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Peltier

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[54] **DEVICE FOR PROVIDING FLUID COMMUNICATION BETWEEN TWO SEALED VESSELS**

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[51] **Int. Cl.**..... **B65d 47/12;** B67d 3/04; B67c 3/26

[58] **Field of Search** ..... 141/19, 311, 309, 319, 141/330, 329, 346, 363, 364, 368, 379, 383, 386, 391, 348; 128/218 M, 218 G, 218 S, 247, 272

[56] **References Cited**

UNITED STATES PATENTS

1,718,593	6/1929	Smith	128/272
2,724,383	11/1955	Lockhart	128/272
2,973,758	3/1961	Murrish	141/330
3,059,643	10/1962	Barton	141/330
3,343,538	9/1967	Morley	141/363
3,484,849	12/1969	Huebner et al.	128/272

FOREIGN PATENTS OR APPLICATIONS

1,122,616	5/1956	France	128/272

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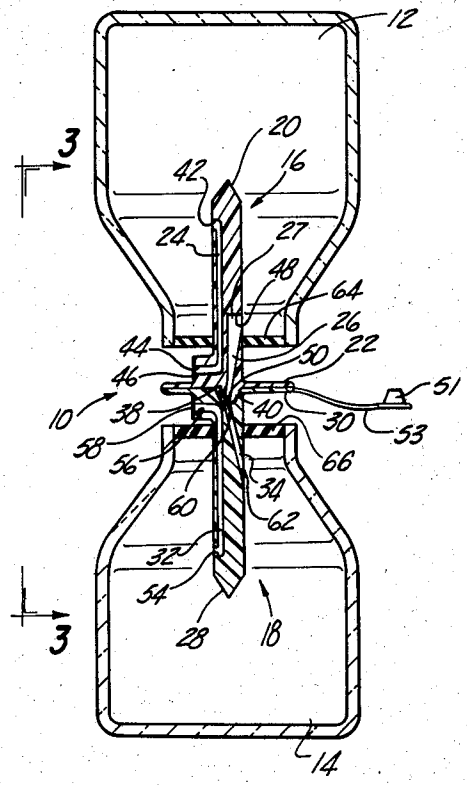
[57] **ABSTRACT**

A device for providing fluid communication between two sealed vessels to allow the contents of the vessels to be mixed together in one of the vessels without having to break the seal. The device is particularly useful in the medical field where it is extremely important to maintain a sterile environment when mixing substances together. The device comprises two cannula members disconnectably attached to each other, one of the cannula members being insertable into one of the vessels through the sealed opening thereof and the other of the cannula members being insertable in the other of the two vessels through its sealed opening. Each of the two cannula members comprises an air passageway and a liquid passageway. The liquid passageways of the two cannula members communicate with each other to provide a means of fluid communication between the two vessels. Further, after the ingredients of the two vessels have been mixed together in one of the vessels, the fluid passageway of the cannula member associated with that vessel provides a means for withdrawing the mixture therefrom. A plug is attached to the cannula member of the vessel containing the mixture to close the fluid passageway therein when the vessel containing the mixture is stored.

12 Claims, 4 Drawing Figures



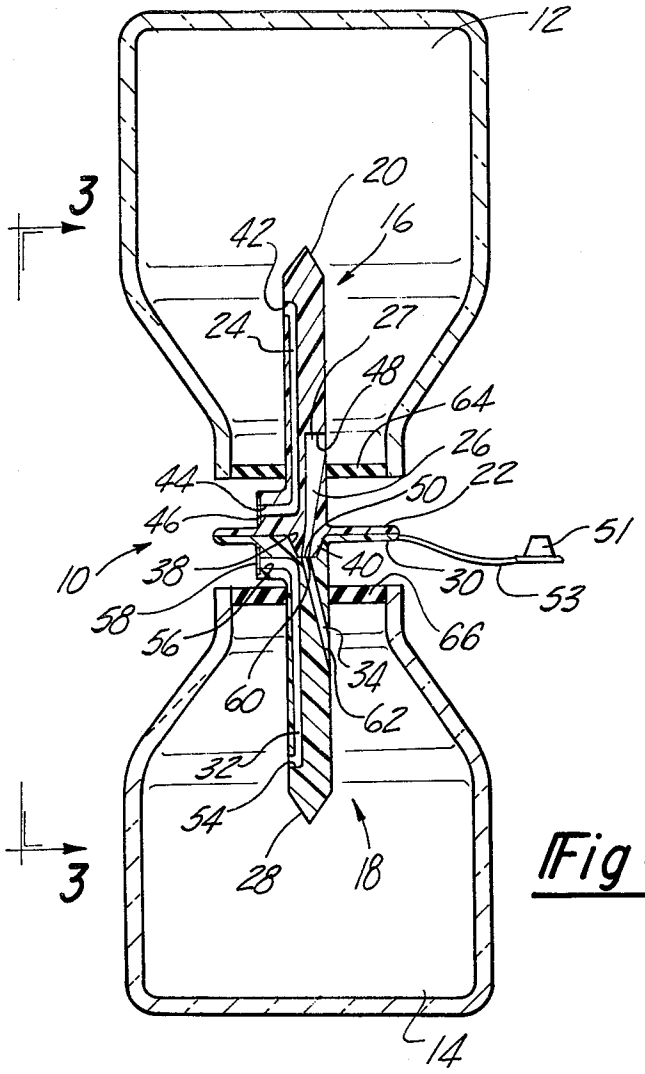


Fig - 1

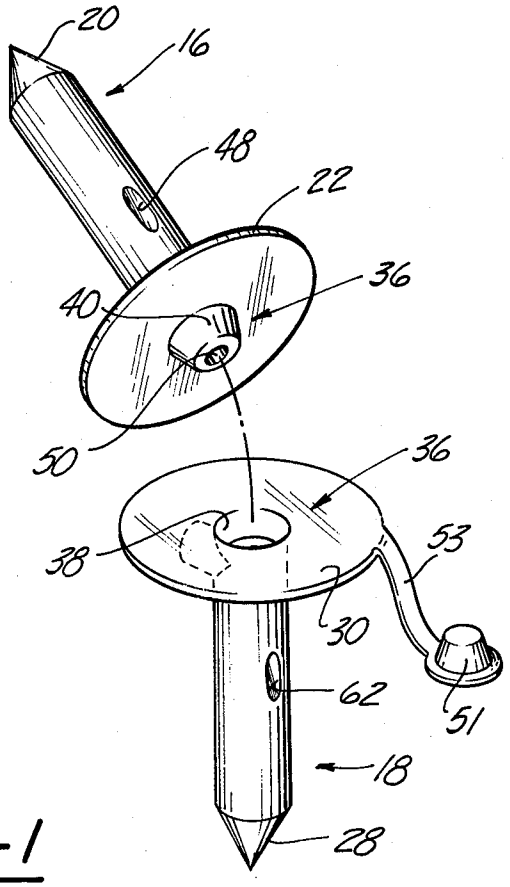


Fig - 2

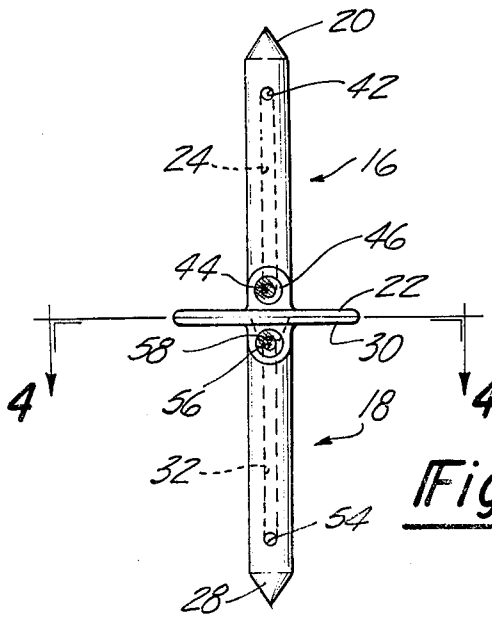


Fig - 3

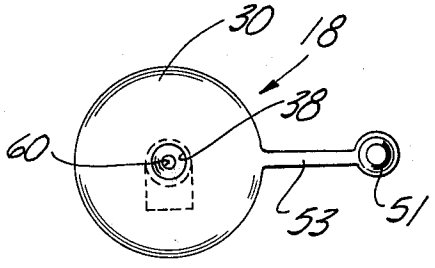


Fig - 4

DEVICE FOR PROVIDING FLUID COMMUNICATION BETWEEN TWO SEALED VESSELS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to fluid handling, and more particularly to systems in which a flow passage leads from one receptacle to another receptacle in series.

2. Description of the Prior Art

In the medical field today, particularly in hospitals where there are many patients, it is required that medication be custom mixed to suit the particular needs of a particular patient, or a small number of patients. In addition, a number of medicaments may have an application among a greater number of patients but have a short shelf or storage life, whereas the components of that medicament separately may have a substantial storage life.

There are previously known devices for providing fluid communication between two sealed vessels in order to mix their contents in one of the vessels, thus maintaining a pre-existing sterile environment interior to the vessel. However, the previously known devices address themselves solely to transferring the contents of one sealed vessel to the interior of another sealed vessel, but do not approach the problem of storing the mixture contained in one of the sealed vessels after mixing, nor the problem of easily and conveniently gaining access to the mixture in the vessel.

SUMMARY OF THE INVENTION

The present invention is directed to, and solves the problems connected with providing a fluid communication between two sealed vessels so that the contents may be mixed in one of the vessels without breaking the seal, storing the mixture of the contents in one of the sealed vessels and gaining access to the interior of the vessel containing the mixture so that the mixture can be used.

The usual method of administering liquid medicaments is by a syringe and injecting the medicament into the body of the patient. It is important that each syringe be quickly and efficiently filled.

It is therefore a primary objective of the present invention to provide a device for providing fluid communication between two sealed vessels so that the components of a particular medicament may be mixed together in a sterile environment and, in addition, to provide a device enabling the mixture of the components from the two vessels to be stored in such a manner as to maintain the sterile environment without having to transfer that mixture to another vessel, and to a device which provides for the quick and efficient filling of a syringe from the container containing the mixture.

The device of the present invention is comprised of two cannula members each having a pointed end, and a means for connecting them together disposed at the opposite end. Furthermore, each cannula member comprises an air passageway and a fluid passageway. A filter media is disposed over an opening of the air passageway to the ambient environment to prevent contaminants from entering the vessel. In addition, a plug is connected by a strap to one of the cannula members.

After the two cannula members are inserted into their respective vessels, that portion of the cannula members exterior to the vessels are connected together such that the fluid passageways communicate with each other to form in effect a continuous fluid passageway between the interior of the vessels.

It is apparent that in the alternative the cannula members can be secured together. The distal end of the first cannula member is inserted into the first vessel. That vessel then can be set on its base and the stopper of the second vessel would be punctured by the distal end of the second cannula member. The assembly can then be inverted to permit free flow of fluid, by gravity, from the first vessel into the second vessel.

After the contents of the vessels have been mixed together in one of the vessels, the cannula members are disconnected from each other and the empty vessel and its associated cannula member are discarded. The fluid passageway in the cannula member of the vessel containing the mixture now provides an opening to the interior of the vessel for the quick and efficient insertion of the lever adapter of the syringe into the vessel to extract a measured amount of medicament therefrom without having to go through any additional manipulations, such as removing the cannula member and replacing it with a device which would allow access to the contents. After the measured amount of medicament is removed using the syringe, the plug is inserted into the opening into the fluid passageway of the cannula member, thus closing it, so that the sterile interior of the vessel is maintained during storage.

DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the invention reference is made to the accompanying drawings illustrating the preferred embodiment thereof in which like numerals refer to like parts throughout the several views and in which:

FIG. **1** is a sectional view of the invention providing fluid communication between two sealed vessels;

FIG. **2** is an exploded perspective view of the device of FIG. **1** but excluding the vessels;

FIG. **3** is a view of the device of FIG. **1** as seen from line 3—3 of FIG. **1** but excluding the vessels; and

FIG. **4** is a view of the device of FIG. **1** taken along line **4**—**4** of FIG. **3.**

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The FIGS. illustrate a device **10** for providing fluid communication between a first vessel **12** and a second vessel **14.** The first, or top, vessel **12** contains a liquid substance to be mixed with a solid or liquid substance contained in the second, or bottom, vessel **14.** The device for providing fluid communication between two sealed vessels is shown as comprising a first cannula member **16** removably connected to a second cannula member **18.** When connected together, the first cannula member **16** and the second cannula member **18** have coaxially disposed longitudinal axes.

The first cannula member **16** is generally cylindrical and comprises a pointed end **20,** a radially projecting flange **22** integrally formed at the opposite end of the first cannula member **16** from the pointed end **20,** an air passageway **24** and a liquid passageway **26.** The radially extended flange **22** could also be made as a separate component and glued, or otherwise attached, to the first cannula member **16.**

The second cannula member **18** is also generally cylindrical and comprises a pointed end **28**, a radially extending flange **30** integrally formed at the opposite end of the second cannula member **18** from the pointed end **28**, an air passageway **32**, and a liquid passageway **34**. As in the case of the radially extending flange **22**, the flange **30** may also be formed as a separate component and glued, or otherwise attached, to the second cannula member **18**.

Means for removably connecting the first cannula member **16** to the second cannula member **18**, generally denoted as **36**, is disposed at the ends of the cannula members opposite the pointed ends **20** and **28**, respectively. The removable connecting means **36** comprises an open cavity **38** formed in the second cannula member **18** and an extension member **40**, complementary in shape to the open cavity **38**, projecting from the end of the first cannula member **16**. The extension member **40** is receivable in the open cavity **38**. The extension member **40** is preferably frusto-conical in shape, tapering outwardly from the first cannula member **16**, and is disposed coaxially therewith. The open cavity **38** is also frusto-conical in shape, tapering inwardly of the second cannula member **18** and is disposed coaxial therewith. It is also contemplated, however, that the frusto-conical projection **40** could project from the second cannula member **18** and the frusto-conical cavity **38** be formed in the first cannula member **16**.

The air passageway **24** has a longitudinal axis substantially parallel to the longitudinal axis of the first cannula member **16** and comprises two spaced apart openings **42** and **44**. The opening **42** is disposed in proximity to the pointed end **20** and the opening **44** is disposed in proximity to the flange **22**. A non-wettable dust cover **46**, formed of a fine filter media, is located over the opening **44** into the air passageway **24**. The filtered dust cover **46** allows the passage of air therethrough and into the first passageway **24**, but prevents contaminants from entering.

The liquid passageway **26** has a longitudinal axis generally inclined to the longitudinal axis of the first cannula member **16**, and comprises two spaced apart openings **48** and **50**. The opening **48** is spaced a distance from the flange **22** in a longitudinal direction of the first cannula member **16** and the other opening **50** is located at the free end of the frusto-conical extension member **40**. The opening **50** is generally centered in the first cannula member **16**. The liquid passageway **26** further comprises a pocket **27** formed adjacent the opening **48** which encourages fluid flow into the second aperture **26** by providing an increased throat area for the ingress of fluid and provides a pocket for air trapped in the liquid passageway **26**, thus preventing an air lock from being formed in the liquid passageway **26**.

The air passageway **32** is disposed with its longitudinal axis substantially parallel to the longitudinal axis of the second cannula member **18**, and comprises two spaced apart openings **54** and **56**. The opening **54** is disposed in proximity to the radially extending flange **30**. A non-wettable dust cover **58**, formed of a fine filter media which allows the passage of air therethrough and into the air passageway **32**, is located over the opening **56**.

The liquid passageway **34** has a longitudinal axis inclined to the longitudinal axis of the second cannula member **18**, and comprises two spaced apart openings **60** and **62**. The opening **60** is disposed at the bottom wall of the frusto-conical cavity **38**, generally centered in the second cannula member **18**, and the opening **62** is spaced from the radially extending flange **30** in the direction of the longitudinal axis of the second cannula member **18**.

In practice, it has been determined that a length of 2¾ inches from the pointed ends **20**, **28** to the flanges **22**, **30**, respectively, and a distance of ¾ inches from the flanges **22**, **30** to the openings **48**, **62**, respectively, into the second apertures **26**, **34**, respectively, works well.

The second cannula member **18** further comprises a plug **51** having a generally frusto-conical shape substantially identical to the frusto-conical shape of the extension member **40** which is attached to the flange **30** by a flexible strap **53**. The purpose of the plug **51** is to close the opening **60** into the liquid passageway **34** when the first and second cannula members are separated, as will hereinafter be discussed. In the event that the projection **40** projects from the second cannula member **18** instead of the first cannula member **16**, the plug **51** would be cup-shaped to fit over the extension **40** to close the passageway **34**.

When the first and second cannula members are connected together (see FIGS. **1** and **3**), the opening **50** into the liquid passageway **26** and the opening **60** into the liquid passageway **34** are generally coaxially disposed and provide a means for fluid communication between the liquid passageways **26** and **34** and, thus, the vessels **12** and **14**.

The first cannula member **16** and the second cannula member **18** are joined together by inserting the frusto-conical extension member **40** into the complementary shaped frusto-conical cavity **38** such that the radially extending flanges **22** and **30** abut one another. The radially extending flanges **22** and **30** produce a more stable connection by providing an increased area of contact between the two cannula members.

Further, because the opening **50** of the liquid passageway **26** and the opening **60** into the liquid passageway **34** are each disposed on the centerlines of their respective cannula members, they will be coaxial regardless of the radial orientation of the cannula members with respect to one another.

Referring to FIG. **1**, the top vessel **12** contains a sterile solvent, the opening into the top vessel is closed by a stopper **64**, and the bottom vessel **14** contains a sterile liquid or solid, the opening into the bottom vessel is closed by a stopper **66**. The object is to mix the sterile materials in the vessels **12** and **14** without contaminating either of them or their mixture, and without removing the stoppers **64** and **66**. To accomplish this, the first cannula member **16** is inserted in the vessel **12** through the stopper **64** by placing the pointed end **20** against the stopper **64** and pushing the cannula member **16** axially such that the opening **44** is located outside of the vessel **12** and the opening **48** is located inside the vessel **12**. Likewise, the second cannula member **18** is inserted into the bottom vessel **14** through the stopper **66** in the same manner and positioned therein such that the opening **56** is located outside of the vessel **14** and the opening **62** is located inside the vessel **14**. The first and second cannula members **16** and **18** are then joined together as described hereinabove, thus providing a fluid communication between the vessels through the liquid passageways **26** and **34**.

As described heretofore the stoppers **64** and **66** of the vessels **12** and **14**, respectively, can be punctured by the cannula members **16** and **18** while the cannula members are joined.

Liquid flow through the passageways **26** and **34** is promoted by the fact that the air pressure in the vessels **12** and **14** is at ambient due to the fact that the air passageways **24** and **32** fluidly connect the interior of the vessels **12** and **14**, respectively, with the ambient environment.

After the ingredients of the two vessels **12** and **14** have been mixed, the two vessels are separated by separating the first cannula member **16** from the second cannula member **18.** This is accomplished by merely removing the frusto-conically shaped extension member **40** from the frusto-conically shaped open cavity **38.** The liquid passageway **34** of the second cannula member **18** now provides a passageway for the insertion therethrough of the lever adapter of a syringe into the vessel **14,** allowing one to fill the syringe with the mixture of the two ingredients without the necessity of removing the second cannula member **18.**

In order to maintain the sterile condition interior to the vessel **14** when the mixture is stored, the frusto-conically shaped plug **51** is inserted into the frusto-conically shaped open cavity **38,** thus closing the opening **60** into the passageway **34.** When it is desired to again fill a syringe from the vessel **14,** the plug **51** is removed from the cavity **38.**

The device **10** can be manufactured from almost any material, however, the material should be capable of being sterilized. Preferably, the device is formed of a plastic material.

The foregoing detailed description is given primarily for clearness of understanding and no unnecessary limitation should be understood therefrom for modifications will be obvious to those skilled in the art upon reading this disclosure and can be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A device for providing fluid communication between two sealed vessels, comprising: a first cannula member, said first cannula member having an air passageway and a liquid passageway, said passageways extending longitudinally wherein one end of said air passageway is longitudinally displaced from the corresponding end of said liquid passageway; a second cannula member, said second cannula member having an air passageway and a liquid passageway, said passageways of said second cannula member extending longitudinally wherein one end of said air passageway is longitudinally displaced from the corresponding end of said liquid passageway; means for removably connecting said first cannula member to said second cannula member with said liquid passageways in registry whereby the liquid passageway of said first cannula member communicates with the liquid passageway of said second cannula member.

2. A device as defined in claim **1,** wherein:

said liquid passageway of said first cannula member has an opening to the wall of said first cannula member and another opening to said means for removably connecting said first cannula member to said second cannula member; and

said liquid passageway of said second cannula member has an opening to the wall of said second cannula member and another opening to said means for removably connecting said first cannula member to said second cannula member.

3. A device as defined in claim **1,** wherein said means for removably connecting said first cannula member to said second cannula member comprises:

an open cavity defined in one of said cannula members; and

an extension member complementary in shape to said open cavity, projecting from the other of said cannula members, said extension being received in said cavity to removably connect said first cannula member to said second cannula member.

4. A device as defined in claim **3,** wherein:

said defined passageway in said other cannula member opens to said means for removably connected said first and second cannula members at the free end of said extension; and

said liquid passageway in said one cannula member opens to said means for removably connecting said first and second cannula members at the bottom wall of said open cavity.

5. A device as defined in claim **4,** wherein:

said extension member is generally frusto-conical in shape tapering outwardly from said other cannula member; and

said cavity is generally frusto-conical in shape tapering inwardly of said other cannula member.

6. A device as defined in claim **1,** further comprising:

a first flange connected to and disposed around said first cannula member proximate one end thereof, the plane of said first flange being generally perpendicular to the longitudinal axis of said first cannula member; and

a second flange connected to and disposed around said second cannula member proximate one end thereof, the plane of said second flange being generally perpendicular to the longitudinal axis of said second cannula member,

such that when said first and second cannula members are connected together said first and second flanges are disposed in relative abutting juxtaposition.

7. A device as defined in claim **1,** wherein:

said first cannula member further comprises one pointed end;

said air passageway in said first cannula member has an opening to the wall of said first cannula member proximate said pointed end;

said air passageway in said first cannula member has another opening to the wall of said first cannula member spaced from said first mentioned opening;

said second cannula member further comprises one pointed end;

said air passageway in said second cannula member has an opening to the wall of said cannula member proximate said pointed end; and

said air passageway in said second cannula member has another opening in said cannula member to the wall of said second cannula member spaced from said first mentioned opening.

8. A device as defined in claim **7,** further comprising:

a filter media disposed over said other opening of said air passageway of said first cannula member; and

a filter media disposed over said other open end of said air passageway of said second cannula member.

9. A device as defined in claim **7**, wherein:

said liquid passageway of said first cannula member is inclined to the longitudinal axis of said first cannula member; and

said liquid passageway of said second cannula member is inclined to the longitudinal axis of said second cannula member.

10. A device as defined in claim **1**, further comprising means for selectively opening and closing said liquid passageway in said second cannula member.

11. A device as defined in claim **3**, further comprising:

a plug having a shape complementary to said open cavity, and being selectively insertable into said cavity; and

a flexible strap connected at one of its ends to said cannula member having said cavity, and connected at its other end to said plug thereby connecting said plug to said cannula member having said cavity.

12. A device as defined in claim **2**, further comprising a pocket formed in said liquid passageway of said first cannula member adjacent said first mentioned opening to the wall of said first cannula member.

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