

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
24 April 2008 (24.04.2008)

PCT

(10) International Publication Number
WO 2008/048123 A2

(51) International Patent Classification:
F16L 17/00 (2006.01)

(74) Agent: **BUCHANAN, Elspeth, Victoria**; P.L. Berry & Associates, 61 Cambridge Terrace, Christchurch 8013 (NZ).

(21) International Application Number:
PCT/NZ2007/000314

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(22) International Filing Date: 19 October 2007 (19.10.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
550701 20 October 2006 (20.10.2006) NZ

(71) Applicant (*for all designated States except US*): **HAIGH TOOLING LIMITED** [NZ/NZ]; 19 King Edward Terrace, Woolston, Christchurch (NZ).

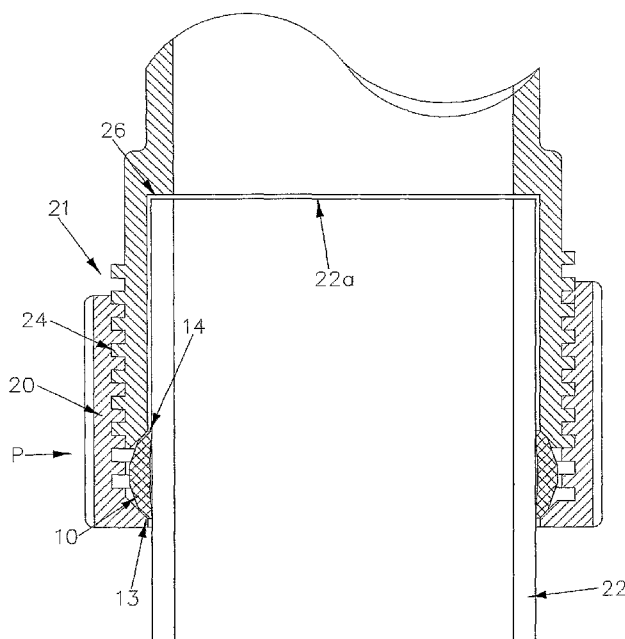
(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(72) Inventor; and

(75) Inventor/Applicant (*for US only*): **HAIGH, Brian** [NZ/NZ]; 44c Halswell Junction Road, Halswell, Christchurch (NZ).

[Continued on next page]

(54) Title: SEAL FOR A COMPRESSION JOINT



(57) Abstract: A seal for a compression joint, said seal including an annulus having: - a substantially smooth inner surface; - an outer surface having a perimeter portion around each edge of the seal and a central section between the perimeter portions; the thickness of the central section being greater than the thickness of either of the perimeter portions; the material of which the seal is made and the thickness of the outer edge of each perimeter portion being such that each perimeter portion can flex inwards when subjected to an inward pressure in use.

WO 2008/048123 A2



Published:

- *without international search report and to be republished
upon receipt of that report*

Title: Seal for a Compression JointField of the Invention

5 The present invention relates to a seal for a plumbing fitting and in particular to a seal for a compression joint, i.e. a joint where two pipes are connected together using a compression nut and a seal. The present invention further relates to a compression joint incorporating this seal.

10 One embodiment of the seal of the present invention has been developed especially for sink waste traps, and therefore will be described with particular reference to this application. However, it will be appreciated that the seal of the present invention may be used for any of a range of applications where a compression joint is required, and a second embodiment will be described with reference to a larger-scale, general-purpose compression joint.

15

Background of the Invention

It is known to use a compression joint to connect, e.g. a pipe with a fitting such as an S-bend. In a compression joint, an annular seal is fitted around the outer surface of the pipe, which has a slightly smaller outer diameter than the internal diameter of the fitting with which it is to be connected. The end of the pipe carrying the seal is then slid into the end of the fitting; the end is externally screw threaded. A compression nut is then slid over the outer surface of the pipe and over the joint area; the compression nut is internally screw threaded with a tapered thread. Thus, as the screw thread of the nut engages the screw thread of the fitting, the nut compresses the fitting and the screw threaded end of the fitting is compressed onto the seal and the end of pipe inside the fitting. This compression compresses the seal on the end of the pipe and gives a firm, watertight fit.

30 The compression joint described above can be very fiddly to use in practice:- bearing in mind that the joint may have to be made in a very confined space and/or working at an awkward angle, removing the compression nut from the end of the fitting, sliding both the nut and a loose seal onto the end of the pipe, engaging the end of the pipe with the fitting, and then tightening the nut, can be a difficult job.

Disclosure of Invention

It is therefore an object of the present invention to provide a compression joint, and a seal for a compression joint, which overcomes the above described drawbacks.

5 The present invention provides a seal for a compression joint, said seal including an annulus having:

- a substantially smooth inner surface;
- an outer surface having a perimeter portion around each edge of the seal and a central section between the perimeter portions;

10 the thickness of the central section being greater than the thickness of either of the perimeter portions;

the material of which the seal is made and the thickness of the outer edge of each perimeter portion being such that each perimeter portion can flex inwards when subjected to an inward pressure in use.

15

Preferably, the cross-sectional shape of the seal is bilaterally symmetrical, such that the seal is reversible in use.

Preferably, each perimeter portion is inclined at an acute angle to the inner surface.

20 Alternatively, each perimeter portion may be formed as a step, i.e. with a first part at or adjacent to the outer edge of the seal parallel to the inner surface and a second part perpendicular to the first part.

Preferably each perimeter portion terminates in a flat at each outer edge of the seal.

25

The present invention further provides a seal assembly for a compression joint, said seal assembly including:

- one or more annular seals;
- a spacing ring adjacent each edge of the or each seal, each spacing ring being made

30 of a more rigid material than the or each seal;

- the or each seal having: a substantially smooth inner surface; and outer surface having a perimeter portion around each edge of the seal and a central section between the perimeter portions; each perimeter portion being at a first angle to said inner surface; the thickness of the central section being greater than the thickness of

35 either of the perimeter portions; the material of which the seal is made and the thickness of the outer edge of each perimeter portion being such that each perimeter

portion can flex inwards when subjected to an inward pressure in use;

- the portion of each spacing ring adjacent each edge of the or each seal being inclined at a second angle which is different to said first angle, such that when each perimeter portion of the or each seal is forced into contact with said adjacent portion of said spacing ring, the spacing ring effects inward flexion of said perimeter portion.

The present invention also provides compression joints incorporating the above described seals.

Brief Description of the Drawings

By way of example only, a preferred embodiment of the present invention is described in detail with reference to the accompanying drawings in which:-

Figure 1 is a side view of a seal in accordance with a first embodiment of the present invention;

Figure 2 is a cross-section through the seal of Figure 1;

Figure 3 is a longitudinal section through the parts of a compression joint in accordance with the first embodiment of the present invention, before assembly;

Figure 4 is a longitudinal section through an assembled compression joint in accordance with Figure 3;

Figure 5 is a longitudinal section through the parts of a compression joint in accordance with a second embodiment, before assembly;

Figure 6 is a longitudinal section through an assembled compression joint in accordance with Figure 5;

Figure 7 is an enlargement of part of Figure 6; and

Figure 8 is a cross-section through a further embodiment of a seal.

Best Modes for Carrying out the Invention

Referring to Figures 1 and 2 of the drawings, a seal 10 in accordance with the present invention is an annulus with a smooth inner surface 11 and a shaped outer surface 12.

The two perimeter portions 13, 14 of the seal each have an angle of inclination a relative to the surface 11 of approximately 45°. Each portion 13, 14 terminates at its outer edge in a flat 15, 16, rather than tapering to a feather edge. The flat 15, 16 means that each edge of the seal is robust and is not easily damaged, but the taper of the perimeter portions provides comparatively flexible edges which can flex inwards

when a compression nut is tightened over the seal. Typically, the height of each flat 15, 16 is 11-12% of the total thickness of the seal.

5 It is important that the seal is a good fit inside the nut, to prevent the seal becoming misplaced before or during fitting. Ideally, the clearance between the exterior of the seal and the nut should be of the order of 0.2mm. It also is important that there is adequate clearance (typically 1-1.5mm) between the interior of the seal and the exterior of the pipe to be fitted within the seal, so that the pipe can slide easily through the seal during fitting.

10

Immediately adjacent each perimeter portion 13, 14 is an inclined portion 17, 18 which has an angle of inclination b relative to the surface 11 of about 15° . Centrally between the inclined portions 17, 18 is a rib 19 which is parallel to the surface 11. The inclined portions 17 and 18 and the rib 19 together make up the central section of the seal.

15 The portions 13 and 14 are equal in width, as are the portions 17 and 18, so that the seal is symmetrical and reversible:- it cannot be placed in the fitting the wrong way round.

The seal is formed with the rib 19 simply for ease of manufacture; this feature is not
20 essential.

The seal may be made of any suitable tough, resilient, compressible material, e.g. thermoplastic rubber.

25 Figures 3 and 4 show the parts of a typical compression joint:- a compression nut 20, the upper part of a fitting 21, a pipe 22 and the seal 10. The compression nut 20 and the corresponding portion of the fitting 21 are standard compression joint design.

Before assembly, the compression nut 20 is engaged with the first few turns of the
30 external screw thread 24 of the fitting 21 and the seal 10 is a loose fit in the upper portion 22 of the compression nut 20. The seal 10 is retained in position in the compression nut by the outer rim 23 of the compression nut and the tapered upper edge 25 of the fitting 21. In this configuration, the nut, fitting and seal are prepared ready for final assembly and the seal cannot be misplaced.

35

To fully assemble the compression joint, one end 22a of the pipe 22 to be connected to the fitting 21 is pushed into the fitting 21 (with the nut 20 in place on the fitting) until the end of 22a of the pipe 22 contacts a shoulder 26 formed in the interior of the pipe. When the end 22a of the pipe is pushed into the fitting, it is pushed through the seal 10.

The compression nut 20 is then tightened down onto the screw thread 24 of the fitting 21 in the usual way, applying pressure in the direction of arrows P. This pushes one perimeter portion 13 of the seal 10 into tight engagement with the rim 23 of the compression nut and the other perimeter portion 14 of the seal into engagement with the tapered upper edge 25 of the fitting 21. Both the outer rim 23 of the compression nut and the upper edge 25 of the fitting 21 are tapered to an angle less than the angle of the corresponding perimeter portion 13, 14 of the seal; typically, the rim 23 and the edge 25 tapered at an angle of about 27°. Thus, as the compression nut 20 is tightened onto the screw thread 24, the perimeter portions 13, 14 of the seal 10 are flexed or rolled inwards towards the pipe 22, to form a tight seal against the pipe 22; further tightening of the nut 20 compresses the seal between the pipe and the fitting.

It will be appreciated that, in a confined space and/or at an awkward angle, it is relatively simple to push the end of the pipe 22 into the partially assembled fitting described above, and then tighten the compression nut. The procedure is simply reversed to disassemble the fitting.

Referring to Figures 5-7, in a second embodiment of the invention, a seal for a compression joint is provided by a multipart sealing assembly 50, which includes two seals 51, 52 and three spacing rings 53, 54 and 55. The arrangement shown in these Figures is suitable for use with larger-diameter pipes (e.g. 200mm external diameter) and may be used e.g. to secure a single pipe to another fitting or to secure to pipes together end to end.

The second embodiment of the invention is described with specific reference to a sealing assembly having two seals, but it will be appreciated that any number of seals, with their accompanying spacing rings, may be used, depending upon the size of the joint to be sealed and the pressure to be applied to the joint.

In the sealing assembly 50, each of the seals 51,52 is identical to the seal 10 described with reference to Figures 1 and 2. The seals 51,52 may be formed separately, as shown in Figure 5, or may be formed with a connecting web 56 (shown in broken lines) connecting the adjacent edges of the seals. The connecting web 56 is used simply for convenience in handling the seals 51,52 and does not contribute to the formation of a seal.

Each of the spacing rings 53-55 is an annulus made of a rigid, tough, abrasion resistant, low friction material (e.g. polypropylene) and has a cross-sectional shape as shown in Figure 7:- the outer surface 60 is smooth and the inner surface provides a central rib 62 flanked on each side by a sloping peripheral portion 63,64. Like the seals, the spacing rings are bilaterally symmetrical in cross-section. The angle of inclination of each sloping peripheral portion 63,64 is less than the angle of the corresponding perimeter portion 13,14 of the seal; typically the angle of inclination α is approximately 27° compared to the angle α of the perimeter portion is 13,14 of approximately 45° .

Each seal 51,52 is arranged with a spacing ring on each side of the seal; if a connecting web 56 is formed between adjacent seals, then the spacing ring overlies the web. At the end of the sealing assembly 50 which first contacts with the compression nut, a half-thickness spacing ring 55 may be used in place of a full thickness spacing ring, since only half of the spacing ring will be required. Alternatively, an angled compression surface can be formed on the interior of the compression nut, as described with reference to the first embodiment. However, for the larger seals, the frictional forces are such that the compression nut tends to lock onto the seal material and twist the seal out of alignment, and so it is preferred to provide a top spacing ring 55 (whether half or full thickness) to provide a low friction surface over which the compression nut can slide.

Because the sealing assembly 50 is much longer than the seal shown in the first embodiment, the seal is accommodated in the interior of an externally screw threaded fitting 70, rather than in the interior of the compression nut. The interior of the fitting 70 is smooth walled, and the seals 51,52 and spacing rings 53-55 are a snug fit inside the fitting.

The fitting 70 may be formed at the end of another fitting, or may be formed as a separate collar if it is to be used to connect two pipes end to end.

5 In use, the seals 51,52 and spacing rings 53-55 are arranged alternately inside the fitting 70, with each seal 51,52 arranged with a spacing ring at each side. The half thickness spacing ring 55 is positioned around the outermost edge of the outermost seal 51.

10 An internally threaded compression nut 71 of known type is partially engaged with the external screw thread on the fitting 70, and a pipe 73 to be connected to the fitting 70 is pushed into the fitting 70, to the desired position relative to the fitting. The compression nut 71 is then tightened on to the fitting 70 in known manner, applying pressure in the direction of arrows P. As the compression nut 71 is tightened, each of the seals 51,52 is compressed, in the same manner as described with reference to
15 Figures 1-4, with the seals 51,52 being pushed tightly against the adjacent spacing rings 53-55 so that the difference between the angles of inclination α and x results in the perimeter portions 13,14 of each seal being flexed or rolled inwards towards the pipe 63 to form a tight seal against the pipe.

20 The embodiment described with reference to Figures 1-4 could be produced with a single seal and a pair of spacing rings, i.e. spacing rings could replace the rim 23 and the edge 25.

Figure 8 shows a cross-section through a three seal sealing assembly 80 in which
25 three seals 81,82,83, are formed with a connecting web 84 and are separated by spacing rings 85 - 88. In this embodiment, rather than the perimeter portions of each seal being inclined at an acute angle to the inner surface 89 of the seal, the perimeter portions are cut as right angles steps, with each step in providing a first portion 90 which is spaced from, but in a plane parallel to, the inner surface 89, and the second
30 portion 91 which lies in a plane at right angles to the plane of the first portion.

For ease of handling the sealing assembly, the perimeter portions of adjacent seals are joined together.

35 Adjacent seals are separated by spacing rings 85 - 88; the spacing rings are formed with inclined sides 93,94 which are inclined at an acute angle to the base 95 of the

ring. The angle of inclination γ is depicted as approximately 45° but may in fact be any of a wide range of acute angles.

- 5 For all of the above described embodiments, it must be emphasised that the precise angles of the perimeter portions of the seal and the angles of the corresponding portions of the rim and the edge (in the case of the embodiment of Figures 1 - 4) or of the spacing rings (in the case of the embodiments of Figures 5 - 8) are not important, since the only requirement is that the rim and edge/spacing rings can distort the perimeter portions of the seals when pressure is applied by the compression nut in the direction of arrow P. In other words, the rim and edge/spacing rings must be made of a more rigid material than the seal or seals, and the angles of the perimeter portion of each seal must be different to the angle of the corresponding portion of the rim and edge/spacing rings.
- 10
- 15 It will be appreciated that the greater the number of seals in the sealing assembly, the greater the seal on the pipe.

CLAIMS

1. A seal for a compression joint, said seal including an annulus having:
 - a substantially smooth inner surface;
 - 5 - an outer surface having a perimeter portion around each edge of the seal and a central section between the perimeter portions;
the thickness of the central section being greater than the thickness of either of the perimeter portions;
the material of which the seal is made and the thickness of the outer edge of
10 each perimeter portion being such that each perimeter portion can flex inwards when subjected to an inward pressure in use.
2. The seal as claimed in claim 1, wherein the cross-sectional shape of the seal is bilaterally symmetrical, such that the seal is reversible in use.
- 15 3. The seal as claimed in claim 1 or claim 2, wherein each perimeter portion terminates in a flat around each outer edge of the seal.
4. The seal as claimed in claim 3, wherein the height of each said flat is in the
20 range 11 - 12% of the total thickness of the seal.
5. The seal as claimed in any one of the preceding claims, wherein each perimeter portion is inclined at an acute angle to the inner surface.
- 25 6. The seal as claimed in claim 5, wherein said acute angle is approximately 45°.
7. A compression joint including:-
 - a seal as claimed in any one of claims 1 - 6;
 - a compression nut providing an internally screw threaded surface;
 - 30 - a fitting one end of which provides an externally screw threaded surface adapted to co-operate with the internally screw threaded surface of the compression nut to form a compression joint;
 - one end of said compression nut being arranged to extend beyond the corresponding end of said fitting when the nut is fully engaged with the fitting,
 - 35 said one end of said compression nut being formed with an internal rim which is configured to retain said seal and to flex the adjacent perimeter portion of

said seal inwards when the compression nut is tightened on to the fitting;

- the outer end of said fitting being formed with an internal surface which is configured to flex the adjacent perimeter portion of said seal inwards when the compression nut is tightened onto the fitting.

5

8. A compression joint including:-

- a seal including an annulus having a substantially smooth inner surface; and outer surface having a perimeter portion around each edge of the seal, each perimeter portion being inclined at an acute angle to the inner surface, and a central section between the perimeter portions; the thickness of the central section being greater than the thickness of either of the perimeter portions; the material of which the seal is made and the thickness of the outer edge of each perimeter portion being such that each perimeter portion can flex inwards when subjected to an inward pressure in use; the cross-sectional shape of the seal being bilaterally symmetrical, such that the seal is reversible in use;

10

- a compression nut providing an internally screw threaded surface;

- a fitting one end of which provides an externally screw threaded surface adapted to co-operate with the internally screw threaded surface of the compression nut to form a compression joint;

20

- one end of said compression nut being arranged to extend beyond the corresponding end of said fitting when the nut is fully engaged with the fitting, said one end of said compression nut being formed with a tapered internal rim which is configured to retain said seal and to flex the adjacent perimeter portion of said seal inwards when the compression nut is tightened onto the fitting;

25

- the outer end of said fitting being formed with a tapered internal surface which is configured to flex the adjacent perimeter portion of said seal inwards when the compression nut is tightened onto the fitting.

9. A seal assembly for a compression joint, said seal assembly including:

30

- one or more annular seals;

- a spacing ring adjacent each edge of the or each seal, each spacing ring being made of a more rigid material than the or each seal;

- the or each seal having: a substantially smooth inner surface; and outer surface having a perimeter portion around each edge of the seal and a central section between the perimeter portions; each perimeter portion being at a first angle to said inner surface; the thickness of the central section being greater

35

than the thickness of either of the perimeter portions; the material of which the seal is made and the thickness of the outer edge of each perimeter portion being such that each perimeter portion can flex inwards when subjected to an inward pressure in use;

- 5 - the portion of each spacing ring adjacent each edge of the or each seal being inclined at a second angle which is different to said first angle, such that when each perimeter portion of the or each seal is forced into contact with said adjacent portion of said spacing ring, the spacing ring effects inward flexion of said perimeter portion.

10

10. The seal assembly as claimed in claim 9, wherein said first angle is 90° and said second angle is an acute angle.

15

11. The seal assembly as claimed in claim 9, wherein said first angle is an acute angle and said second angle is an acute angle substantially smaller than said first angle.

20

12. The seal assembly as claimed in any one of claims 9 - 11, wherein the cross-sectional shape of the or each seal and of each spacing ring is bilaterally symmetrical.

25

13. A compression joint including:-
- a compression nut providing an internally screw threaded surface;
 - a fitting one end of which provides an externally screw threaded surface adapted to co-operate with the internally screw threaded surface of the compression nut to form a compression joint;
 - a seal assembly as claimed in any one of claims 9 - 12, configured to be received within said one end of said fitting.

30

Fig.1

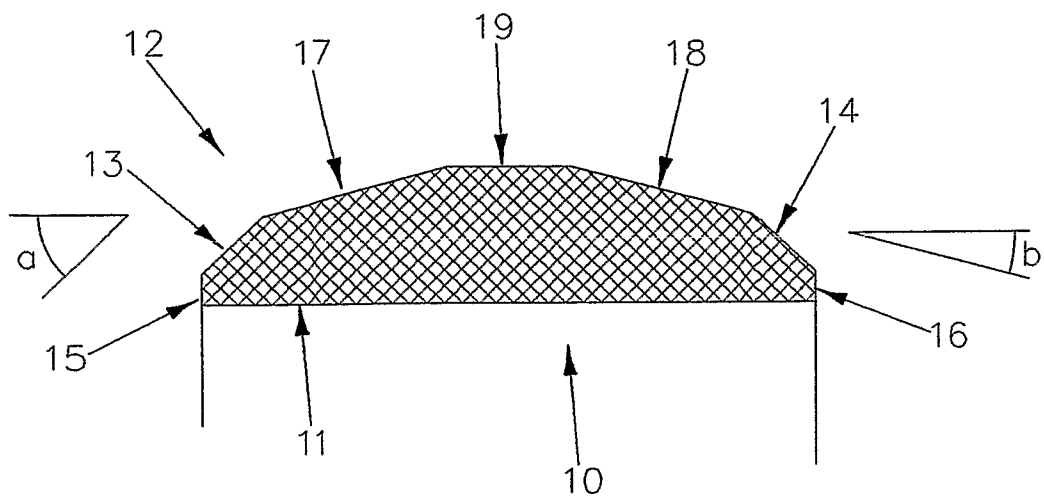
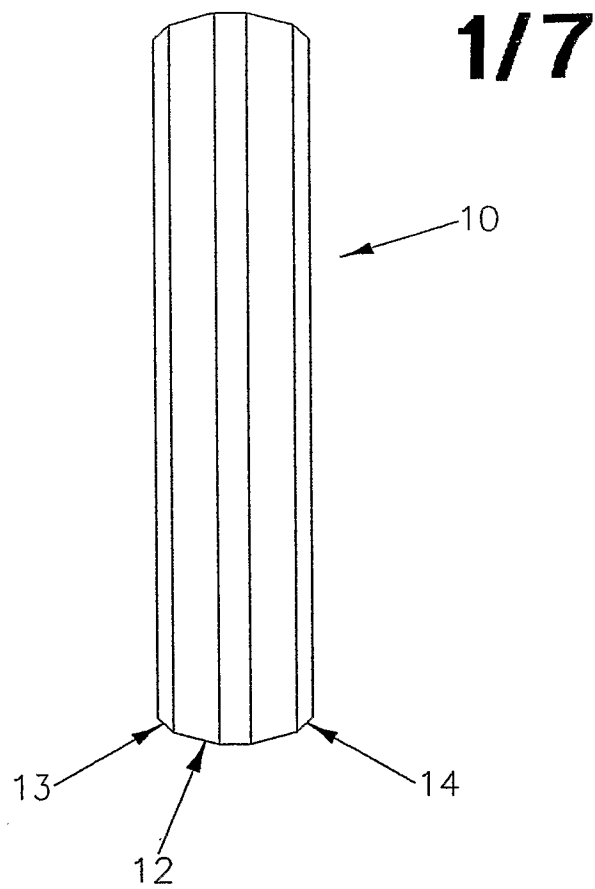


Fig.2

2/7

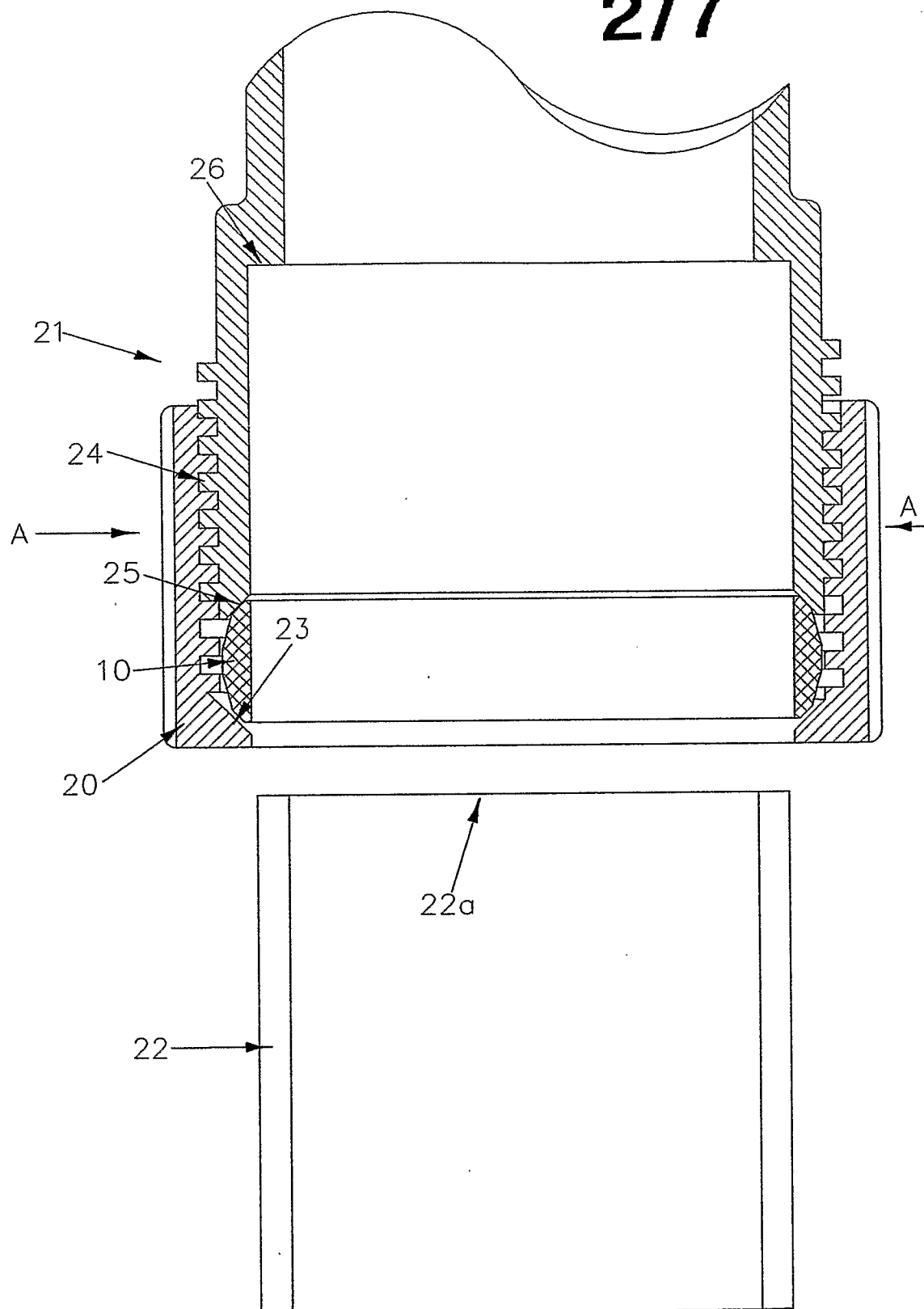


Fig.3

3/7

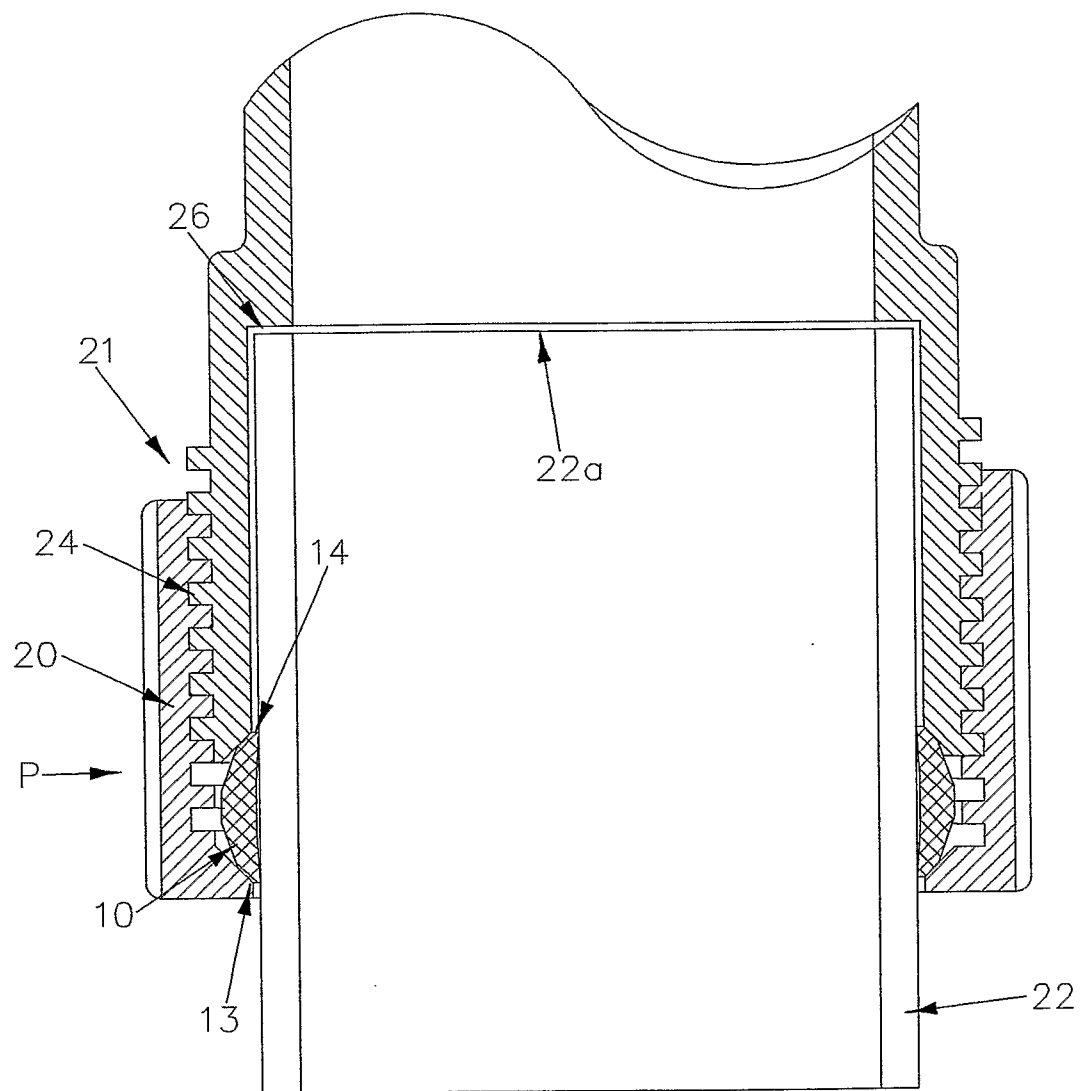


Fig.4

4/7

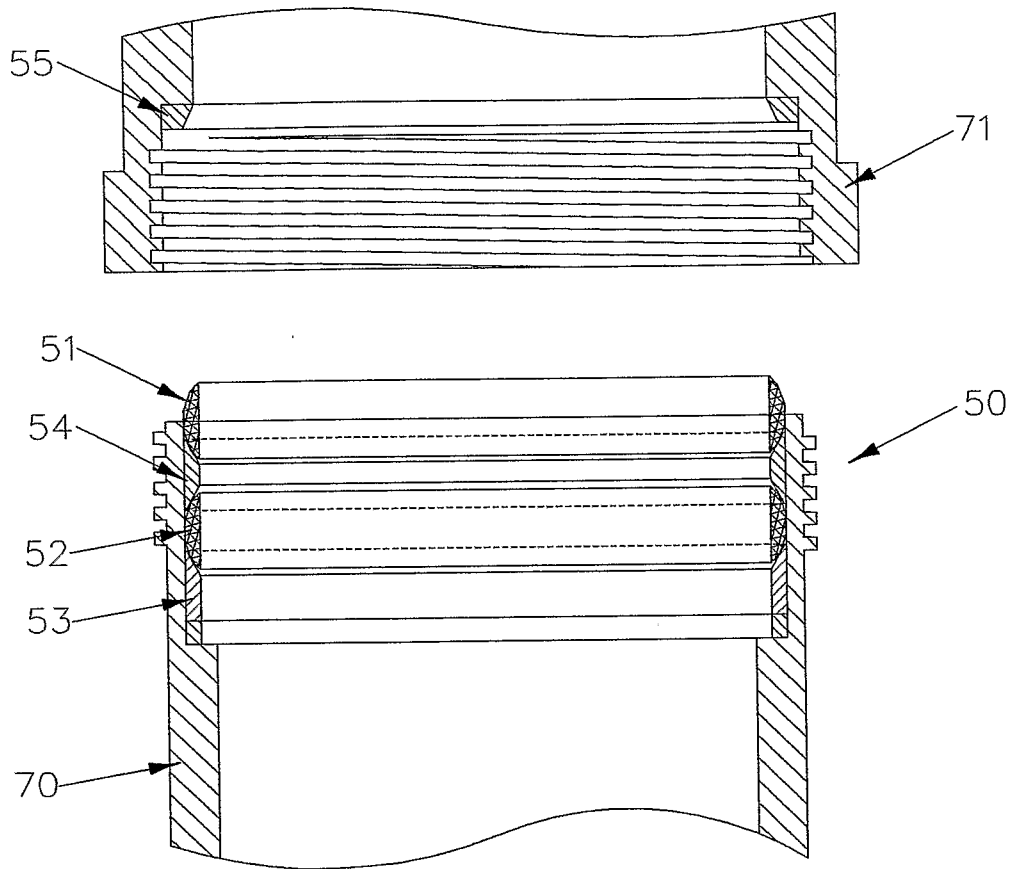


Fig.5

5/7

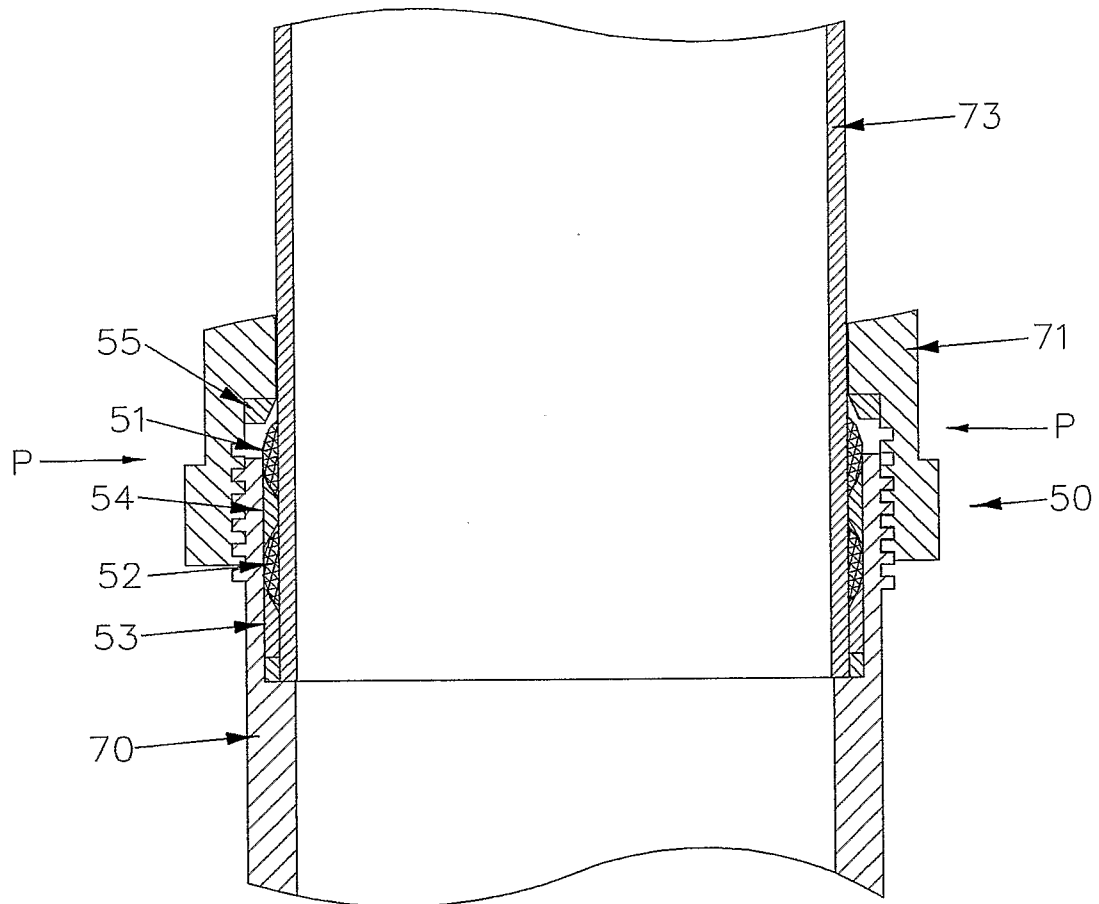


Fig.6

6/7

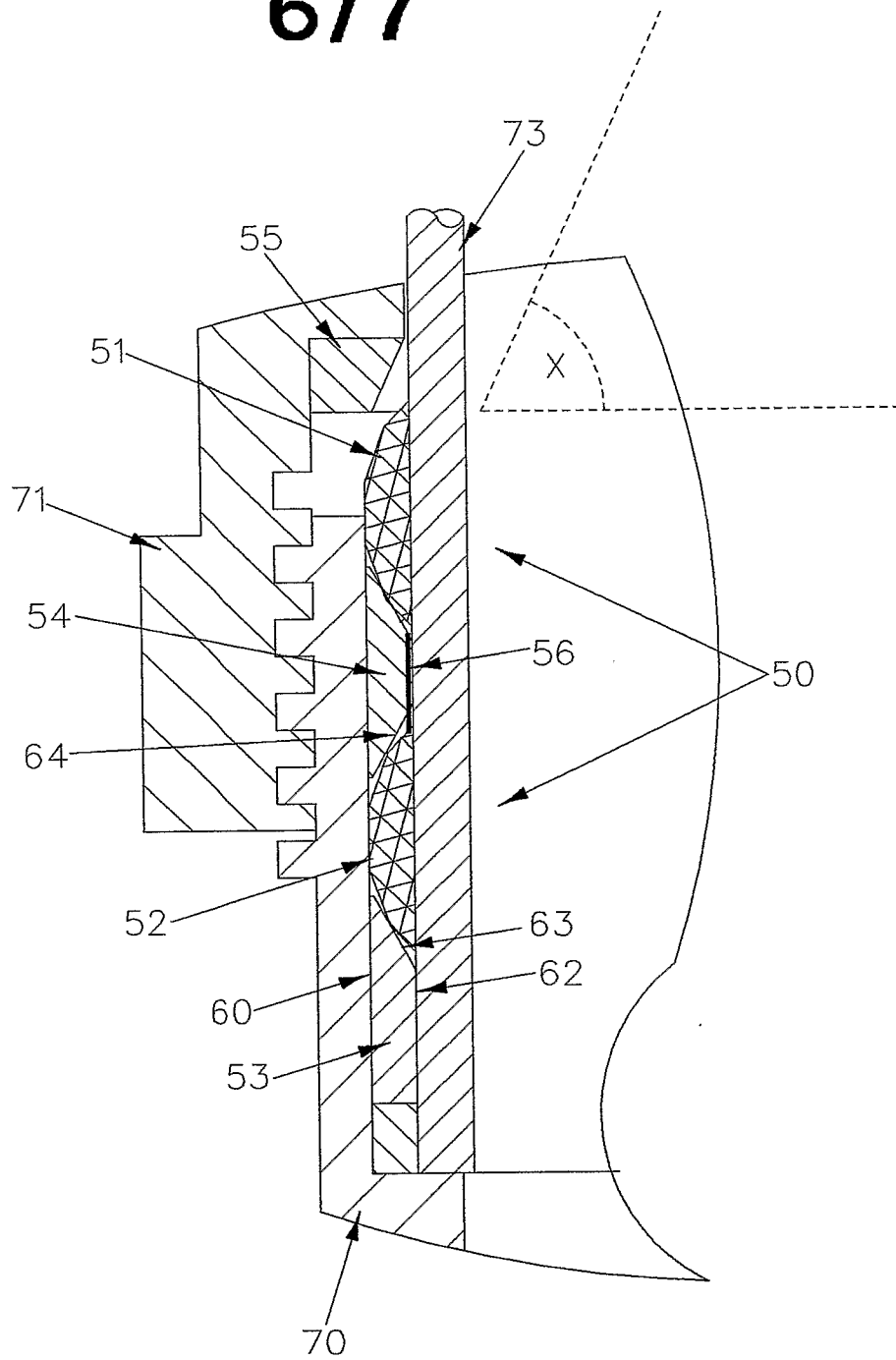


Fig.7

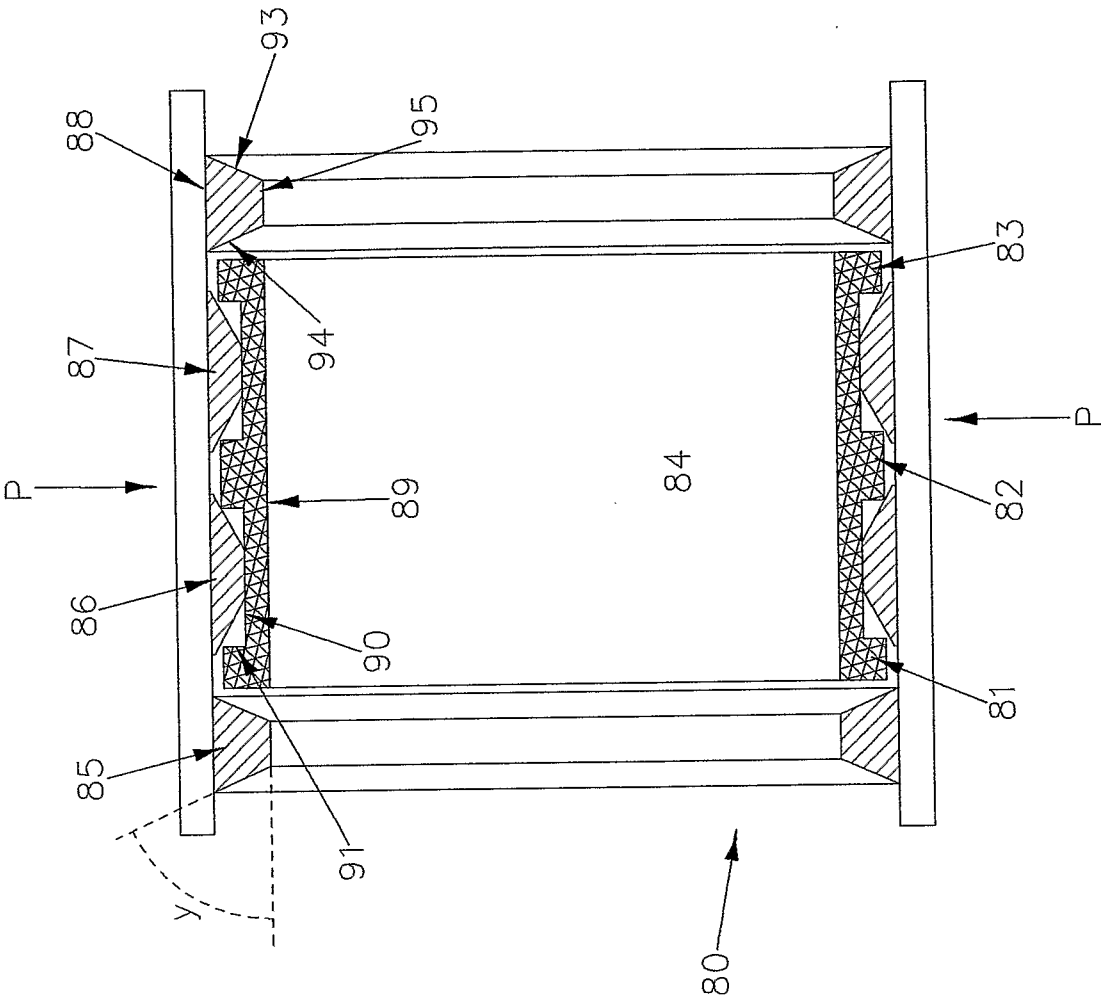


Fig.8