July 25, 1950 J. R. HOLICER 2,516,387

CONTROL FITTING

Filed Aug. 20, 1945 3 Sheets-Sheet 1

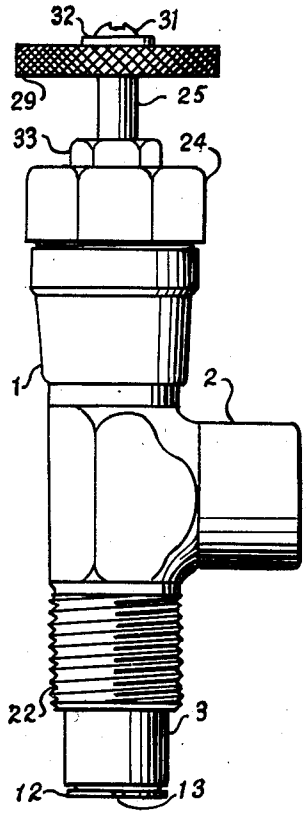


Fig. I

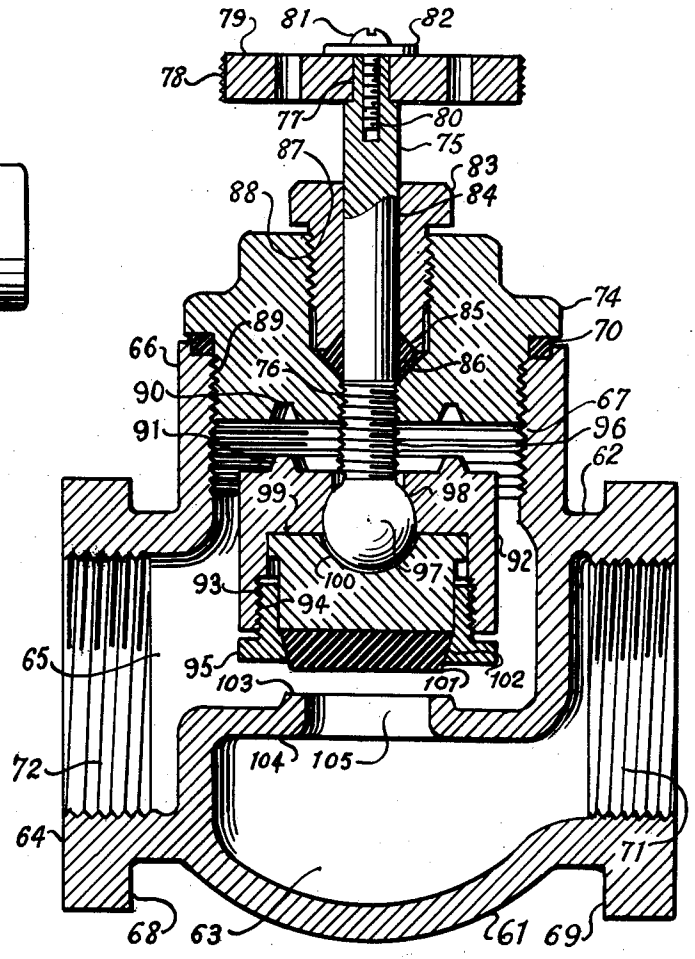


Fig. VI

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CONTROL FITTING

Filed Aug. 20, 1945 3 Sheets-Sheet 2

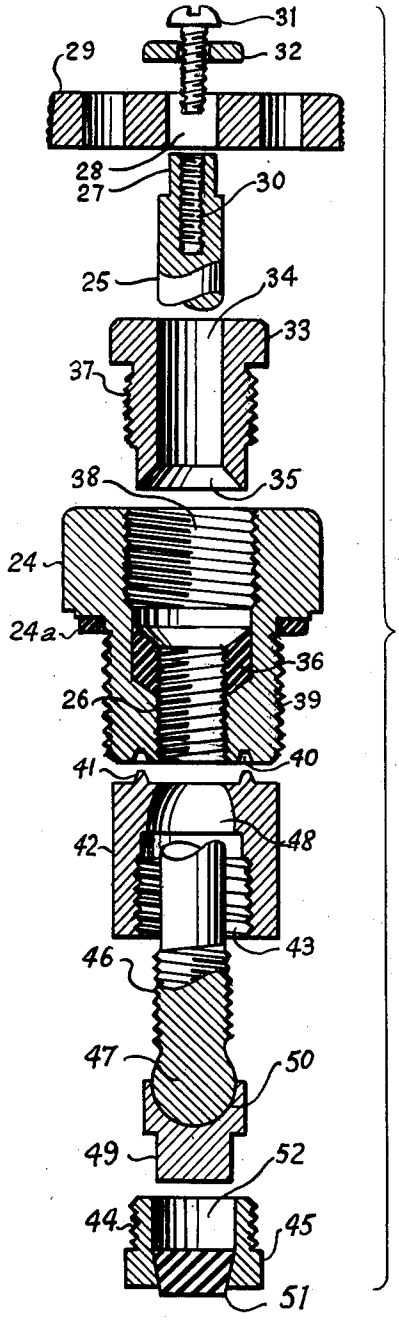


Fig. IV

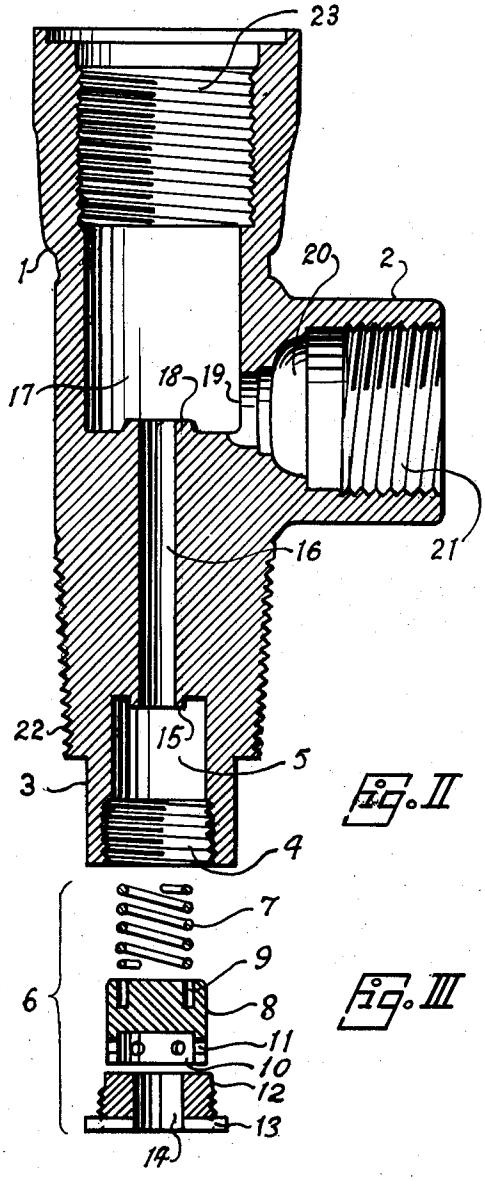


Fig. II

Fig. III

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July 25, 1950 J. R. HOLICER 2,516,387

CONTROL FITTING

Filed Aug. 20, 1945 3 Sheets-Sheet 3

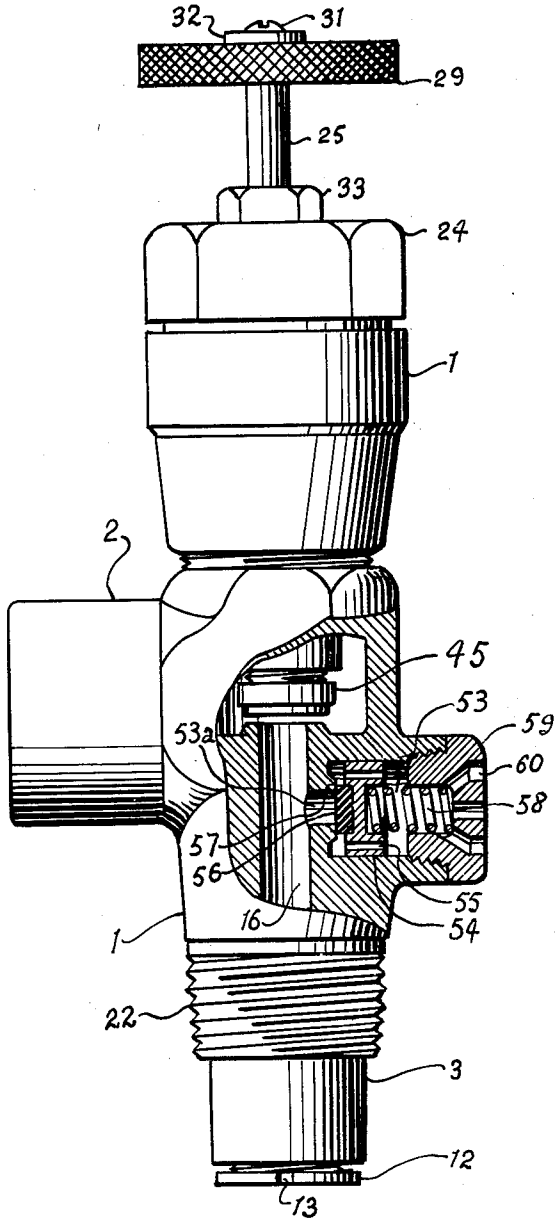


Fig. V

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UNITED STATES PATENT OFFICE

2,516,387

CONTROL FITTING

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Application August 20, 1945, Serial No. 611,579

5 Claims. (Cl. 277—55)

1

This invention has to do with valve apparatus for controlling and handling inflammable fluids, such as derivatives of petroleum, acetylene and the like.

The device consists of a single control fitting, leakproof and of compact and unitary design, to be removably carried by any tank or vessel which may be found suitable for use in transporting, storing and dispensing inflammable fluids, and particularly liquefied petroleum gases.

Such gases attain a liquid state when placed under pressure and/or reduced in temperature. For instance, normal butane liquid has a boiling point of 32.9° Fahrenheit, and propane liquid boils at 48.1° F. below zero; and ethane reaches this point at —127.7° F. Therefore, these gases exert relatively high pressures on the vessels containing them at average atmospheric temperature. When the temperature is 100° F., propane has an absolute pressure of 187 pounds per square inch, and butane then exerts a pressure of 52.2 pounds per square inch.

These gases are heavier than air, propane being approximately one and one-half times heavier and butane being approximately two times heavier; and when such gases are released in volume they sink into low places in the terrain and into the basements of houses to form violently exposive and inflammable pools of gas.

Because they have such physical characteristics and properties such gases demand the use of safety measures of highly dependable character. Once these dangerous fuels leave the keeping of refiners and transporters, who are experts in handling them, they are usually lodged on the premises of laymen who have no knowledge of their inherent properties and who are unskilled in handling such dangerous fluids. To prevent disaster to such people it is highly desirable that control fittings for liquefied petroleum gas be made very safe. They should be dependable to the greatest degree reasonably possible, especially taking into consideration the probable carelessness and lack of knowledge on the part of untrained users of such fuel.

Where a householder is provided with a storage tank charged with LP gas, the tank must be provided with control valve means to open and close the conduit which carries fuel from the storage tank; and such control device should be designed to prevent leaks and the escape of fuel in ordinary use, and also under unusual conditions and especially when the conduit or fittings beyond the control valve have suffered accidental damage or breakage.

2

Because of these needs this fitting has been created with the primary object of promoting safety above all things. To prevent and minimize dangerous leaks the valve body or casing has been made in one piece of material in which the removable and operable elements have been so integrated as to prevent leaks.

This single fitting has been made to provide a positive and leakproof sealing effect when the main shut off valve is closed, and it has been constructed to positively prevent and seal against any leaks through the bonnet and around the valve stem when this valve is open.

Likewise, the device has been made to afford and allow the release of any dangerously excessive pressure from within the fitting itself. The fitting has also been made to control and cause the cessation of excess flow of fluid through the opened valve body should the conduit leading from it be broken off. The excess flow control cooperates with both the pressure control and the shut off valve. The maximum volume deliverable by the shut off valve will cause the excess flow control to operate and close the inlet from tank to valve body. However, the maximum volume deliverable by the pressure relief control will not act to operate the excess flow control. These three valve controls have a balanced and inter-dependent relation.

Therefore, the specific objects to be attained by this device include the following:

(*a*) A high degree of safety in valve mechanism for controlling the delivery of inflammable fluids.

(*b*) An integral and seamless valve body casing to minimize leaks.

(*c*) The free and easy seating of the main valve head.

(*d*) Means provided to transmit pressure of the descending valve stem directly to the resilient disc which closes and seals the valve seat.

(*e*) Means to seal the upper side of the movable valve head assembly when it comes in contact with the under surface of the valve bonnet during the time that the main valve is wide open, thus to prevent leaks from around the valve stem and bonnet by providing auxiliary sealing means below the bonnet and around the stem.

(*f*) A close fitting ground joint of semi-spherical design within the upper part of the movable valve head assembly to prevent leaks thereabove and around the valve stem.

(*g*) An automatically self-closing excess flow check valve arranged within the base of the main valve casing so as to be disposed within

the storage tank and so responsive to the pressure within the tank that should the conduit leading from the opened shut off valve be broken the excess flow valve will instantly close and prevent the further escape of fluid.

(*h*) Means for relieving excess pressure within the body of the fitting without interrupting the continuous flow of fluid therethrough.

With these objects in view preferred forms of the device are disclosed in the accompanying drawings and further set out in this specification. However, it may be readily seen that changes may be made in the construction of these discloures without in any manner departing from the spirit and objects of this invention.

In the drawings:

Fig. I shows a side elevation of a control fitting completely assembled and ready for use.

Fig. II shows a sectionalized elevation of an integral fitting body.

Fig. III shows a sectionalized elevation of the excess flow check valve assembly to be carried in the base of the body.

Fig. IV shows a sectionalized elevation of the usual complement of removable parts carried in the upper end of the body.

Fig. V shows an elevation of a modified control fitting in which a section of the body wall has been cut away to disclose the relief mechanism in section.

Fig. VI shows a form of the main shut off valve adapted to the construction of valves of the globe type.

In the drawings the various parts of this device are indicated by numerals; and numeral 1 indicates a typical valve body or casing, which is preferably made of one piece of material without seams or joints, such as is more clearly shown in Fig. II. This minimizes the chances for leaks. The body is provided with an outlet branch 2, through which fluid may be discharged whenever the main valve is open. This branch is not only provided with internal threads, but the innermost part thereof is formed into a concavity 20 into which the rounded head of a compression connection of a conducting tube (not shown) may be fitted and tightly held in close compression against the rounded wall of the branch so as to absolutely seal against fluid leaks.

The base 3 of the body affords an extension which can be arranged to depend into a tank or container with which this fitting is used. Within this base there is provided threaded inlet 4 which will communicate with the tank. Above this inlet is cylindrical chamber 5 arranged to provide a housing for an excess flow check valve assembly, collectively indicated as 6.

This check valve assembly includes valve spring 7 which may be fitted into an annular groove in the uppermost part of chamber 5 and which extends downwardly to cooperate with valve thimble 8 in which annular recess 9 is provided to receive the spring. This thimble has a flat top, and is made sufficiently small in diameter to allow passageway between the external walls of the thimble and the internal walls of chamber 5. This may be very conveniently accomplished by giving a hexagonal contour to the thimble so that each of its flat sides will provide passage space of pre-determined area, just sufficient to admit the flow of a predetermined quantum of fluid.

There is an open cylindrical space 10 arranged in the bottom of the thimble from which ports 11 lead outwardly through the thimble wall. These ports are so spaced and located as to pass through the flat and narrow sections of the thimble wall. They are of calculated and predetermined area so as to properly accommodate the normal flow of fluid required to pass upwardly around the thimble without causing it to move from its normal resting place on the threaded retaining plug 12 which is carried in inlet 4 to support the thimble.

A slot 13 is made in the exposed end of the plug to accommodate a wrench or screw driver for inserting and removing the plug; and there is a passageway 14 arranged through the plug to communicate with space 10 in the thimble.

Passageway 14 will allow the flow of a much greater quantity of fluid than can be passed through ports 11, so that when fluid flows upwardly through this passageway with a certain excess of volume and velocity greater than the ports will accommodate, then the thimble is lifted up in chamber 5 so that its upper face comes to rest firmly against valve seat 15 which is constructed in the upper part of the chamber to co-act with the thimble to form an excess flow check valve. The closure of this valve precludes the discharge of any fluid whatsoever through intake channel 16 arranged within the valve body 1. This channel is so constructed that it allows the passage of fluid upwardly and into the main valve chamber 17, within the body 1, whenever thimble 8 is in a normal position at the bottom of chamber 5.

A valve seat 18 is arranged in the lower end of valve chamber 17 to provide the seat for the main shut off valve carried by that chamber. A conduit 19 is arranged within branch 2 to communicate with chamber 17 and with the concave enlargement 20, so that fluid may freely flow from the tank, through the excess flow check valve, upwardly along channel 16, into chamber 17 and out of branch 2, from which branch a conduit will carry the fluid to some distant place where it is used. The last named conduit will be firmly fixed and held in place by a compression nut (not shown); and to accommodate this nut internal threads 21 are provided in branch 2. However, it is obvious that flanges and bolts may be provided, instead of threads, to firmly force this compression nut down into branch 2, or any other suitable means of connection may be employed.

In order to fix the main body 1 of the device into a tank containing fluid to be valved and controlled, there may be arranged threads 22 externally of the lower part of the body. These may fit into a threaded opening in the tank, or flanges and bolts, or other means, may be employed to make this connection. Such connection, however, must be made very tight and leakproof to prevent the escape of explosive and inflammable gases.

The upper end of body 1 is provided with internal threads 23 to receive threaded valve bonnet 24, through which valve stem 25 is arranged to pass so that it may be carried by the bonnet on threads 26 arranged within the lower part of the bonnet.

Companion threads 46 are arranged on the outside of the lower end of the valve stem to co-act with threads 26 to cause the movement of the stem along the bonnet when the valve stem is rotated.

The valve stem may be provided with a squared or deformed end 27 to fit into opening 28 in hand-

wheel 29, which wheel is arranged to rotate the stem. A handle or other means may be provided to effect this rotation. Internal threads 30 are provided in the upper end of the stem to receive set screw 31, which is used in connection with washer 32 to hold the rotating means in place.

A packing gland nut 33 is provided with an opening 34 therethrough to allow the passage of the valve stem, and this opening also acts as a guide for the stem. This opening ends in an enlargement having an annular beveled edge 35 which is seated firmly into packing material 36 carried within the bonnet, so that this packing material is compressed and held firmly against the valve stem to prevent leaks therearound whenever the gland nut is forced downwardly into the bonnet. External threads 37 are carried on the member 33 to make connection with internal threads 38 within the bonnet, which, in turn, is provided with external threads 39 to cooperate with the threads 23 in the body.

On the bottom of the bonnet 24 there is provided an annular recess 40 which will surround the valve stem. Annular projection 41 is arranged on the upper end of movable valve head 42, so that when the valve stem is withdrawn, to the fullest extent possible, projection 41 and recess 40 co-act to form a tight sealing auxiliary valve to prevent leaks around the valve stem.

Obviously this arrangement may be reversed and function in exactly the same way by arranging the annular recess on the upper face of the movable valve head and arranging the annular projection on the lower face of the bonnet. In any event a tight auxiliary valve is provided which is of considerable importance as a safety device to preclude and prevent leaks, such as frequently occur around the valve stem in an ordinary valve not provided with this safety feature.

Further sealing means to prevent leaks around the valve stem is provided through the arrangement of the rounded enlargement 47 on the lower end of the valve stem and the arrangement of a co-acting concave recess 48 in the upper end of valve head 42. The concavity is constructed on such radius as to provide tight frictional engagement with member 47 when the valve stem is retracted. The contacting members may be ground and finished to such an exact fit as to provide and effect another sealing valve which can be kept tightly closed to prevent the passage of any fluid around the valve stem whenever the main valve in the body 1 is open. This is a safety measure of considerable importance.

Furthermore, no leakage may occur around the outside of bonnet 24 because of the provision of gasket ring 24*a*, which is compressed into a shouldered recess arranged in the very uppermost part of fitting body 1; or a ground and polished joint may be substituted for the gasket arrangement.

Internal threads 43 are provided within valve head 42 to receive threads 44 arranged externally about valve head nut 45. When the nut is fitted into the head then member 47 is entirely encased in such manner that the head 42 is carried on the end of valve stem 45, and the head moves with the stem whenever the latter is rotated. The valve head cannot get loose from the valve stem.

Valve plug 49 is provided with concavity 50 to receive and articulate with member 47; and the lower end of this plug passes into opening 52 in the top of member 45. This opening is

beveled and of smaller diameter at its lower end to receive and retain packing disc 51. This disc is roughly of the shape of the frustrum of a cone, inverted; and such arrangement prevents the packing disc from falling out or being forced out of member 45; and it will always be retained therein.

Such construction also allows a very important function: The plug 49 will receive all of the compressing force of the valve stem when the latter is rotated downwardly, and this force is transmitted directly to disc 51, the lower face of which rests on valve seat 18. Thus, it will be seen that a firm and final rotation of the valve stem in downward direction will keep disc 51 tightly and firmly compressed against seat 18 to form and provide the most effective type of leakproof valve closure. This is a factor of great importance and advantage in handling liquefied petroleum gas fuels, because they are dangerous.

The valve control assembly described immediately hereinabove presents obvious safety features and advantages. However, the device is made more safe and effective when there is provided therein a pressure relief valve having cooperative relation with excess flow valve 6 and fluid discharge branch 2.

The details of such relief valve are shown in Fig. V, wherein 53 is a hollow branch of body 1, constructed to communicate with channel 16 through the provision of cross channel 53*a*, which is fashioned at its outward end to form valve seat 57.

Valve head 54 is movable within the hollow branch 53; and it is provided with perforations 55, of a very definite and calculated total area, as related to the total area of the ports 11 in thimble 8 of the excess flow check valve and the area of the passageway around this thimble. Ports 55 remain always open to the atmosphere but they receive no fluid from the tank in which this fitting is carried until the relief valve carried in branch 53 is opened. They are calculated, designed and built to discharge a smaller volume of fluid than is required to cause excess flow check valve 6 to close; and this is a matter of importance, in that this relief valve may open and discharge a volume of fluid of pre-determined quantity without causing the excess flow valve to close.

Valve head 54 carries within a recess on its inner face resilient valve disc 56; and this disc remains seated on valve seat 57 to keep the relief valve normally closed by the pressure and operation of valve spring 58. The relief valve is kept in branch 53 by the use of retaining plug 59 which is fashioned to form a housing for one end of the spring and which is provided with a plurality of outlets 60 to permit the escape to the atmosphere of fluid passing through the valve.

Not only will the relief valve pass a smaller volume of fluid than normally passes through the excess flow check valve without causing the closing of the latter, but this fact is further insured by having cross channel 53*a* of smaller diameter than is channel 16; and the latter is of smaller diameter than the passageway 14 in the bottom of the fitting.

The balanced and reciprocal relation between these valves and apertures insures a normal pressure, within pre-determined limits, inside the body of the fitting while it is normally function-

ing for the delivery of fluid fuel. However, should the conduit leading away from branch 2 be broken or damaged sufficiently to allow the undesirable discharge of an abnormal amount of explosive fluid to the atmosphere, then the single inlet from the tank to the fitting is automatically and completely closed, so that even the relief valve is closed. No fluid then will pass through the fitting body; and this body will remain closed against the tank by reason of a constant pressure within the tank sufficient to effect and maintain this closure. Then no leak whatever is possible.

While the preferred form of this controlling device is outlined in the construction details hereinabove given, there is an alternate form shown in Fig. VI to reveal a modified construction in which the essential elements of the main shut off valve are installed in a valve body 61, presenting the appearance of a globe valve in which the inlet and outlet branches are oppositely disposed. The modification in Fig. VI will employ no relief valve as a part of the function of the device; nor does it have an excess flow check valve.

In Fig. VI the numerals 62 indicate the outlet branch of body 61, communicating with outlet chamber 63 in the base of the body. Inlet branch 64 communicates with inlet chamber 65, arranged in the upper part of the valve body to provide a housing for the valve. The branch 66 is arranged to carry the valve bonnet, and associated mechanism comprising the movable parts of the valve assembly.

Each of the three branches of this body may be threaded to receive connections. As shown at 67 such threads are made in the bonnet branch. As shown at 71 threads are provided in the outlet branch; and as shown at 72 threads are provided in the inlet branch. However, these various threads may be dispensed with, and these various branches may be provided with a flange and bolts. Any suitable form of connection may be employed.

Collars 68 and 69 on branches 64 and 62, respectively, may be provided with shoulders or flat faces thereon to accommodate tools for making up the joints.

In the very top of the bonnet branch 66 there is provided an annular recess to receive ring gasket 70 which will seal the bonnet and prevent it from leaking. When the bonnet 74 is screwed down in place, it compresses this gasket.

Valve stem 75 is carried by internal threads 76 arranged within the bonnet to co-act with threads 96 on the lower end of the stem; and the stem has a squared end 77 about which may be fitted the handwheel 79 for rotating the stem. A threaded hole 80 may be provided within the free end of the valve stem to be used in affixing any suitable rotating means to the stem; and the set screw 81 and washer 82 will attach and hold in place such means.

Packing gland nut 83, having an opening 84 therethrough to receive the valve stem, is provided with a beveled face 85 on its lower end to effect a seat in the packing material 86 which is carried within the bonnet. When this packing material is compressed tightly against the valve stem, and held thereby the packing gland nut, there can be no leaks through the bonnet around the stem.

External threads 87 on member 83 are arranged to connect with internal threads 88 in the upper part of the bonnet; and external threads 89 on the bonnet are arranged to engage internal threads 67 within branch 66.

There is an annular recess 90 formed within the lower face of bonnet 74 and arranged to receive annular projection 91 provided on the upper face of the movable valve head 92, to form auxiliary sealing means which operates to prevent the escape of fluid around the valve stem when the valve is fully opened. This efficient and auxiliary sealing means is of considerable importance in constructing safe valve control apparatus in that it prevents the very undesirable escape of inflammable fluids.

Within the valve head there are provided internal threads 93 to engage the external threads 94 on the valve head nut 95.

The lower end of the valve stem has a rounded head 97 which is fitted into a concave recess 98 in the valve head in such manner that the rounded end may not be withdrawn through this recess, and it is further so constructed and disposed that the surface contacts between the members 97 and 98 may be made very tight when the valve is fully opened, thus to further prevent leaks.

Valve plug 99 is housed and slidably retained within the head; and it is provided with a concave recess 100 on its upper face to receive the lower end of member 97. Packing disc 101 is securely carried in conical opening 102 provided through the lower face of the plug. This disc engages valve seat 103 which is arranged in the partition wall 104, dividing chambers 63 and 65. This partition has an opening 105 therethrough, around which the valve seat is disposed. When the disc is firmly pressed against this seat, the chambers are sealed off from one another, and the valve is closed against the flow of any fluid therethrough.

Through the employment of construction detailed immediately above, the valve disc can be compressed tightly against the valve seat by rotating the valve stem. The pressure of this stem, when it is forced downward to its lowest position, is transmitted directly to the valve plug, which in turn keeps the disc under compression.

The valve head, nut, plug and disc form a compact assembly carried by the valve stem in engagement with member 97 in such manner that the assembly cannot get loose from the valve stem, yet it is freely responsive to the movement thereof. When the assembly is moved downwardly into a position to close the valve, its attachment to the valve stem is sufficiently loose to allow the free and easy setting of the disc on the valve seat. This disc cannot come to rest upon the seat in an unleveled or strained position. The entire undersurface of the disc which contacts the seat receives firm and equal pressure from the valve stem, so that the valve is closed with an effective and uniform engagement all around the seat. This prevents a weak contact or incomplete engagement at any one point on the valve seat. This valve closes firmly, uniformly and in leakproof fashion.

The fitting hereinabove described provides a very safe and dependable device for controlling the flow of inflammable and explosive fluids, such as the liquefied petroleum gases.

Unusually effective sealing means have been provided around the valve stem so as to positively prevent leakage. Such means include well placed and effectively compressed packing material around the stem and a well ground and polished ball-and-socket joint between the valve

stem and the valve head, which arrangement is effective against leaks when the valve is opened wide.

In addition there is provided a still more important auxiliary sealing arrangement disposed about the valve stem through a construction which employs an annular recess and an annular projection oppositely disposed on the contact faces of the valve bonnet and the valve head. This arrangement works to completely seal the valve stem against any leaks therearound when the main valve is opened to its fullest extent. Such position is the normal position of this valve most of the time when it is used in the control of the flow of such fuels as butane, and the like, between a storage tank and the place where fuel is utilized or conditioned.

It is just as important to have the main control valve tightly sealed against leakage when the valve is open as when the valve is closed. No valve heretofore known has been so effective in providing safety sealing measures.

Emphasis has been placed upon the sealing against leaks around the valve stem, because this stem must move, from time to time, through its housing and casing. There is no danger of leakage around the valve bonnet, once it is firmly put in place, because of the provision of gasket ring 70. It is to be remembered that this bonnet is very rarely removed, and the gasket is easily replaceable.

To prevent undue pressure of fluid seeking escape around the valve stem and around the bonnet, and so that such pressure will never become abnormally high, and with the purpose of further reducing the possibility of leakage (already rendered highly improbable because of the sealing means arranged about the valve stem and the means provided to prevent leaks about the bonnet) a small relief valve has been built directly into the body of the control fitting so that it communicates with the main channel in the fitting through which fluid is conducted from the inlet base of the fitting, disposed within the tank, and the outlet branch of the fitting, supplying a conduit which carries the fluid away.

This relief valve is made with a predetermined capacity, considering both volume and pressure, and such capacity has direct functional relation with the normal flow of fluid through the fitting, volume and pressure considered. This relief valve is related in operation to the excess flow check valve, carried in the base of the fitting. The check valve allows only a normal flow of fluid therethrough, without closing. During this normal flow the pressure may become high within the fitting, yet not sufficiently high to cause the closure of the check valve. Unless an excess flow of fluid seeks passageway through the relief valve, or because of a major leak or breakage in the conduit leading from the delivery branch of the fitting, there will be no closure of the check valve. This simply means that the relief valve may be caused to operate and open and relieve pressure while the check valve remains open. Thus, there will never be pressure maintained within the fitting sufficient to cause any leakage therefrom.

This arrangement also affords cooperative relation between the delivery branch (while the main shut off valve leading thereto is open) and the pressure relief valve and the excess flow check valve. Such relation has been described in part above; but there is a further relation.

Should the conduit from the delivery branch leak badly, or be broken off entirely, then the volume of out-rushing fluid will become enough to cause the instantaneous closure of the check valve; and this valve will continue closed until the leak is repaired. Meanwhile no fluid is discharged from the broken line. This is so because the pressure in the tank is always sufficient, and the intake opening below the check valve is always large enough, to cause the closure of this valve whenever there is a break in the conduit leading from the discharge branch of the fitting. This means that at no time, under normal or abnormal operating conditions, will there be sufficient pressure within the fitting to cause it to leak. Immediately after the closure of the check valve, following an accidental breakage of the delivery conduit, there will be only normal atmospheric pressure within the fitting. Therefore, under no conditions will this fitting leak. Pressure is never really high within the fitting.

The fitting is very simply placed and carried in the fuel storage tank by having it firmly and securely attached through the wall of the tank, so that the base of the fitting is at all times within the tank. When in this position, the discharge branch of the fitting is about the tank, and so is the relief valve. Also the valve bonnet and means for rotating the main valve stem are handily disposed outside the tank, for manual operation. The main shut off valve is either kept entirely closed (when fuel is not being delivered) or entirely open (when fuel is being delivered). The rotation of the valve stem is the only manual operation that can be carried on in connection with this fitting. The operations of the check valve and of the pressure relief valve are entirely automatic.

Through structure carrying out the objects and purposes of this invention, as first hereinabove disclosed and as appears through the specification, a control fitting for the delivery of liquefied petroleum gas is provided which affords maximum safety for the handling of such fluid. Even persons untrained in the handling of volatile and explosive fuel can safely initiate the delivery of such fuel by simply turning a handwheel, in one direction as far as it will go; and during such delivery they may enjoy complete safety and freedom from danger. Likewise, the reverse of the operation will cut off the flow in such way that the operator is completely protected; and such safety is accomplished through the use of a single fitting, capable of only one manual operation (which may be reversed). Further operations of the fitting affording additional safety are so entirely automatic as to cause no concern whatever.

I claim:

1. In valve apparatus, a hollow valve body provided with four integrally constructed hollow branches, each communicating with a common chamber within the body; a shutoff valve so operable within the chamber as to control the flow of fluid through said chamber and so arranged that its operating mechanism is carried by one such branch; an outlet so provided in another such branch as to allow the discharge of fluid from the chamber when the valve is open; a passage within another such branch arranged for the inlet of fluid to the valve body, and said passage being provided with an enlargement at its inlet end; a check valve carried in said enlargement; a pressure relief valve constructed within the remaining branch of the body; said check valve be-

ing so arranged and operable that upon its closure the flow of fluid will be prevented to every other valve in the apparatus including the relief valve; and a conduit leading from the last-named branch to the passage and being so constructed that the area thereof is such as to allow the escape of fluid in volume and rate of flow substantially less than that required to close the check valve, so that the relief valve may operate to lessen pressure within the body without causing the closure of the check valve.

2. In valve apparatus, a hollow valve body provided with four integrally constructed hollow branches, each communicating with a common chamber within the body; a shutoff valve so operable within the chamber as to control the flow of fluid through said chamber and so arranged that its operating mechanism is carried by one such branch; an outlet so provided in another such branch as to allow the discharge of fluid from the chamber when the valve is open; a passage within another such branch arranged for the inlet of fluid to the valve body, and said passage being provided with an enlargement at its inlet end; a check valve carried in said enlargement, said valve having a movable thimble provided with apertures so constructed as to allow a predetermined volume of fluid to normally pass therethrough without moving the thimble to closed position; a pressure relief valve constructed within the remaining branch of the body and being so arranged that the maximum volume and rate of flow of fluid dischargeable therefrom is less than the volume and rate of flow of fluid normally passing through said check valve, so that the relief valve may operate to lessen pressure within the body without causing the closure of the check valve; said check valve being so arranged and operable that upon its closure the flow of fluid will be prevented to every other valve in the apparatus, including the relief valve; and a conduit leading from the passage to the last-named branch.

3. In valve apparatus, a hollow valve body provided with four integrally constructed hollow branches, each communicating with a common chamber within the body; a shutoff valve so operable within the chamber as to control the flow of fluid through said chamber and so arranged that its operating mechanism is carried by one such branch; an outlet so provided in another such branch as to allow the discharge of fluid from the chamber when the valve is open; a passage within another such branch arranged for the inlet of fluid to the valve body, and said passage being provided with an enlargement at its inlet end; a check valve of predetermined capacity carried in said enlargement, said valve being provided with spring means to regulate the pressure at which it will operate; a pressure relief valve constructed within the remaining branch of the body; a conduit leading from the passage to the last-named branch; the relief valve being so constructed that pressure sufficient to open it is substantially less than that required to close the check valve, so that the relief valve may operate to lessen pressure within the body without causing the closure of the check valve; and the check valve being so arranged and operable that upon its closure the flow of fluid will be prevented to every other valve in the apparatus, including the relief valve.

4. In valve apparatus, a hollow valve body provided with four hollow branches and having a chamber with which each of said branches communicates; a shutoff valve seat provided in said chamber; valve operating mechanism carried by one such branch, including a valve stem having a spherical terminal within the chamber, and including a valve head provided with a concavity so constructed as to seal against passage of fluid around the valve stem when the terminal is drawn into the concavity in opening the valve, and including a resilient valve disc of frustum shape coacting with the said valve seat and so arranged as to receive the compressive force of the valve stem when the latter is lowered to close the valve; an outlet so arranged in one such branch as to allow the discharge of fluid from the chamber when the aforesaid valve is open; a passage within another such branch arranged for the inlet of fluid to the body; a pressure relief valve arranged within another such branch of the body; a conduit leading from the passage to the last-named branch and being so constructed as to allow the discharge of fluid in volume and the rate of flow substantially less than that which may be accommodated by the said passage, so that fluid may be discharged by the relief valve without causing the cessation of flow through the shutoff valve; and a check valve so arranged in the inlet branch as to close such branch against the introduction of any fluid to the apparatus whenever the discharge branch is broken.

5. In apparatus for the control of liquefied petroleum gas, a hollow bodied fitting having an intake passage, a discharge passage, and a relief passage, the latter being so arranged as to be intermediate the outer ends of the intake and discharge passages and so constructed as to communicate with the intake passage through a conduit having a cross-sectional area substantially less than that of the intake passage, so that the rate of flow through such conduit is substantially less than the rate of flow through the intake passage; a manually operated shut-off valve so arranged with respect to the discharge passage as to control the flow of fluid therefrom; a check valve so arranged with respect to the intake passage as to normally allow the flow therethrough of a predetermined volume of fluid without causing the closure of the valve, and the valve being closable by the attempted flow therethrough of fluid at a rate of flow exceeding the predetermined normal therefor, and being so operable as to prevent the introduction of fluid into the fitting when the check valve is closed; and a relief valve mounted in the relief passage and being so operable as to relieve excess pressure from the hollow bodied fitting without causing the closure of the check valve or the cessation of flow through the shut-off valve.

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