

Description

The seal according to the invention has particular application for use between two components which are capable of relative slidable movement with respect to each other. It is the condition of such seals that they not only be resiliently flexible in order to be able to maintain intimate surface contact with one of the surfaces but that they also have a relatively low co-efficient of sliding friction with the surface with which they are in contact and that they be wear resistant. It is generally not possible to have all of these properties in a single element and therefore a number of compromises have to be met in order to achieve a satisfactory result.

It is an object of this invention to provide a seal which is able to maintain close intimate contact with a surface with which it is to be held in sealing engagement, has a relatively low co-efficient of sliding friction and is durable.

According to the present invention there is provided a seal for use between a pair of substantially concentric elements capable of relative movement with respect to each other, said seal comprising a sealing element, said sealing element being adapted to be supported from one element by a support means and being in close abutting relationship with the other element, said sealing element being formed of a resilient wear resistant material having a low coefficient of sliding friction and being resiliently deformable both axially and radially, said seal being characterised by said sealing element having the configuration of a helix having a length in excess of one revolution of said helix, said support means including a resiliently flexible tubular element which tubular element acts as a clamping means for causing continuous resilient compression of the seal axially inwardly from each axial end thereof and also radially in a direction against the other element.

According to a preferred feature of the invention said resiliently flexible tubular element extends over the radial face remote from the other element and extends beyond each axial end thereof.

Other preferable features of this invention will be apparent from the sub claims.

Reference is made to French Patent Specification No. 2206830 which shows a stack of sealing rings surrounded by a sleeve of elastic material and an outer cylindrical surface of said sleeve is freely subjected to high-pressure gas so that said surface is compressed against the sealing rings.

Throughout this specification and claims the term tube or tubular shall not be taken as being restricted to instances where the components are of a circular cross-section or where the inner and outer surfaces are of similar cross-sectional con-

figuration.

The invention will be more fully understood in the light of the following description of several specific embodiments. The description is made with reference to the accompanying drawings of which;

Figure 1 is a sectional elevation of a first embodiment;

Figure 2 is a part section elevation of a second embodiment;

Figure 3 is a part sectional elevation of a third embodiment;

Figure 4 is a sectional elevation of a fourth embodiment; and

Figure 5 is a sectional elevation of a fifth embodiment

Figures 6a, 6b and 6c are sectional elevations of various seals which can be used in each of the embodiments.

The first embodiment as shown in Figure 1 relates to a seal which is used between a pair of concentric tubes 11 and 12 wherein the inner tube 12 is capable of slidable movement with respect to the outer tube 11. The inner tube 12 is supported in the outer tube 11 by a seal housing 13 which is received in one end of the outer tube 11 and is received concentrically between the inner tube 12 and outer tube 11. An O ring seal 14 is provided between the inner face of the outer tube 11 and the exterior face of the seal housing 13. The inner portion of the seal housing 13 is formed with a reduced diameter portion whereby the exterior face of the reduced diameter portion is spaced from the internal face of the outer tube 11. To seal the interface between the exterior face of the inner tube 12 and the seal housing 13 a seal 15 is utilised. As shown the seal 15 comprises a helix having at least one revolution. It is formed of a wear resistant resilient material which has a low co-efficient of sliding friction with the surface of the inner tube. In addition the wall thickness of the seal is greater than the reduced diameter portion of the seal housing 13 and the internal diameter of the seal in its unstressed position is less than the external diameter of the inner tube 12. The seal is received over the outer surface of the inner tube 12 and is held in abutment with the inner edge of the seal housing 13. The seal is associated with an annular bush 16 which is located to the opposite side of the seal from the inner end of the seal housing 13 such that the seal is retained between the seal housing 13 and the bush 16. To retain the seal 15 and bush 16 in position relative to the seal housing a flexible resilient tubular element 17 formed of an elastomeric material such as neoprene or rubber is applied over the reduced diameter portion of the seal housing 13, the seal 15 and the bush 16. The flexible resilient tubular element

17 surrounds the seal radially and extends axially to each side thereof and applies a radial force onto the seal against this inner tube 11. In order to locate the seal over the inner tube 12 it is necessary that it be expanded radially and as a result the seal is resiliently biased into engagement with the tube. Since the wall thickness of the seal is greater than that of the reduced diameter portion of the seal housing and the bush, the seal is further biased into engagement with the outer surface of the inner tube due to the radial deformation caused in the tubular element 17. In addition the tubular element serves to prevent axial displacement of the bush 16 and axial expansion of the seal 15. Furthermore on application of the tubular element 17 it is stretched axially such as to provide a biasing force onto the seal 15 to prevent axial expansion thereof. During slidable movement of the inner tube 12 within the outer tube 11 any pressure that is generated in the space between the inner and outer tubes 11 and 12 will be exerted on the exterior face of the resilient tubular element 17 which will further serve to bias the seal 15 into engagement with the outer surface of the inner tube 12 and thus enhance the sealing action. Such sealing action furthermore would occur at a time when such greater sealing is required (i.e. during increased pressure conditions). The axial compression of the seal effected through the tubular element 17 serves to prevent fluid flow along the interface between the turns of the helix.

The second embodiment as shown at Figure 2 is similar to the first embodiment and identical reference numerals have been used to identify similar components. The difference between the first and second embodiments resides in the nature of the tubular element 17 which is provided with a lip seal 20 at its outer end for engagement with the inner face of the outer tube 11 in replacement of the O ring seal 14 of the first embodiment. In addition the reduced diameter portion of the seal housing 13 is recessed at an intermediate portion 21 to positively locate the tubular element 17. Furthermore the bush 15 is replaced by an inwardly directed flange 18 at the outer end of the tubular element 17.

The third embodiment as shown at Figure 3 is similar to the second embodiment in which the only variation comprises the configuration of the seal 15 and the flange 18 of the tubular element. The seal is formed such that its axial faces are inclined to the central axis of the seal whereby when in position the axial faces are inclined to the external face of the inner tube 11 in the direction of the inward movement of the inner tube 11 into the outer tube 12 and the flange 18 of the tubular element 17 has a complementary configuration.

The fourth embodiment as shown at Figure 4 is a further variation of the second and third embodiments whereby the seal housing 13 is not formed with a reduced diameter portion and the seal and tubular element 17 are in abutting face to face engagement with the inner end of the seal housing 13. In addition the seal housing is associated with a retaining ring 22 which is supported on the internal face of the outer tube 11 and in closely spaced in relation to the inner end of the seal housing 13. The tubular element 17 is formed with a flange seal 23 which is sealingly engaged between the inner end of the seal housing 13 and the retaining ring 22. The seal 15 and the tubular element 17 are floatingly supported from between the seal housing 13 and the retaining ring 22 to be capable of relative radial movement therebetween whereby on any radial movement of the inner tube 12 within the outer tube 11 such movement can be accommodated for by seal without the degeneration of the sealing contact between the two surfaces.

In the case of the fifth embodiment as shown at Figure 5 the sealing arrangement of the embodiment comprises one where the seal is applied to the internal face of a tubular member. An example of the embodiment comprises a seal provided on a piston 52 which is received within a cylinder body 51 whereby the piston 52 is supported on the end of a piston rod 64. The piston is formed at its inner end with a reduced diameter portion which supports a flexible resilient tubular element 57 which is formed of an elastomeric material such as neoprene or rubber. The tubular element 57 is retained on the reduced diameter portion of the piston 52 by being engaged in a plurality of recesses 61 provided on the reduced diameter portion. Associated with the tubular element is a support ring 53 which is concentrically received over the tubular element 57 to overlie the portion received over the reduced diameter portion of the piston 52. A seal 55 of similar form to the previous embodiments is received over the tubular element 57 adjacent the innermost edge of the support ring 53. The seal has a wall thickness which is greater than that of the support ring 53 and has an external diameter which is greater than the internal diameter of the cylinder body 51 such that it must be compressed in order to be located within the cylinder body 51. The seal 55 is retained in position by an annular bush 56 which is received over the tubular element 57. The inner face of the annular bush 56 is formed with a groove and the inner face of the tubular element 57 in the region opposite that recess 65 accommodates a resilient circlip 67 which serves to engage the tubular element 57 with the annular bush 56 to prevent axial displacement of the annular bush 56 with respect to the tubular element 57. As a result of the relative wall thicknesses of

the seal with respect to the tubular wall thicknesses of the support 53 and the annular bush 56, the tubular element 57 is caused to be deformed radially inwardly by the seal 55 which further serves to bias the seal 55 outwardly against the inner face of the cylinder body 51. Furthermore during use increased pressure generated within the cylinder body 51 would be exerted on the internal face of the tubular band 57 to further bias the seal in sealing engagement with the inner face of the cylinder body 51.

As shown at Figures 6a,b and c the seal which can be used in each of the embodiments described above may take a variety of configurations depending upon the configuration of the spaces in which the seal is to be located. In addition there can be an advantage in inclining the axial faces of the helix in respect to the central axis of the seal in order to improve the flexibility characteristics of the seal.

In addition the helix may be formed as a part of the seal housing of each of the embodiments described above.

It is desired the seal of the invention need not be limited to use where the other element is of constant cross-section but has application where the other element is tapered or is of irregular cross-section.

Claims

1. A seal for use between a pair of substantially concentric elements (11 and 12) capable of relative movement with respect to each other, said seal comprising a sealing element (15), said sealing element (15) being adapted to be supported from one element by a support means (17) and being in close abutting relationship with the other element, said sealing element (15) being formed of a resilient wear resistant material having a low coefficient of sliding friction and being resiliently deformable both axially and radially, said seal being characterised by said sealing element (15) having the configuration of a helix having a length in excess of one revolution of said helix, said support means (17) including a resiliently flexible tubular element which tubular element acts as a clamping means for causing continuous resilient compression of the seal axially inwardly from each axial end thereof and also radially in a direction against the other element.
2. A seal as claimed in Claim 1 in which the resiliently flexible tubular element extends over the radial face of the sealing element (15) remote from the other element (12) and extends to each side thereof.
3. A seal as claimed in Claim 2 in which the support means comprises a support element (13,16) to each side of the sealing element (15) and in close axial abutting relationship therewith whereby the clamping means (17) overlies the sealing element and at least a portion of each support element.
4. A seal as claimed in Claim 2 in which the support means comprises a support element (13) supported from said one element (11) wherein said sealing element is located in close abutting axial relation with the support element (13) and said tubular element (17) is formed with a retention means (18) for engaging the axial face of the sealing element remote from the support element.
5. A seal as claimed in Claim 4 in which said resilient tubular element (17) is formed with a portion (20) extending radially for sealing engagement with the one element.
6. A seal as claimed in Claim 1 in which the support means comprises a support element (13) fixed to said one element (11) wherein said sealing element (15) is maintained in close abutting axial relationship with the support element and is capable of relative sliding movement radially with respect to the support element.
7. A seal as claimed in Claim 6 in which the resiliently flexible tubular element (17) extends over the radial face of the sealing element remote from the other element.
8. A seal as claimed in Claim 7 in which the tubular element (17) is formed with a radially directed flange which engages the axial face of the sealing element (15) remote from the support element.
9. A seal as claimed in Claim 7 or 8 in which a retaining ring (22) is fixed to the one element (11) at a position spaced axially from the support element (13) and said tubular element (17) is slidably supported between the support element and the retaining ring for said radial movement.
10. A seal as claimed in any one of the preceding claims in which the internal face of said one element (11) is of a substantially circular cross section and said other element (12) is concentrically received therein.



the seal with respect to the tubular wall thicknesses of the support 53 and the annular bush 56, the tubular element 57 is caused to be deformed radially inwardly by the seal 55 which further serves to bias the seal 55 outwardly against the inner face of the cylinder body 51. Furthermore during use increased pressure generated within the cylinder body 51 would be exerted on the internal face of the tubular band 57 to further bias the seal in sealing engagement with the inner face of the cylinder body 51.

As shown at Figures 6a,b and c the seal which can be used in each of the embodiments described above may take a variety of configurations depending upon the configuration of the spaces in which the seal is to be located. In addition there can be an advantage in inclining the axial faces of the helix in respect to the central axis of the seal in order to improve the flexibility characteristics of the seal.

In addition the helix may be formed as a part of the seal housing of each of the embodiments described above.

It is desired the seal of the invention need not be limited to use where the other element is of constant cross-section but has application where the other element is tapered or is of irregular cross-section.

Claims

1. A seal for use between a pair of substantially concentric elements (11 and 12) capable of relative movement with respect to each other, said seal comprising a sealing element (15), said sealing element (15) being adapted to be supported from one element by a support means (17) and being in close abutting relationship with the other element, said sealing element (15) being formed of a resilient wear resistant material having a low coefficient of sliding friction and being resiliently deformable both axially and radially, said seal being characterised by said sealing element (15) having the configuration of a helix having a length in excess of one revolution of said helix, said support means (17) including a resiliently flexible tubular element which tubular element acts as a clamping means for causing continuous resilient compression of the seal axially inwardly from each axial end thereof and also radially in a direction against the other element.
2. A seal as claimed in Claim 1 in which the resiliently flexible tubular element extends over the radial face of the sealing element (15) remote from the other element (12) and extends to each side thereof.

3. A seal as claimed in Claim 2 in which the support means comprises a support element (13,16) to each side of the sealing element (15) and in close axial abutting relationship therewith whereby the clamping means (17) overlies the sealing element and at least a portion of each support element.
4. A seal as claimed in Claim 2 in which the support means comprises a support element (13) supported from said one element (11) wherein said sealing element is located in close abutting axial relation with the support element (13) and said tubular element (17) is formed with a retention means (18) for engaging the axial face of the sealing element remote from the support element.
5. A seal as claimed in Claim 4 in which said resilient tubular element (17) is formed with a portion (20) extending radially for sealing engagement with the one element.
6. A seal as claimed in Claim 1 in which the support means comprises a support element (13) fixed to said one element (11) wherein said sealing element (15) is maintained in close abutting axial relationship with the support element and is capable of relative sliding movement radially with respect to the support element.
7. A seal as claimed in Claim 6 in which the resiliently flexible tubular element (17) extends over the radial face of the sealing element remote from the other element.
8. A seal as claimed in Claim 7 in which the tubular element (17) is formed with a radially directed flange which engages the axial face of the sealing element (15) remote from the support element.
9. A seal as claimed in Claim 7 or 8 in which a retaining ring (22) is fixed to the one element (11) at a position spaced axially from the support element (13) and said tubular element (17) is slidably supported between the support element and the retaining ring for said radial movement.
10. A seal as claimed in any one of the preceding claims in which the internal face of said one element (11) is of a substantially circular cross section and said other element (12) is concentrically received therein.



11. A seal as claimed in any one of Claims 1 to 6 in which said other element (12) has an internal face which is of a substantially circular cross-section and said one element (11) is concentrically received therein.

12. A seal as claimed in any one of the preceding claims in which the axial faces of the helix are inclined to the central axis thereof.

Patentansprüche

1. Eine Dichtung zur Anwendung zwischen einem Paar von im wesentlichen konzentrischen Elementen (11, 12), die relativ zueinander beweglich sind, wobei diese Dichtung ein Dichtungselement (15) umfaßt, welches Dichtungselement (15) von einem Element mittels einer Halteanordnung (17) gehalten werden kann und in enger Anlagestellung relativ zu dem anderen Element ist, wobei dieses Dichtungselement (15) aus einem federnden, verschleißfesten Material besteht, das einen niedrigen Gleitreibungskoeffizienten hat und sowohl axial als auch radial elastisch verformbar ist, wobei diese Dichtung dadurch gekennzeichnet ist, daß das Dichtungselement (15) die Form einer Helix mit einer Länge größer als eine Helixwindung hat, und daß die Halteanordnung (17) ein elastisches, flexibles, rohrförmiges Element umfaßt, das als ein Klemmorgan wirksam ist, um eine kontinuierliche, federnde Druckkraft der Dichtung axial nach innen von jedem axialen Ende davon und auch radial in einer Richtung gegen das andere Element zu bewirken.
2. Eine Dichtung nach Anspruch 1, bei der das elastische, flexible, rohrförmige Element sich entgegengesetzt von dem anderen Element (12) über die Radialfläche des Dichtungselementes (15) und zu beiden Seiten desselben erstreckt.
3. Eine Dichtung nach Anspruch 2, bei dem die Halteanordnung ein Stützelement (13, 16) an beiden Seiten des Dichtelementes (15) und in enger axialer Anlagestellung dazu umfaßt, wobei das Klemmorgan (17) das Dichtungselement und mindestens einen Abschnitt jedes Stützelementes überlagert.
4. Eine Dichtung nach Anspruch 2, bei dem die Halteanordnung ein Stützelement (13) aufweist, das von diesem einen Element (11) getragen ist, wobei dieses Dichtungselement in enger anliegender Axialposition mit dem Stützelement (13) liegt, und wobei das rohrförmige Element (17) mit einer Sicherungsanordnung

(18) versehen ist, um die Axialfläche des Dichtungselementes entgegengesetzt von dem Stützelement zu beaufschlagen.

5. Eine Dichtung nach Anspruch 4, bei dem dieses elastische rohrförmige Element (17) einen sich radial erstreckenden Abschnitt (20) für die dichtende Anlage gegen das eine Element aufweist.
6. Eine Dichtung nach Anspruch 1, bei dem die Halteanordnung ein an dem einen Element (11) befestigtes Stützelement (13) umfaßt, wobei dieses Dichtungselement (15) in eng anliegender Axialposition mit dem Stützelement gehalten ist und eine relative Gleitbewegung radial relativ zu dem Stützelement ausführen kann.
7. Eine Dichtung nach Anspruch 6, bei der das elastische, flexible, rohrförmige Element (17) sich über die Radialfläche des Dichtungselementes an der von dem anderen Element abgewandten Seite erstreckt.
8. Eine Dichtung nach Anspruch 7, bei der das rohrförmige Element (17) mit einem radial gerichteten Flansch ausgebildet ist, der die Axialfläche des Dichtungselementes (15) an der von dem Stützelement abgewandten Seite beaufschlagt.
9. Eine Dichtung nach Anspruch 7 oder 8, bei der ein Haltering (22) an dem einen Element in einer von dem Stützelement (13) axial im Abstand liegenden Position befestigt ist, und wobei das rohrförmige Element (17) für diese Radialbewegung gleitend zwischen dem Stützelement und dem Haltering gelagert ist.
10. Eine Dichtung nach einem der vorhergehenden Ansprüche, bei der die Innenfläche dieses einen Elementes (11) einen im wesentlichen kreisförmigen Querschnitt hat, während das andere Element (12) konzentrisch darin aufgenommen ist.
11. Eine Dichtung nach einem der Ansprüche 1 bis 6, bei der dieses andere Element (12) eine Innenfläche aufweist, die einen im wesentlichen kreisförmigen Querschnitt hat, und wobei dieses eine Element (11) konzentrisch darin aufgenommen ist.
12. Eine Dichtung nach einem der vorhergehenden Ansprüche, bei dem die Axialflächen der Helix relativ zur Zentralachse derselben schräggestellt sind.



Revendications

1. Joint destiné à être utilisé avec une paire d'éléments sensiblement concentriques (11 et 12) capables d'un mouvement relatif l'un par rapport à l'autre, ledit joint comportant un élément d'étanchéité (15), ledit élément d'étanchéité (15) étant prévu pour être supporté sur un élément par des moyens de support (17) et étant en relation de butée rapprochée avec l'autre élément, ledit élément d'étanchéité (15) étant réalisée dans une matière élastique résistante à l'usure ayant un faible coefficient de friction de glissement et qui est élastiquement déformable à la fois axialement et radialement, ledit joint étant caractérisé par ledit élément d'étanchéité (15) qui a la configuration d'une hélice ayant une longueur supérieure à un tour de ladite hélice, lesdits moyens de support (17) comprenant un élément tubulaire flexible élastiquement qui sert de moyens de serrage destinés à engendrer une compression élastique continue du joint axialement vers l'intérieur depuis chaque extrémité axiale de celui-ci et également radialement dans une direction à l'encontre de l'autre élément. 5 10 15 20 25
2. Joint selon la revendication 1, dans lequel l'élément tubulaire flexible élastiquement s'étend sur la face radiale de l'élément d'étanchéité (15) éloignée de l'autre élément (12) et s'étend de chaque côté de celui-ci. 30
3. Joint selon la revendication 2, dans lequel les moyens de support comportent un élément de support (13, 16) de chaque côté de l'élément d'étanchéité (15) et en relation de butée axiale rapprochée, les moyens de serrage (17) recouvrant l'élément d'étanchéité et au moins une partie de chaque élément de support. 35 40
4. Joint selon la revendication 2, dans lequel les moyens de support comportent un élément de support (13) supporté par ledit élément (11), ledit élément d'étanchéité étant en relation de butée axiale rapprochée avec l'élément de support (13) et ledit élément tubulaire (17) étant réalisé avec des moyens de retenue (18) destinés à engager la face axiale de l'élément d'étanchéité éloignée de l'élément de support. 45 50
5. Joint selon la revendication 4, dans lequel ledit élément tubulaire élastique (17) est réalisé avec une partie (20) s'étendant radialement pour engagement d'étanchéité avec l'élément. 55
6. Joint selon la revendication 1, dans lequel les moyens de support comportent un élément de support (13) fixé sur ledit élément (11), ledit élément d'étanchéité (15) étant maintenu en relation de butée axiale rapprochée avec l'élément de support et étant capable d'un mouvement de coulissement relatif radialement par rapport à l'élément de support.
7. Joint selon la revendication 6, dans lequel l'élément tubulaire élastique flexible (17) s'étend sur la face radiale de l'élément d'étanchéité éloignée de l'autre élément.
8. Joint selon la revendication 7, dans lequel l'élément tubulaire (17) est réalisé avec une bride dirigée radialement qui engage la face axiale de l'élément d'étanchéité (15) éloignée de l'élément de support.
9. Joint selon la revendication 7 ou 8, dans lequel une bague de retenue (22) est fixée sur l'élément (11) dans une position espacée axialement de l'élément de support (13) et ledit élément tubulaire (17) est supporté de façon coulissante entre l'élément de support et la bague de retenue pour ledit mouvement radial.
10. Joint selon l'une quelconque des revendications précédentes, dans lequel la face interne dudit élément (11) est de section sensiblement circulaire et ledit autre élément (12) y est reçu de façon concentrique.
11. Joint selon l'une quelconque des revendications 1 à 6, dans lequel ledit autre élément (12) a une face interne qui est de section sensiblement circulaire et ledit élément (11) y est reçu de façon concentrique.
12. Joint selon l'une quelconque des revendications précédentes, dans lequel les faces axiales de l'hélice sont inclinées par rapport à l'axe centrale de celle-ci.