This invention relates to a closure for a container. More particularly, this invention relates to a combination pressure and temperature controlled safety relief unit for containers or tanks used in the storage and utilization of liquefied gases, or gases under high pressures.

In recent years the increased demand for liquefied petroleum gases, both industrially and domestically, has presented the industry with the problem of designing safer and more economical systems for supplying such gases. Containers used for storing and dispensing liquefied gases, such as propane and butane, being subjected to high pressures are designed accordingly with an ample safety factor for ordinary conditions. However, additional safety devices must be provided to prevent the bursting of a container, as internal pressure generated in such a container, by the heat of a fire, for example, may rupture the wall and scatter the inflammable contents thereby augmenting or spreading the fire.

To guard against such an occurrence, the present method is to incorporate a separate pressure relief valve and fusible metal plug or insert in openings made in the wall of the container. Where a single combined valve tap plug including a safety pressure relief valve and a fusible plug as illustrated in applicant's U.S. Patent No. 2,172,311, issued September 5, 1939, is used a single large aperture is made in the wall of the container and the valved tap secured therein. Another type of construction uses separate relief valve, fusible plug, and tap plug which requires three separate openings to be made in the outer wall of the container.

Applicant has devised a combined relief valve and fusible plug which eliminates the need for such a large single opening or for one of the smaller openings, thereby improving the construction in strength and lessening the cost.

Another object of this invention is to provide a simple and compact relief valve and fusible plug combining the elements of each into a single device easily made and assembled in a liquefied gas container.

A further object of applicant's invention is to provide a unitary device capable of protecting a liquefied fuel gas system against excessive temperature and pressure changes.

A still further object of the invention is to provide a single relief valve and fusible plug so combined and constructed that when the fusible plug melts, due to a dangerously high surrounding temperature, the pressure within will not blow the relief valve bodily from the wall of the container.

Since a pressure sufficient to rupture the wall may be generated by heat on the container, it is very dangerous to have a relief valve not securely attached to the wall, which depending on the fusible plug for support, will be explosively expelled when the latter melts.

Other objects and advantages of this invention, not at this time more particularly enumerated, will be apparent from the following detailed description in conjunction with the accompanying drawings forming a part thereof, in which:

Figure 1 is a cross-sectional view through one embodiment of applicant's structure, illustrating the same in connection with the container, which is fragmentarily shown, and a pressure relief valve shown in elevation;

Figure 2 is a similar view of a second embodiment,

Figure 3 is a view similar to that of Figure 1 of a third embodiment of applicant's invention.

Figure 4 is a transverse section taken on the line 4--4 of Figure 2 with fusible metal 23 removed from holes 41, and

Figure 5 is a transverse section taken on the line 5--5 of Figure 3.

Referring now more particularly to Figure 1 of the drawing, there is fragmentarily illustrated a wall of a container 10, which may be of any suitable size or type but which for the purposes of explaining this invention is adapted to contain fluids under pressure, such as liquefied petroleum gases which may be utilized as fuel upon release of the pressure. This container is provided with a circular aperture 11 in which is inserted the circular body member or housing 12 formed with an annular shoulder 13 which is of greater diameter than the remainder of the housing, and which is formed to support the housing in position on the container. Weld 14 secures and holds housing 12 in position on container 10, although any other suitable means of securing the housing to the container may be used.

Centrally of the housing 12 is provided a circular bore 15 extending part way through the housing having the upper portion thereof screw threaded as at 16, while the lower portion presents a continuous annular wall 17 in which fits a flexible packing ring 18, made of resilient material, such as rubber or any other sufficiently compressible material and including soft metals. A second bore 19 of reduced diameter axially aligned with bore 15 is also provided and continues through the under face of the housing.

Screwed into bore 15 and the threads at 16 is a second circular body member or plug 20 externally threaded on its upper portion to engage the threads at 16. This member is of reduced diameter at its lower end so as to fit into bore 19 of housing 12. An annular shoulder 21 seats on packing ring 18 and forms a sealing engagement therewith between housing 12 and plug 20.

Plug 20 is provided with a circular bore 22 extending from its upper face through to the under face. This bore or passage places the interior
of container 10 in communication with the exterior thereof and is normally closed by a fusible metal filling 23, preferably of a metal having a melting point at about 165 degrees Fahrenheit, extending into the passage. Thus it will be seen that when the temperature surrounding container 10 reaches this point the metal will melt and permit flow into the container or be blown from passage 22 by the increased pressure, thereby opening passage 22 and venting the container.

A second circular bore or passage 24 also extends through plug 20, having a narrow restricted orifice at 25 to improve the popping action of the relief valve, hereinafter described, as will be understood by those skilled in this art. The lower portion of this bore is of enlarged diameter and screw threaded as at 26 to engage threads on the body of pressure relief valve assembly 21. This valve assembly is similar to a tire core valve as commonly used in the automotive industry for vehicle tires and its general operation will be readily understood by reference to applicant's above described patent. It should be noted that this valve assembly is spring loaded having a coiled spring 27A and an adjustable nut and locknut at 27—B projecting inside of container 10. This feature permits a reduction in the thickness of the supporting plug 20 as well as providing protection for the valve.

Keg 26 adapted to receive a screw driver blade for purposes of assembling is cut into the upper face of plug 20.

Thus it will be seen that in the event metal 23 melts and bore 22 is opened allowing the container to vent, relief valve 27 is still securely held in place by the threaded engagement at 26 with plug 20 which in turn is threaded at 16 to housing 12.

Figure 2 illustrates a modified type of improved closure member for containers. Numerical 10 indicates a fragmentary part of a wall of a container similar to that of Figure 1, provided with a circular aperture 11, in which is inserted a circular body member or housing 29. This member is formed with an annular shoulder 30 having a greater diameter than the remainder of the housing and which serves to support housing 29 in position on container 10. Weld 14 secures and holds this member 29 to container 10, although any other suitable means of securing the member to the container may be used.

Centrally of housing 29 is provided a circular bore 31 extending part way through and having its upper portion screw threaded as at 32, while its lower portion presents a continuous annular wall 33 in which fits a flexible packing ring 18, made of resilient material, such as rubber or any other equivalent compressible material. A second bore 34 of reduced diameter axially aligned with bore 31 is also provided and continues through the under face of housing 28.

Screwed into bore 31 and the threads at 32, is a second circular body member or plug 35 externally threaded on its upper portion to engage the threads at 32. This member is of reduced diameter at its lower end so as to fit into bore 34 of housing 29. An annular shoulder 36 seats on packing ring 18 and forms a sealing engagement therewith between housing 28 and plug 35.

Plug 35 is centrally provided with a circular bore 37 extending from the upper face part way through and terminating in an annular wall 38. A second circular bore 39 of reduced diameter, internally threaded at 40 to engage threads on the exterior of the relief valve assembly 27 ex-
either event the space between the sleeve and the valve housing will be cleared forming a passage to the interior of the container serving to vent it to the atmosphere.

Valve housing 86 is cylindrical in shape and adapted to be readily inserted through the central bore of ring 83 with the annular shoulder 88 formed on the lower end of the housing seating against the ring. This housing has a central bore 89 forming a passage in which the relief valve assembly 27 is mounted. Threads on the valve assembly 27 engage threads as at 81 in the lower portion of the bore thus holding the valve assembly securely mounted within the housing 86. The upper portion of this bore in housing 86 terminates in a restricted orifice 28 which was found to improve the popping action of the valve.

Sleeve 40 terminates at its upper end in a tool socket slotted as at 81 to receive a tool head to be used in tightening the members or to facilitate their removal.

Assembly of this fuse plug, particularly the embodiments in Figures 2 and 3 is accomplished as follows: plug 35, Figure 2, is screwed into housing 29 seating on packing ring or gasket 18. Bore 37 of plug 35 is then filled with fusible metal 23 which upon hardening becomes an integral part of the plug. Valve assembly 27 may then be screwed into the threads at 40.

Sleeve 40 of Figure 3, is screwed into housing 43, seating on ring 18 then washer 83 is placed in recessed portion 82, and valve housing 86 is inserted. Annular space 57 is filled with fusible metal 23 which becomes an integral part of the sleeve member and which fills recessed portion 81 forming a shoulder. Shoulder 88 of housing 86 engages the lower side of washer 83 and prevents the housing with valve assembly 27 screwed therein from being blown from the container.

While I have described specific embodiments of my invention, it is to be understood that the forms of this invention, herewith shown, are preferred examples thereof and that various modifications may be made without materially departing from the spirit of the invention as defined by the appended claims.

Having thus described my invention, I claim:

1. A closure for containers comprising a plug removably secured to the container and having two passages extending therethrough connecting the interior of the container with the atmosphere, one of said passages being concentric of the other passage and closed by a filling of fusible metal integral with the plug member, the other of said passages being normally closed by a pressure relief valve held against removal from the container independently of the fusible metal.

2. A closure for containers comprising a plug removably secured to the container and having two passages extending therethrough connecting the interior of the container with the atmosphere, the first of said passages comprising in part an annular groove formed in the plug surrounding the other passage, said first passage being closed by a septum of fusible metal the other of said passages being normally closed by a pressure relief valve held against removal from the container independently of the fusible metal.

3. A closure for containers comprising a plug removably secured to the container and having two passages extending therethrough connecting the interior of the container with the atmosphere, the first of said passages comprising in part a series of small orifices in the plug disposed substantially in a circle surrounding the other passage, said first passage being closed by a septum of fusible metal the other of said passages being normally closed by a pressure relief valve held against removal from the container independently of the fusible metal.

4. A closure for containers comprising a plug removably secured to the container and having two passages extending therethrough connecting the interior of the container with the atmosphere, the first of said passages comprising in part a series of small orifices in the plug disposed substantially in a circle, an annular groove formed in the plug surrounding the other passage, and connected to said orifices, said first passage being closed by a septum of fusible metal the other of said passages being normally closed by a pressure relief valve held against removal from the container independently of the fusible metal.

5. A closure for a container opening comprising plugging means having in combination a central cylindrical portion, a fluid pressure relief valve secured to and closing the interior of the central cylindrical portion, an annular outer portion, an annular septum sealing the inner portion to the outer portion comprising a sleeve of fusible metal cast integrally to the inner and outer portions, means on the outer portion for removably securing the plugging means to the container opening, and means independent of the fusible metal positively restraining the inner portion from moving outward through the outer portion under fluid pressure.

ROSSWELL W. THOMAS.