elevated. When piston 59 is fully elevated, the tapered portion of rod 52 enters bore 58 to prevent passage of fluid from primary air separation chamber 34 through passages 61, 62 and 64 into secondary air separation chamber 49. Thus when secondary chamber 49 accumulates sufficient liquid, flow of further liquid thereto is avoided until most of the liquid has been exhausted through valve 53.

Operation

The operation of my pump is as follows: Assuming that the pump has been initially installed in a dispensing system, it is necessary to fill the primary air separation chamber with liquid to facilitate priming although the pump will prime as long as the liquid level therein is above recirculation passage 24. When the motor has been started, liquid will pass through recirculation passage 24, impeller chamber 17 and passages 23 in wearing ring 20 to the region of the lateral passages 16 in impeller 11. The rotation of impeller 11 with respect to wearing ring 20 will cause periodic communication of each lateral passage 16 with passages 23 in wearing ring 20. Passages 16 are so designed that each time this communication occurs a slug of liquid will be introduced into the corresponding radial passage 14 causing a liquid seal therein. Rotation of the impeller and the introduction of successive slugs of liquid in each radial passage before the preceding slug becomes discharged from the impeller periphery causes entrapment of air within the impeller and builds up suction at the impeller inlet. The air and liquid thus discharged from the impeller during priming will pass into and through the impeller discharge chamber 32 to the primary air separation chamber 34 wherein the air is permitted to separate from the surface of the liquid and the liquid becomes available for further priming. This sequence continues, employing the same body of liquid in the primary air separation chamber for priming, until any air in the pump inlet line or the suction inlet conduit becomes discharged from the system and the pump starts to pump liquid from the inlet conduit. Once this occurs, pressure begins to build up within the primary air separation chamber 34 until it attains pumping pressure whereupon liquid is available for a dispensing operation. However, check valve 39 will remain closed, due to the pressure in the metering and discharge system thereabove, until the outlet valve in the dispensing hose is opened. This releases the pressure above check valve 39 and permits the flow of liquid therethrough from the pump unit. In the meantime, any air which has developed in the primary air separation chamber and separated from liquid therein bleeds off through conduit 37 into secondary air separation chamber 49 wherein further air separation occurs, the air being exhausted to the atmosphere and the liquid being returned to suction conduit 4 through conduit 55 when the liquid level within chamber 49 becomes sufficient to open valve 53. The opening of valve 53 is assisted by the jet action of fluid under pressure at 62 against the face of piston 59, insuring that the valve will not stick to seat 54 when a predetermined quantity of liquid accumulates in chamber 49. When valve 53 opens, the action of piston 59 and float 51 causes piston 59 to become completely elevated within bore 58 such that the tapered portion 63 of rod 52 interrupts the flow of fluid from primary air separation chamber 34 to secondary air separation chamber 49. This provides an opportunity for most of the liquid to be exhausted from chamber 49, so that the chamber will not become flooded were liquid to enter the chamber faster than it could be removed. Such flooding, which is common in gasoline dispensing systems employing float controlled air separation chambers, could be serious if liquid were permitted to escape from vent 50. When chamber 49 becomes sufficiently exhausted of liquid, the weight of the float valve assembly will carry valve 53 back to its seat despite the pressure acting upon piston 59. In addition, piston 59 performs the further function of hastening the attainment of pumping pressure within chamber 34. Between operations, when the pump is not working, chamber 34 is under atmospheric pressure. When the pump starts again, chamber 34 must rapidly rebuild its lost pressure to sufficient magnitude for a disbursing operation. In starting, some liquid from chamber 34 initially in the form of a liquid jet is forced into chamber 49 under normal operating conditions, such that float 51 and piston 59 become elevated, thus interrupting communication between chambers 34 and 49. Since pressure relief from chamber 34 is thereby cut off, this permits the pressure within chamber 34 to build up more rapidly than were pressure relief afforded for chamber 34 through secondary chamber 49.

Once the pump is in a primed condition, inlet check valve 9 will ordinarily hold a sufficient column of liquid in the inlet conduit so that little recirculation through priming passage 24 is necessary. For this reason, passage 24 may be provided with a small check valve, not shown, designed to interrupt liquid flow therethrough to the impeller 11 when the pump is in a primed condition and the liquid in the primary air separation chamber 34 is under pressure. However, during summer operation when gasoline tends to volatilize, and after long periods of idleness, an air or vapor lock may form in the suction inlet conduit. This presents no problem to the operation of my pump since the priming facilities of the primary air separation chamber through passage 24 are fully capable of meeting this contingency, as they are after initial installation of my pump unit in a dispensing system.

The attainment of the objects of my invention previously set forth should make apparent many of the advantages of my invention and the various applications thereof. Perhaps most significant of these advantages is the fact that I have provided a practical pump unit for employing a centrifugal pump in a gasoline dispensing system and an improved priming means therefor. In this connection I have provided an improved impeller construction of wide flexibility which enhances the applicability of my pump unit in gasoline dispensing systems. With present dispensing systems, when it is desired to substantially increase the capacity of the system, it is necessary to employ a larger pump. However, with my pump unit this result may be accomplished simply by performing an exchange of impellers, employing an impeller having a larger number of radial passages or radial passages of greater size. Thus, the same pump unit may be variously used for dispensing gasoline to automobiles or trucks simply by choosing the appropriate impeller.

In addition, the construction and arrangement of secondary air separation chamber 49 and its associated elements eliminates the danger of flooding, which is a frequent malady characteristic of many dispensing systems, and also permits more rapid attainment of pumping pressure in chamber 34. In short, the float valve and jet assist design in secondary chamber 49 lends for better pump operation.

Other important advantages of my invention accrue from the novel form of integrated construction I have provided. In ordinary gasoline dispensing systems it is customary to locate a foot valve in the conduit extending down into the storage tank. By placing a check valve within my pump unit and a strainer in advance thereof, I have eliminated the need for a foot valve and in turn have eliminated a frequent source of trouble which attends the use of such systems. The strainer will prevent unseating of the valve due to possible extraneous material in the gasoline. Furthermore, all valves and parts in my pump unit are readily accessible for servicing through the four removable closures 7, 10, 41 and 56, and motor end plate 19, without the necessity of disconnecting the entire pump unit from the dispensing system. In addition, my integrated pump unit saves space, which is thus made available for more flexible installation and maintenance of the pump unit and other accessories used in connection therewith. The manufacture, assembly, and maintenance of ordinary dispensing equipment, because of the size of the various parts and connections, is expensive, heavy, bulky, troublesome to handle, and not too efficient. It occupies space in proportion to the number of these parts and therefore requires larger enclosures with heavier structural members. All of this means increased cost. On the other hand, my pump unit has reduced the number of parts to a minimum to provide economies in manufacture, assembly and maintenance of an attractive magnitude.

It should be understood that many modifications may be made of the specific embodiment I have shown and described herein and equivalents of many elements I have employed in combination may be used without departing from the spirit of the invention. My invention is to be limited solely by the scope of the claims hereinafter made.

I claim:

1. In a centrifugal pump having an inlet, an outlet and an air separation chamber communicating with said outlet, the improvement therewith for priming comprising a relatively flat cylindrical impeller provided with a central inlet eye, radial passages in said impeller connecting said eye with the outer periphery thereof, lateral passages in said impeller located adjacent said eye, each said lateral passage extending from an end face of said impeller to one of said radial passages, an annular chamber communicating directly with a face of said impeller and communicating with the liquid in said air separation chamber through a passage therebetween, a wearing ring in said annular chamber cooperating with said impeller face and provided with a duct directing liquid from said annular chamber to the region of said lateral passages in said impeller.

2. In a centrifugal pump having an inlet, an outlet and an air separation chamber connecting with said outlet, the improvement therewith for priming comprising a relatively flat cylindrical impeller provided with a central aperture adapted to receive a drive shaft and an annular inlet passage thereabout extending through an end face of said impeller, a bearing around the outer periphery of said annular inlet passage, said cylindrical body being further provided with radial passages of circular cross section connecting said annular inlet passage with the outer periphery of said impeller, and lateral passages located at points adjacent said bearing and spaced a substantially equiradial distance therefrom, extending to said radial passages from the end face of said impeller carrying said bearing, and means adapted to periodically communicate each lateral passage in said impeller with liquid in the air separation chamber as said impeller rotates.

3. In a centrifugal pump having an inlet, an outlet and an air separation chamber connecting with said outlet, the improvement therewith for priming comprising a relatively flat cylindrical impeller provided with a central aperture adapted to receive a drive shaft and an annular inlet passage thereabout extending through an end face of said impeller, a bearing around the outer periphery of said annular inlet passage, said cylindrical body being further provided with radial passages of circular cross section connecting said annular inlet passage with the outer periphery of said impeller, and lateral passages located at points adjacent said bearing and spaced a substantially equiradial distance therefrom, extending to said radial passages from the end face of said impeller carrying said bearing, and an annular chamber communicating directly with a face of said impeller and communicating with the liquid in said air separation chamber through a passage therebetween, a wearing ring in said annular chamber cooperating with said impeller face and provided with a duct directing liquid from said annular chamber to the region of said lateral passages in said impeller.

4. An integral casting for a centrifugal pump comprising a housing provided on a side thereof with a recess forming an impeller chamber adapted to receive an impeller and a motor mounting plate, an inlet in the base of said housing and an inlet conduit extending laterally to the side thereof and vertically to the top thereof and downwardly to form a suction elbow delivering centrally into said impeller chamber, the top and bottom portions of said housing at the ends of the vertical portion of said inlet conduit being formed with openings adapted to receive removable closures and said inlet conduit being adapted to receive a strainer and a check valve thereabove, a volute surrounding and communicating with said impeller chamber and discharging downwardly and laterally therefrom, an air separation chamber extending beneath said suction elbow from the discharge portion of said volute, the partition separating said air separation chamber from said impeller chamber being provided with a connecting passage, a baffle within said air separation chamber forming a well about said volute discharge, said air separation chamber having an opening in its top to receive a removable closure and a second, smaller opening in the top thereof adapted to receive a restricted conduit for air discharge, an outlet conduit beneath said removable closure and adapted to receive a check valve and extending laterally therefrom to form an outlet from said housing, a float chamber adjacent said air separation chamber and inlet conduit adapted to receive a float and a float operated valve in the base thereof, said base being provided with a conduit connecting with said pump inlet conduit, and the top of said float chamber being provided with an air vent and further having an opening for reception of a removable closure carrying the restricted conduit from said air separation chamber.

5. A centrifugal pump comprising a housing provided with a recess forming an impeller chamber, an impeller mounted therein, an inlet in the base of said housing and an inlet conduit extending laterally to the side thereof, thence vertically and downwardly to form a suction elbow delivering centrally into said impeller chamber, the top and bottom portions of said housing at the ends of the vertical portion of said inlet conduit being formed with openings adapted to receive removable closures and said inlet conduit being adapted to receive a strainer and an inlet check valve thereabove, a volute surrounding said impeller and discharging into an adjacent air separation chamber within said housing, said air separation chamber having an opening at a high point therein to receive a removable closure and a second, smaller opening adapted to receive a restricted conduit for air discharge, an outlet conduit beneath said last-named remov-

able closure and adapted to receive an outlet check valve and extending laterally therefrom to form an outlet from said housing, a float chamber adjacent said air separation chamber adapted to receive a float, and a float operated valve in the base thereof, said base being provided with a conduit connecting with said pump inlet conduit, and the top of said float chamber being provided with an air vent and further having an opening for reception of the restricted conduit from said air separation chamber.

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