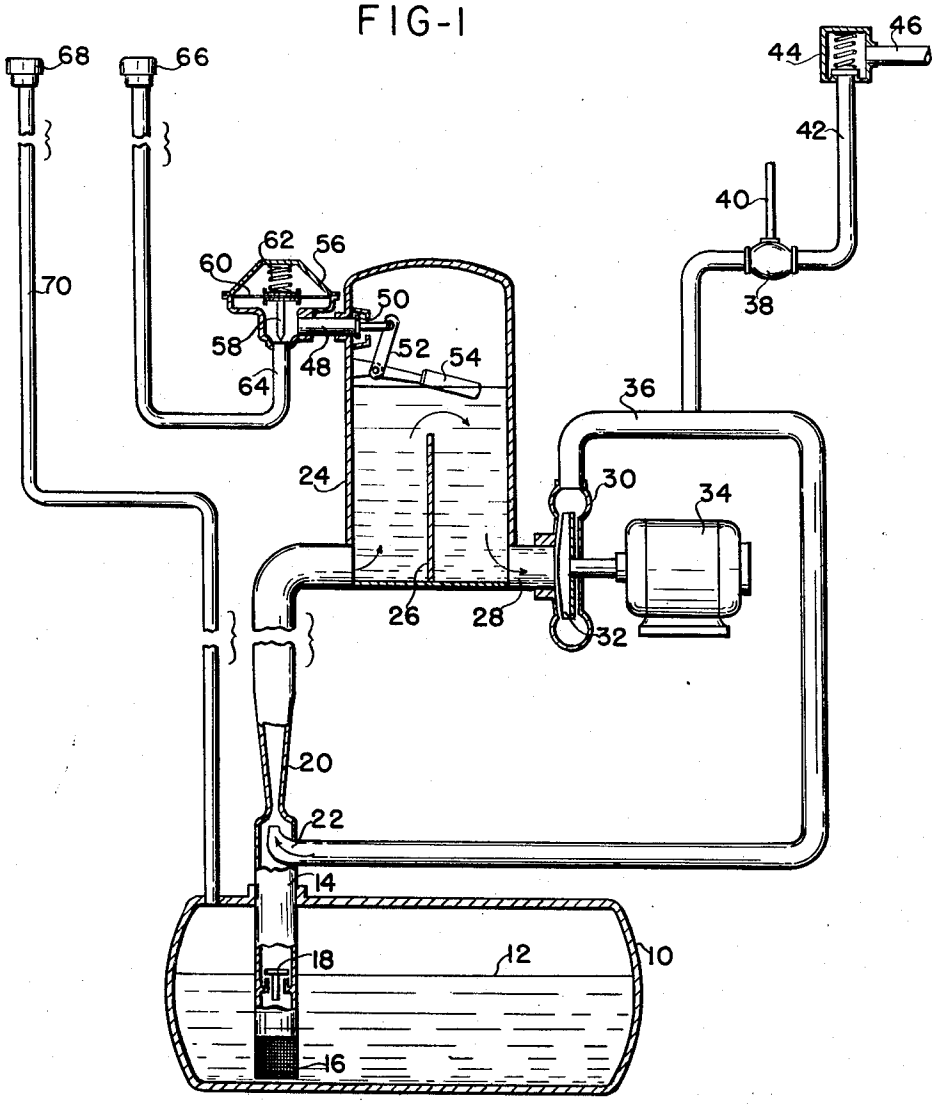
April 6, 1954 K. R. LUNG 2,674,189

PUMPING SYSTEM AND METHOD OF OPERATION

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FIG-1



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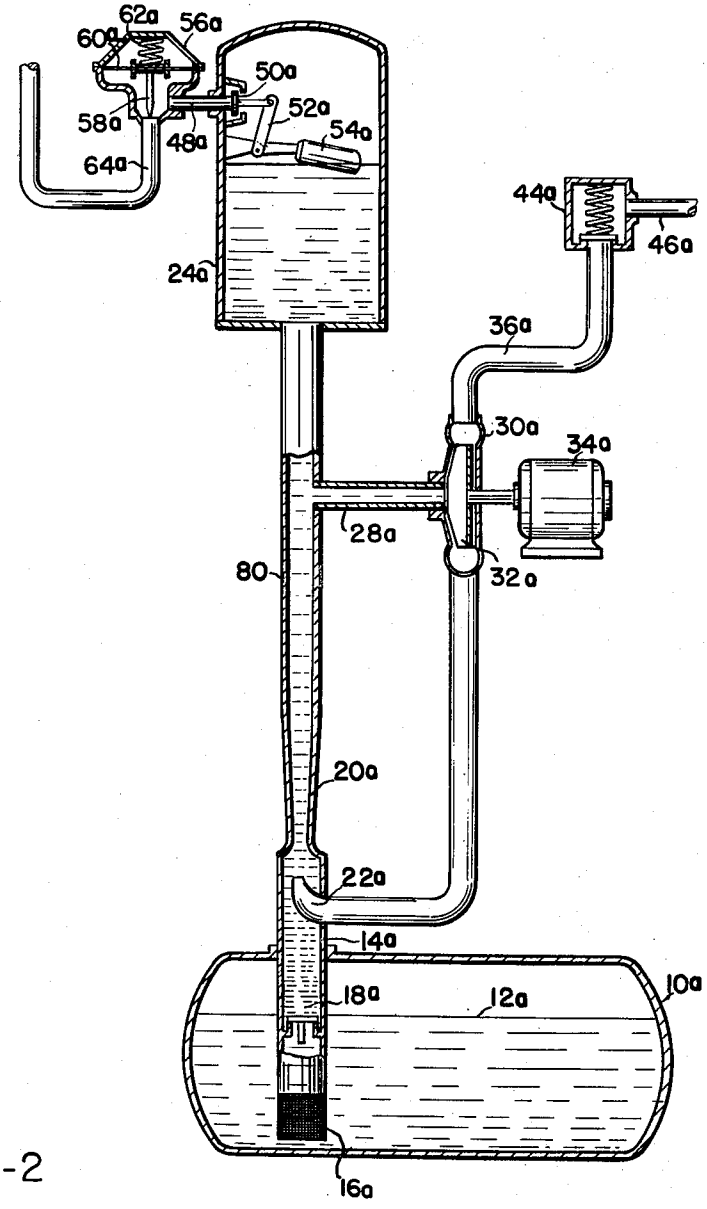


FIG-2

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PUMPING SYSTEM AND METHOD OF OPERATION

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3 Claims. (Cl. 103—5)

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This invention relates to pumping systems and particularly to pumping systems especially adapted for use with gasoline and similar volatile fluids, although not limited thereto.

In the dispensing of gasoline and like substances, as, for example, in filling stations, the usual arrangement includes a reservoir for the liquid being dispensed, a pump and meter arranged in series, and a dispensing hose having a nozzle at its extreme end controlling the discharge.

The pump is ordinarily positioned above the ground with the tank being located beneath the ground. Such a system is generally satisfactory, but certain drawbacks are inherent therein. For example, in hot weather the volatile fluid in the hose will tend to vaporize, so that the quantity of fluid delivered therefrom is actually somewhat less than is indicated by the meter.

Furthermore, such vaporizing of the fluid, when the fluid is of a combustible nature, introduces a fire hazard.

When fluids are dispensed in the manner described above and are measured by a meter, it is extremely important for the delivery to be air-free, and heretofore some difficulty has been encountered in effecting a complete separation of the air from the pumped fluid. The question of separating the air from the liquid is also present in connection with water pumping systems and is particularly important where a jet pump is employed because any air in the supply of liquid to the jet of such a pump will greatly detract from its efficiency, due to the interruption of the fluid flowing into the jet and also due to the expansion of the entrained gas in the venturi to which the jet is delivered.

Having the foregoing in mind, the present invention has for its primary object the provision of an arrangement wherein the difficulties referred to above are eliminated from pumping systems.

A particular object is the provision of a pumping system for gasolines and like fluids which is widely adaptable for all circumstances, and which results in improved operation.

Another particular object is the provision of an improved pumping system utilizing a jet pump and a centrifugal pump in series characterized in an absolutely air-free delivery of fluid to the jet of a jet pump.

Still another object is the provision of an arrangement for maintaining a predetermined minimum pressure in a pumping system of the nature described, thereby inhibiting the vaporization of at least the more volatile of the liquids pumped by the system.

The foregoing objects and still other objects and advantages of the present invention will become more readily apparent upon reference to

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the following specification, taken in connection with the accompanying drawings, wherein Figure 1 illustrates a pumping system according to my invention arranged for dispensing gasoline or a similar volatile fluid, and Figure 2 shows a somewhat modified arrangement wherein a solid and continuous column of fluid stands between the jet pump and the centrifugal pump.

Referring to the drawings somewhat more in detail, in Figure 1, there is a container 10 adapted for receiving the liquid 12 to be pumped, and which container may advantageously be located underground in the customary manner.

Extending into the container is a lift pipe 14 having a screen 16 at its lower end and including a foot valve 18.

Above the container 10, pipe 14 includes a venturi section 20 having associated therewith a jet 22. The discharge side of venturi 20 is connected with the bottom of a tank 24 on one side of a partition 26 extending upwardly from the bottom wall of the tank. At the bottom of the tank on the other side of the partition is a conduit 28 leading to the inlet of a centrifugal pump having a casing 30 and a rotor 32 connected for being driven by motor 34.

The discharge from the casing 30 of the centrifugal pump is delivered to a conduit 36 which has one branch leading to jet 22 and another branch leading to meter 38, which comprises a shaft 40 driven by the meter to operate indicating and computing instrumentalities.

The discharge from meter 38 is conveyed through a conduit 42 to the inlet of a spring loaded check valve 44, which discharges through conduit 46 through a dispensing hose or through any other suitable conduit system.

The purpose of spring-loaded check valve 44 is to maintain a pressure within the pumping system which will prevent vaporization of the liquid therein and also insure immediate operation of the system whenever motor 34 is energized to start the centrifugal pump.

In connection with gasoline dispensing systems, for example, check valve 44 may impose a pressure of from 15 to 25 pounds per square inch on the system. With other fluids, the desired pressure will vary somewhat either upwardly or downwardly, and, in certain instances, it may not be necessary to maintain any pressure on the system whatsoever. Furthermore, in cases where conduit 42 discharges to a storage tank said storage tank could be arranged to maintain the necessary head on the system at all times.

Turning again to intermediate tank 24, adjacent the upper end thereof is an air bleed conduit 48 whose end within the tank is adapted for being closed by valve member 50 mounted on the end of one arm of a bell crank lever 52 that is pivoted inside the tank and which has a float 54 on the

end of its other arm for co-action with the liquid in the tank.

The external end of conduit 48 opens into a diaphragm operated pressure regulating valve 56 having a valve member 58 which is in the form of a needle and which is carried by a diaphragm 60 clamped in the housing of the valve. A spring 62 normally urges the needle valve member 58 downwardly into position to close the end of discharge conduit 64 that leads to the atmosphere through vent 66.

It will be apparent that needle valve member 58 will close off vent conduit 64 until a predetermined minimum pressure is built up in the valve casing beneath the diaphragm 60.

A similar vent 68 is connected by a conduit 70 with container 10 in the usual manner.

The arrangement of the described air bleed-off for tank 24 is such that the escape of air from the tank will be prevented by valve member 50 whenever the liquid level in the tank rises above a predetermined point. However, when the liquid level drops below the said predetermined point, valve member 50 will be lifted off the end of conduit 48 and thereafter air will bleed from tank 24 through valve 56 to atmosphere whenever the pressure on the said air exceeds a predetermined amount.

It will be understood that the pressure at which valve 56 will open will be on the same order as the pressure standing in the system, on account of spring loaded check valve 44, or the static head imposed on the system by a storage tank, and slightly less than the pressure in the air separation chamber when the pumps are operating.

The size of tank 24 is of importance in that the area of the flow passage in the tank on the right side of partition 26, which is the side on which the fluid flows downwardly in the tank toward the discharge conduit 28, is so determined that air entrained in the liquid will pass upwardly therethrough to the air space in the upper end of the tank and will not be carried by the liquid through the discharge conduit and into the centrifugal pump.

It will be evident that the particular size of tank 24 will vary considerably with the type of fluid being pumped, and will tend to be larger for the highly viscous fluids and smaller for the less viscous fluids, will be somewhat larger for fluids in which air is readily soluble, and can be considerably smaller for those fluids in which air is substantially insoluble.

The system is readily adaptable to both deep and shallow installations, and extremely high lifts of the fluid can be obtained. The system is thus ideal for gasoline dispensing systems of the nature encountered in airports, where large underground tanks are employed, and with the dispensing of gasoline at some distance therefrom, and some times at considerable height above the level of the liquid in the tank.

The system, of course, may be adapted substantially without change to ordinary water systems of the type usually found in rural areas.

The arrangement shown in Figure 2 is substantially the same as that illustrated in Figure 1, and corresponding parts bear the same reference numerals, with the addition of a subscript (*a*). The essential difference that the Figure 2 arrangement offers is that there is a solid and continuous column of fluid standing in conduit 80 between the discharge side of the jet pump and the inlet side of the centrifugal pump.

The air separation chamber 24*a* is arranged in direct communication with conduit 80, but is not interposed between the jet pump and the centrifugal pump. The illustrated arrangement, with the spring loaded check valve 44*a* and the foot valve 18*a* in combination with the arrangement of the pumping means and the volume of fluid in the air separation chamber insures that the pumping system will always be charged with fluid and the arrangement is, therefore, instantaneous and the movement of fluid as soon as the motor 34*a* is energized.

The efficiency of air separation may be somewhat less than that which obtains for the Figure 1 arrangement, but, in any case, a small amount of entrained air is of no disadvantage. In these cases, the Figure 2 arrangement may offer advantages over the Figure 1 arrangement.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. In a pumping system; a jet pump arranged to draw fluid from a source, an air separation tank to which the jet pump delivers, said tank being maintained at a predetermined pressure, a centrifugal pump arranged to draw fluid from the tank and to discharge said fluid through a pressure-responsive check valve, said check valve being responsive to substantially the same pressure as the aforementioned predetermined pressure, a branch conduit leading from the discharge of said centrifugal pump to the jet of said jet pump, an air discharge channel leading from the upper end of said tank and venting to the atmosphere, first valve means in said channel, float means to open said first valve means when the liquid level in the separation tank falls below a predetermined level, second valve means in said channel between said first valve means and said vent, said second valve means being adjusted to open at a pressure less than the predetermined pressure in said separation tank whereby said centrifugal pump remains continually primed with air-free liquid from said tank.

2. A pumping system as claimed in claim 1 with a diametrically extending dividing partition projecting upwardly from the bottom of the separation tank, the jet output and centrifugal pump intake at the bottom of said tank, one to either side of said partition.

3. A pumping system as claimed in claim 2 with said separation tank being of such dimensions that the rate of liquid flow downwardly on one side of the partition when the pump means are operating is less than the speed with which air will move upwardly through the liquid.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,724,262	Dunham	Aug. 13, 1929
1,823,459	McCarthy	Sept. 15, 1931
1,856,105	Marden	May 3, 1932
2,148,131	Parker	Feb. 21, 1939
2,176,658	Gruman	Oct. 17, 1939
2,348,357	Parks	May 9, 1944
2,486,288	Jacuzzi et al.	Oct. 25, 1949
2,545,915	Bovee et al.	Mar. 20, 1951
2,608,157	Conery	Aug. 26, 1952
2,651,259	Brush	Sept. 8, 1953