

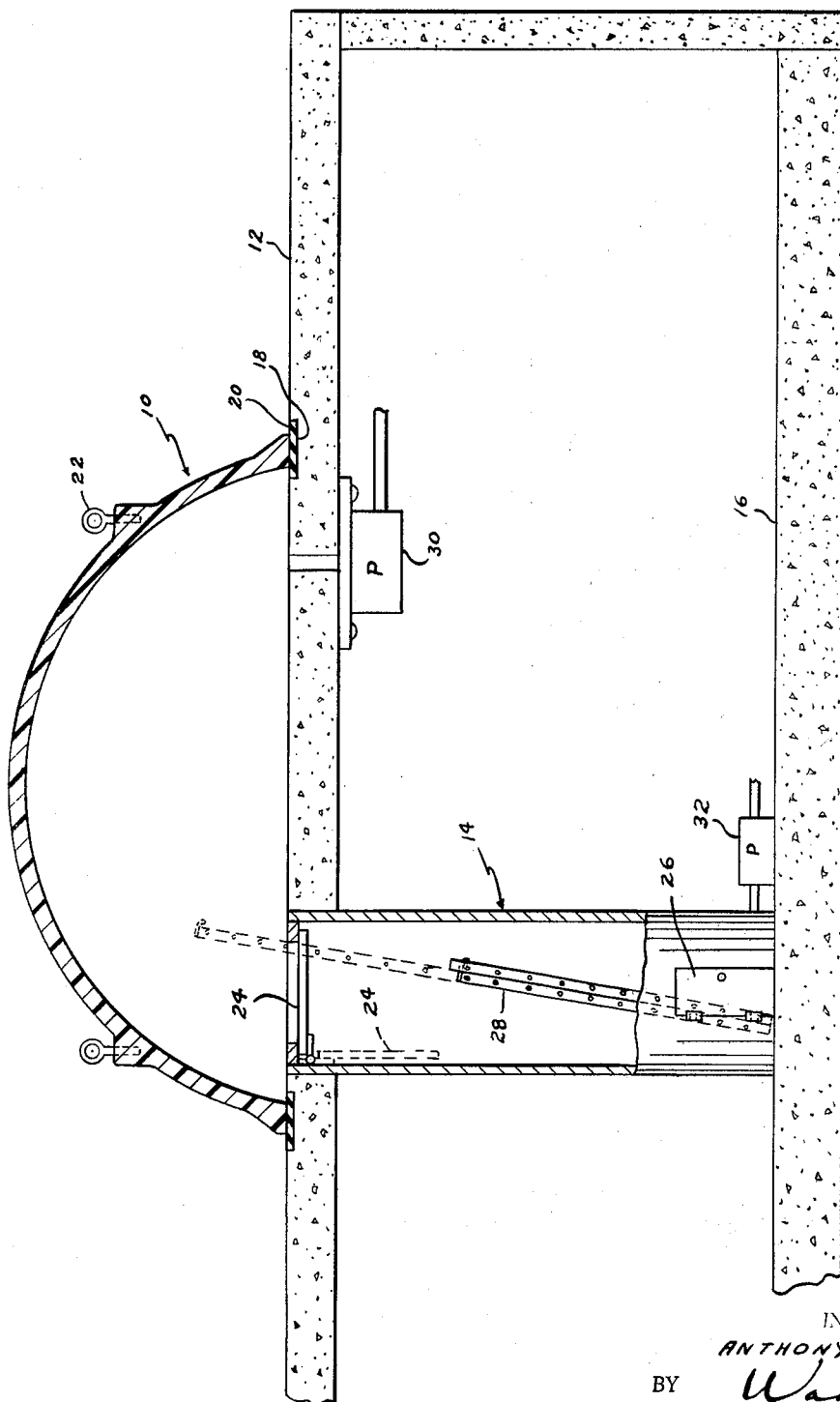
March 29, 1966

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3,242,845

EVACUATION CHAMBER

Filed Feb. 27, 1964



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3,242,845

EVACUATION CHAMBER

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Filed Feb. 27, 1964, Ser. No. 347,964

10 Claims. (Cl. 98-29)

The invention described herein may be manufactured and used by or for the United States Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to evacuation chambers and, in particular, to large chambers of a size capable of housing large animals up to the size of horses. This invention further relates to evacuation chambers which may be opened to permit the ingress and egress of the large animals. The chamber embodied by this invention also provides for the ingress and egress of personnel through lock means without unduly disturbing the atmosphere within the chamber.

While not limited to such use, and for purposes of illustration, the evacuation chamber to be disclosed will be described and discussed in connection with the conduct of toxicology studies in which test species may be exposed to, and observed in various controlled atmospheres such as encountered in space flight. Such atmospheres may not of themselves be toxic on short exposure, but may produce physical and/or physiological effects only after prolonged exposure. When making such studies over a prolonged period of time on animals, service personnel must enter the chamber periodically to feed and care for the animals, as well as to service the instrumentation and auxiliary equipment within the chamber with minimum disturbance to the chamber atmosphere.

One object of this invention is to provide an evacuation chamber suitable for the ingress and egress of large animals and apparatus.

Another object of this invention is to provide an evacuation chamber which may easily be parted to permit the ingress and egress of large animals and apparatus too large to pass through conventional lock doors.

Still another object of this invention is to provide a simple evacuation chamber formed on one side by a portion of a nonpermeable floor.

A further object of this invention is to provide an evacuation chamber in which the entire portion above the floor may be lifted for unobstructed access.

Yet another object of this invention is to provide an evacuation chamber in which that portion above the floor may be of hemispherical shape which is optimal for the uniform distribution of toxic gases, dusts and aerosols, and in which there are no corners where such materials could accumulate.

Yet a further object of this invention is to provide an evacuation chamber having an optically clear dome permitting observation and photography from all angles without blind spots.

Additional objects, advantages and features of the invention reside in the construction, arrangement and combination of parts involved in the embodiment of the invention as will appear from the following description and accompanying vertical cross sectional drawing.

The drawing shows an evacuation chamber, as embodied by this invention, on two floors of a building; the dome 10 resting on the upper floor 12 and the personnel lock 14 resting on the lower floor 16 and extending through the upper floor to communicate with the interior of the dome. The lower floor may be of any convenient material such as concrete. The upper floor may likewise be of any convenient material which is nonpermeable at the pressure differential encountered during evacuation. If made of concrete, as illustrated, the section below the dome must have sufficient strength to withstand the load-

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ing impressed, and must be suitably reinforced with steel to prevent excessive deflection. The reinforced concrete floor may be designed to be nonpermeable; or, if desired, the floor may be faced with steel, preferably on the bottom side, in order to not have a slippery floor top side. The particular design of the floor does not constitute a portion of this invention; it being sufficient to provide any suitable floor of sufficient strength which is nonpermeable.

Dome 10 may be any suitable structure open at the bottom and providing the walls and ceiling of the chamber. As shown on the drawing, the dome is of substantially hemispherical form, since this is the ideal form for a large evacuation chamber, and offers the greatest resistance to collapse. The dome may be in the form of any hollow spherical sector, within the scope of this invention, up to and including a hemisphere. The dome for some purposes may be made of opaque material within the scope of the invention; however, for the present purpose with toxicology studies with animals, the dome is preferably made of a transparent material such as high strength plastic to provide a transparent monostructure. Such material will assure complete visibility from any external point of view, both for observation and for photography. The rim of the dome may be reinforced as shown in order to provide more bearing area resting against gasket 20. The gasket 20 is shown in the form of a large flat washer, and may be made of neoprene or other suitable material. The gasket may be conveniently retained within a circular groove 18 in the upper surface of the floor. If desired, the bearing surface of the dome in engagement with the gasket may be circularly serrated in the manner well known to the art. In lieu of the flat gasket shown and described, other sealing means may be used within the scope of the invention; for example, O-rings or inflatable seals.

Means, not constituting a portion of this invention, must be provided for lifting the dome when necessary. The particular lifting means are optional with the user and may be hydraulic jacks or an overhead crane. As shown on the drawing, the dome is provided with a plurality of eye bolts 22 to which the sling from an overhead crane may be joined.

All ducting, electrical services, instrumentation lines, and tubes for the introduction of gases or fluids into the chamber may be passed through the floor beneath the dome. These services, including any drainage means for washing the floor, do not constitute a portion of the invention, and have been omitted from the drawing.

The personnel lock 14, which is preferably of the cylindrical form shown and provides a passage into the chamber under the dome, is either joined to the lower floor 16 in a leakproof manner, or is provided at the lower end with a head in the manner well known to the art. The upper end of the lock passes through and is joined in any convenient leakproof manner to the upper floor 12. The lock is preferably located to be near a wall of the chamber in order to have the largest possible unobstructed floor area. If desired, the personnel lock may be of horizontal form and may be either suspended from the upper floor, or supported by a suitable base.

Contained within the upper end of the lock is a horizontally mounted trap door 24. The trap door may be of any convenient type, either manual or power actuated, within the scope of the invention. The particular door shown is of the hinged gravity type which falls free in the absence of a pressure differential acting to hold the door shut. Such a door is provided with sufficient hinge clearance on the hinge pins to permit axial movement of the door against sealing means. The trap door is shown in the closed position, and by dotted lines the door is shown in the open position. If desired, the door shown may be counterbalanced by spring or weight means.

The lower portion of the lock is provided with a door 26 for use by personnel making ingress to or egress from the chamber. As shown on the drawing, a collapsible ladder 28 may be placed within the lock for use by the personnel entering or leaving the chamber. The solid lines show the sections of the ladder with the trap door closed, and the dotted lines show the ladder extending through the open trap door. If desired, a ladder may be joined to the interior wall of the lock. The chamber is provided with any well known vacuum pump system 30 for controlling the pressure under the dome between ambient pressure and a determinable pressure below ambient; and the lock is provided with a similar vacuum pump system 32. The various circuits, switches and interlocks used in connection with the vacuum pump systems, the trap door and the lock door are all well known to the art; and since they do not constitute a portion of the invention, they have all been omitted from the drawing for brevity and clarity.

When the chamber is evacuated to less than ambient pressure and a man wishes to enter the chamber, he enters the lock and closes the door behind him. The lock itself is then evacuated by the vacuum pump system 32 until the pressure within the lock is substantially reduced to that within the chamber at which time the trap door will open by gravity and the vacuum pump system 32 is stopped. The man then extends the ladder and enters the chamber under the dome. If the man is to remain within the chamber for an extended period of time, he retracts the ladder and closes the trap door behind him, after which the lock is returned to ambient pressure, which, because of the pressure differential, holds the trap door shut. The man may leave the chamber by reversing the operating sequence.

The valves or device for returning both the main chamber and the lock to ambient pressure are regarded as incorporated into the vacuum pump systems. If desired, guide means may be joined to the floor to assist in lowering the dome to the proper position.

It is to be understood that the embodiment of the present invention as shown and described is to be regarded as illustrative only, and that the invention is susceptible to variations, modifications and changes within the scope of the appended claims.

I claim:

1. An evacuation chamber structure comprising: a floor member, a dome member open at the bottom and removably resting on said floor member to form a chamber, sealing means between said floor member and said dome members, a personnel lock means below said floor member with one open end passing through and joined to said floor member to provide a passage between the chamber formed by said dome member on said floor member and said personnel lock means, openable door means in the passage between said chamber and said personnel lock means, a vacuum pump system for variably controlling the pressure of the atmosphere within said chamber between ambient pressure and a determinable pressure below ambient, and a vacuum pump system for variably controlling the pressure of the atmosphere within said personnel lock means between ambient pressure and a determinable pressure below ambient.

2. An evacuation chamber structure comprising: a floor member, a dome member open at the bottom and removably resting on said floor member to form a chamber, sealing means between said floor member and said dome member, a vertical personnel lock means below said floor member with the upper open end passing through and joined to said floor member to provide a passage between the chamber formed by said dome member on said floor member and said personnel lock means, a horizontally mounted openable door means in the passage between said chamber and said personnel lock means, a vacuum pump system for variably controlling the pressure of the atmosphere within said chamber be-

tween ambient pressure and a determinable pressure below ambient, and a vacuum pump system for variably controlling the pressure of the atmosphere within said personnel lock means between ambient pressure and a determinable pressure below ambient.

3. An evacuation chamber structure comprising: a floor member, a dome member open at the bottom and removably resting on said floor member to form a chamber, sealing means between said floor member and said dome member, a personnel lock means below said floor member with one open end passing through and joined to said floor member to provide a passage between the chamber formed by said dome member on said floor member and said personnel lock means, a horizontally mounted gravity openable trap door means in said personnel lock means, said trap door means falling open when the pressure within said lock means is substantially equal to the pressure within said chamber, a vacuum pump system for variably controlling the pressure of the atmosphere within said chamber between ambient pressure and a determinable pressure below ambient, and a vacuum pump system for variably controlling the pressure of the atmosphere within said personnel lock means between ambient pressure and a determinable pressure below ambient.

4. An evacuation chamber structure comprising: a floor member, a dome member open at the bottom and removably resting on said floor member to form a chamber, sealing means between said floor member and said dome member, a vertical personnel lock means below said floor member with the upper open end passing through and joined to said floor member to provide a passage between the chamber formed by said dome member on said floor member and said personnel lock means, a horizontally mounted gravity openable trap door means in the upper end of said personnel lock means, said trap door means falling open when the pressure within said lock means is substantially equal to the pressure within said chamber, a vacuum pump system for variably controlling the pressure of the atmosphere within said chamber between ambient pressure and a determinable pressure below ambient, and a vacuum pump system for variably controlling the pressure of the atmosphere within said personnel lock means between ambient pressure and a determinable pressure below ambient.

5. An evacuation chamber structure comprising: a floor member, a dome member open at the bottom and removably resting on said floor member to form a chamber, said dome member being of a hollow substantially spherical sector form, sealing means between said floor member and said dome member, a personnel lock means below said floor member with one open end passing through and joined to said floor member to provide a passage between the chamber formed by said dome member on said floor member and said personnel lock means, openable door means in the passage between said chamber and said personnel lock means, a vacuum pump system for variably controlling the pressure of the atmosphere within said chamber between ambient pressure and a determinable pressure below ambient, and a vacuum pump system for variably controlling the pressure of the atmosphere within said personnel lock means between ambient pressure and a determinable pressure below ambient.

6. An evacuation chamber structure in accordance with claim 5 in which said dome member is a transparent monostructure.

7. An evacuation chamber structure comprising: a floor member, a dome member open at the bottom and removably resting on said floor member to form a chamber, said dome member being of a hollow substantially spherical sector form, sealing means between said floor member and said dome member, a vertical personnel lock means below said floor member with the upper open end passing through and joined to said floor member to provide a passage between the chamber formed by said dome

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member on said floor member and said personnel lock means, a horizontally mounted openable door means in the passage between said chamber and said personnel lock means, a vacuum pump system for variably controlling the pressure of the atmosphere within said chamber between ambient pressure and a determinable pressure below ambient, and a vacuum pump system for variably controlling the pressure of the atmosphere within said personnel lock means between ambient pressure and a determinable pressure below ambient.

8. An evacuation chamber structure in accordance with claim 7 in which said dome member is a transparent monostructure.

9. An evacuation chamber structure comprising: a floor member, a dome member open at the bottom and removably resting on said floor member to form a chamber, said dome member being of a hollow substantially spherical sector form, sealing means between said floor member and said dome member, a vertical personnel lock means below said floor member with the upper open end passing through and joined to said floor member to provide a passage between the chamber formed by said dome member on said floor member and said personnel

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lock means, a horizontally mounted gravity openable trap door means in the upper end of said personnel lock means, said trap door means falling open when the pressure within said lock means is substantially equal to the pressure within said chamber, a vacuum pump system for variably controlling the pressure of the atmosphere within said chamber between ambient pressure and a determinable pressure below ambient, and a vacuum pump system for variably controlling the pressure of the atmosphere within said personnel lock means between ambient pressure and a determinable pressure below ambient.

10. An evacuation chamber structure in accordance with claim 9 in which said dome member is a transparent monostructure.

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