

July 25, 1944.

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2,354,286

AUTOMATIC CHANGEOVER DEVICE

Filed Sept. 14, 1942

2 Sheets-Sheet 1

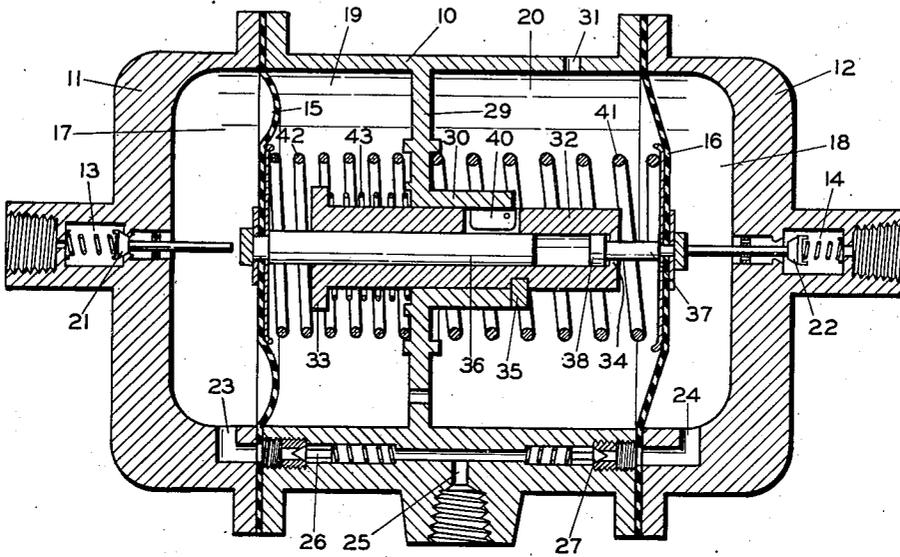


FIG. 1

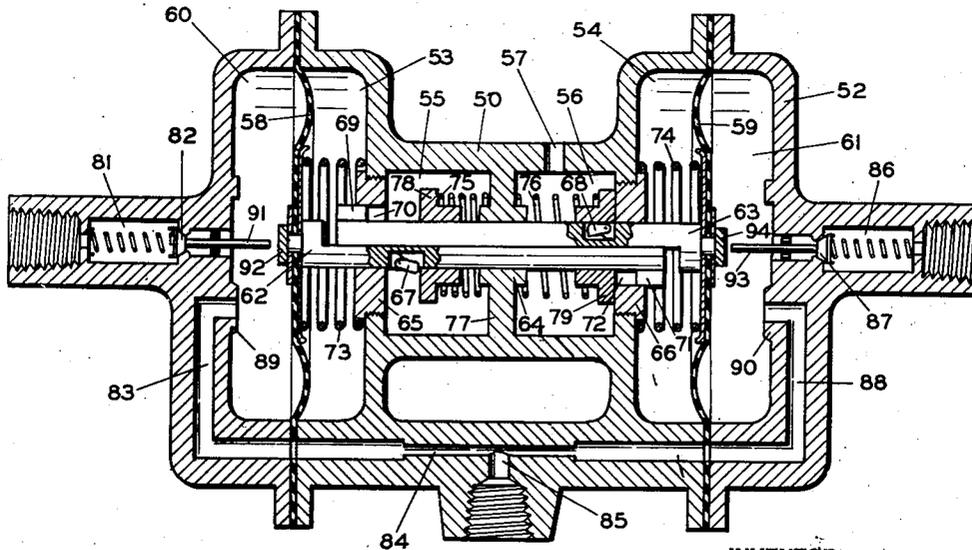


FIG. 2

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2 Sheets-Sheet 2

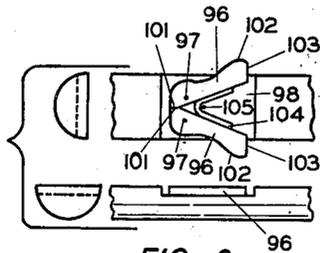


FIG. 3

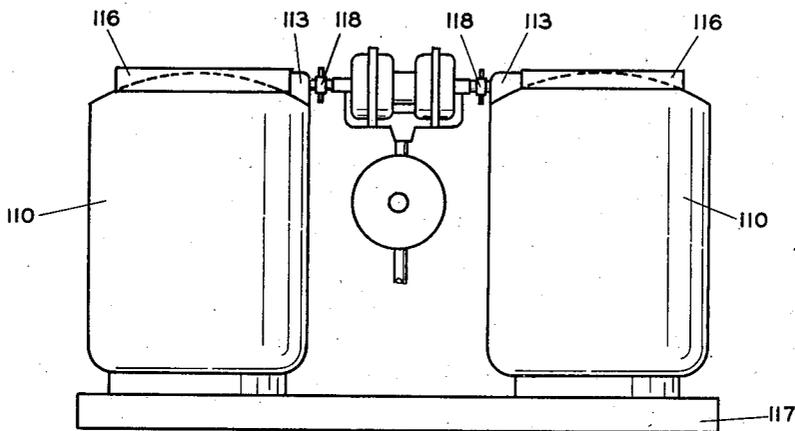


FIG. 4

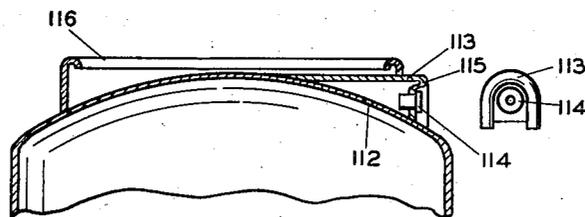


FIG. 5

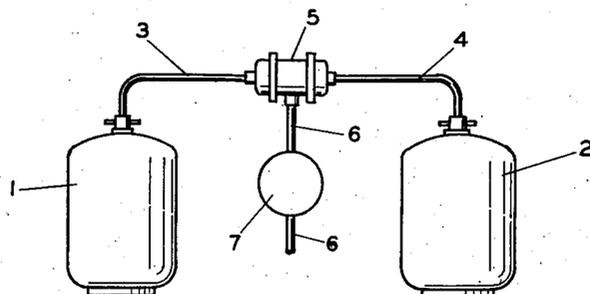


FIG. 6

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2,354,286

AUTOMATIC CHANGE-OVER DEVICE

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Application September 14, 1942, Serial No. 458,293

10 Claims. (Cl. 62—1)

This invention relates to a dispensing system for high pressure fluids and includes a device for automatically changing withdrawal connections from a plurality of fluid sources.

In dispensing fluid under pressure from containers, as, for example, liquefied petroleum gas, a device for automatically changing withdrawal connections from one container to another is desirable to insure an uninterrupted flow of the fluid. Various semi-automatic and fully automatic changeover devices have been proposed heretofore. The purpose of the present invention is to provide a dispensing system including an improved fully automatic changeover device which possesses several desirable characteristics. In a system of this type, high pressure piping should preferably be avoided to insure safety. The changeover device should withdraw gas preferentially from one container, utilizing the other as a reserve supply until the one is depleted, then automatically change to preferentially withdraw gas from the other.

An object of this invention is to provide a dispensing system for high pressure or liquefied gases.

Another object is to provide an improved container for use in such a system.

Still another object is to provide an improved device for effecting a changeover of withdrawal connections.

These and other objects and advantages will be apparent from the drawings and the following detailed description.

Fig. 1 is a cross sectional view of one form of the changeover device.

Fig. 2 is a cross section of a modification of the changeover device.

Fig. 3 is a detailed showing of an improved latch for use in the changeover device.

Fig. 4 is an elevational view of a dispensing system showing the application of the automatic changeover and the improved container.

Fig. 5 is a fragmentary cross sectional view of a portion of the improved container forming a part of this invention.

Fig. 6 is an elevational view of a dispensing system embodying the changeover device.

With reference to Fig. 1, the changeover device comprises a housing having a central member 10 with two end members 11 and 12. Similar inlet passages 13 and 14 are provided in each end member to admit high pressure gas from two separate sources to the changeover device. Two imperforate, flexible diaphragms 15 and 16 divide the space within the housing into three separate sections, forming several compartments. For convenience the compartments between the diaphragms and the end members will be referred to as service compartments 17 and 18, and the central compartments will be referred to as the

spring compartments 19 and 20. Gas from the inlet passages 13 and 14 is admitted to the service compartments through inlet valves 21 and 22 respectively. Each service compartment is provided with an outlet for the gas, passages 23 and 24 which join in the body member and from which the gas may flow through the passage 25 to a service line or second stage regulator. Each of the outlets 23 and 24 are provided with suitable check valves 26 and 27 to prevent back flow of gas. The poppet and spring type valves shown in the drawing are merely representative of one type which may be used, obviously any other suitable check valves may be used in these outlet passages.

The partition 29 between the two spring compartments serves to hold the springs in position and support the cylindrical guide 30. The partition is preferably perforate to allow communication between the spring compartments. A suitable vent 31 is provided to vent the spring compartments to the atmosphere. Slidably mounted in the guide 30 is a cylindrical sleeve 32 which has an external flange 33 at one end and an internal flange 34 at the other. A stop 35 attached to the sleeve cooperates with the guide 30 to limit the movement of the sleeve in one direction. A stem 36 is mounted within the bore of the cylindrical sleeve and slidable with respect thereto. The stem 36 is attached to the diaphragm 15. The diaphragm 16 is attached to the stem 37 which extends within the bore of the sleeve 32 and to which is attached the piston 38, slidable within the bore of the sleeve. A latch 40 is mounted in the sidewall of the sleeve 32 and is arranged to be retracted by the guide 30. When the latching device is extended, it cooperates with the end of stem 36 as will be described in more detail in connection with the operation of the device. In the spring compartment 20, a spring 41 is interposed between the diaphragm 16 and the partition 29. The spring 42 in compartment 19 is interposed between the diaphragm 15 and the partition 29. A spring 43 is also contained in the spring compartment 19, between the flange 33 on the sleeve and the partition 29. All of the springs are of the compression type and oppose the gas pressure on the opposite sides of the diaphragms with which the springs are associated. When the gas pressure in a service compartment falls below that required to overcome the opposing action of the spring associated with the corresponding diaphragm, the inlet valve to the service compartment is opened, allowing gas to enter the service compartment until the gas pressure therein, acting on the diaphragm, is sufficient to overcome the opposing spring action, whereupon the inlet valve is closed.

The spring 41 is designed to open the inlet valve 22 at a pressure higher than that at which the spring 42 will open the valve 21. Consequently, with the changeover parts in the position indicated in Figure 1, gas from the inlet passage 14 is preferentially admitted to the service compartment 18 from which it passes through the passage 25 for use. When the source of supply with which the inlet passage 14 communicates is depleted, or for any reason fails, the pressure in the service compartments 17 and 18 drops to that at which the valve 21 is opened by the action of spring 42. Gas is then supplied through the valve 21 and flows through the service compartment 17 and outlet 23 to the passage 25 at a pressure somewhat less than that at which gas was previously supplied from the service compartment 18. The action of the spring 42 in opening the valve 21 moves the stem 36 to the left. At the same time the decrease in pressure allows the spring 41 to move the diaphragm 16 to the right. The action of spring 41 moves the stem 37 and piston 38 to the right until the piston cooperates with the flange 34 of the sleeve. Further movement of the diaphragm 16 to the right moves the sleeve 32 also, compressing the spring 43. The depleted source of gas supply associated with the inlet passage 14 is replenished by replacement of the depleted container with a filled container. When the empty container is disconnected, gas from the service compartment 18 is vented to the atmosphere through the open valve 22 and the inlet passage 14. The check valve prevents flow of gas from the outlet passage 24 to the compartment. When the pressure in the service compartment is reduced to atmospheric or thereabouts, the spring 41 will have moved diaphragm 16 to the extreme right, moving the sleeve 32 to the right and further compressing the spring 43. When the sleeve 32 is moved to the right, the latch 40 moves away from the guide 30 and drops into position behind the right end of stem 36. When a filled container is again connected to the inlet passage 14 the gas enters compartment 18 restoring pressure therein and forces the diaphragm 16 to the left against the action of the spring 41. The piston 38 then no longer bears on flange 34, and stems 36 and 37 are free to act independently. The latch 40 in extended position engages the right end of stem 36 transmitting the compressive force of the spring 43 to the diaphragm 15 to augment the action of the spring 42. The combined forces of springs 42 and 43 are greater than the force exerted on diaphragm 16 by the spring 41. This causes the valve 21 to open and remain open until the discharge pressure built up in the discharge conduits is sufficient to overcome the action of springs 42 and 43. Gas is preferentially withdrawn from the container associated with the inlet conduit 13 until the supply fails. When the discharge pressure drops to that at which the spring 41 opens the valve 22, gas is again supplied from the container associated with inlet 14. When the depleted container associated with the inlet 13 is disconnected, the diaphragm 15 moves to the extreme left. This action moves the stem 36 out of engagement with the latch 40. The spring 43 moves the sleeve 32 to the left until the stop 35 engages the guide 30. At the same time, the action of the sleeve and the cooperation between the latch 40 and the guide moves the latch into inoperative position as illustrated in Figure 1. When a full container is again connected to the inlet 13, the diaphragm

15 is returned to the position illustrated in Figure 1, completing the cycle of operation.

With reference to Figure 2 of the drawings, a modification of the changeover device is shown. The housing comprises a central member 50, a left end member 51 and a right end member 52. The central member contains two main spring compartments 53 and 54, and two auxiliary spring compartments 55 and 56. All of the spring compartments are vented to the atmosphere through the vent hole 57. Two imperforate, flexible diaphragms 58 and 59 between the central section and the end sections separate the main spring compartments from the service compartments 60 and 61. A stem 62 is attached to the diaphragm 58. A similar stem 63 is attached to the diaphragm 59. The two stems are carried by the guides 64, 65, and 66, and are arranged to slide relative to one another through the guides. Each of the stems 62 and 63 is provided with a spring actuated latch 67 and 68 respectively, of the type commonly employed in umbrellas. At the end of stem 63 is a key 69 arranged to slide in the slot 70 of the guide 65; at the end of stem 62, the key 71 which slides in slot 72 in the guide 66. In the main spring compartment 53 is a main spring 73 which exerts a force on the diaphragm 58 in opposition to the gas pressure in the service compartment 60. In the main spring compartment 54 a similar main spring 74 acts against the diaphragm 59. In the auxiliary spring compartments 55 and 56 are auxiliary springs 75 and 76 which are interposed between the partition 77 in the center member of the housing and the washers 78 and 79 which are slidably mounted on the stems 62 and 63. The inlet passage 81 and inlet valve 82 admit gas to the service compartment 60 from which it is discharged through the outlet passages 83 and 84 to the service conduit at 85. The inlet passage 86 and inlet valve 87 admit gas to the service compartment 61 from which it is discharged through the outlet passages 88 and 89 into the service line at 85. Backflow of gas from the outlet passages 83 and 88 is prevented by suitable check valves, for example by the raised valve seats 89 and 90 which are closed by the corresponding diaphragms in extreme position to prevent flow of gas from the outlet passages to the service compartments. The valve stem 91 associated with the valve 82 cooperates with the screw 92 attached to stem 62 to open the valve 82. Similarly, the valve 87 is opened by co-action of the valve stem 93 with the screw 94 in the stem 63.

In operation, each of the inlet conduits 81 and 86 are connected to a source of gas under pressure. The diaphragm 58 is acted upon by the main spring 73, and at the same time by the auxiliary spring 75. The compressive force of spring 75 is transmitted to the diaphragm 58 through the washer 78, latch 67 and stem 62. The diaphragm 59 is acted upon only by the main spring 74. It will be at once apparent that under these conditions a lower pressure is required to overcome the compressive force of the main spring acting on diaphragm 59 to allow the valve 87 to close than is required to overcome the combined action of the main and auxiliary springs on diaphragm 58 to allow the valve 82 to close. Consequently, gas is preferentially withdrawn from the source of supply associated with the inlet passage 81. When the gas supply associated with the inlet 81 is depleted, or fails, the pressure in the service compartments fall until the action of spring 74 causes the screw 94

to co-act with the valve stem 93 to open the valve 87 and allow withdrawal of gas from the source of supply associated with the inlet conduit 86. When the container connected to the inlet conduit 81 is disconnected, the gas from the service compartment 60 escapes to the atmosphere reducing the pressure in the service compartment. The springs 73 and 75 move the diaphragm 58 and the attached stem 62 to the left. The key 71 attached to the stem 62 engages the washer 79 moving it to the left and compressing the auxiliary spring 76. When the diaphragm 58 has moved to the extreme left position, the washer 79 uncovers the latch 68 which is extended to engage the washer. At the same time, the latch 67 is retracted by the guide 65 allowing the washer 78 to abut against the guide 65. When a full container is again connected to the inlet passage 81, gas enters the service compartment 60 again moving the diaphragm 58 to the right against the action of the main spring 73 only. The auxiliary spring 76 now augments the action of the main spring 74 through washer 79, latch 68 and stem 63. Gas is, therefore, preferentially withdrawn from the source of supply associated with the inlet passage 86 until that supply fails or becomes exhausted. When the container associated with the inlet passage 86 is disconnected, the gas from compartment 61 escapes to the atmosphere lowering the pressure therein. The diaphragm 59 is moved to the extreme right by the action of the springs 74 and 76. This action moves the stem 63 to the right whereupon the key 69 contacts the washer 78 moving the washer to the right compressing the auxiliary spring 75 to the position shown in Figure 2. The latch 67 is extended to engage the washer 78. Simultaneously, the latch 68 is retracted by the action of the guide 66 allowing the washer 79 to abut against guide 66. When a full container is again connected to the inlet passage 86, the pressure is restored in compartment 61 returning the diaphragm and stem to the position shown in Figure 2, thereby completing the cycle.

A unique feature of the automatic changeover of my invention is that the characteristics of the changeover mechanism are not affected by a temporary cessation of the gas supply. Gas is preferentially withdrawn from a designated container until that container is disconnected from the system. At that time, a change in the operating mechanism takes place to allow preferential withdrawal from the opposite container until it is depleted. Therefore, if "freezing" of a container occurs during service, withdrawal of gas from that container continues as soon as the pressure in the container is restored to the pressure at which the changeover device discharges. This pressure is preferably much reduced from the normal container pressure. Hence, the containers are rather completely emptied. Any suitable indicator may be used to indicate that a container has been depleted and should be replaced by a filled container.

Figure 3 shows an improved latching mechanism in which an opposed pair of identical latches 96, pivoted on the pins 97, are mounted in a recess 98 in the stem which attaches to the diaphragms in Figure 2. The latches are provided with bumpers 101, camming surfaces 102 and shoulders 103. The latches are urged apart by the spring 104 held in position by the pin 105. The bumpers 101 limit the extended position of the latches. The camming surfaces 102 engage the guides to retract the latches, while the should-

ers 103 engage the washer associated with the auxiliary spring when the latches are in extended position. The latching mechanism is compact, requiring little space, and is not affected by ordinary wear. The camming surfaces are so designed that wear on the pins 97 or bumpers 101 will not materially affect the position at which the latches are retracted. The two shoulders 103 on opposite sides of the stem take the thrust of the auxiliary springs (75, 76) against the stems (62, 63).

With reference to Figure 4, a system is shown in which the automatic changeover mechanism of Figure 2 is used with improved containers forming a part of this invention. The fragmentary cross sectional view, Figure 5, shows details of the improved containers employed in the system of Figure 4. The containers 110 are constructed in the conventional manner and may be provided with the customary safety devices, not shown in the drawings. The gas outlet is through an opening 112 in the top of the container. Attached to the top of the container over the opening and forming a part thereof is a shield 113 forming a part of the container and having an outlet closed by the valve tap plug 114. The tap plug is protected by the rim 115 of the shield. A conventional guard ring 116 may be provided to protect the shield and cylinder head from damage. When placed in service the two containers are placed on a suitable support 117 with the tap plugs turned toward one another. The two containers may then be coupled to the changeover device by means of the couplings 118 and without the necessity of using flexible conduits subjected to the high gas pressures. Couplings which are self-aligning are suitable for use. Such couplings have previously been devised and need no further description. The valved tap plugs and couplings disclosed by R. W. Thomas in Patents Nos. 2,172,310 and 2,172,311 may be used as the tap plugs 114 and couplings 118.

Figure 6 shows the automatic changeover device used in a conventional liquefied gas dispensing system. Liquefied gas in the containers 1 and 2 is vaporized and the gas is delivered through the high pressure conduits 3 and 4 to the changeover device of my invention designated generally by the numeral 5. Gas passing the changeover device is delivered to the service conduit 6. If desired, a gas pressure regulator 7 may be interposed in the service line 6.

While I have shown specific embodiments of my invention various changes may be resorted to, particularly changes in the valves associated with the changeover device, and changes in the size, shape, and relative positions of parts without departure from the spirit of my invention.

I claim:

1. In a liquefied gas system, a completely automatic changeover valve mechanism for the purposes described, comprising in combination a body provided with a valved inlet port for each of two supply sources, a pressure responsive diaphragm associated with each of said valved ports, a pressure chamber formed by each of said diaphragms on their inlet sides, a channel communicating each of said pressure chambers to a common outlet, back-flow check valves in each of said channels, a spring housing between said diaphragms, a main loading spring associated with each diaphragm, an auxiliary loading spring for a least one of said diaphragms, and means controllable by said diaphragms and said main loading springs to alternately apply and remove

the loading of said auxiliary loading spring to and from one of said diaphragms.

2. In a liquefied gas system, a fully automatic device for exchanging delivery of gas from one source of supply to another comprising a body fitted with a valved inlet for each of said supply sources, pressure responsive means for operating each of said valves independently of the other, means for loading each of said responsive means to a dissimilar extent, auxiliary resilient means in a part of said body, and means for alternately engaging and disengaging said auxiliary loading means with and from the pressure responsive means associated with the lesser of the recited dissimilar loading means upon predetermined movement of said pressure responsive means.

3. In a device of the class described for dispensing liquefied petroleum gases, the organization which comprises a housing containing a pair of axially opposed diaphragms, an apertured wall therebetween, a spring loading one of the diaphragms away from said wall, a second spring of lesser strength loading the second diaphragm away from said wall, a sleeve portion projecting axially from the periphery of said aperture, a sliding member movable axially in said sleeve, a third spring loading said sliding member in the direction of the second recited diaphragm, a loading element attached to said second diaphragm and extending slidably within said sliding member, a motivating member having lost-motion engagement with said sliding member and attached to the first of said diaphragms, and a latch member carried by said sliding member, said latch member being arranged so as to be retracted when disposed within said sleeve portion and extensible to engage said loading element when withdrawn from said sleeve and beyond the end of said loading element.

4. In a liquefied gas system, a fully automatic changeover device of the class described comprising a body provided with a pair of inlet passages discharging to a common outlet, a valve in each of said inlets for reducing the pressure of fluid flowing therethrough, a diaphragm operatively associated with each of said valves, a pair of springs of equal strength, each loading one of said diaphragms in a valve-opening direction, a second pair of springs of lesser strength than the first said pair but equal in strength to each other, and automatic means controlled by movement of said diaphragms to place said auxiliary springs singly and alternately in augmentive relationship with the respective springs of the first-mentioned pair.

5. In a liquefied gas system, a fully automatic changeover device of the class described comprising in combination a housing, valved inlet ports formed in the walls of said housing for connection of two sources of fuel under pressure, a pressure responsive element associated with each of said inlet valves, a pressure chamber defined between each said diaphragm and its associated inlet port, a channel communicating each of said chambers to a common outlet, a back-flow check valve in each of said channels, a primary resilient member associated with the unpressured side of each diaphragm, a secondary resilient member for each of said diaphragms, and latching means operable to alternately bias the resilient loading of the respective diaphragms by sequential engagement and disengagement of the re-

spective secondary resilient members therewith.

6. In a changeover device for liquefied gas systems of the class described, the organization which comprises a case containing a pair of axially opposed diaphragms, a pair of apertured walls in said case between the diaphragms, a main loading spring associated with each diaphragm for loading the same away from the nearest of said walls, an apertured central wall between the said pair of walls, a separate loading shaft attached to each of said diaphragms and supported by the said walls within their apertures, said shafts being slidable in said apertures and relative to each other, a pair of sliding members engageable with said shafts, a pair of auxiliary springs, each loading one of said sliding members away from said central wall, and latching members carried on each of said shafts for engagement with said sliding members.

7. In a liquefied gas system, a changeover device comprising a body member having a gas outlet and gas inlets to accommodate two sources of gas supply, a valve controlling the flow of gas to each of said inlets, valve operating means associated with the valves to operate one valve in preference to the other until a minimum discharge pressure is reached at the gas outlet and then to operate the other valve, and means responsive to predetermined movement of said valve operating means to change the operation of said valve operating means to open the other valve in preference to the first mentioned valve until a minimum discharge pressure is reached and then to open said first mentioned valve.

8. In a liquefied gas system, a changeover device comprising a body member having a gas outlet and gas inlets to accommodate two sources of gas supply, valves to control the flow of gas through each of said gas inlets, gas pressure responsive means operating each of said valves in response to the pressure at the gas outlet, means for resiliently loading each of said gas pressure responsive means in opposition to the pressure at the gas outlet, and means responsive to predetermined movement of said pressure responsive means to alternately increase and decrease the loading on at least one of said pressure responsive means.

9. In a liquefied gas system, a changeover device comprising a body member having a gas outlet and gas inlets to accommodate two sources of gas supply, valves to control the flow of gas through each of said gas inlets, gas pressure responsive means operating each of said valves, means for resiliently loading each of said pressure responsive means, and means responsive to predetermined movement of said pressure responsive means to supplement the loading of at least one of said pressure responsive means.

10. In a liquefied gas system, a changeover device comprising a body member having a gas outlet and gas inlets to accommodate two sources of gas supply, a valve to control the flow of gas through each of said gas inlets, a diaphragm for each of said inlets, springs loading each diaphragm in the direction of valve opening position, an auxiliary loading spring for supplementing the loading on one of said diaphragms, and means responsive to predetermined movement of said diaphragms for alternately engaging and disengaging said auxiliary spring.

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