

Señor Jefe de la
DIVISION DE NUEVAS CREACIONES
Superintendencia de Industria y Comercio
E. S. D.

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 07-031044- -00004-0000

Fecha: 2008-07-07 12:44:24 Dep. 2020 NUECREACIONES
Tra. 11 PATENTEIYII Eve: 379 FASENACIONALII
Act. 538 PETICION Folios: 2

Tramite 011 - Evento 379 - Actuación

Re: Expediente: 07 031044
Fase Nacional: Solicitud de Patente Internacional No.
PCT/JP2005/0013710
Titulo: Empaque Succional de Doble Miembro
Solicitante: Kokoku Intech Co. y Honda Giken Kogyo
Tokyo, Japón

Obrando como apoderado del solicitante en el proceso de la referencia,
respetuosamente

MANIFIESTO

1. La solicitud de la referencia apareció publicada en la Gaceta de Propiedad Industrial No. 587 de Enero 18, 2008.
2. El artículo 44 de la Decisión 486 de la Comisión de la Comunidad Andina ordena solicitar que se adelante el examen de patentabilidad dentro de los seis (6) meses siguientes a la publicación.
3. Dentro del término legal, adjunto a la presente el Recibo Oficial de Caja No. 08 - 53,206 de Julio 4, 2008 por valor de \$210,000, tasa correspondiente a la Tasa Nuevas Creaciones - Fase Nacional - Examen de Patentabilidad de Invención - Capítulo II PCT.

SOLICITO

Que ese despacho proceda a adelantar el examen de fondo de la solicitud de la referencia.

De usted atentamente,

CAMILO H. ALVÁREZ BERNATE
T.P.A. No. 20,343
C.C. 19,219,009 de Bogotá
Código No. 5352

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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 07-031044- -00004-0000

Fecha: 2008-07-07 12:44:24 Dep. 2020 NUECREACION
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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 08 - 53.206
FECHA : JULIO 4 DE 2008

***** CONSIGNACION *****

IDENTIFICANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
CARLOS ALVAREZ	CONSIGNACION	BANCO DE BOGOTA	062754387	3402000	04/07/2008	1,116.000.00

***** D E N O T A C I O N *****

CAPT. RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1 50005-01-01 SOLICITUDES	114 PTC CAP-II EXAMEN DE PATENTIBILIDAD	210,000.00
	TOTAL :	\$ 210,000.00

SON: DOSCIENTOS DIEZ MIL PESOS

RESPONSABLE :

RECIBO DE CAJA APLICADO AL EXPEDIENTE No.

122



DIVISIÓN DE NUEVAS CREACIONES

RADICACIÓN EXPEDIENTE No. 07-31044

EL EXTRACTO DE LA PRESENTE SOLICITUD DE **PATENTE DE INVENCION**

FUE PUBLICADO EN LA GACETA DE PROPIEDAD INDUSTRIAL No **587** DE

FECHA **18 DE ENERO DE 2008** EL TÉRMINO HÁBIL SEÑALADO POR LA LEY

EXPIRA EL **16 DE ABRIL DE 2008**

NOTA: Dentro del plazo de los seis (6) meses siguientes a partir de la fecha de publicación en la gaceta de Propiedad Industrial, deberá solicitar y cancelar el examen de patentabilidad so pena de que la solicitud caiga en abandono, de acuerdo con lo establecido en el Artículo 44 de la Decisión 486/2000.

SE PRESENTARON OPOSICIONES POR PARTE DE TERCEROS.

SI _____

NO X

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Primary Examiner—Robert I. Smith

Attorney, Agent, or Firm—Robert D. Yeager

[57] **ABSTRACT**

A fluid-tight seal formed by a dual, surface mounted sealing gasket is disclosed. The gasket has a web joining the spaced sealing members. The web engages post members mounted along one of the surfaces to be sealed. The post members serve as spacing means for the surfaces to be sealed, thereby to prevent undue crushing forces on the sealing gasket.

277/206 A

[58] **Field of Search** 277/206.1, 180, 166,
277/235 R

[56] **References Cited**

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5 Claims, 4 Drawing Figures

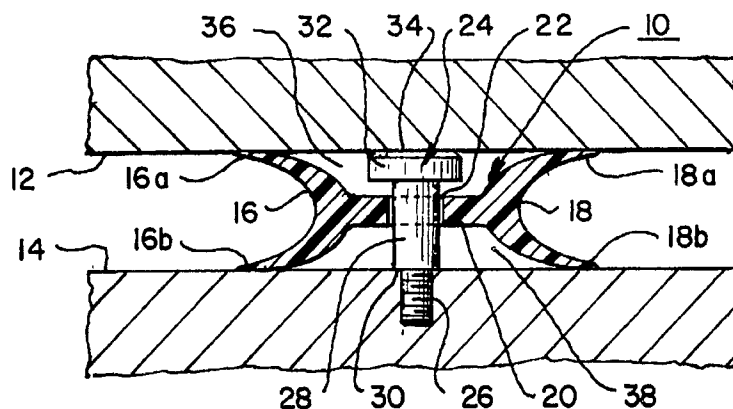


Fig. 1.

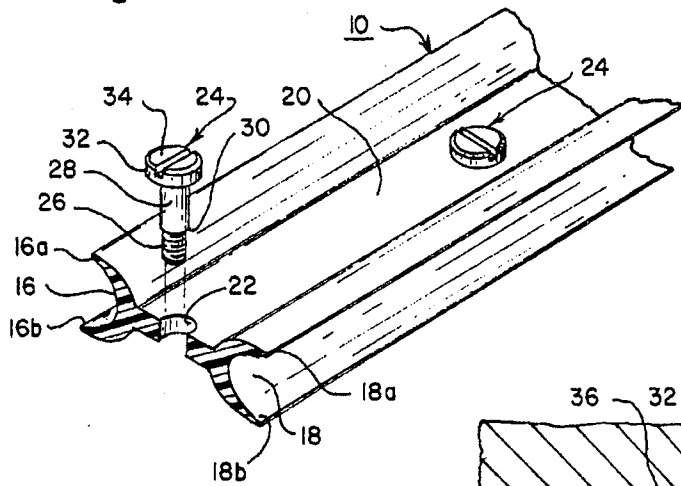


Fig. 2.

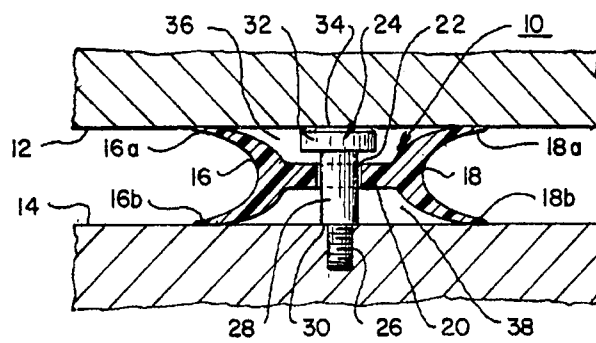


Fig. 3.

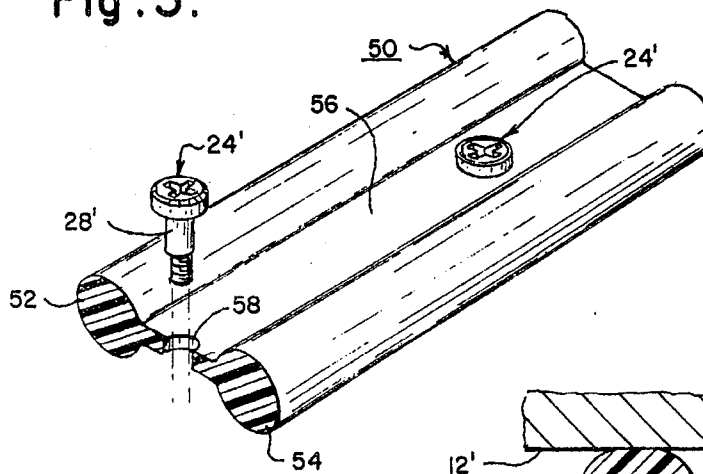
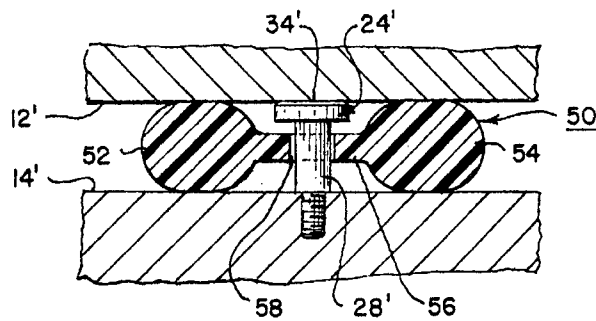


Fig. 4.



FLUID-TIGHT SEAL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to apparatus for forming a fluid-tight seal between confronting surfaces; more particularly, to a surface-mounted gasket having dual sealing members.

2. Description of the Prior Art

Providing a reliable, durable seal between an opening in a pressure vessel and its closure has posed a continuing challenge to workers in the art despite the many innovations in materials for use in sealing devices. In a sterilizer, for example, which may operate under both positive and negative pressures during a given sterilization cycle, there exists the problem of providing an effective seal between the sterilizer door and the door frame under conditions of high door usage.

Sealing gaskets for sterilizer doors, whether mounted on the door or on the frame, traditionally have been held in place by means of gasket bars, which extend around the perimeter of the opening to be sealed and involve the application of considerable labor during installation and removal of a gasket, or precisely machined grooves in one of the surfaces to be sealed. The latter hold the base of the gasket in place and require close tolerances with the gasket dimensions to be effective.

A further problem associated with sealing gaskets for sterilizer doors is the tendency of the gasket material to acquire permanent deformation (or set) after being repeatedly crushed between the surfaces to be sealed. This problem is most critical when a compression-type sealing gasket is employed because a certain amount of compressive force on the gasket is necessary to effect a seal. When excessive compression is applied, principally by the sealing surfaces being brought too closely together for the particular gasket present, there is a drastic reduction in the life of the gasket due to the permanent deformation or set.

When a lip seal gasket is employed, crushing of the seal is not essential to its operation because the seal depends for its effectiveness on the presence of a pressure differential across the lip. Nevertheless, undue crushing of a lip seal can cause permanent deformation of the flexible lips and a resultant decrease in seal life. As with compression seals, the maintenance of proper spacing between the surfaces to be sealed by a lip seal is vital to its operation.

In general, neither gasket bars nor grooves as mounting means for sterilizer door sealing gaskets address the problem of providing repeatable proper spacing between the surfaces to be sealed with each door closing.

SUMMARY OF THE INVENTION

The present invention overcomes the foregoing problems associated with sealing gaskets by providing a convenient means for mounting a sealing gasket on one of the surfaces to be sealed without the need for cumbersome gasket bars, and, of course, eliminating the need for a mounting groove; the gasket mounting means of the present invention also serves as a spacing means between the surfaces to be sealed, thereby diminishing the opportunity for the occurrence of permanent deformation of the seal.

The present invention provides apparatus for forming a fluid-tight seal between two confronting surfaces

comprising: a plurality of spaced gasketing mounting members disposed along one of the surfaces and adapted to engage the other of the surfaces when it is brought into confronting relationship to provide a space between the confronting surfaces; gasket means longitudinally extending between the confronting surfaces and having a pair of spaced sealing members to engage the confronting surfaces to form seals therebetween; and web means joining the spaced sealing members and being detachably secured to the gasket mounting members.

Preferably, the gasket mounting members used in the present invention are rigid post members having enlarged head portions. Further, the web means of the present invention preferably is formed of elastomeric material and has a plurality of longitudinally spaced openings which, upon deformation, pass over the enlarged head portions of the post members, thereby providing means for retaining the gasket means in place.

The sealing members of the present invention preferably are either of the double lip seal variety or are cylindrical-shaped compression seals, although other types of sealing members may be useful with the present invention.

Other details and advantages of the present invention will become apparent from the following detailed description, taken with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary isometric view of a double lip sealing gasket mounted in accordance with the present invention;

FIG. 2 is a fragmentary sectional view of the sealing gasket of FIG. 1 and the surfaces sealed thereby;

FIG. 3 is a fragmentary isometric view of a compression-type dumbbell shaped sealing gasket mounted in accordance with the present invention; and

FIG. 4 is a fragmentary sectional view of the sealing gasket of FIG. 3 and the surfaces sealed thereby.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, first to FIGS. 1 and 2, there is shown a sealing gasket 10 suitable for use in forming a fluid-tight seal between confronting surfaces 12 and 14, which might represent the door and door frame, respectively, of a sterilizer. Gasket 10 is formed of any suitable elastomeric material, such as silicone rubber, and in the embodiment of FIGS. 1 and 2 is configured to form a pair of spaced, outwardly-facing, double lips 16 and 18. Each pair of double lips 16, 18 is generally C-shaped in section and symmetrical. The upper and lower portions 16a, 18a and 16b, 18b, respectively, of double lips 16, 18 taper outwardly toward their free ends. This taper is intended to provide the flexibility needed in the operation of a lip seal.

Sealing gasket 10 is especially adapted for use where there are reversing pressure differentials across gap between the surfaces to be sealed, as for example in a sterilizer which operates under both pressure and vacuum. In such an application with the sterilizer environment acting on the right side of FIG. 2 and the atmosphere acting on the left side, positive pressure in the sterilizer vessel acts against double lip 18, forcing upper and lower portions 18a and 18b, respectively, apart and into sealing engagement with surfaces 12 and 14, respectively. When the sterilizer vessel operates under vac-

uum, the positive pressure differential across sealing gasket 10 reverses. Now atmospheric pressure acts on double lip 16, forcing upper and lower portions 16a and 16b, respectively, into sealing engagement with surfaces 12 and 14, respectively.

In the operation of sealing gasket 10 just described, it may be seen that the double lip opposite the side against which positive pressure is exerted performs no function as long as that condition exists. More importantly, however, it may be seen that this type of operation, in which forces on sealing gasket 10 alternate, requires a mounting means for sealing gasket 10 that prevents lateral displacement of gasket 10. Such a mounting means is provided by the present invention and will now be described.

Double lips 16 and 18 are joined together by web 20 which is shown in FIGS. 1 and 2 as being of rectangular cross section with some width. A series of longitudinal spaced holes 22 are formed in web 20. The spacing of holes 22 coincides with the spacing of post members 24 now to be described.

Post members 24 preferably are rigid screws with threaded end portions 26 adapted to fit into tapped bores longitudinally spaced along one of the surfaces to be sealed, in this case surface 14. Each post member 24 has a shank portion 28 which may have a shoulder 30 separating shank portion 28 from threaded portion 26 to assure that all of post members 24 project a uniform distance above surface 14. Post members 24 have enlarged head portions 32 with flat top surfaces except for appropriate grooves to be engaged by a driving member as clearly shown in the drawings.

With post members 24 in place, sealing gasket 10 may be mounted on surfaces 14 by aligning holes 22 with post members 24 which have the same spacing as holes 22. Although the diameter of each hole 22 is less than the diameter of enlarged head portion 32 of post member 24, the elastomeric properties of web 20 permit stretching to snap web 20 over the enlarged head portion.

It may be seen in FIG. 2 that when web 20 surrounds shank portion 28 of post member 24, an annular space is provided because of the difference in diameters of holes 22 and shank portion 28. This annulus provides a positive advantage to reduce a suction cup effect that may occur in the upper or lower longitudinally extending passages 36, 38 formed by sealing gasket 10 with surfaces 12 and 14. This suction cup effect otherwise would tend to oppose separation of surfaces 12 and 14, as for example when it is attempted to open a sterilizer door. The fact that web 20 can move relative to shank portion 28 of post member 24 tends to form a crease in sealing gasket 10 when surfaces 12 and 14 initially move away from one another and this creasing action tends to break the seal forming the suction cup effect.

Post members 24, in addition to forming the means for securing mounting sealing gasket 10 on surface 14, serve another important function: namely, to assure proper spacing between surfaces 12 and 14 and thereby prevent any undue crushing forces exerted by those surfaces on sealing gasket 10. When surfaces 12 and 14 are moved into confronting relationship, the top surfaces 34 of post members 24 contact surface 12 and prevent it from moving closer to surface 14. Because sealing gasket 10, fitted with double lip seals, does not depend for its operation on compressive forces exerted upon it by surfaces 12 and 14, the spacing feature provided by post members 24 is not as critical as when compression seals, next to be described, are employed. Nevertheless, undue compression forces on a lip seal can cause permanent deformation of the flexible lip

members, e.g. 16a, 16b, and consequent ineffective sealing action.

Referring now to FIGS. 3 and 4, there is shown an embodiment of the present invention in which sealing gasket 50 employs double compression-type seals. Each sealing member 52, 54 is formed of a suitable elastomer in cylindrical cross section. Sealing members 52, 54 are joined by web 56 which is constructed identically to web 20 and has a series of aligned openings 58. Sealing gasket 50 is mounted on surface 14' by means of post members 24' which are constructed and mounted into surface 14' in the same manner as post members 24. Also, the same relationship of diameters exists between each opening 58 and its corresponding shank portion 28' as was described for sealing gasket 10 to provide an annular space therebetween.

The sealing action of gasket 50 is provided by the crushing action of surfaces 12', 14' on sealing members 52, 54. As suggested above, this brings into greater prominence the advantage afforded by the spacing action provided by post members 24'. Because the top surfaces 34' of post members 24' prevent surface 12' from moving closer to surface 14' than the dimension fixed by the dimensions of post members 24', an unvarying amount of crushing force is exerted by those surfaces on sealing members 52, 54 with each door closing. With the dimensions and properties of sealing members 52, 54 properly established, both effective sealing action and the absence of permanent deformation is assured.

What is claimed is:

1. Apparatus for forming fluid-tight seal between two confronting surfaces comprising:
 - a plurality of spaced rigid post members mounted to one of said surfaces and adapted to engage the other of said surfaces when it is brought into said confronting relationship to provide a space between said confronting surfaces;
 - gasket means longitudinally extending between said confronting surfaces and having a pair of spaced sealing members adapted to engage said confronting surfaces to form seals therebetween; and
 - deformable web means joining said spaced sealing members and having a plurality of longitudinally spaced openings formed therein,
 - said post members having enlarged head portions adapted to pass through said openings in said web means by deforming said openings and thereby retain said gasket means.
2. Apparatus as recited in claim 1 wherein: said post members have shank portions, each of which being dimensioned to fit loosely within its corresponding opening in said web means.
3. Apparatus as recited in claim 1 wherein: said pair of spaced members comprise a pair of double lip seals.
4. Apparatus as recited in claim 1 wherein: said pair of spaced sealing members comprise a pair of cylindrical-shaped compression seals.
5. A fluid-tight seal comprising:
 - a pair of spaced-apart, confronting surfaces to be sealed;
 - a plurality of spaced gasket mounting members disposed along one of said surfaces and adapted to abut the other of said surfaces to maintain said space between said confronting surfaces;
 - gasket means longitudinally extending between said confronting surfaces and having a pair of spaced sealing members adapted to engage said confronting surfaces to form seals therebetween; and
 - web means joining said spaced sealing members and being detachably secured to said gasket mounting members.

* * * * *

United States Patent [19]

Hopper

[11] 4,337,956

[45] Jul. 6, 1982

[54] DOUBLE LIP SEAL WITH PRESSURE COMPENSATION

[75] Inventor: James A. Hopper, Erie, Pa.

[73] Assignee: American Sterilizer Company, Erie, Pa.

[21] Appl. No.: 221,425

[22] Filed: Dec. 30, 1980

[51] Int. Cl.³ F16J 15/32; F16J 15/40

[52] U.S. Cl. 277/29; 277/70; 277/152; 277/59

[58] Field of Search 277/3, 27, 59, 70, 152, 277/153, 165, 207 R, 207 A, 208, 29

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Primary Examiner—Robert S. Ward, Jr.
Attorney, Agent, or Firm—Robert D. Yeager

[57] ABSTRACT

A sealing device for application between two confronting, generally parallel surfaces. One of the surfaces has a longitudinally extending groove for receiving the sealing device. The sealing device includes a base member having bottom surface contours to define a pair of spaced, longitudinally extending fluid passages between the base member and the groove. A pair of lip members are connected to the base member and extend therefrom for spaced-apart engagement with the other one of the confronting surfaces, thereby to form a third fluid passage between the lip members and the other said surface. Fluid communication means are provided between the fluid passages aforesaid.

10 Claims, 4 Drawing Figures

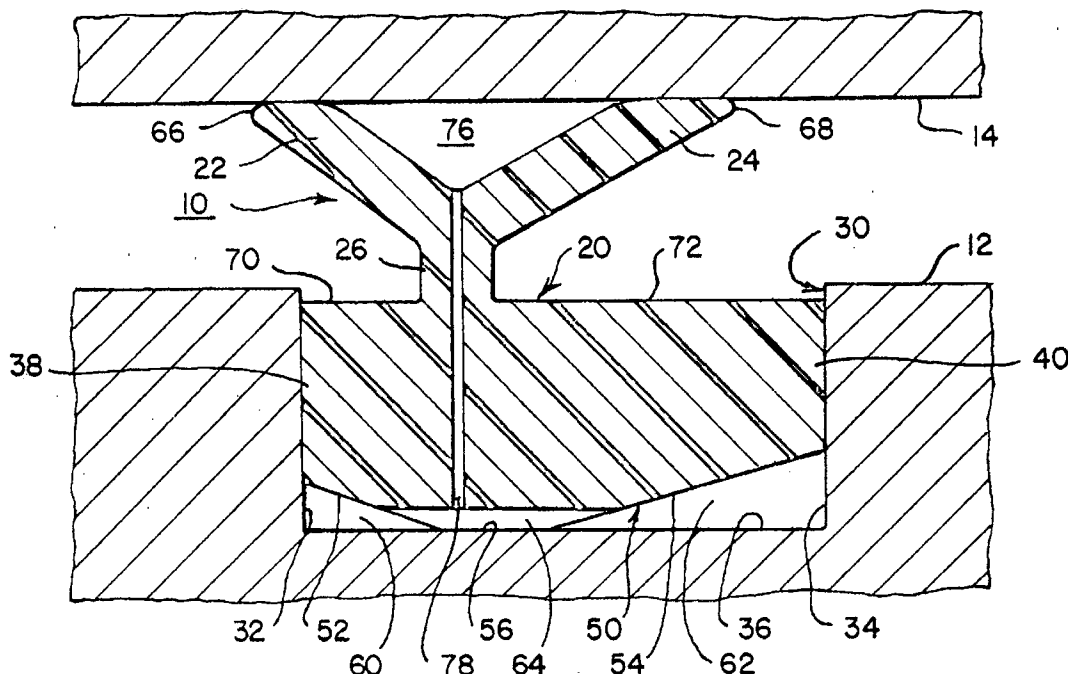


Fig. 1.

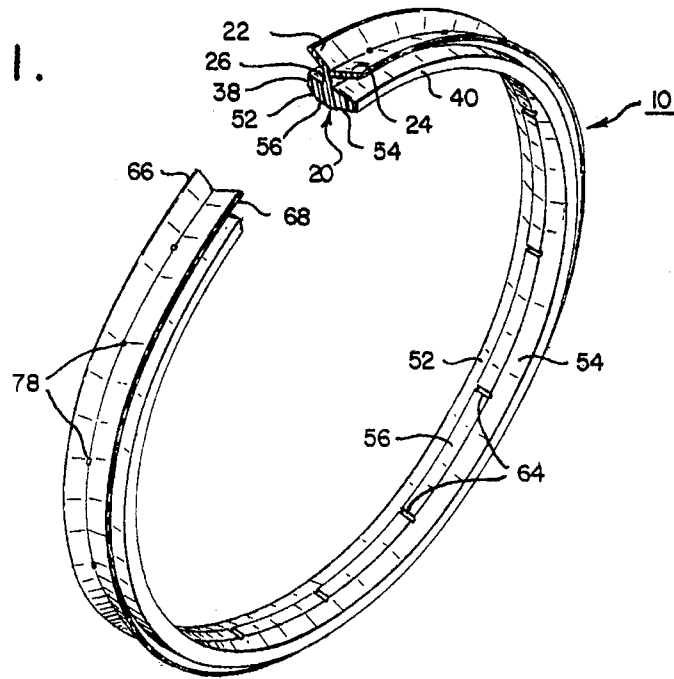
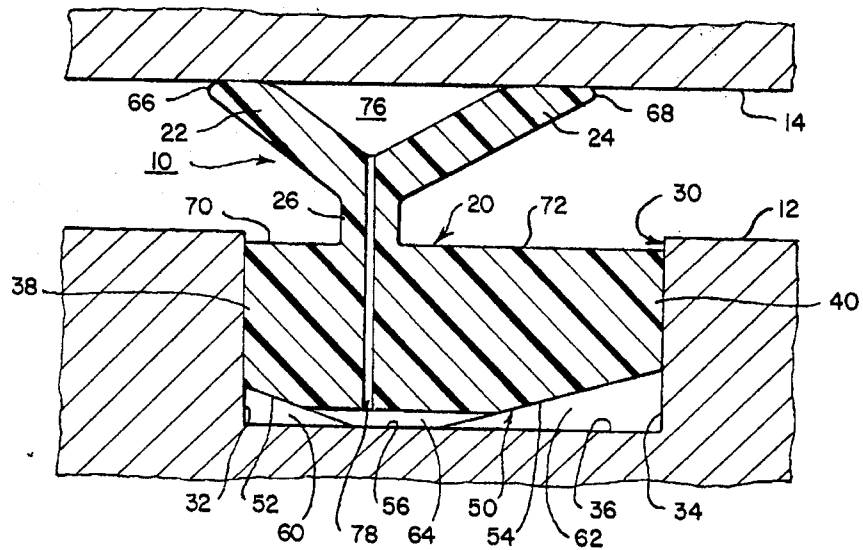


Fig. 2.



DOUBLE LIP SEAL WITH PRESSURE COMPENSATION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a fluid tight seal which is particularly adapted for use when the direction of applied pressure across the seal alternates.

2. Description of the Prior Art

Under certain conditions it is desirable to perfect a seal between two surfaces that have fluid under pressure present therebetween with the pressure applied first in one direction and then in the opposite direction. An example of such conditions is the seal required for the door of a sterilizing chamber that operates under positive pressure during part of the sterilizing cycle and under vacuum during another part of the cycle.

Typically, the sealing devices used to seal the doors of sterilizing chambers are compression-type devices that depend for their efficacy on being crushed between the sterilizer door and the doorjamb. Such devices, though effective, are subject to wear upon each opening and closing of the door and eventually require repair or replacement. It would be desirable, therefore, to provide a sealing device that would be effective when the applied pressure across the seal alternates, yet would not depend on the application of mechanical compression forces between the surfaces to be sealed for its sealing properties.

SUMMARY OF THE INVENTION

The present invention employs a sealing device mounted in one surface to be sealed and having a pair of lips that engage the other surface to be sealed. The seal between the surfaces is effected by the application of fluid pressure against one or the other of the lips. By means of unique venting means embodied in the seal of the present invention, fluid pressures generated behind the base of the sealing device during operation are controlled to ensure retention of the base with minimal physical retention means. Because the seal of the present invention is achieved by the application of fluid pressure to the seal itself, the wear associated with mechanical compression seals is minimized. Further, the complex and expensive devices required to achieve mechanical compression seals are eliminated.

The present invention provides a sealing device for application between two confronting, generally parallel surfaces, one of which surfaces having a longitudinally extending groove for receiving the sealing device, comprising: a base member formed of resilient material and, in its undeformed state, being dimensioned to snugly contact the groove only at portions of its opposed sides and at a portion of its bottom surface, thereby to form first and second spaced, longitudinally extending fluid passages between the base member and the groove; a pair of independently flexible, longitudinally extending, lip members connected to the base member and extending therefrom for longitudinally uninterrupted, spaced-apart engagement with the other one of the generally parallel surfaces, thereby to form a third fluid passage between the lip members and the other surface; means for providing transverse fluid communication between the first and second fluid passages; and means for providing fluid communication between the third fluid passage and the transverse fluid communication means.

In a preferred form, the base member of the present invention is formed with sides contoured to match substantially the sides of the groove and with a bottom portion defining a truncated dihedron offset from the central axis of the base member. In the same preferred form, the lip members are joined opposite their free ends and connected to the base member at a point offset from the central axis thereof in the same direction as the truncated dihedron.

With the base member of the sealing device of the present invention mounted in the groove formed in one surface to be sealed, the extending lip members form a Y-shaped structure with the adjacent inner surfaces of the upper legs of the "Y" being in contact with the other surface to be sealed. When pressure is applied to one side of the sealing device, the lip member on that side is forced into sealing contact with its associated surface. At the same time, the portion of the base member on the pressure side of the seal is forced further into the groove, causing fluid under pressure in the first and second fluid passages to be vented to atmosphere through the fluid communication means between those passages and the third fluid passage, into the third fluid passage, and between the lip member opposite the pressure side and its associated surface. When pressure is applied to the opposite side of the seal, the corresponding but opposite actions of the sealing device occur.

Other details and advantages of the present invention will become apparent as the following detailed description, taken with the accompanying drawings, proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a portion of an annular sealing device embodying features of the present invention;

FIG. 2 is a sectional view showing the sealing device of FIG. 1 mounted to effect a seal between two generally parallel surfaces;

FIG. 3 is a view similar to FIG. 2 showing the operating characteristics of the sealing device upon application of pressure thereto from the right side; and

FIG. 4 is a view similar to FIG. 2 showing the operating characteristics of the sealing device upon application of pressure thereto from the left side.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, particularly to FIG. 1, there is shown a sealing device, generally designated by the numeral 10, constructed in accordance with the present invention. In the embodiment shown in FIG. 1, sealing device 10 is formed in a ring, intended for perfecting a seal in an annular space between two surfaces such as confronting surfaces 12 and 14 shown in section in FIG. 2. Sealing device 10 may be formed from any suitable elastomeric resilient material; e.g. silicone rubber.

Sealing device 10 includes a base member, generally designated by the reference numeral 20, and a pair of lip members 22 and 24 connected to base member 20 by an upstanding neck portion 26. Together, lip members 22 and 24, and neck 26 form a Y-shaped structure extending from base member 20 and preferably formed integral therewith.

Sealing device 10 is intended to perfect a seal between surfaces 12 and 14. For this purpose, surface 12 has machined therein a groove, generally designated by the reference numeral 30 and, in the embodiment shown

in the drawings, being of rectangular cross section. Groove 30 includes vertical sidewalls 32 and 34, and a flat bottom 36. Base member 20 of sealing device 10 is dimensioned such that, in its undeformed (or free form) state, sides 38 and 40 of base member 20, respectively, are contoured to match the contours of sidewalls 32 and 34 of groove 30 and to fit snugly thereagainst.

The bottom of base member 20, generally designated by the reference numeral 50, is formed of three surfaces: surfaces 52 and 54 inwardly extending from sides 38 and 40, respectively, at obtuse angles therefrom, and meeting flat surface 56. These surfaces together produce a downwardly extending, truncated dihedron as the bottom portion of base member 20. Preferably, and as shown in the drawings, the midpoint of flat surface 56 is transversely offset from the central axis of groove 30.

The relationship of inclined surfaces 52, 54 and flat surface 56 of bottom 50 with flat bottom 36 and vertical sides 38, 40 of groove 30 produce two spaced, longitudinally extending passages (or voids) 60 and 62, respectively, between base member 20 and groove 30. Passages 60 and 62 are interconnected for fluid communication at spaced intervals longitudinally along sealing device 10 by means of groove 64 (see FIG. 1) cut transversely in flat surface 56.

Referring now to the top portion of sealing device 10, lip members 22 and 24 are formed to be independently flexible and have rounded free end portions 66 and 68, respectively. Lip members 22 and 24 are joined opposite their free ends to neck 26 which, in turn, is joined to the top of base member 20. Preferably, and as shown in the drawings, neck 26 is transversely offset from the central axis of groove 30 in the same direction as flat surface 56 is offset therefrom. The top surface of base member 20 thereby is divided into a narrow top surface portion 70 to the left of neck 26 and a wide top surface portion 72 to the right of neck 26.

When lip members 22 and 24 are in engagement with surface 14, a longitudinally extending fluid passageway 76 is formed therebetween. Passageway 76 is connected for fluid communication with passageways 60 and 62 by means of vertical bores 78 in sealing device 10, extending between passageway 76 and grooves 64 at their same spaced intervals (see FIG. 1). Bores 78 in conjunction with grooves 64 thus provide means for venting fluid under pressure in either of fluid passageways 60 or 62 to fluid passageway 76; if the fluid pressure in the passageway thus exceeds the fluid pressure acting against the outer surface of either of lip members 22, 24, that pressure will force a momentary separation between such lip member and surface 14 to cause pressure equalization on both sides of the lip member involved.

It will be apparent to those skilled in the art that sealing device 10 and groove 30 may be variously constructed to depart from the embodiment just described in order to achieve the operative features of the present invention next to be described.

With sealing device 10 in place in groove 30, surfaces 12 and 14 are brought into confronting relationship as shown in the drawings; in this position, the adjacent inside surfaces of the ends 66, 68 of lip members 22, 24 are in contact with surface 14. In practice, this condition may be reached, for example, by closing the door of a sterilizing chamber wherein sealing device 12 is being used to seal the annular space surrounding the door. It will be noted that the operation of sealing device 10 does not depend upon being crushed between surfaces 12 and 14; thus, the only physical wear experienced by

sealing device 10 is the gentle pressure needed to bring surface 14 into contact with lip members 22, 24 as just described.

Upon the application of fluid pressure across groove 30 from right to left as shown by the arrow in FIG. 3, lip 24 is pushed inwardly and upwardly to effect a seal against surface 14. At the same time, the positive fluid pressure exerts force on surface portion 72 of base member 20, pushing the right side of base member 20 further into groove 30. This downward flexing action causes the partial or complete elimination of fluid passage 62 and a corresponding reduction in the volume available in fluid passages 60, 62, and groove 64. Any fluid trapped in these confines is forced upwardly (as indicated by the arrows in FIG. 3) through bore 78 and into fluid passage 76. Because of the reduction in volume as aforesaid, the pressure of the fluid in fluid passage 76 exceeds atmospheric pressure acting upon the left side of lip member 22; consequently, free end 66 of lip member 22 is forced to separate momentarily from its engagement with surface 14 to permit fluid under pressure in fluid passage 76 to escape to atmosphere (as shown by the arrows in FIG. 3). When the pressure on both sides of lip member 22 equalizes at atmospheric pressure, free end 66 of lip member 22 returns to contact surface 14.

It may be seen that the downward flexing of the right side of base member 20 enhances the sealing action between side 40 of base member 20 and sidewall 34 of groove 30. This downward flexing action also is transmitted to the left side of base member 20 to enhance the sealing action between side 38 of base member 20 and sidewall 32 of groove 30. Because the fluid pressure within fluid passage 60 has been brought to atmospheric pressure in the manner just described, there is no pressure differential between fluid passage 60 and surface portion 70 of base member 20. Accordingly, there is no tendency to force the left side of base member 20 out of groove and thereby "pop" the seal. This pressure equalization feature of the present invention represents a major improvement of prior art sealing devices employed under similar conditions.

It may also be seen that because of the venting action achieved by bore 78 as described above, there is no significant fluid pressure resistance to the downward flexing of the right side of base member 20 under the influence of the positive pressure exerted above. As indicated above, the greater the downward flexing of the right side of base member 20, the greater the sealing action of base member 20 within groove 30.

The action of sealing device 10 when there is a reversal of the pressure applied across groove 30 now will be described. This reversal of applied pressure may occur, for example, when the chamber being sealed by sealing device 10, say a sterilizing chamber, is operated under vacuum conditions.

As indicated by the arrow in FIG. 4, such conditions cause the applied pressure across groove 30 to be acting from left to right. The pressure causes lip 22 to be pushed inwardly and upwardly to effect a seal against surface 14. At the same time, the fluid pressure exerts force on surface portion 70 of base member 20, pushing the left side of base member 20 further into groove 30. This downward flexing action causes the partial or complete elimination of fluid passage 60 and a corresponding reduction in the volume available in fluid passages 60, 62 and groove 64. Any fluid trapped in these confines is forced upwardly (as indicated by the arrows in FIG. 4) through bore 78 and into fluid pas-

sage 76. Because of the reduction in volume as aforesaid, the pressure of the fluid in fluid passage 76 exceeds the subatmospheric fluid pressure acting upon the right side of lip member 24; consequently, free end 68 of lip member 24 is forced to separate momentarily from its engagement with surface 14 to permit fluid under pressure in fluid passage 76 to escape to the area of reduced pressure (as shown by the arrows in FIG. 4). When the pressure on both sides of lip member 24 equalizes at some subatmospheric value, free end 68 of lip member 24 returns to contact with surface 14.

As with the operation of sealing device 10 under positive pressure described above, the downward flexing of the left side of base member 20 enhances the sealing action of sides 38, 40 of base member 20 against sidewalls 32, 34 of groove 30. Again, because of the venting action achieved through bore 78 and the resultant equalization of pressure acting between fluid passage 62 and surface portion 72 of base member 20, there is no tendency to "pop" the seal by the right side of base member 20 being forced out of groove 30. Also, this venting action substantially eliminates any resistance to the downward flexing of the left side of base member 20 by exhausting fluid under pressure from fluid passage 60.

The present invention, therefore, operates to perfect excellent sealing action between surfaces 12 and 14 under application of either superatmospheric or subatmospheric pressure to the chamber being sealed. Further, when it is desired to separate surfaces 12 and 14, the present invention minimizes the "suction cup" effect that is usually experienced with double lip seals. That is, a double lip seal with no means for venting fluid passage 76 often acts as a suction cup against surface 14; when separation of the sealed surfaces is attempted in such case, the suction cup effect acting on one surface causes the sealing device to be pulled from its mounting on the opposite surface.

If, by reason of the particular design of the sealing device of the present invention or the materials of construction used therein, there exists any tendency for the suction cup effect to occur upon attempted separation of surfaces 12 and 14, the effect may be eliminated by first venting fluid passage 76 to atmosphere through passage 80 located in groove 30 (shown only in FIG. 3). Alternatively, fluid passage 76 may be vented to atmosphere through passage 80' located in surface 14.

What is claimed is:

1. A sealing device for application between two confronting, generally parallel, longitudinally extending surfaces, one of which surfaces having a longitudinally extending groove for receiving said sealing device, comprising:

a base member formed of resilient material and, in its undeformed state, being dimensioned to snugly contact said groove only at portions of its opposed sides and at a portion of its bottom surface, thereby to form first and second spaced, longitudinally extending fluid passages between said base member and said groove;

a pair of independently flexible, longitudinally extending lip members connected to said base member and extending therefrom for longitudinally uninterrupted, spaced-apart engagement with the other one of said generally parallel surfaces, thereby to form a third fluid passage between said lip members and said other surface;

means for providing transverse fluid communication between said first and second fluid passages; and means for providing fluid communication between said third fluid passage and said transverse fluid communication means.

2. A sealing device as recited in claim 1 wherein: said base member is formed with sides contoured to match substantially the sides of said groove and with a bottom portion defining a truncated dihedral offset from the central axis of said base member.

3. A sealing device as recited in claim 2 wherein: said lip members are joined opposite their free ends and connected to said base member at a point offset from the central axis thereof in the same direction as said truncated dihedral.

4. A sealing device as recited in claim 3 wherein: said lip members are formed integrally with said base member and define in section a Y-shaped structure extending therefrom.

5. A sealing device as recited in claim 3 wherein: said transverse fluid communication means comprises at least one transverse groove formed in the bottom surface of said truncated dihedral.

6. A sealing device as recited in claim 5 wherein: said fluid communication means between said third fluid passage and said transverse fluid communication means comprises at least one bore generally aligned with the vertical leg of said Y-shaped structure and intersecting said transverse groove.

7. A fluid seal comprising:
a pair of confronting, generally parallel, longitudinally extending surfaces surrounding an opening in a vessel adapted to operate at both superatmospheric and subatmospheric pressures, one of said surfaces having a longitudinally extending groove formed therein and adapted to receive a sealing device therein;

fluid under pressure disposed between said surfaces with the pressure applied first in one direction and then in the opposite direction across said groove; and

a sealing device disposed within said groove and effecting a seal between said surfaces;

said sealing device having:

(i) a base member formed of resilient material and, in its underformed state, being dimensioned to snugly contact said groove only at portions of its opposed sides and at a portion of its bottom surface, thereby to form first and second spaced, longitudinally extending fluid passages between said base member and said groove,

(ii) inboard and outboard independently flexible, longitudinally extending lip members connected to said base and extending therefrom for longitudinally uninterrupted, spaced-apart engagement with the surface opposite said grooved surface, thereby to form a third fluid passage between said lip members and said opposite surface,

(iii) means for providing transverse fluid communication between said first and second fluid passages, and

(iv) means for providing fluid communication between said third fluid passage and said transverse fluid communication means;

whereupon during conditions when said vessel is operating at superatmospheric pressure and said fluid under pressure disposed between said surfaces

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is applied across said groove in a direction away from said vessel, the portion of said base member under superatmospheric pressure is forced further into said groove and fluid under pressure in said first and second fluid passages is vented to atmosphere through said third fluid passage and thence between said outboard lip member and said surface opposite said grooved surface;
whereupon during conditions when said vessel is operating under subatmospheric pressure and said fluid under pressure disposed between said surfaces is applied across said groove in a direction toward said vessel, the portion of said base member against which said pressure is applied is forced further into said groove and fluid under pressure in said first and second fluid passages is vented to said vessel through said third fluid passage and thence between said inboard lip member and said surface opposite said grooved surface.

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8. A fluid seal as recited in claim 7 which further comprises:

means for venting said third fluid passage prior to separation of said confronting surfaces.

9. A fluid seal as recited in claim 8 wherein: said venting means comprises a fluid passage communicating between said transverse fluid passage and the atmosphere.

10. In a fluid seal between a pair of confronting, generally parallel surfaces, one of said surfaces having mounted thereon a sealing device having a pair of lip members adapted for contact with the other of said confronting surfaces and defining therebetween a fluid passage subject to subatmospheric pressures when said sealing device is operative, the improvement comprising:

means disposed in one or the other of said confronting surfaces for venting said fluid passage to atmosphere prior to effecting separation of said confronting surfaces.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 4,337,956

DATED : July 6, 1982

INVENTOR(S) : James A. Hopper

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

Col. 6, line 47, delete "underformed", and substitute
therefor --undeformed--.

Signed and Sealed this

Fourteenth Day of September 1982

[SEAL]

Attest:

GERALD J. MOSSINGHOFF

Attesting Officer

Commissioner of Patents and Trademarks