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3,397,490

SEALABLE CLOSURE

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FIG. 1

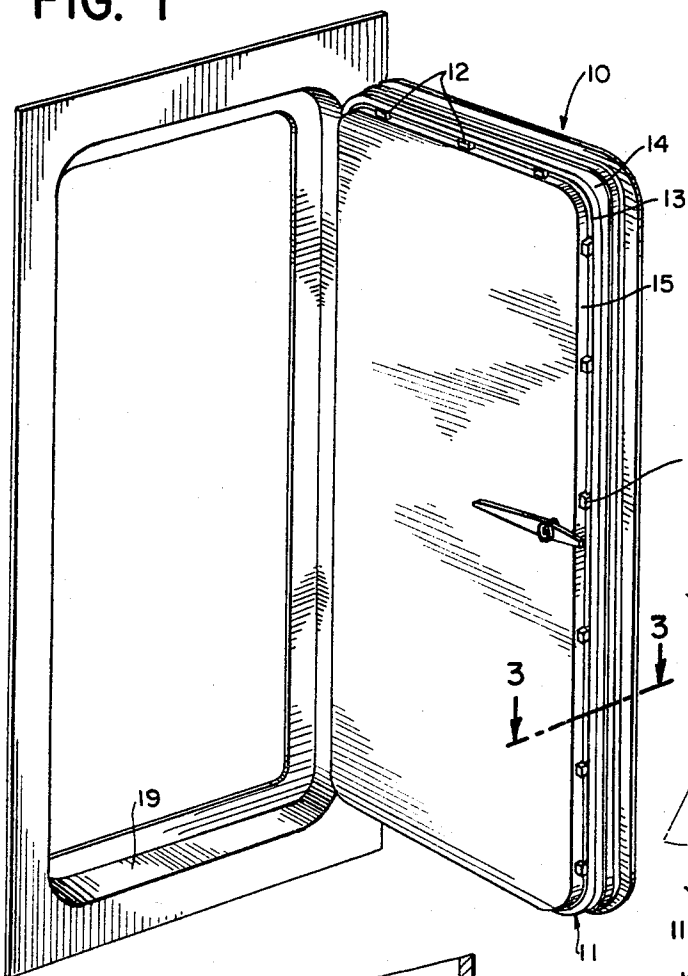


FIG. 2

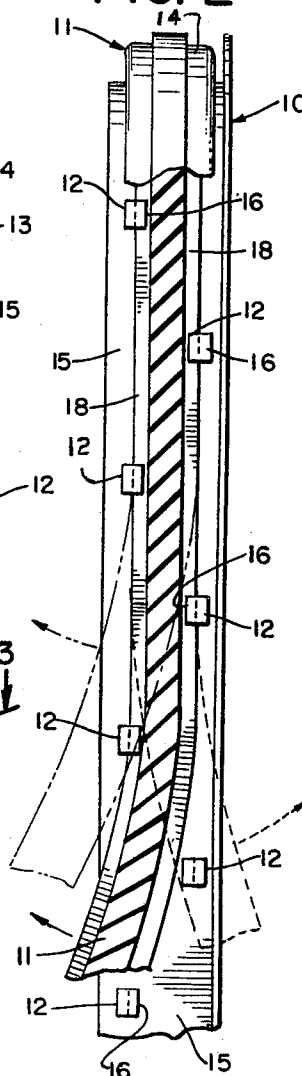
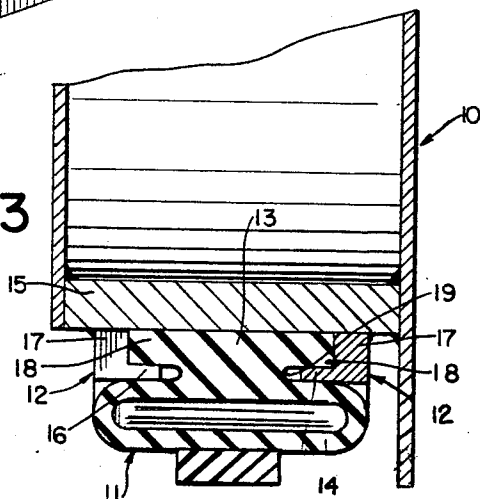


FIG. 3



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1

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SEALABLE CLOSURE

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ABSTRACT OF THE DISCLOSURE

A sealing arrangement utilizing a flexible, pneumatically inflatable sealing strip, in which the strip is attached to a door frame by intermittently spaced, staggered clips, providing for simple installation and removal of the strip by flexing the strip in serpentine fashion along its longitudinal axis.

Background and summary of the invention.—In a wide variety of closure applications, it is desirable to employ, in connection with the door or other closure element and its surrounding frame, a sealing element which may be inflated after shutting the closure element, to complete the seal. Typical applications employing such sealing means to advantage include environmental test chambers, water tight and/or dust free enclosures, and the like. Inflatable sealing strips are well suited for such applications because of their adaptability to uneven surfaces and their capability of being adjusted to various degrees of firmness by using different inflation pressures.

However, since these seals would be used in critical applications, it is of primary importance that they be easily replaceable when and if they fail. Ideally, replacement should be accomplished without making any structural changes to the door or hatch on which the seal is used since such operations tend to create additional possibilities of leakage and are time consuming.

This invention provides a highly simplified means for attaining this ideal by utilizing an inflatable sealing strip with a flanged cross section in conjunction with staggered L shaped retaining clips. This arrangement allows the strip to be installed or removed simply by flexing it into a serpentine configuration.

It is with these problems and objectives in mind that this invention has evolved.

It is accordingly the primary object of this invention to provide a sealing means for use in critical areas where leakage must be held to an absolute minimum.

It is another object of the invention to provide a method for easily installing and replacing these seals, when necessary, with a minimum of effort and time expenditure.

The specific details of a preferred embodiment of the invention, and its mode of functioning will be particularly pointed out in clear, concise and exact terms in conjunction with the accompanying illustrative drawings, wherein:

Description of drawing.—FIG. 1 is a perspective view of a bulkhead closure with an inflatable seal, as constructed in accordance with the invention.

FIG. 2 is a elevational view of the edge of the bulkhead closure of FIG. 1 showing the inflatable seal during installation and the method of installation.

FIG. 3 is an enlarged cross section taken along line 3—3 of FIG. 1 showing the configuration of the seal and retaining clips.

Description of preferred embodiment.—As shown in the drawings, a door 10 is provided with an inflatable sealing strip 11, installed on its edge wall 15. As best illustrated in FIGS. 2 and 3, the sealing strip is retained on the door edge 15 by the use of a plurality of clips 12, which engage and hold a flanged section 13 of the

2

sealing strip. In the illustrated embodiment, the clips 12 are permanently affixed to the door edge as by welding, but may be removably attached to the door or integral with it depending on the requirements of the particular application under consideration.

The seal 11 itself consists of two integrally connected sections, as shown in FIG. 3. These are, a solid flanged section 13, which is engaged by the clips 12, and an inflatable section 14 which projects beyond the clips and forms a compressible seal. The flanged and inflatable sections are connected by an integral web section 19.

The retaining clips 12, which are shown in FIGS. 2 and 3, are staggered and alternate from one sealing strip edge to the other. These clips typically are L shaped, including a first leg 16 parallel to the door edge 15 and a second leg 17 extending toward the door edge and suitably secured thereto. Sufficient clearance is provided between the parallel leg 16 of the L and the door edge 15 to permit the edges 18 of the flanged section 13 of the sealing strip to fit snugly in the clearance space.

As shown best in FIG. 3, the widthwise spacing of opposed pairs of the clips 12 is such that the inside surfaces of the perpendicular legs 17 are separated a distance substantially equal to the overall width of the flange section 13 of the sealing strip. However, in accordance with the invention, alternate clips 12 are spaced a considerable distance apart in the direction of the longitudinal axes of the sealing strip 11, substantially as indicated in FIG. 2. The longitudinal spacing between alternate clips is established to be such that the inflatable sealing strip, when in its uninflated (and therefore relatively supple) condition, may easily be installed on the door edge by being bent alternately from one side to the other, in serpentine fashion, to insert opposite flange edges 18 under alternate ones of previously installed clips. Once the installation has been completed, the sealing strip is reliably kept in position by the clips 12 for normal service. At the same time, the strip may readily be removed for inspection, servicing, replacement, etc.

When the sealing strip 11 is inflated, for effecting a tight seal between the door 10 and the surrounding door jamb 19, the strip is, of course, tightly gripped between the opposed surfaces of the door and the jamb. In addition, when the seal is in an inflated condition, it is more rigid than otherwise and thus tends to be even more securely held by the staggered clips 12.

The staggering pattern should be such that a retaining clip on either side of the sealing strip should be, if transposed to the other side of the strip, midway between two clips on that side. This arrangement is desirable for ease of installation. Of course these dimensions can be varied to adapt the invention to different conditions of strip configuration, clip dimensions, etc. As a general rule, however, the spacing of the retaining clips should be increased as the width of the sealing strip increases.

When replacement of a sealing element is desirable, the method of this invention converts what used to be a time consuming job, requiring removal and replacement of the seal retaining devices, into the simple operation of flexing the uninflated strip out of the retaining clips and quickly installing a fresh strip. The concept of staggering the clips on alternate sides of the sealing strip allows this simplified procedure to be utilized without compromising the effectiveness of the seal. Installation, servicing or replacement of the seal then becomes a routine operation that can be performed expeditiously when the failure occurs. This method also makes it feasible to change seals periodically in order to reduce the chance of failure.

When the seal is to be replaced, it will be in a deflated condition prior to removal. The actual removal proce-

3
 dure is to grasp the strip at a point midway between two clips along either edge of the strip and to flex it away from the retaining clip immediately opposite the initial grasping point. When this is done the longitudinal axis of the strip is bent and takes on a sinuous or serpentine configuration in this immediate area. The result of this action is to free the flanged edge of the sealing strip from this retaining clip. This sequence is performed for each retaining clip until the entire strip is free.

10
 The initial step in installing a sealing strip is to insert a flanged edge 18 under a retaining clip. The strip is then flexed away from the next retaining clip thus allowing the other flanged edge to be inserted under this next clip. The actual insertion of the flanged edge under the clip takes place when the strip is flexed back toward the clip in order to line up the next clip for this operation. The strip is flexed back and forth across the area defined by the clips while its flanged edges are inserted under the clips until the strip is completely installed.

20
 The method of the invention eliminates the dismantling or removal of the seal retaining clips when replacing seals, by utilizing a seal that is flexible prior to inflation and relatively rigid after inflation, in conjunction with staggered, retaining clips permanently installed on the member to be sealed.

25
 The preceding description is concerned with a specific embodiment of the invention and should not be interpreted as limiting its scope. Many variations may be made in the specific design of the components, for example, without departing from the scope of the invention as defined in the following claims.

I claim:

1. A sealable closure comprising, in combination,
 - (a) a closure member having a substantially flat surface;
 - (b) an elongated flexure sealing strip having a flange along each longitudinal edge;
 - (c) said flanges defining first and second regions of retention;
 - (d) said sealing strip being fastened to said flat surface by retaining elements which engage said flanges;
 - (e) said retaining elements being spaced along said flat surface alternately on opposite sides of the principal axis of said sealing strip;
 - (f) the spaced relationship between alternate ones of said retaining elements along said axis being such that said strip may be installed on said surface by manipulating said strip in a serpentine manner to insert said flanges successively under alternate retention elements.
2. The sealable closure combination of claim 1 further characterized by
 - (a) the spaced relationship between alternate retaining elements being such that the sealing strip can be removed by flexing its longitudinal axis substantially in a plane parallel to the plane of the flat surface.
3. The sealable closure combination of claim 1 wherein,
 - (a) the retaining elements are clip-like elements permanently affixed to said flat surface and having retaining portions extending over said surface toward the axis of said sealing strip.
4. The sealable closure combination of claim 1 wherein,

- (a) the flat surface is the edge of a door-like closure member.
5. The sealable closure combination of claim 1 wherein,
 - (a) the flexible sealing strip comprises an inflatable portion and a flanged portion;
 - (b) said sealing strip having substantially greater flexibility when its inflatable portion is free of pressure than when the strip is inflated under pressure for sealing.
6. The sealable closure combination comprising a sealing strip with flanged edges attached to a flat surface by means of retaining elements that engage said flanged edges, having the following characteristics
 - (a) said retaining elements being spaced a predetermined distance apart along both longitudinal flanged edges of the sealing strip;
 - (b) the arrangement of said retaining devices being such that the shortest straight line distance from a first retaining element to a second retaining element on the opposite edge of the sealing strip exceeds the width of the flanged portion of the strip, whereby
 - (c) the sealing strip can be installed and removed by flexing its longitudinal axis in a plane substantially parallel to the plane of the flat surface.
7. The sealable closure combination of claim 6, wherein
 - (a) the flexible sealing strip is inflatable;
 - (b) the cross sectional configuration of said sealing strip being such that said strip is relatively less flexible when under inflation pressure.
8. The sealable closure combination of claim 7, wherein said cross sectional configuration includes
 - (a) a flat portion bearing against said flat surface and forming the flanged edges of said sealing strip;
 - (b) a hollow, inflatable portion adjacent the outer surface of said flat portion; and
 - (c) a web portion integrally connecting said flat and said hollow portions.
9. The method of installing a flexible, flanged sealing strip on a flat surface having intermittently spaced seal retaining elements alternating from side to side of an area defined by the width of the sealing strip comprising
 - (a) inserting one flanged edge of the sealing strip into a retaining element on one side of the area;
 - (b) flexing the longitudinal axis of the sealing strip in a serpentine manner and in a plane substantially parallel to the plane of the flat surface, in a direction away from the next retaining element;
 - (c) inserting the other flanged edge of the sealing strip into the next retaining device; and
 - (d) repeating steps (b) and (c) until installation is complete.

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