United States Patent

Bicicchi

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[45] **July 25, 1972**

[54] DOOR WITH DOUBLE-INFLATABLE SEAL AND PRESSURE CHAMBER

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[52] **U.S. Cl.** **49/68**, 49/477

[51] **Int. Cl.** **E06b 7/00**

[58] **Field of Search** 49/68, 477

[56] **References Cited**

UNITED STATES PATENTS

2,757,225	7/1956	Dunn	49/477 X
2,760,791	8/1956	Neubauer et al.	49/477 X
3,032,835	5/1962	Saar et al.	49/68

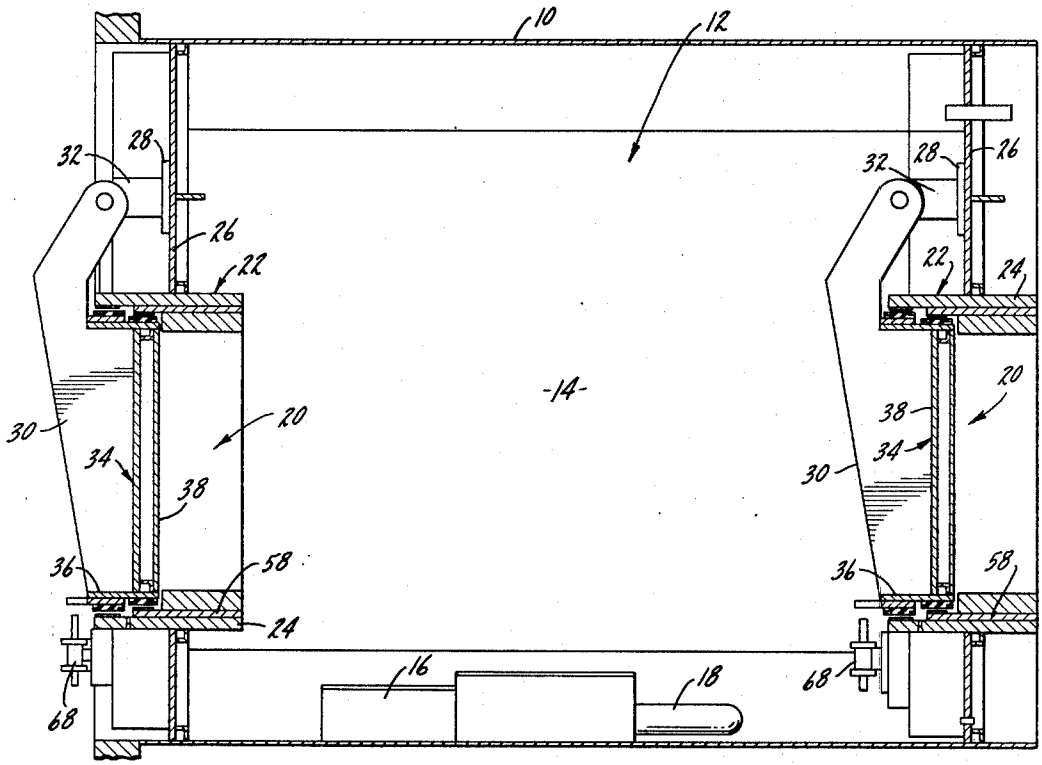
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[57] **ABSTRACT**

A door seal structure for use with a door frame having a door movably attached thereto. The seal structure includes a pair of spaced inflatable seals mounted on the periphery of the door and positioned for sealing contact with the door frame when expanded under the influence of a suitable pressure fluid. There is a space between the inflatable seals and means for pressurizing the space to provide a pressure barrier between the seals.

1 Claim, 4 Drawing Figures



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2 Sheets-Sheet 1

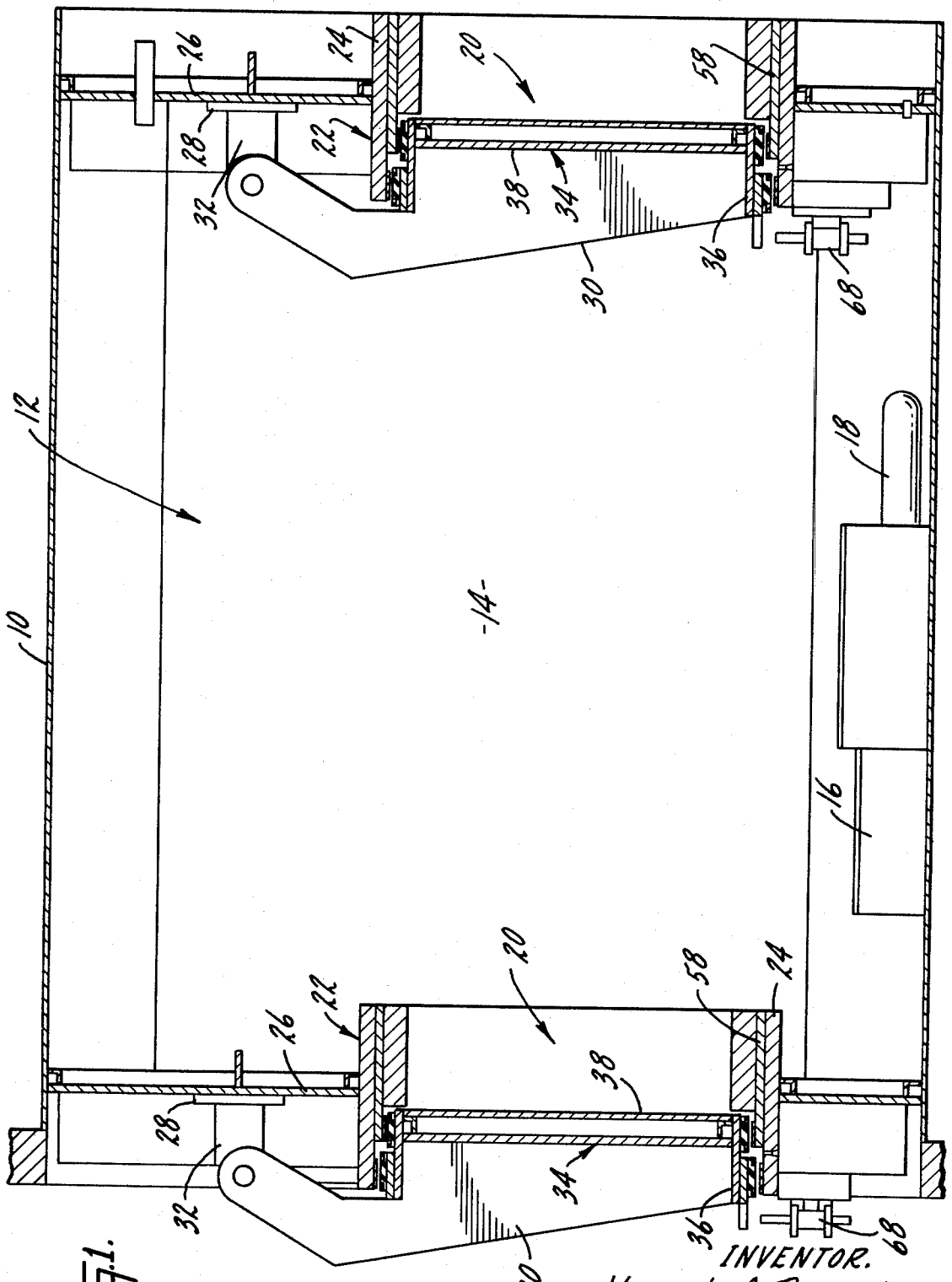


Fig. 1.

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fig. 2.

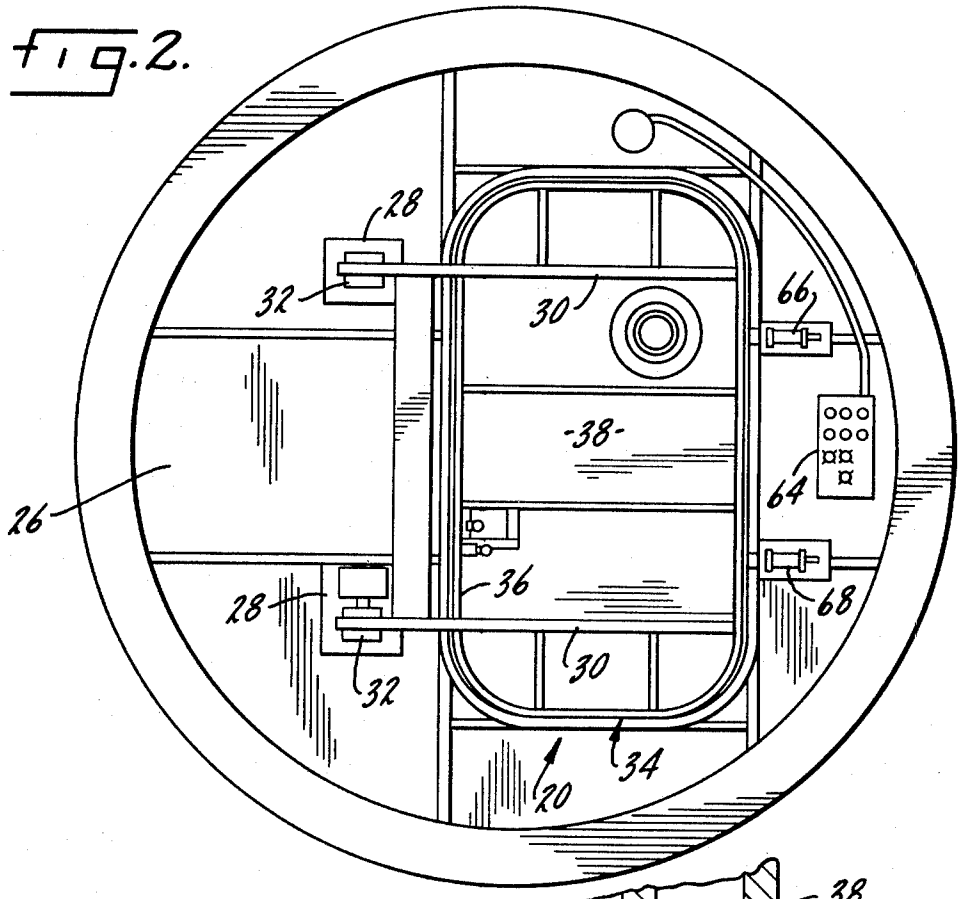
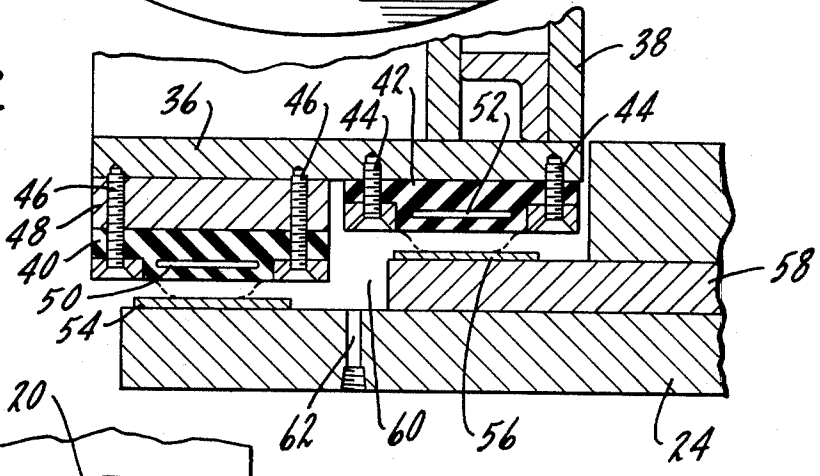


fig. 3.



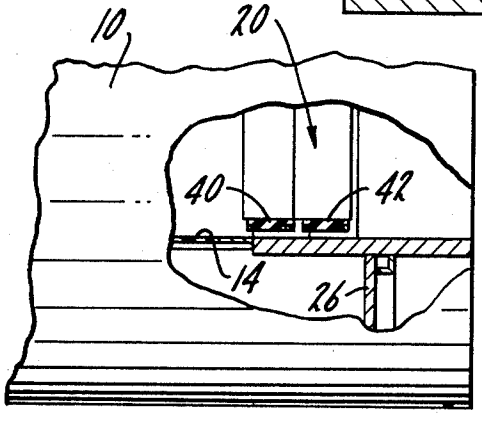


fig. 4.

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DOOR WITH DOUBLE-INFLATABLE SEAL AND PRESSURE CHAMBER

SUMMARY OF THE INVENTION

The present invention relates to a door seal and particularly to an inflatable seal structure including a pressure chamber between inflatable seals.

Another purpose is an air lock including a pair of doors, each of which includes a seal structure made up of a pair of spaced inflatable seals positioned about the periphery of the door.

Another purpose is a seal structure of the type described in which each inflatable seal has a separate air supply and in which there is a pressure chamber between the seals having its own air supply to effectively provide a plurality of separate sealing areas between the door and the door frame.

Another purpose is an air lock structure of the type described in which the seal elements are arranged to inflate against the floor to provide sealing contact.

Other purposes will appear in the ensuing specification, drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated diagrammatically in the following drawings wherein:

FIG. **1** is an axial section through an air lock of the type described,

FIG. **2** is an end view from the left side of FIG. **1**,

FIG. **3** is an enlarged partial section illustrating the inflatable seal structure, and

FIG. **4** is a partial section illustrating the relationship between the door and the floor within the air lock.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The air lock shown herein may have a variety of applications, however, the structure has found practical use in an air lock to control access to a nuclear reactor. The invention obviously should not be limited to this particular application, nor should the invention be limited to an air lock. The particular inflatable seal structure shown has application in a variety of constructions in which it is desirable to seal a movable door to a door frame.

In FIG. **1** a housing **10** defines a chamber **12** which provides a pass-through area for the air lock. There is a floor **14** in the air lock so that workmen may pass through to the nuclear reactor, if that is the application. At one side of the air lock is an air and hydraulic control box **16** and an air reservoir **18** for use in inflating the seal structures described hereinafter.

At each end of the air lock there are door structures indicated generally at **20**. Since the door structures are substantially identical, only one will be described in detail. The door structures include a door frame **22**, which has a peripherally extending frame element **24**. The frame element **24** is welded or otherwise suitably attached to a wall member **26**. There are a pair of hinge plates **28** mounted on the wall members **26** and arms **30** are pivotally attached to brackets **32** extending outwardly from the plates **28**. Each of the arms **30** are attached to a door **34**. The doors **34** consist essentially of a peripherally extending rim **36**, illustrated in detail in FIG. **2** and generally rectangular in shape with rounded corners, and a central plate **38** which covers the space inside the peripherally extending rim **36**.

As illustrated in FIG. **3**, the entire periphery of the door is defined by the rim **36** and there are a pair of peripherally extending inflatable seals **40** and **42** attached to the rim **36**. The inflatable seals may be of various types and the seal structure shown in my U.S. Pat. No. 2,932,862 has been found to be satisfactory. Screws or the like **44** may attach the seal **42** to the rim **36** and screws or the like **46**, which pass through a plate **48**, may be used to attach the seal **40** to the rim **36**. Plate **48** extends about the door along the sides and top, but not across the bottom. Thus, seal **40** is concentric with and spaced outwardly from seal **42** along the sides and top, but is parallel

to seal **42** along the bottom of the door. Note FIG. **4**. In this way, the floor may extend through the air lock and beyond, and both seal elements will inflate against the floor at the bottom of the door. The seal elements **40** and **42** each have an inner space **50** and **52** which, as described in my earlier patent, will receive air under pressure to inflate the seal so as to urge it against oppositely positioned and aligned seating surfaces.

Door frame **24** may have a seating surface **54**, which is preferably stainless steel, and which extends peripherally about the door frame except for the floor area. Seal **40**, when inflated, will move to the dotted line position shown, to provide a firm seal between the door and the door frame at this point. In like manner, seating surface **56** will provide a seating area for seal **42** when it is expanded. In this case, however, since seal **42** is inside of seal **40**, there is a peripheral plate **58** generally the same thickness as plate **48** which mounts the seating surface **56**. The seals may be identical, as may be the seating surfaces, and the plates **48** and **58** merely provide a stepped construction for the door seal.

The space between seals **40** and **42** defines a pressure chamber **60**. A conduit **62** provides access to the chamber **60** and a means for pressurizing it. Thus, not only are there a pair of spaced inflatable seals, but there is a pressure chamber or pressure barrier between the seals which provides yet a third means of effecting a complete seal between the inside and the outside of the door.

Returning to FIG. **2**, a control station is indicated at **64** and will provide the control buttons for operating the door to permit access to the air lock. Also illustrated in FIGS. **1** and **2** are latch structures **66** and **68** which are used to latch the doors in position when they are closed. The door frame will completely hold the door against any pressure blow-out from within, however, because there is a slight opening force component created by the differential pressure areas within chamber **60**, it has been found to be desirable to include the latch structures indicated at **66** and **68** to prevent any creeping of the door.

In operation, and assuming again use in a nuclear reactor, if the air lock is designed to prevent pressure as high as 70 psi within the reactor from escaping and carrying radioactive contamination to the outside, the inflatable seals would be pressurized to about 95 psi or approximately 25 psi above the possible pressure within the reactor. The chamber **60** would also be pressurized to 70 psi, or the pressure which could be created within the reactor. Thus, there would be no pressure differential across the seal and therefore no leakage across the seal. Not only do the seals themselves, each having separate and independent air supplies, provide a firm seal at the door, but by creating a pressure chamber within or between the door seals and by having this pressure chamber pressurized to approximately the pressure to be protected against, there is no possibility of leakage.

As indicated above, each seal on each door has its own separate air supply, so that failure of any one seal does not affect any of the other three seals of the four making up the air lock. The invention should not be limited to any particular size of air lock, nor to an air lock per se. Clearly, the inflatable seal structure made up of a pair of spaced inflatable seals and including a pressure barrier between them, has wide application in a door seal structure.

It should be pointed out that the pressure chamber **60** is continuously pressurized during operation. It is not solely for the purpose of testing or determining if there is leakage across the inflatable seals. W

Whereas the preferred form of the invention has been shown and described herein, it should be realized that there are many modifications, substitutions and alterations thereto.

I claim:

1. An air lock having a housing defining a chamber, a floor in said chamber, a pair of door frames in said housing, a door pivotally mounted in each frame, a pair of spaced seating surfaces on each door frame, said seating surfaces being spaced

concentrically with each other, with one being inside of the other,

a seal structure for seating each door within its associated frame and including a pair of spaced peripherally extending inflatable seal elements mounted on the periphery of said door for sealing contact with the spaced seating surfaces on its associated door frame, the space between each pair of seal elements defining a peripherally extending pressure chamber, and means for pressurizing each of said chambers,

at the bottom of each door, adjacent the floor, said seal elements lie in a horizontal plane parallel to the floor, the seal elements over the remaining periphery of the door being arranged with one seal element positioned concentrically with and outside of the other.

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