

Sept. 30, 1941.

R. W. THOMAS

2,257,249

AUTOMATIC CHANGE-OVER DEVICE

Filed July 18, 1938

2 Sheets-Sheet 1

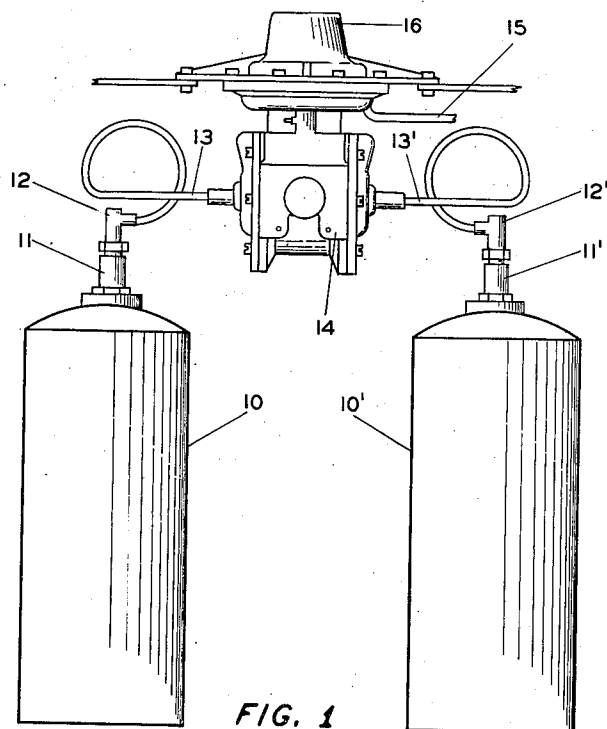


FIG. 1

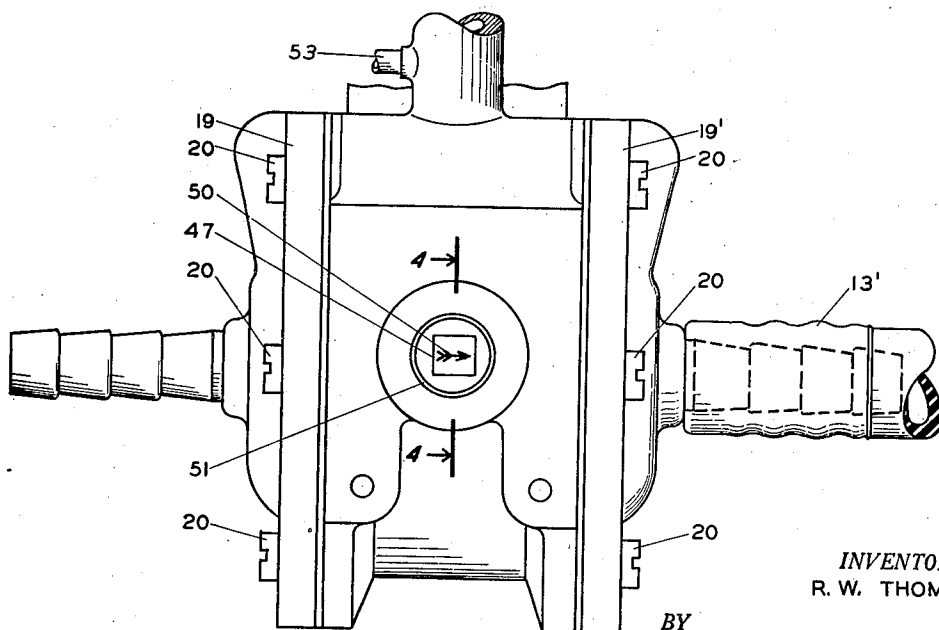


FIG. 2

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2 Sheets-Sheet 2

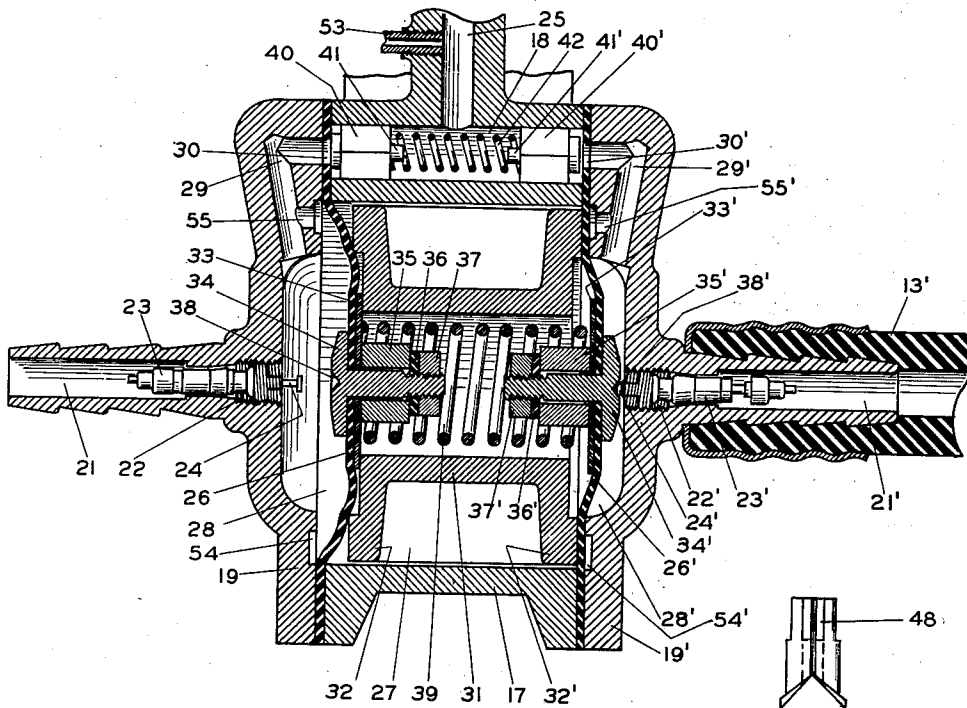


FIG. 3

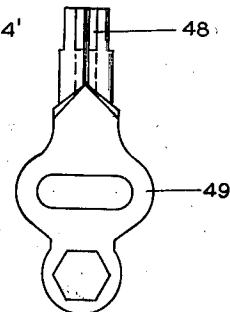


FIG. 5

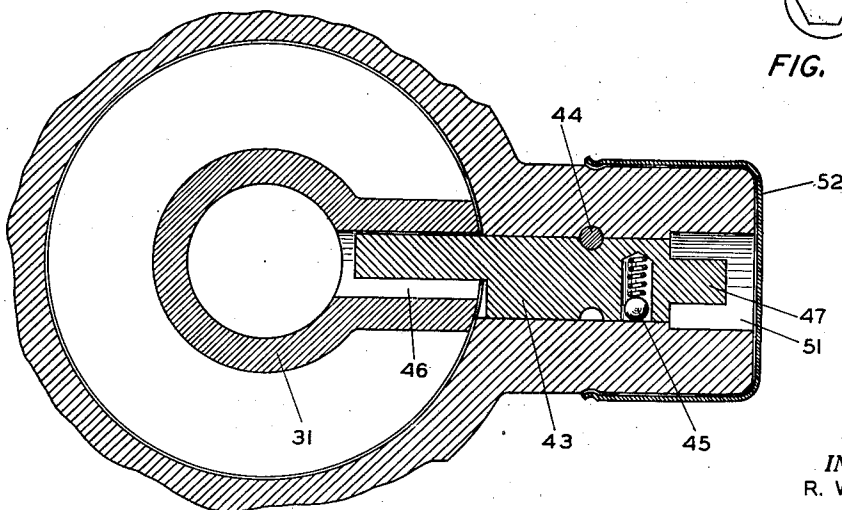


FIG. 4

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AUTOMATIC CHANGE-OVER DEVICE

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Application July 18, 1938, Serial No. 219,866

13 Claims. (Cl. 62—1)

This invention relates to improvements in devices for automatically changing over from one source of high pressure gas supply to another source of supply upon depletion of the gas supply in the first source.

Heretofore, the usual two drum system for the distribution of bottled gas, such as liquefied petroleum gas, comprised a pair of cylinders containing liquefied gas, and a service line to the gas consuming appliances connected through a pressure reducing device to both the cylinders. Provision was made to place one or both of the cylinders in service for supplying gas to the pressure regulator and thence through the service line to the appliances. Under early practice the valve on one cylinder was opened and placed in service while the valve on the other or reserve cylinder remained closed. When the active cylinder became exhausted, its valve was turned off and the valve controlling the reserve cylinder was opened. The above outlined procedure was followed in order to prevent the high pressure gas in the reserve cylinder from being fed into the exhausted cylinder. This proved unsatisfactory, however, since it resulted in an interval during which there was a cessation of the gas supply to the appliances. Also, all pilot lights became extinguished. A similar hiatus, during which there was no gas supplied to the appliances, occurred every time an exhausted cylinder was removed from the system and replaced by a full cylinder, as it was necessary to close the valve in the active cylinder to prevent escape of its gas into the atmosphere while the replacement was being made.

In recent years great strides have been made which presented improvements in dispensing equipment for liquefied gas. Various types of apparatus have been devised correcting many of the disadvantages inherent in earlier methods and equipment. A number of automatic change-over devices have been developed which have rendered it feasible to place a reserve cylinder of liquefied gas into service as soon as the active cylinder became substantially exhausted without the undesirable interruptions in continuous supply experienced in the past. Two notable advancements in this field are shown in U. S. Patents Nos. 1,960,466, issued to Walter I. Thrall, and 2,047,338, issued to the present inventor, but these devices are complex and expensive.

The present invention affords a simple and inexpensive means of automatically accomplishing the change-over from an exhausted cylinder to the reserve cylinder without cutting off the supply of gas to the appliances.

One important object of this invention is to provide an automatic change-over device which is simple in construction, compact in design, and inexpensive to manufacture.

Another important object of this invention is

to provide an automatic change-over device capable of being set so as to permit withdrawal of gas from either of the two cylinders first.

A further important object of this invention is to provide an automatic change-over device which operates in a positive and efficient manner.

A still further important object of this invention is to provide an automatic change-over device in which there are no external adjustments required. This feature of the invention eliminates the possibility of users, curious bystanders, or other unauthorized persons from tampering with the device.

These and other objects and advantages will be apparent from the following specification and annexed drawings which describe and illustrate a preferred embodiment of the invention.

This invention is an improvement over the inventions disclosed in U. S. Patent No. 2,138,988 of the applicant, and U. S. Patent No. 2,138,989 of the applicant and Charles MacSporran.

Figure 1 is a schematic representation in elevation of a gas dispensing plant.

Figure 2 is a front elevation view of the present invention.

Figure 3 is a vertical cross section view taken through the center of Figure 2.

Figure 4 is an enlarged vertical cross section view of a portion of the device taken about on line 4—4 of Figure 2 and illustrates details of the parts of the device which are used in shifting the sliding sleeve. A cover, not illustrated in Figure 3 is also shown.

Figure 5 illustrates a key to actuate the shifting mechanism represented in Figure 4.

Referring to Figure 1 of the drawings, reference numerals 10 and 10' indicate a pair of cylinders for containing liquefied gas. These cylinders are normally closed by means of valves 11 and 11' which are connected by couplings 12 and 12' to withdrawal pipes or tubes 13 and 13', which are preferably flexible. Pipes 13 and 13' terminate in a manifold 14 which in turn is connected to a consumer's service or supply line 15. Intermediate manifold 14 and service line 15 is a regulator 16 for controlling the pressure of the gas to be fed to the appliances at the other end of the service line. It is evident that pipe 13, manifold 14, and pipe 13', as a unit, constitute a conduit connecting the two cylinders 10 and 10' and also that service line 15 is in communication with manifold 14.

Referring to Figures 2 and 3, which show manifold 14 in enlargement, a central body member 17, having a cross port 18, and two end members 19 and 19' comprise the manifold housing. This housing is united into a complete assembly by bolts 20. Integral with each of the end members 19 and 19' are gas inlets 21 and 21' which communicate with pipes 13 and 13' and are threaded

at 22 and 22' to receive pressure reducing valves 23 and 23'. While a preferred type of pressure regulator is illustrated by the tire valve core type of valves 23 and 23', each having a valve stem 24 and 24', respectively, it is to be understood that I do not intend to limit myself to any particular type or style of valve. A gas outlet 25 is in communication with cross port 18 and regulator 16 indicated in Figure 1. It will be apparent that outlet 25 forms part of the consumer's service line of which conduit 15 is a part, with regulator 16 interposed therein.

A pair of flexible diaphragms 26 and 26' are interposed between end members 19 and 19' and central body member 17. The diaphragms divide the interior of the manifold housing into three compartments, namely, a control compartment 27 and two gas compartments 28 and 28'. It is to be noted that the control compartment 27 is sealed off from the rest of the manifold housing by the diaphragms while the gas compartments 28 and 28' are in communication with each other through ducts 29 and 29' in the end members, openings 30 and 30' in the diaphragms, and cross port 18 in the central body member.

Referring more particularly to the control compartment, it is seen that a sleeve 31, having flanged ends 32 and 32', is slidably contained therein. Mounted on the control compartment side of the diaphragms are back-up plates 33 and 33', which are fixedly attached to the diaphragms through the cooperation of bolts 34 and 34', sleeves 35 and 35', lock washers 36 and 36' and nuts 37 and 37'. The heads of bolts 34 and 34' are preferably counter sunk at 38 and 38' so that during the operation of this invention the valve stems 24 and 24' will become properly centered on the bolts heads and thereby overcome chattering which might otherwise occur under certain load conditions. A compression spring 39 is guided by sleeves 35 and 35' and exerts an equal outward force on both back-up plates 33 and 33' and hence on both diaphragms 26 and 26'.

A pair of check valves 40 and 40' control the passage of gas from ducts 29 and 29' through cross port 18 and finally into duct 25 or vice versa. The body of each of these valves is shown as being square in cross section although any one of a variety of shapes will be suitable for the purposes of the present invention. Each valve is provided with a stem 41 and 41', which stems support and guide a common compression spring 42. These check valves prevent the escape of gas in case the line opposite the one which is supplying gas to the manifold is defective, broken or disconnected from its cylinder.

The sliding sleeve 31 is moved to the right or left by means of the shifting mechanism illustrated in Figures 4 and 5. The essential parts of this mechanism are an eccentric shaft 43 which is retained in central body member 17 by a pin 44. A spring loaded ball lock is indicated by reference numeral 45 to maintain the shaft in any desired position. The inner end of this shaft terminates in a shifting slot 46 in sliding sleeve 31. The outer or actuating end 47 of shaft 43 is square in cross section and is adapted to coact with aperture 48 in key 49 to shift sleeve 31 to the right or left, as desired. An arrow or other suitable signal 50 is stamped on the exposed end of the shaft to inform the user as to the position of the sliding sleeve. Member 17 is recessed at 51 in order to protect the shaft from becoming fouled by dust or dirt. If the manifold is installed

in the open, a cover such as the one shown at 52 may be provided to exclude rain, sleet, or snow.

In order to denote to the user or service man which cylinder is active as more fully described below, an indicator, not shown in the drawings, is connected to the interstage gas passage 25 by tubing 53.

End members 19 and 19' are recessed to form annular channels 54 and 54' which communicates with ducts 29 and 29' through ports 55 and 55'. The purpose of these channels and ducts is to prevent the diaphragm from adhering to end members 19 and 19' in those areas at which they have been clamped.

For the purpose of describing the operation of this invention, let us assume that cylinders 10, 10' are connected as shown in Figure 1, but valves 11, 11' are closed. With shaft 43 in such position that arrow 50 points upwardly in Figure 2, the sleeve 31 will be in a central position and neither of the diaphragms 26, 26' will be restrained thereby. Since there is no gas pressure present in pipes 13, 13', the heads of bolts 34, 34' will, due to spring 39, urge valve stems 24, 24' into valve opening position. If, as shown in the drawings, it is desired to use cylinder 10' for supply and cylinder 10 for reserve, shaft 43 is turned so that arrow 50 points in the direction of cylinder 10'. Such action operates the shifting mechanism sliding sleeve 31 to the right as shown in Figure 3. In this position of the sleeve the peripheral surface of end 32' is moved into contact with diaphragm 26', clamping the same against housing end member 19'. Under these conditions the area of diaphragm 26' is reduced by the amount of area clamped while diaphragm 26 is unimpeded. The position of bolt heads 34, 34' is not changed, still being urged into valve opening position by spring 39. There are therefore present two gas pressure regulators, one having a larger diaphragm than the other and both having a common spring 39. The area of each diaphragm when in unclamped position is designed, in cooperation with spring 39 to maintain a pressure of, for example, 6 pounds in the associated gas compartment 28 or 28', so long as a pressure of 6 pounds exists at the source of gas supply. When clamped, due to the smaller area of diaphragm exposed to the pressure, a higher pressure of, for example, 9 pounds will be necessary to maintain the corresponding bolt head 34 or 34' off its associated valve stem.

From the above it will be evident that with the sleeve positioned as shown in Figure 3 and with valves 11, 11' in open position, gas under a pressure will be admitted to the manifold through both valves 23 and 23'. When more than 6 pounds pressure has developed on the valve side of diaphragm 26, bolt head 34 will have been moved away from valve stem 24 and valve 23 will be closed. Since it takes a greater pressure to move clamped diaphragm 26' away from valve stem 24', valve 23' will remain open until 9 pounds pressure has been developed in gas compartment 28'. The pressure in gas compartment 28 may remain at 6 pounds due to check valve 40, this being immaterial since no gas can flow from compartment 28 into cross port 18 so long as the pressure is greater in the cross port. This condition continues until the pressure in gas inlet 21' drops to six pounds, due either to exhaustion of the liquefied gas in cylinder 10' or "freezing" up of this cylinder. "Freezing," so called in the industry, takes place when the liquefied gas is vaporized so rapidly due to heavy load that the

temperature of the body of the liquid tends to drop below the vaporizing temperature and the amount of gas evolved is then limited by the amount of heat exchange between the body of liquid and its surroundings.

In either of the above cases when the pressure in gas compartment 28' drops below 6 pounds, the same pressure plus the pressure drop across check valve 40 is present in gas compartment 28. Since valves 40 and 40' are purely check valves, the above mentioned pressure drop is negligible. When the pressure in gas compartment 28 reaches 6 pounds, diaphragm 26 has been moved by spring 39 so that bolts head 38 contacts valve stem 24 to open valve 23. If cylinder 10' is exhausted, cylinder 10 continues to supply gas.

If cylinder 10' is merely "frozen", cylinder 10 momentarily carries the peak load until cylinder 10' builds up sufficient pressure to raise the pressure in gas compartment 28 to above 6 pounds. If the overload condition continues both cylinders may supply the gas.

Upon depletion of the liquefied gas in cylinder 10' and with cylinder 10 supplying the gas, cylinder 10' is disconnected from connector 12 and a new cylinder connected at this point. During this procedure check valve 40' prevents gas in cross port 18 from escaping to atmosphere. The new cylinder is closed by a valve corresponding to valve 11 and if this cylinder is to be used as the supply cylinder and cylinder 10 retained as reserve, this valve is opened. The new cylinder then assumes the load as described above in the case of cylinder 10'.

Usually it is desirable to make cylinder 10 the supply cylinder and the new cylinder the reserve. In this case shaft 43 is turned so that arrow 50 points toward cylinder 10 with the result that sleeve 31 slides to the left, releasing diaphragm 26' and clamping diaphragm 26. The action of the device is then the same but in reverse sense to that described above.

It will be noted that the pressure in the inter-stage gas outlet 25 is indicative of whether the supply or reserve cylinder as determined by arrow 50 is supplying the gas. Thus, if the pressure at this point is around 9 pounds the supply cylinder is in use while if the pressure is around 6 pounds the reserve cylinder is in use.

It is to be understood that the form of this invention, herewith shown and described, is to be taken as a preferred example of the same and that various changes in size, shape and arrangement of parts may be resorted to without departing from the spirit of this invention, and further that the theories of operation set out, although believed to be accurate, are not to be considered as the sole basis of the operativeness of this device, but that this device does operate successfully whether or not upon the principles described herein, this invention to be limited only by the appended claims.

I claim:

1. In a system for storing and utilizing high pressure gas, the combination comprising a pair of containers for said gas, a conduit connected between said containers, a consumer's service line connected to said conduit, a pair of valves in said conduit, one of said valves on each side of said service line, a pair of diaphragms in said conduit, one of said diaphragms associated with one of said valves, the other said diaphragm associated with the other said valve, a spring intermediate said diaphragms for opening said valves, and a movable member operable from the ex-

terior of said conduit for co-acting with said diaphragms so that whichever one of said valves desired will open at a lower pressure than the other.

2. A manifold for use in high pressure gas systems wherein a pair of containers for said gas are connected to a consumer's service line, comprising a housing having a pair of gas inlets for connection with said containers and a gas outlet for connection with said service line, a valve associated with each of said gas inlets, a pair of diaphragms in said housing, one of said diaphragms associated with one of said valves, the other said diaphragm associated with the other said valve, spring means for actuating said diaphragms to open said valves, a sliding sleeve intermediate said diaphragms, and a shaft operable from the exterior of said housing for positioning said sleeve so that whichever one of said valves desired will open at a lower pressure than the other.

3. A manifold for use in high pressure gas systems wherein a pair of containers for said gas are connected to a consumer's service line, comprising a housing, a pair of diaphragms dividing the interior of said housing into a control compartment and two gas compartments, a gas inlet communicating with each of said gas compartments, a gas outlet communicating with both of said gas compartments and said consumer's service line, slidable means intermediate said diaphragms in said control compartment, a spring in said slidable means for coacting with said diaphragms to open said valves, and a shaft operable from the exterior of said housing for positioning said slidable means so that whichever one of said valves desired will open at a lower pressure than the other.

4. A manifold for use in high pressure gas systems wherein a pair of containers for said gas are connected to a consumer's service line, comprising a housing, a pair of diaphragms dividing the interior of said housing into a control compartment and two gas compartments, a gas inlet communicating with each of said gas compartments, a valve of the tire valve core type associated with each of said gas inlets, a cross port communicating with each of said gas compartments, a gas outlet communicating with said cross port and said consumer's service line, valve means in said cross port for controlling the passage of said gas from either one of said gas compartments to the other, a movable member in said control compartment intermediate said diaphragms, spring means coacting with said diaphragms to open said gas inlet valves, and a shaft operable from the exterior of said housing for positioning said movable member so that whichever one of said valves desired will open at a lower pressure than the other.

5. In a system for storing and utilizing gas under pressure comprising a plurality of containers for the gas, a service line, conduits connecting the interior of the containers to the service line, a control valve in each conduit having an inlet side and an outlet side, a diaphragm in communication with each conduit on the outlet side of the control valve movable in response to pressure changes in the conduit, valve operating elements acting between the diaphragms and the control valves on movement of the diaphragms, resilient means acting on each diaphragm tending to move the same into valve opening position, and additional means independently co-acting with the diaphragms to change the relative

pressure response characteristics of the diaphragms.

6. In a system for storing and utilizing gas under pressure comprising a plurality of containers for the gas, a service line, conduits connecting the interior of the containers to the service line, a control valve in each conduit having an inlet side and an outlet side, a diaphragm in communication with each conduit on the outlet side of the control valve movable in response to pressure changes in the conduit, a check valve in each conduit on the outlet side of the control valve to prevent reverse flow through the conduit, valve operating elements acting between the diaphragms and the control valves on movement of the diaphragms, resilient means acting on each diaphragm tending to move the same into valve opening position, and additional means independently co-acting with the diaphragms to change the relative pressure response characteristics of the diaphragms.

7. In a system for storing and utilizing gas under pressure comprising a plurality of containers for the gas, a service line, conduits connecting the interior of the containers to the service line, a control valve in each conduit having an inlet side and an outlet side, a diaphragm in communication with each conduit on the outlet side of the control valve movable in response to pressure changes in the conduit, valve operating elements acting between the diaphragms and the control valves on movement of the diaphragms, resilient means acting on each diaphragm tending to move the same into valve opening position, and means associated with each diaphragm and independent of the resilient means for changing the pressure response characteristic of the diaphragm.

8. In a system for storing and utilizing gas under pressure comprising a plurality of containers for the gas, a service line, conduits connecting the interior of the containers to the service line, a control valve in each conduit having an inlet side and an outlet side, a diaphragm in communication with each conduit on the outlet side of the control valve movable in response to pressure changes in the conduit, valve operating elements acting between the diaphragms and the control valves on movement of the diaphragms, resilient means acting on each diaphragm tending to move the same into valve opening position, and a diaphragm restraining element for each diaphragm movable into contact with the diaphragm to change the pressure response characteristic of the same.

9. In a system for storing and utilizing gas under pressure comprising a plurality of containers for the gas, a service line, conduits connecting the interior of the containers to the service line, a control valve in each conduit having an inlet side and an outlet side, a diaphragm in communication with each conduit on the outlet side of the control valve movable in response to pressure changes in the conduit, valve operating elements acting between the diaphragms and the control valves on movement of the diaphragms, resilient means acting on each diaphragm tending to move the same into valve opening position, and an impeding element for each diaphragm movable into contact with the diaphragm to change the pressure response characteristic of the same.

10. In a system for storing and utilizing gas under pressure comprising a plurality of con-

tainers for the gas, a service line, conduits connecting the interior of the containers to the service line, a control valve in each conduit having an inlet side and an outlet side, a diaphragm in communication with each conduit on the outlet side of the control valve movable in response to pressure changes in the conduit, valve operating elements acting between the diaphragms and the control valves on movement of the diaphragms, resilient means acting on each diaphragm tending to move the same into valve opening position, and a diaphragm clamping element movable into contact with the diaphragm to decrease the effective area of the same.

11. In a system for storing and utilizing gas under pressure comprising a plurality of containers for the gas, a service line, conduits connecting the interior of the containers to the service line, a control valve in each conduit having an inlet side and an outlet side, a diaphragm in communication with each conduit on the outlet side of the control valve movable in response to pressure changes in the conduit, valve operating elements acting between the diaphragms and the control valves on movement of the diaphragms, resilient means acting on each diaphragm tending to move the same into valve opening position, a diaphragm restraining element for each diaphragm movable into contact with the diaphragm to change the pressure response characteristic of the same, and unitary means for moving one element into contact with the associated diaphragm while moving another element out of contact with the associated diaphragm.

12. In a system for storing and utilizing gas under pressure comprising a plurality of containers for the gas, a service line, conduits connecting the interior of the containers to the service line, a control valve in each conduit having an inlet side and an outlet side, a diaphragm in communication with each conduit on the outlet side of the control valve movable in response to pressure changes in the conduit, valve operating elements acting between the diaphragms and the control valves on movement of the diaphragms, resilient means acting on each diaphragm tending to move the same into valve opening position, an impeding element for each diaphragm movable into contact with the diaphragm to change the pressure response characteristic of the same, and unitary means for moving one element into contact with the associated diaphragm while moving another element out of contact with the associated diaphragm.

13. In a system for storing and utilizing gas under pressure comprising a plurality of containers for the gas, a service line, conduits connecting the interior of the containers to the service line, a control valve in each conduit having an inlet side and an outlet side, a diaphragm in communication with each conduit on the outlet side of the control valve movable in response to pressure changes in the conduit, valve operating elements acting between the diaphragms and the control valves on movement of the diaphragms, resilient means acting on each diaphragm tending to move the same into valve opening position, a diaphragm clamping element movable into contact with the diaphragm to decrease the effective area of the same, and unitary means for moving one element into contact with the associated diaphragm while moving another element out of contact with the associated diaphragm.

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