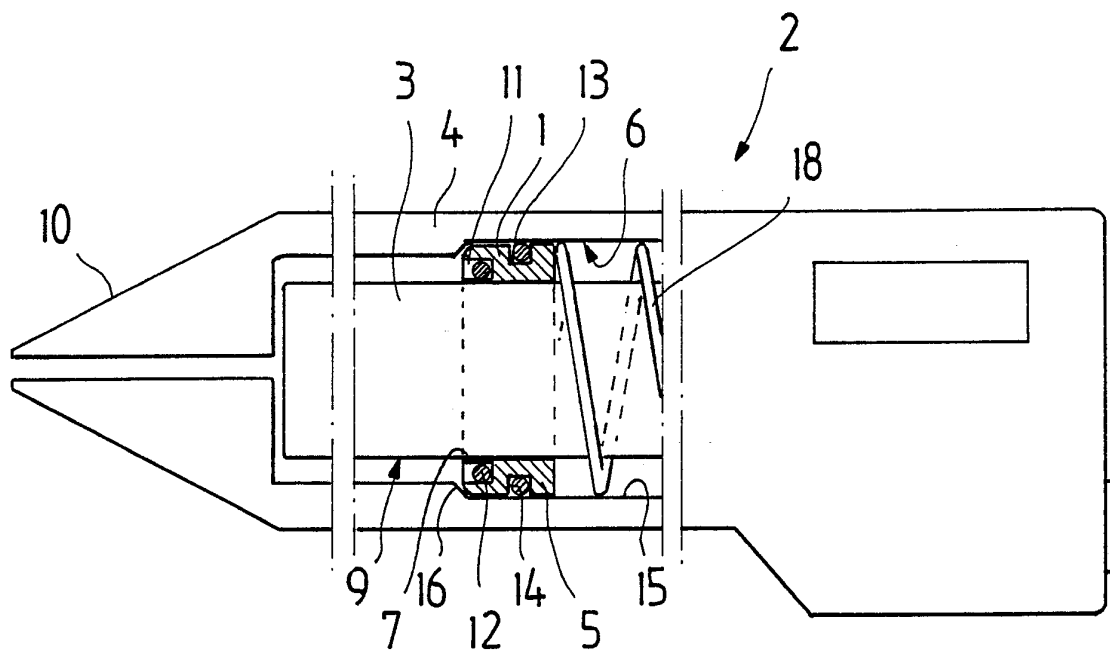




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(21) International Application Number: PCT/FI92/00075 (22) International Filing Date: 18 March 1992 (18.03.92) (30) Priority data: 911346 19 March 1991 (19.03.91) FI (71) Applicant (for all designated States except US): BIOHIT OY [FI/FI]; Verkkosaarencatu 4, SF-00580 Helsinki (FI). (72) Inventor; and (75) Inventor/Applicant (for US only) : SUOVANIEMI, Osmo [FI/FI]; Verkkosaarencatu 4, SF-00580 Helsinki (FI). (74) Agent: PAPULA REIN LAHTELA OY; Box 981, Kansak- ouluku 5 A, SF-00101 Helsinki (FI).		(81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), HU, IT (European patent), JP, LU (European patent), MC (European patent), NL (European patent), RU, SE (European patent), US. Published <i>With international search report.</i>

(54) Title: PACKING RING FOR A PIPETTE PLUNGER**(57) Abstract**

A packing ring (1) for sealing the plunger (3) of a pipette (2), comprising a body part (5) which forms a thin-walled lip portion (7) projecting in the direction of the plunger and its inner surface (8) disposed to press and to seal against the outer surface (9) of the plunger (3) moving relative to the packing ring (1).

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PACKING RING FOR A PIPETTE PLUNGER.

The present invention concerns a packing ring for a pipette plunger, serving to seal the plunger against the inner surface of the cylinder.

In high-precision pipettes employed in medical analytics, certain problems are inherent in the sealing of the plunger against the inside of the cylinder. Primary importance attaches to absolutely tight sealing under all and any conditions independent of the pipette's degree of filling, filling status (filling/emptying) and potential manufacturing errors of the cylinder, such as uneven surfaces for instance. It is further required that the friction between plunger and cylinder be made such as is desired, so that no problems may arise from friction in filling or emptying the pipette nor, particularly, regarding measuring accuracy, in spite of the operating means. Moreover, there may occur, in some motor-operated pipettes, vibration of the plunger relative to the cylinder, resulting from vibration caused by the motor or other operating means.

Owing to the causes mentioned, extremely high requirements are imposed on a pipette plunger packing, regarding structural design and function of the packing ring.

The packing rings which are being used in existing high-precision pipettes fail to meet all those requirements mentioned in the foregoing which are imposed on the packing ring.

The object of the present invention is to eliminate the drawbacks to which reference has been made in the foregoing.

It is a particular aim of the invention, to provide a novel packing ring for sealing a pipette plunger in the cylinder in such a way that the sealing is efficient under all and any conditions, and in all and any states of application of the pipette.

It is further an object of the invention, to provide a packing ring which produces between the plunger and cylinder of the pipette an accurately pre-determinable friction.

5 It is further an object of the invention, to provide a packing ring which can be used to eliminate plunger vibration e.g. in motor-driven precision pipettes, and particularly to centre the plunger accurately and with forced guidance in the cylinder.

10 Regarding the features characterizing the invention, reference is made to Claim 1.

The invention is based on a packing design in which the packing forms a thin-walled lip portion projecting in the direction of the piston, the inner
15 diameter of said lip portion being fitted to press with sealing action against the outer surface of the piston moving relative to the packing ring. The lip portion is advantageously thin-walled, its wall thickness on the order of 0.5 to 0.1 mm, e.g. 0.15 to 0.3 mm, advantage-
20 ously about 0.2 to 0.25 mm.

The packing ring is made of resilient and deformable plastic, such as polyolefines, fluorinated polyolefines, polyamides or other equivalent polymers generally known as packing materials.

25 The inner diameter of the packing ring advantageously constitutes a minimum at the lip portion, for enhancing the sealing action and for reducing friction.

The body portion of the packing ring may further constitute a groove encircling the lip portion, a
30 tightening ring being placeable in said groove such as a conventional O ring, a spring, or equivalent, to press the lip portion against the plunger.

Furthermore, on the outside surface of the packing ring is advantageously provided a locking
35 groove for interlocking the packing ring with the inner cylinder surface, with the aid of a locking ring.

The packing ring is, in a certain embodiment,

advantageously elongated, substantially shaped like a hollow cylinder, its length advantageously greater than its outer diameter, and it constitutes a guide for the plunger. In this embodiment the packing ring, made of
5 highly elastic, shock-absorbing material, can be advantageously employed to attenuate vibration.

The invention is described in the following in detail with the aid of embodiment examples, referring to the attached drawing, wherein:-

- 10 Fig. 1 presents a packing ring according to the invention, sectioned,
Fig. 2 shows the packing ring of Fig. 1, mounted in the cylinder volume of a motor-operated precision pipette, and
15 Fig. 3 presents another packing ring according to the invention, sectioned.

In Fig. 1 is depicted a packing ring 1 according to the invention, in elevational view and partly sectioned; the same packing ring is shown in Fig. 2,
20 mounted in position to seal the plunger 3 of a pipette 2 against the cylinder 4; in Fig. 2 the operating means of the pipette has not been shown, in order to illustrate the design and function of the packing ring.

In Figs 1-2, the packing ring comprises a body
25 part 5 made of elastic material, this body part being disposed to effect sealing against the inner surface 6 of the cylinder 4 of the pipette 2. Furthermore, the body part 5 provides a thin-walled lip portion 7 projecting in the direction of the plunger 3 towards the
30 tip 10 of the pipette. The inner surface 8 of said lip portion is disposed to press and seal against the outer surface 9 of the plunger 3 moving relative to the packing ring. Hereby the packing ring constitutes a ring sealed against and interlocked with the inner surface
35 of the cylinder, its lip portion, presenting the minimum of the packing ring's inner diameter, being arranged to press and seal slidably against the outer

surface of the plunger.

In Figs 1-2, the body part forms a groove 11 encircling the lip portion 7, in which a particular tightening ring 12 has been placed, such as an O ring or a spring, to press the lip portion with sealing effect against the plunger 3. Thanks to said tightening ring, efficient sealing is present in all and any circumstances and independent, e.g., of minor manufacturing errors that may be found on the plunger surface. Moreover, the sealing of the plunger and the friction of the plunger against the cylinder can be adjusted to be such as is desired, by exchanging the tightening ring, in other words, the tightening ring can be selected in connection with manufacturing the device, to meet any desired operating conditions and characteristics.

In the embodiment depicted in Figs 1-2 a particular locking groove 13 has been provided on the outer surface of the body part 5 of the packing ring 1, a locking ring 14 being placed in said groove to interlock the packing ring with the inner surface of the cylinder 4. This locking ring may consist e.g. of an O ring, a D ring, or another equivalent locking ring known in the art.

In Fig. 3 is shown an embodiment in which the packing ring 1 is elongated, substantially cylinder-shaped and constitutes a guide for the plunger. The length l of the packing ring is greater than the diameter d of the ring. The packing ring is made of elastic, shock-absorbing material, and it absorbs vibrations and movements of the plunger. The packing ring shown in Fig. 3 constitutes an efficient positive plunger guide. The packing ring shown in Fig. 3 is equivalent to the embodiment of Figs 1-2 as regards the lip portion 7, the tightening ring groove 12 and the groove 13 for the locking ring 14.

In Fig. 2, the inner surface 6 of the cylinder

4 forms an expanded portion 15 with abutment border 16. The packing ring 1 is placed in said expanded portion 15 in such manner that the thicker part of the packing ring projecting over the groove encircling the lip portion 7, i.e., the sealing portion 17 (Fig. 1) pushes against said abutment border 16. The pipette is furthermore provided with a tightening member, such as a spring 18, arranged to press the packing ring against the abutment border 16.

10 The embodiment examples are only meant to illustrate the invention, and the embodiments of the invention may vary within the scope of the claims following below.

CLAIMS

1. A packing ring (1) for sealing the plunger (3) of a pipette (2) in the cylinder (4), comprising a body part (5) made of elastic material and disposed to seal against the inner surface (6) of the cylinder, characterized in that the body part (5) forms a thin-walled lip portion (7) projecting in the direction of the plunger (3) and its inner surface (8) disposed to press and to seal against the outer surface (9) of the plunger (3) moving relative to the packing ring (1).

2. Packing ring according to claim 1, characterized in that the lip portion (7) projects towards the tip (19) of the pipette (2).

3. Packing ring according to claim 1 or 2, characterized in that the body part (5) forms a groove (11) encircling the lip portion (7) and in which is placed a tightening ring (12) to press the lip portion against the plunger (3).

4. Packing ring according to any one of claims 1-3, characterized in that on the outside surface of the body part (5) is provided a locking groove (13) for interlocking the packing ring with the aid of a locking ring (14) with the inner surface (6) of the cylinder (4).

5. Packing ring according to any one of claims 1-4, characterized in that the packing ring (1) is elongated, substantially shaped like a hollow cylinder, and constitutes a guide for the plunger.

6. Packing ring according to any one of claims 1-5, characterized in that the inner diameter of the packing ring (1) has a minimum at the location of the lip portion.

7. Packing ring according to any one of claims 1-6, characterized in that the packing ring (1) is made of elastic polymer, such as polyolefines, fluorinated polyolefines, polyamides or other equivalent polymers.

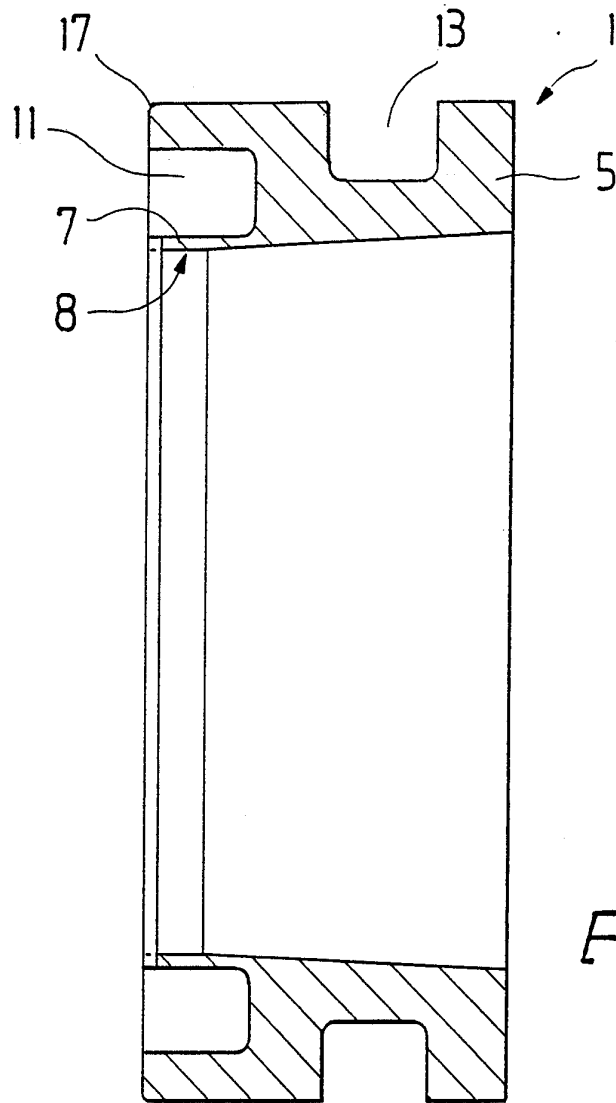


Fig.1

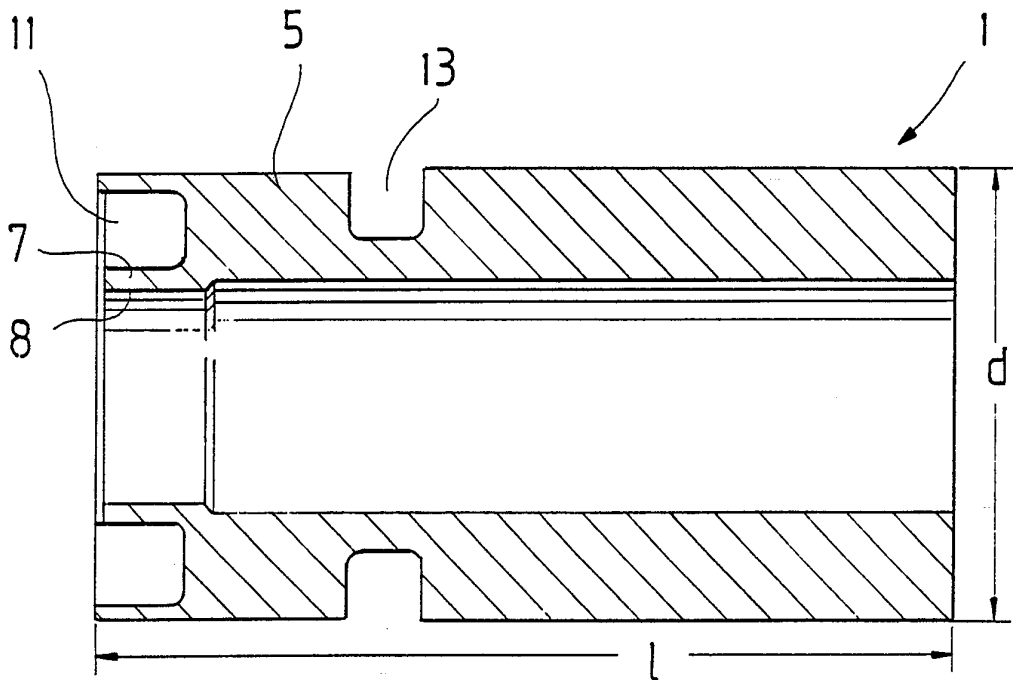


Fig.2

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 92/00075

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: B 01 L 3/02, F 16 J 15/32														
II. FIELDS SEARCHED Minimum Documentation Searched⁷ <table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Classification System</td> <td style="border: none;">Classification Symbols</td> </tr> <tr> <td style="border: 1px solid black; height: 40px; vertical-align: bottom;">IPC5</td> <td style="border: 1px solid black; height: 40px; vertical-align: bottom;">B 01 L; F 16 J</td> </tr> </table> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸ SE,DK,FI,NO classes as above			Classification System	Classification Symbols	IPC5	B 01 L; F 16 J								
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IPC5	B 01 L; F 16 J													
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category *</th> <th style="width: 70%;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 20%;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td>CH, A5, 642570 (SEPPO JUHANI METSÄLÄ) 30 April 1984, see page 2, column 2, line 60 - line 63; page 3, column 2, line 32 - line 36; figures 1,3 -- </td> <td style="text-align: center; vertical-align: top;">1-3,5-7</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td>US, A, 4618153 (ROLF NILSSON) 21 October 1986, see column 2, line 44 - column 3, line 52; abstract; figures 1,2 -- </td> <td style="text-align: center; vertical-align: top;">1,2,5-7</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td>US, A, 3847389 (WILLIAM A. ROGERS) 12 November 1974, see column 1, line 14 - line 19; column 1, line 49 - column 2, line 5; figures 2,4 -- </td> <td style="text-align: center; vertical-align: top;">1,3</td> </tr> </tbody> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	Y	CH, A5, 642570 (SEPPO JUHANI METSÄLÄ) 30 April 1984, see page 2, column 2, line 60 - line 63; page 3, column 2, line 32 - line 36; figures 1,3 --	1-3,5-7	Y	US, A, 4618153 (ROLF NILSSON) 21 October 1986, see column 2, line 44 - column 3, line 52; abstract; figures 1,2 --	1,2,5-7	Y	US, A, 3847389 (WILLIAM A. ROGERS) 12 November 1974, see column 1, line 14 - line 19; column 1, line 49 - column 2, line 5; figures 2,4 --	1,3
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<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> * Special categories of cited documents:¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td style="width: 50%; vertical-align: top;"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family </td> </tr> </table>			* Special categories of cited documents:¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family										
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IV. CERTIFICATION <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> Date of the Actual Completion of the International Search 18th June 1992 </td> <td style="width: 50%; border: none; vertical-align: top;"> Date of Mailing of this International Search Report 1992 -06- 2 6 </td> </tr> <tr> <td style="width: 50%; border: none; vertical-align: top;"> International Searching Authority SWEDISH PATENT OFFICE </td> <td style="width: 50%; border: none; vertical-align: top;"> Signature of Authorized Officer Gunnel Wästerlid </td> </tr> </table>			Date of the Actual Completion of the International Search 18th June 1992	Date of Mailing of this International Search Report 1992 -06- 2 6	International Searching Authority SWEDISH PATENT OFFICE	Signature of Authorized Officer Gunnel Wästerlid								
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International Searching Authority SWEDISH PATENT OFFICE	Signature of Authorized Officer Gunnel Wästerlid													

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	DE, B2, 2736586 (OXFORD LABORATORIES INC.) 7 June 1979, see column 4, line 61 - column 6, line 5; figure 7 --- -----	1-7

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. PCT/FI 92/00075**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 29/05/92. The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		AU-B- 516744	81-06-18
		AU-D- 5059279	80-03-13
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		SE-B- 443630	86-03-03
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		JP-C- 1047140	81-05-28
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