

Aug. 15, 1950

F. F. HUMBARGER ET AL
AUTOMATIC CHANGEOVER MECHANISM

2,518,894

Filed June 14, 1945

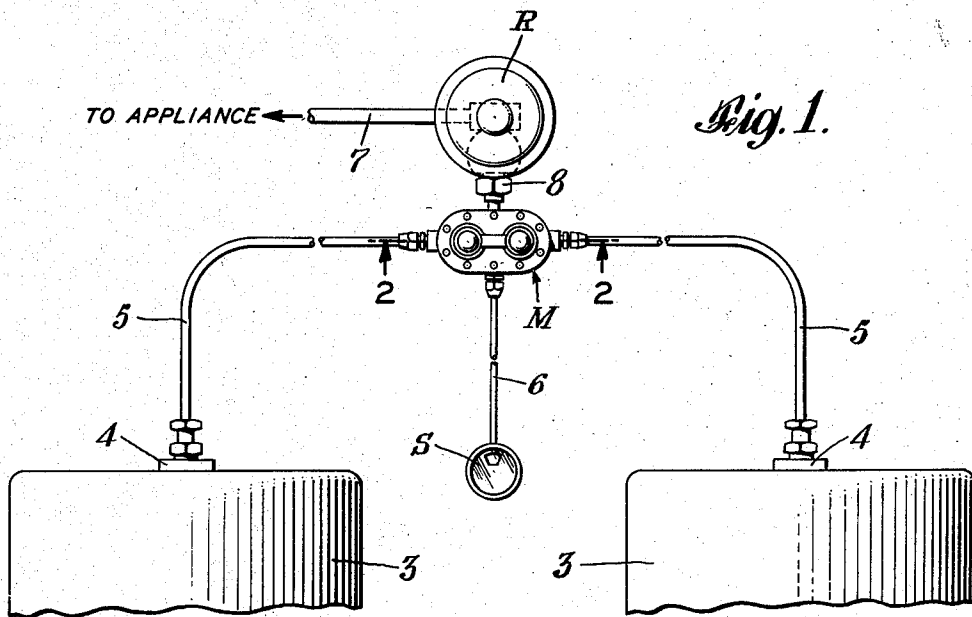


Fig. 1.

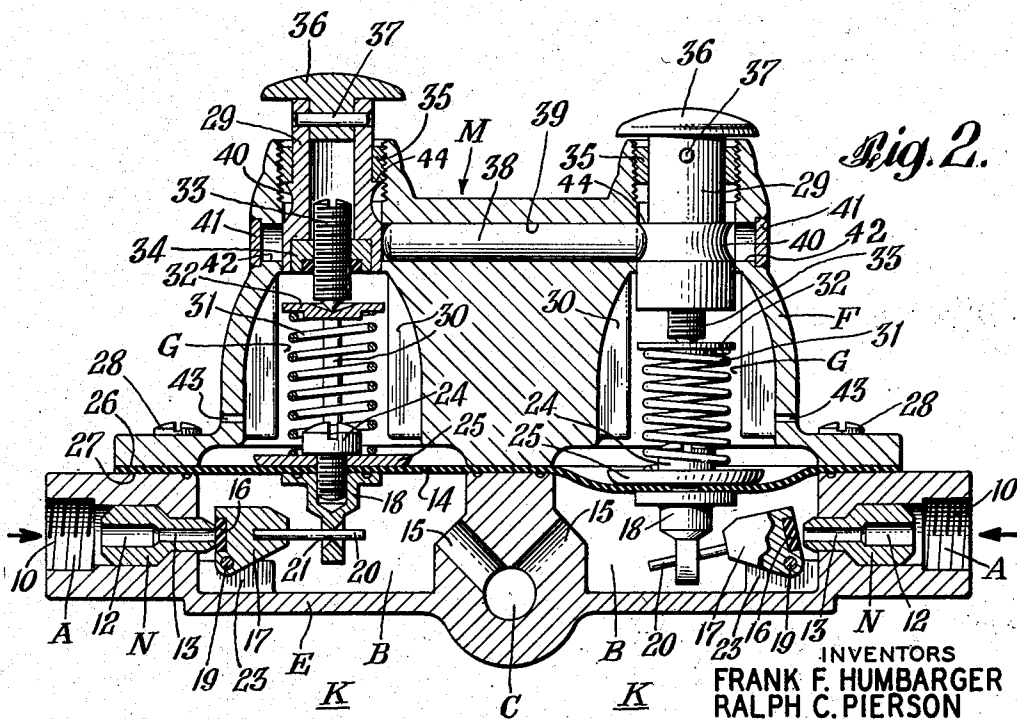


Fig. 2.

INVENTORS
FRANK F. HUMBARGER
RALPH C. PIERSON
WILLIS G. SCHEPMAN
BY
Greenwald
ATTORNEY

UNITED STATES PATENT OFFICE

2,518,894

AUTOMATIC CHANGEOVER MECHANISM

Frank F. Humbarger, United States Navy, Ralph C. Pierson, Indianapolis, and Willis G. Schepman, Speedway, Ind., assignors to Union Carbide and Carbon Corporation, a corporation of New York

Application June 14, 1945, Serial No. 599,486

10 Claims. (Cl. 137-144)

1

This invention relates to an automatic service-reserve changeover mechanism which is adapted to maintain an uninterrupted supply of fuel gas to the consumer by automatically changing the source of gas from service to reserve when the service gas supply has been withdrawn.

Originally, liquefied petroleum gas systems, for example, were all non-automatic, and when the service gas supply cylinder was emptied it was necessary for the customer to go outdoors and turn on the reserve supply of gas. Since the customer had to be educated to the operation of the cabinet and had to depend upon himself for the control of the gas supply, the need for an automatic changeover mechanism became imperative. This need increased with the advent of the use of liquefied petroleum gas for refrigeration, automatic water heating, etc. The automatic changeover mechanism was desirable since it overcame the disadvantages associated with manually changing the supply by providing uninterrupted service.

The main object of this invention is to provide an improved service-reserve changeover mechanism that is fully "automatic," providing economical and practical means of insuring a constant or uninterrupted supply of gas in a dual-source liquefied petroleum gas distribution system. Another object is to provide a fluid distribution system changeover mechanism that is safe, efficient, compact, simple and effective.

According to the invention, there is provided an automatic changeover mechanism for liquefied petroleum gas distribution systems, which comprises two supply regulator valves, one for the service gas source and the other for the reserve gas source, operative automatically to maintain an uninterrupted supply of gas when the pressure of the service gas source falls to a predetermined value. When the gas in the service source falls to such value, the changeover mechanism automatically changes the system over to the reserve gas source. The changeover mechanism does not operate under full cylinder pressure. That is to say, the supply regulator valves operate to reduce the gas pressure to which the regulators are subjected by closing the valves automatically in response to certain gas pressures which are low compared to full cylinder pressure. Further, according to the invention, a novel service-reserve alternating mechanism is provided having an interlocking bar that only allows one gas source to be connected in reserve at a given time.

Such mechanism provides positive means for

2

maintaining one of two regulator springs in a less-compressed state (reserve side). The ends of the interlocking bar are tapered and the distance between them is longer than the face-to-face distance between two push rods, so that the bar is forced by the other regulator spring into a groove in the push rod being depressed to load its spring; thus relieving spring pressure on such other push rod, and thereby causing the latter to be released from its depressed position.

Referring to the drawing:

Fig. 1 is a fragmentary view in front elevation of a distribution system exemplifying the invention; and

Fig. 2 is an enlarged view in section taken on line 2-2 of Fig. 1, showing details of construction of the changeover mechanism.

The system shown in Fig. 1 comprises a pair of gas containers such as cylinders 3, one of which constitutes a service source of gas supply and the other, a reserve source of gas supply. The cylinders 3 have their cylinder valves 4 connected by pipes or leads 5 to a changeover mechanism M which is described below in detail. A signal gauge S is connected to the device M by a pipe 6. Also connected to the manifold is a service regulator R the gas outlet of which is connected to an appliance such as a stove, by a conduit 7.

The changeover mechanism M, as illustrated in Fig. 2, comprises two gas inlet passages A, two gas pressure chambers B, a gas outlet C, a signal gauge outlet (not shown), a lower valve body E, an upper valve body F, and two spring chambers G. Since both sides of the device M are similar, for brevity and clearness, only one side will be described below.

The gas inlet passage A is internally threaded at 10 and is provided with a nozzle N having an enlarged gas inlet passageway portion 12 and a reduced portion 13. The gas inlet passage A is formed in an integral portion of the lower valve body E in any suitable manner, such as, casting, machining, or a combination of such operations, whereas the nozzle N is an insert of the gas inlet passage A.

The gas pressure chamber B is bounded by the gas inlet nozzle N in the gas inlet passage A on the gas inlet side. It is bounded below by the lower valve body E, which is also a portion of the side of this chamber B. Above, it is bounded by a flexible diaphragm 14. On the gas outlet side it is bounded by a gas passageway 15 which leads to the gas outlet C and signal gauge outlet (not shown). The gas pressure chamber B con-

tains a valve seat 16, composed of suitable resilient material, which is capable of making contact with the gas inlet nozzle N and is part of a pivoted valve seat holder 17.

For the diaphragm and valve seat, any comparatively resilient material may be used that is not soluble in liquefied petroleum gas, such as propane, for example, in either the liquid or vapor states, and also is relatively unaffected by temperature.

The valve seat holder 17 is actuated by a lower diaphragm plate 18 about a fulcrum pivot 19. A lever arm 20 is rigidly connected to the valve seat holder 17. The lever arm 20 extends through and is freely movable relatively to aperture 21 that is formed in a portion of the lower diaphragm plate 18. The aperture 21 is conically counter-bored at its opposite ends to leave an intermediate aperture portion slightly larger in cross-section than the lever arm 20, and to provide a knife edge that engages the lever arm 20. The arm 20 is movable through the lever opening 21 when the lower diaphragm plate 18 is acted upon by the flexible diaphragm 14. The valve seat holder 17 is pivotally attached to an elevated portion 23 of the lower valve body E. This arrangement minimizes humming, which greatly lessens the life of the valve, and also produces a more constant flow of gas.

A diaphragm screw 24 holds the lower diaphragm plate 18 in the center of the upper wall of the gas pressure chamber B and in contact with the flexible diaphragm 14, opposite an upper diaphragm and lower spring plate 25, forming a gas-tight seal.

The flexible diaphragm member is secured in gas-tight relation between flat rim portions 26 and 27 of the lower valve body E and upper valve body F, respectively, by screws 28. The flexible diaphragm member thus acts as a gasket between the valve bodies E and F.

Gas outlet passage 15 connects the gas pressure chamber B to the gas outlet C and signal gauge outlet passage. The gas outlet C is at one end of the connecting passage and the signal gauge outlet at the other. The gas outlet C is connected to the regulator R by a coupling 8; and the signal gauge outlet is connected to the signal gauge S by the pipe 6.

The spring chamber G is bounded on the sides by the upper valve body F, on the bottom by the flexible diaphragm 14, and on the top by a push rod 29. The spring chamber G contains at least three ribs 30 which are a portion of the upper valve body F and serve as guides for a valve spring 31. The valve spring 31 presses against the plate 25 at its lower end; whereas the upper end of the spring is in contact with an upper valve plate 32 which thereby is held against a pressure adjusting screw 33. An elastic lock-nut 34 or other suitable means retains the pressure adjusting screw 33 in its adjusted position, and is incorporated in the hollow push rod 29. The screw 33 is mounted on the inside of the push rod for adjustment to determine the upper operating pressure on the diaphragm 14 when the spring 31 is compressed.

A ring 35 is threaded inside of the body F, providing a stop which engages an annular shoulder 44 on the rod 29 and thus limits the outward movement of rod 29 by the spring 31, so that adjustment of the screw 33 determines the lower operating pressure of the spring when the rod 29 is released. The ring 35 also acts as part of the guide for the push rod 29. A push button 36 is

attached to the push rod 29 by suitable means such as a locking pin 37. The push button 36 closes the upper end of the rod, so that the screw 33 is not readily accessible. An interlocking bar 38 having rounded ends is disposed in an interlocking bar cavity or way 39 in the body F. The bar 38 is slightly greater in length than the face-to-face distance between push rods 29, so that one end is located in a groove 40 of the compressed push rod when the other end is in contact with the surface outside of the groove in the other push bar. A cap 41 is provided for an opening through which the interlocking bar 38 is moved when the parts of changeover mechanism M are being assembled.

Small air vents or holes 43 are provided in the wall of the upper valve body F, so as to maintain atmospheric pressure on the upper side of the diaphragm 14.

The illustrated changeover mechanism M thus consists of two interconnected gas supply regulators K, one for the service gas source and the other for the reserve gas source. Either regulator may be made the service side by depressing a push button 36, which automatically makes the other one the reserve side. The interlocking bar 38 is shifted by the force of the other spring 31, acting through its push rod 29 and groove 40 on the rounded end of the bar, and thus latches the selected supply regulator in adjusted position, when the groove 40 of the selected rod is presented to the other end of the bar 38. Because of the compression of the spring 31, the gas supply regulator, which operates at a lower gas pressure, automatically meets the demand for gas from the service cylinder. The signal gauge S which works on the pressure differential between the service and reserve sources, indicates when the service gas supply container has been depleted.

When the service gas supply container has become depleted, the other gas supply regulator automatically meets the demand for gas from the reserve cylinder. The automatic changeover mechanism occurs by virtue of the fluid pressure in conjunction with the different compression loads on the springs 31. The more compressed spring 31 causes the regulator valve controlled by such spring to operate first, and when the gas pressure falls sufficiently, the less compressed spring 31 automatically causes its valve to operate. When the gas pressure in either chamber B reaches the value at which the springs 31 are set, the corresponding valve is automatically closed, so that the supply of gas is pressure regulated first by one supply regulator (service) then by the other supply regulator (reserve). When the reserve regulator valve remains closed, the service regulator operates; and when the reserve regulator is in operation, the service regulator valve remains open.

The signal gauge S may be merely a pressure gauge whose face has been "blanked off" and a red portion is put on the gauge dial which is set to show red when the automatic changeover mechanism is operating on the reserve cylinder. Thus, the consumer notifies a service man that he is now using the reserve cylinder. When the service man replaces the empty cylinder, he reverses the positions of the push buttons 36 by simply depressing the reserve push button and thereby the former service side becomes the new reserve side.

Since the device M may be used with a conventional signal gauge S, the gas supply regu-

lators K are set at approximately 16 p. s. i. and approximately 9 p. s. i., for service and reserve operation, respectively. If other operating conditions are to be met, different pressure regulation can be made.

The changeover mechanism M has sufficient capacity, when coupled with a service regulator R, that reduces the pressure to approximately ten inches of water column pressure and is used in almost all propane distribution systems, to provide fifty cubic feet per hour, or enough capacity to provide a three-cabinet installation (two cylinders each) per automatic changeover mechanism M and service regulator R. It will be evident that details of the disclosed construction may be varied, and certain features may be utilized independently of others, without departing from the principles of the invention.

While the invention has been described in connection with a gas, it will be understood that the invention is not limited thereto, but may be used in connection with a liquid, and the term "fluid" in the claims is intended to include liquid as well as gas.

We claim:

1. An automatic service-reserve changeover mechanism for dual-source fluid supply systems, comprising a pair of fluid supply regulators including differently loaded springs, and means for alternating the loads on said springs comprising push rods, each provided with exposed manually engageable means in line with the major axis of the corresponding spring and latch means acting by virtue of the force of one of said springs automatically to release one push rod and latch the other push rod when the latter is pushed to load its spring.

2. An automatic service-reserve changeover mechanism for dual-source fluid supply systems, comprising a pair of fluid pressure responsive regulators adapted to operate at different fluid pressures, so that one regulator operates until the service fluid source is depleted, whereupon the other regulator is caused to operate, each of said regulators comprising a regulator spring, a push rod opposing the force of said spring, and a push button on said push rod, and a common latch for said push rods, the arrangement being such that a selected regulator is loaded by pushing the push button to move the push rod longitudinally directly against the force of the spring until said latch operates automatically by virtue of the force of the other spring to secure the push rod in loaded position.

3. In combination, a pair of compression springs, spaced parallel manually engageable push rods for selectively adjusting the force of said springs, said rods having grooves, and a cross bar having ends disposed between said rods, the length of said bar being such that one end fits the groove of one rod when the other end contacts the surface outside of the groove of the other rod, said grooves being positioned so that pushing one push rod directly against the force of its spring moves the groove of that rod into line with said bar, causing the other spring to force its push rod to shift said bar out of the groove of the latter push rod, and into the groove of the pushed push rod, thereby releasing the former and latching the latter, the arrangement being such that one push rod is released and the other is latched by merely pushing the rod selected to be latched.

4. An automatic service-reserve changeover mechanism comprising a pair of gas supply reg-

ulators each including a gas inlet nozzle, a valve lever, a valve seat on said lever facing said nozzle, a valve lever, a valve seat on said lever facing said nozzle and providing a gas supply valve, a gas pressure responsive diaphragm connected to said valve lever, means including said diaphragm providing a gas pressure chamber for each regulator, such chambers having a common gas outlet, a compression spring acting on the side of said diaphragm opposite each chamber to close said valve, and a push rod compressing said spring, and common latch means acting by virtue of the force of one of said springs automatically to release one push rod and latch the other push rod when the latter is pushed to load its spring.

5. An automatic service-reserve changeover mechanism comprising one body having two gas inlet passages, two gas chambers, and a common gas outlet, a diaphragm member disposed on said body, a second body having two spring chambers and a common way, said second body being disposed on said diaphragm member with said spring chambers opposite said gas chambers, means securing said bodies together with the diaphragm member clamped therebetween, compression springs in said spring chambers acting against the resulting diaphragms, valves in said gas chambers operatively connected to said diaphragms, push rods compressing said springs, said rods each having an exposed push-end and a lateral recess, and a reciprocatory cross bar in said common way, one end of said cross bar engaging a recess and thereby latching one of said push rods in spring loaded position by virtue of the contact of the other end of said bar with the periphery of the other rod.

6. In a service-reserve changeover mechanism, a gas supply regulator comprising a regulator spring, a spring push rod which is tubular, a push-button removably mounted on the outside of said rod, retaining means mounted on the inside of said rod, a screw threaded in said retaining means, said screw being accessible through said tubular rod when the push-button is removed, and a spring engaging member disposed between said spring and said screw, so that the force of said spring may be adjusted by adjusting said screw in said retaining means.

7. In a service-reserve changeover mechanism, a gas supply regulator comprising a body having a spring chamber, said body having a hole in line with said chamber, a hollow push rod in said hole, said rod having a shoulder, an adjustable annular stop for said shoulder, threaded to said body within said hole for limiting the outward movement of said rod under the force of said spring, and a push-button having a stem secured within said hollow push rod, said push-button being adapted to engage said body for limiting the inward movement of said rod.

8. In a fluid pressure regulator, in combination, a casing having a chamber provided with a fluid inlet; means, including a diaphragm responsive to the fluid pressure within said chamber, for controlling the admission of fluid through said inlet; and adjustable means for applying force against the outer side of said diaphragm, said adjustable means including a spring bearing against said diaphragm, an adjustable abutment mounted on said casing and having a bore extending therethrough, a push rod in said bore, said push rod having a shoulder adapted to engage said abutment, said push rod also having an axial bore, a screw bearing against said spring and adjustably mounted in one end of said bore;

and a push button closing the opposite end of said bore.

9. In an automatic changeover mechanism, the sub-combination comprising a body having spaced parallel push-rod bores, and a common cross-bar way extending between such bores; a push rod disposed in each bore for limited longitudinal movement between "in" and "out" positions, and a cross-bar disposed in such way for limited longitudinal movement between said rods, the ends of said bar and the lateral surfaces of said rods having cooperating shapes adapted to cause the bar to positively lock one push rod in "in" position when the other push rod is in "out" position, and permit the latter push rod to be moved to "in" position to alternate the lock, said cross-bar being completely housed within the body.

10. In a service-reserve changeover mechanism, a fluid pressure regulator comprising a regulator spring, a push-rod, a body having a chamber for said spring, a stop for said push-rod adjustably mounted on said body, adjustable means

including a screw disposed between said push-rod and said spring, and means for latching said rod to hold the rod in place after said spring has been compressed, the adjustment of said stop and screw determining the minimum spring-compression and lower operating pressure of the regulator when said rod is unlatched, and the adjustment of said screw when said rod is latched determining the maximum spring-compression and upper operating pressure of the regulator.

FRANK F. HUMBARGER.

RALPH C. PIERSON.

WILLIS G. SCHEPMAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
986,921	Jackson	Mar. 14, 1911
2,168,701	Buttner	Aug. 8, 1939