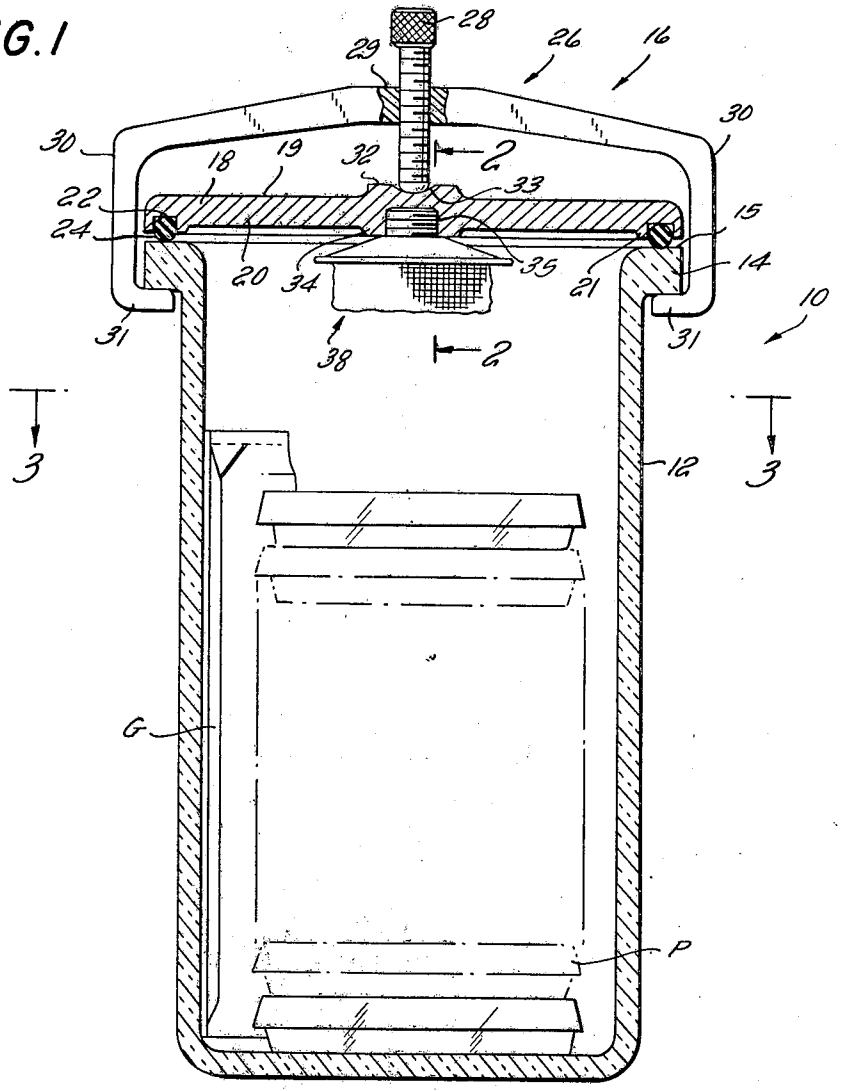
Dec. 9, 1969 J. H. BREWER 3,483,089

ANAEROBE JAR CLOSURE ASSEMBLY

Filed May 31, 1966 2 Sheets-Sheet 1

FIG. 1



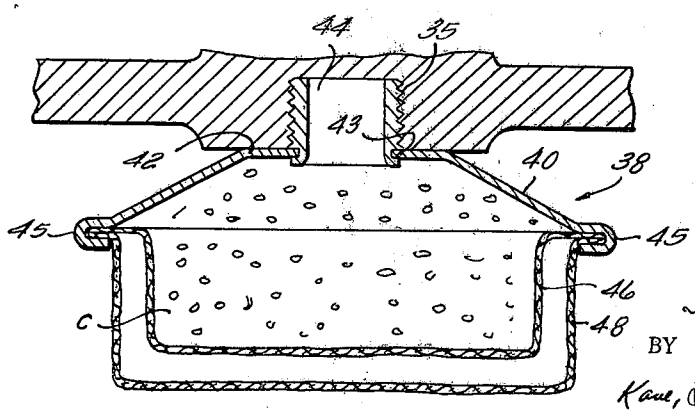


FIG. 2

INVENTOR.
JOHN H. BREWER
BY
Kane, Dalsimer, Kane & Smith
ATTORNEYS

Dec. 9, 1969 J. H. BREWER 3,483,089

ANAEROBE JAR CLOSURE ASSEMBLY

Filed May 31, 1966 2 Sheets-Sheet 2

FIG. 3

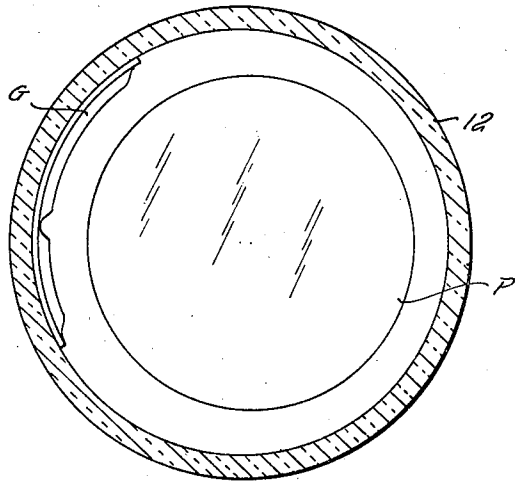
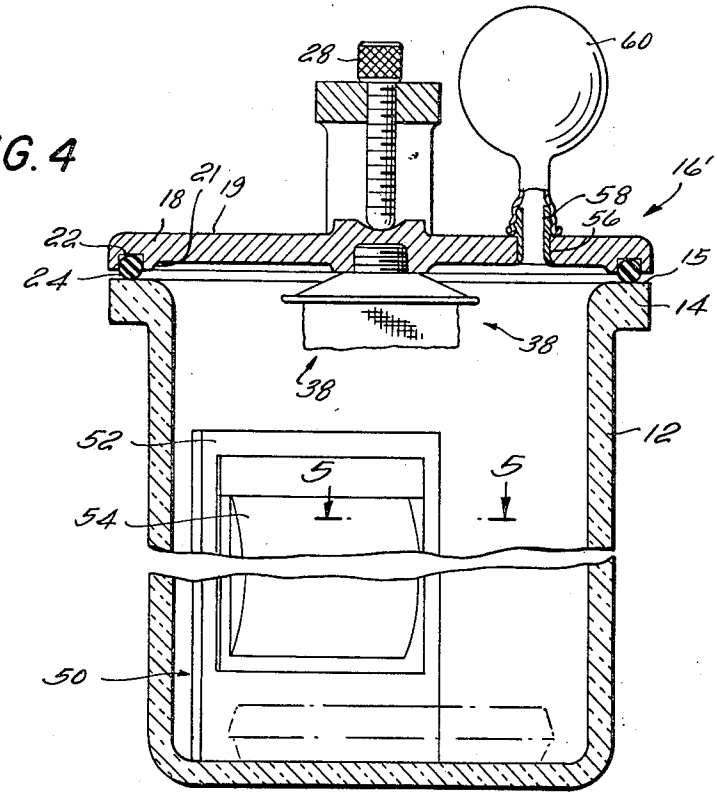


FIG. 4



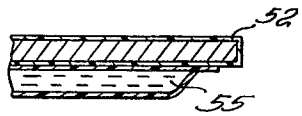


FIG. 5

INVENTOR
JOHN H. BREWER

BY
Kane, Dalsimer, Kane & Smith
ATTORNEYS

United States Patent Office 3,483,089
Patented Dec. 9, 1969

3,483,089

ANAEROBE JAR CLOSURE ASSEMBLY

John H. Brewer, Towson, Md., assignor to B-D Laboratories, Inc., East Rutherford, N.J., a corporation of Delaware

Filed May 31, 1966, Ser. No. 553,823
Int. Cl. C12b 1/10
U.S. Cl. 195—127 2 Claims

ABSTRACT OF THE DISCLOSURE

An improved cover for an anaerobe jar assembly adapted to be mounted on the open end of the anaerobe jar in sealing engagement therewith. A clamping device which includes a clamping strap of greater length than the diameter of the open end of the jar and which extends across the cover and is formed with depending end portions with means for engaging beneath the exterior of the flange of the jar and a clamping screw extending through the strap in threaded engagement therewith to engage the top surface of the cover so as to releasably hold the cover in place on the jar.

This invention relates to an improved anaerobe jar assembly and more particularly to an improved closure assembly capable of being mounted on a container member so as to provide a portable anaerobic jar which includes gas generating and catalyst means thereby obviating the necessity of providing laboratory equipment for culturing anaerobic microorganisms.

Anaerobe jars, such as disclosed in my prior U.S. Patent No. 2,463,143, granted Mar. 1, 1949, are presently in use. The anaerobe jar disclosed therein comprises a container member having a flanged upper surface for receiving a cast metal closure means preferably made from bronze. The closure means is provided with a gas inlet opening and a heating element is suitably mounted thereon. The heating element is sealed in a brass container surrounded by a plantinized catalyst wire. A fine wire safety screen encloses the heating element and catalyst wire. The outer peripheral edge of the cover is provided with a relatively flat, flanged surface so that when mounted to the upper flanged surface of the jar an airtight seal is formed therebetween. To facilitate such a seal a suitable lubricant is employed.

Such an apparatus, although quite suitable for culturing anaerobic microorganisms in an equipped laboratory, is not completely portable, that is, it cannot be readily employed in the field where laboratory equipment is not readily available for operating the jar assembly. For example, vacuum pumps, an anaerobic gas source and an electrical power source required in operation for reacting the oxygen contained in the jar with hydrogen to provide an oxygen-free atmosphere are normally not available.

It is an object of the present invention to overcome the disadvantages heretofore encountered and to provide a portable anaerobe jar assembly having an improved closure therefor.

Another object of the invention is to provide an improved closure assembly which does not require inlet and outlet openings for the attachment of vacuum pumps and anaerobic gas sources. Further, it is an object to obviate the necessity of an electrical power source for reacting with the oxygen contained in the jar with the hydrogen from the anaerobe gas source to provide an oxygen-free atmosphere.

It is another object of this invention to provide a clamping means which will seal the anaerobe jar yet disengage from the anaerobe jar when an excess of gas pressure is

present within the jar thereby preventing the anaerobe jar assembly from exploding.

A further object of this invention is to provide an assembly jar having a catalyst for reacting with the gases in the jar and means to physically isolate the catalyst thereby to prevent the auto-ignition of gases present in the jar.

It is another object of this invention to provide an improved closure assembly which is readily adapted to existing anaerobe jars and which is relatively inexpensive to manufacture and simple to operate.

My invention generally provides an improved closure asembly for mounting on an anaerobe jar for culturing anaerobic microorganisms. The anaerobe jar is formed with an open upper end surrounded by an exterior flange for the receipt of the closure assembly. The closure assembly comprises a cover large enough to close and rest an the open upper end of the anaerobe jar and includes within the region of the cover periphery an annular cutout within which a sealing ring is disposed. The sealing ring, when the cover is received on the jar, rests on the exterior flange thereby to provide a seal between the cover and the open end of the jar. A clamping device for clamping the cover in sealing engagement with the open end of the jar includes a clamping strap of a length so as to span the diameter of the cover. The clamping strap is formed with depending end portions together with means for engaging the underside of the exterior flange of the jar. The clamping strap is provided with a clamping screw which is in threaded engagement with the strap and in abutting engagement with the top surface of the cover. Also, the improved closure assembly may be provided with a relatively fine mesh screen or gauze which is mounted to the bottom surface of the cover for holding a catalyst for catalyzing the reaction between the oxygen of the atmosphere of the jar and the hydrogen or other reactants from the gas source within the jar so that the unreacted portion of the atmosphere contained in the jar is substantially oxygen free.

Other features of the invention will be best understood from the following description of the drawings which illustrate the improved anaerobe jar assembly and closure means, in which:

FIG. 1 is an elevational sectional view of my improved anaerobe jar assembly in which culture dishes are shown disposed in the jar in phantom;

FIG. 2 is a detailed elevational sectional view on an enlarged scale taken on the lines 2—2 of FIG. 1 showing a housing assembly containing a catalyst therein and mounted to the under surface of the closure means;

FIG. 3 is a sectional view taken on the lines 3—3 of FIG. 1 showing petri dishes and a disposable hydrogen generator gas source disposed in the container member;

FIG. 4 is an elevational sectional view of an anaerobe jar illustrating a modified embodiment of the closure assembly and having disposed therein a disposable anaerobic assembly; and

FIG. 5 is a partially sectional view taken on the lines 5—5 of FIG. 4.

Referring to the drawings and principally to FIGS. 1 and 2, the anaerobe jar assembly is generally indicated by the numeral **10**. Container member or jar portion **12** is of a construction which is similar to that construction of the jar as described in my U.S. Patent No. 2,463,143. Thus, container member **12** at its open end is provided with a flange **14** having a substantially flat upper surface **15** for mounting closure assembly **16** in airtight sealing engagement thereon. The materials employed for making container member **12** may vary, for example, glass, rigid plastic or metal can be used. The latter two materials are preferred when employing anaerobe jar assembly **10** for use outside of the laboratory as a portable unit so as to

reduce the possibility of accidentally breaking the container in transport or other handling mishaps. However, the anaerobe jar assembly as disclosed herein is completely portable regardless of the materials employed for container member **12**.

My improved closure assembly **16** comprises a cover **18** having a generally flat top surface **19**. Bottom surface **20** of cover **18** is formed with a depending annular rim **21** at the periphery thereof and is provided with a channel or groove **22** for receiving a ring-shaped, replaceable, resilient washer, gasket or O-ring **24** so that when closure assembly **16** is mounted on flat upper surface **15** of container member **12**, an airtight seal is formed therebetween.

Clamping means **26** is adjustably mounted to cover **18** by threaded stud **28** which is in threaded engagement with clamping means **26** through threaded opening **29**. Clamping means **26** comprises: a central bridging portion having a pair of depending arms **30** which are bent inwardly at their ends **31** so as to form a substantially U-shaped clamp. End portions **31** are positioned under flange **14** of container member **12** so as to removably mount closure assembly **16**. When threaded inwardly of the central bridging portion, clamping means **26** will be forced in an upward position so that ends **31** will be forced against a portion of flange **14** thereby compressing resilient member **24** so as to effect an airtight seal between the cover member **18** and container member **12**. Clamping means **26** is preferably made of metal having spring-like characteristics. Further, the clamping means is sufficiently resilient so as to be yieldable thereby to allow the end portions **31** of clamping means **26** to disengage from flange **14** when a pressure in excess of a maximum gas pressure is formed within the anaerobe jar assembly. Thus, rupture of the container is obviated. Therefore, the clamping means **26** is so designed as to assure absolute safety of personnel when using the assembly for culturing anaerobic microorganisms.

To help center the stud **28**, a raised annular surface **32** is formed on the upper surface of cover **18** and is provided with a generally semispherical recess **33** to insure centering of clamping means **26**.

Bottom surface **20** of cover **18** is provided with an annular raised portion **34** preferably in the center of cover **18** thereby to be opposite the annular raised portion **32** on the top surface thereof. This provides a sufficient amount of material so that a threaded zone or opening **35** may be formed therein to provide a means for mounting housing assembly **38** in which a catalytic agent C is disposed. Housing assembly **38**, clearly illustrated in FIG. 2, includes a cap **40** that is formed generally in the configuration of a truncated cone. The flat upper surface **42** of cap **40** is provided with an opening **43** to receive threaded stud **44**. Threaded stud **44** may be rigidly mounted in opening **43** of cap **40** so that housing assembly **38** may be removably mounted on cover **18** in threaded opening **35**. Alternatively, cover **18** may be provided with a rigidly mounted stud having a threaded zone extending downwardly therefrom to threadedly engage housing assembly **38** thereon. Cap **40** is provided with a generally laterally extending annular rim **45** formed at the end portions thereof so as to provide a means for mounting a relatively fine wire mesh screen **46** by simply crimping annular rim **45** in the form of a U so as to rigidly mount screen **46** therein. If desired, second screen **48** may be mounted on cap **40** at annular rim **45** along with screen **46** as shown in FIG. 2. Second screen **48** may or may not be of the same mesh size as screen **46** although second screen **48** is a protective screen and should generally be of a smaller mesh size so as to insure that no particles of catalyst will fall into jar **12**. In addition, second screen **48** acts as a safety screen flame arrester. For example, if catalyst C becomes hot as a result of catalyzing the reaction between the oxygen present in container **12** and the hydrogen obtained from the anaerobic gas source to form water vapor, hot spots will form on screen **46**. If sufficient heat energy is present, the auto-ignition temperature of hydrogen and oxygen may be reached and cause an explosion or fire. However, screen **48** is spaced from screen **46** so that a temperature gradient is set up therebetween thereby maintaining the temperature below the auto-ignition temperature of the gases present.

In practice, catalyst C will be disposed in screen **46** prior to mounting to cap **40**. When all of the catalyst has been used, the entire housing assembly **38** is removed and catalyst C is either regenerated by standard procedures or discarded and a new assembly inserted in its place.

Generally, it has been found that catalyst C may be provided in the form of pellets, such as 0.5% platinum on ⅛" alumina which is readily purchased from Engelhard Precious Metals, Catalyst Chemical Division, Newark, New Jersey. Further, it has been found that from 5 to 50 pellets of catalyst are sufficient to insure complete reaction of the oxygen within the container. Varying proportions of platinum may be applied on the alumina if desired. Other metals may be substituted for platinum, for example, palladium, rhodium or the like. Also, the size of the pellet may vary; however, ⅛" to ¼" has been found to be quite suitable.

FIG. 4 illustrates a modified closure assembly **16'** which is identical in construction to the closure assembly illustrated in FIG. 1, except that an opening **56** is provided therein. An adapter **58** is mounted in the opening so as to provide a mounting means for collapsible expansion chamber **60**. Collapsible expansion chamber **60** may be made of any elastomeric material such as rubber or a suitable plastic which will permit any excess gas contained in the anaerobe jar assembly to freely expand therein. In most instances, collapsible chamber **60** will be in the expanded condition prior to the elimination of the oxygen contained in the assembly.

Disposed within container **12** is an indicator assembly **50** which visually aids the operator of the anaerobe jar to determine when anaerobic conditions are present therein. Indicator assembly **50** comprises backing sheet **52** which is preferably made of cardboard and coated with a plastic material such as polyethylene so as to render it non-absorbent. Backing sheet **52** is preferably formed having a white background so as to readily note a color change in indicator solution **55**. Backing sheet **52** may also be made of a plastic material either transparent or having a white background. A flexible plastic envelope **54** which is impermeable to liquid but permeable to gases is mounted to backing sheet **52**. Flexible plastic envelope **54** is preferably made of polytetrafluoroethylene since this plastic material is extremely permeable to oxygen transfer. An aqueous solution containing equal parts of 60% tri(hydroxymethyl) amino methane, 4% dextrose and 0.02% methylene blue is placed in envelope **54** and sealed. A volume of 1.5 ml. is sufficient for most purposes. Envelope **54** may be readily mounted to backing sheet **52** by stapling through a tab portion formed on envelope **54** or may be mounted thereon with a suitable adhesive. When oxygen is present in the anaerobe jar, indicator solution **55** will remain a blue-like color. However, as soon as substantially all of the oxygen has been removed, indicator solution **55** turns colorless and indicates anaerobic conditions. Methylene blue acts as a hydrogen acceptor and loses its blue color in the reduced form. When substantially all of the oxygen has been removed from the gaseous atmosphere, the indicator solution is colorless or leuco in form. This reaction is readily reversed by exposing indicator solution **55** to air or other oxygen sources.

After catalyst C has catalyzed the reaction between the oxygen of the atmosphere with the hydrogen from the gas source to form water vapor, the excess volume of gas will be withdrawn from collapsible expansion chamber **60** so that while the anaerobe jar is in operation, expansion chamber **60** is in a collapsed condition. Also, collapsible

expansion chamber **60** is constructed as a means for releasing excess pressure within the anaerobe jar assembly in the event an excess amount of gas is accumulated, thus obviating the danger of the jar assembly from exploding. As stated previously, clamping means **26** is constructed so as to be releasable from flange **14** of container **12** in the event an excess amount of pressure is generated within the anaerobe jar assembly.

When employing my improved portable anaerobe jar assembly, anaerobic microorganisms to be cultured are placed in container **12**, using conventional petri dishes P, as illustrated in FIG. 1 in phantom. To provide a ready anaerobic gas source which requires no special storage cylinders, metering valves or the like, a gas generating device G, as disclosed in my U.S. Patent No. 3,246,959 and which is commercially available, may be employed.

The invention disclosed therein provides an envelope having a material disposed therein for evolving a predetermined amount of gas. The envelope is formed having a plurality of chambers. One of the chambers is provided with a material such as magnesium turnings, sodium chloride and zinc chloride which, when mixed with a liquid, such as water, evolves or generates hydrogen as the non-toxic gas or atmosphere suitable for culturing anaerobic microorganisms. Another chamber receives a liquid and transfers it at a controlled, relatively slow rate to the first chamber, whereby the gas or atmosphere is evolved at a similarly controlled slow rate. In most instances, it is preferred that the gas evolved is hydrogen so that the hydrogen present will react with the oxygen contained in the air in the presence of catalyst C to form water vapor, thereby providing an anaerobic atmosphere suitable for culturing microorganisms. At the time the gas is evolving, closure assembly **16** is placed in position on container member **12**. The clamping means **26** secures closure assembly **16** thereon in airtight relation. Since the amount of gas being generated is a predetermined volume, as disclosed in my above-referenced U.S. patent, the possibility of explosion of the jar assembly is substantially eliminated.

If desirable, indicator assembly **50** may also be placed within the anaerobe jar assembly so that the operator can visually observe when anaerobic conditions are present by the change in color of indicator solution **55** and also observe whether any leaks of air or other oxygen sources are passing into the anaerobe jar assembly.

The anaerobe jar assembly is then placed in a thermal atmosphere suitable for the growth of anaerobic microorganisms. The thermal atmosphere is generally maintained at a temperature of 36–37° C.; however, this temperature may be varied where specific microorganisms require different temperatures for optimum growth.

By following the above procedure for operating an anaerobe jar assembly having my improved closure assembly, it is obvious that the assembly is completely portable, requires no laboratory equipment for providing an anaerobic gas source which necessitates metering valves and requires no power source for catalyzing the reaction between the oxygen present in the container with the hydrogen or other reactants from the gas source to form water vapor. The anaerobe jar assembly also requires no valves or openings in the cover assembly or container assembly for evacuating or pressurizing the jar to provide an anaerobic atmosphere. Also, the improved clamping means is such that it will be disengaged from the anaerobe jar so as to release the closure assembly therefrom when an excess of pressure is present within the jar, thereby preventing an explosion. In addition, the housing assembly for holding the catalyst is constructed to prevent the auto-ignition of gases present in the jar due to the heat encountered during the catalyzing of the reaction of the gases present in the jar.

The anaerobe jar with the improved cover assembly is inexpensive to manufacture and relatively easy to construct and may be employed using non-technical laboratory personnel.

I claim:

1. A closure assembly for hermetically sealing a portable anaerobe jar having an open upper end-surrounded by an outwardly flanged annular lip, said closure assembly comprising a cover member for said jar, said cover member being of a size to rest upon and substantially completely overlay said outwardly flanged annular lip and including cut-out portion in the undersurface adjacent the peripheral edge adapted to receive a sealing ring; a sealing ring disposed in said annular cut-out thereby to engage the flanged annular lip surface of said anaerobe jar when said cover member is received thereon to provide an hermetic seal between the cover member and the jar; means supporting a catalytic agent on the underside of said cover member so that when the cover is mounted on and in sealing engagement with the flanged annular lip said catalytic agent will be spatially removed from an anaerobic gas generator adapted to be disposed within the jar for evolving hydrogen gas yet positioned in fluid contact with the generated gases and an oxygen atmosphere within the jar thereby to catalyze the reaction between said hydrogen gases and the oxygen atmosphere and to create anaerobic conditions within the jar whereby a charge of anaerobic microorganisms disposed within the jar may be cultured, said catalytic agent supporting means including a substantially cup shaped screen having openings of a size less than the size of the catalytic agent therein for supporting said catalytic agent and a second cup-shaped screen in surounding spaced relation to the catalytic agent supporting screen to provide a flame arrestor means so that a temperature gradient is formed between the screens thereby to maintain the temperature below the auto ignition temperature of the gases present; and clamping means for securing the cover in sealing engagement with the flanged annular jar lip, said clamping means defined by a resilient clamping strap of length to span the cover and which includes at each end a downward depending finger portion including means for engaging the undersurface of said outward flanged jar lip, said clamping means being formed of a material having a spring-like characteristic so that said clamping means sealingly secures said cover member on said flanged annular lip surface yet being of sufficient resiliency so as to be yieldable and disengageable from the undersurface of said outward flanged lip to release the cover member from the jar upon the occurrence of internal pressures in excess of a maximum predetermined pressure thereby to prevent damage to the jar and closure member, and a clamping screw having an end in engagement with the top surface of the cover and passing through the strap in threaded engagement so that said cover may be removably and sealingly mounted on said jar.

2. The closure assembly as set forth in claim **1** wherein said cover member is formed with an opening communicating the interior of the jar to the atmosphere and comprising a connector sealingly mounted in said opening, and a collapsible expansion chamber supported by the connector on the upper surface of the cover member for receiving excess atmosphere contained in said jar.

References Cited

UNITED STATES PATENTS

1,137,388	4/1915	Earp-Thomas	195—54
2,279,991	4/1942	Hotchkiss.	
2,348,448	5/1944	Brewer.	
2,463,143	3/1949	Brewer	195—127
3,000,706	9/1961	Royce	195—103.5 XR

ALVIN E. TANENHOLTZ, Primary Examiner

U.S. Cl. X.R.

23—232, 254; 215—88, 89, 94