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# DESCRIPTION

## FIELD OF INVENTION

**[0001]** The present invention relates to sealing glands and in particular though not solely to sealing glands for sealing the join formed between and about an elongate member such as for example a pipe with a substantially flat surface, for example a wall, ceiling or floor.

## BACKGROUND OF THE INVENTION

**[0002]** Specific requirements for clean areas for example in food handling, biologically sensitive areas, or other such areas requiring a clean seal, requires use of a seal that can be cleaned easily, applied easily and become functional easily yet is also consistent in its sealing engagement to both the pipe and the wall, and that is manufactured from inert and chemically resistant materials, so as to not contaminate the immediate environment, and to withstand cleaning and the like.

**[0003]** There are numerous ways of sealing a cavity and join about pipes and similar elongate members to a flat surface which they may pass through. The most simple method for sealing a pipe to a wall is the application of sealant about the periphery of the pipe adjacent the region of the wall into or through which the pipe may pass through. Prior art methods that use sealants and similar are messy and time consuming and the sealant cannot be easily removed and replaced, meaning that the pipe, wall panel or similar cannot be easily removed and replaced.

**[0004]** Another example of these is the use of a stainless steel flange attached to the elongate pipe or member. This is then attached to the flat surface in a first method by standing this off the flat surface and then sealing the space with sealant. This is not an easily removable system. The second is the bolting of the flange to a further wall fitting and locating between the two a sealing component, e.g. an "O" ring. This method and the previous one do not stand up well to vibration and flexure of the pipe relative to the flat surface.

**[0005]** Further methods utilize boots and similar to engage both the pipe and wall. Other methods use a boot with a cut to allow it to be placed and seal an existing pipe and wall installation. Methods that have used boots to date have not resulted in a consistently sealing boot about the pipe and against the bulk head. The solutions that currently exist with a sealable cut for sealing about an existing pipe and wall share the same problems as the uncut ones together with the added problem that the cut does not seal consistently either. To date all resealable glands require the addition of sealant to obtain an effective seal.

**[0006]** A number of solutions exist for sealing a pipe to a protective sleeve. However all of these require some form of additional sealant added to affect a proper seal between the pipe

and the protective sleeve.

**[0007]** Increasingly hygienic environments, for example food handling and preparation premises, require high standard chemically inert materials to be present. This is not only to preserve the hygienic environment but also the method of cleaning such places uses highly corrosive clean in place chemicals that attack most materials such as rubbers and steels, including 305 stainless steel. These chemicals or environments are also often thermally elevated increasing their reactivity. Such environments require materials that are compatible with such harsh environments.

**[0008]** Additionally such environments require a vibration and flexure resistant sealing and often fire retardance and resistance. Such relative movement can occur due to impact of the pipe or surface, flow in the elongate member, water or gas hammer or thermal expansion. The relative movement can be both radially and axially of the elongate member.

**[0009]** To date no such gland exists that offers all these properties and there is a long felt want in the industry that as yet has not been addressed.

**[0010]** In this specification where reference has been made to patent specifications, other external documents, or other sources of information, this is generally for the purpose of providing a context for discussing the features of the invention. Unless specifically stated otherwise, reference to such external documents is not to be construed as an admission that such documents, or such sources of information, in any jurisdiction, are prior art, or form part of the common general knowledge in the art.

**[0011]** It is therefore an object of the present invention to provide a sealing gland to overcome the above problems with the prior art or at least to provide the public with a choice.

**[0012]** AU 200042690, US 2005/0055889 and AU 199911298 each disclose sealing glands known in the art.

## **BRIEF DESCRIPTION OF THE INVENTION**

**[0013]** In a first aspect of the present invention there is a peripheral sealing gland according to claim 1 of the appended claims.

**[0014]** Preferably said seal formed is water and particulate impervious.

**[0015]** Preferably there are at least two of said endless lip seal each concentric to each other.

**[0016]** Preferably there are four said endless lip seals.

**[0017]** Preferably said second plurality of apertures does not pass through said endless lip

seals.

**[0018]** Preferably said second plurality of apertures lies between two concentric endless lip seals.

**[0019]** Preferably said upper seal and said flange are of elastic resilient material and preferably chemically inert material (for example silicon).

**[0020]** Preferably said compression ring is made from a stainless steel.

**[0021]** Preferably said upper seal is defined by cutting the apex of a conical shaped skirt that preferably has marking to indicate a zone of cutting for particular said elongate members.

**[0022]** Preferably said upper seal and flange are of sufficient internal diameter to seal over any diameter enlargement in said elongate member.

**[0023]** Such diameter enlargement may be affected by welding, union nuts, or similar known methods and also die size of the aperture in the substantially flat surface to be sealed.

**[0024]** Preferably said second plurality of apertures is each of lesser size than said fastener to fit there through to aid establishing of a seal.

**[0025]** Preferably the outer most of said plurality of endless lip seals is larger than those at the inside of it.

**[0026]** Preferably said skirt and said flange are integrally formed.

**[0027]** Preferably said sealing gland is split, from said upper seal to the external edge of said flange.

**[0028]** Preferably said sealing gland can be applied to form a seal between an in situ elongate member and a substantially flat surface by opening said split and

**[0029]** slipping the gland laterally over the elongate member and thereafter applying pressure to close the split.

**[0030]** Preferably there is a continuous upstand depending outwards from said skirt each side of said resealable split.

**[0031]** Preferably there is an undercut or retaining groove running along each of the external surfaces of said continuous upstand.

**[0032]** Preferably said compression ring is split to under engage and apply sealing pressure at least along part of said resealable split on said flange.

**[0033]** Preferably there is a compression clamp able to apply pressure either side of the remainder of said resealable opening at said undercut by continuous contact either side of said resealable opening.

**[0034]** Preferably said compression clamp comprises at least two spaced opposing closure members, said two spaced opposing closure members joined by a plurality of connection members along their length, said plurality of connection members arching from one of said at least two spaced opposing closure members to the other, wherein in use said at least two spaced opposing closure members are in continuous contact with external surfaces either side of said continuous upstand to apply pressure to seal said resealable split.

**[0035]** The term 'comprising' as used in this specification means 'consisting at least in part of, that is to say when interpreting statements in this specification which include that term, the features, prefaced by that term in each statement, all need to be present but other features can also be present.

**[0036]** The term "gland" as used herein includes the meaning of a member to seal between two surfaces, typically where one intrudes into, or near another surface or one member passes through another member or surface.

**[0037]** The term "continuous" here is meant in the normal meaning of continuous over time and also includes continuous over a length.

**[0038]** To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the descriptions herein are purely illustrative and are not intended to be in any sense limiting.

**[0039]** The invention consists in the foregoing and also envisages constructions of which the following gives examples.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0040]** Preferred embodiments to the present invention will now be described in reference to the accompanying drawings, whereby;

**Figure 1** shows in plan a first embodiment of the sealing gland of the present invention, prepared for use,

**Figure 2** shows a bottom elevation of the embodiment of Figure 1,

**Figure 3a** shows a side elevation of the sealing gland of Figures 1 and 2,

**Figure 3b** shows the sealing gland of the first embodiment before it has been prepared for use, having a full cone on its upper portion,

**Figure 4** shows the sealing gland of the first embodiment of the present invention in top perspective view,

**Figure 5** shows the sealing gland of the first embodiment of the present invention in bottom perspective view,

**Figure 6** shows a cross-sectional view of the first embodiment of the sealing gland of the present application in use, sealing to a pipe and also bearing on a substantially flat surface by means of a compression ring, with the sealing gland located over a union nut of two pipes,

**Figure 7A** shows the detail A of Figure 6 with the lips deformed against the substantially flat surface, and Figure 7B shows the undeformed lips with fastener,

**Figure 8** shows a perspective view of a sealing gland according to an example not according to the invention,

**Figure 9** shows a cutaway view of the sealing gland of Figure 8, in perspective view,

**Figure 10** shows similar view to that of Figure 8 with the addition of tension band improve sealing a bottle second *pipe*,

**Figure 11** shows a similar view to that of Figure 9 with the addition of the tension band of Figure 10,

**Figure 12** shows the sealing of the gland of an example not according to the invention to the second pipes,

**Figure 13** shows a similar view to Figures 9 and 11 with the addition of the two elongate members of different diameter shown,

**Figure 14** shows two resealable sealing glands of the prior art showing the discrete pressure application to the resealable portion in perspective view,

**Figure 15** shows a perspective view of a further embodiment of the present invention showing a resealable opening of the peripheral sealing gland including the compression ring and compression clamp,

**Figure 16** shows a resealable peripheral compression gland of the further embodiment in isometric view sealed about a elongate member and against a substantially flat surface,

**Figure 17A** shows a perspective compression clamp for the resealable peripheral sealing gland, and Figure 17B shows in end view a preferred form of compression clamp,

**Figure 18** shows a compression ring for this further embodiment with a break to allow passage

there through of the resealable opening,

**Figure 19A** shows a cross section perpendicular to the resealable opening showing a compression clamp of one form prior to deformation and application of sealing pressure, and **Figure 19B** shows the same view as A with the exception that the compression clamp has been deformed to apply sealing pressure to the resealable opening, **Figure 19C** shows a further embodiment of the compression clamp being clipped in place over the continuous upstands prior to inward

deformation, and **Figure 19D** shows this second embodiment compression clamp deformed and applying continuous pressure to said resealable split,

**Figure 20** shows in cross section of the seal portion two possible variations of a labyrinth seal, A showing a seal surface with lips similar to those on the bottom of the flange, and B a labyrinth comprised of ribs that engage along the length of the seal.

**Figure 21** shows a further example not according to the invention in a) plan view and b) a cross-sectional view through A-A the particular form being of a substantially planar disk with an aperture there through,

**Figure 22** shows the example not according to the invention of **Figure 21** in plan isometric,

**Figure 23** shows a similar view to that of **Figure 21** in that a compression ring has been added in plan view a) and a sectional view and b) a sectional view along the line of B-B,

**Figure 24** shows a similar view to that of **Figure 22** in that a plan isometric view is shown with the addition of the compression ring, the sealing gland shown sealing a pipe or similar elongate member,

**Figure 25** shows us a similar view to that of **Figures 21** and **23** with the addition of a retaining lip for the compression ring shown in plan view a) and also b) a cross-sectional view along line C-C,

**Figure 26** shows a similar view to that of **Figures 22** and **24**,

**Figure 27** shows a similar view to that of **Figure 25** with the addition of a compression ring being retained by the retaining lip in a) plan view and b) a section view along the line D-D,

**Figure 28** shows a similar view to that of **Figure 26** with the addition of the compression ring, and

**Figure 29** shows a bottom isometric view of the embodiment shown in **Figures 21** through **28**.

## DETAILED DESCRIPTION

**[0041]** Preferred embodiments of the present invention and along with examples not according to the invention will now be described with reference to Figure 1 through 29. The sealing gland (1) consists of a tapered skirt (5) that is substantially frustoconical in the preferred embodiment. It should be noted that in alternative embodiments this skirt (5) could be pyramid-shaped, with multiple sides from three upwards. The size of the skirt (5) will depend on the location it is to seal. The sizes will be determined by the size and presence of any pipe unions present or the size of the aperture through which the pipe (2) may pass through.

**[0042]** A flange (7) extends outwards from the base or lower periphery of the upper part 5. The upper part 5 (or "skirt") may be a full cone having an apex (14), as shown in Figure 3Eb, with the cone including markings (13) in rings at different heights around the cone, which indicate at which point a user should cut to create an aperture suitable for a particular size of elongate member (2). The marking (13) may additionally include indicia to indicate a particular diameter or size which may occur when cutting at that mark. It should be noted that although in the preferred embodiment these markings are perpendicular to the centre line, or centre of rotation of the upper part 5, these could be angled to create oval apertures for pipes of oval cross-section, or if an angled construction, with the elongate member angled away from perpendicular with said surface, is required. It should also be noted that the skirt (5) may be pre-cut to a required size of a particular elongate member (2).

**[0043]** The tapered skirt, truncated cone, pyramid or frustoconical skirt (5) thus created has an upper aperture 20 which defines an upper periphery for sealing against an elongate member.

**[0044]** As described above, the skirt (5) has at its upper portion (19) an opening (20) (which may be provided by the pre-cut sealing gland (1) or when cut from the cone configuration as per Figure 3(b)). The opening (20) provides an upper seal (6) or a surface for an upper seal (6). The flange (7) will now be described in more detail with reference to the Figures.

**[0045]** The flange (7) has a lower surface 21, the opposite side from the apex 14 of the cone 5. In the preferred embodiment, a number of endless lip seals (8) are located on this surface and they are able to form a labyrinth seal. The endless lip seals (8) are of sufficiently thin cross section so that with the application of a small amount of pressure from a surface or object they are able to deform and seal about or on that surface or object. This is best shown in Figure 7(a) where the endless lip seals (8) have deformed against an object, in this case a substantially flat surface (3). By having a number of concentric endless lip seals (8) a number of sealing points on such a surface or object are formed to further ensure the integrity of such a seal formed.

The flange (7) also has a plurality of flange apertures (12) formed there through. In use, these receive fasteners (10). In the preferred embodiment these flange apertures (12) are each of a lesser diameter than the fasteners (10) which they are to receive. This is to further ensure the integrity of the seal formed, as the preferred material from which the flange (7) is manufactured is a deformable, elastic, and resilient material which is also chemically inert, such as silicon based compounds, or similar. The flange apertures (12) will therefore stretch to

fit around the fasteners (10) and thereafter seal against them.

**[0046]** Present also towards the lower portion of the skirt (5) is a retention flange (16) this presents in one embodiment as an undercut to the skirt or cone (5), or an extension of the skirt (5) and presents approximately an aperture of similar thickness to a compression ring (9), as described below. The retention flange (16) is intended to retain the compression ring (9).

**[0047]** This is also a major point of difference between the present invention and the prior art. The prior art sealing glands that have such a metal outer ring present have this bonded to the flexible material of the gland. This bonding is achieved through a lengthy in mould process requiring substantial preparation of the metal outer ring, or requires post working, gluing and curing to attach the metal ring to the gland.

**[0048]** The compression ring (9) is a hollow ring which in use slips over the skirt or cone 5, and is located so that its lower surface rests against the upper surface of the flange (7), with the upper surface of the inner edge underneath the lower surface of the retention flange (16), so that the retention flange bears upon the upper surface of the compression ring (9). It can be seen that the inner edge or inner part of the compression ring 9 will be sandwiched between the retention flange 16 and the flange 7, with the two surfaces acting in co-operation to retain the compression ring (9) to the sealing gland (1). Any other form of retention of the ring is within the scope of the invention.

**[0049]** The compression ring (9) is made of a sufficiently resilient material such that when the sealing gland (1) is applied and fasteners are used, the compression created by the fasteners is able to be resisted by the stiffness of the compression ring so that an even or substantially even pressure is applied to the flange (7) by the compression ring (9). If a higher degree of seal is required then a stiffer compression ring (9) may be used so that more force may be exerted onto the flange (7) and therefore the endless lip seals (8).

**[0050]** This is a further major point of difference between the prior art sealing glands and the present invention. The metal ring, when present on other sealing glands, is not a resilient stiff ring but rather is flexible to allow conformation of the ring and gland to the surface below. Also prior art sealing glands rely on the addition of sealant after the gland is in place to affect a complete seal

**[0051]** In the preferred embodiment, the compression ring (9) has a first plurality of apertures (11) spaced at intervals around its body, which allow fasteners to pass there through. The apertures (11) are in the preferred embodiment concentric and able to be co-located with the second plurality of apertures (12) in the flange (7).

**[0052]** In applying the sealing gland to an elongate member (2) and substantially flat surface (3) to be sealed the following steps are undertaken. The correct opening (20) diameter to form the upper seal (6) is selected and/ or cut. The sealing gland is thereafter slid down or along the

elongate member (2) (for example a pipe or similar conduit) until the endless lip seals (8) meet the substantially flat surface (3). The substantially flat surface (3) is only an example and any form of sealing surface may be appropriate and in some embodiments the compression ring (9) and/ or flange (7) may be formed to conform to various surfaces that may not be flat, for example corrugated, curved or similar. There may additionally be some form of reinforcing internal of the flange (7) which allows confirmation of the flange (7) to the required surface. This reinforcing or conformable, yet shape retaining material, may be in exclusion or in addition to the compression ring (9). The upper seal (6) deforms and shapes itself around the elongate member (2) by the elastic tension of the skirt (5) to form a seal. The opening (20) is therefore generally cut to a slightly smaller diameter or size than that of the elongate member (2) to which it is to seal to.

**[0053]** In some uses the gland may be assembled to the elongate member separate to the compression ring (9). For example the compression ring (9) may be slide of the elongate member (2) before sliding the sealing gland (1) over. The compression ring (9) only being associated with the retention flange (16) after the gland is located against the substantially flat surface (3).

**[0054]** In the preferred embodiment, the elongate member (2) (and thus the corresponding opening (20) are round and created from a conical upper part 5. This is useful for example when the sealing gland 1 is used with pipes or similar. However, if a pyramidal upper part 5 is used, the shape of the aperture 20 created may also be rectangular, triangular, a regular or irregular polygon or any other shape that is necessary to be sealed to. Correspondingly the pending skirt (5) and flange (7) may be of a corresponding shape to that of the opening or may form a transition from the shape of the opening to for example a substantially circular flange (7).

**[0055]** Once the sealing gland (1) is in place on the elongate member (2) and the surface (3), fasteners (10) are passed through the apertures 11, 12 on the compression ring 9 and the flange 7 respectively. These fasteners then pass through and engage either into corresponding nuts or corresponding fastening means in the surface (3) or through the surface (3). Thereafter the fasteners (10) are tightened such that the endless lip seals (8) deform against the surface (3) to form a seal. Additionally if higher compression pressures are required to form the seal further plurality of apertures may be added to both the compression ring (9) and flange (7) so that further force can be exerted without deformation or substantial deformation of the compression ring (9) by use of further fasteners (10).

**[0056]** The material selected for forming at least the upper portion (19) of the skirt (5) is sufficiently resilient to pass over or be able to be deformed over most unions or joins (15) which may be present in the elongate member (2). For example such union or joins (15) may be affected by welding in which case minimal deformation is required to pass over the weld, but conversely the join may be affected by a set of union nuts as shown in Figure 6 and rather than disassembling the whole elongate member (2) structure the sealing gland (1) can be stretched over the past for its final resting point.

**[0057]** The advantage conveyed by this invention is that a seal can be affected simply, quickly, and repetitively over an elongate member (2) and joins thereof and surface which the elongate member may penetrate. The seal is affected with no sealant required and relies upon the elastic properties of the materials used to form this sealing gland (1).

**[0058]** The same materials that are used to form the upper portion (19) of the sealing gland (1) may also be used to form the endless lip seals (8).

**[0059]** In the preferred embodiment the endless lip seals (8), flange (7), and skirt (5) are of unitary, or one piece construction. Such unitary construction is preferably made by moulding or similar in the resilient material, for example silicon as mentioned. The sealing gland (1) therefore in the preferred embodiment is a two piece construction being the silicon moulded component and metallic component of the compression ring (9). As stated the compression ring (9) is preferably manufactured from a stainless steel and in conjunction with the inert nature of the silicon provides a chemically resistant seal about the elongate member (2) on the surface (3).

**[0060]** The above-described embodiment is useful for creating a seal between a surface and a elongate member. In some situations it may be desirable to create a seal between two elongate members of different diameters. An example gland not according to the invention is particularly intended for sealing of a first pipe 105 to a second pipe 106, that the first pipe 105 runs through, for example the second pipe 106 may be a kick pipe in a floor (or a wall) and provides protection of the first pipe 105 from knocking or damage, and provides also an aperture for the first pipe 105 to communicate through the floor or wall.

**[0061]** An example not according to the invention that can be used to create this type of seal, shall now be described with reference to Figures 8 and 13.

**[0062]** A sealing gland 100 is shown, in a similar fashion to the sealing gland of the first embodiment described above, this has a tapered skirt or conical upper part 101. Again, it should be noted that this upper part could be pyramid-shaped, with multiple sides from 3 upwards, to encompass elongate members which do not have circular cross-sections. Alternatively it may be circular in cross section but have a non-circular aperture formed therein.

**[0063]** As in the embodiment described above, the upper part 101 is marked at intervals along its height or length with cut marks 102. As described above, these can also be marked to show the suitable point at which a user should cut so that the sealing gland 100 can be used with a first pipe or elongate member 105 of certain diameter.

**[0064]** The lower section 103 of the sealing gland 100 extends from the base of the upper part 101. In the preferred example not according to the invention, the lower section 103 is a hollow cylindrical shape, with an open lower end 104. However in other examples not according to the invention this

tubular section may be a square tube or other multisided poly in cross section, whether regular or not.

**[0065]** As in the preferred embodiment described above, the sealing gland 100 is made from a silicon material, or similar.

**[0066]** In use, the upper part 101 is cut to create an upper aperture, in a similar fashion to that already described for the first embodiment. A first pipe 105, or first elongate member can be passed into the sealing gland, with the perimeter of the upper aperture deforming around the outer surface of the first pipe 105 to form a seal.

**[0067]** A second pipe 106 or elongate member is introduced into the lower aperture or open lower end 104, with at least the end of the lower part deforming around the outer surface of the first elongate member to form a seal.

**[0068]** It can of course be seen that the second elongate member 106 is of greater diameter than the first elongate member 105.

**[0069]** If required, the inner surface 107 of the lower portion 103 can be fitted with one or more endless lip seals 108 running in an unbroken loop around the inner surface of the lower portion 103. These aid in sealing between the inner surface of the lower portion 103 and the outer surface of the second elongate member. These may also be present in the upper part 101 to seal to the first pipe 105. The diameters of the portions where the elongate member pass through are slightly smaller than the actual diameters of the elongate members that are to pass there through. This is so that the natural elasticity of the material of the gland can stretch and form a seal onto the elongate member. In one preferred example not according to the invention a tensile band 109 is used at least on the outer surface of the lower section to constrict the lower section at the second pipe 106. This helps improve the seal. The lower portion of the lower end 104 has a thickened band 111. This thickened band serves two purposes. Firstly it reinforces the lower portion 104 and stops tearing, particularly so when tools may be used to apply the sealing gland. Secondly the thickened band 111 serves as a reference to locate the tensile band 109 and prevent it working or falling off.

**[0070]** There may be a similar extension of the upper part as a sleeve which can have a similar tensile band if need be included. Such bands are known in the art.

**[0071]** It should be noted that where references to an orientation have been made above (e.g. upper, lower, base, horizontal etc), these references are relative, and are made for the sake of convenience only. They refer to the gland oriented with the cone or skirt 5 facing upwards, and the sealing flange located at the lowest part or base of the sealing gland. The device of the invention can of course be utilised in any orientation desirable to a user.

**[0072]** A third embodiment of the present invention will now be described with reference to Figures 14 through 20.

**[0073]** The prior art resealable sealing glands shown in Figure 14 have a discontinuous pressure applied across the resealable opening thereof. This results in an incomplete seal along the length of the opening and thus the seal will allow migration or entrance of water and particulate materials. This is undesirable and is what the present invention strives to overcome. Furthermore the present invention is made from a silicon base material as a requirement for conformability and to meet certain specifications whether for food handling or otherwise. The nature of a silicon based material is that it tears very easily. The use of a discontinuous crimping member of the prior art that has sharp edges will result in a tear and therefore failure of the sealing gland when made in silicon. This is particularly the case when the silicon material is under tension as is likely to occur with a resealable gland.

**[0074]** In this section where similar integers are used two integers previously described in this specification then they are taken to be the same integers.

**[0075]** The sealing gland 1 in a similar fashion to the first embodiment sealing gland has an upper seal 6 at or towards its upper portion 19. Though not desirable yet possible the upper seal 6 may be formed by removal of a cone portion as earlier described. Additionally there again are marks 13 to indicate where the skirt 5 can be cut to suit elongate members of varying sizes.

**[0076]** The body of the sealing gland 1 consists of an at least in part substantially frustoconical skirt 5. From the lower portion 18 of the skirt depends a flange 7. The sealing gland 1 has a resealable split or elongate opening 30. The resealable split runs from the upper portion 19 or upper seal 6 to the external edge or surface 35 of the flange 7. This allows the sealing gland 1 to be opened and applied around and in situ elongate member 2, for example a pipe and thereafter sealed down as described below to form a seal between the elongate member 2 and substantially flat surface 3.

**[0077]** Along each side or edge of the resealable split 30 there are continuous upstands 29. The continuous upstands run the entire length of the resealable split or elongate opening 30. The inner upstand surfaces 28 mate upon sealing of the resealable split 30 to form a complimentary sealing surface 39 (also referred to as apposing seal faces). The complimentary sealing surface 39 may be a straight line or planar in cross section but alternatively may be labyrinthine as required. The resealable split or elongate opening 30 also may be a straight line as depicted in Figures 15 and 16 but alternatively may follow a curve, line, a seal line 45 or any other shape as required, and is not necessarily a near radial line as depicted.

**[0078]** On the external surfaces 32 of the continuous upstands 29 there is each an undercut 31. This undercut may either be performed in the external surface 32 or may be formed by the compression clamp or crimpable clamp 33, and compression ring 9 as described below.

**[0079]** The flange 7 also has a portion of a resealable split 30. This is held into place by the

compression ring 9 having a split 22. Upon application of the sealing the compression ring 9 is opened in a spiral form to pass over the elongate member 2. The compression ring 9 is then located to under engage the retention flange 16 and the edges of the split 22 locate into undercuts 31 (either preformed or formed by the compression ring) in the continuous upstands 29. The resilience of the compression ring 9 in the hoop direction 36 is preferably sufficient to form the seal at the upstands 29 in the flange 7. Alternatively fasteners either side of the upstands 29 and the flange 7 will provide sufficient force to create the seal in this portion. If

additional sealing force is required then a compression clamp 33 (to be described) can be added to this portion. This can be seen in Figure 16.

**[0080]** Along the remainder of the resealable split 30 a compression clamp or crimpable clamp 33 is located. This can either be slid along the length of the resealable split 30 and may impart sealing pressure as it is applied. Alternatively it may be passed over the sealable split 29 in a clipping fashion. If required the compression clamp 33 can thereafter be deformed inwards by a deformation tool 38 to provide sufficient or additional sealing pressure. Such additional pressure may be applied at the time of installation or at a later date if for any reason the seal proves to not seal 100%.

**[0081]** The compression clamp 33 consists of two substantially parallel rails 37 that have on them pressure application surfaces 42. The pressure application surfaces 42 are the inner surfaces of the parallel rails 37 which will engage with the external surface of each of the undercuts 31. Each of the parallel rails 37 has connection portions 40 running from one parallel rail 37 to the other parallel rail 37. In the preferred embodiment these connection portions 40 follow the general external contour of the two continuous upstands. Therefore they are arched so that they run out, above and over the continuous upstands 29 of the sealing gland 1 and resealable split 30. In other embodiments the connection portions 40 may be arched or follow other contours. The clamp in the preferred embodiments has the connection portions 40 welded to the parallel rails 37.

**[0082]** The lower external portion 47 of the connection portion 40 is cut away so that no sharp surface is presented to the material of the gland. This can be clearly seen in Figure 19C. In this way the gland is prevented from tearing and also the clamp can slide smoothly into place.

**[0083]** Although this is the preferred method of attachment other methods known in the art such as press metal forming, forging can also manufacture the compression clamp and are considered to be within the scope of the invention. In use the sealing gland 1 is applied around a elongate member 2 and located against a substantially flat surface 3. The compression rings 9 with its split 22 is then located

about the elongate member 2 and down onto the flange 7. The compression clamp 33 is then located about the remainder resealable split 30 to seal either by its static form or seal by the addition of deformation inwards to seal the resealable split 30. The compression ring 9 and compression clamp 33 together provide continuous contact along the length of the resealable split 30, either side of the complimentary sealing surface. Due to the tearable nature of the

material forming the sealing gland 1 the sealing gland 1 is prevented from tearing particularly as it would otherwise do so when a clamp of discrete nature of the prior art is used.

**[0084]** The open nature of the connection portions, 40 allow the compression clamp to bend either before installation or in use to follow any contour the continuous upstands 29 and resealable split need to take. For example the compression clamp can easily be conformed lines radial of the elongate member 2, even if the radial line is curved in side view.

**[0085]** If desired the compression clamp 33 and ring 9 can be removed to allow removal and reapplication of the sealing gland 1. The compression clamp 33 can either be slid off, or the connection members 40 can be cut and a new compression clamp 33 applied upon resealing.

**[0086]** Shown in Figure 20 are two possible forms of labyrinth seal. A seal lip 48 form is shown in Figure 20A. This is essentially a seal lip 48 similar in cross section to the lip seal 8 on the underside of the flange 7. This form of labyrinth seal relies upon deformation of at least one seal lip 48 against and into the opposing complimentary mating surface 39. In the preferred form there are number of lip seals 48 present on one, other or both opposing complimentary mating surfaces 39.

**[0087]** Another form of labyrinth seal is shown in Figure 20B. This form relies upon at least one extending seal lip 48 of a rib form on one opposing complimentary mating surface 39 and at least one complimentary seal recess 49 on the other opposing complimentary mating surface 39. In the preferred embodiment there are at least two of each.

**[0088]** Other forms of labyrinth may be used that are known in the art and are considered to be immaterial variants of those examples shown.

**[0089]** A further example not according to the invention will now be described with reference to Figures 22 through 29. The sealing gland (60) consists of a sealing body (63) and a compression ring (68). The sealing body (63) is a substantially planar disc shaped member. On the underside of the planar sealing body (63) is at least one endless lip seal (65) (best shown in Figure 29). In the preferred example not according to the invention there are four such endless lip seals (65), concentrically arranged. At or near the periphery (67) of the planar sealing body (63) is a first plurality of holes (66). In the preferred example not according to the invention these are equally spaced around the periphery (67) of d1e planar sealing body. The plurality of holes (66) have diameter(s) such that when a fastener is passed there through an interference fit will be created. In the preferred example not according to the invention this interference fit (i.e. a seal being created between the hole and the fastener (71) may be formed either by the size of the apertures being slightly less that of the fastener put there through or may be formed once the gland is assembled and compressed by the compression ring (68). The compression of the material of the gland (60) between the substantially flat surface and the compression ring (68) causing bulging or swelling of d1e material to seal about the fastener (71). The compression ring (68) can either simply fit on the top side of the sealing gland (60) (Figure 23b) or alternatively may be retained there by a retention lip (73). The

retention lip (73) rises up from the body of the planar sealing body (63) to overlap at least in part the compression ring (68). The apertures of the compression ring (68) and the apertures of the planar sealing body (63) at least in some parts line up so that fasteners can be located there through to engage with the substantially flat surface underneath.

**[0090]** In assembling this example not according to the invention the sealing gland (60) is passed over the elongate member (61) and brought to bear with the endless lip seals (65) against the substantially flat surface (62). Fasteners are then located through the apertures to the substantially flat surface (62) and tightened to sufficiently compress the material of the planar sealing body (63) under the compression ring (68) and also the endless lip members (65) to seal against the substantially flat surface. The sealing aperture (74) is either pre-cut into the supplied unit before its use or may be cut by a user immediately prior to installation or as required for the uses of the sealing gland (60). To aid this cutting by the user (or indeed manufacture prior to supply to the user) a series of concentric indications (75) are on the inner portion of the planar sealing body (63). These may either be rises, detents or simply printed thereon. In the shown example not according to the invention they are circular as is the planar sealing body. However in other examples not according to the invention the planar sealing body and therefore the sealing gland may have an overall plan shape that is not circular (e.g. a polygon of three or more sides) and or the sealing aperture (74) may be other than circular depending upon the shape of the elongate member to be sealed to. Therefore the concentric indications (75) may also be of this shape other than circular (e.g. triangular, square or rectangular).

**[0091]** When the sealing gland (60) is applied over the elongate member the sides of the sealing aperture (74) are slightly less in size than the overall size of the elongate member. This results in elastic deformation of the periphery of the sealing aperture (74) and forms a seal about the elongate member. This has been earlier described in the other examples not according to the invention. In other methods of installation the sealing gland (60) may be mounted to the substantially flat surface (62) and then the elongate member (63) is passed through the appropriately formed sealing aperture (74). The material of this example not according to the invention is similar to that of the previous embodiments and examples not according to the invention in that it is a thermally resistant, or chemically resistant, or fire retardant, (or all of these) material, for example a high grade silicon. The material must also possess an inherent elastic nature to allow the deformation of the endless lip seals (65) and also the elastic deformation about the elongate member in the sealing aperture (74).

## REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- [AU200042690 \[0012\]](#)
- [US20050055889A \[0012\]](#)
- [AU199911298 \[0012\]](#)

**Patentkrav**

- 1.** Perifer tætningsbøsning (1) til at danne en tætning, mellem et langstrakt element (2) og en i alt væsentligt flad overflade (3), der har en åbning ind i
- 5 hvilken nævnte langstrakte element strækker sig, hvor nævnte perifere tætningsbøsning omfatter eller inkluderer,
- et mindst delvist frustokonisk formet skørt (5) igennem hvilket nævnte langstrakte element skal passere og hvor der defineres, ved den øvre periferi af skørtet, en deformerbare øvre tætning til at deformere omkring og tætnes til en
- 10 periferi af nævnte langstrakte element,
- en flange (7) nedadhængende fra den nedre periferi af nævnte skørt, der inkluderer, på sin udad fra skørtet præsenterede overflade, mindst en endeløs læbe ("endeløs læbetætning") (8), til at tætnes, når bragt i kontakt, mod nævnte i alt væsentligt flade overflade,
- 15 en kompressionsring (9) i stand til at presse på nævnte flange, til at være fastgjort til nævnte i alt væsentligt flade overflade til at fange flangen derimellem, hvor nævnte kompressionsring er stiv, for således at påføre et i alt væsentligt konsekvent tryk på nævnte mindst ene endeløs læbe til at danne en tætning mod nævnte i alt væsentligt flade overflade og hvor kompressionsringen er
- 20 tilstrækkeligt stiv således at den ikke deformeres i brug,
- hvor nævnte kompressionsring inkluderer en første flerhed af åbninger (11) til at modtage fastgørelseselementer,
- hvor nævnte flange har en anden flerhed af åbninger (12) af hvilke mindst nogle er koaksiale med nævnte første flerhed,
- 25 og hvor nævnte skørt har, mod nævnte flange, en fastholdelsesflange til at presse på og overlape på en radialt indre overflade af nævnte kompressionsring til at fastholde nævnte kompressionsring til nævnte flange.
- 2.** Perifer tætningsbøsning (1) ifølge krav 1, hvor der er mindst to af nævnte
- 30 endeløse læbetætninger (8), begge koncentriske med hinanden.

- 3.** Perifer tætningsbøsning (1) ifølge krav 2, hvor nævnte anden flerhed af åbninger ikke passerer igennem nævnte endeløse læbetætninger (8).
- 4.** Perifer tætningsbøsning (1) ifølge et hvilket som helst af kravene 1 til 3, hvor nævnte anden flerhed af åbninger (12) er konfigureret til at tilvejebringe en prespasning med hver af nævnte fastgørelseselementer ved at hver er af en mindre størrelse end nævnte respektive fastgørelseselement.
- 5.** Perifer tætningsbøsning (1) ifølge et hvilket som helst af kravene 1 til 4, hvor nævnte skørt (5) og nævnte flange (7) er udformet integreret.
- 6.** Tætningsbøsning (1) ifølge et hvilket som helst af kravene 1 til 5, hvor et øvre afsnit af nævnte skørt (5) inkluderer markeringer (13) til at indikere en skæring af nævnte øvre afsnit for at tilvejebringe en indikator til skæring af størrelsen af nævnte deformerbare øvre tætning.
- 7.** Perifer tætningsbøsning (1) ifølge et hvilket som helst af kravene 1 til 6, hvor nævnte tætningsbøsning har en genlukkelig spalte, der strækker sig fra nævnte øvre tætning til den eksterne kant af nævnte flange (7), hvor der er en kontinuerlig opadragende del (29) nedadhængende udad fra nævnte skørt (5) på hver side af nævnte genlukkelige spalte og nævnte kompressionsring (9) er delt for således at indgribe under og påføre tætnende tryk i det mindste langs en del af nævnte genlukkelige spalte på nævnte flange.
- 8.** Perifer tætningsbøsning (1) ifølge et hvilket som helst af kravene 6 eller 7, hvor sammenstødende overflader af nævnte genlukkelige spalte er komplementære for at danne nævnte tætning når genlukket.
- 9.** Perifer tætningsbøsning (1) ifølge krav 8, hvor der er en underskæring eller fastholdelsesrille, der løber langs hver af de eksterne overflader af nævnte kontinuerlige opadragende del (29).

**10.** Perifer tætningsbøsning (1) ifølge krav 9, hvor der er en kompressionsklemme (33) i stand til at påføre tryk på hver side af nævnte åbning ved kontinuerlig kontakt ved nævnte underskæring på hver side af nævnte åbning.

5

**11.** Perifer tætningsbøsning (1) ifølge krav 10, hvor nævnte kompressionsklemme (33) omfatter mindst to med mellemrum anbragte modstående lukkeelementer, hvor nævnte to med mellemrum anbragte modstående lukkeelementer er forbundet af en flerhed af forbindelseselementer (40) langs deres længde, hvor  
10 nævnte flerhed af forbindelseselementer buer fra et af nævnte mindst to med mellemrum anbragte modstående lukkeelementer til det andet, hvor under anvendelse nævnte mindst to med mellemrum anbragte modstående lukkeelementer er i kontinuerlig kontakt med eksterne overflader på hver side af nævnte kontinuerlige opadragende del (29) til at påføre tryk til tætning af nævnte  
15 genlukkelige spalte.

# DRAWINGS

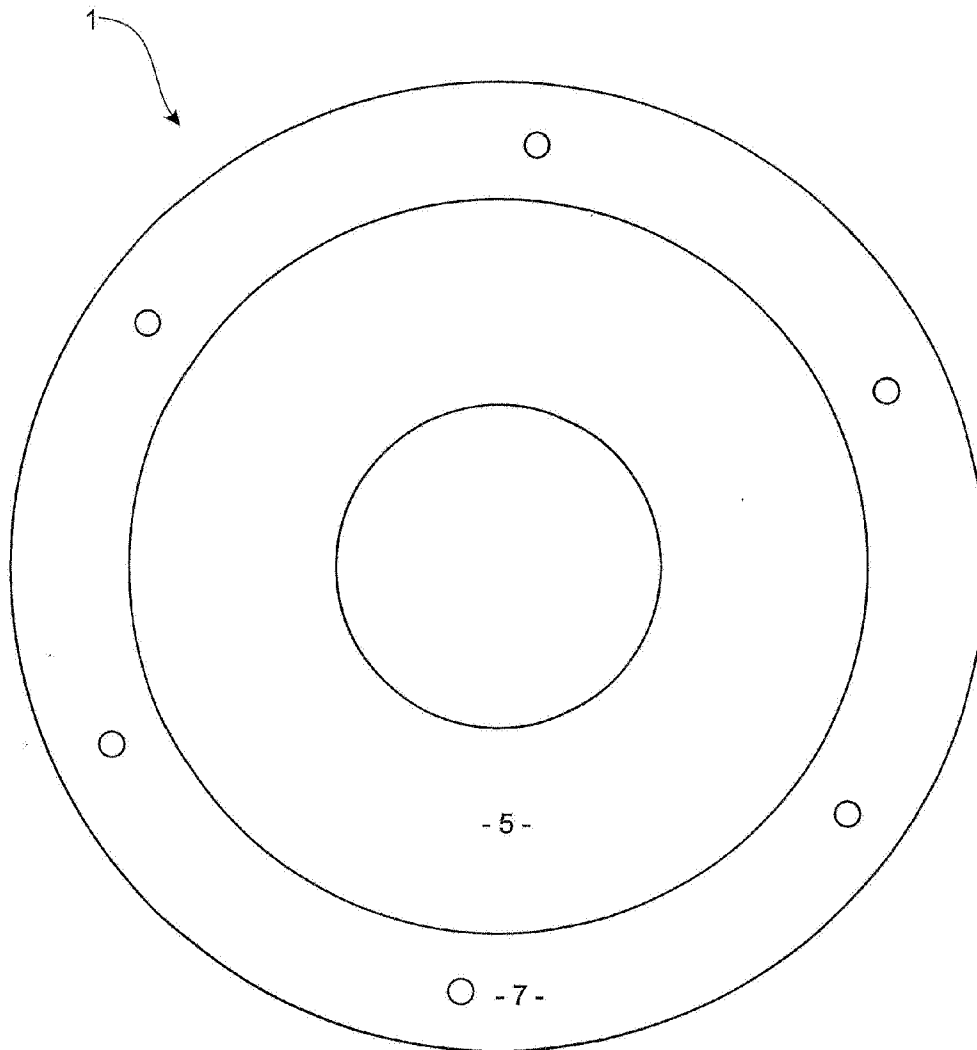


**FIGURE 1**

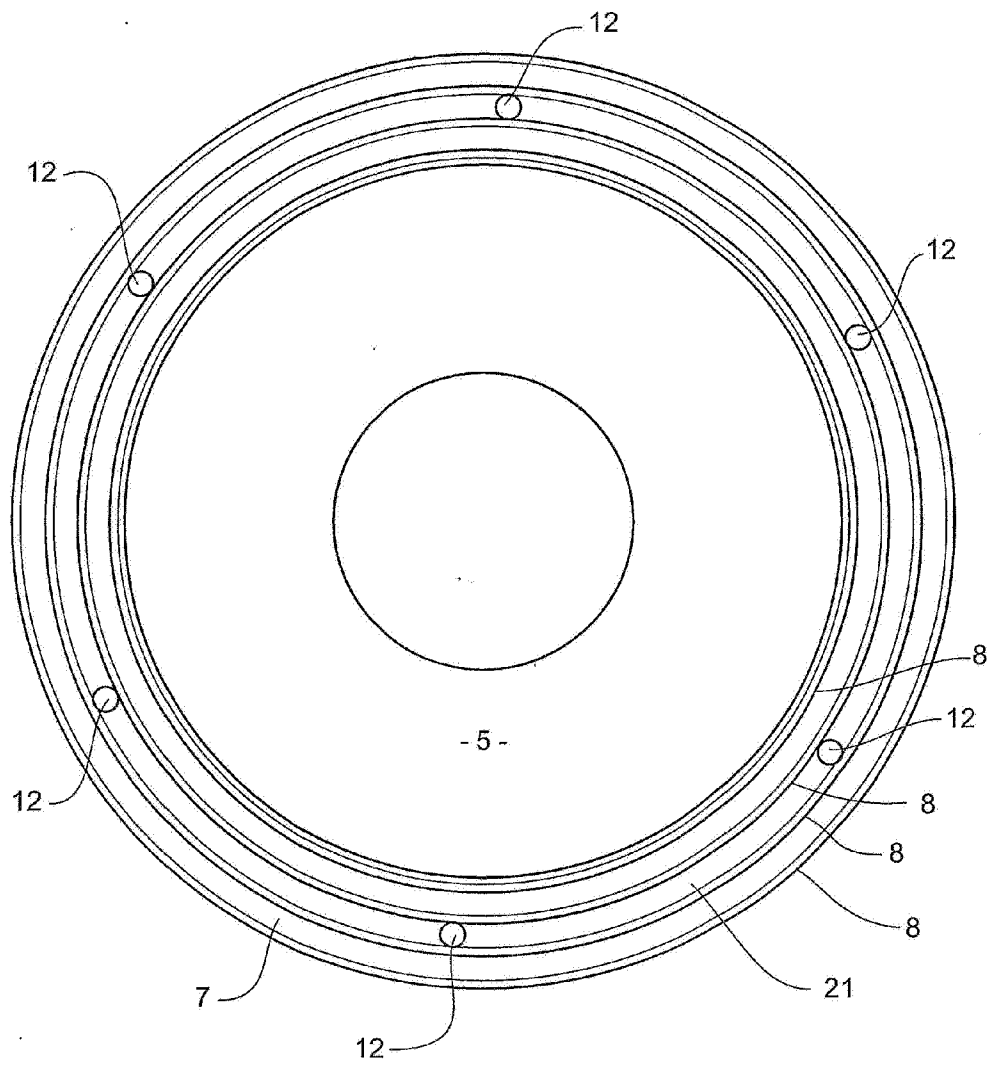


**FIGURE 2**

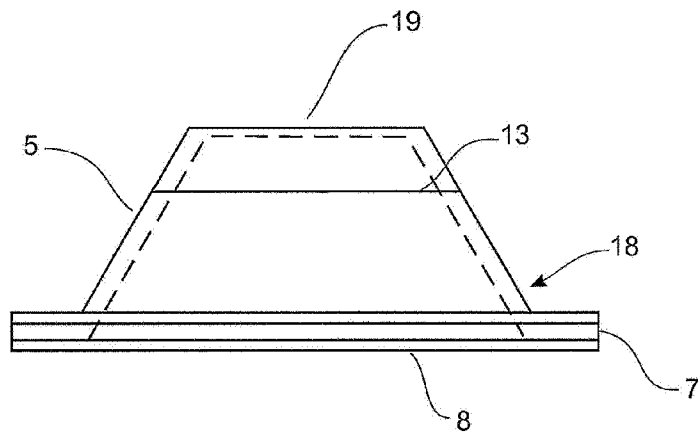


**FIGURE 3a**

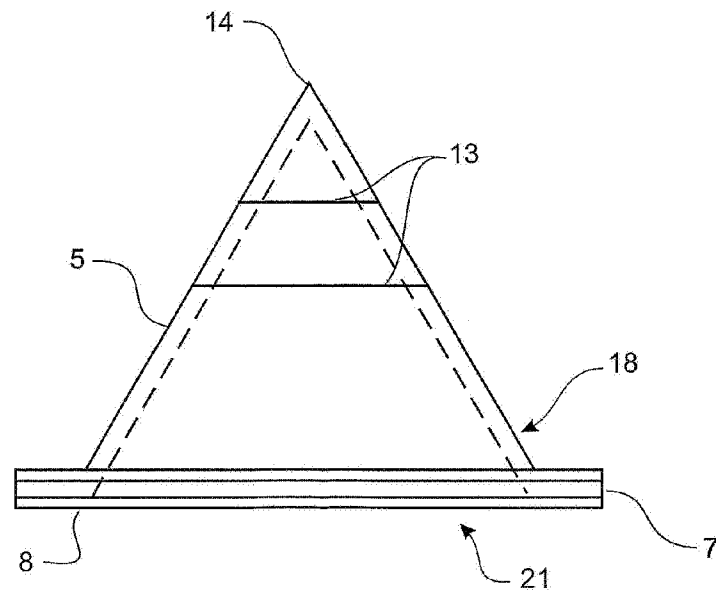
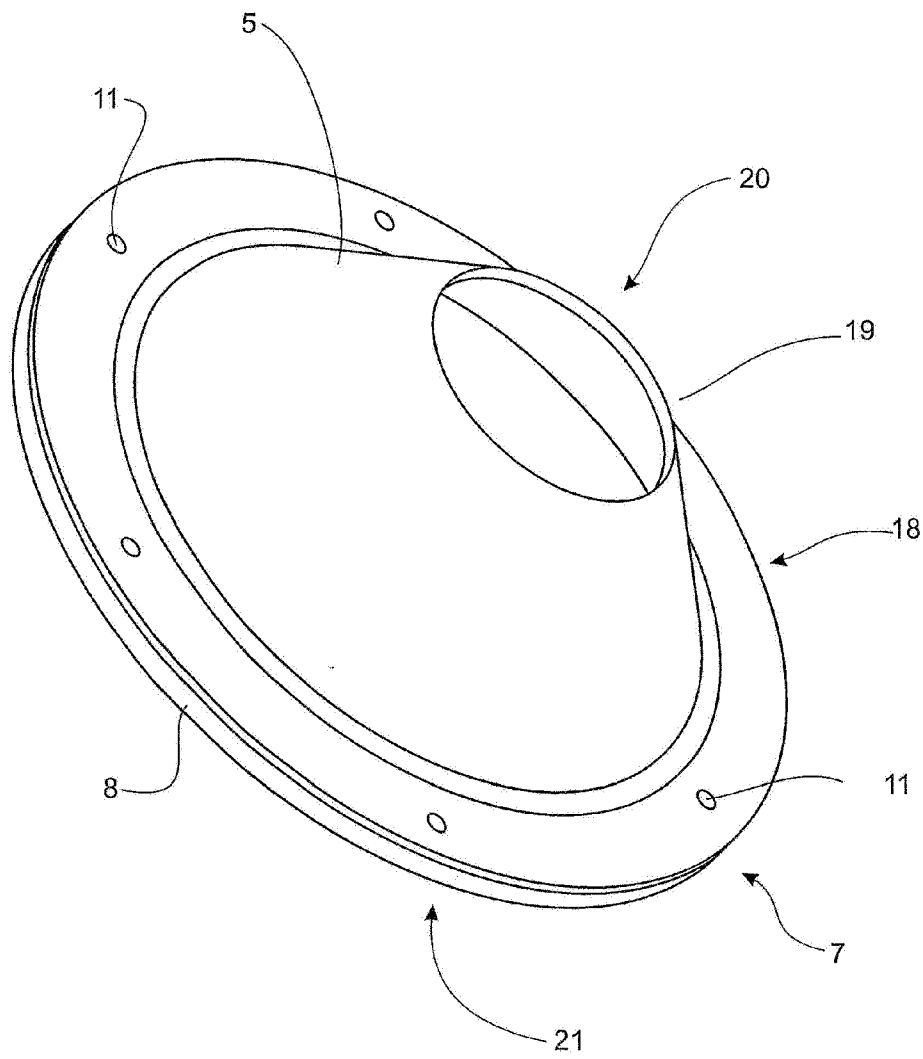


**FIGURE 3b**

**FIGURE 4**

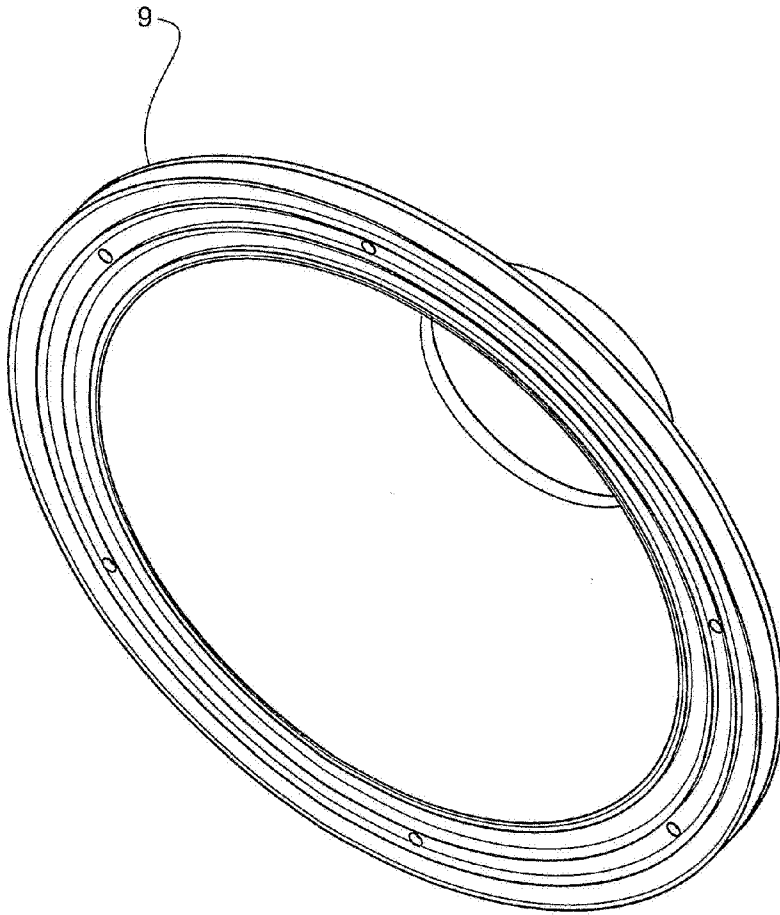


**FIGURE 5**

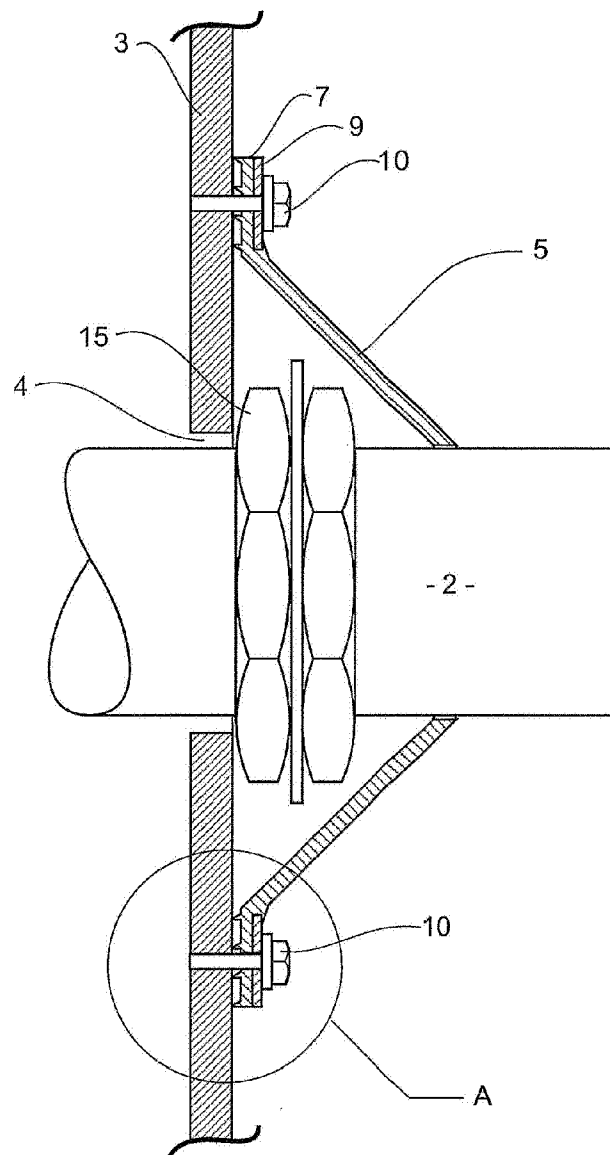


FIGURE 6

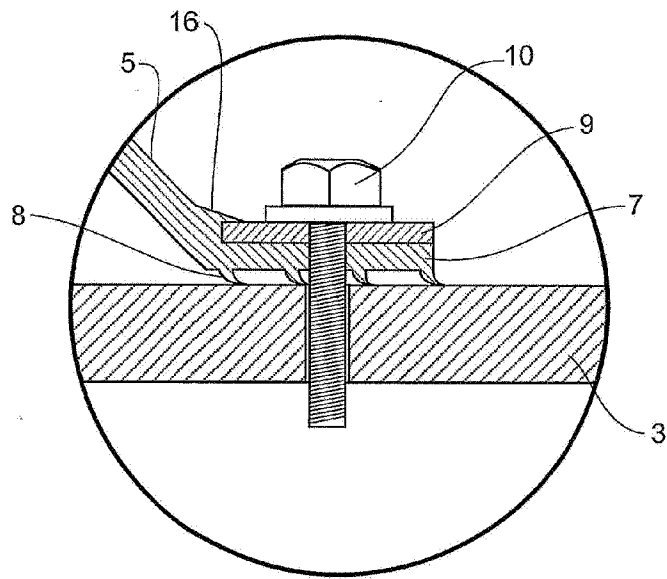


**FIGURE 7a**

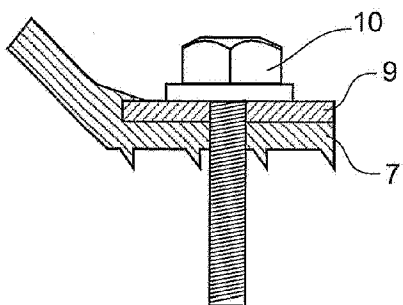


**FIGURE 7b**

**FIGURE 8**

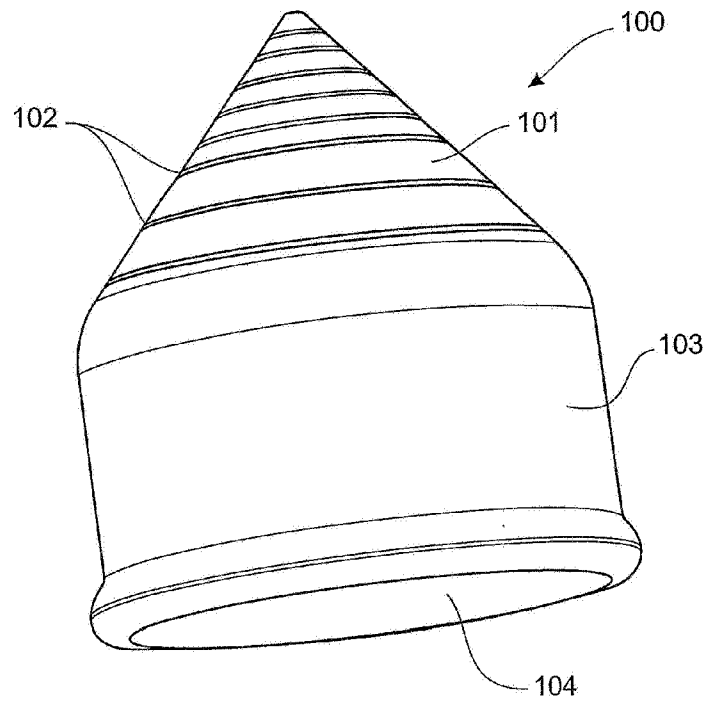


**FIGURE 9**

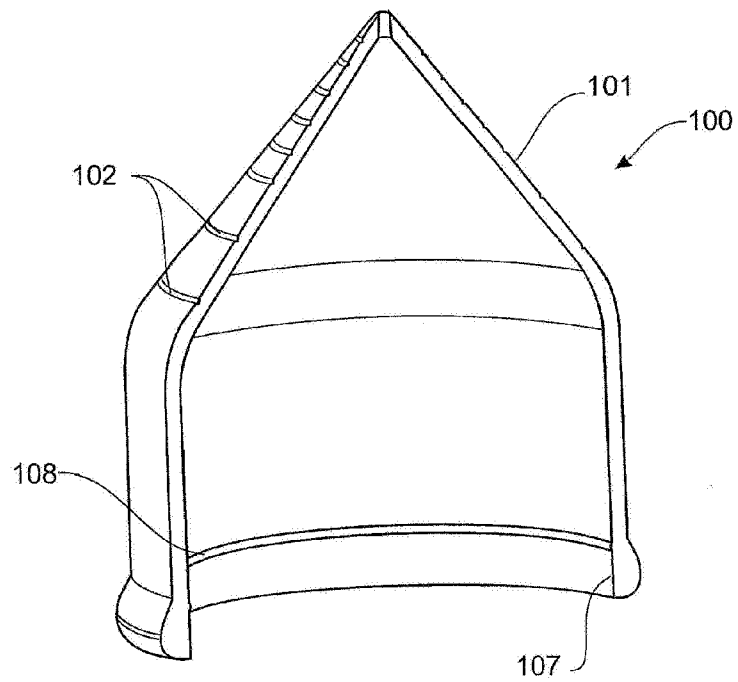


**FIGURE 10**

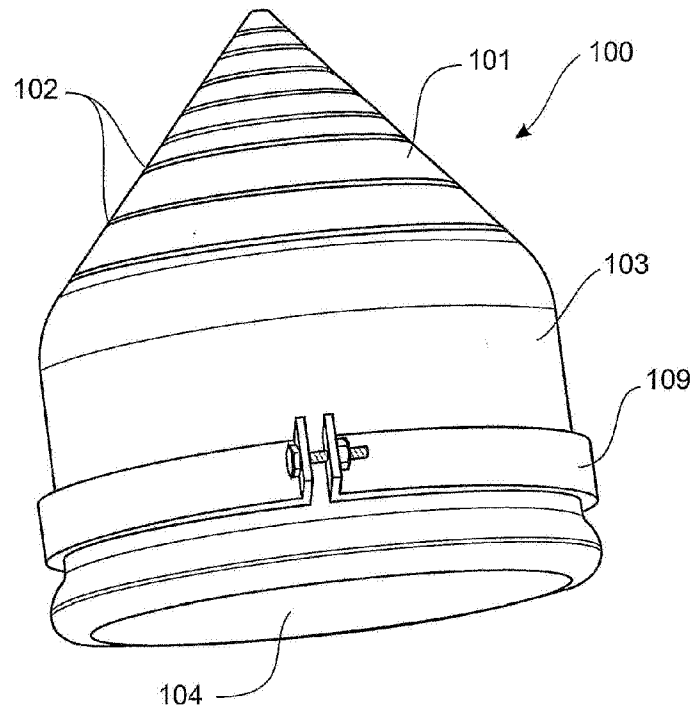


**FIGURE 11**

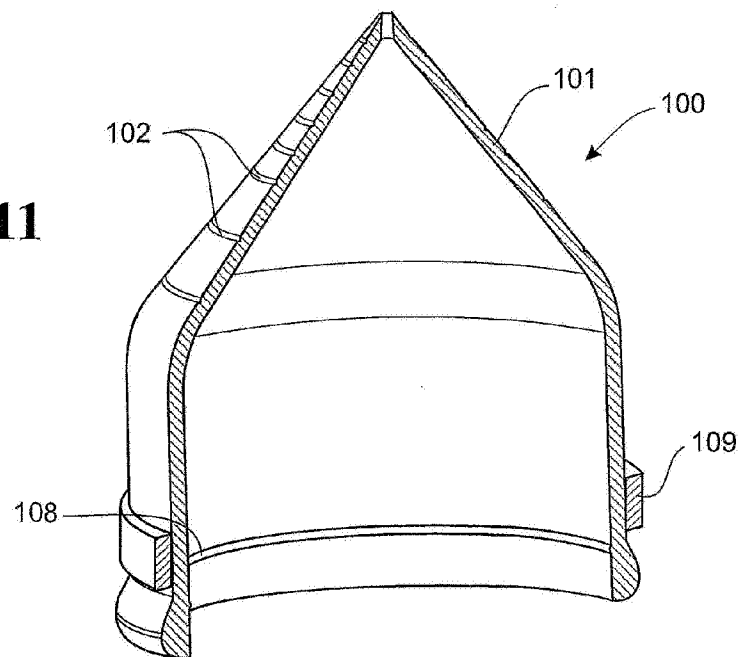
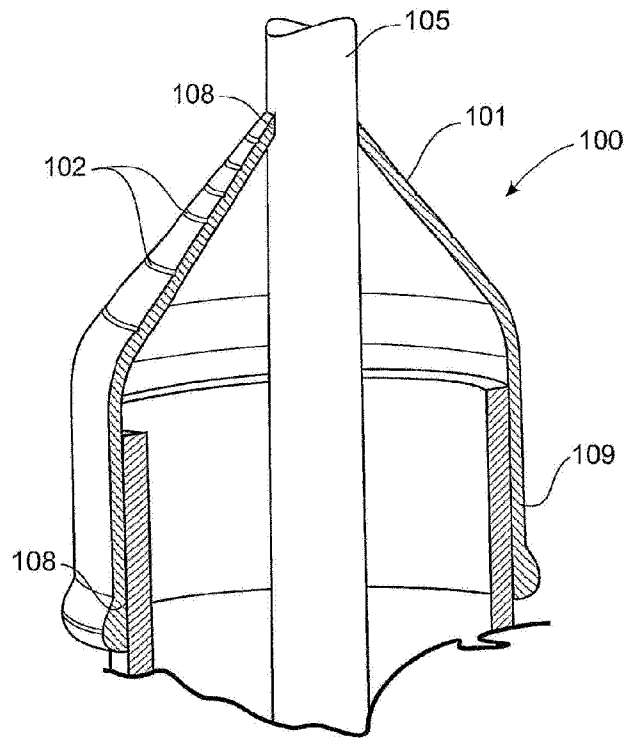
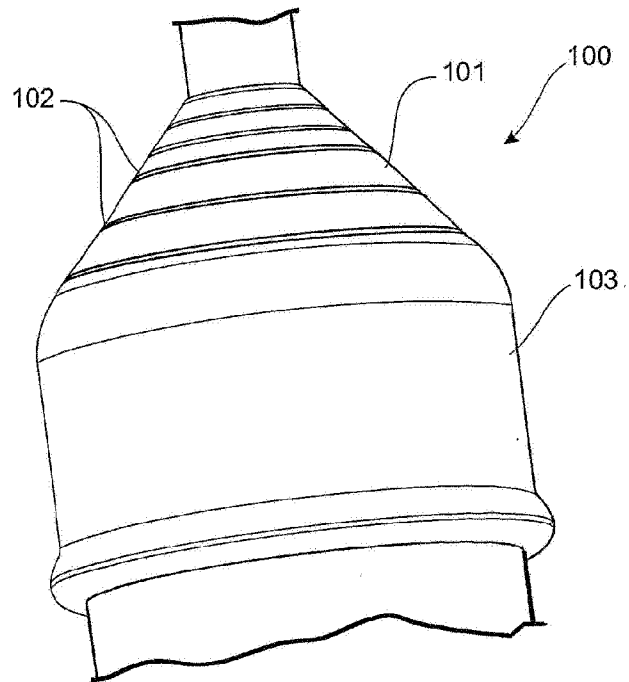


**FIGURE 12****FIGURE 13**

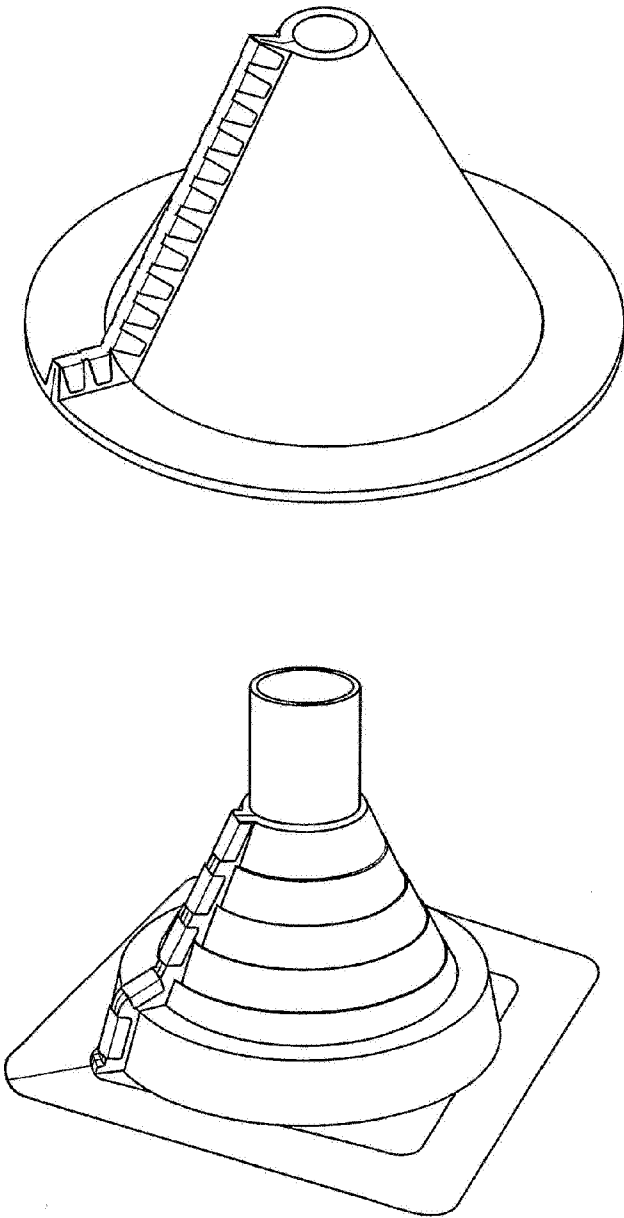


**FIGURE 14**  
**(prior art)**

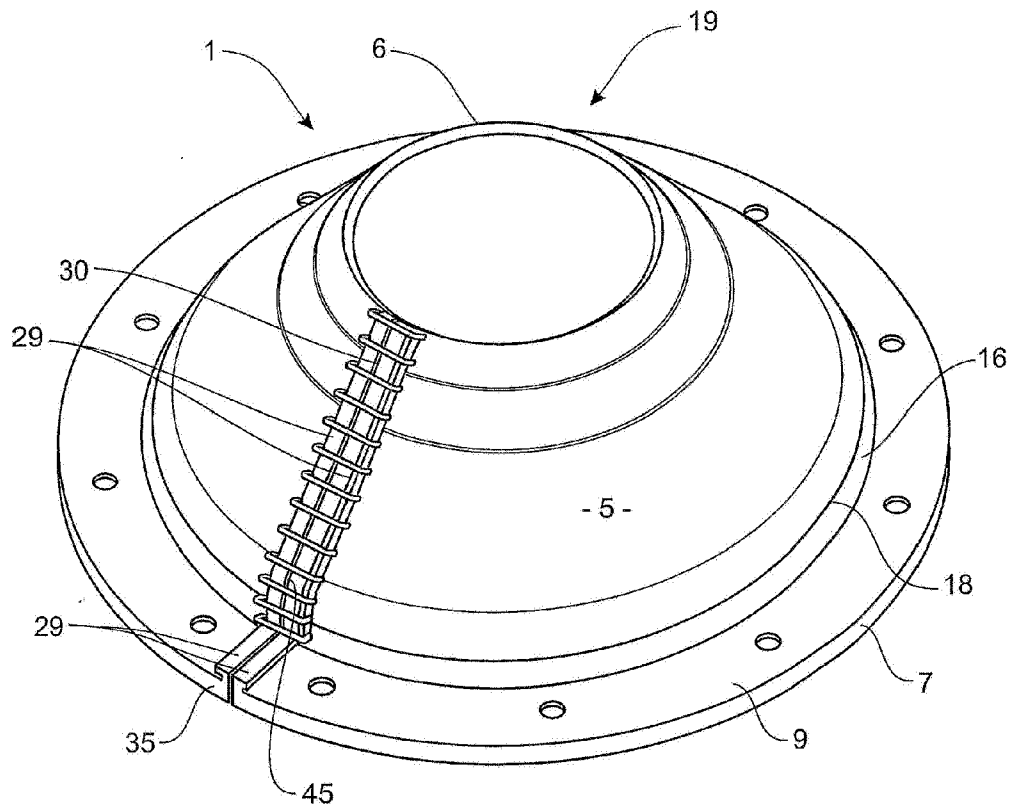


**FIGURE 15**

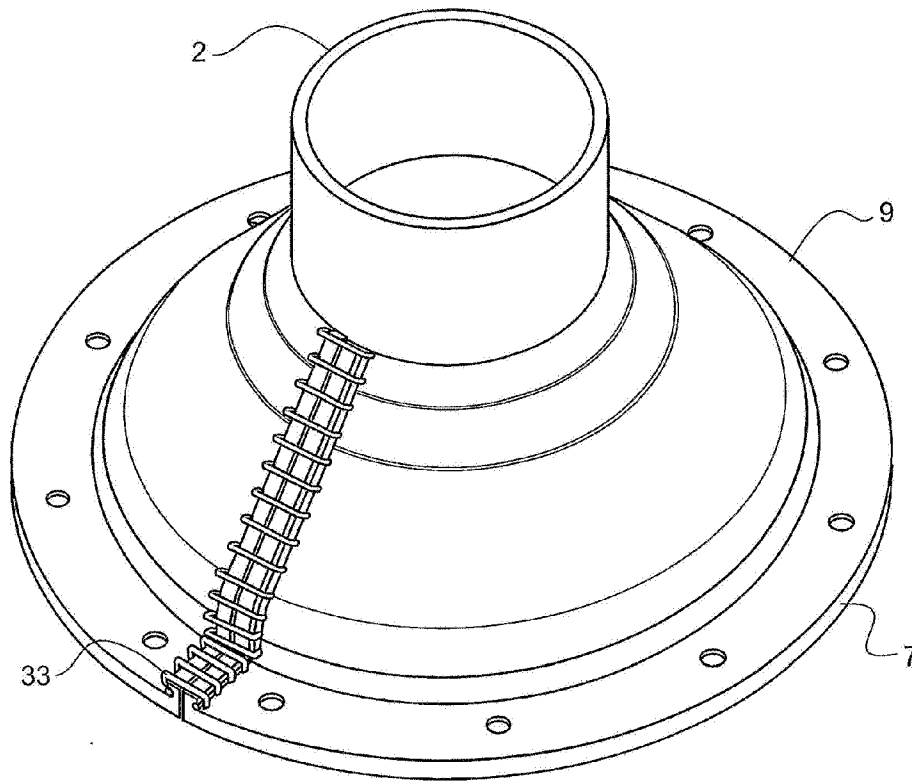


**FIGURE 16**

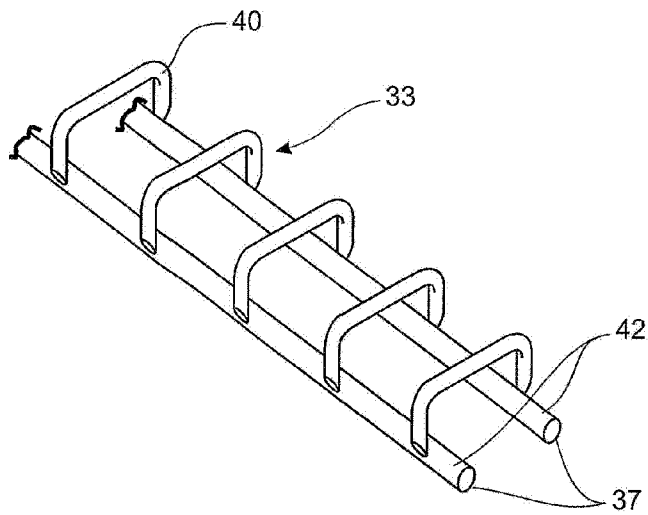


**FIGURE 17a**

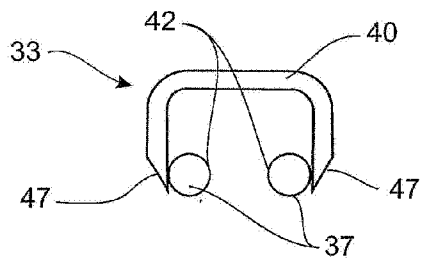


**FIGURE 17b**

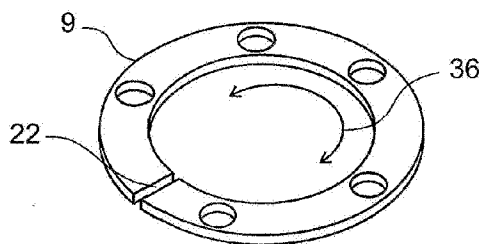


**FIGURE 18**

**FIGURE 19a**

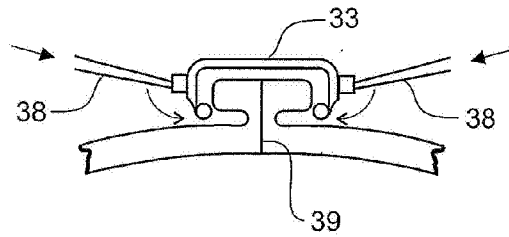


**FIGURE 19b**

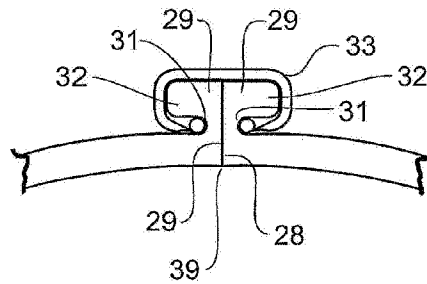


**FIGURE 19c**

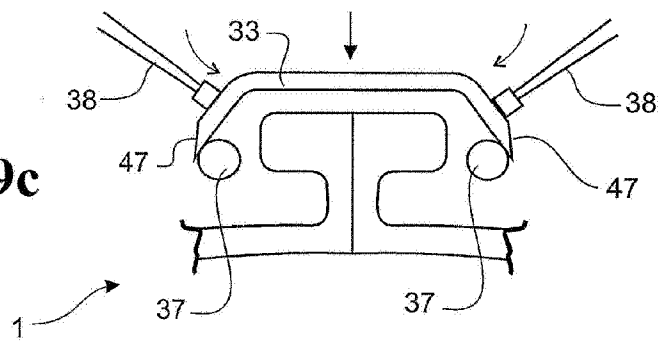
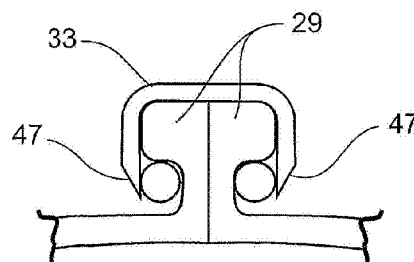


**FIGURE 19d**



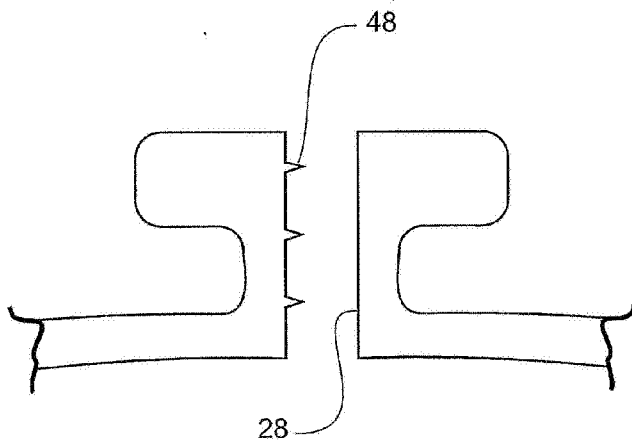


**FIGURE 20a**

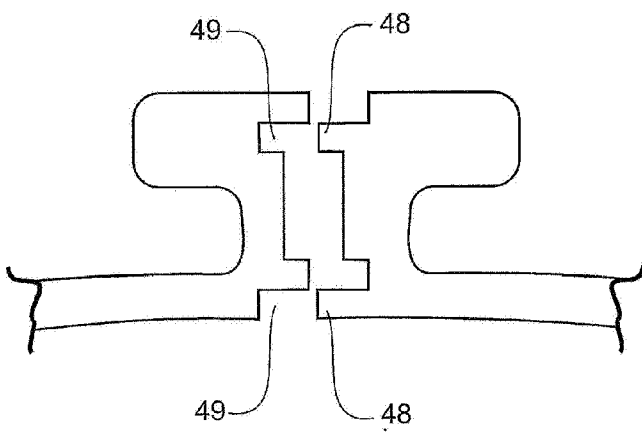


**FIGURE 20b**

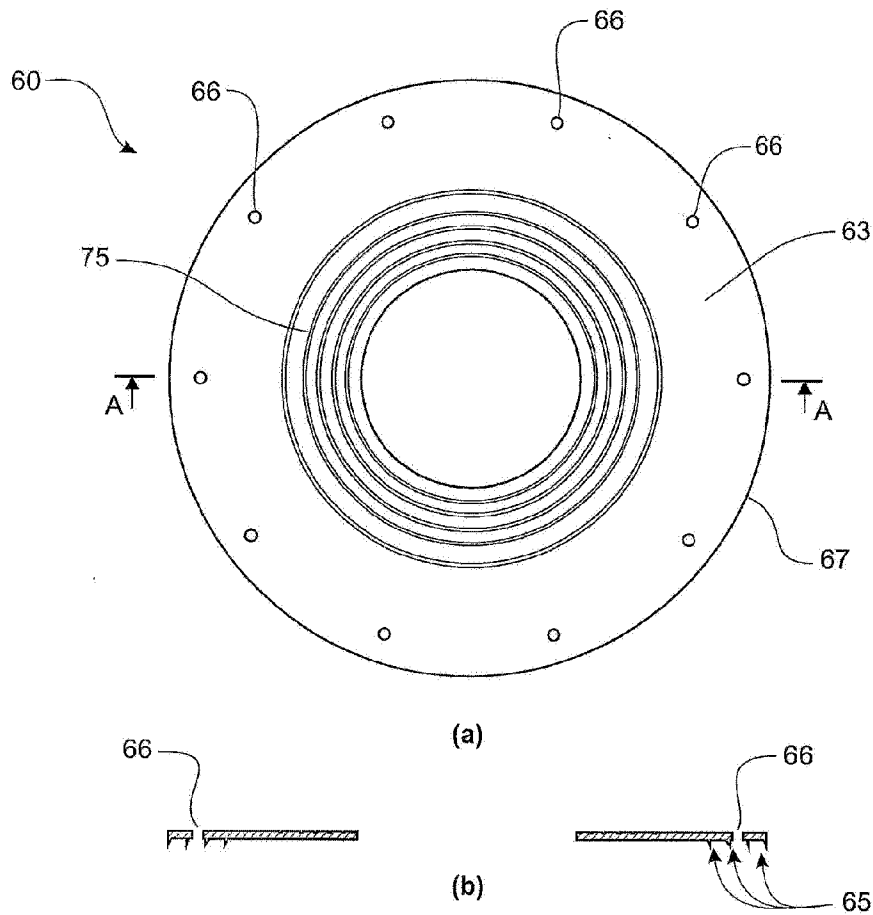


**FIGURE 21**

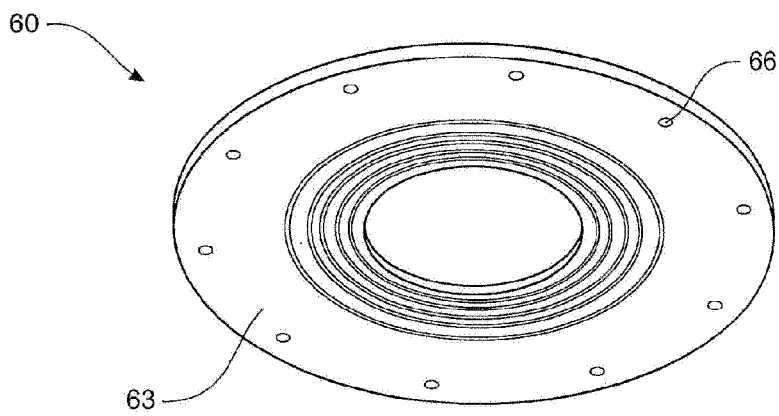


**FIGURE 22**

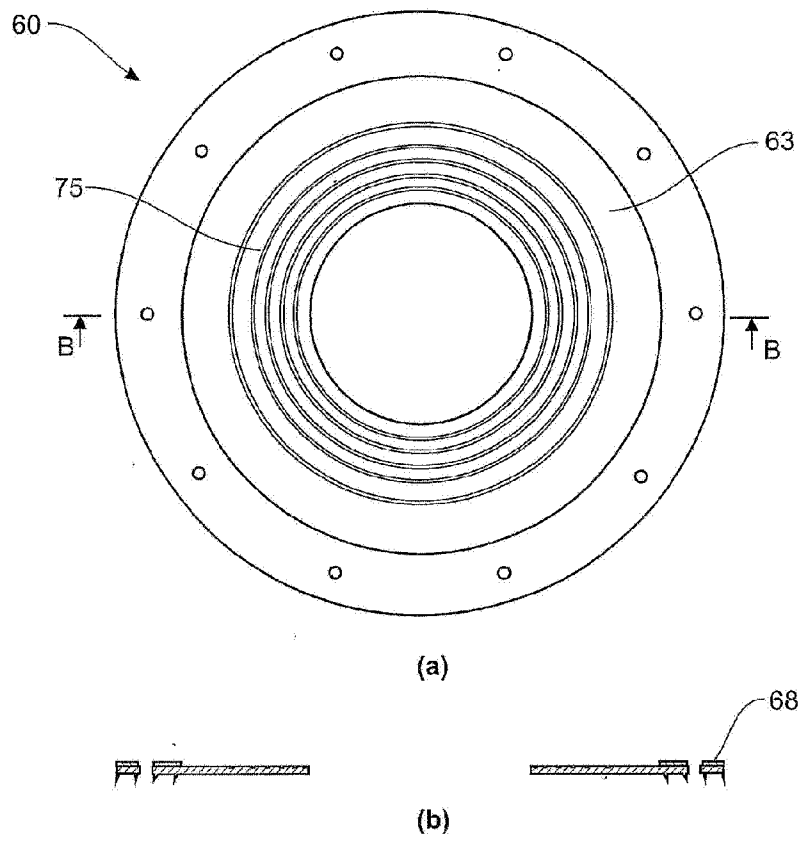


**FIGURE 23**

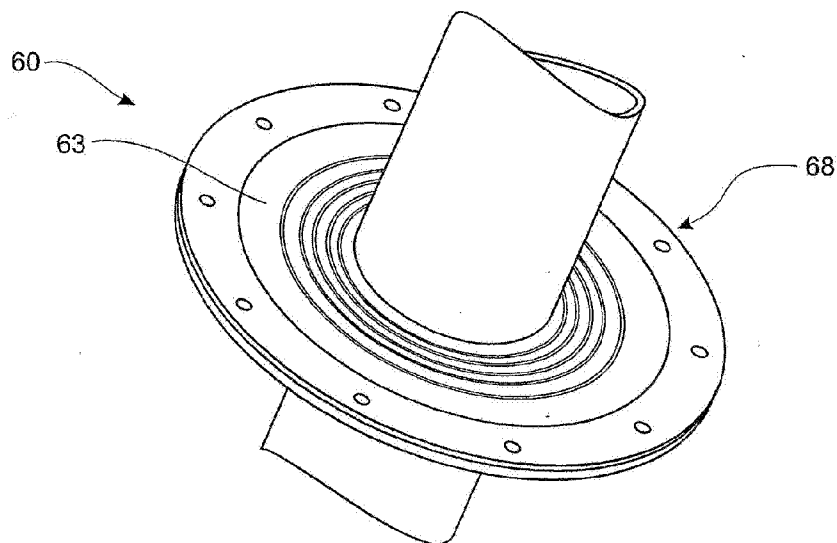


**FIGURE 24**

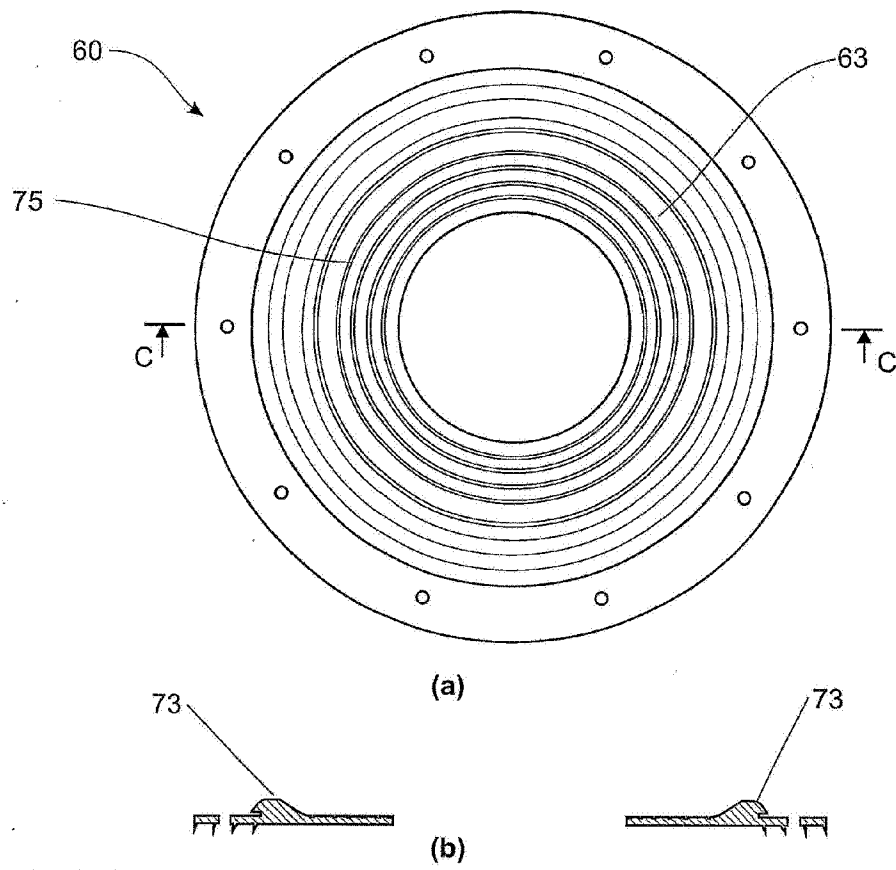


**FIGURE 25**

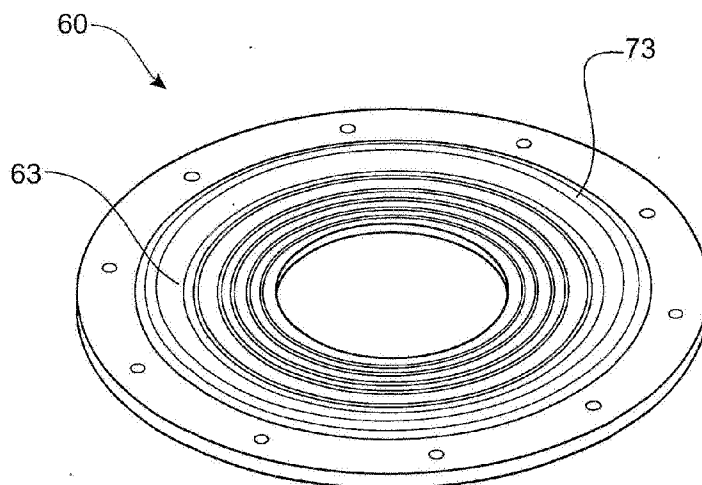
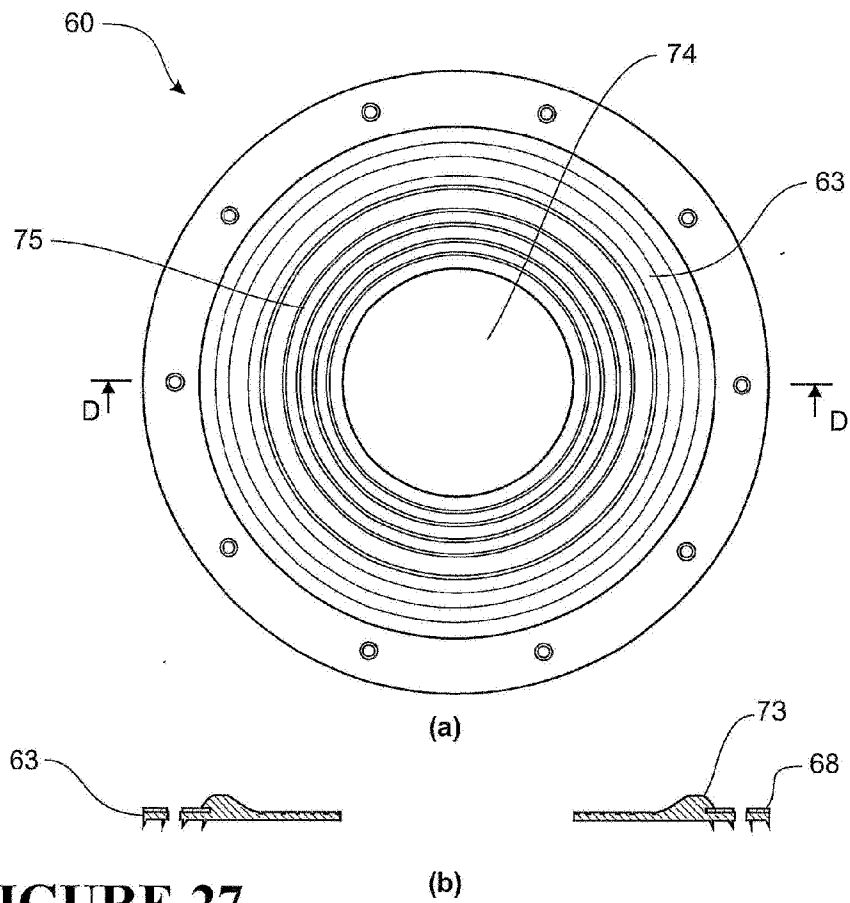
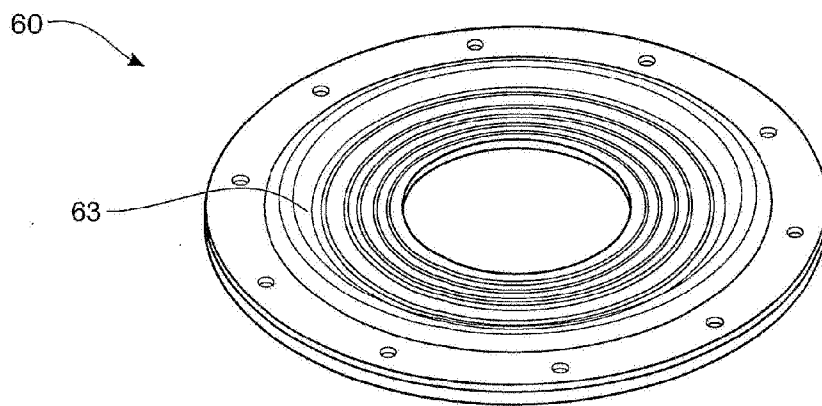


**FIGURE 26**

**FIGURE 27****FIGURE 28**

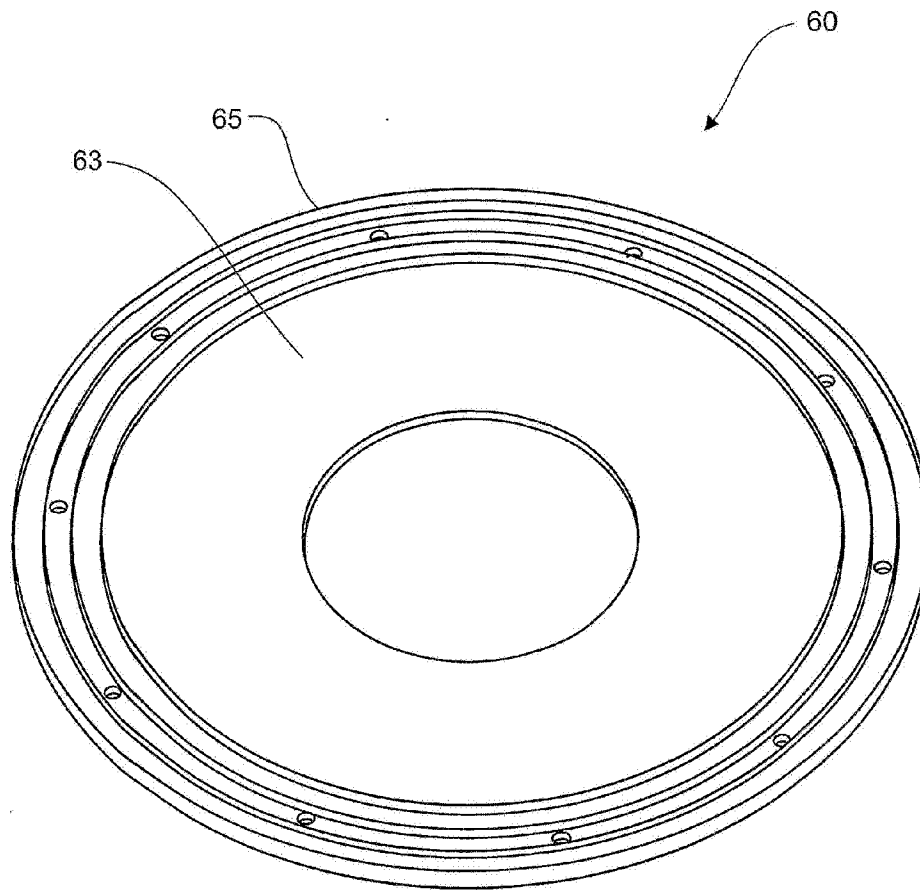


**FIGURE 29**