May 8, 1962 T. A. ST. CLAIR 3,033,220

AUTOMATIC MANIFOLD

Filed March 17, 1958 2 Sheets-Sheet 1

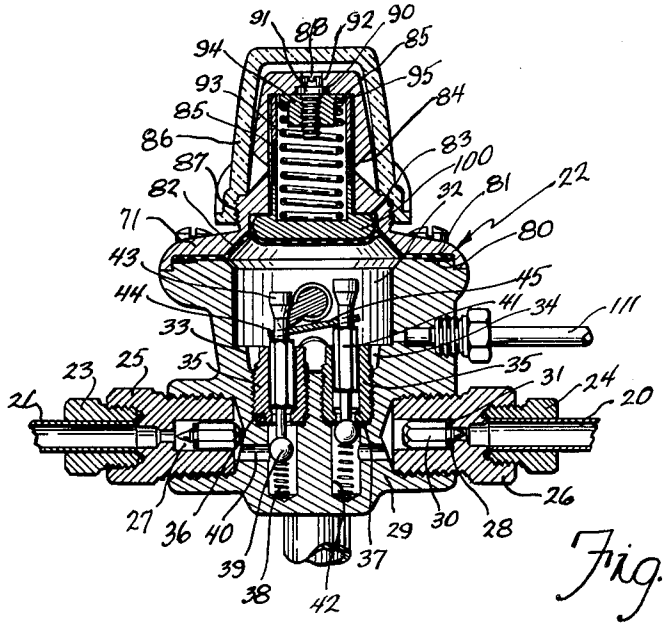


Fig. 2

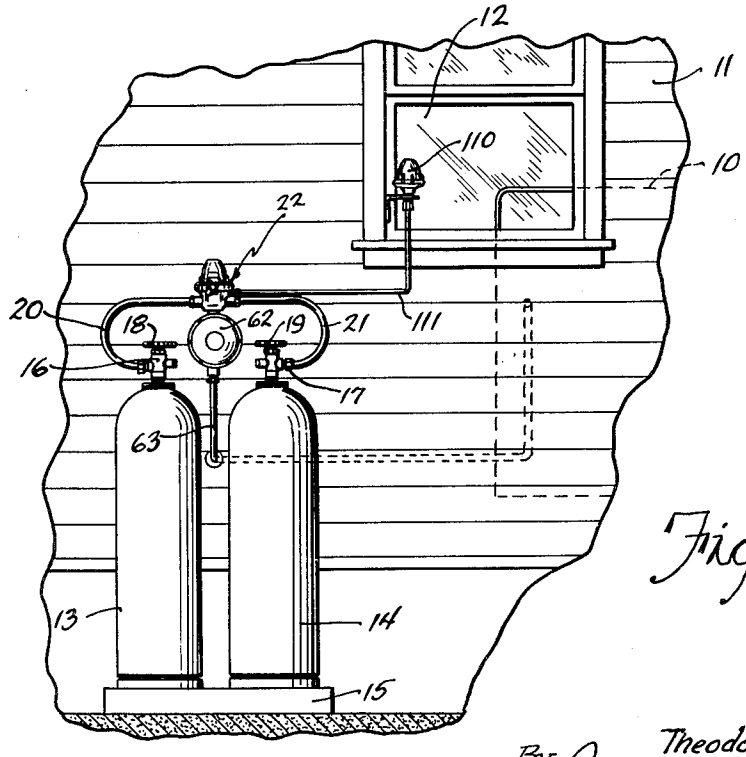


Fig. 1

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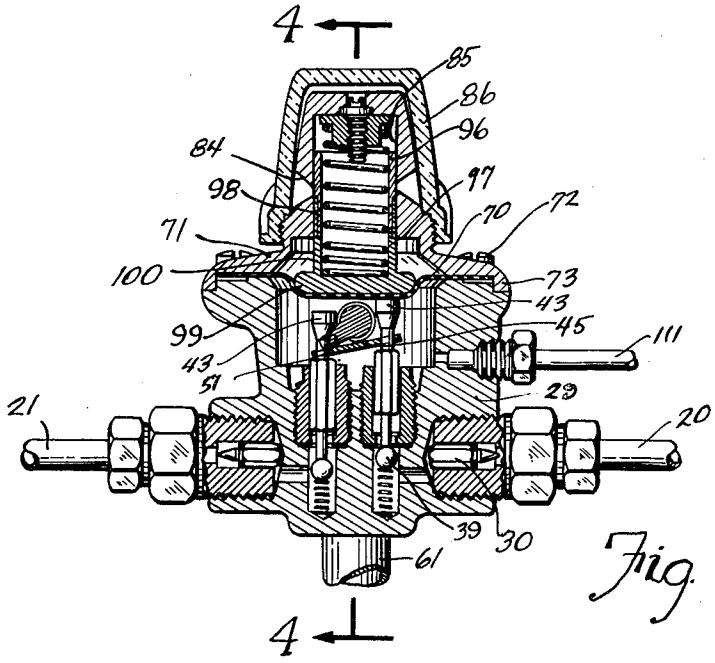


Fig. 3

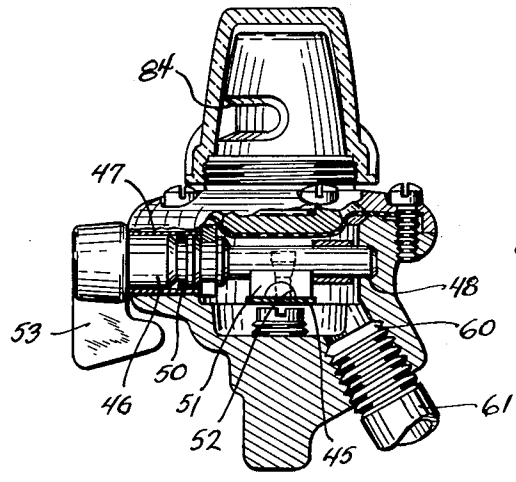


Fig. 4

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United States Patent Office

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AUTOMATIC MANIFOLD

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The present invention relates to an automatic manifold contral for selective withdrawal of liquefied petroleum gas from either one of two tanks as the main supply tank, with the other one serving as a standby or reserve tank to begin its operation when the main supply tank becomes empty.

Heretofore a great deal of complicated structure has been employed to provide what is commonly referred to as an automatic throwover manifold in a portable duel tank liquefied petroleum gas dispensing system, and the cost thereof has been correspondingly high. Consequently, many liquefied gas dispensing system manufacturers have resorted to manual devices and a reliance upon the watchfulness of the users to change over to the reserve tank when the service tank is exhausted. This requires careful attention by the user to change over at just the right time before the service line pressure drops to a point where safety devices on appliances have to be reactivated.

One of the objects of the present invention is to provide a low cost domestic automatic throwover or control device which is suitable and thoroughly reliable as original equipment in competition with the price and results attained by more expensive conventional constructions, and also is suitable for replacement equipment to upgrade older manual systems both new and used yet be competitive therewith pricewise.

A further object of the invention is to combine the functions of an automatic pressure indicator, an automatic pressure reducing device and an automatic changeover from one tank to another, in a single piece of equipment under the control of a single diaphragm in an arrangement which is inexpensive to manufacture, rugged in construction, dependable and easily managed in operation.

The invention is characterized by a throwover manifold arrangement which is not necessarily a first stage regulator but which serves as such during reserve tank operation to render the system non-critical with respect to the relative effective area of valves and diaphragms of associated elements and adjustment of springs for proper indication and operation.

Another object of the invention is to provide a device whose function and indicator operates with complete freedom from pressure variation and variations in diaphragms sensitivity.

The invention also contemplates an arrangement in which the pressure requirements for an indicator are directly related through a common diaphragm to the changeover pressure of the system regardless of the range or the limits of the changes in pressure involved in the system.

These being among the objects of the invention, other and further objects will become apparent from the drawings, the description relating thereto and the appended claims.

Referring now to the drawings:

FIG. 1 is a side elevational view of a two tank liquefied petroleum gas dispensing system for a dwelling house in which the present invention is embodied;

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FIG. 2 is an enlarged sectional view taken vertically through the valve and indicator assembly shown in FIG. 1;

FIG. 3 is a view similar to FIG. 2 showing changes in the position of working parts, and

FIG. 4 is a section taken upon the line 4—4 in FIG. 3.

The invention contemplates, among other things, in a liquefied petroleum gas dispensing system of the type described, the use of a single diaphragm in a manifold to perform multiple operations in which the inlets of two normally closed valves in the manifold are connected to two separate storage tanks through conduits detachable at the tanks, one of said valves being set in its open position. The diaphragm not only operates a device which indicates the relative dispensing conditions of the two tanks through the manifold but also in cooperation with the valves involved operates that one of the two valves which has not been manually set in its open position to regulate automatically the pressure of gas coming from the reserve tank when the supply tank connected to the open valve is empty.

Briefly, the valve to the tank which is serving as the "service" tank is manually set at its open position to conduct gas under tank pressure to the low pressure regulator in the service conduit. At this pressure the diaphragm is lifted away from and leaves closed the valve that is connected to the tank which is serving as the "reserve" tank. This movement of the diaphragm also actuates the indicator. Thereafter when the service tank is emptied and the waning inlet pressure ultimately drops to a predetermined pressure, the diaphragm is spring forced into its alternate position, thereby shifting the indicator and operating the closed valve as a pressure regulating valve until the empty tank is replaced. Then when the empty "service" tank is replaced with a full tank by detaching the detachable conduit the control of the valves is reversed manually for repeat operations with the new tank serving as the "reserve." The manual control is so constructed that one or the other of the valves is held open constantly while the other is free to be actuated by the diaphragm. In brief the indicator is self assuring in its own operation in that it is certain to move from its high pressure position to its low pressure position when the service tank is empty because the pressure continues to drop until it does move into a position to open and operate the reserve valve as a pressure reducing valve.

Referring now to the drawings in further detail a home appliance such as a gas range **10** is shown in a house **11** having a window **12** therein. Outside of the window, as shown in FIG. 1, two portable liquefied petroleum gas dispensing storage tanks **13** and **14** are shown standing on a block **15**, both being provided with hand-opened cylinder valves **16** and **17**, respectively, operated by hand wheels **18** and **19**. The outlets of the cylinder valves are detachably connected to conduits or pigtails **20** and **21** which in turn are connected to the automatic control manifold identified generally at **22**.

As more particularly shown in FIG. 2 the pigtails **20** and **21** are secured by flared couplings **23** and **24** to backflow check valve bodies **25** and **26**, each having a passage **27** therethrough enlarged at its inner end to provide a valve seat **28** and to receive a back flow check valve plunger **30** therein which carries an O-ring check valve seat **31** that closes against the seat **28**.

The check valve bodies are threaded into a manifold body **29** which has a cavity in the top thereof forming a

valve chamber 32 having two wells 33 and 34. The wells are enlarged and threaded at the top to receive a valve housing sleeve 35 which is sealed at the bottom thereof against an offset or shoulder 36 by an apertured valve seat disk 37. The disk holds in place below it a ball valve member 39 urged to closed position by a compression spring 38. The bottom of each well is in communication with the passage 27 in its respective check valve body through a conduit 40 offset with respect to the passage 27 so that stock in the body 29 is present at these points as walls to hold the valve plungers 30 in operative positions.

Valve stems 41 are mounted in the valve housing sleeves 35 and are provided with reduced lower ends or needles 42 that pass through the valve seat disks 37 to displace and open the ball valves 39. Above the sleeves 35 the stems 41 are of reduced diameter below heads 43 where they are received in longitudinal slots 44 in a change-over plate 45 which thereby holds the stems in operative position. The assembly of the parts described is readily and easily made. As more clearly shown in FIG. 4 the change-over plate 45 is normally held a substantial distance above the sleeves 35 by the spring pressed balls and stems of the two valve assemblies described.

A shaft 46 is journalled in a horizontal opening 47 in the front wall of the manifold body and a recess 48 coaxial therewith in the rear wall at a level just above the plate 45. This shaft is sealed at the front opening by an O-ring 50 and carries a cam ear 51 which moves either end of the plate 45 downwardly to open the valve ball at that end as limited at opposite ends of its movement by the heads 43, the cam being arched on its lower edge as at 52 to engage the stems. The cam moves back and forth between limits through a lower arc where in passing its middle position it opens both valves to make sure that gas is being supplied all the time that the shaft 46 is being manipulated.

The outer end of the shaft 46 receives an indicator handle 53 thereon for operating the cam. Thus, movement of the handle from one side to the other opens one or the other valves and also points, as shown in FIG. 1, when so moved, to the tank which is operating as the supply tank. In FIG. 1 it is tank 13. It will be apparent that if the handle is inadvertently left in an intermediate position, a gas supply is still assured if the rounded lower edge of the cam fails to slide to one of its limits of movement.

To the rear of the manifold body 29 as shown in FIG. 4 there is a threaded opening 60 which receives a short nipple 61 supporting a service pressure regulator 62 (FIG. 1) connected in the service conduit 63 leading to the stove 10.

A diaphragm 70 closes the cavity or chamber 32 as held in sealed relationship marginally therewith by a bonnet 71 secured thereto by screws 72 and carrying the indicator construction which now will be described.

The bonnet 71 has a downwardly extending marginal flange 73 engaging the body 29 to seal the diaphragm edge from the weather and also a shoulder 81 marginally engaging the diaphragm to compress the diaphragm bodily at its edge into the groove 80 on the body 29 to thereby clamp it in sealed relationship under a controlled compression of the diaphragm material. The bonnet otherwise is correspondingly recessed as at 82 above the center of the diaphragm to provide working space above the diaphragm and is bored out to a large diameter shallow cavity 83 in its top and a deep well-like cavity 85 thereabove. A wide window 84 (FIG. 4) is cast in the wall of the cavity 85. A transparent Lucite bell or hood 86 is threaded to the bonnet at 87 to cover the window so that the window is visible through it and also any elements behind the windows that are located in the cavity 85. The thread at 87 includes a truncated or interrupted thread contour that permits restricted communicaion with the atmosphere for the flow of air to cushion the action of the diaphragm.

At its upper end the bonnet is apertured at 88 and provided with a downwardly facing shoulder 90 to receive a screw 91 therein as supported against upward displacement by a flange 92. The depending threaded end of the screw as shown in FIGS. 2 and 3 receives an adjusting nut 94 thereon externally flanged as at 95. The flange supports the upper end of a compression spring 93 whose lower end rests in the bottom of a cup 100 reciprocably mounted in cavity 85. Preferably the cup is made of two integrated sleeve portions, one a red translucent plastic sleeve 96 at the top and the other a green plastic cup element 97 at the bottom. The two are joined at an overlap 98 to provide a line of demarcation therebetween which passes back and forth over the window 84 when the cup 100 is reciprocated between its limits of travel as carried by the diaphragm in an arrangement in which an enlarged base 99 on the cup 100 rests on the diaphragm.

The reduced portion 85 of the bonnet snugly engages the base 99 of the inverted cup member 100 so that the sleeves are held in correct position to provide constant clearance between them and the wall of the bore 85 so that sleeves may reciprocate freely therein.

As shown in FIG. 3, the integrated sleeves of the cup 100 are of such height and proportion that the green is not seen and the red sleeve is seen when the diaphragm is at its lowest point (FIG. 3), and, the green sleeve covers the window opening when the diaphragm is in its uppermost position (FIG. 2). As mentioned, the compression spring 93 is disposed between the nut flange 95 and the bottom of the upright cup 100. The tension on the spring is varied by turning the screw 41 to adjust the vertical position of the nut in order to determine at what low pressure the diaphragm and cup will be forced downwardly to show the red sleeve at the window and the closed valve will be opened.

Thus the indicator indicates by the exposure of the red sleeve behind the window that the system is operating upon "reserve" (low regulated pressure with the "service" tank empty) or by the exposure of the green cup behind the window to show that the system is on the "service" tank (high tank pressure).

An auxiliary indicator 110, such as that shown in the Billington Patent No. 2,850,900, reference to which is hereby made, can also be located any place convenient for additional warning as connected to the valve compartment 32 through conduit 111 as shown in FIGS. 1 and 2. Such a place would be where it can be seen outside the kitchen window every time somebody looks out the window. The construction of the working parts of such a remote indicator preferably would be the same as that described herein but need not be, so long as it is set for the same low pressure as that provided herein for the movement of the diaphragm. Such a low pressure could be six pounds gauge and then the present invention would fit in with conventional installations whether they be high or low priced within the parlance of the trade.

Having thus described the embodiment of the invention and the particular arrangement and operation of the parts, it will be apparent to those skilled in the art that an invention is provided within the purposes and objects stated at the beginning of the description and that various changes and alterations may be made therein without departing from the essential features of the invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. A throwover regulator comprising a body having two inlet port openings into the same pressure chamber, diaphragm means closing said chamber including a resilient diaphragm, a bonnet defining a cavity adjacent said diaphragm, the walls of said bonnet having a window therein, an element having a portion slidably disposed within said cavity with a signal area thereon normally disposed below said window and movable in response to movement of said diaphragm to bring the signal area behind said window, means for urging said dia-

phragm and said element in one direction in which said signal area is disposed below said window when the pressure in the chamber is below a predetermined pressure, means for clamping the marginal edges of the diaphragm in sealed relationship between said body and bonnet, two valve systems controlling the flow of fluid through said ports including a member for operating either system independently of the other, and means actuating said member for holding one of the valve systems open continuously, said diaphragm operating the other valve below said predetermined pressure in said chamber.

2. A throwover regulator comprising a body having two inlet port openings into the same pressure chamber, diaphragm means closing said chamber including a resilient diaphragm, a bonnet defining a cavity adjacent said diaphragm, the walls of said bonnet having a window therein, an element having a portion slidably disposed within said cavity with a signal area thereon normally disposed below said window and movable by said diaphragm to bring the signal area behind said window, means engaging said element for urging said diaphragm and said element in one direction in which said signal area is disposed below said window, two normally closed valves controlling the flow of fluid through said ports including valve stems engageable by said diaphragm, and means engaging said valves for holding one of the valves open including a handle actuated manually, said diaphragm engaging the stem of the other valve below a predetermined pressure in the valve chamber.

3. A throwover manifold having two conduits terminating in inlet ports opening into and an outlet conduit from a pressure chamber, back flow check valves in said conduits, diaphragm means closing said chamber, two valve systems controlling the flow of fluid through said ports including an element for operating either system independently of the other, means actuating said member for selectively holding one or the other of the valve systems open continuously, means for urging said diaphragm in a direction against pressure in said chamber for operating the other valve below a predetermined pressure in the chamber, and indicator means actuated by said diaphragm above said predetermined pressure.

4. A throwover manifold having two inlet ports opening into and an outlet conduit from a pressure chamber, a single diaphragm closing said chamber, means for urging said diaphragm towards said pressure chamber, two normally closed valves controlling the flow of fluid through said ports including valve stems engageable by said diaphragm and having shoulders, means for holding one of the valves open including a plate resting on said shoulders and a handle actuated manually comprising an arm movable across said plate between said stems to displace the portion of the plate downwardly that is engaged by said arm, said diaphragm engaging the stem of the other valve below a predetermined pressure in the chamber, and indicator means actuated by said diaphragm above said predetermined pressure.

5. A throwover regulator comprising a body having two conduits terminating inside the body in inlet ports opening into a pressure chamber and an outlet conduit therefrom, back flow check valves in said conduits, diaphragm means closing said chamber including a resilient diaphragm, a bonnet defining a cavity adjacent said diaphragm, and a signal element having a portion slidably disposed within said cavity and movable by said diaphragm, means engaging said element for urging said diaphragm and said element in one direction, two normally closed valves controlling the flow of fluid through said ports including valve stems engageable by said diaphragm, and means engaging said valves for selectively holding one of the valves open continuously including a handle actuated manually, said diaphragm engaging the stem of the other valve below a predetermined pressure in the valve chamber.

6. A throwover regulator comprising a body having two conduits terminating inside the body in inlet ports opening into a pressure chamber and an outlet conduit therefrom, back flow check valves in said conduits, diaphragm means closing said chamber including a resilient diaphragm, a bonnet covering the diaphragm and defining a cavity the wall of which has an opening therethrough, signal means disposed within said cavity and actuated by said diaphragm including a signalling element movably associated with said opening, means engaging said signal means for urging said diaphragm and said element in one direction, the pressure in said chamber moving the diaphragm in the opposite direction, two normally closed valves controlling the flow of fluid through said ports including valve stems engageable by said diaphragm, and means engaging said valves for holding one of the valves open continuously in a direction away from and out of contact with the diaphragm including a handle actuated manually, said diaphragm engaging the stem of the other valve below a predetermined pressure in the valve chamber.

7. A throwover manifold having two inlet ports opening into and an outlet from a pressure chamber, a single diaphragm closing said chamber, a bonnet covering said diaphragm, means for urging said diaphragm towards said pressure chamber, two normally closed valves controlling the flow of fluid through said ports including valve stems engageable by said diaphragm, means engaging said stems for selectively holding one of the valves in an open position and out of engagement with the diaphragm including a cam movable between two positions and a handle actuatable manually for operating said cam, said diaphragm engaging the stem of the other valve below a predetermined pressure in the valve chamber to operate said other valve, said indicator means being carried by the bonnet and actuated by said diaphragm above said predetermined pressure.

8. A throwover valve mechanism comprising a body having a pressure chamber a plurality of inlet conduits and an outlet conduit opening into the pressure chamber, a normally closed valve for closing each opening, manual means for selectively holding one of said valves open continuously; pressure responsive means for operating another of said valves below a predetermined pressure in said chamber, signal means operated by the pressure responsive means above said predetermined pressure, and back flow check valve means in said conduits obstructing back flow of gas therethrough from said chamber when one of said valves is open.

9. In a liquefied gas system an automatic manifold mechanism comprising a body having a pressure chamber, an outlet conduit in communication with said pressure chamber, a plurality of inlet conduits for liquefied gas under pressure having valve seat ports opening into the pressure chamber, a valve element closing against each valve seat port, means for urging said valve elements to their closed position, valve actuating means for each valve element having a portion disposed for actuation in said pressure chamber for opening said valve element, pressure responsive means movable to one position by pressure in said pressure chamber, means opposing said pressure in the pressure chamber for urging said pressure responsive means to another position in engagement with said valve actuating means to operate said valve elements as pressure reducing valves and provide a low pressure in said pressure chamber, manual means selectively identifying and moving one of said valve actuating means out of engagement with said pressure responsive means and its corresponding valve element to a continuously open position to provide a high pressure in said pressure chamber and thereby move the pressure responsive means out of engagement with the other of said valve actuating means, and back flow check valve means in each inlet conduit obstructing back flow of gas therethrough from said pressure chamber when the valve element of its respective inlet conduit is open.

10. The combination called for in claim 9 including indicator means responsive to low pressure in said pressure chamber for indicating operation of said other valve actuating means by said pressure responsive means.

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