Feb. 13, 1962 H. BROWNING ET AL 3,020,926

BREATHER VALVES

Filed Sept. 8, 1958 2 Sheets-Sheet 1

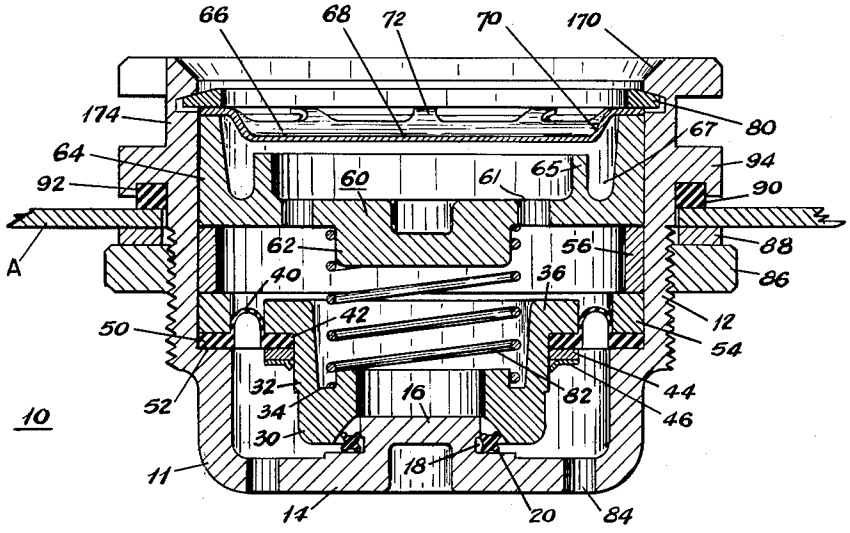


Fig. 1.

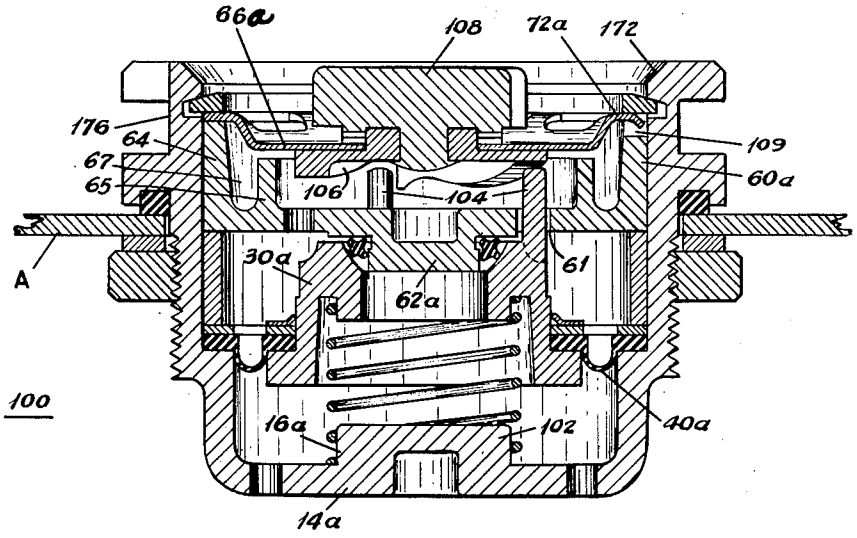


Fig. 2.

INVENTORS
HARRISON BROWNING
WESLEY C. PATTERSON
ILYA S. LIVNEY
BY Mod E. Shirk
ATTORNEY

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BREATHER VALVES

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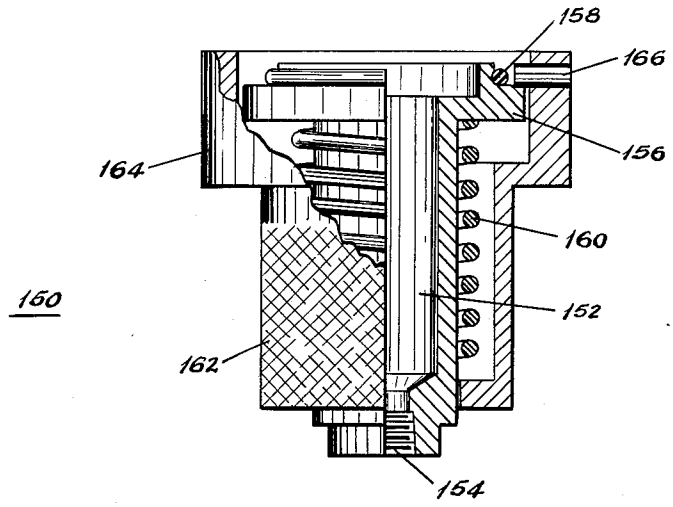


Fig. 3.

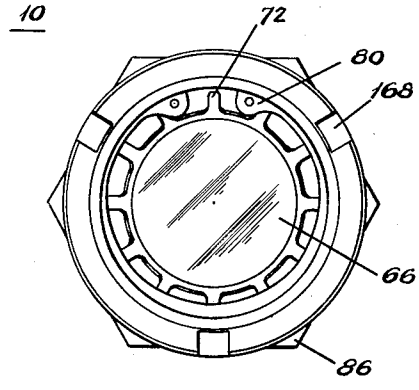


Fig. 4.

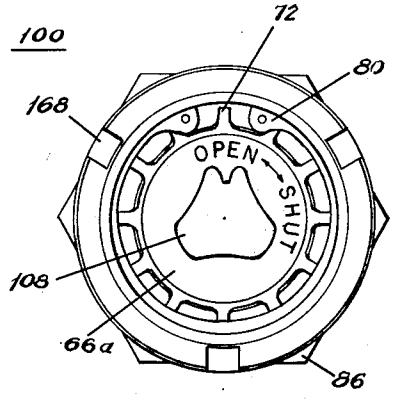


Fig. 5.

INVENTORS
HARRISON BROWNING
WESLEY C. PATTERSON
ILYA S. LIVNEY
BY Mop E. Slick
ATTORNEY.

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3,020,926

BREATHER VALVES

Harrison Browning, 3544 E. Fort Lowell Road; Wesley C. Patterson, 5346 E. 18th St.; and Ilya S. Livney, 2926 E. Glenn St., all of Tucson, Ariz.

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This invention relates to breather valves for eliminating the need of using heavy gauge steel for sealed shipping and storage guided missile containers to withstand changes in external and internal pressures when the containers are transported in an airplane. The valves are used in pairs. One relieves pressure from within the container and the other relieves a vacuum within the container by admitting pressure thereto.

Missile packaging has generally followed the trend of aircraft engines. This a normal result of the container design parameters established by the anticipated shock, vibration and environmental criteria. A fundamental design characteristic of the resulting containers is the pressure vessel configuration.

This characteristic develops from the pressure differentials encountered during airlift. These pressure differentials are in the order of 10 p.s.i.g., but the container is generally tested to 15 or 20 p.s.i.g. to assure safety. This one requirement has a greater effect on weight and cube than the other design considerations.

The vital interest in containers of minimum cube and weight has revised the approach to the pressure problem and a concept of progressive adjustment to pressure has replaced resistance by sheer strength of materials.

The two most useful solutions may be briefly described as:

(1) Free breathing of the container.
(2) Restricted breathing of the container.

Free breathing containers are based on the use of tubes open to the atmosphere. This provides an air passage but, by design, impedes the transfer of moisture vapor. An impirical ratio of 1:10 has been established by the tube diameter to length. Diameters of .040 in. and less have been satisfactory in use. The data indicates that tubes of .25 in. diameter by 2.5 in. long may be used in larger containers. This indicates a maximum flow of approximately 12 c.f.m. at 4 p.s.i.g. and a substantial reduction in flow is to be expected where the breather is connected to a desiccant-filled dehydrating tube. No protection is given against the entrance of water as such.

Restricted breathing containers employ low-pressure, high-flow valves which constantly adjust the container pressure to changes in the atmospheric pressure and prevent excessive pressure differentials during airlifts. Our invention deals with the application of restricted breathing to containers suitable for missiles and large missile components.

Since the containers must be tested for leaks under pressure with the breather valves in place, it was necessary in the prior art practice to make additional holes in the containers to accommodate a filler nozzle used to fill the containers with air while under water and to accommodate a gauge used to indicate the test pressure. Of course, there was then no assurance that the holes were properly sealed after the filler nozzle and gauge were removed.

The breather valves of our invention are adapted to receive a special fitting or connector which, in turn, accommodates filler nozzles and pressure gauges. This eliminates the necessity of providing extra holes in the missile containers.

Also, the presure relief valves presently available are not adapted to prevent dirt and moisture from entering the container when the relief valve that admits air to the

container opens due to a drop in the pressure inside thereof. In addition, a vacuum sometimes forms inside the container. When this happens, it is very difficult to open the container without damaging it. Our invention overcomes these problems, as will be apparent from the description which follows:

It is an object of the invention to provide a low-pressure, high flow valve which constantly adjusts the pressure within a shipping container to changes in the atmospheric pressure and prevents excessive pressure differentials during airlifts.

Another object of the invention is to provide a breather valve for containers which eliminates the need for a special opening in the container to accommodate filler nozzles and pressure gauges.

A further object of the invention is to provide a sand and moisture trap for a breather valve.

A still further object of the invention is to provide a breather valve having mechanical means for unseating the valve to break any vacuum which might exist inside the container to which the valve is attached.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed hereto and forming a part of this specification.

For a better understanding of the invention, however, its advantages and specific objects obtained with its use, reference should be had to the accompanying drawings and descriptive matter in which is illustrated and described a preferred embodiment of the invention.

FIG. 1 is a cross sectional view of an outlet valve of the present invention;

FIG. 2 is a cross sectional view of an inlet valve of the invention;

FIG. 3 is an elevational view, partly in section, of a special fitting of the invention which is adapted to accommodate filler devices and pressure gauges;

FIG. 4 is a plan view of the valve of FIG. 1; and

FIG. 5 is a plan view of the valve of FIG. 2.

Referring now to FIG. 1, a breather or outlet valve **10** includes an open-topped housing **11** having an upstanding side wall **12** and bottom wall **14**. The bottom wall **14** has a cylindrical upstanding portion **16** with an annular groove **18** near the bottom thereof, which is adapted to receive a resilient annular valve **20**. The annular valve **20** has four sealing edges, as shown. A valve seat **30** encircles the upstanding portion **16** of bottom wall **14** and seats on valve **20**. The valve seat **30** has an upstanding wall **32** which, in turn, houses an annular spring seat **34** and has a shoulder **36** constituting an integral part of the valve seat **30**.

A convoluted, torus shaped diaphragm **40** has an inner lip **42** retained in position by means of inner retainer rings **44** and **46**, respectively, subjacent the shoulder **36** of the valve seat **30** and an outer lip **50** retainer in position superjacent the shoulder **52** of housing **11** by means of an outer retainer ring **54** and spacer **56**. The spacer **56** may be made as an integral part of retainer ring **54** and is used so that the internal parts of the valve will not become dislodged when the container is subjected to impact. Each part which contacts the lips **42** and **50** of diaphragm **40** has an annular groove, not shown, in contact with the respective lip to assure that air does not leak past the diaphragm **40**.

An integral sand-moisture trap **60** and spring seat **62** may be placed on top of spacer **56**. The sand-moisture trap **60** includes air outlet ports **61** and has an outer, upstanding wall portion **64** and an inner upstanding wall **65** which is spaced from wall **64** forming an annular chamber **67** therewith. A moisture and sand deflection plate **66** rests on top of the wall **64**. The plate **66** has a substantially flat recessed portion **68**, a sloping wall **70** and spaced, horizontally extending teeth **72** (FIG. 4).

The slope of the wall **70** is such that it will impart an angle of incidence to air coming in contact therewith such that the angle of reflection of the air will tend to deflect sand and moisture which may be present in the air away from the interior portion of the breather valve **10**.

Sand and moisture which is not deflected by the plate **66** will be caught in the chamber **67** of the sand and moisture trap **60**.

A snap ring **80** retains the assembled parts of the breather valve **10** in position within the valve.

A spring **82** is calibrated to exert a closing force on valve seat **30** of sufficient magnitude to maintain the valve seat **30** closed until the pressure entering holes **84** in the bottom wall **14** of the housing **11** exerts a force on the diaphragm **40** exceeding the pressure to be maintained inside any container to which the breather valve may be attached.

The breather valve **10** may be installed in the wall A of a container and maintained in airtight relation therewith by tightening hexagonal nut **86** against wall A, washer **88** and gasket **90**. The gasket **90** may be installed in an annular groove **92** in a shoulder **94** which may be an integral part of the exterior portion of the upstanding wall **12**.

Referring to FIG. 2, the inlet valve **100** may be identical in structure to the outlet valve **10**, except that:

(1) The upstanding portion **16***a* of bottom wall **14***a* is not grooved and serves as a spring seat **102**;

(2) The spring seat **62***a* on sand-moisture trap **60***a* is grooved to receive the resilient valve **20**;

(3) The valve seat **30***a* and the diaphragm **40***a* are turned over to work in the opposite direction; and

(4) The valve seat **30***a* includes upstanding pins **104** which contact a cam **106** designed to unseat the valve seat **30***a* when knob **108** is turned to its "open" position (FIG. 5). Also, in the inlet valve **100**, one tooth **72***a* on plate **66***a* is recessed into a slot **109** in sand-moisture trap **60***a* to prevent the plate **66***a* from turning with the knob **108**. The knob **108** is turned to the "open" position to mechanically unseat the valve **100** to relieve a vacuum inside the container so that it may be opened without damaging it.

Referring to FIG. 3, a special fitting or coupling **150** has a cylindrical core **152** which is tapped at one end as shown at **154**. The opposite end of the core **152** has a flange **156** surmounted by an annular, resilient gasket **158**. The core **152** is surrounded by a spring **160** and a casing **162**. A flange **164** at the top of the casing **162** includes dowel pins, such as the one shown at **166**, which are adapted to engage slots **168** (FIGURES 4 and 5) in the breather valves **10** and **100**. The coupling **150** may be placed over the valves **10** and **100** so that the resilient gasket **158** contacts the chamfered portions **170** and **172** of valves **10** and **100**, respectively (FIGURES 1 and 2).

When the casing **162** of coupling **150** is depressed against the spring **160** and rotated, the dowel pins **166** engage annular grooves **174** and **176** in the valves **10** and **100**, respectively. Thus, the coupling **150** forms an air tight connection with the valves **10** and **100**.

In operation, the valves **10** and **100** are placed in the wall A of a guided missile container. The container is sealed and a first coupling **150** is attached to inlet valve **100** while a second coupling **150** is attached to the outlet valve **10**.

A filler nozzle, not shown, may be attached to the tapped end of the core **152** of the first coupling **150** and a pressure gauge, not shown, may be attached to the core **152** of the second coupling **150**. The container is then submerged in water and filled with air until a reading appears on the gauge at the outlet valve **10** indicating that it has opened. The gauge may then be read to see if the outlet valve **10** has opened at the proper pressure. Air to the inlet valve **10** is then cut off, and the gauge at the outlet valve **10** is observed to determine if the valve has closed. The container will then be full of air at a pressure just under the opening pressure of outlet valve **10** and the entire surface of the container may be observed for leaks.

After the container has been removed from the water, a missile may be placed therein and the container closed at ambient pressures.

During ascent the container builds up a positive pressure. When this reaches the operating range of the outlet valve **10** a high-flow air exchange compensates for altitude changes. During level flight the valve **10** is inoperative and the container retains a positive pressure.

During descent the container develops a vacuum and the intake valve **100** operates. Again the flow compensates for the altitude change until descent ceases. At ground level the container retains a vacuum equivalent to the operating pressure of the intake valve **100**.

During ground storage the valves **10** and **100** are essentially static. Extremely wide temperature variations are compensated for by valve action, but diurnal changes are not usually great enough to activate the valves.

Valves of our invention are usually mounted in one end of the container, with other accessories such as the humidity indicator. The intake valve **100** may be mounted in the desiccant access door, if an access is used. This assures drying of the incoming air. Recessed and covered receptacles, not shown, are generally provided to protect the valving. However, successful containers have been designed with the valves exposed and just within the maximum projection of the container.

It will be obvious that the embodiment of the invention shown in the drawings can be modified without departing from the spirit and scope of the invention. Accordingly, it is to be understood that we do not wish to limit ourselves to the exact details of construction shown herein for purposes of exemplification but not of limitation.

We claim:

1. A low-pressure, high-flow breather valve for controlling the pressure within a closed container comprising; an open-topped housing having an upstanding sidewall and a bottom wall; ports in said bottom wall; a valve seat including a spring seat and a sidewall; said sidewall of said valve seat encompassing said spring seat; a convoluted, torus-shaped, flexible diaphragm having an inner lip and an outer lip; said diaphragm encircling the sidewall of said valve seat and having said inner lip affixed thereto; the outer lip of said diaphragm being affixed to the sidewall of said housing; an annular, resilient valve member mounted in said housing adjacent said valve seat; a spring having one end mounted in said spring seat and another end mounted in said housing in such a manner that said spring biases said valve seat in valve closing direction; and a sand-moisture trap rigidly mounted in said open top of said housing superjacent said valve seat; said trap including passage means placing said open-top of said housing in fluid communication with said valve seat, an annular chamber and a sand-moisture deflecting plate; said plate being mounted superjacent said annular chamber and including a substantially flat, recessed portion and a sloping wall exposed directly to ambient atmosphere.

2. A low-pressure, high-flow breather valve for exhausting gaseous media from a container comprising; an open-topped housing having an upstanding sidewall and a bottom wall; a cylindrical, upstanding boss mounted on said bottom wall; a resilient, annular valve member supported by said bottom wall in encircling engagement with said boss; a valve seat encompassing said boss superjacent said resilient valve member; said valve seat including an upstanding wall encompassing a first spring seat; a convoluted, flexible diaphragm having one lip affixed to the wall of said valve seat in encircling engagement therewith and another lip affixed to the sidewall of said hous-

ing; ports in said bottom wall for admitting gaseous media to one side of said diaphragm; a sand-moisture trap rigidly mounted in said open top superjacent said valve seat; said trap including a second spring seat, an annular chamber, ports, and a sand-moisture deflecting plate; said ports being intermediate said chamber and said second spring seat; said plate including apertures and being mounted in said open top superjacent said chamber; and a spring having one end mounted in said first spring seat and another end mounted in said second spring seat, whereby said spring biases said valve seat in valve closing direction.

3. A low-pressure, high-flow breather valve for admitting gaseous media to a container comprising; an open-topped housing having an upstanding sidewall and a bottom wall; a cylindrical, upstanding boss mounted on said bottom wall; an upstanding spring encircling said boss; a valve seat mounted in said housing superjacent said boss; said valve seat having a depending wall and a spring seat; said depending wall of said valve seat encompassing said spring seat in spaced relation; the end of said spring remote from said boss seating in said spring seat; a convoluted, flexible diaphragm having one lip affixed to the depending wall of said valve seat in encircling engagement therewith and another lip affixed to the sidewall of said housing; ports in said bottom wall; a sand-moisture trap rigidly mounted in said open-top superjacent said valve seat; said trap including cylindrical valve supporting means depending into said valve seat, an annular chamber formed by an outer, upstanding wall and a spaced, inner upstanding wall, air inlet ports intermediate said chamber and said cylindrical valve supporting means, and a sand-moisture deflecting plate rigidly mounted in said housing superjacent said annular chamber; said plate having apertures placing said open-top of said housing in fluid communication with said air inlet ports; and a resilient, annular valve member supported by said valve supporting means; said spring biasing said valve seat against said resilient valve member.

4. The breather valve of claim 3 including also means for mechanically unseating said valve seat.

5. The breather valve of claim 4 characterized in that said unseating means comprises upstanding pins rigidly affixed to said valve seat and a cam rotatably mounted on said sand-moisture deflection plate superjacent said pins.

6. The breather valve of claim 1 including also a slotted flange having a chamfered inner periphery and being an integral part of the top of the sidewall of said breather valve housing.

7. A coupling member in combination with the breather valve of claim 6, said coupling member comprising, a cylindrical core having a threaded end and a flanged end, a gasket encircling said flanged end, said gasket seating on said chamfer, and a casing surrounding said core, said casing having dowel pins engaging said slotted flange.

References Cited in the file of this patent

UNITED STATES PATENTS

610,359	Lees	Sept. 6, 1898
1,035,803	Mintz	Aug. 13, 1912
1,783,646	Hajek	Dec. 2, 1930
1,945,760	Strouf	Feb. 6, 1934
2,067,924	Illsley	Jan. 19, 1937
2,452,612	Swenberg	Nov. 2, 1948
2,666,278	Metasovic	Jan. 19, 1954
2,859,770	Buivid	Nov. 11, 1958

FOREIGN PATENTS

28,982	Great Britain	Dec. 22, 1911