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INTERNAL ACCESS MEANS FOR CONTAINERS

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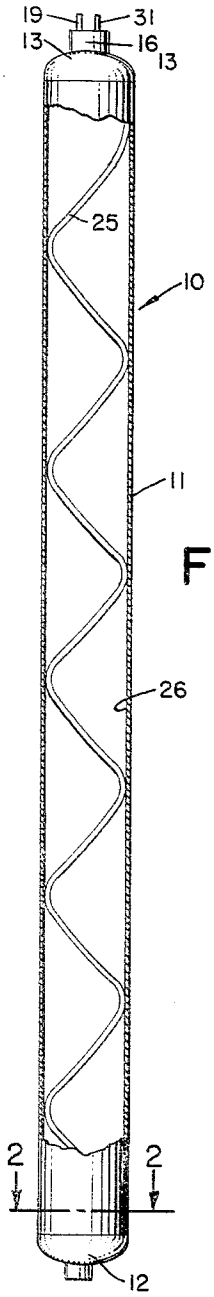


FIG. 1

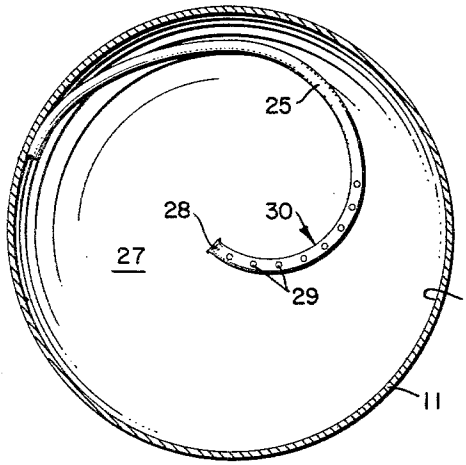
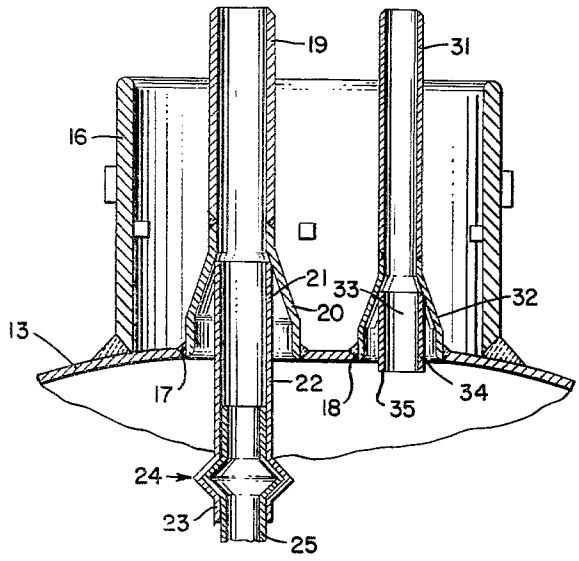


FIG. 2

FIG. 3



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INTERNAL ACCESS MEANS FOR CONTAINERS

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This invention relates to access means for establishing communication with the interior of containers. More particularly it concerns a configured access conduit which supports the greater part of its length in a container by expanding resiliently against the container walls. The inventor, an employee of The Lummus Company, made the invention while engaged in development work undertaken by that organization in techniques of natural gas transportation.

While the internal access means of the invention can serve many purposes which will be apparent from the following discussion, it is primarly designed for use in pressure vessels such as elongated cylindrical containers for holding refrigerated and compressed natural gas. In certain uses of such containers, access conduits must enter through one end thereof and communicate not only with the adjacent internal end portion but also with the remote internal end portion at the opposite end of the container. Consequently, one access conduit must extend substantially throughout the length of the inside of the container.

It is characteristic of this type of container that no fasteners or attachments should be present on its inner wall except on the one end where its access conduits enter, because stresses tend to concentrate at such points even when the attachments carry no weight. Whatever form of access conduit is used to communicate with the remote end of the container, it must be inserted into the container and after the latter is sealed it must remain in place without the support of fasteners attached to the container walls. This presents considerable difficulty when varying inertia loads on the access conduit must be accommodated during operation, as for example in the transport of such containers by ships subject to rolling and pitching in heavy seas. An even more serious problem of support arises from the relative expansion and contraction between this access conduit and the container as a result of the differential temperatures which occur as the container is filled and emptied. Such conditions require that the access conduit have all degrees of freedom relative to the container walls necessary to adjust to these changes in dimensions and yet be supported against the inertia forces mentioned above.

Broadly stated, the internal access means of the invention for use in a container comprises a conduit of a resilient configuration which is compressible to fit within said container without plastic deformation and expandable thereafter into forcible supporting engagement with the interior of said container. In its more specific form, the conduit configuration is helical and of greater length or diameter (or both) in a relaxed state than the internal length and diameter of the container. Consequently, the conduit can be compressed into place so that it is supported solely by slideable engagement throughout the greater part of its helical configuration with the sides and ends of the container.

This form of access conduit requires no fasteners on the container wall, other than at the entry end of the container, to maintain its proper position. Therefore it does not render the container susceptible to concentration of stresses. More importantly, the new conduit can accommodate any possible degree of contraction or expansion relative to the container as a result of variations in temperature during operation by sliding along its zone of forcible engagement with the wall, and yet without impairing the desired support afforded by that engagement. Once this improved conduit is installed and the entry end of the container is sealed, the conduit can provide satisfactory service indefinitely without maintenance or other attention.

A preferred embodiment of this invention is described hereinbelow with reference to the drawing wherein:

FIG. 1 is an elevation partly broken away of a vertical pressure vessel equipped with the helical access conduit of the invention;

FIG. 2 is a section taken substantially along the line 2—2 of FIG. 1; and

FIG. 3 is an enlarged fragmentary elevation in section of the top portion of the pressure vessel of FIG. 1.

The pressure vessel shown in the drawing is an elongated bottle **10** of the type used to hold natural gas under moderate refrigeration and compression in ships. A multiplicity of such elongated bottles may be carried vertically in a ship in a plurality of batteries. Each bottle **10** is constructed of a cylindrical shell **11** made of a suitable alloy resistant to low temperautres which may be three or four feet in diameter and generally about fifty feet long, though its size is not a limiting factor in the invention. The shell **11** of the bottle **10** is closed by rounded bottom and top portions **12** and **13**, the latter being the entry end of the bottle where first and second access conduit assemblies extend inside the vessel. Attached to the top end portion **13** of the shell **11** and extending upwardly therefrom is a cylindrical collar **16** by which the bottle **10** can be supported and through which the respective access conduit assemblies project. Formed in the top end portion **13** of the shell **11** within the collar **16** is a large opening **17** and a smaller opening **18** through which the first and second access conduit assemblies respectively extend.

The first flexible conduit assembly is comprised of a first pipe **19** which is attached at a flared end **20** to the top portion **13** of the shell about the large opening **17** and extends upwardly away from the top portion. Extending internally within the flared end portion **20** of the first pipe **19** is one end **21** of a rigid intermediate connecting tube **22** which is securely attached to the first pipe and has its opposite end **23** terminating within the vessel. The connecting tube has an inside diameter substantially equal to that of the first pipe but has a smaller outside diameter. Extending into the end **23** of the connecting tube and connected thereto by a swaged joint **24** is a conduit **25** of helical configuration which is maintained in contact with the inner wall **26** of the shell **11**. As shown in FIG. 2, the conduit **25** has a lower end crimped closed at **28** and a plurality of spaced openings **29** along an end portion **30** adjacent thereto. The conduit end portion **30** rests on the bottom of the bottle so that the openings **29** face upwardly to the opposite end of the bottle. Also there is attached to the top end portion **13** of the shell **11** about the smaller opening **18** a second pipe **31** which extends parallel to the first pipe **19** and upwardly away from the top portion. Extending within a flared end portion **32** of the second pipe **31** is one end **33** of a rigid second access conduit **34** which is securely attached to the second pipe and has its opposite end **35** terminating within the bottle in communication with the top region thereof. These flared connections associated with the tube **22** and the conduit **34** serve to prevent thermal shock caused by the passage of fluids of differing temperatures, though it is to be understood that as an alternate design the end of the conduit **25** may be inserted directly into the flared end portion **20** without the use of the connecting tube **22**.

Before it is installed the helix defined by the conduit **25** has an overall length and diameter when relaxed which are greater than the length and diameter of the bottle **10**. The helical configuration is therefore twisted to reduce its diameter and contracted longitudinally to reduce its length so that it can be fitted into the bottle **10** before the top portion **13** thereof is attached. Once within the bottle **10**, the conduit **25** tends to untwist and expand in length

so that throughout virtually its entire length it is urged into forcible sliding engagement with the bottle wall and end portions. This engagement is sufficient to support the conduit **25** against inertia changes which would tend to shift its position appreciably but it permits the limited movement relative to the bottle **10** which is necessary to accommodate thermal expansion and contraction. Also, vibrational forces cannot create a resonant response in the conduit because its unsupported length is short and its frictional engagement with the bottle has a dampening effect. In achieving these results, the conduit **25** requires no fasteners or attaching means on the bottle walls at which stresses might otherwise concentrate.

In operation, extremely cold gases and liquids may pass into and out of the bottle **10** through the first and second access conduits **25** and **35**. When a colder fluid enters the bottle through the first access conduit **25** it is directed out of the plurality of openings **29** at the lower conduit end portion **30** and does not impinge directly on the bottom **12** of the bottle in a manner which could result in undue thermal shock. Consequently, an attachment similar to a shower head fitting may be used in place of the spaced holes **29**. Whatever changes in length occur between the conduit **25** and the bottle **10** during this operation, there is no significant stress exerted on any part of the assembly because the helical conduit **25** simply slides in its resilient supporting engagement with the interior of the bottle and thereby adjusts for all expansion and contraction.

I claim:

1. In combination with a cylindrical container for holding refrigerated and compressed fluids, internal access means comprising a conduit of a resilient helical configuration greater in at least some overall dimensions in a relaxed state than the internal dimensions of said container, said configuration being compressed longitudinally within said container without plastic deformation and expanded into forcible supporting engagement with the interior of said container.

2. Access means according to claim **1** wherein said configuration is greater in length in a relaxed state than the internal length of said container.

3. Access means according to claim **1** wherein said configuration is greater in outside diameter in a relaxed state than the internal diameter of said container.

4. In combination with an elongated cylindrical container for holding compressed fluids, internal access means comprising a conduit of a resilient helical configuration greater in length and outside diameter in a relaxed state than the internal length and diameter of said container, said configuration being compressed in length and diameter to fit longitudinally within said container without plastic deformation and expanded into forcible slideable supporting engagement with the interior ends and sides of said container.

5. In combination with an elongated cylindrical metal container having rounded ends for holding refrigerated and compressed fluids, internal access means comprising a metal conduit of a resilient helical configuration greater in length and outside diameter in a relaxed state than the internal length and diameter of said container, said configuration being compressed in length and diameter to fit longitudinally within said container without plastic deformation and expanded into forcible slideable supporting engagement with the interior ends and sides of said container, one end portion of said conduit being formed with a plurality of openings.

6. In combination with an elongated cylindrical container for holding compressed fluids, internal access means comprising a conduit communicating through one end of said container and extending in helical configuration throughout said container to the opposite end thereof, said conduit being resiliently restrained and supported in place throughout the greater part of its helical configuration solely by slidable engagement with the sides and ends of said container.

7. In combination with an elongated cylindrical metal container having rounded ends for holding refrigerated and compressed fluids, internal access means comprising a metal conduit communicating through one end of said container and extending in helical configuration throughout said container to the opposite end thereof, said conduit being resiliently restrained and supported in place throughout the greater part of its helical configuration solely by slideable engagement with the sides and ends of said container, the end of said conduit remote from where it communicates through said container being closed and formed along its adjacent end portion with a plurality of openings facing the opposite end portion of said conduit.

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Dedication

3,250,420.—*Harold B. Kohn*, Yonkers, N.Y. INTERNAL ACCESS MEANS FOR CONTAINERS. Patent dated May 10, 1966. Dedication filed Sept. 16, 1971, by the assignee, *Vehoc Corporation*.

Hereby dedicates to the Public the entire remaining term of said patent.

[*Official Gazette December 28, 1971.*]