

[54] **PNEUMATICALLY SEALABLE FLOOD
PANEL ASSEMBLY**

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61/28

[51] Int. Cl. **E06b 7/18, E05c 21/02**

[58] Field of Search **49/477, 466, 465, 463;**
160/215; 61/29, 28, 22 A

[56]

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[57]

ABSTRACT

The disclosure relates to a flood panel assembly for installation in doorways and other access openings of buildings to improve water-tight integrity under moderate flood conditions. The invention is applicable particularly to stone or concrete structures, such as factory buildings which are substantially water-tight except at limited doorways and other access openings.

The apparatus of the invention includes a conversion frame, arranged for permanent installation in the access opening. A flood panel of suitable height for the conditions expected is removably positioned in the conversion frame. The flood panel has an air-inflatable sealing element extending along its side and bottom edges. After initial positioning of the flood panel in the conversion frame, the sealing element is inflated, completely sealing off the access opening.

9 Claims, 10 Drawing Figures

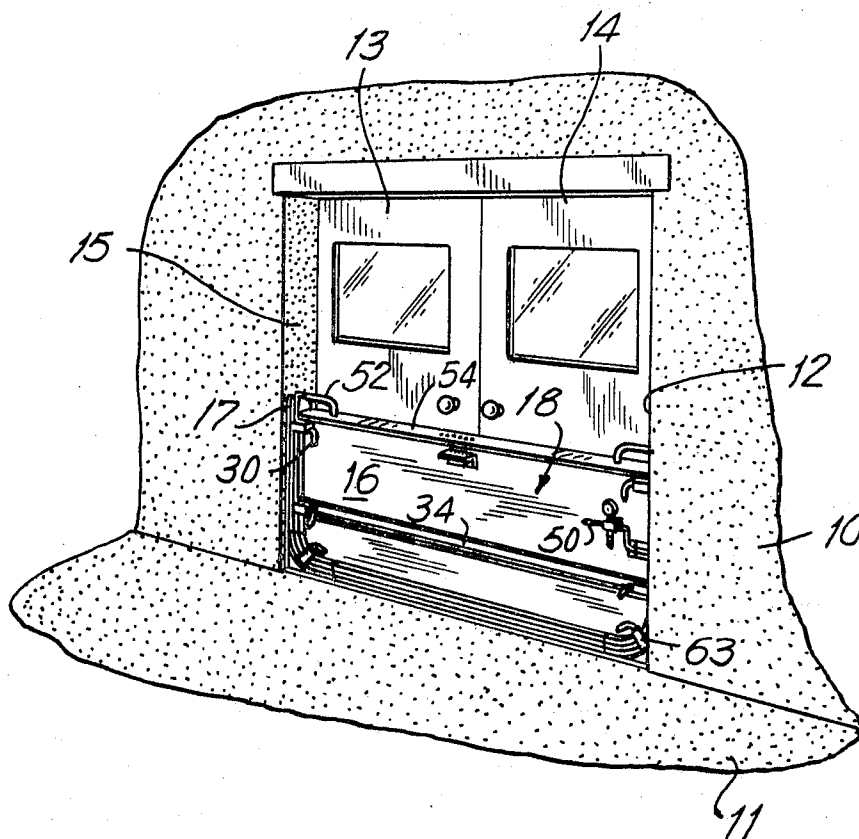


FIG. 1

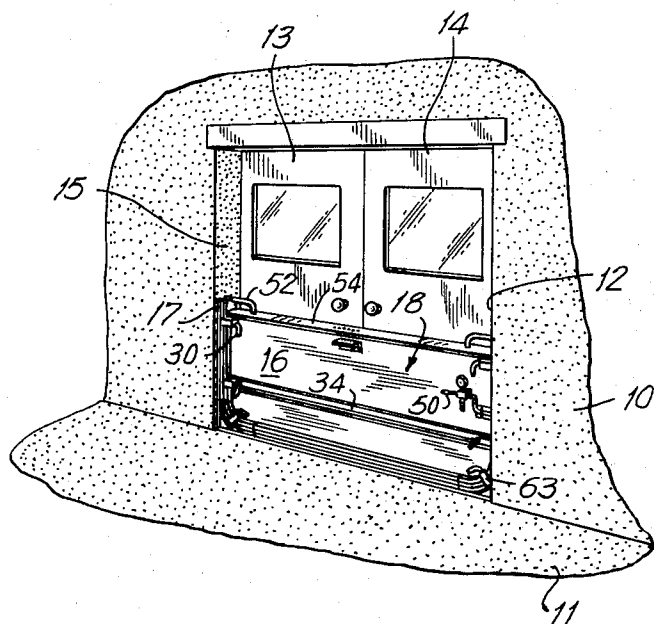


FIG. 3

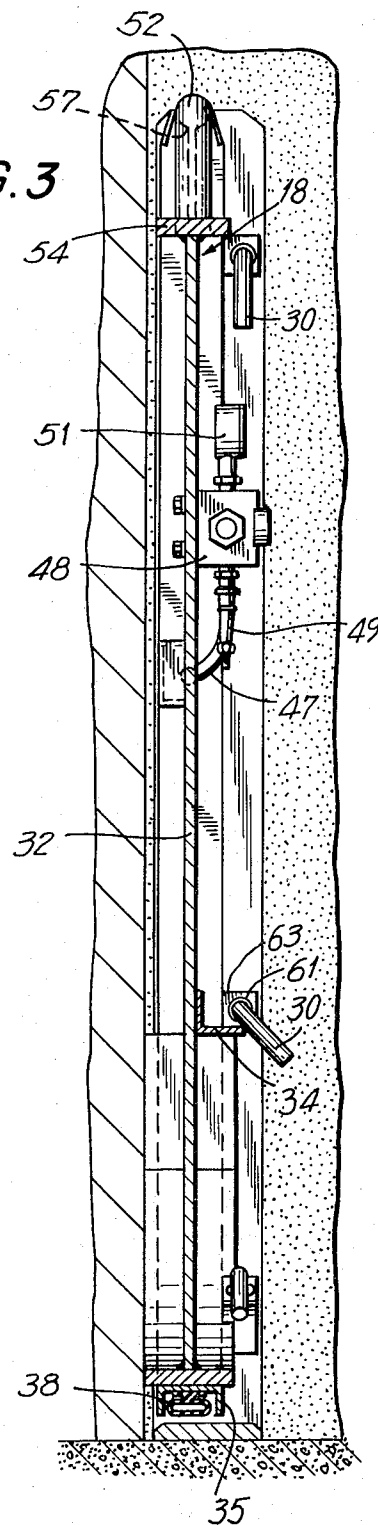


FIG. 4

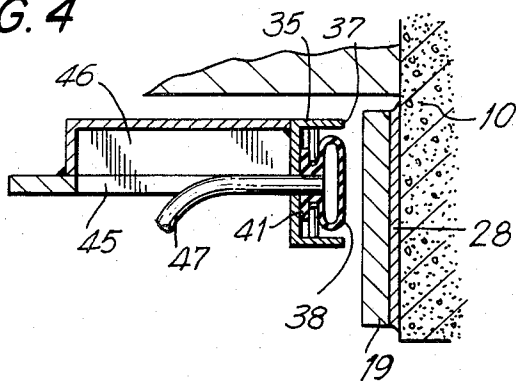


FIG. 2

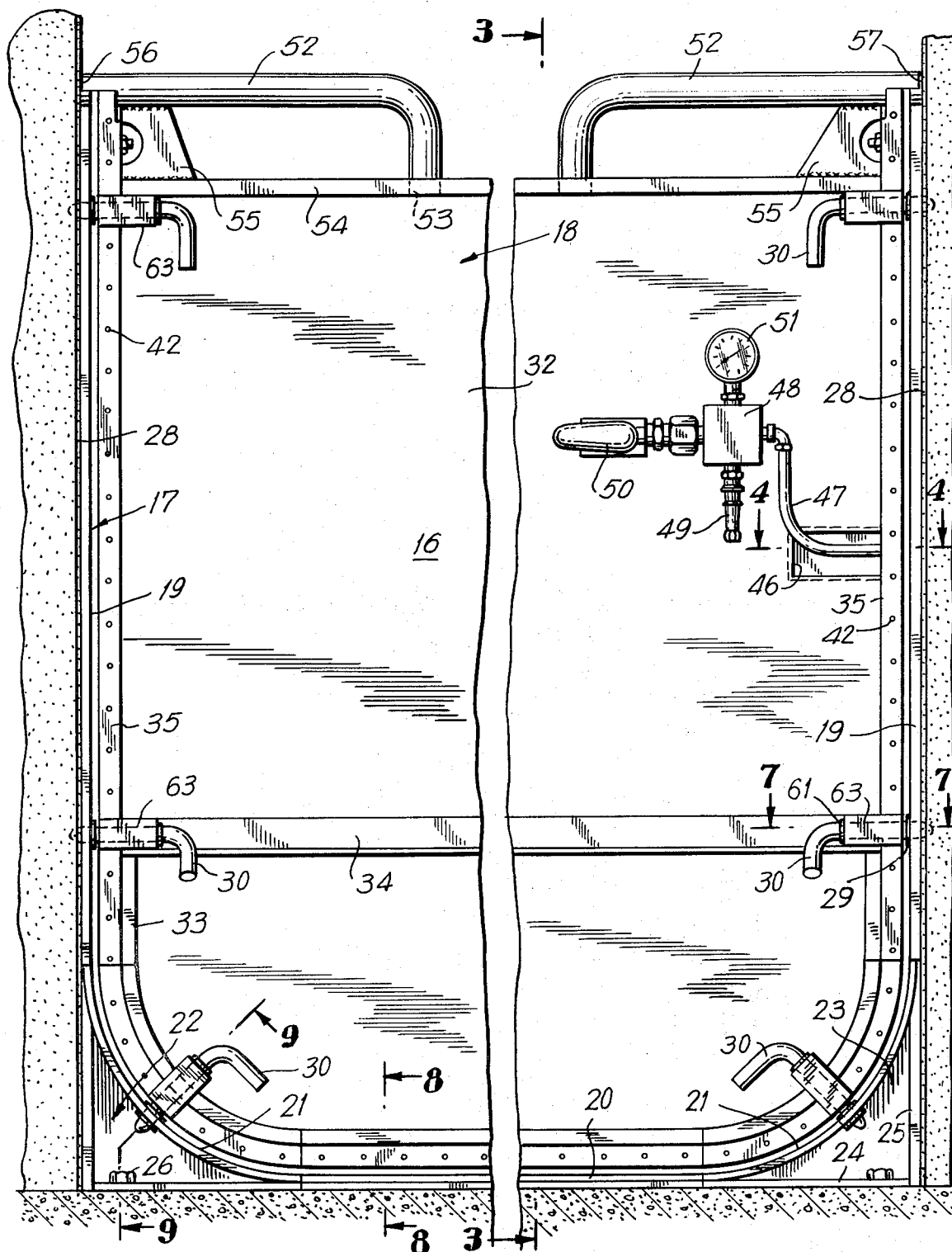


FIG. 5

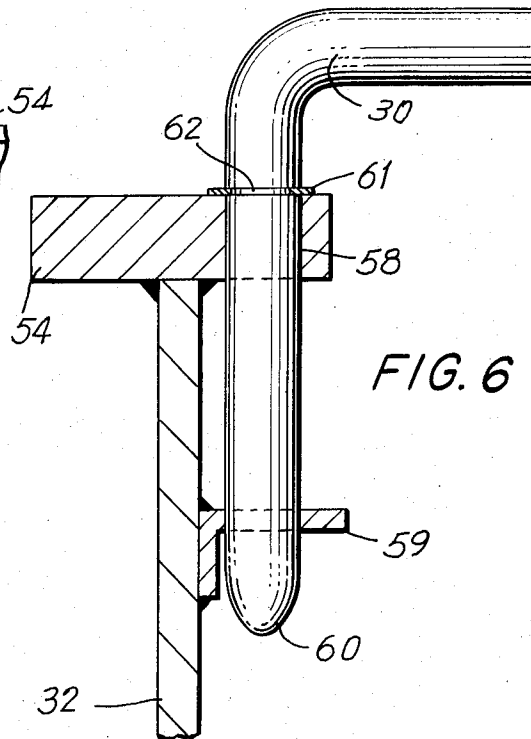
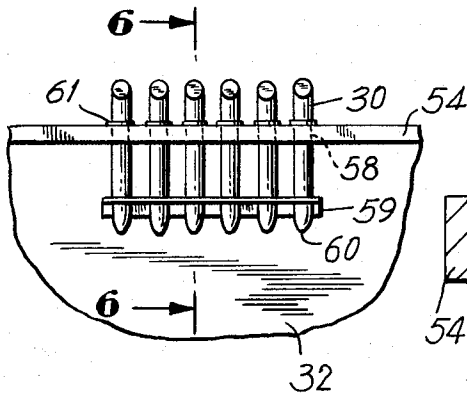


FIG. 7

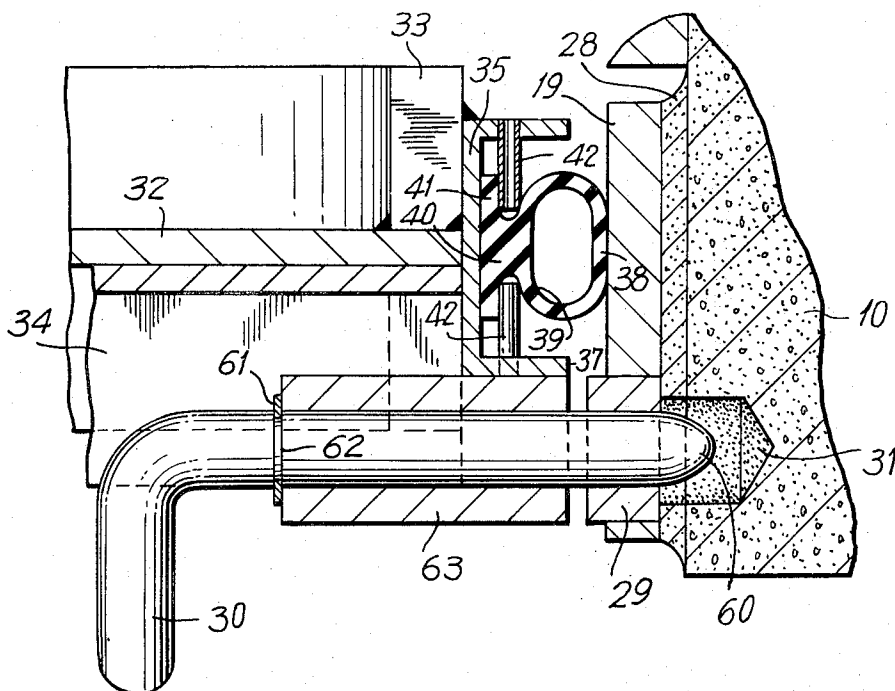


FIG. 8

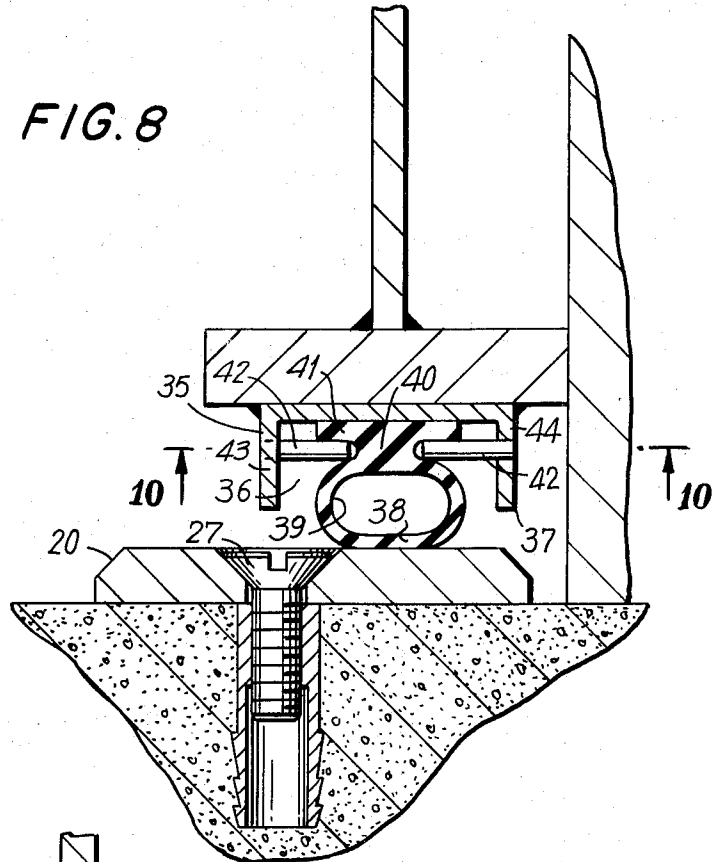


FIG. 9

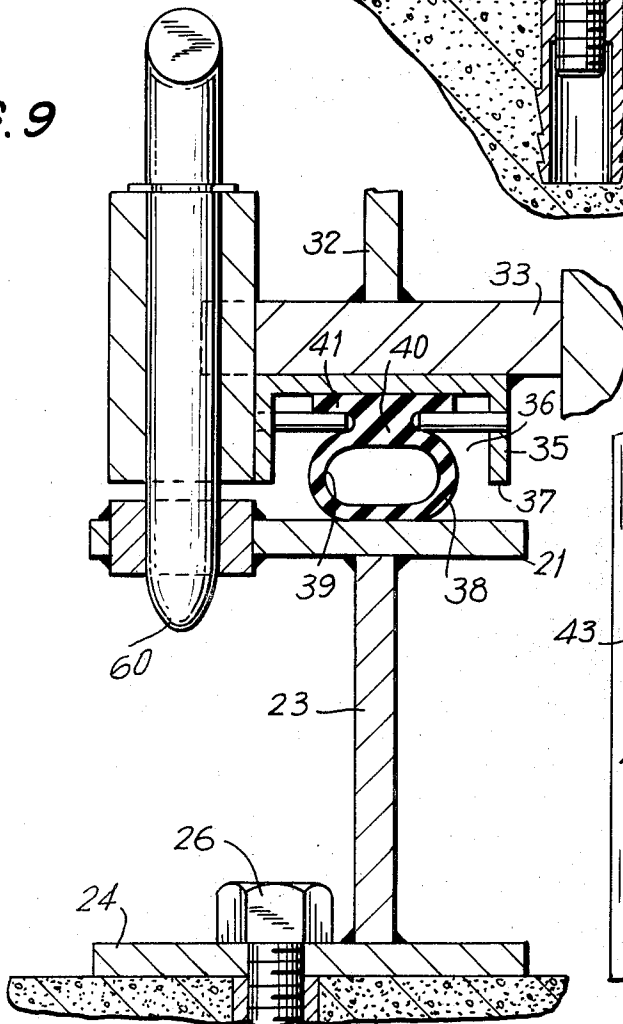
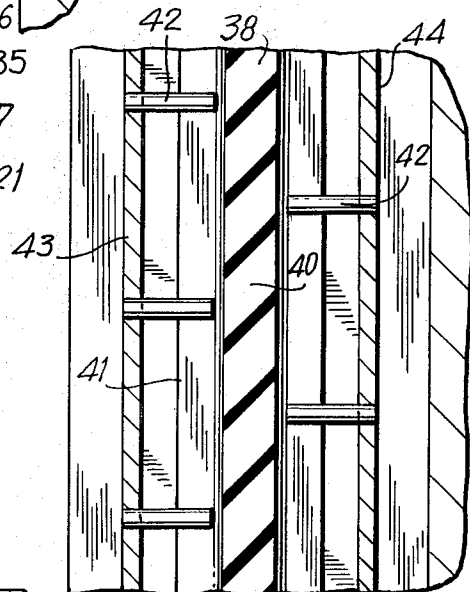


FIG. 10



PNEUMATICALLY SEALABLE FLOOD PANEL ASSEMBLY

BACKGROUND AND SUMMARY OF THE INVENTION

In locations subject to flooding from over-flowing rivers and/or heavy rain accumulations, it is usual for factory buildings and other structures in low-lying areas to be inundated by the flood waters. In many such cases, the level of the flood waters in the building may not be especially high, yet the damage caused can be very extensive. In a factory building, for example, a flood water inundation of even a few inches may cause massive damage to valuable machinery, electric motors, electronic controls, etc.

Modern factory and office buildings frequently are of concrete, stone or brick construction, such that the walls of the structure have substantial integrity against water inundation. However, the doors and other access openings to such buildings provide such a ready path for the inflow of flood waters that inundation will be expected under flooding conditions. The present invention provides a relatively simplified and yet wholly effective standby apparatus, which can be quickly installed at the access openings of an otherwise relatively water-tight structure, to completely seal off the access openings against the entry of flood waters. The apparatus of the invention comprises two principal parts, a conversion frame structure permanently installed in the access opening, and a removable panel arranged to be quickly inserted in the conversion frame and arranged to establish a water-tight association therewith.

In accordance with the invention, the removable flood panel is provided about its effective edges with an inflatable, flexible sealing element, which is normally in a deflated condition. When the flood panel is installed in the conversion frame, it is initially locked in position by mechanical means, providing a uniform clearance space around the operative edges. Thereafter, the sealing element is inflated, thereby causing it to expand and thus be brought into tight, sealing relation with the confronting surfaces of the conversion frame.

Typically, the conversion frame and flood panel will be designed to provide a seal along two side edges and the bottom edge of the flood panel, to provide a barrier for the lower portion of an access opening. Consistent with the teachings of the invention, however, the conversion frame and flood panel may be constructed to provide sealing about the entire periphery of the panel, to provide for complete sealing of smaller openings, such as windows, for example.

For a better understanding of the invention and its various features and advantages, reference should be made to the following detailed description and to the accompanying drawing.

DESCRIPTION OF DRAWING

FIG. 1 is a fragmentary perspective view of a structure having an access opening and incorporating the flood panel assembly of the invention.

FIG. 2 is a greatly enlarged, fragmentary front elevational view of the complete flood panel assembly of FIG. 1.

FIGS. 3 and 4 are enlarged, cross-sectional views taken generally along lines 3—3 and 4—4, respectively, of FIG. 2.

FIG. 5 is an enlarged, fragmentary view illustrating details of the apparatus of FIG. 2.

FIG. 6 is an enlarged, cross-sectional view taken along line 6—6 of FIG. 5.

FIGS. 7, 8 and 9 are enlarged, fragmentary cross-sectional views taken generally along lines 7—7, 8—8 and 9—9, respectively, of FIG. 2.

FIG. 10 is an enlarged, fragmentary cross-sectional view taken generally along line 10—10 of FIG. 8.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to the drawing, and initially to FIG. 1 thereof, the reference numeral 10 designates the wall of a typical commercial structure, such as a factory or office building. The floor of the structure is designated by the numeral 11, and the structure has an access opening 12 which, in the illustrated instance, comprises outwardly swinging double doors 13, 14. The access opening 12 is of conventional construction and configuration, and typically provides a pair of inwardly facing surfaces 15 inside of the doors.

In the illustration of FIG. 1, a complete flood panel assembly 16 according to the invention is shown secured in the lower portion of the access opening, inside of the doors 13, 14. To advantage, when the doors open outwardly, the flood panel assembly 16 is mounted on the inside. This permits the doors to be opened and closed while the flood panel assembly is in position, which normally is desirable.

In accordance with the invention, the flood panel assembly 16 comprises a conversion frame generally designated by the numeral 17 and a removable panel generally designated by the numeral 18. The conversion frame 17 is arranged to be permanently secured in the building structure, whereas the panel 18 can be removed and stored when it is not needed.

As shown in FIGS. 2 and 3, the illustrated conversion frame 17 is of generally U-shaped configuration, comprising vertical strip sections 19 at each side, a horizontal strip section 20 along the bottom, and arcuate strip sections 21 at each corner connecting the respective vertical and horizontal sections 19 and 20. At each corner, the conversion frame 17 is provided with corner fillets 22 including corner plates 23 and flange strips 24, 25. The strips 19—21 and 24, 25 typically are wide, flat strips of metal, together forming an effectively continuous flat sealing surface along the inside of the conversion frame.

In accordance with the invention, the U-shaped conversion frame is permanently secured in place in the access opening 12 as by a plurality of bolts 26 and recessed screws 27 (FIGS. 8 and 9), and suitable caulking or grouting 28 (see FIG. 4) is provided between the conversion frame and the building structure to provide a permanent, effective water seal therebetween.

At the corners, the conversion frame provides for generously rounded sealing surfaces, although the access opening itself may present a right angle corner configuration. In this respect, the conversion frame for a door opening is desirably on the side of the door opposite that toward which the door swings in opening, since otherwise the arcuate corner structure of the conversion frame could interfere with normal door movement. This will, of course, depend upon the particular configuration of the access opening and its normal closure facility and can be readily ascertained by a person skilled in the art.

At selected locations about the periphery of the conversion frame, there are provided apertured sockets 29 (see FIG. 7) for the reception of locking pins 30 to be more fully described. Typically, the grouting 28 and the wall structure 10 of the building may also be recessed, as at 31, to receive the projecting end of the locking pin.

The panel member 18 of the flood panel assembly comprises a large, flat sheet metal panel plate 32, of a general shape and size to correspond to the interior configuration of the conversion frame, with ample clearance between the plate edges and the conversion frame. The lower portion of the panel structure is strengthened by means of a strip 33 extending laterally from the panel in both directions and forming a stiffening flange. An angle section 34 extends transversely across one face of the plate at the upper extremities of the flange strip 33, to impart rigidity to the panel in this region.

Extending about the sides, corners and bottom edges of the plate is a channel section 25. The channel section is suitably secured to the panel, as by welding, and provides an outwardly facing recess 36 about the operative periphery (sides and bottom, in the illustrated embodiment) of the panel assembly 18. The dimensions of the plate 32 and channel 35 are such that, when the panel is properly positioned in the conversion frame, a narrow clearance space is provided between the flange extremities 37 of the channel and the sealing surfaces of the conversion frame. Typically, such clearance may be on the order of one-quarter inch.

Secured within the channel 35 is a pneumatically expandable sealing element 38, which is sealed at its opposite ends and extends about the entire length of the channel. The sealing element 38 has a hollow, tubular outer portion 39, which is integrally joined by a narrow neck 40 with a transverse flange portion 41. To great advantage, the sealing strip is fabric reinforced, to provide strength and dimensional stability. The sealing element is secured in position in the channel 35 by means of pins 42 (see FIGS. 9 and 10), which project alternately inward from opposite flanges 43, 44 of the channel. The arrangement of alternately projecting pins greatly facilitates the installation of the sealing element, as described more fully in my prior U.S. Pat. No. 3,397,490.

As reflected in FIGS. 3, 4 and 7, for example, the inflatable sealing element 38 in its deflated or retracted condition is of relatively flat cross section and is contained more or less completely within the confines of the channel member 35. Upon expansion of the element under internal air pressure, however, the element assumes a more circular cross section and thus expands outwardly, bringing outer surface portions thereof into firm, sealing contact with the exposed sealing surfaces of the conversion frame. Control of the inflation of the sealing element 38 may be accomplished by any suitable means. To advantage, however, the plate 32 is provided at one side with an opening 45 sealed off by a well 46. The opening 45 receives a section of tubing 47 extending from the sealing element and connected to a manifold block 48. Also connected to the manifold block 48 are an inlet valve 49, a manually operated discharge valve 50, and a pressure gauge 51. Inflation of the sealing element is effected by closing the valve 50 and connecting the inlet valve fitting 49 to a source of

air under pressure. The sealing element is inflated to a suitable pressure, as reflected by the gauge 51.

For proper initial positioning of the panel assembly 18, mechanical means are provided to rigidly locate the panel both vertically and horizontally with respect to the conversion frame. To great advantage, the mechanical means includes a pair of lifting handles 52 in the form of L-shaped rods secured at one end 53 in a flange strip 54 extending across the top of the plate 32 and at the other end by the end extremity of the channel 35 in conjunction with a small welded gusset plate 55. As reflected particularly in FIG. 2, the upper outer end extremities 56 of the handles 52 project slightly outward, beyond the channel flanges, and overlie the upper end extremities of the conversion frame sections 19. Appropriate recesses 57 (FIG. 3) are provided in the upper extremities of the conversion frame to receive the outer ends of the handles, in the manner reflected in FIG. 2. Thus, when the panel assembly 18 is gripped by the handles and lowered into place in the conversion frame, the panel assembly initially will be suspended by the handles. The outer end extremities 56 of the handles also will serve to position the panel laterally.

After the panel assembly is initially suspended and positioned by its handles 52, it is locked in place at a plurality of locations about its periphery by suitable means such as the L-shaped locking pins 30 previously mentioned. Typically, a plurality of such pins 30 are kept conveniently in a rack formed by openings 58 in the upper flange strip 54 (FIG. 5) and in an angle member 59. The locking pins may be in the form of bent rod, tapered at one end 60 and provided with shoulder means formed by a suitable locking ring 61 received in an annular groove 62.

At appropriate locations about the periphery of the panel assembly, there are welded or otherwise secured bearing blocks 63, disposed opposite the apertured sockets 29 in the conversion frame. Thus, when the panel is installed in its initial position, suspended by the handles 52, the several locking pins may be inserted through the bearing blocks 63 and into the sockets 29 of the conversion frame, to rigidly lock the panel assembly and conversion frame together in predetermined, evenly spaced relationship. The number and location of mechanical locking devices will, of course, be a function of the physical dimensions of the components.

In accordance with the invention, inflation of the sealing element 38 is not commenced until the panel assembly has been mechanically positioned in the conversion frame in a manner to provide for substantially uniform expansion of the sealing element 38 as it establishes sealing contact with the conversion frame. This assures an effective seal about the entire sealing periphery, particularly in the corner regions.

The new flood panel assembly can be used to great advantage in conjunction with factory and office buildings which are otherwise of relatively waterproof construction to provide practical and effective sealing of the various access openings. The assembly is adapted especially for such structures which are located in low-lying areas susceptible to moderate flooding conditions from time to time.

In accordance with the invention, effective temporary sealing of access openings is made possible by the cooperative sealing association of a removable panel assembly and a conversion frame. The conversion

frame, although constructed specifically for association with a given panel assembly, is installed as a permanent part of the building structure, enabling the panel itself to be quickly and easily installed when needed. The conversion frame is easily installed and is inconspicuous.

It should be understood, of course, that the specific form of the invention herein illustrated and described is intended to be representative only, as many changes may be made therein without departing from the clear teachings of the disclosure. Accordingly, reference should be made to the following appended claims in determining the full scope of the invention.

I claim:

1. A flood panel assembly or the like adapted for installation in doorways and other access openings of factory and office buildings and other structures, comprising
 - a. a conversion frame adapted for permanent installation in an existing access opening of generally rectangular outline,
 - b. said conversion frame having upstanding side walls and a bottom wall,
 - c. the bottom and side walls of said conversion frame forming an effectively uninterrupted sealing surface about at least the lower regions of said access opening and providing arcuate sealing surfaces in the region of the lower corners of the access opening,
 - d. a panel member adapted for removable reception in said conversion frame and providing a barrier wall in said access opening,
 - e. an inflatable sealing element carried by the panel member and extending about at least its sides and bottom,
 - f. said sealing element being expandable under inflation pressure to seal off the clearance space between the panel and the conversion frame, and
 - g. mechanical positioning means provided on at least one of said frame or panel for effecting initial proper positioning of the panel prior to inflation of said sealing element,
 - h. said mechanical positioning means including means extending laterally from the upper portion of the panel and engageable by upper end portions of the conversion frame.
2. A flood panel assembly according to claim 1, further characterized by
 - a. the laterally extending means comprise portions of panel lifting handles at each side of the panel.
3. A flood panel assembly according to claim 1, further characterized by
 - a. the mechanical positioning means comprising a plurality of locking elements engageable with said panel and said conversion frame at spaced locations.

tions.

4. A flood panel assembly for structures having one or more access openings of generally rectangular outline and otherwise having reasonable water-tight integrity in the lower wall structure, which comprises
 - a. a conversion frame having flat, strip-like sections forming bottom and side sealing surfaces,
 - b. said conversion frame being closely received in the lower portion of the access opening and permanently secured therein in substantially sealed relation,
 - c. the lower corner portions of said frame forming arcuate sealing surfaces in the region of the angular lower corners of the access opening,
 - d. a panel receivable in the embrace of the conversion frame,
 - e. said panel carrying an inflatable sealing element about its side and bottom edges,
 - f. positioning means interengaging the frame and panel for initially supporting the panel in predetermined spaced relation to the frame,
 - g. said sealing element being expandable into sealing engagement with the sealing surfaces of said conversion frame.
5. The flood panel assembly of claim 4, further characterized by
 - a. said conversion frame including fillet means sealing the corner areas between the frame and access opening.
6. The flood panel assembly of claim 4, further characterized by
 - a. an effectively continuous channel element being rigidly secured to the side and bottom edges of the panel member,
 - b. said sealing element being seated within said channel and normally recessed within the side flanges thereof when deflated.
7. The flood panel assembly of claim 4, further characterized by
 - a. said positioning means supporting said panel to provide a substantially uniform space between the inner wall of the channel and the sealing surface of the conversion frame.
8. The flood panel assembly of claim 7, further characterized by
 - a. the positioning means includes laterally projecting portions of lifting handles on the panel member and cooperating recess means formed at the upper ends of the conversion frame.
9. The flood panel assembly of claim 7, further characterized by
 - a. the positioning means includes a plurality of retractable locking pins engageable with the panel and frame at spaced locations.

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