

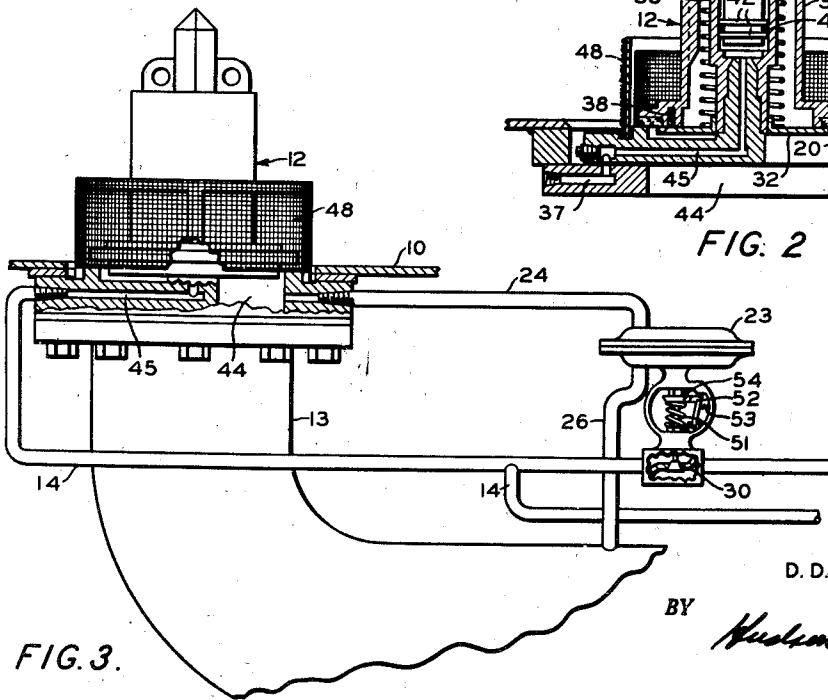
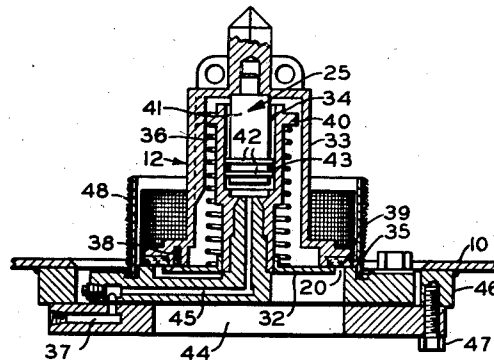
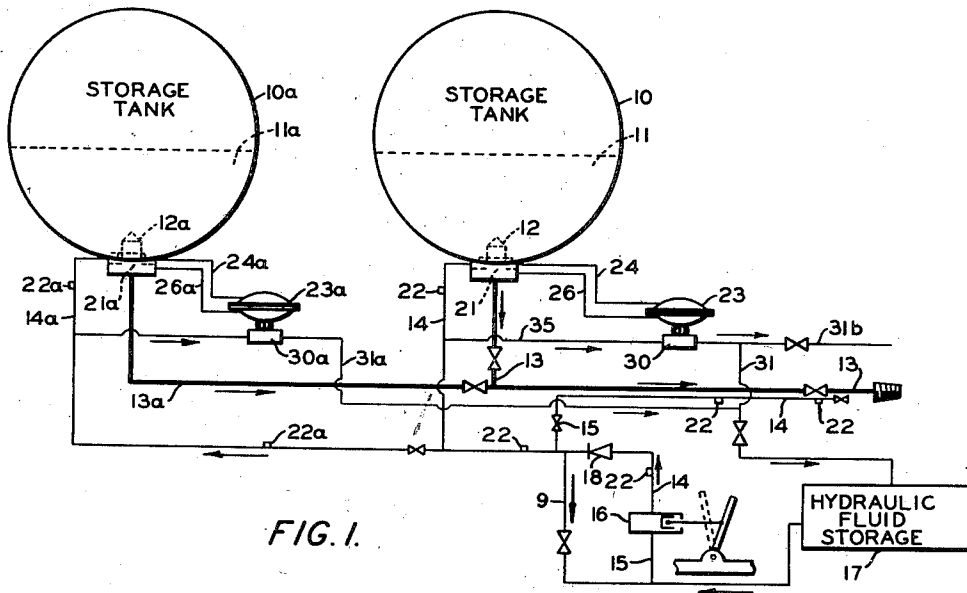
Oct. 2, 1951

D. D. BUTTOLPH
FLUID DISPENSING SYSTEM

2,569,554

Filed Dec. 16, 1949

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

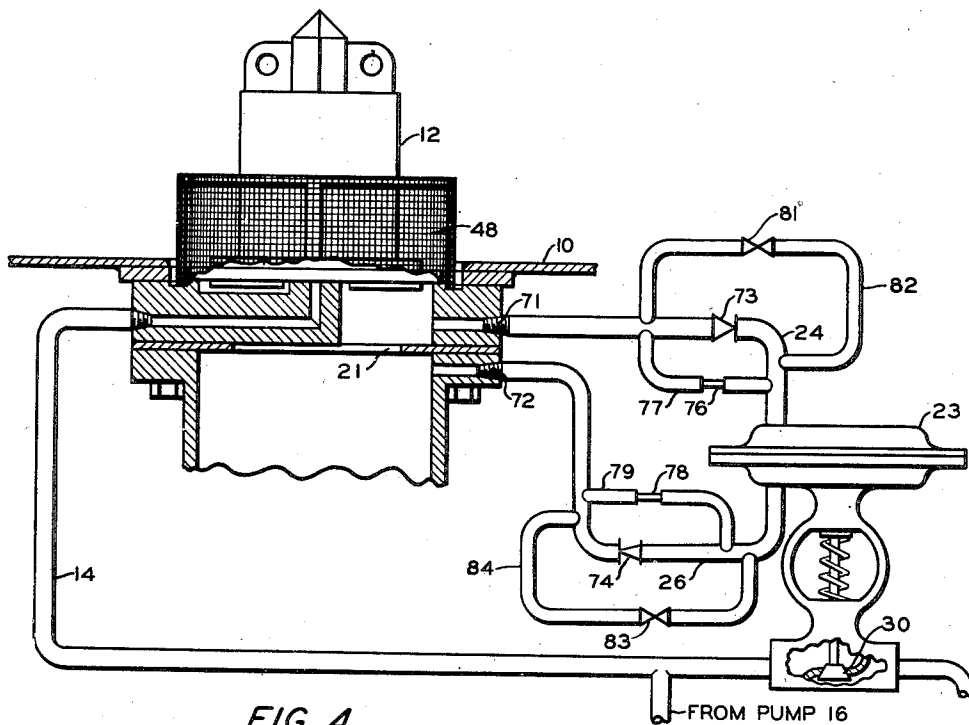


FIG. 4.

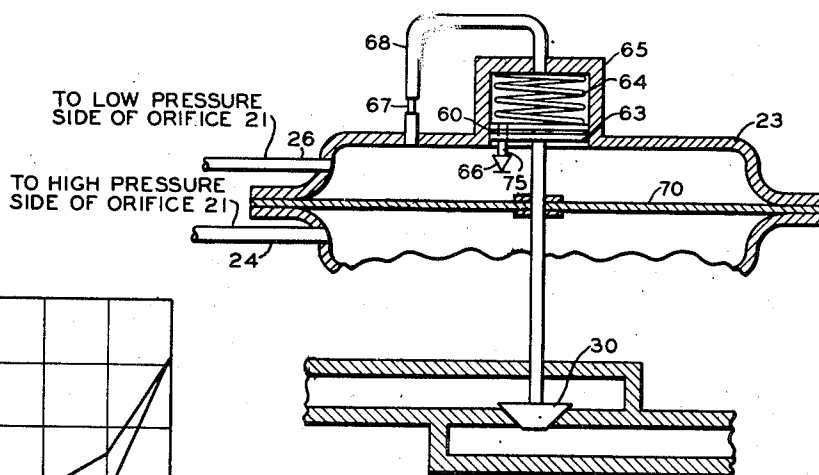


FIG. 5.

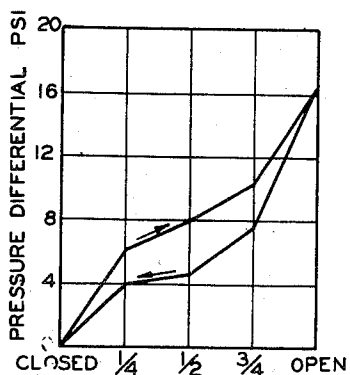


FIG. 6.

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FLUID DISPENSING SYSTEM

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Application December 16, 1949, Serial No. 133,264

12 Claims. (Cl. 62-1)

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This invention relates to apparatus for controlling flow of fluids. In one embodiment this invention relates to a system for dispensing liquefied gases. In another embodiment this invention relates to a system by means of which an uncontrolled flow of liquefied gas from a storage tank can be terminated automatically, thereby enhancing the safety of handling such liquids.

From the standpoint of safety it is essential that all connections to liquefied petroleum gas containers be protected as much as possible from the results of mechanical damage. Under a few special circumstances it is entirely possible to assemble various tank outlets with their valves and fittings into a relatively small area and to protect the assembly with a heavy guard. However, on most mobile equipment it is necessary to have pipe lines located in areas which will be vulnerable to breakage through collision. It has been the practice to use excess flow valves to protect liquefied petroleum gas containers against loss of contents through outlet connections in case of pipe breakage. The excess flow valves are generally installed in the tank outlet nozzles. Such a valve is held in a normally open position by means of a spring, and the valve closes automatically when a flow occurs greater than that for which the valve is designed. While the excess flow valve is a reliable safety device under most conditions, there are instances where it cannot perform its desired function. For example, if an excess flow valve is designed to pass 100 gallons per minute and a line break on the down stream side of the valve is such that the break will pass only 75 gallons per minute, the excess flow valve will not close. Obviously, the escape of an inflammable liquid, as liquid propane or butane at such a rate would create a tremendous hazard.

My invention is concerned with a control system in combination with a storage tank containing a fluid under superatmospheric pressure, providing for the emergency shut-off of liquid flow from the storage tank, in the case of line breakage in the dispensing system, or the occurrence of fire in close proximity to the system.

An object of my invention is to provide a system for dispensing gas under pressure.

Another object of my invention is to provide safe equipment for handling liquefied gases, that will be safe as can be devised, and that will comply with the "Standards of the National Board of Fire Underwriters and the NBFU pamphlet No. 58," and all similar standards of safety.

Another object is to provide a system for handling liquefied gases.

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Another object is to provide, in combination with a storage tank containing liquefied gases at superatmospheric pressure, a safe system for dispensing liquid from the tank.

Another object is to provide for the automatic shut-off of liquefied gas flow from a storage tank, in the event of the occurrence of fire in close proximity to the flow system.

Another object is to provide for the automatic shut-off of liquefied gas flow from a storage tank, when such liquid is being dispensed therefrom or delivered thereinto, in the event of a break or rupture of a conduit carrying such liquid.

Other objects will be apparent to those skilled in the art from the accompanying discussion and disclosure.

In accordance with my invention I have provided a system in combination with a storage tank containing a fluid under superatmospheric pressure, for dispensing the fluid from the tank and automatically terminating fluid flow therefrom, in the event of line breakage in the dispensing system, or the occurrence of fire in close proximity to the tank and dispensing system.

In a broad embodiment, the dispensing system of my invention, in combination with the tank, comprises a dispensing line in communication with the tank, a pressure fluid conduit for conducting fluid flow under pressure, means for establishing fluid pressure in the conduit, a first motor valve in the liquid dispensing line, comprising a "shut-off" valve controlling flow of liquid from the tank, a motor controlling the valve, and means biasing the valve closed. The motor of the first motor valve is connected to the fluid pressure conduit and is operated by fluid pressure therein to overcome the biasing means and to open the valve. Means is employed for effecting a pressure differential between a first and second point in the liquid dispensing line. A second motor valve is employed, the motor of which is connected to the dispensing line at the first and second points above described, and operated by the pressure differential across these two points when that pressure differential exceeds a predetermined value. The valve of the second motor valve is connected to the pressure fluid conduit at a point between the fluid pressure establishing means and the motor of the first motor valve, and bleeds the pressure fluid conduit of fluid pressure when operated by the motor of the second motor valve, whereby the biasing means above discussed, closes the first motor valve and stops flow through the dispensing line when the pressure differential exceeds a predetermined value.

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In a preferred embodiment the valve of the first motor valve is disposed inside the tank, and the dispensing line and fluid pressure conduit are disposed in close proximity to each other, preferably in parallel. At least one fusible plug and generally a plurality, is disposed at selected points in the wall of the fluid pressure conduit. The second motor valve is preferably a diaphragm motor controlled valve and can be supplemented with means for causing additional hysteresis to regulate its rate of closing to permit fluid pressure to be completely bled from the pressure conduit so as to insure that the biasing means will completely close the valve in the dispensing line, and thereby terminate flow from the tank.

The dispensing system of my invention is superior from a safety standpoint to the excess flow valve previously discussed above, because the valve in the first motor valve, i. e. the shut-off valve, is in a normally closed position except when fluid is being pumped into or out of the tank, so that except when flow is occurring, the tank is protected at all times by means of a closed shut-off valve. When liquid is being passed through the dispensing line, the system of my invention provides for automatically bleeding, or venting, fluid from the pressure fluid conduit in case of fire in close proximity to the system or in case of line breakage above discussed, whereby in either instance or both, the valve in the liquid dispensing line is closed and the flow of liquid from the tank is terminated. Fusible plugs employed in the pressure conduit wall can be fabricated of such low melting materials as Wood's metal, or bismuth solder, or other such suitable fusible alloys having a melting point lower than that of the materials of which the pressure conduit is fabricated. Generally, fusible plugs are selected having melting points not lower than about 80° C., and not exceeding about 200-300° C., although plugs having melting points outside that range may be utilized if desired. In case of fire in close proximity to the dispensing system, the fusible plugs in the fluid pressure conduit become heated, and melt, providing openings in the wall of the fluid pressure conduit through which fluid under pressure immediately escapes, thus permitting the tank shut-off valve to close.

I prefer to locate the fluid pressure conduit and the gas dispensing line in close proximity to each other, in order that any breakage that occurs in one line will be very likely to occur in the other, so that the combined features of my invention will be employed concomitantly, to terminate flow of liquid from the tank. For these reasons I prefer to dispose the liquid dispensing line and fluid pressure conduit in parallel to each other. It is to be understood however that my invention provides for terminating the flow of liquid from the storage tank when either the pressure fluid conduit or the liquid dispensing line is broken, regardless of whether or not they are in close proximity to each other.

For a better understanding of my invention, reference is made to the attached figures illustrating various embodiments of my invention. It is to be understood that Figures 1 to 5 are diagrammatic only and may be altered in many respects by those skilled in the art and yet remain within the intended scope of my invention. Figure 6 is a graphic illustration of hysteresis of a diaphragm controlled valve employed in the practice of my invention, and discussed more fully hereafter.

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Figure 1 is a diagrammatic elevational view of a plurality of storage tanks in combination with a liquid dispensing system embodying one form of my invention. In Figure 1 is illustrated the use of an orifice in the liquefied gas dispensing line, and a diaphragm motor valve responsive to pressure drop across the orifice, i. e. it vents hydraulic fluid from the fluid pressure conduit in response to excessive liquid flow through the opened shut-off valve. It is to be understood that a single storage tank or a plurality, may be employed in conjunction with the dispensing system, as desired.

Figure 2 is a sectional elevational view of a motor valve, operated by fluid pressure in the fluid pressure conduit, above discussed, that can be employed in the practice of my invention to permit flow of liquid to and from the storage tank.

Figure 3 is a diagrammatic elevational view, with parts broken away, of one embodiment of apparatus by means of which the diaphragm controlled valve of Figure 1 can be operated to vent fluid pressure from the fluid pressure conduit. In the embodiment of Figure 3 the diaphragm controlled motor valve is opened in response to pressure differential across the liquefied gas flowline, when it exceeds a predetermined value, and the valve remains permanently open, until manually closed.

Figure 4 is a diagrammatic elevational view with parts broken away of another embodiment, differing from that of Figure 3, by means of which the fluid pressure can be vented from the pressure fluid conduit. In this embodiment a check valve in combination with an orifice is employed, each on the high pressure side and the low pressure side of the diaphragm, whereby a desired hysteresis effect is provided so as to cause the diaphragm control valve to slowly close, so that ample time is provided for venting the necessary amount of hydraulic fluid.

Figure 5 is a sectional view of another embodiment of a diaphragm controlled valve that can be employed to vent fluid pressure from the fluid pressure conduit. This embodiment provides still a further modification in the design of the diaphragm controlled valve already discussed in Figures 3 and 4, and employs a piston and chamber in conjunction with a single check valve and an orifice, to provide a hysteresis effect to permit the valve to close slowly so as to permit the necessary amount of fluid to be vented from the fluid pressure conduit.

With reference to Figure 1, storage tank 10 is provided for storing liquefied gaseous hydrocarbons 11 and such vapors as may be present. A liquid dispensing line 13 is connected with tank 10 in communication with liquid therein. Conduit 14 is a pressure fluid conduit, and fluid pump 16, is connected to one end of conduit 14, to withdraw fluid from storage 17 through line 15 and to deliver same under pressure into conduit 14. A motor valve 12 comprises an outlet shut-off valve 20 (see Figure 2) in liquid dispensing line 13, preferably disposed inside tank 10, and a fluid operated motor 25 (see Figure 2) biasing the valve 20 closed. Motor 25 is connected to conduit 14 and operated by fluid pressure therein to overcome the biasing effect of the motor and to move valve 20 into an open position. Orifice 21 is located in gas dispensing line 13, preferably at a point outside tank 10 and often in close proximity to motor 12. Orifice 21 is located in line 13 to constrict the flow of liquid there-through so as to develop a pressure differential

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therein commensurate with a desired rate of liquid flow from tank 10 through line 13. Conduit 14 is equipped with fusible plugs 22. Check valve 18 is located in conduit 14 at a point in close proximity to the discharge side of pump 16 to insure constant pressure of fluid therein, i. e. to prevent fluid in line 13 from "backing" toward pump 16, during normal dispensing operations.

A second motor valve comprises a diaphragm controlled motor 23, connected on one side of the diaphragm by connecting line 24 to dispensing line 13 at a point on the high pressure side of orifice 21, and connected through line 26 on the other side of the diaphragm to line 13 at a point on the low pressure side of orifice 21. Normally closed valve 30 of the second motor valve is connected with pressure fluid conduit 14 through connecting line 35 at a point intermediate pump 16 and motor 25 of motor valve 12. Diaphragm motor 23 is responsive to pressure differential across orifice 21 when that differential exceeds a predetermined value, at which time it causes valve 30 to move into an open position.

In the operation of the embodiment illustrated in Figure 1, hydraulic fluid is withdrawn from storage 17 through line 15 into the low pressure side of pump 16, and discharged therefrom into conduit 14 to develop a hydraulic fluid pressure therein such as from 10-20 p. s. i. g. to as high as 300 p. s. i. g., depending on the pressure exerted by fluid in the tank. Fluid under pressure in conduit 14 is passed to motor 25 of motor valve 12, causing the motor to move shut-off valve 20 into an open position, permitting thereby a flow of liquid from tank 10 through line 13 and orifice 21. The normal pressure differential across orifice 21 is commensurate with the normal rate of liquid flow from tank 10 through line 13. Normal rate of liquid flow from tank 10 can be any desired value, often from 75-300 gallons per minute. It is an abnormal flow, by which I mean liquid flow from tank 10 through line 13 at a rate higher than the normal rate, with which my invention is concerned. Ordinarily, such abnormal flow results from a breakage in line 13 thereby causing liquid to escape from the system and to constitute a serious fire hazard. In the event that such a break occurs, it is of course desirable to terminate the flow of liquid 11 from tank 10, and this is done by bleeding, or venting, fluid from conduit 14, thereby relieving fluid pressure on motor 25 and permitting spring 36 to close valve 20. Bleeding of fluid from conduit 14 is done by means of diaphragm motor 23 operating normally closed valve 30. Motor 23 is responsive to pressure differential across orifice 21 when it exceeds the value predetermined as being commensurate with normal liquid flow from tank 10 through line 13, and when so responding, operates valve 30 to move it into an open position. When valve 30 is opened by diaphragm motor 23, fluid is vented from chamber 34 through line 14, line 35, valve 30, discharged through line 31, and returned to storage 17, or when desired, discharged directly through lines 31 and 31b to the atmosphere. When it is desired to manually terminate normal flow of liquid from tank 10, fluid under pressure in line 14, can be withdrawn therefrom and returned to storage 17, through line 9, thereby permitting motor valve 25 to bias valve 20 closed.

Fusible plugs 22 are disposed preferably at a plurality of points in conduit 14, so that in the

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case of occurrence of fire in close proximity to the liquid flow system, these plugs become heated and melt, providing thereby openings in the side wall of conduit 14 through which fluid under pressure therein can escape, whereby fluid is vented from chamber 34, permitting spring 36 to close valve 20, terminating flow of liquid from tank 10. As stated hereinbefore I prefer to utilize conduit 14 and line 13 preferably disposed in parallel. In a preferred form of one such embodiment, a flexible fluid pressure conduit 14 is disposed in close parallel relation to a flexible dispensing line 13 along the entire length of line 13. This is particularly advantageous when dispensing liquid from a mobile unit to a liquid storage, as for example a storage tank in a domestic heating system.

The flow system of my invention offers particular advantages in the operation of mobile units for the reason that in such cases it may happen that during the time the liquefied petroleum gas is being dispensed from, or being charged into tank 10, the dispensing unit is damaged by collision therewith of a passing vehicle, or by interference from sources uncontrolled by the operator of the unit. Any line breakage during dispensing operation is serious for the reason that it endangers the surrounding area by discharging inflammable materials thereinto. When that happens the flow of liquid from tank 10 is abnormally high and valve 30 is immediately moved into an open position by diaphragm motor 23, whereby fluid is vented from line 14 and shut-off valve 20 is closed. Similarly when for any reason conduit 14 is broken, fluid pressure is vented therefrom, permitting valve 20 to close.

If desired to operate the system of Figure 1 without the feature of maintaining line 13 in close proximity to, and in parallel with conduit 14, that can be done by closing valve 15. With reference to Figure 2, illustrative of a motor valve 12 of Figure 1, motor valve 12 is comprised of valve disk 39, held in place by disk retainer 32 and cap member 33 against valve seat 35. The valve 20 as illustrated is in a closed position and is biased closed by means of coil spring 36 supported from points 40 on the exterior wall of the top portion of piston chamber 34. Disk retainer 32 is held in place by screws 38. Valve disk 39 is raised from seat 35 by raising cap member 33 in an upward direction against the force of spring 36. This is done by means of fluid pressure exerted upwardly against the interior of cap 33, by hydraulic fluid introduced under pressure through conduit 45 against the bottom of piston 41. Piston 41 is disposed vertically inside piston chamber 34 and is held in alignment by piston rings 42 separated by an O ring 43. In response to pressure of hydraulic fluid thus introduced, piston 41 is raised upwardly against the top portion of cap member 33, raising it vertically. When this occurs, the extent to which the valve is opened is dependent upon fluid pressure, which in turn is regulated to permit the desired rate of flow of liquid, to be passed through valve 20. Liquid passed through valve 20 is discharged through opening 44.

Suitable arrangements can be employed such as ring 46 welded to the outside of tank 10 to which the main body of motor valve 12 can be secured by means of studs 47. Screen 48 is disposed to prevent contact of foreign materials such as tank sediments, mill scale, and the like,

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within tank 10, with valve disk 39 and valve seat 35, thereby preventing any possible damage to these members of motor valve 12.

As illustrated in Figure 2, motor valve 12 is opened and closed by regulating the pressure of hydraulic fluid in line 14. Accordingly, motor valve 12 can be used during dispensing and charging operations since it can be operated to permit liquid flow through line 13 in either direction.

With reference to Figure 3, an orifice 21 is omitted and instead a pressure differential commensurate with normal rate of liquid flow in line 13, is developed by selection of line 13 of length and size to provide an inherent pressure differential in liquid flow therethrough, commensurate with the desired flow rate from tank 10 through line 13. As illustrated in Figure 3 diaphragm motor 23 is connected on its high pressure side by connecting conduit 24 with line 13 at a point on the high pressure side of the pressure differential therein, and is connected on its low pressure side with line 13 at a point on the low pressure side of the differential therein. In this embodiment, when pressure differential in line 13 exceeds a predetermined value, valve 39 is moved by diaphragm motor 23 into an open position, thereby venting fluid from conduit 14, and permitting motor valve 12 to close and terminate flow of liquid from tank 10.

As an added feature of my invention I have provided a means for holding valve 30 in an open position until manually closed. This is done by means of catch 52 driven by spring 53 to engage ring 54 on valve stem 51, when stem 51 is moved in a downward direction to unseat valve 30. This feature of my invention provides for the complete venting of hydraulic fluid pressure from conduit 14 to assure complete closure of motor valve 12 to terminate flow of liquid from tank 10. Obviously, if valve 30 were adapted to be raised to an open position by motor 23, member 52 and ring 54 would be altered by one skilled in the art, to cause valve 30 when open, to be held in the open position until manually closed.

With reference to Figure 4, another embodiment of my invention is illustrated by means of which diaphragm motor 23 causes valve 30 to open in response to a pressure differential across orifice 21 when that differential is higher than a predetermined value. In this embodiment, pressure taps 71 and 72 are disposed on the high pressure and low pressure sides of orifice 21 respectively. Conduit 24 connects the high pressure side of diaphragm motor 23 with the high pressure side of orifice 21 in line 13 and contains check valve 73. Similarly, conduit 26 containing check valve 74 is engaged with pressure tap 72 at one end, and is connected at the other end with the low pressure side of diaphragm motor 23. When an excessive pressure drop is developed across orifices 21, valve 30 is caused to move into an open position as already discussed. However, in some instances a sufficient amount of fluid may not have been vented from conduit 14 to permit motor valve 12 to be completely closed at the time that the pressure differential across orifice 21 has been lowered to a value commensurate with the normal flow rate. In such a case, the flow of liquid from tank 10 is not terminated, and the uncontrolled escape of liquid from conduit 13 must still be reckoned with. In this embodiment such insufficient venting is prevented by means of orifice 76 in by-pass line 77 disposed around check valve 73, and orifice 78 in line 79 installed as a by-pass around check valve 74. Check valve 73 permits

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one-way fluid flow in a direction from tap 71 toward diaphragm motor 23, and check valve 74 permits one-way flow of fluid through line 26 toward tap 72. After diaphragm motor 23 in response to excessive pressure differential across orifice 21 has caused valve 30 to open, and when a normal differential is developed across orifice 13, check valve 73 prevents the escape of any fluid from diaphragm 23 through line 24, and instead, fluid passes into line 77 through orifice 76 at a retarded rate. Similarly, fluid entering the low pressure side of diaphragm motor 23 in response to a lowered pressure differential across orifice 21, must enter at a retarded rate through orifice 78, accordingly, the rate at which valve 30 is permitted to close is thereby lessened, whereby the necessary amount of fluid is vented from conduit 14 before valve 30 can be closed.

Although I have illustrated the use of the combination in line 24 of check valve 73, by-pass line 77 and orifice 76, together with the combination in line 25 of check valve 74, by-pass line 79 and orifice 78, it is to be understood that, if desired, only one of such combinations need be utilized in providing the desired hysteresis effect on motor 23. Thus, in operating the embodiment of Figure 4, valve 81 in by-pass line 82 can be opened, when valve 83 in by-pass line 84 is closed, or valve 83 can be open when valve 81 is closed.

In Figure 5, I have illustrated still another embodiment of my invention whereby, after valve 30 has been moved into an open position by motor 23 and then permitted to close, it can close at a retarded rate to permit complete venting of fluid pressure from conduit 14. With reference to Figure 5, piston chamber, closed at one end and open at the other, is connected at its open end with the low pressure side of diaphragm motor 23. Piston 63, supported pressure tight in chamber 65 by ring 60, is connected to the diaphragm 70 of diaphragm motor 23, and is urged in a direction toward the diaphragm 70 by coil spring 64, disposed in that portion of chamber 65 intermediate its closed end and the piston.

Conduit 75 extends through piston 63 to connect that portion of chamber 65 intermediate its closed end and the piston, with the low pressure side of diaphragm motor 23. Check valve 66 is disposed in conduit 75 at a point on the diaphragm side of the piston and permits one-way fluid flow through conduit 75 in a direction toward diaphragm 70.

A suitable means for permitting restricted fluid flow into chamber 65 from the diaphragm side of piston 63 is employed, as for example, an orificed passageway through piston 63, or a check valve 65 adapted to permit a predetermined amount of leakage. Such means specifically illustrated, is conduit 68 connecting the portion of chamber 65 intermediate its closed end and piston 63, with the diaphragm side of piston 63, and orifice 67, in conduit 68. Operating in accordance with the embodiment of Figure 5, valve 30, having been moved into an open position by motor 23 and then being permitted to close, is closed at a retarded rate, by virtue of orifice 67 in line 68, which permits only a slow return of fluid from the low pressure side of orifice 21 to the spring side of piston 63, whereby the reseating of valve 30 is delayed, and line 14 is sufficiently bled of fluid pressure.

Obviously, the embodiment of Figure 5, is not limited to operation with an orifice 21, but can be applied in conjunction with any means for effect-

ing a pressure differential responsive to liquid flow, from tank 10 through line 13.

The embodiments illustrated in Figures 3, 4 and 5 with respect to diaphragm motor 23 and valve 30 clearly demonstrate means by which a desired hysteresis effect can be imposed on the diaphragm motor controlled valve so as to assure complete venting or bleeding of fluid pressure from fluid pressure conduit 14 delivering fluid to motor valve 12. However, in various instances dependent upon the specific equipment at hand, the inherent hysteresis in the valve assembly employed will prevent any unduly quick closing action of diaphragm motor 23 on valve 30. This effect is more clearly illustrated in Figure 6 which shows graphically the relation of pressure differential to operation of a diaphragm controlled motor valve, and further illustrating that a lower differential can be utilized in holding the valve open than is required to initially move it to that open position. In other words, the friction that results between the valve stem and packing for example, inherently retards the closing of the valve to an extent that in most instances wherein a diaphragm controlled motor valve is employed, fluid pressure will be permitted to be completely relieved from conduit 14 before valve 30 is permitted to close, making it unnecessary for any means of the type illustrated for imposing an additional hysteresis effect on the diaphragm controlled motor valve.

In the discussion hereinabove with respect to the location of motor valve 12, I have stated that it is preferred to locate the valve of that assembly inside tank 10. This is preferable for the reason that, in that position, it is less vulnerable to the effect of mechanical damage, providing thereby a greater safety factor in the operation of the control system of this invention.

Although it is not a preferred feature of my invention, if desired, line 13 can be extended into tank 10 and the valve of motor valve 12 can be disposed in line 13 in tank 10 at any desired point.

It is to be understood that although in Figure 1 I have illustrated the liquid dispensing line 13 and fluid pressure conduit 14 disposed in parallel relation to the other, it is a feature of my invention that liquid flow from tank 10 will be terminated when breakage occurs in either line 13 or conduit 14, or both, regardless of whether or not they are in parallel.

Although with reference to the drawings I have presented a preferred embodiment of my invention as applied to dispensing a liquefied gas under superatmospheric pressure, it is to be understood that my invention more broadly provides for dispensing fluids of any type under pressure, such as a normally gaseous hydrocarbon, ammonia, or the like, either in gaseous or liquid state.

As will be evident to those skilled in the art, various modifications of this invention can be made, or followed, in the light of the foregoing disclosure and discussion, without departing from the spirit or scope of the disclosure or from the scope of the claims.

I claim:

1. A liquefied gas dispensing system, comprising in combination, a tank, a liquid dispensing line in communication with said tank, a pressure fluid conduit, means to establish fluid pressure in said conduit, a first motor valve comprising a valve in said line controlling flow of liquid from said tank, a motor controlling said valve

and means biasing said valve closed, said motor being connected to said conduit and operated by fluid pressure therein to overcome said biasing means and open said valve, means for effecting a pressure differential between a first and second point in said line responsive to liquid flow therein, a second motor valve comprising a motor connected to said line at said points and operated by said pressure differential when it exceeds a predetermined value and a valve connected to said conduit between said fluid pressure establishing means and the motor of said first motor valve bleeding said conduit of fluid pressure when operated by said motor of said second motor valve, whereby said biasing means closes said valve in said line and stops liquid flow in said line when said differential exceeds said predetermined value.

2. The apparatus of claim 1 wherein said liquid dispensing line and said pressure fluid conduit are disposed parallel and adjacent to each other.

3. The apparatus of claim 1 wherein said means for effecting a pressure differential in said liquid dispensing line, is said line of a predetermined length and size through which pressure differential inherent in the flow of liquid therethrough is said pressure differential.

4. The apparatus of claim 1 wherein at least one plug fusible at a temperature within the limits of 80 to 300° C. is disposed in the wall of said pressure fluid conduit.

5. A liquefied gas dispensing system, comprising in combination a tank, a liquid dispensing line connected with said tank, a pressure fluid conduit, a pump connected to said conduit to deliver fluid thereinto under pressure, a first motor valve comprising a valve in said tank connected to said dispensing line controlling flow of liquid from said tank through said dispensing line and a motor normally biasing said valve closed, said motor being connected to said conduit and operated by fluid pressure therein to overcome its normal biasing effect and to open said valve, an orifice in said dispensing line for effecting a pressure differential between a first and second point in said line responsive to liquid flow therein, a second motor valve comprising a motor connected to said line at said points and operated by said pressure differential when it exceeds a predetermined value and a valve connected to said conduit between said pump and the motor of said first motor valve bleeding said conduit of fluid pressure when operated by said motor of said second motor valve, whereby said biasing means closes said valve in said line and stops liquid flow in said line when said differential exceeds said predetermined value.

6. A liquefied gas dispensing system comprising in combination, a tank, a liquid dispensing line communicating with said tank, a pressure fluid conduit, means to establish fluid pressure in said conduit, a first motor valve comprising a valve in said line controlling flow of liquid from said tank, a motor controlling said valve and means biasing said valve closed, said motor being connected to said conduit and operated by fluid pressure therein to overcome said biasing means and open said valve, an orifice for effecting a pressure differential between a first and second point in said line responsive to liquid flow therein, a second motor valve comprising a diaphragm motor connected at its high pressure side by a first connecting conduit to said dispensing line at a point on the high pressure side of said orifice and connected at its low pressure

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side by a second connecting conduit to said dispensing line at a point on the low pressure side of said orifice and a normally closed valve connected to said pressure fluid conduit and moved to an open position when operated by said diaphragm motor, said diaphragm motor being operated by said pressure differential when it exceeds a predetermined value, whereby fluid pressure is bled from said conduit and said biasing means closes said valve in said line and stops liquid flow in said line when said differential exceeds said predetermined value, a check valve in said first connecting conduit permitting flow of fluid in a direction toward said motor, a by-pass line around said check valve and an orifice in said by-pass line, a check valve in said second connecting conduit permitting flow of fluid in a direction away from said motor, a by-pass line around the last said check valve and an orifice in the last said by-pass line, whereby hysteresis of said second motor valve is provided so that after it has been moved into an open position and then permitted to close it closes at a predetermined retarded rate and fluid pressure is vented from said pressure fluid conduit.

7. A liquefied gas dispensing system, comprising in combination, a tank, a liquid dispensing line communicating with said tank, a pressure fluid conduit, means to establish fluid pressure in said conduit, a first motor valve comprising a valve in said line controlling flow of liquid from said tank and a motor normally biasing said valve closed, said motor being connected to said conduit and operated by fluid pressure therein to overcome its normal biasing effect and open said valve, said dispensing line of predetermined length and size providing a pressure differential between a first and second point in said line responsive to liquid flow therethrough, a second motor valve comprising a diaphragm motor connected on its high pressure side to a point in said dispensing line on the high pressure side of said pressure differential therein and connected on its low pressure side to a point in said dispensing line on the low pressure side of said pressure differential, and a normally closed valve connected to said pressure fluid conduit adapted to be moved to an open position when operated by said diaphragm motor, said diaphragm motor being operated by said pressure differential when it exceeds a predetermined value, and locking means for preventing automatic closure of said valve after it has been moved to an open position.

8. A liquefied gas dispensing system, comprising in combination, a tank, a liquid dispensing line communicating with said tank, a pressure fluid conduit, means to establish fluid pressure in said conduit, a first motor valve comprising a valve in said line controlling flow of liquid from said tank and a motor normally biasing said valve closed, said motor being connected to said conduit and operated by fluid pressure therein to overcome its normal biasing effect and open said valve, an orifice for effecting a pressure differential between a first and second point in said line responsive to liquid flow therein, a second motor valve comprising a diaphragm motor connected on its high pressure side to said dispensing line at a point on the high pressure side of said orifice and connected on its low pressure side to said dispensing line at a point on the low pressure side of said orifice and a normally closed valve connected to said conduit at a point intermediate said pressure establishing

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means and the motor of said first motor valve, said normally closed valve being adapted to be moved into an open position when operated by said diaphragm motor, said diaphragm motor being operated by said pressure differential when it exceeds a predetermined value, a piston chamber having an open end and a closed end and connected at its open end with the low pressure side of said diaphragm motor, a pressure-tight piston in said chamber connected with the diaphragm of said motor and adapted to be moved in said chamber in a direction away from said diaphragm when said normally closed valve is operated by said diaphragm motor to move into an open position, spring means in said chamber urging said piston in a direction towards said diaphragm, a conduit extending through said piston connecting the low pressure side of said diaphragm with the portion of said chamber intermediate its closed end and said piston, a check valve in the last said conduit on the diaphragm side of said piston permitting flow of fluid therethrough towards said diaphragm, and an orifice connecting said intermediate chamber portion with the low pressure side of said diaphragm.

9. A liquefied gas dispensing system, comprising in combination a tank, a liquid dispensing line connected with said tank, a pressure fluid conduit, said conduit being disposed in parallel with and adjacent said liquid dispensing line, at least one plug fusible at a temperature within limits of 80-300° C. disposed in the wall of said conduit, a pump connected to said conduit to deliver fluid therinto under pressure, a first motor valve comprising a valve in said tank and connected to said dispensing line controlling flow of liquid from said tank through said dispensing line, a motor controlling said valve and means biasing said valve closed, said motor being connected to said conduit and operated by fluid pressure therein to overcome said biasing means and to open said valve, an orifice in said dispensing line for effecting a pressure differential between a first and second point in said line responsive to liquid flow therein, a second motor valve comprising a diaphragm motor connected to said dispensing line at said points and operated by said pressure differential when it exceeds a predetermined value and a normally closed valve connected to said conduit at a point intermediate said pump and the motor of said first motor valve, said normally closed valve being operated by said diaphragm motor to move into an open position when said pressure differential exceeds said predetermined value, thereby bleeding said conduit of fluid pressure.

10. A liquefied gas dispensing system comprising in combination, a tank, a liquid dispensing line communicating with said tank, a pressure fluid conduit, means to establish fluid pressure in said conduit, a first motor valve comprising a valve in said line controlling flow of liquid from said tank, a motor controlling said valve and means biasing said valve closed, said motor being connected to said conduit and operated by fluid pressure therein to overcome said biasing means and open said valve, an orifice for effecting a pressure differential between a first and second point in said line responsive to liquid flow therein, a second motor valve comprising a diaphragm motor connected at its high pressure side by a first connecting conduit to said dispensing line at a point on the high pressure side of said orifice and connected at its low

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pressure side by a second connecting conduit to said dispensing line at a point on the low pressure side of said orifice and a normally closed valve connected to said pressure fluid conduit and moved to an open position when operated by said diaphragm motor, said diaphragm motor being operated by said pressure differential when it exceeds a predetermined value, whereby fluid pressure is bled from said conduit and said biasing means closes said valve in said line and stops liquid flow in said line when said differential exceeds said predetermined value, a check valve in said first connecting conduit permitting flow of fluid in a direction toward said motor, a by-pass line around said check valve and an orifice in said by-pass line, whereby hysteresis of said second motor valve is provided so that after it has been moved into an open position and then permitted to close it closes at a predetermined retarded rate and fluid pressure is vented from said pressure fluid conduit.

11. A liquefied gas dispensing system comprising in combination, a tank, a liquid dispensing line communicating with said tank, a pressure fluid conduit, means to establish fluid pressure in said conduit, a first motor valve comprising a valve in said line controlling flow of liquid from said tank, a motor controlling said valve and means biasing said valve closed, said motor being connected to said conduit and operated by fluid pressure therein to overcome said biasing means and open said valve, an orifice for effecting a pressure differential between a first and second point in said line responsive to liquid flow therein, a second motor valve comprising a diaphragm motor connected at its high pressure side by a first connecting conduit to said dispensing line at a point on the high pressure side of said orifice and connected at its low pressure side by a second connecting conduit to said dispensing line at a point on the low pressure side of said orifice and a normally closed valve connected to said pressure fluid conduit and moved to an open position when operated by said diaphragm motor, said diaphragm motor being operated by said pressure differential when it exceeds a predetermined value, whereby fluid pressure is bled from said

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conduit and said biasing means closes said valve in said line and stops liquid flow in said line when said differential exceeds said predetermined value, a check valve in said second connecting conduit permitting flow of fluid in a direction away from said motor, a by-pass line around the last said check valve and an orifice in the last said by-pass line, whereby hysteresis of said second motor valve is provided so that after it has been moved into an open position and then permitted to close it closes at a predetermined retarded rate and fluid pressure is vented from said pressure fluid conduit.

12. A fluid dispensing system, comprising in combination, a tank, a fluid dispensing line in communication with said tank, a pressure fluid conduit, means to establish fluid pressure in said conduit, a first motor valve comprising a valve in said line controlling flow of fluid from said tank, a motor controlling said valve and means biasing said valve closed, said motor being connected to said conduit and operated by fluid pressure therein to overcome said biasing means and open said valve, means for effecting a pressure differential between a first and second point in said line responsive to fluid flow therein, a second motor valve comprising a motor connected to said line at said points and operated by said pressure differential when it exceeds a predetermined value and a valve connected to said conduit between said fluid pressure establishing means and the motor of said first motor valve bleeding said conduit of fluid pressure when operated by said motor of said second motor valve, whereby said biasing means closes said valve in said line and stops fluid flow in said line when said differential exceeds said predetermined value.

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