United States Patent [19]

Cox et al.

[11] **3,907,389**

[45] **Sept. 23, 1975**

[54] **GLOVE BOX CHAMBER**

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[22] Filed: **Dec. 12, 1973**

[21] Appl. No.: **426,672**

[52] **U.S. Cl.** ..... **312/1;** 128/1 R; 128/1 B

[51] **Int. Cl.**[2] **A61G 11/00**

[58] **Field of Search** ..... 23/259; 128/1 R, 1 B; 312/1

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[57] **ABSTRACT**

An environmental chamber is described which enables an operator's hands to have direct access within the chamber without compromising a special atmosphere within such chamber. A pair of sleeves of a flexible material are sealed to the chamber around associated access apertures and project outwardly from such chamber. Each aperture is closed by a door which is openable from within the sleeve associated therewith so that upon an operator inserting his hand and arm through the sleeve, the operator can open the door to have access to the interior of the chamber. A container which is selectively separable from the remainder of the chamber is also provided to allow objects to be transferred from the chamber without such objects having to pass through the ambient atmosphere, and an antechamber permitting objects to be passed directly into the chamber from the ambient atmosphere is included.

16 Claims, 9 Drawing Figures

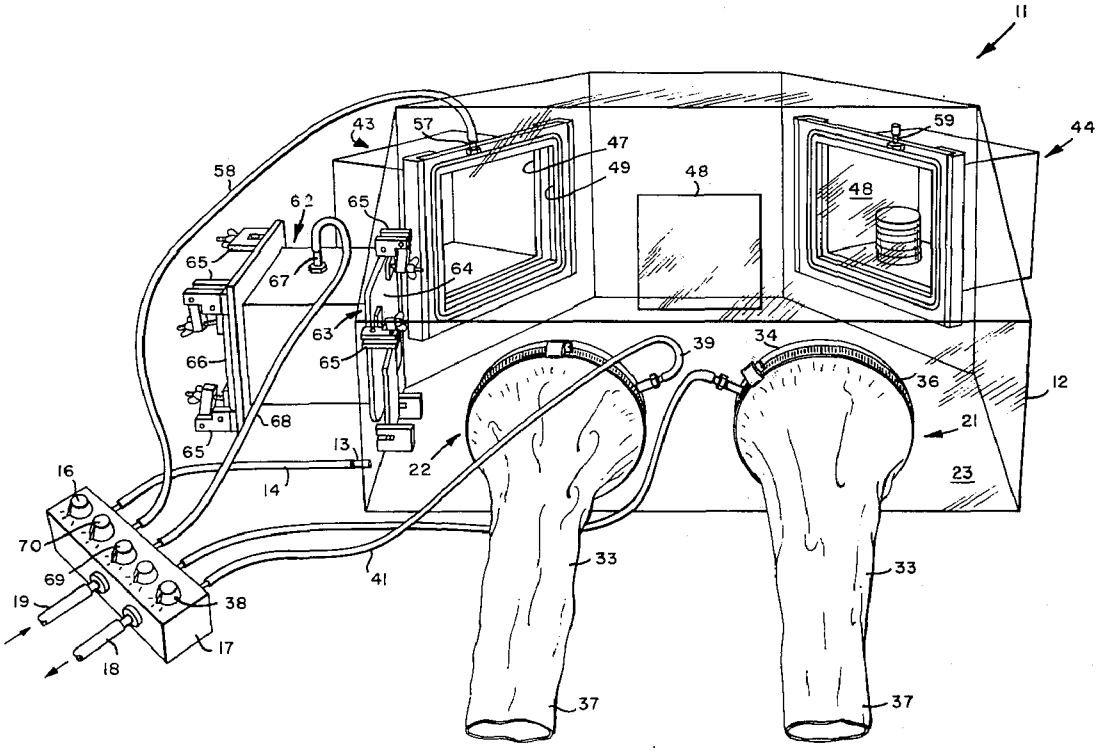

FIG. 1

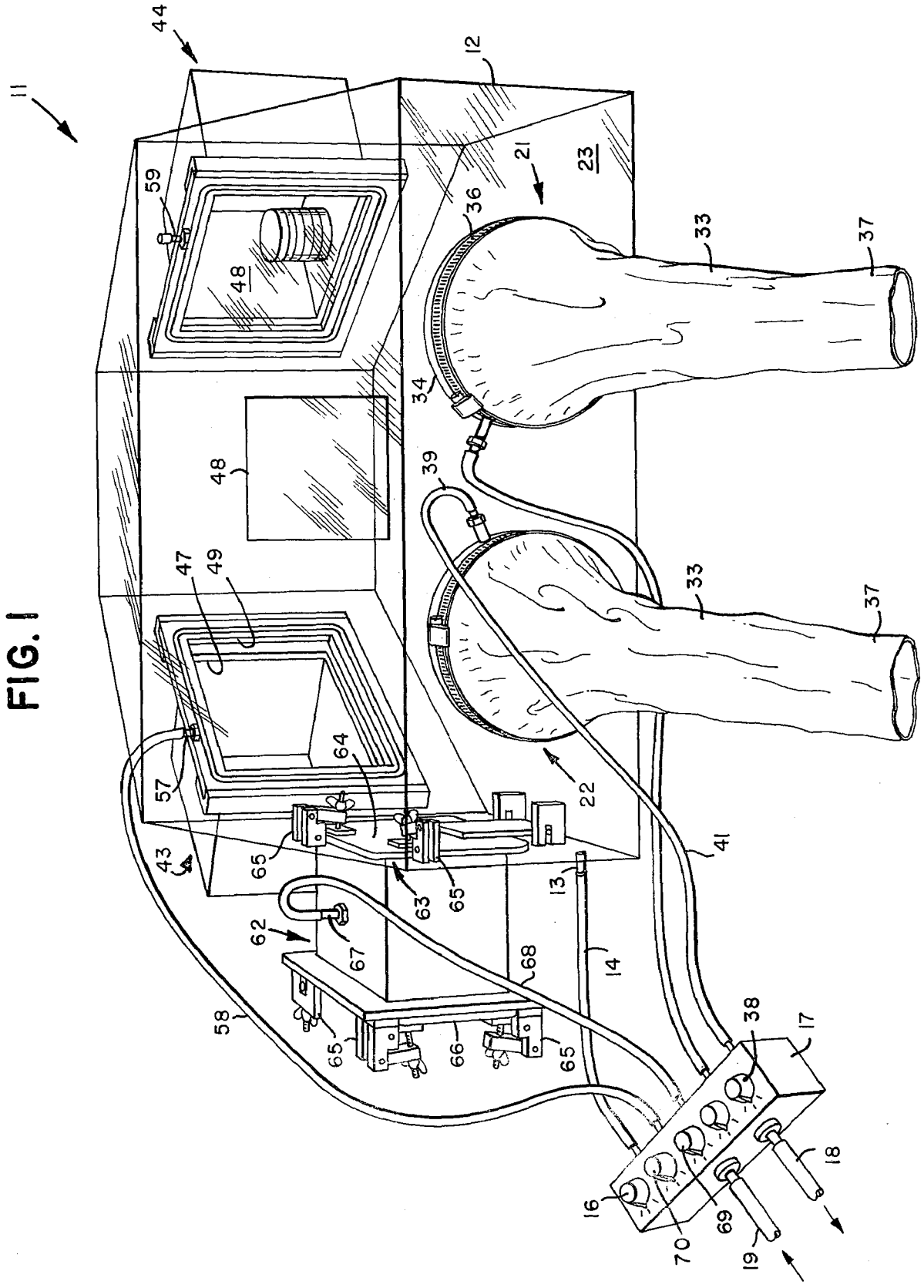
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FIG. 2

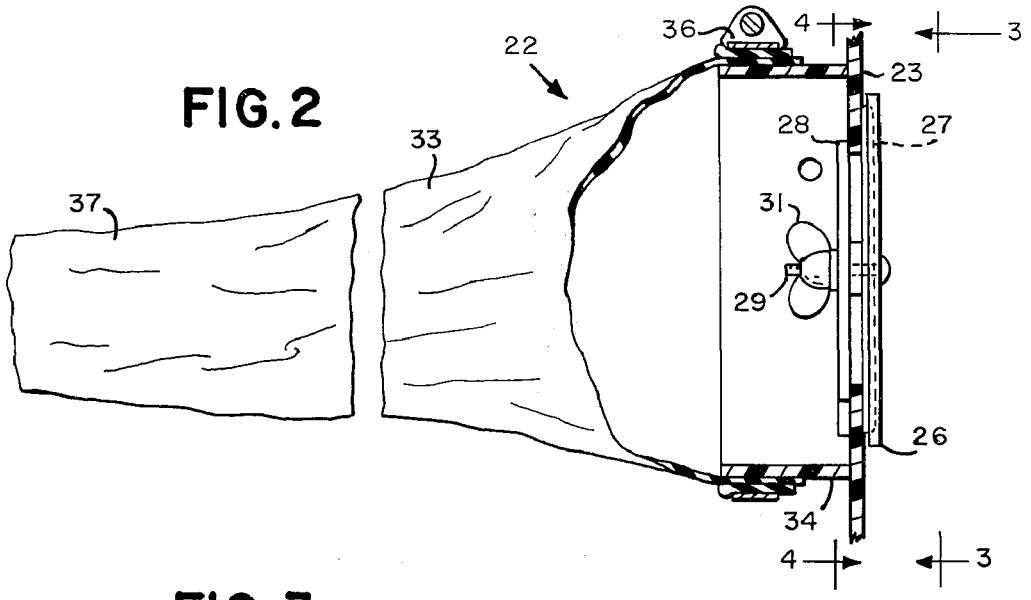
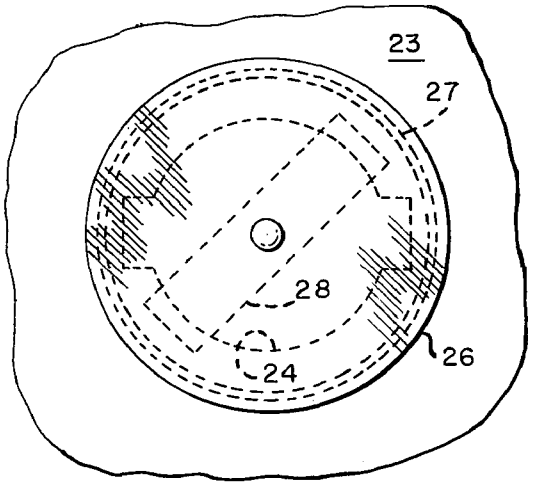


FIG. 3



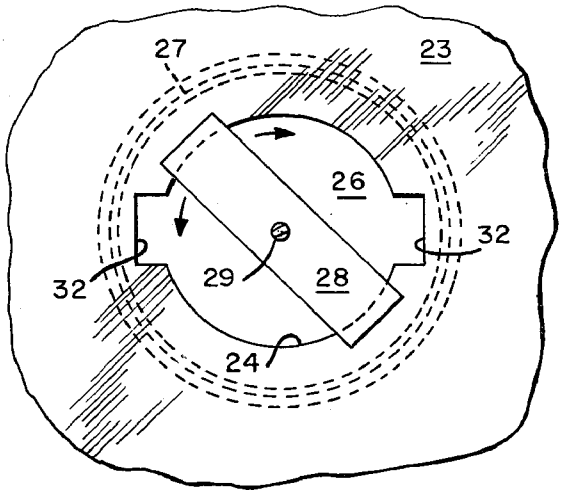
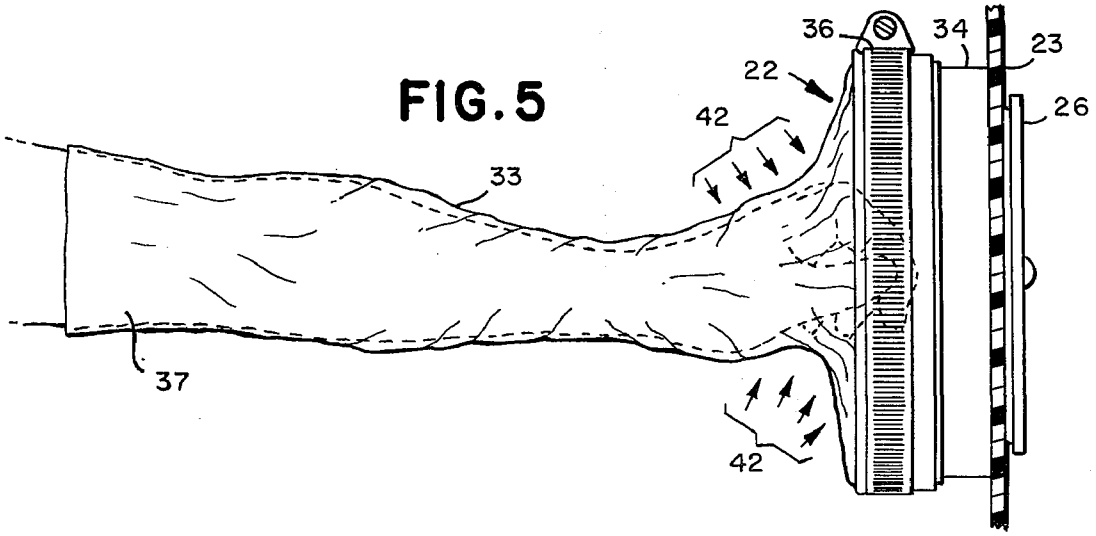


FIG. 4

FIG. 5



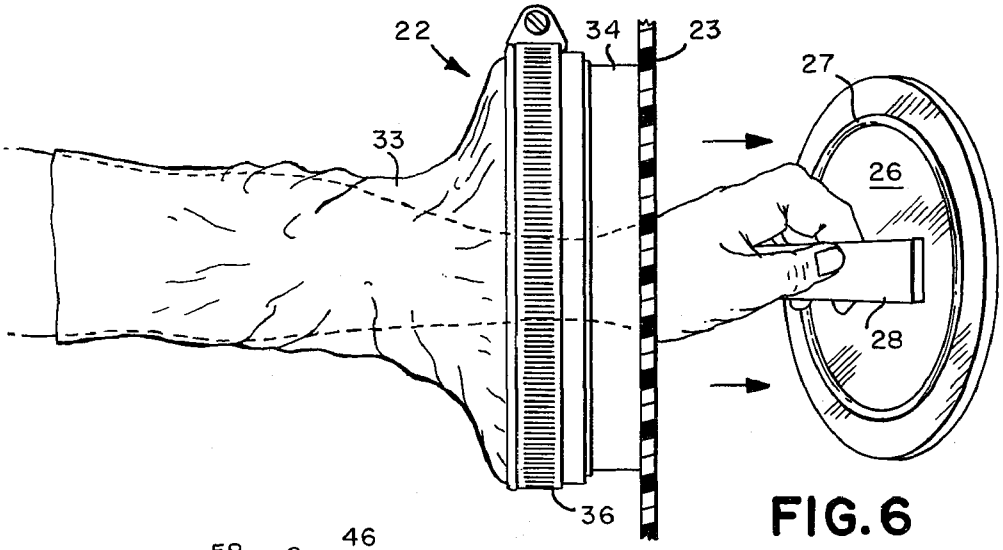


FIG.6

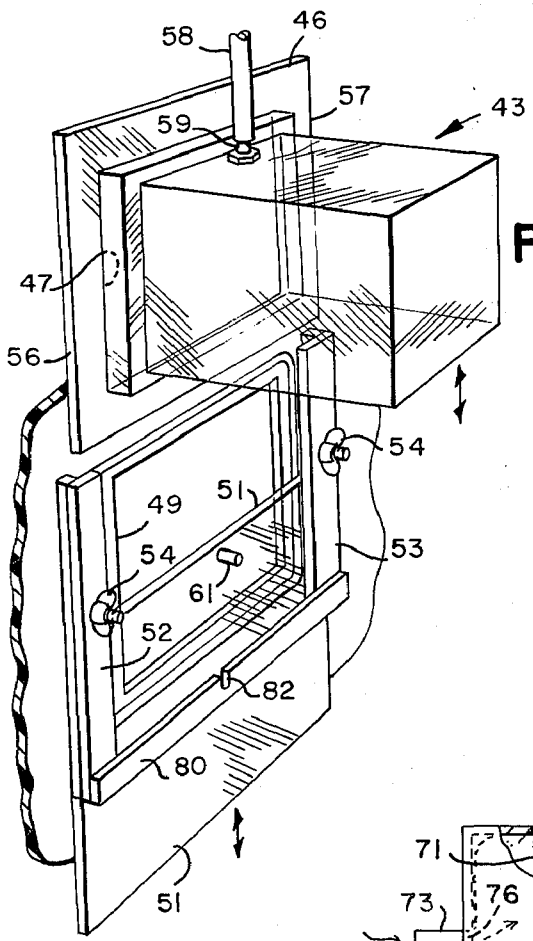


FIG.7

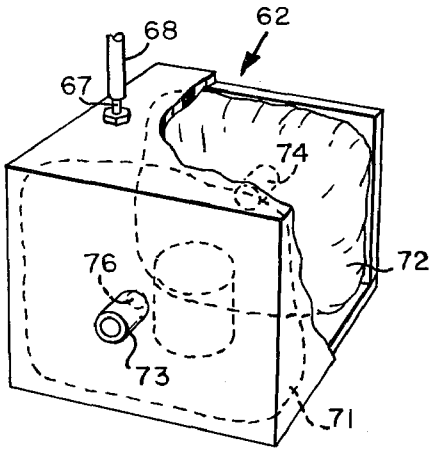


FIG.8

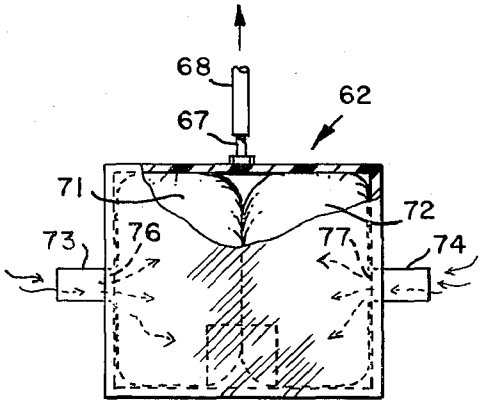


FIG.9

GLOVE BOX CHAMBER

BACKGROUND OF THE INVENTION

The present invention relates to a chamber for maintaining an object within an isolated environment and, more particularly, to such a chamber which facilitates hand manipulation of an object so maintained from the exterior of the chamber, as well as passage of the object into or out of the chamber without deleterious contamination from the surrounding atmosphere.

Small environment isolation chambers or, as they are more commonly called, glove boxes, are extensively used in research, industry and medicine to facilitate the hand manipulation of an object of one sort or another within an isolated environment. For example, glove boxes are used in clinical laboratories in connection with the culturing of anaerobic bacteria in an oxygen free atmosphere. To enable manipulation of the object within the chamber, rubber gloves are normally provided projecting into the chamber enclosure with their sleeve ends sealed around an opening through a wall of such enclosure. The gloves provide, in effect, a continuation of the chamber enclosure wall and separate not only an operator's hands extended through the opening from the interior of the enclosure, but also prevent the ambient atmosphere from entering into the enclosure through such opening.

The rubber gloves normally have relatively thick walls in order to increase their life and reduce the chances of a leak through them. However, as will be recognized, such thickness reduces the "feel" which an operator can have through the gloves for objects within the enclosure, as well as the operator's manual dexterity. Moreover, glove leaks often occur, especially in old gloves, in spite of the thickness, due to the continual flexing of the glove material and the careless handling of sharp instruments or the like within the enclosure.

Most conventional glove boxes are also deficient in the manner provided for introducing or removing objects or specimens from the same. For example, typical laboratory glove boxes include a pass-through or pre-access chamber having both a door to the exterior and a door to the main chamber enclosure for this purpose. An object to be introduced into the chamber enclosure is first placed within the pass-through enclosure and then the desired special atmosphere introduced into such passthrough enclosure before communication is provided between the same and the main chamber enclosure. While this procedure will assure that none of the ambient atmosphere is allowed to enter the main chamber enclosure, it does not provide any protection for the object or specimen before it enters the pass-through enclosure. Moreover, the removal of an undesired atmosphere from the pass-through enclosure prior to its communication with the main chamber is often a time-consuming operation.

SUMMARY OF THE INVENTION

The present invention provides a chamber for maintaining an object in an isolated environment which enables an operator to introduce his hands directly into the chamber enclosure for manipulation of such object while assuring that the atmosphere of the chamber is not contaminated by the surrounding atmosphere. To this end, the chamber includes, as is usual, an enclosure for separating the object from the surrounding atmosphere. At least one access port is provided into the enclosure enabling admission of the hand of an operator for the desired manipulation. The access port includes a door which seals the aperture in the wall of the chamber through which the operators hand is extendable, and a sleeve which is sealed to such enclosure in communication with the aperture. In keeping with the invention, a free end portion of the sleeve extends to the exterior of the enclosure and provides a pre-access chamber for separating the hand of the operator from the ambient atmosphere prior to the opening of the door for access of such hand into the enclosure. Most simply, such sleeve is one of an elastic material, such as latex, which sealingly engages or grips the arm of the operator to define the pre-access chamber. In this connection, means are most desirably provided for evacuating the pre-access chamber prior to the door opening.

As another feature of the chamber of the invention, it further includes means for transferring a desired object between the chamber and a container therefor without opening either such container or the chamber enclosure to the atmosphere. To this end, the chamber enclosure includes an access opening through its wall over which is positionable, which a slide cover slide cover is guided by slide guides along a path traversing the opening between a closed position in which such opening is covered and an open position in which it is exposed. The container to which the object is to be transferred also includes an access opening within a wall thereof which includes slide guides complementary to the slide guides on the main enclosure to guide such container wall across the enclosure access opening to replace the slide cover thereover when the slide cover is moved to its open position. Such container wall thus closes the enclosure opening and provides access between the enclosure opening and its own access opening. Most desirably, the cover over the container opening is sized to fit through the enclosure opening so that such cover is removable from the interior of the main chamber enclosure to enable the container and chamber to be simply communicated, without the container cover having to be removed from the container when the container opening is exposed to the ambient atmosphere. Thus, an object is movable between the container and the chamber without ever having to pass through the ambient atmosphere.

The invention also includes an arrangement which substantially reduces the time involved in evacuating an ambient atmosphere from a pass-through enclosure. To this end, the pass-through enclosure for the main enclosure includes a wall portion which responds to the reduction of gas pressure within such pass-through by moving inwardly of the enclosure to reduce its volume. Because of this reduction in volume, the amount of vacuum which must be applied to the pass-through enclosure in order to obtain a desired gas reduction is reduced.

The invention includes other features and advantages which will be described or will become apparent from the following more detailed description of a preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the accompanying three sheets of drawings:

FIG. 1 is an overall perspective view illustrating a preferred embodiment of the isolation chamber of the invention;

FIG. 2 is a partial and broken-away elevation view of the access port providing a pre-access chamber for the hand of an operator to be introduced into the chamber;

FIGS. 3 and 4 are elevation views, taken on planes indicated by the lines 3—3 and 4—4 in FIG. 2, respectively;

FIG. 5 is a partial view similar to FIG. 2 illustrating the access port of the invention with an operator's hand within the pre-access chamber defined thereby;

FIG. 6 is an elevation view similar to FIG. 5 but illustrating the operator's hand gaining access to the interior of the main chamber;

FIG. 7 is a partial perspective view illustrating the communication of a container for an object with the main chamber; and

FIGS. 8 and 9 are generally schematic, broken away perspective and elevation views, respectively, of the pass-through for the chamber of the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

With reference to the accompanying drawing, FIG. 1 is an overall perspective view of a chamber, generally referred to by the reference numeral **11**, of the invention for defining an isolated environment for an object. As is illustrated, such chamber includes a main, gas-tight enclosure **12** for separating an object to be maintained in an isolated environment from the ambient atmosphere. Although the material providing the walls of the enclosure **12** is not critical, most desirably such material is transparent, such as of a clear rigid plastic, to facilitate an operator observing manipulations within the interior of such enclosure.

Means are provided for introducing a desired atmosphere into the enclosure **12**. More particularly, such enclosure is communicated via a nipple **13** and tubular line **14** with a three-way valve **16** in a valve manifold **17**. The input to such valve manifold is provided through line **18** to a source (not shown) of vacuum, and through line **19** to a source (also not shown) of a desired gas or gas mixture. Valve **16** is similar to the other valves in the valve manifold in that it has a first position in which it communicates the vacuum source with the enclosure, a second position in which it communicates the gas supplied by line **19** with the enclosure, and a third position in which it closes line **14**. The other valves within the manifold are communicated through suitable lines with other components of the chamber as will be described hereinafter.

In accordance with conventional practice, it is desirable to maintain the pressure within the enclosure **12** slightly above the surrounding pressure so that if there are any small leaks in the chamber, leakage flow will be from the interior of the chamber to the exterior, rather than vice versa. The result is that the likelihood of contamination of the chamber due to a small leak is avoided.

As a particularly salient feature of the instant invention, it includes a pair of access ports which enable an operator to insert both of his hands into the interior of the enclosure for manipulating an object therein, without opening the enclosure to the ambient atmosphere. The invention accomplishes this without requiring the use of rubber gloves with their inherent disadvantages as discussed above. More particularly, a pair of access ports **21** and **22** are provided in the front wall **23** of the enclosure, which access ports are positioned to facilitate admission into the chamber of an operator's right and left hands, respectively. Such access ports are essentially identical, and only one of the same, access port **22**, will be described in detail.

With reference to FIGS. **1** through **6**, it will be seen that the access port **22** includes a circular aperture **24** through enclosure wall **23**, which aperture is closed or sealed by a circular door plate **26**. In this connection, the door plate has a diameter greater than that of the aperture **24** so that the peripheral edge of such plate will overlap the aperture and provide an annular surface area which engages the interior surface of the wall **23** for sealing thereagainst. An O-ring **27** assures that such seal is a gas-tight seal.

Locking means manipulatable from the exterior of the enclosure are provided for opening the door **26**. That is, a latch bar **28** is pivotally mounted centrally of the exterior side of the door by a bolt **29** which freely passes therethrough. As is illustrated, a wing nut **31** is on the threaded end of such bolt on the exterior side of the door. As is best illustrated in FIGS. **3** and **4**, the length of the latch bar **28** is greater than the diameter of the aperture **24** so that the wall **23** can be sandwiched between the door plate and the latch bar as illustrated to provide a tight seal around the periphery of such aperture. However, the aperture is provided with opposed notches **32** through which the ends of the latch bar **28** will fit to enable removal of the door into the interior of the enclosure **12**.

A sleeve **33** of a gas impermeable, flexible material has one end sealed to the enclosure in communication with the aperture **24**. More particularly, an annular flange **34** is provided on the exterior side of the wall **23** projecting outwardly therefrom and circumscribing aperture **24**. As is illustrated, one end of the sleeve **33** is fitted around the flange **34** and is tightly and sealingly held in position by an adjustable ring clamp **36**. The sleeve **33** thus provides, in effect, a flexible extension of the flange **34**.

In keeping with the invention, the sleeve **33** projects outwardly from the enclosure **12** and terminates in a free end portion **37**. Such free end portion provides a pre-access chamber for separating the hand of an operator from the ambient atmosphere prior to the opening of the door **26** for access of such hand into the enclosure. In this connection, the sleeve end portion **29** is most desirably of a highly elastic, as well as flexible, material such as latex rubber and has a diameter which assures that it sealingly engages the arm of an operator inserted therethrough toward the enclosure. Such construction of the sleeve will assure that it automatically provides a gas-tight seal about the arm of an operator inserted therein, without requiring a clamp or other structure providing a seal between the operator's arm and the sleeve end portion.

Means are provided for evacuating the pre-access chamber defined by the sleeve of its ambient pressure prior to the opening of the door **26** for access of an operator's hand into the enclosure **12**. That is, a three-way valve **38** in manifold **17** is communicated with a nipple **39** in flange **34** via a tubular line **41**. The valve **38** enables communication of the interior of the sleeve **33** with the vacuum source, in order to remove ambient atmosphere therefrom. Because of the sleeve's inherent flexibility, evacuation of its interior in this manner will result in the same being drawn around the full arm and hand of the operator, as is represented in FIG. **5** by the

arrows 42. If desired, the pre-access chamber defined by the sleeve can then be communicated with the special atmosphere within the enclosure 12 also via the valve 38. In any event, after the sleeve pre-access chamber has been evacuated of the ambient atmosphere, it is a simple matter for the operator to then loosen the wing nut 31 and rotate the latch bar 28 from within the pre-access chamber to permit access of his hand into the chamber without concern for the integrity of the atmosphere within the enclosure. He is then free to perform desired manipulations within the enclosure. In this connection, it may be desired in certain instances for the operator to wear gloves within the enclosure to prevent physical contact between his hand and the object being manipulated. Such gloves, however, can be thin and tightly fitting, such as surgical gloves, rather than the heavy rubber gloves normally associated with glove boxes. Thus, the operator's dexterity and "feel" within the glove box will be essentially unaffected by the gloves.

As mentioned previously, prior art glove boxes typically have not lent themselves to transferring an object between it and a container having a special atmosphere, without requiring the object to pass through the ambient atmosphere. As another salient feature of the instant invention, it includes a simple arrangement enabling transferance of an object between a container and the enclosure without opening either the container or the enclosure to the atmosphere ambient thereto. To this end, the chamber of the invention further includes a pair of essentially identical containers 43 and 44, which are especially adapted to selectively communicate with the enclosure 12. In this connection, as can be seen from FIG. 1, such containers communicate with the enclosure 12 at back walls of the enclosures which obliquely face the access ports to facilitate access of the operator's hand into such containers from within the enclosure.

As illustrated in FIGS. 1 and 7, each of the containers 43 and 44 is rectangular in shape and includes an end wall 46 which extends beyond the side walls thereof for a purpose which will be described. An access opening 47 into the container is provided in the end wall 46 and is closed when the container is not in communication with the enclosure by a cover 48. Such cover 48 is illustrated in FIG. 1 within the interior of the enclosure 12 removed from the container access opening 47.

The container access opening 47 of each of the containers is designed to communicate with a corresponding access opening 49 in a back wall panel of the enclosure 12.

As is best illustrated in FIG. 7, a slide cover plate 51 is provided on the exterior side of the enclosure wall for normally closing each enclosure access opening 49. Slide guide means are provided on the enclosure for defining a path for the slide cover traversing the enclosure access opening between a closed position covering the opening as illustrated, and an open position exposing such opening. Such slide guide means is in the form of a pair of parallel guide rails 52 and 53 respectively facing one another from opposite sides of the enclosure access opening 49. Such guide rails define with the wall of the enclosure to which they are secured parallel channels which receive opposite side edges of the slide cover plate 51 as shown. Suitable clamps, such as provided by wing nut and bolt combinations 54, can be provided on each of the guide rails for clamping the cover plate tightly against the enclosure back wall to assure a gas-tight seal around the opening 49.

The end wall 46 of each of the containers defines slide guide means which are complimentary to the slide guide rails 52 and 53 to enable such container wall to traverse the enclosure access opening 49 to replace the slide cover thereover. More particularly, the container end wall 46 has an outer periphery substantially the same as the outer periphery of the cover plate 48 and, in this connection, opposite and parallel side edges 56 and 57 thereof engage within the channels defined by the guide rails 52 and 53. It will be appreciated that with this arrangement, as the slide cover plate 51 is moved, for example, downward from over the opening 49, the container can be moved downward to replace such slide cover. The downward movement of the container can be performed simultaneously with the downward movement of the slide plate so that there is essentially no time at which the access opening 47 is exposed to the atmosphere ambient to the chamber.

To facilitate sliding supplantation of the slide cover plate by the container, the face of the container wall 46 which slides against the enclosure wall is provided with substantially the same geometry as the face of the slide cover plate 51 which also slides against such enclosure wall. In this connection, as can be seen from FIG. 1, the container wall is provided with a recess at the container access opening within which the container cover 48 fits to provide the container cover with a smooth planar surface when the cover is on the container. Means are also provided for both maintaining each container in position over its associated enclosure access opening and holding the cover plate 51 in its open position. More particularly, a stop bar 80 extends transversely between the guide rails 52 and 53. A central slot 82 in the stop bar is engaged by a limit pin 61 projecting from the cover plate adjacent its top edge, when the cover plate is in its lowered position. When the container is properly positioned over the enclosure access opening, the container bottom wall also engages the stop bar in order to prevent further downward movement of the container.

It will be recognized that when the container is so positioned over the enclosure access opening 49, access is provided between such enclosure access opening 49 and the container access opening 47. Moreover, container opening 47 is smaller than enclosure opening 49 so that the cover 48 for the container is removable through the enclosure opening into the enclosure. The integrity of the atmosphere within the interior of the container can be maintained until such time as the container is in position to provide access between it and the enclosure. Thus, in those instances in which the container is maintaining an object or specimen in a special atmosphere prior to the time such container is communicated with the enclosure, the object or specimen need never be passed through the ambient atmosphere when being transferred from the container and the enclosure. Of course, when it is desired to remove the container from the enclosure the container cover is replaced on its opening and then as such container is moved upward for disengagement from the enclosure, the enclosure opening door is moved upward to close the enclosure opening. Moreover, the container is provided with a suitable nipple 59 which can be communicated through line 58 with one of the valves 70 of the manifold 17. Such communication allows the container

to be evacuated of any ambient or other undesired atmosphere therein prior to the time such container is communicated with the enclosure **12.**

In certain situtations, it is desirable to be able to transfer objects or specimens into the interior of the enclosure from the ambient atmosphere. The environmental chamber of the invention includes an improved pass-through or antechamber for introducing objects into enclosure **12** without opening the latter to the ambient atmosphere. To this end, an antechamber **62** is provided exteriorly of the main enclosure **12** and communicating therewith through a selectively closable post **63** adapted for passage of an object it is desired to introduce into the enclosure. As is illustrated in FIG. **1**, port **63** is closed via a door **64** which is hinged adjacent its bottom for swinging operation. Suitable clamps, such as those schematically illustrated at **65**, are provided for sealing the door closed. Another door **66** is also provided, closing an opening providing access to the interior of the antechamber from its exterior and, thus, also from the exterior of the main enclosure **12.** Suitable clamps **65** operable from the exterior of the chamber are also provided for sealing door **66** closed.

Means are also provided for evacuating antechamber **62** when the doors **64** and **66** are closed. In this connection, a nipple **67** in the top wall of the antechamber is provided communicating through a gas line **68** with a valve **69** of manifold **17.**

To the extent described to this point, the antechamber **62** is of a generally conventional nature. In operation, an object to be introduced into the main enclosure **12** is first introduced into the antechamber through the door **66** at a time when the door **63** is closed so that the main chamber is not communicated through the antechamber with the ambient atmosphere. Then with both doors **63** and **66** closed, the ambient atmosphere within the antechamber is evacuated. Such evacuation is achieved by reducing the pressure in the antechamber via the valve **69** and the vacuum source and then, if desired, introducing into such antechamber the special atmosphere which is within the container **12.** Once the atmosphere within the antechamber is compatible with that within the enclosure **12,** the door **64** can be opened from the interior of such antechamber **12** to enable the object to be passed from the antechamber into the main enclosure.

As mentioned previously, the operation of evacuating an antechamber of the ambient atmosphere to the extent necessary is often a time-consuming operation. The antechamber **62** of the invention, however, includes means for substantially reducing the time involved in such operation. More particularly, as can best be seen from the schematic illustrations in FIGS. **8** and **9,** a pair of inflatable bags **71** and **72** are provided within the interior of the antechamber with their stems **73** and **74,** respectively, communicating with the ambient atmosphere through apertures **76** and **77** in the side walls of the antechamber. If there is a generally tight fit between each of the stems **73** and **74** and its associated aperture through the side wall of the antechamber, the initial leakage into the antechamber when a vacuum source is communicated with the chamber will be sufficiently low. It will be appreciated, though, that in some instances even low leakage cannot be tolerated and it may be necessary to seal the stem to the side wall to prevent leakage.

Each of the bags provides, in effect, a wall portion of the antechamber which responds to the reduction of gas pressure therein by moving inwardly of such antechamber to reduce its volume. More particularly, because the stems **73** and **74** extend to the exterior of the antechamber, the interior of each of the bags is communicated with the ambient atmosphere. Thus, when the valve **69** is actuated to communicate the vacuum source with the interior of the antechamber and its pressure is correspondingly reduced relative to the ambient atmosphere pressure, each of the inflatable bags **71** and **72** will expand due to such difference in pressure. Such expansion will result in a consequent reduction in the volume of the antechamber. This will increase the speed at which the antechamber is evacuated since, as is known, as the density of a gas which is being evacuated from a volume decreases, the amount of time that any given vacuum source must be communicated with the volume to cause further reduction correspondingly increases. The reduction of the volume of the antechamber by inflation of the bags **71** and **72** tends to maintain the density of the gas being removed from such chamber generally equal to the ambient pressure. Thus, the vacuum source will "see" a high density of gas throughout its actuated period, with the result that such period will be substantially reduced in time. It will be recongized that after the required amount of ambient atmosphere is removed from the antechamber, the valve **69** can be manipulated to introduce into such antechamber a desired special atmosphere prior to the opening of door **64** to provide communication with the enclosure **12.**

From the above, it will be seen that the environmental chamber of the invention has several features which represent improvements over the prior art. And although the chamber has been described in connection with a preferred embodiment thereof, it will be appreciated that various changes and modifications can be made without departing from its spirit. It is therefore intended that the coverage afforded applicant be limited only by the claims and their equivalent language.

We claim:

1. A chamber for maintaining an object in an isolated environment comprising an enclosure for separating said object from an atmosphere ambient to said chamber; and at least one access port enabling admission of the hand of an operator into said enclosure for manipulation of an object therein, said access port including a door sealing an aperture in the wall of said enclosure through which said hand is extendable into the interior of said enclosure, and a sleeve sealed to said enclosure in communication with said aperture, a free end portion of said sleeve extending to the exterior of said enclosure and providing a pre-access chamber for separating the hand of the operator from the ambient atmosphere prior to the opening of said door for access of said hand into said enclosure.

2. The chamber of claim **1** wherein said door includes locking means manipulatable from within said sleeve exteriorly of said enclosure, whereby said hand of said operator can open said door from said pre-access chamber for access into said enclosure.

3. The chamber of claim **1** further including means for evacuating said pre-access chamber of said ambient pressure prior to the opening of said door for access of said hand into said enclosure.

4. The chamber of claim 1 wherein said free end portion of said sleeve is adapted to sealingly engage the arm of an operator inserted therein toward said aperture.

5. The chamber of claim 4 further including means for evacuating said pre-access chamber prior to the opening of said door and wherein said door includes locking means manipulatable from within said sleeve exteriorly of said enclosure for opening the same inwardly of said enclosure, whereby said hand of said operator can open said door from said pre-access chamber for access into said enclosure.

6. The chamber of claim 4 further including an antechamber for introducing said object into said enclosure without opening the same to the ambient atmosphere comprising a second enclosure exterior of said first enclosure and communicating therewith through a selectively closable port adapted for passage of said object, a door on said second enclosure to provide access thereinto for said object from the exterior of both said first and second enclosures, means for reducing the pressure of gas within said second enclosure when said port and said door are closed, and a wall portion on said second enclosure which responds to reduction of gas pressure within said second enclosure by moving inwardly of said second enclosure to reduce the volume thereof.

7. A chamber for maintaining an object in an isolated environment comprising an enclosure for separating said object from an ambient atmosphere; a container for said object when it is outside of said enclosure having a cover in a wall thereof sealing an access opening therein; and means for transferring said object between said container and said enclosure without opening either said container or said enclosure to the atmosphere ambient thereto, said means including an access opening through the wall of said enclosure, a slide cover on the exterior side of said enclosure for closing said enclosure access opening, slide guide means on said enclosure defining a path for said slide cover transversing said enclosure access opening between a closed position covering said opening and an open position exposing said opening, and slide guide means on the wall of said container through which the container access opening extends complementary to said slide guide means on said enclosure for guiding said container wall traversing said enclosure access opening to replace said slide cover thereover upon said slide cover moving to said open position.

8. The chamber of claim 7 wherein said cover for said container access opening is fittable through said enclosure access opening when access is provided between said enclosure and container access openings to enable removal from the interior of said enclosure of said cover from said container opening to thereby provide communication between said enclosure and the interior of said container.

9. The chamber of claim 7 wherein said slide guide means on said enclosure is a pair of parallel guide rails respectively facing one another from opposite sides of said enclosure access opening, and said complementary slide guide means on said container wall are opposite and parallel side edges of said wall adapted to engage said guide rails.

10. The chamber of claim 9 wherein said container wall is provided with a recess at said container access opening within which said cover fits to provide said container wall with a smooth planar surface when said cover closes said opening, whereby sliding movement of said container wall along said path is facilitated.

11. The chamber of claim 7 further including an antechamber for introducing said object into said enclosure without opening the same to the ambient atmosphere comprising a second enclosure exterior of said first enclosure and communicating therewith through a selectively closable port adapted for passage of said object, a door on said second enclosure to provide access thereinto for said object from the exterior of both said first and second enclosures, means for reducing the pressure of gas within said second enclosure when said port and said door are closed, and a wall portion on said second enclosure which responds to reduction of gas pressure within said second enclosure by moving inwardly of said second enclosure to reduce the volume thereof.

12. The chamber of claim 7 wherein said enclosure further includes at least one access port enabling admission of the hand of an operator into said enclosure for manipulation of an object therein, said access port including a door sealing an aperture in the wall of said enclosure through which said hand is extendable into the interior of said enclosure and a sleeve sealed to said enclosure in communication with said aperture, a free end portion of said sleeve extending to the exterior of said enclosure and providing a pre-access chamber for separating the hand of the operator from the ambient atmosphere prior to the opening of said door for access of said hand into said enclosure.

13. An antechamber for introducing an object into an enclosure defining an isolated environment without opening said enclosure to the ambient atmosphere comprising a second enclosure exterior of said first enclosure and communicating therewith through a selectively closable port adapted for passage of said object, a door on said second enclosure to provide access thereinto for said object from the exterior of both said first and said second enclosures, means for reducing the pressure within said second enclosure when said port and said door are closed, and a wall portion of said second enclosure which responds to reduction of gas pressure within said second enclosure by moving inwardly of said enclosure to reduce the volume thereof.

14. The antechamber of claim 13 wherein the side of said wall portion on the exterior of said second enclosure is communicated with the ambient atmosphere, whereby it is the difference in pressure provided by said ambient atmosphere and the gas pressure within said second enclosure which causes said movement of said wall portion inwardly of said second enclosure to reduce the volume thereof.

15. The antechamber of claim 1 wherein said wall portion is provided by a sheet of flexible material which is moved inwardly by said differential pressure to provide said reduction in the volume of said second enclosure.

16. The antechamber of claim 15 wherein said wall portion of a flexible material is the wall of an inflatable bag, the interior of which is communicated with the ambient atmosphere for expansion of its volume into said second enclosure and a consequent reduction of the volume of said second enclosure upon said reduction of gas pressure within said second enclosure.

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