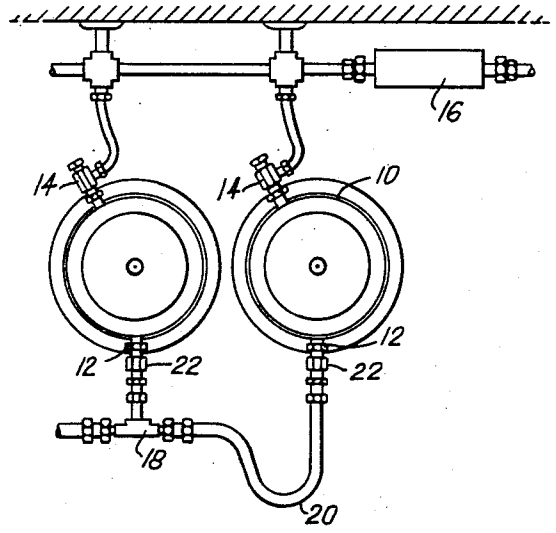
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LIQUID GAS DISTRIBUTION APPARATUS

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FIG. 1



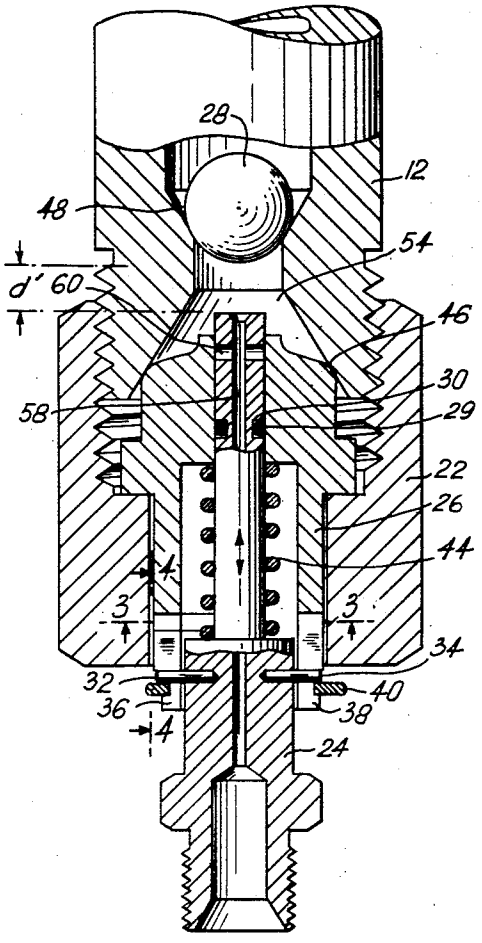


FIG. 2

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LIQUID GAS DISTRIBUTION APPARATUS

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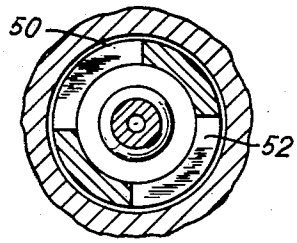


FIG. 3

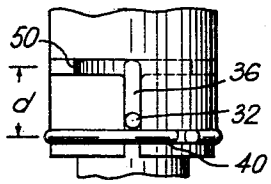


FIG. 4

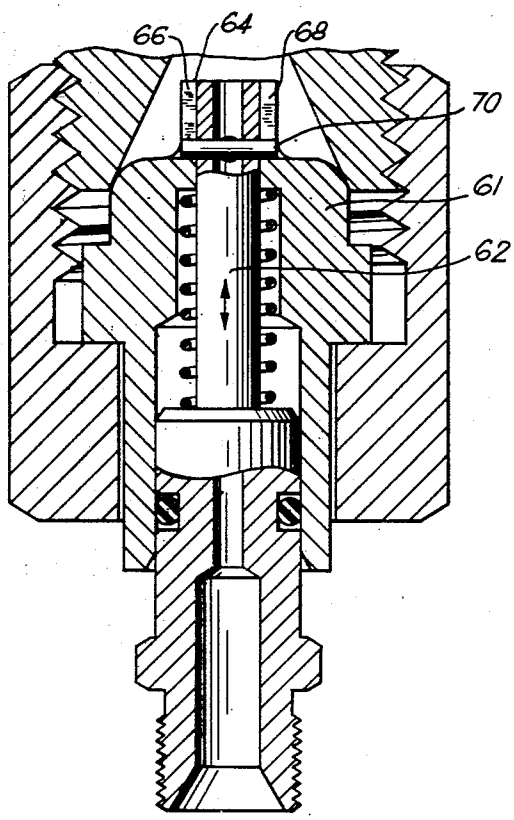


FIG. 5

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LIQUID GAS DISTRIBUTION APPARATUS

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The present invention relates to apparatus for providing a flow of gas from vessels containing the gas in the liquid and vapor phase. It relates more particularly to an apparatus for interconnecting a plurality of liquefied gas vessels to permit equal discharge flows therefrom to a common discharge line.

Prior to the development of insulated liquid gas vessels or containers, industrial gases were supplied to users in the compressed gas state. With the advent of the liquid gas vessels, a more economical means in terms of transportation and handling costs as well as storage space was provided for distributing industrial gases to the consumers. These vessels are so designed that a small amount of heat maintains gas head pressure in the free space above the contained liquid gas. This head pressure forces liquid gas up through a withdrawal tube and into a vaporizing coil where it is gasified by atmospheric heat for discharge to the use point. During use at normal room temperature, about 300 c.f.h. of oxygen, for example, can be continuously vaporized at a delivery pressure of 70 to 75 p.s.i. However, there are numerous applications where a withdrawal rate in excess of that which can be supplied by a single vessel is required, necessitating connecting two or more liquid gas vessels in parallel—that is, manifolding the respective outlets for simultaneous discharge.

Due to the variations in heat pick-up within the vessel itself, and a slight continuous vaporization during non-use, the head pressures in the vessels when received by the consumer may vary, in the case of oxygen, between 75 and 235 p.s.i. Therefore, the amount of liquid passing into the coil to be vaporized into gas will vary from vessel to vessel, depending upon the head pressure in the free space above the liquid. It has been found that when two such vessels, having unequal head pressures, are manifolded together for simultaneous discharge, the vessel having the greatest head pressure will discharge while the other vessel will not discharge until such time as the pressure in the first vessel drops to that of the container having the lower head pressure; this may not occur until the first container is almost empty. Thus, the effect of multiple vessel use is negated unless the respective head pressures are essentially the same.

It is therefore the main object of the invention to overcome the discrepancies in vessel head pressures and to assure a substantially simultaneous equalized rate of flow from each.

Another object is to provide a single and convenient means for interconnecting the vessels so that head pressure differentials existing therebetween may be equalized thereby substantially balancing the discharge flows.

Generally speaking, each liquefied gas vessel of the type herein described has been provided with a filler inlet and a discharge outlet, each having a check valve. The vessels are filled through the inlets by the supplier, and the outlets are connected by the consumer to a manifold outlet line. The purpose of the check valve in the vessel inlet is to prevent the escape of vaporized gas after the vessel has been filled.

According to the present invention, the head pressures of a plurality of vessels manifolded together for simultaneous discharge, are equalized by means of a conduit coupling interconnected between the vessel inlets. This conduit coupling is operable to open the container inlet check valves, permitting fluid flow therethrough.

In the drawings:

FIG. 1 is a diagrammatic view illustrating the interconnecting conduit coupling of the invention co-operatively associated with a pair of outlet manifolded low temperature liquefied gas containers;

FIG. 2 is an axial cross-section of a conduit coupling embodying the present invention;

FIG. 3 is a view of a section taken on line 3—3 of FIG. 2;

FIG. 4 is a fragmentary section taken on line 4—4 of FIG. 2; and

FIG. 5 is an axial section of a modified coupling.

The pressure vessels 10 shown in FIG. 1 each comprise a check valved inlet 12, and an outlet connection 14. The outlet connections are respectively connected to an outlet manifold 16 to direct gas flow to the use point.

Referring to FIG. 1, the preferred embodiment of the invention comprises a manifold conduit 18 having flexible branch conduit members 20, the respective ends of which are provided with an attaching nut 22 adapted to co-operatively engage the check valved inlet 12 of the respective liquefied gas vessels. Attaching nut 22 has a central opening for receiving a nipple 26 therethrough. The inner flange of the nut engages an annular shoulder on the nipple 26 to tighten the nipple in the vessel inlet 12. As shown in FIG. 2, a rotatable valve stem 24 is slideably retained within a central bore of the nipple 26, said valve stem being adapted to inwardly dislodge a ball check member 28 of said gas check valved inlet 12, when the attaching nut 22 is secured onto the gas inlet 12 and the nipple 26 engages the seat 46 of the inlet 12. The ball check member 28 is normally held in a closed position against a mating seat portion 48 by gas pressure within the vessels. A circumferential groove 29 in stem 24 receives an O ring 30 to provide an annular, slideable gas-tight seal against atmospheric leakage. Valve stem 24 and nipple 26 are maintained in operable engagement to permit a limited degree of both axial and rotational movement therebetween.

Movement of the valve stem 24, relative to the nipple 26, is limited by a bayonet joint comprising a pair of diametrically opposed pins 32 and 34 radially projecting from the valve stem and received in a pair of corresponding longitudinal slots 36 and 38 formed into the nipple outer wall. The pins are rearwardly restrained by a ring 40 circumferentially retained in a suitable groove located in said nipple, against which said pins are urged by a resilient compression member such as a coil spring 44 disposed about the valve stem 24 and which urges the valve stem rearwardly. Again referring to FIG. 2, the valve stem 24 may be considered non-operative when the nipple 26 is engaging seat 46 of inlet 12 and there is a minimum distance d' through which the valve stem must be advanced before the ball check 28 is contacted and displaced to allow vapor flow.

In order to provide access to the vessel gas portion and thus permit equilization of the respective head pressures, the valve ball check member 28 must be displaced from its normal repose on the frusto-conical valve seat 48, a sufficient amount to define a passage intermediate the ball and mating seat. This is only done after both ends of the conduit coupling are engaged with corresponding gas container inlets as the respective couplings do not include valves or similar means for controlling flow therethrough. When properly positioned, the distance d shown in FIG. 4 defining the working length of slots 36 and 38 through which the respective pins must advance should be greater than distance d' in FIG. 2. This will assure the ball check member being sufficiently displaced from its seat prior to the valve stem reaching its point

of maximum advancement as determined by the slot length.

As noted above and referring to FIGS. 3 and 4, in unseating the ball check **28**, the valve stem is first manually telescoped through the nipple, a rotational twist of the stem, at the point of maximum advance, then causes the respective pins to register in the peripheral slots **50** and **52** which form a lateral continuation to the longitudinal slots **36** and **38**. The peripheral slots, as shown in FIG. 3, permit approximately 90° of rotation after which the rearward force of spring **44** frictionally maintains the nipple **26** and valve stem **24** in the operable or open position. In this position the ball check **28** will be sufficiently unseated to permit vaporous gas from the container to enter chamber **54** defined by the inlet **12** and nipple **26**.

As seen in FIG. 2, a passage **58** extending axially through the valve stem communicates chamber **54** with the branch conduit **20** by means of a lateral bore **60** terminating in passage **58**. Said bore is located sufficiently forward on the valve stem to permit fluid flow into said passage when the valve stem is advanced to the operable position. Thus there is provided a fluid tight passage through the respective couplings and conduit thereby communicating the head pressure vapor portion of said liquefied gas vessel with the head pressure vapor portion of an adjacent vessel similarly connected to the other end of the conduit coupling. This, of course, does not infer a one-way flow through the conduit; as has been noted, flow in either direction is an essential feature of the invention in order that pressure from the interconnected containers may be equalized in either direction at all times.

An alternate embodiment of a connector falling within the contemplation of the present invention is illustrated in FIG. 5. The connector illustrated is essentially similar to that previously described in relation to FIG. 2 with the singular exception of the means for locking the valve stem in a forward or operable position. The nipple **61** includes a slideable valve stem **62** provided with a forward protruding portion **64** having a pair of diametrically opposed slots **66** and **68** adapted to receive a positioning pin **70**. The pin is preferably disposed perpendicular to the valve stem axis extending laterally from either side a sufficient distance to contact the forward surface of the nipple protruding portion **64** when the valve stem is advanced through the nipple.

As was previously mentioned, a compressed coil spring urges the stem rearwardly into the normally closed or non-operating position. For displacing the check ball, the valve stem is advanced to position pin **70** forward of slots **66** and **68** rotating said stem about 90 degrees, then permits the pin to be rearwardly urged against the end surface of said protruding portion and be there maintained. A V groove is preferably provided in the end surface of said protruding portion for receiving said pin **70** as a positive operating position lock.

In normal operation, the coupling conduit, as herein described, comprises a flexible conduit member having terminal couplings gas-tightedly fastened to each end thereof. The connecting member may also comprise a plurality of conduits suitably communicated at a common point, with a terminal coupling furnished for each of said conduits. Each coupling conduit is then engaged to an appropriate gas inlet on one of the several vessels which are to be interconnected. Prior to, and during the initial engagement of the respective coupling and gas inlet, the respective couplings are preset with the valve stem retracted into the nipple member to avoid dislodging the check valve ball prior to both ends of the conduit being engaged.

It is understood that while the foregoing description is limited to particular embodiments of the apparatus of the invention, modifications and changes may be effected

without departing from the spirit and scope of the invention.

What is claimed is:

1. In a conduit coupling for attaching to the vapor inlets of a plurality of low temperature liquefiable gas vessels having inlet check valves and outlet check valves, the combination in each of said inlets including an outer frustro-conical seat, an inner seat operably associated with a displaceable valve check member for controlling fluid flow from said vessel, said seat and check member being normally urged into fluid sealing relationship by internal vessel pressure, a tubular attaching member terminating in an elongated nipple, said attaching member engaging said inlet for urging said elongated nipple into fluid sealing relation with said outer frustro-conical seat, a valve stem co-axial with and slideably retained in said nipple, gas sealing means surrounding said stem to define an annular seal along the slideably co-operating portion, a compression ring urging said stem rearwardly in relation to said nipple for normally spacing the forward end of said stem away from said check member, guide pins laterally projecting from said valve stem, said pins slideably retained in corresponding longitudinal slots in said nipple, said slots disposed permitting sufficient forward movement of said valve stem in the forward direction to inwardly displace said valve check from said mating seat, a forward portion of said slot being formed to permit a limited rotation of said valve stem and retention of said stem in said forward position, a fluid passage extending axially of said valve stem communicating said gas vessel inlet with said fluid conduit when the valve check member is sufficiently displaced.

2. A conduit coupling for attachment to access check valves in low temperature liquefiable gas vessels, each of said check valves having an outer seat, an inner seat operably associated with a displaceable valve check member normally urged into fluid sealing relationship with the inner seat by internal vessel pressure, said conduit coupling comprising a tubular attaching member terminating in an elongated nipple, said attaching member engaging said check valve and urging said elongated nipple into fluid sealing relation with the outer seat of the check valve, a valve stem co-axial with and slideably retained in said nipple to move forward when so urged to displace the check member from the inner seat of the check valve, resilient means urging said stem rearwardly in said nipple for normally spacing the forward end of said stem away from the check member, at least one guide pin laterally projecting from said valve stem, said pin slideably retained in a corresponding slot in said nipple, said slot disposed to permit sufficient forward movement of said valve stem when urged forward against the resilient means to inwardly displace the check member from the inner seat, a forward portion of said slot being formed to permit a limited rotation of the valve stem and locking of said guide pin in said forward position, a fluid passage extending axially of said valve stem to form a communicating passage for gas flow from the interior of the vessel through and out of the valve stem into a fluid conduit when the valve stem is retained in the forward position.

3. A conduit coupling for attachment to access check valves in low temperature liquefiable gas vessels, each of said check valves having an outer frustro-conical seat, an inner seat operably associated with a displaceable valve check member normally urged into fluid sealing relationship with the inner seat by internal vessel pressure, said conduit coupling comprising a tubular nut terminating in an elongated nipple, said tubular nut engaging said check valve and urging the conically-shaped forward end of said elongated nipple into fluid sealing relation with the frustro-conical outer seat of the check valve, a valve stem co-axial with and slideably retained in said nipple to move forward when so urged to displace the check member from the inner seat of the check valve, a compressed spring surrounding a portion of the valve

stem and bearing against a forward shoulder on said nipple and a rearward shoulder on said valve stem to urge the valve stem rearwardly in said nipple and normally space the forward end of the valve stem away from the check member, at least one guide pin laterally projecting from said valve stem, said pin slideably retained in a corresponding slot in said nipple, said slot disposed to permit sufficient forward movement of said valve stem and pin when urged forward against the spring to inwardly displace the check member from the inner seat, a forward portion of said slot being formed to permit a limited rotation of the valve stem and locking of said pin in said forward position, said valve stem having a fluid passage extending axially of said stem to form a communicating passage for gas flow from the interior of the vessel through and out of the rear end of the valve stem when the valve stem is retained in the forward position, said valve stem having coupling means at its rear end for attachment of a conduit thereto.

4. A conduit coupling for attachment to access check valves in low temperature liquefiable gas vessels, each of said check valves having an outer frustro-conical seat, an inner seat operably associated with a displaceable ball check member normally urged into fluid sealing relationship with the inner seat by internal vessel pressure, said conduit coupling comprising a tubular nut terminating in an elongated nipple, said tubular nut engaging threads on the check valve to urge the conically-shaped forward end of said elongated nipple into fluid sealing relation with the frustro-conical outer seat of the check valve, a valve stem co-axial with and slideably retained in said nipple to move forward when so urged to displace the ball check from the inner seat, gas sealing means surrounding said stem to define an annular seal, a compressed spring surrounding a portion of the valve stem and bearing against a forward shoulder on the nipple and a rearward shoulder on said valve stem to urge said stem rearwardly in said nipple and normally space the forward end of the valve stem away from the ball check, at least one guide pin laterally projecting from said valve stem, said pin slideably retained in a corresponding slot in said nipple, the rear end of the slot in the nipple forming a backstop to limit rearward motion of the stem and pin due to the spring, the slot extending thereafter longitudinally forward in said nipple a sufficient distance to allow forward movement of the valve stem and pin when urged forward against the spring to inwardly displace the ball check from the inner seat, a forward portion of said slot extending in a direction normal to the longitudinal to permit a limited rotation of the stem in the nipple and placement of the pin in the slot extension to lock the pin and stem in the forward position, said valve stem having an axial passage therethrough with at least one radial passage at the forward end to form a communicating passage for gas flow from the interior of the vessel through and out the rear end of the valve stem when said stem is retained in the forward position, and coupling means on said valve stem for attachment to a conduit.

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