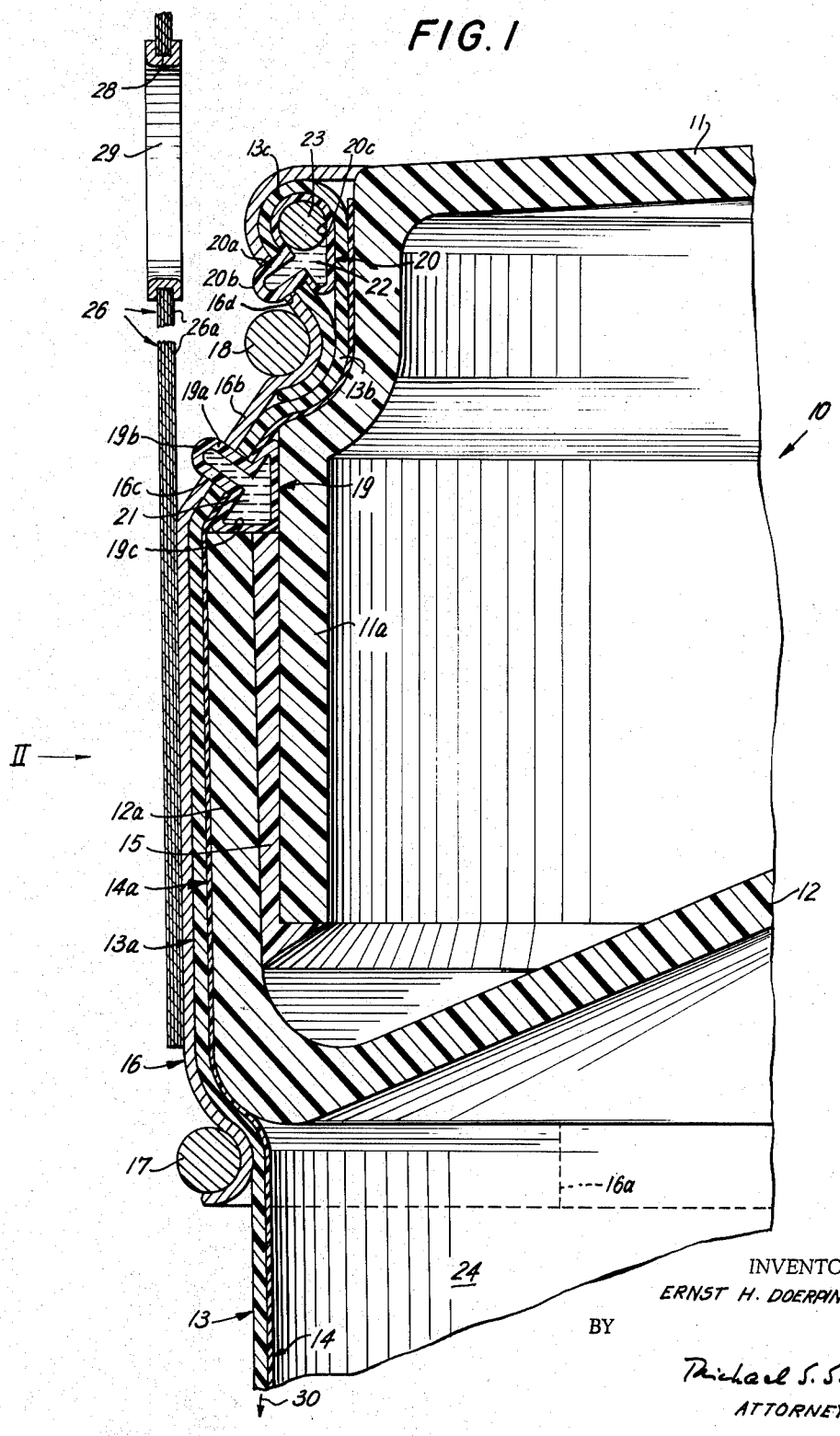
Nov. 23, 1965 E. H. DOERPINGHAUS 3,219,082

COLLAPSIBLE CONTAINER

Filed Feb. 14, 1962 3 Sheets-Sheet 1

FIG. 1

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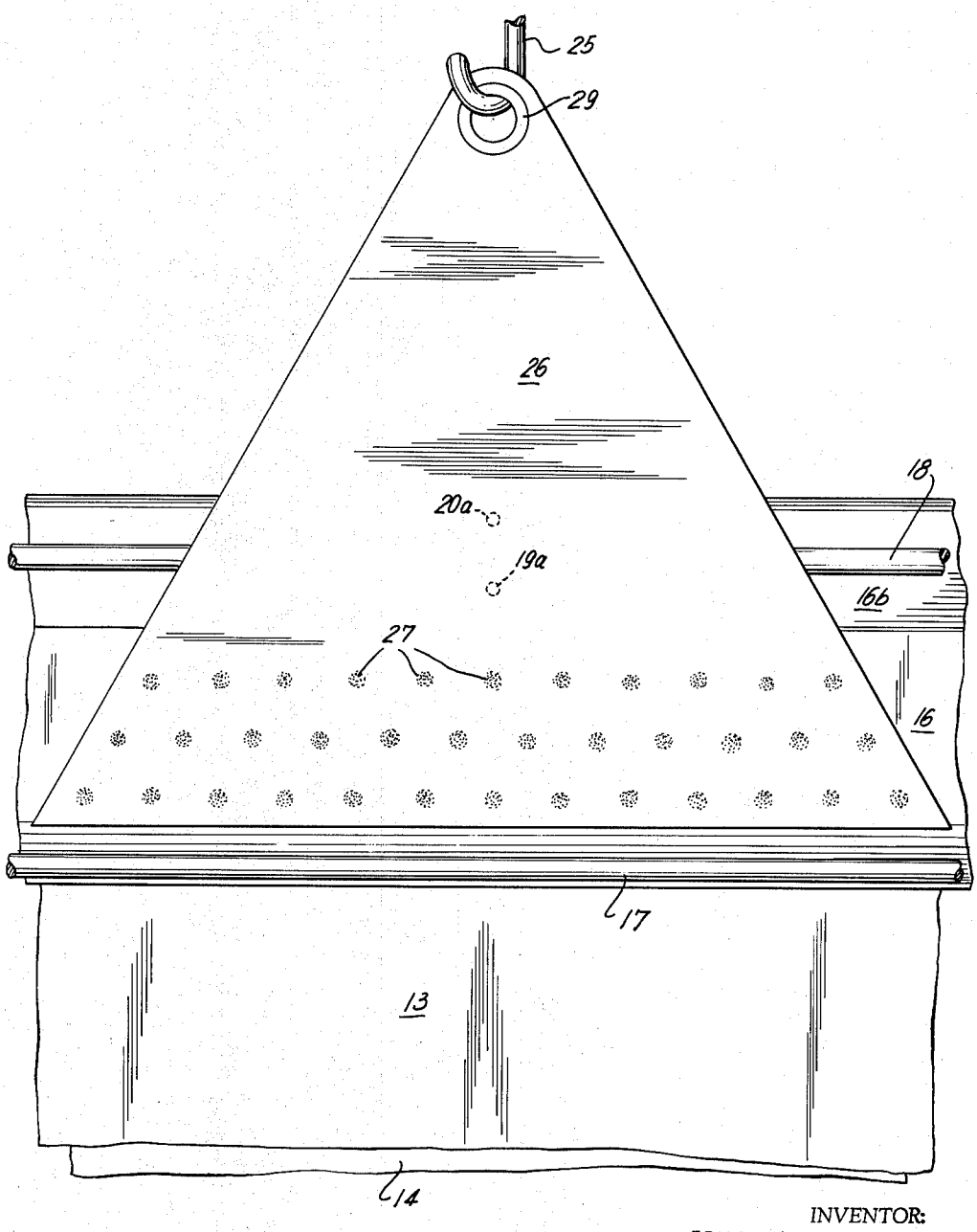
Filed Feb. 14, 1962 3 Sheets-Sheet 2

FIG. 2

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Filed Feb. 14, 1962 3 Sheets-Sheet 3

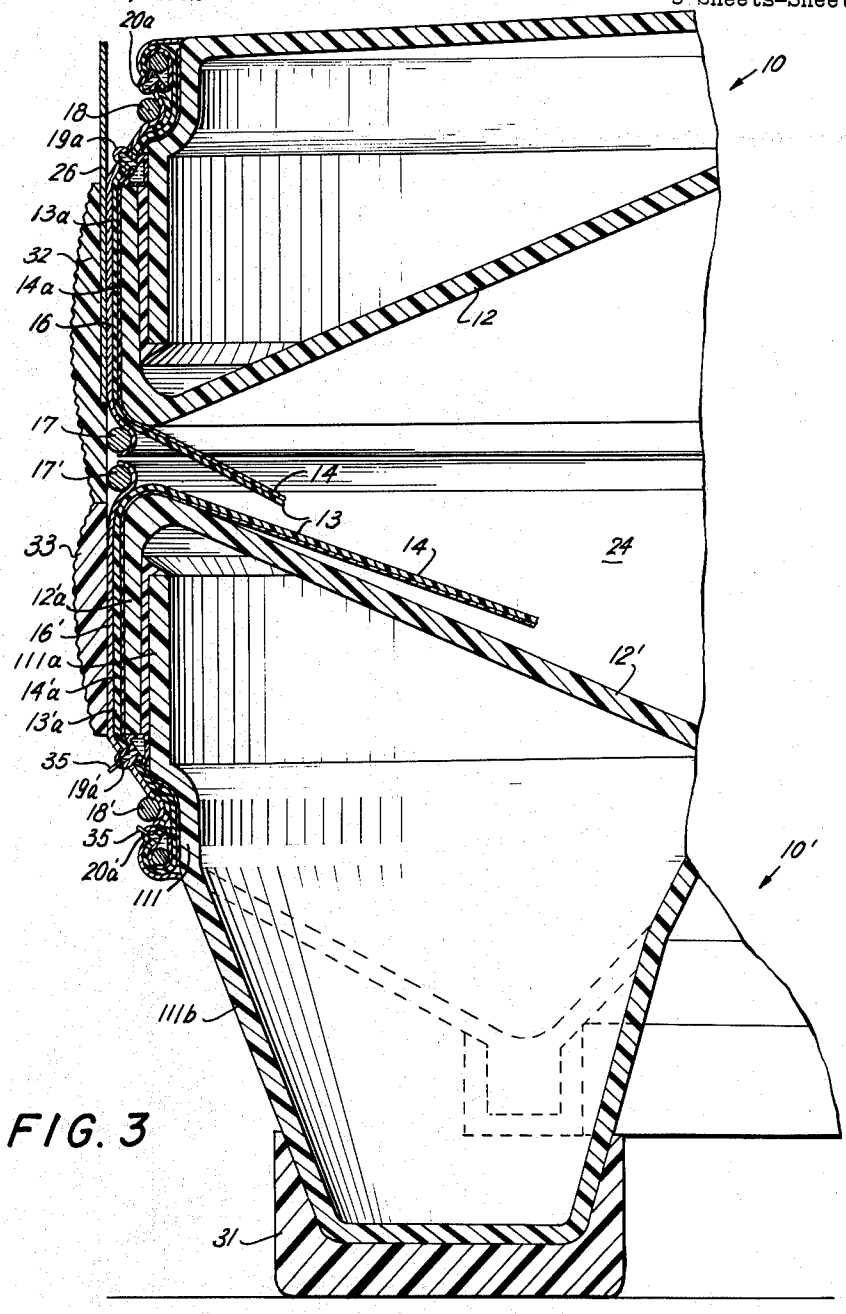


FIG. 3

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3,219,082

# COLLAPSIBLE CONTAINER

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15 Claims. (Cl. 150—.5)

The present invention relates to improvements in collapsible containers comprising a rigid cover member, a rigid bottom member and one or more flexible tubes extending between these members. Containers of this general character are disclosed in my copending applications Serial Nos. 65,105 and 72,363. More particularly, the invention mainly relates to improvements in connections between the rigid and flexible components of such containers.

An important object of the invention is to provide a container of the above outlined characteristics wherein the connections between the flexible component or components and the rigid components remain fluidtight even though the flexible components are separable from the rigid components.

Another object of the invention is to provide improved biasing or sealing means between the rigid and flexible components of a collapsible container.

A further object of the invention is to provide a container of the above outlined type wherein the seal between the flexible and rigid components may be established or terminated in a very simple and time-saving manner.

An additional object of the invention is to provide an improved suspension facilitating system for a container of the above outlined characteristics so that the normally hollow upper end member of the container is not subjected to undesirable deforming stresses when the container is lifted or towed in actual use.

A concomitant object of the invention is to provide a very simple centering device for the end members of a collapsible container which is constructed and assembled in such a way that it may also serve as a means for facilitating rolling of the container along the ground when the container is in collapsed condition.

With the above objects in view, the invention resides in the provision of a collapsible container which comprises a first and a second rigid end member, a first and a second annular clamping member respectively surrounding the first and the second end member, at least one tubular element of flexible material whose end portions are respectively received between the first and second members, and special biasing means provided between at least one clamping member and the respective end member for sealing the cargo chamber defined by the flexible element from the surrounding atmosphere.

Certain other features of the invention reside in special construction of the biasing means, in the provision of special suspension facilitating means which are mounted on one of the clamping members in close proximity of the respective end portion of the flexible element so as to prevent undesirable deformation of the respective end member when the container is suspended, in the provision of centering annuli on the clamping member or members which enable an operator to collapse the container into a shape in which it may be rolled along the ground, and in the provision of special tightening means for the clamping members so that the latter may be separated from the respective end members in order to provide access to the cargo chamber of the container in the event that the cargo cannot be evacuated through the customary discharge opening or openings of the container.

The novel features which are considered as characteristic of the invention are set forth in particular in the



appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following detailed description of certain specific embodiments with reference to the accompanying drawings, in which:

FIG. 1 is a fragmentary central vertical section through the top portion of a container which embodies my invention;

FIG. 2 is a smaller scale fragmentary front elevational view of the container as seen in the direction of the arrow II in FIG. 1; and

FIG. 3 is a fragmentary central vertical section through a slightly modified container, showing the container in collapsed condition in which the two clamping members are centered by an annular centering element secured to the upper clamping member of the container.

Referring now in greater detail to the illustrated embodiments, and first to FIG. 1, there is shown the upper part of a collapsible container which includes a composite upper end member or cover **10** comprising an upper or outer shell **11** and a lower or inner shell **12**, a first flexible tubular element or mantle **13** whose tubular upper end portion **13***a* is detachably secured to the cover **10**, and a second flexible tubular element or liner **14** which is adjacent to the inner side of the mantle **13** and whose upper end portion **14***a* is also detachably secured to the cover **10**. The upper shell **11** has an annular flange **11***a* which extends downwardly and into the upwardly extending annular flange **12***a* of the lower shell **12** where it is retained by an epoxy filler **15**. The shells **11**, **12** preferably consist of suitable rigid synthetic plastic material.

The outer side of the composite cover **10** is surrounded by an annular clamping member **16** made of steel or another metallic material. This clamping member is slotted, as at **16***a*, and is held against radial expansion by a pair of externally applied metallic rings **17**, **18** so that the walls bounding the slot **16***a* actually abut against each other. The ring **17** is received in an external annular groove defined by the lower end portion of the clamping member **16**, and the other ring **18** is accommodated in a second external annular groove defined by the clamping member close to the upper end thereof. The rings **17**, **18** are provided with suitable adjusting means, not shown, e.g. screw locks having right-hand and left-hand threads, for facilitating tightening of the clamping member **16** about the end portions **13***a*, **14***a*.

The container further comprises a pair of fluid-inflated expandible gaskets **19**, **20** which serve as a means for biasing the tubular portions **13***a*, **14***a* into sealing engagement with the member **10** and/or **16**. In the embodiment of FIG. 1, the gasket **19** assumes the form of an elastic tube which is inserted into the space formed between the upper end face of the lower shell **12** and the adjacent conically converging portion **16***b* of the clamping member. The latter is formed with one or more apertures **16***c* for the fluid-admitting nipple or nipples **19***a* of the gasket **19**. The tip **19***b* of the illustrated nipple is sealed by hot welding and may be pierced by a needle or the like to permit introduction or evacuation of pressure fluid **21** which fills the internal space or pressure chamber **19***c* of the gasket **19**. The gasket **19** is preferably a thin-walled tube made of polyvinyl chloride or another synthetic plastic material and the fluid **21** is preferably maintained at a pressure of say five atmospheres to make sure that the tubular portions **13***a*, **14***a* are pressed with requisite force against the inner side of the clamping member **16**. The fluid **21** is preferably non-freezing water. The nipple **19***a* is a thick-walled tube. The other gasket **20** is of analogous construction. It comprises one or more nipples **20***a* extending through the aperture or apertures **16***d* provided in the

uppermost portion of the clamping member **16**, and an internal pressure chamber **20***c* which contains a supply **22** of non-freezing water. The tip **20***b* of the nipple **20***a* is sealed by hot welding and is punctured by a needle (e.g. of 2 mm. diameter) or the like when the liquid **22** is to be admitted to or evacuated from the chamber **20***c*. The chamber **20***c* accommodates a plastic ring **23** of circular cross section which imparts to the gasket **20** a shape necessary for deflection of the topmost zone of the end portion **13***a* so that this end portion comprises a section **13***b* adjacent to the outer side of the cover **10** and a bent-over flap **13***c* which partly overlaps the section **13***b* by surrounding the upper portion thereof and which is adjacent to the inner side of the clamping member **16**. The tubular end portion **14***a* of the liner **14** extends to the upper end of the member **16**, i.e. it need not be bent over the gasket **20**. It will be noted that the inflated gasket **20** biases the flap **13***c* against the clamping member **16** and that this gasket also biases the section **13***b* against the cover **10** so that the internal space **24** of the container is fluidtightly sealed from the surrounding atmosphere. The force necessary for retention of the tubular portions **13***a*, **14***a* between the members **10**, **16** is supplied by the tightening rings **17**, **18**. It will be readily understood that one of the gaskets **19**, **20** may be dispensed with or that more than two gaskets may be provided, if necessary. The lower gasket **19** is preferably adjacent to the non-overlapped zone of the section **13***b*, i.e. it is located at a level below the flap **13***c*. If desired, the ring **23** may be integral with the gasket **20**.

FIGS. 1 and 2 show improved means for facilitating suspension of the container on the hook **25** of a crane or the like. This suspension facilitating means comprises a series of apertured triangular plates **26** (only one shown) which are uniformly distributed about the cover **10** and which are secured to the clamping member **16** by spot welding indicated at **27**. Each plate **26** preferably assumes the form of a package of thin laminations **26***a* (see FIG. 1), and the upper portions of these plates extend beyond the cover **10** where they are formed with apertures **28** having their walls lined by reinforcing eyelets **29**. For example, the suspension facilitating means may comprise three or four plates **26**.

An important advantage of the improved suspension facilitating means is that the composite cover **10** is subjected to negligible bending or deforming stresses because the plates **26** are closely adjacent to the end portion **13***a* of the mantle **13**. When the container is filled with liquid, pulverulent or solid cargo, the tension resulting from the weight of the cargo acts in the direction indicated in FIG. 1 by the arrow **30**, i.e. it tends to pull the end portion **13***a* from the space between the members **10**, **16**. Heretofore, the container was suspended by eye bolts secured to the top plate of the shell **11**, i.e. inwardly of the end portion **13***a*. Consequently, the composite cover **10** was subjected to substantial bending or deforming stresses which are highly undesirable not only because they tend to separate the shell **11** from the shell **12** but also because they can cause leakage between the cover and the mantle **13**. It was found that the cover **10** exhibited signs of deformation if it was suspended on four eyebolts located inwardly of the clamping member **16** and if the weight of the cargo approximated or exceeded eight tons, i.e. about two tons per each eye bolt. Such deformation is effectively prevented if the suspension facilitating means is closely adjacent to the tubular portion **13***a* and is located at the outer side thereof.

FIG. 3 illustrates a slightly modified container in collapsed condition. This container comprises a second end member or bottom **10'** which is similar to the cover **10** and certain of its component parts are identified by the same reference numerals as utilized in FIG. 1, each followed by a prime. The end members **10**, **10'** are arranged in mirror symmetry and the latter comprises a slightly modified outer shell **111** having a downwardly extending annular corrugation **111***b* provided with external U-shaped ground-contacting leg members **31** (only one shown in FIG. 3) on which the container comes to rest. The flange **111***a* of the outer shell **111** is received in the flange **12***a'* of the inner shell **12'**.

The connection between the lower end portion **13***a'* of the mantle **13** and the lower end portion **14***a'* of the liner **14** on the one hand, and the lower end member **10'** and the lower clamping member **16'** on the other hand is analogous to that of FIG. 1. The reference numerals identifying parts of this connection are the same as utilized in FIG. 1, each followed by a prime.

The upper clamping member **16** is surrounded by a centering means in the form of an externally knurled or otherwise roughened anular element **32** which preferably consists of rigid synthetic plastic material and which is cemented or otherwise fixed to the outer side of the clamping member **16**. As shown, the lower portion of the annular element **32** extends beyond the member **16** so that it may receive the upper portion of the lower clamping member **16'** when the container is collapsed. A similar annular element **33** of smaller axial length is cemented to the outer side of the lower clamping member **16'** and abuts against the element **32** when the container is collapsed. The annular element **32** automatically centers the lower portion of the container in the upper portion by receiving the upper portion of the lower clamping member **16'**. In collapsed condition of the container, the mantle **13** and the liner **14** may be folded or otherwise deformed so as to be accommodated in the space between the inner shells **12**, **12'**. As disclosed in the aforementioned application Serial No. 65,105, the purpose of the liner **14** is to serve as a means for ejecting or for speeding up evacuation of cargo from the internal space **24**. This liner may also serve as a means for protecting the mantle **13** from corrosive or other undesirable action of the cargo, e.g. if the cargo is of such nature that it could attack the material of the mantle.

The elements **32**, **33** enable a workman to roll the collapsed container along the ground without damaging the clamping members **16**, **16'** or the tensioning rings **17**, **18**, **17'**, **18'**. If desired, these elements may consist of several sections so as to permit ready separation of the clamping members from the respective end members **10**, **10'**, for example, if the chamber **24** of the container is filled with viscous or like cargo which cannot be evacuated through the customary discharge opening or openings normally provided in the lower end member **10'**. In such instances, the workmen separate the clamping member **16** or **16'** and puncture the tips of the nipples **19***a*, **20***a* or **19***a'*, **20***a'* so as to permit convenient separation of the end portions **13***a*, **14***a* or **13***a'*, **14***a'* from the respective end members.

If the container is utilized for transportation of viscous or thermoplastic substances (e.g. paraffine) i.e. if it is necessary to periodically separate the tubular portions **13***a*, **14***a* or **13***a'*, **14***a'* from the respective end members, the nipples **19***a*, **20***a* and/or **19***a'*, **20***a'* are preferably provided with suitable valves **35**, shown in FIG. 3 on nipples **19'**, **20'**, which may be of the type utilized in inflatable tubes of automobile wheels. The exact construction of the valves **35** forms no part of this invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

**1.** In a collapsible container, in combination, a rigid

end member having a substantially annular outer side; a radially expansible and contractible annular clamping member disposed about said outer side; at least one flexible element having a tubular portion received between said members; means for biasing said tubular portion into sealing engagement with at least one of said members, said biasing means comprising at least one fluid-inflated expandible gasket located between said tubular portion and one of said members for biasing said tubular portion into sealing engagement with the other member; and tightening means arranged to bias said clamping member radially inwardly so that said tubular portion is clamped between said members.

2. In a collapsible container, in combination, a rigid end member having a substantially annular outer side; a radially expansible and contractible annular clamping member disposed about said outer side; at least one flexible element having a tubular portion received between said members; means for biasing said tubular portion into sealing engagement with at least one of said members, said biasing means comprising at least one fluid-inflated expandible gasket located between said tubular portion and one of said members for biasing said tubular portion into sealing engagement with the other member, said gasket having at least one fluid-admitting nipple extending outwardly through said clamping member; and tightening means arranged to bias said clamping member radially inwardly so that said tubular portion is clamped between said members.

3. In a collapsible container, in combination, a rigid end member having a substantially annular outer side; a radially expansible and contractible annular clamping member disposed about said outer side; at least one flexible element having a tubular portion received between said members, said tubular portion having a section adjacent to said outer side and a bent-over flap surrounding said section and inwardly adjacent to said clamping member; means for biasing said tubular portion into sealing engagement with said members, said biasing means comprising at least one fluid-inflated expandible gasket located between said section and said flap whereby said section and said flap are respectively biased into sealing engagement with said end member and with said clamping member; and tightening means arranged to bias said clamping member radially inwardly so that said tubular portion is clamped between said members.

4. In a collapsible container, in combination, a rigid end member having a substantially annular outer side; an annular clamping member disposed about said outer side; at least one flexible element having a tubular portion received between said members, said tubular portion having a section adjacent to said outer side and a bent-over flap partially overlapping said section and inwardly adjacent to said clamping members; and means for biasing said tubular portion into sealing engagement with said members, said biasing means comprising a first fluid-inflated expandible gasket located between said section and said flap so as to respectively bias said section and said flap into sealing engagement with said end member and with said clamping member, and a second fluid-inflated expandible gasket located between the non-overlapped zone of said section and said outer side for biasing said section into sealing engagement with said clamping member.

5. A collapsible container comprising, in combination, a first and a second rigid end member, each of said members having a substantially annular outer side; a first and a second clamping member respectively disposed about said first and said second end member; at least one flexible element having a first tubular end portion received between said first end member and said first clamping member, and a second tubular end portion received between said second end member and said second clamping member; and means for respectively biasing said tubular end portions into sealing engagement with at least one of said first and second members, each of said biasing means comprising at least one first fluid-inflated expandible gasket located between said first end portion and one of said first members for biasing said first end portion into sealing engagement with the other first member, and at least one second fluid-inflated expandible gasket located between said second end portion and one of said second members for biasing said second end portion into sealing engagement with the other second member.

6. A collapsible container comprising, in combination, a first and a second rigid end member, each of said members having a substantially annular outer side; a first and a second annular clamping member respectively disposed about said first and said second end member; at least one flexible element having a first tubular end portion received between said first end member and said first clamping member, and a second tubular end portion received between said second end member and said second clamping member; means for respectively biasing said tubular end portions into sealing engagement with at least one of said first and second members, each of said biasing means comprising at least one first fluid-inflated expandible gasket located between said first end portion and one of said first members for biasing said first end portion into sealing engagement with the other first member, and at least one second flued-inflated expandible gasket located between said second end portion and one of said second members for biasing said second end portion into sealing engagement with the other second member, each of said gaskets having at least one fluid-admitting nipple extending outwardly through the respective clamping member; and means for centering one of said clamping members with respect to the other clamping member, said centering means comprising an annular centering element disposed about and fixed to one of said clamping members and having a portion extending beyond said one clamping member so as to receive a portion of the other clamping member when said container is collapsed and the two clamping members are adjacent to each other.

7. A container as set forth in claim 6, further comprising a second annular centering element disposed about and fixed to the other clamping member, said second centering element abutting against said portion of the first mentioned centering element in collapsed condition of said container.

8. A collapsible container comprising, in combination, a first and a second rigid end member, each of said members having a substantially annular outer side; a first and a second annular clamping member respectively disposed about and fixed to said first and said second end member; at least one flexible element having a first tubular end portion received between said first end member and said first clamping member, and a second tubular end portion received between said second end member and said second clamping member; means for respectively biasing said tubular end portions into sealing engagement with at least one of said first and second members, each of said biasing means comprising at least one first fluid-inflated expandible gasket located between said first end portion and one of said first members for biasing said first end portion into sealing engagement with the other first member, and at least one second fluid-inflated expandible gasket located between said second end portion and one of said second members for biasing said second end portion into sealing engagement with the other second member; and means for facilitating suspension of said container, said suspension facilitating means comprising a plurality of apertured plates secured to the outer side of one of said clamping members and extending beyond said one clamping member in a direction away from the other clamping member.

9. A container as set forth in claim 8, wherein said plates are welded to the outer side of said one clamping

member and wherein each of said plates is a laminated structure having an aperture in that portion thereof which extends beyond said one clamping member.

**10.** In a collapsible container, in combination, a rigid end member having a substantially annular outer side; a radially expansible and contractible annular clamping member disposed about said outer side; at least one flexible element having a tubular portion received between said members; means for biasing said tubular portion into sealing engagement with at least one of said members, said biasing means comprising at least one fluid-inflated expandible gasket located between said tubular portion and one of said members for biasing said tubular portion into sealing engagement with the other member, said gasket having at least one valve-controlled fluid-admitting and fluid-evacuating nipple extending outwardly through said clamping member; and tightening means arranged to bias said clamping member radially inwardly so that said tubular portion is clamped between said members.

**11.** In a collapsible container, in combination, a rigid end member having a substantially annular outer side; annular clamping means diposed about said outer side, said clamping means comprising a slotted annular clamping member surrounding said outer side and at least one metallic ring surrounding said annular member so as to prevent radial expansion thereof; at least one flexible element having a tubular portion received between said members; and means for biasing said tubular portion into sealing engagement with at least one of said members, said biasing means comprising at least one fluid-inflated expandible gasket located between said tubular portion and one of said members for biasing said tubular portion into sealing engagement with the other member.

**12.** In a collapsible container, in combination, a rigid annular end member having two edge portions of reduced diameter along the opposite edges thereof; a radially expansible, contractable and detachable annular clamping member of rigid material surrounding said rigid annular end member and including also two edge portions of reduced diameter corresponding to and superimposed upon said edge portions of reduced diameter of said rigid annular end member; a flexible container wall including a tubular end portion located between said rigid annular end member and said annular clamping member; and tightening means surrounding at least one of said edge portions of reduced diameter of said annular clamping member biasing said reduced diameter edge portion of said clamping member inwardly so that said tubular end portion of said flexible element is clamped between the same and the corresponding reduced diameter edge portions of said rigid annular end member, while simultaneously movement of said annular clamping member relative to said rigid annular end member in axial direction thereof is prevented by engagement of said reduced diameter edge portions of said annular clamping member and the corresponding reduced diameter edge portions of said rigid end member.

**13.** In a collapsible container according to claim **12**, two tightening means each surrounding one of said edge portions of reduced diameter of said annular clamping member.

**14.** In a collapsible container according to claim **12**, said clamping member being slotted.

**15.** In a collapsible container according to claim **12**, said tightening means comprising a ring surrounding an edge portion of reduced diameter.

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