July 16, 1968 F. G. JOHNSON ETAL 3,392,489

PRESSURE CONTAINING VESSELS

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Fig. 1.

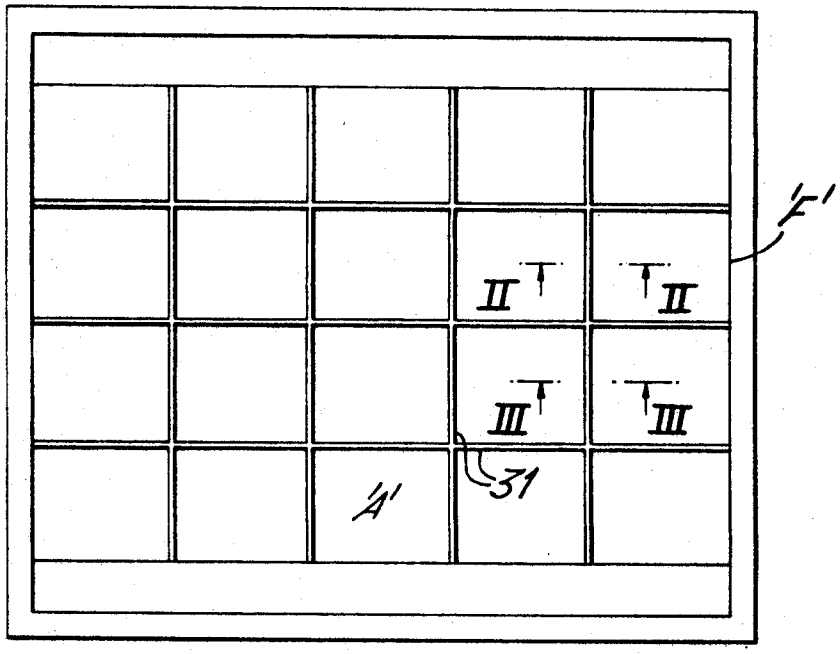
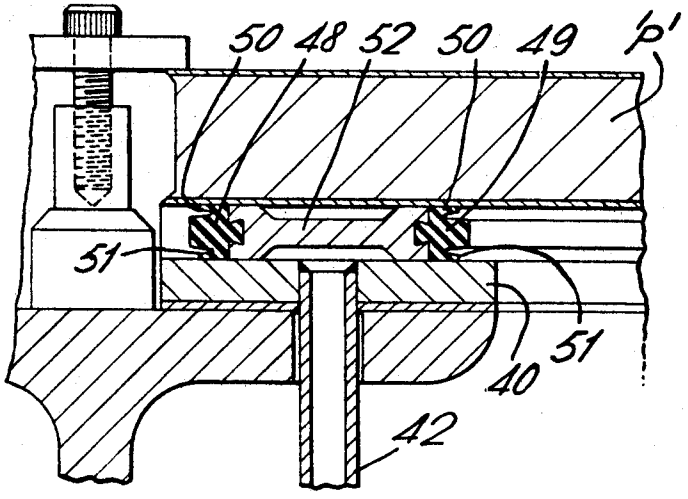


Fig. 3.



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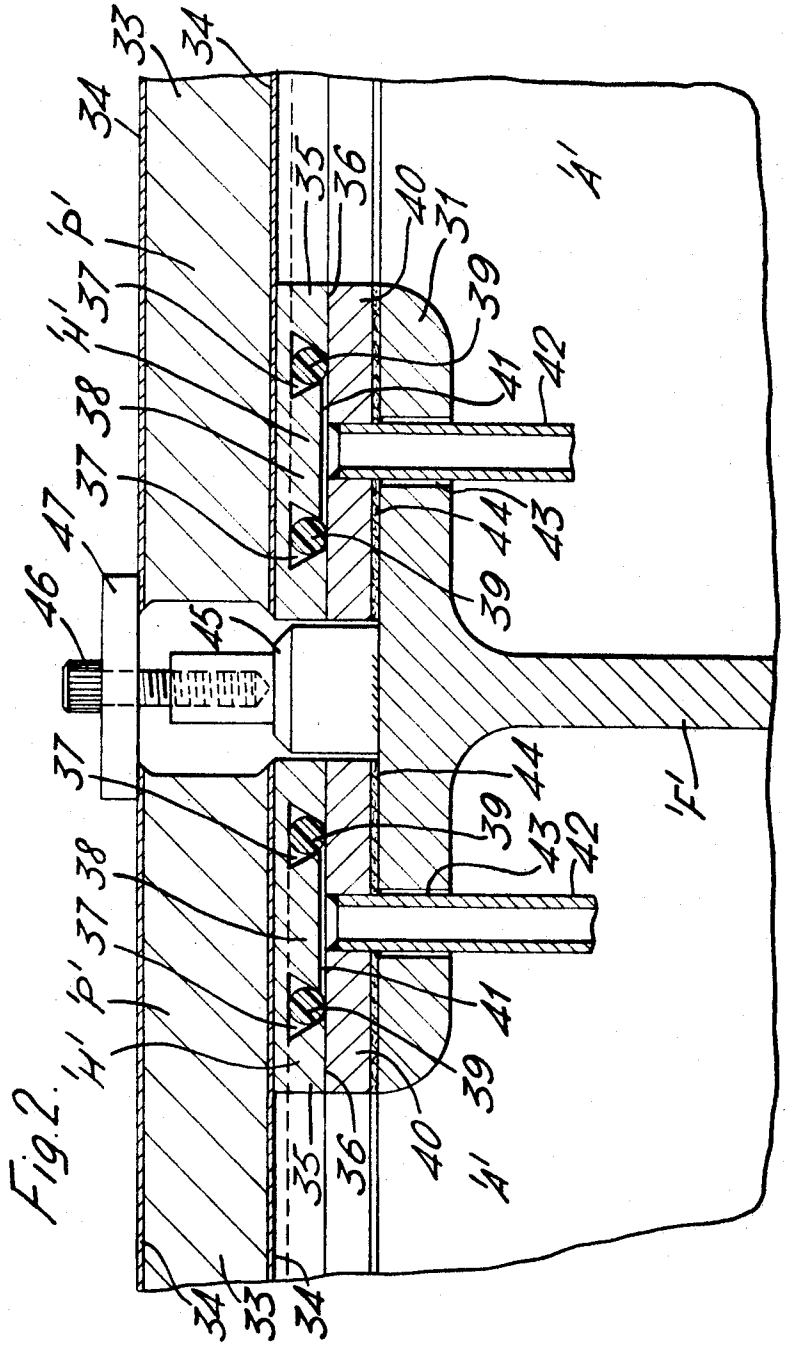

Fig. 2.

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PRESSURE CONTAINING VESSELS

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ABSTRACT OF THE DISCLOSURE

Structure for closing a large wall opening of a building, the structure comprising framework dividing the opening into a plurality of apertures and closure panels for the apertures held to the framework by vacuum means.

This invention relates to building structures and is concerned with a structure for closing a wall opening of a pressure containing enclosure which can effect a rapid pressure reduction in the enclosure when the differential pressure across the structure exceeds a predetermined value.

It is known to use pressure relief valves and frangible membranes as closure means for wall openings in pressure containing enclosures for effecting pressure reductions when pressure within the enclosure exceeds a predetermined value. However, such devices are unsuitable where circumstances require that a wall opening in a pressure contaning enclosure shall be large (for example, of the order 16 feet high, 21 feet wide) and have closure means for containing gas or vapour at a low pressure (for example, .5 p.s.i.g.) but which will open to discharge gas or vapour quickly when the selected pressure is exceeded. In particular, when a frangible membrane is breached the rupture membrane still offers a large resistance to outflow of gas or vapour and furthermore it is difficult to design a frangible membrane for a large opening of the order of size hereinbefore stated, which in retaining such a relatively low pressure will breach when the pressure differential across the membrane is increased by a small margin of the order of 0.1 to 1.0 p.s.i.a.

According to the invention, a building structure for closing a wall opening in a building is provided which comprises framework dividing the opening into a plurality of apertures each closed by a rigid panel which is held to the framework by vaccum means. The vacuum means comprises evacuable chambers between the framework and panels and evacuating means arranged so that when the pressure within the building exceeds a predetermined value, at least one panel is ejected thereby destroying the vacuum and allowing the remaining panels to be ejected.

A construction of building structure embodying the invention will now be described, by way of example, with reference to the accompanying drawings wherein:

FIGURE 1 is a front view of a framework of a first building structure,

FIGURE 2 is a fragmentary sectional view on line II—II of FIGURE 1, and

FIGURE 3 is a fragmentary view of a second building structure in section on line III—III of FIGURE 1.

With reference to the drawings, there is shown a building structure for sealably closing a wall opening of a pressure containing enclosure. The building structure comprises a framework F defining apertures A each aperture A being sealably closed by a panel **32** (held in abutment with the framework by holding means H which is actuated by pressure differential and which is responsive

to displacement of one of the panels so that, when used normally to close the wall opening in sealing manner, displacement of one of the panels serves to effect displacement of the remaining panels.

In greater detail the framework defines a wall opening of a pressure containing enclosure. The opening has dimensions of the order 16 feet high, 21 feet wide and has transverse structural members **31** dividing the opening into twenty equal size apertures A of rectilinear form grouped in side-by-side arrangement. As shown in FIGURE 2 the apertures A are sealably closed by rigid aluminium panels P which are releasably held against a member **31** of the framework F by holding means H actuated by differential pressure. Two adjacent panels are shown held against a common structural member **31**; each panel P comprises an aluminium cellular member **33** faced on each side with a thin aluminium sheet **34** providing a light but rigid panel structure and including a rectangular stainless steel frame member **35** bonded to the side of the panel which abuts the framework F. The frames each have two continuous grooves **37** of dove-tail shape extending about the frame one inside the other. The intervening lands **38** are of reduced depth and the grooves house sealing members **39**. The framework F includes stainless steel frame members **40** secured and sealed thereto by bolts (not shown) and a gasket **44**. The frame members **40** are complementary to frame members **35** and have a ground sealing face **36** so that a sealed chamber **41** is defined between each panel P and the framework and bounded by each pair of inner and outer sealing members **39**.

Pipe connections **42** extend through apertures **43** in the members **31** and are secured to the frame members **40** to provide ducts extending into the chambers **41**. Between adjacent side edges of each pair of panels there is provided a screw threaded boss **45** attached to the frame member **31** and having a bolt **46** which carries a clamping member **47**. Each aperture A has a pipe connection **42** which communicates via pipework and an isolating valve (not shown) with vacuum pumps of known construction and also not shown in the drawings.

To mount the panels P in position over the apertures A the panels are first clamped to the framework F and members **31** by means of the bolts **46** and clamping members **47**. Then the valves are opened to connect the chambers **41** to the vacuum pumps to evacuate the chambers, whereupon the panels become secured to the structure by pressure differential between the interiors and exteriors of the chambers **41**. The clamping members **47** are then removed.

In the event of pressure within the vessel increasing to a predetermined value, the force on the panels is sufficient to displace at least one of the panels P whereupon the vacuum is destroyed so that the remaining panels are released to open fully the wall opening.

The building structure shown in FIGURES 1 and 2 has application in a pressurised nuclear reactor installation which comprises a nuclear reactor core housed within a primary containment which communicates with a secondary containment via lutes venting into a pool of water in the secondary containment. The secondary containment is a pressure containing enclosure having a wall opening normally closed to atmosphere by the described structure. The panels are designed to be detached whenever the pressure in the secondary containment increases to a value within the range 0.5 to 1.5 p.s.i.g. so as to relieve the pressure.

The wall opening of the nuclear reactor installation also has a pivotable closure member disposed inside the vessel. The pivotable closure member is hinged eccentrically about a horizontal axis so as to bias it into a closed

position and is normally held open against the biassing by co-operating vacuum cups attached one to each of the pivotable closure member and the structure of the secondary containment. The vacuum cups may be connected to the same vacuum source as the differential pressure means of the aperture closure panels so that in the event of pressure within the vessel rising to a value sufficient to overcome the holding means so as to displace the panels and relieve the pressure in the vessel by discharge of fluid via the wall openings, discharge of the panels destroys the vacuum thereby releasing the vacuum cups. Thus when the outflow of fluid from the vessel subsides (the initial outflow continues to hold the pivotable closure member open even though the pivotable closure member has been released by the vacuum cups) the pivotable closure member closes the wall openings again.

In a further construction of building structure the general arrangement of panels and framework is generally in accordance with FIGURES 1 and 2 but the stainless steel frames are omitted from the panels P and the sealing members are of a different form. As shown in FIGURE 3, the endless sealing members **48**, **49** are arranged as inner and outer members and each have two sealing lips **50**, **51** those of member **48** being directed inwardly and those of member **49** directed outwardly. Each pair of sealing members is bonded to an aluminium former **52** which holds them in spaced relation. Each assembly of former **52** and sealing members **48**, **49** is attached to a face of the panel P by bonding the sealing members thereto and the lips **51** of each sealing member abut the ground faces of a stainless steel frame member **40**. Each pipe connection **42** communicates with a chamber bounded by the lips **51** of the sealing members, the former **52** and the frame member **40**.

Advantage lies in the elimination of the frame members **35** with their grooves **37** thereby simplifying the construction and reducing the cost of the panels P.

We claim:

1. A building enclosure having at least one face comprising:

a framework formed by a plurality of rigid members defining a plurality of apertures therebetween,

a plurality of panels in abutment with one side of said framework serving to close said apertures,

sealing means between said panels and said framework providing yieldable supports for said panels,

means defining chambers bounded by said framework, said panels and said sealing means, and

means for connecting said chambers with common evacuating means for evacuating said chambers to produce a vacuum seal between said panels and said framework whereby when the pressure within the enclosure exceeds a predetermined value at least one of said panels is ejected.

2. A building enclosure having at least one face comprising:

a framework formed by a plurality of rigid members defining a plurality of apertures therebetween,

a plurality of panels in abutment with one side of said framework serving to close said apertures,

a plurality of pairs of endless, resilient sealing members between said panels and said framework providing yieldable supports for the panels, each panel having a pair of said sealing members and said sealing members being arranged as spaced inner and outer sealing members extending around said panel adjacent its periphery,

means defining a chamber bounded by said framework, each panel, and said inner and outer sealing members, and

means defining a duct extending from said chamber to a connection for common evacuating means for evacuating said chambers to produce a vacuum seal between said panels and said framework whereby when the pressure within the enclosure exceeds a predetermined value at least one of said panels is ejected.

3. A building structure forming part of a wall of a sealed pressurised enclosure comprising:

a framework formed by a plurality of rigid members defining a plurality of apertures therebetween,

a plurality of panels in abutment with one side of said framework serving to close said apertures,

sealing means between said panels and said framework providing yieldable supports for said panels,

means defining chambers bounded by said framework, said panels and said sealing means,

means for connecting said chambers with common evacuating means for evacuating said chambers to produce a vacuum seal between said panels and said framework whereby when the pressure within the enclosure exceeds a predetermined value at least one of said panels is ejected, and

releasable mechanical clamping means for securing said panels in abutment with said framework when said chambers are disconnected from said common evacuating means.

4. A building structure comprising:

a framework formed by a plurality of rigid members defining a plurality of apertures therebetween,

a plurality of panels in abutment with one side of said framework serving to close said apertures,

a plurality of pairs of endless, resilient sealing members between said panels and said framework providing yieldable supports for the panels, each panel having a pair of said sealing members and said sealing members being arranged as spaced inner and outer sealing members extending around said panel adjacent its periphery,

means defining a chamber bounded by said framework, each panel, and said inner and outer sealing members,

means defining a duct extending from said chamber to a connection for common evacuating means for evacuating said chambers to produce a vacuum seal between said panels and said framework whereby when the pressure within the enclosure exceeds a predetermined value at least one of said panels is ejected, and

releasable mechanical clamping means for securing said panels in abutment with said framework when said chambers are disconnected from said common evacuating means.

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