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(54) **Title**: PIPETTE WITH PISTON ROTATION LOCK

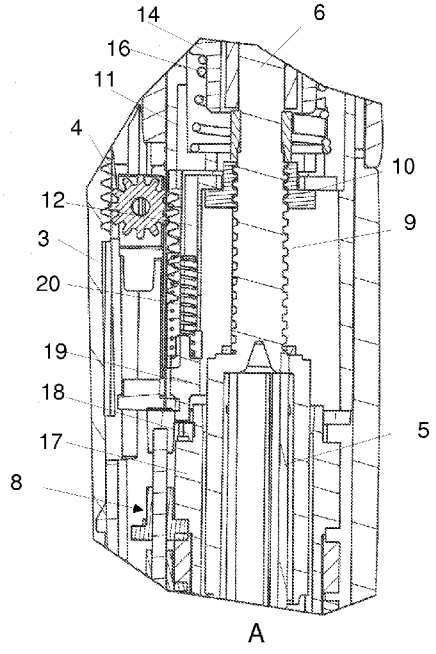


Fig. 3

(57) **Abstract**: The invention concerns a pipette comprising a mechanism with which the stroke length of a piston (5) can be changed by rotating the piston rod (6). The pipette comprises a locking mechanism (12, 19), which prevents the rotation of the piston rod when the piston has been pushed a certain distance downwards from its upper position, but does not prevent the rotation when the piston is in its upper position.

PIPETTE WITH PISTON ROTATION LOCK

Description

Technical field

The invention relates to liquid dispensing and concerns a pipette, in which the dosage volume is set by rotating the piston rod and which comprises a locking device with which accidental change of set volume is prevented.

Technical background

Piston pipettes, which comprise a piston rod extending above the handle, are used for liquid dispensing for example in laboratories. The piston can thus be moved by the rod. Also such pipettes are used in which the length of the intake movement of the piston can be set by rotating the rod. Such a pipette comprises also a volume display, typically based on digit rings, on which the set volume is displayed. One problem of these kinds of pipettes is that the rod may be accidentally rotated during pipetting, whereby also the set volume accidentally changes. In document WO84/00119 a pipette is described in which for preventing accidental rotation there is a ring-like spring above the uppermost digit ring, the spring comprising at its lower surface protrusions and, corresponding to these, hollows on the upper surface of the ring. The rod can be rotated stepwise against the force of the spring.

The pipette according to document US 4 909 991 comprises around the piston rod a flange non-rotatable with the rod. The body comprises above the flange a threaded sleeve, the upper end of which extends above the body. By rotating the sleeve its lower end can be pressed tightly against the flange, whereby friction force prevents the accidental rotation of the rod.

The pipette according to document WO 91/16976 comprises a sleeve rotating with the piston rod and having longitudinal grooves on its outer surface. In the body there is a locking device comprising a spring and at its end a claw settling against a groove. The rod can be stepwise rotated against the force of the spring. The locking device can be, however, lifted up above the grooves, whereby the rod is freely rotatable. For this the locking device comprises an operation peg extending outside the body.

Summary of the invention

Now a pipette in accordance with the claims has been invented.

The pipette comprises a locking mechanism, which prevents the rotation of the piston rod when the piston has been pushed a certain distance downwards from its upper position, but does not prevent the rotation when the piston is in its upper position. Thus the change of volume setting is prevented during liquid dispensing. In this way no additional operations are needed in order to prevent a setting change, but the mechanism functions automatically when the piston is pushed downwards. A sufficient movement distance for starting the mechanism in action may be e.g. 0.5 – 3 mm, preferably 1 – 2 mm.

The locking mechanism may comprise a locking pin which presses against a part rotating with the rod. This rotating part may be e.g. a part of a digit ring display, such as the step spring of a digit ring which stops the digit rings so that the digits of the rings match to each other.

The locking mechanism may comprise a locking spring, which, when in locking position, presses a locking pin.

The mechanism may prevent the rotation with the help of friction. However, it is also possible to arrange a mechanism in which the rotation is prevented by form locking.

Drawings

The enclosed drawings are a part of the written description of the invention, and they relate to the detailed description of some embodiments of the invention presented next. In the drawings, Fig. 1 shows a pipette in accordance with the invention from front, Fig. 2 shows the upper part of the pipette from behind as an enlarged cut figure, Fig. 3 shows the partial enlargement A of Fig. 2, Fig. 4 shows the locking sleeve of the pipette obliquely from above, and Fig. 5 the locking sleeve obliquely from above in another angle.

Detailed description of some embodiments of the invention

The pipette in accordance with the Figs. comprises at is lower end a tip part 1, at the lower end of which there is a pipette tip or tip 2 for liquid. On the tip part there is a sliding tip removal sleeve, and on the side of body there is a tip remover bush button 3 as an extension of the sleeve, which button has been forced to move along the body by means of a wheel in order to decrease the operation force (see, e.g., US 5 435 197). In the upper end of the body on the opposite side from the button there is a finger support. In the body there is a cylinder and as an extension thereof a aspirating channel going through the tip part. In the cylinder there is a moveable piston 5 having an extending piston rod 6, in the upper end of which there is a piston knob 7 above the upper end of the body. The piston is moved by pushing the knob. The desired dispensing volume is set by rotating the rod by the knob. The set volume is displayed in the opening on the side of the body by a digit ring display 8 having for digit rings.

In the tip part there is arranged around the piston 5 a primary spring (not in the drawings), which presses the piston against the piston rod 6. The piston rod comprises at its lower end a hollow, in which the upper end of the piston settles. The piston rod comprises an adjustment thread 9, on which an adjustment nut 10 has been fitted so that its rotation in relation to the body has been prevented. In the body there is a fixed limiter 11. A sliding locking sleeve 12 has been fitted around the piston rod. The primary spring presses the adjustment nut against a flange at the upper end of the locking sleeve, whereby the adjustment nut and the locking sleeve settle against the fixed limiter. The adjustment nut and the fixed limiter thus define the upper limit of the piston stroke. Around the upper part of the rod there is placed a limiter piece 13 having at its upper end a broader limiter flange. Around the limiter piece there is fitted a sliding sleeve-like secondary support 14 having a flange on its outer surface. Above the secondary support there is fitted in a boring in the handle a calibrating screw 15. Between the fixed limiter and the flange in the secondary support there is fitted a secondary spring 16, which is stronger than the primary spring, the secondary spring thus pressing the secondary support against the calibration screw.

When the piston rod is pushed, it moves downwards against the force of the primary spring until the flange of the limiter piece 13 meets the upper end of the secondary support 14. When the pipette tip 2 is now brought into the liquid to be aspirated and the piston is let to return to its upper position, a liquid volume corre-

sponding to the stroke length is received into the tip. By rotating the calibration screw 15, the lower limit of the aspiration movement may be slightly changed and thus the volume calibrated precisely to correspond to the nominal volume. When removing the liquid, after the limit piece meets the secondary support, the rod is pushed still more, whereby also the secondary spring 16 yields in and the piston moves further lower. Thus the liquid is removed as completely as possible.

The volume display 8 is based on digit rings. On the piston rod 6 there is fitted sliding but non-rotating the uppermost digit ring 17. It rotates by means of the first step wheel the second digit ring, which rotates the third, and this the fourth. The uppermost digit ring comprises a projection, on the upper surface of which a stepping spring 18 is attached. It stops the digit spring on its place sot that the digit set on the ring is seen in the middle of the body opening. With a small force the digit ring can be rotated, however. A snapping sound is formed from the step movement. Corresponding volume adjustments have been described e.g. in documents EP 112 887, and WO 2005/050554.

On the outer surface of the locking sleeve 12 there is a longitudinal groove, on the lower end of which there is attached a locking pin 19. A locking spring 20 presses the locking pin downwards in the groove. The upper end of the locking spring is against the fixed limiter 11. When the piston is pushed downwards, the locking spring pushes the locking sleeve downwards, whereby the locking pin presses against the stepping spring 18 preventing the uppermost digit ring from rotating. Thus the volume setting is not accidentally changed when the liquid is dispensed. The move distance of the locking pin may be e.g. 1 – 2 mm. Using a sufficiently great force, the knob can, however, be rotated also in the locking position. Thus for instance accidental breakage of the construction may be prevented. Thereby the locking force may also be changed by replacing the locking spring with stronger or weaker one. The locking may be made also completely non-sliding by arranging for the locking pin locking holes, into which the lower end of the pin protrudes.

Claims

1. A pipette, comprising
- a body with an upper end and a lower end,
- in the body, a cylinder with an upper end and an open lower end,
- in the cylinder, a piston (5) comprising a piston rod (6) on the upper end side of the cylinder, whereby the piston has an upper position from which it can be pushed downwards by the rod,
- a mechanism with which the stroke length of the piston can be changed by rotating the piston rod,
characterized in that
- the pipette comprises a locking mechanism (12, 19), which prevents the rotation of the piston rod (6) when the piston has been pushed a certain distance downwards from its upper position, but does not prevent the rotation when the piston is in its upper position.

2. The pipette according to claim 1, wherein the locking mechanism comprises a locking pin (19) which, when the mechanism prevents the rotation of the piston rod (6), presses against a part (18) rotating with the piston rod (6).

3. The pipette according to claim 2, comprising a digit ring display (8) of volume and wherein the part rotating with the piston rod is a digit ring (17) or a step spring (18) connected with it, which spring stops the digit rings stepwise so that the digits of the rings match each other.

4. The pipette according to any one of claims 1 to 3, comprising a locking spring (20) which in the locking position presses a locking pin (19).

5. The pipette according to any one of claims 1 to 4, wherein the locking mechanism (12, 19) prevents the rotation of the piston rod by the help of friction.

6. A method for preventing the rotation of a piston in a pipette, comprising
- a body with an upper end and a lower end,
- in the body, a cylinder with an upper end and an open lower end,
- in the cylinder, a piston (5) comprising a piston rod (6) on the upper end side of the cylinder, whereby the piston has an upper position from which it can be pushed downwards by the rod,

- a mechanism with which the stroke length of the piston can be changed by rotating the piston rod,

characterized in that

- the piston rod (6) is prevented from rotating by a locking mechanism (12, 19) when the piston has been pushed a certain distance downwards from its upper position, but is not prevented from rotating when the piston is in its upper position.

7. The use of the pipette according to any one of claims 1 to 5 for liquid dispensing.

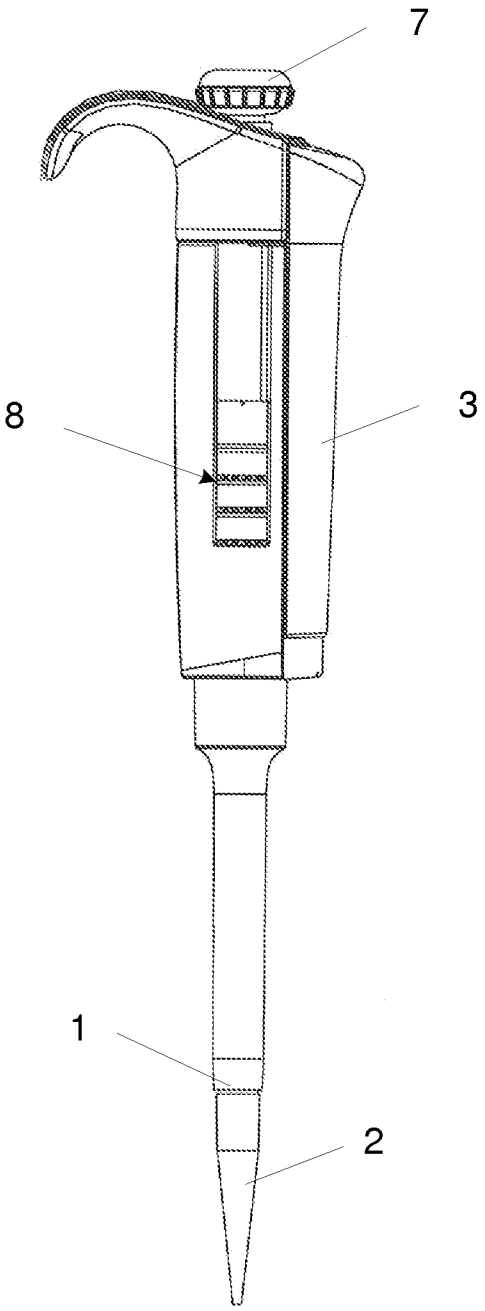


Fig. 1

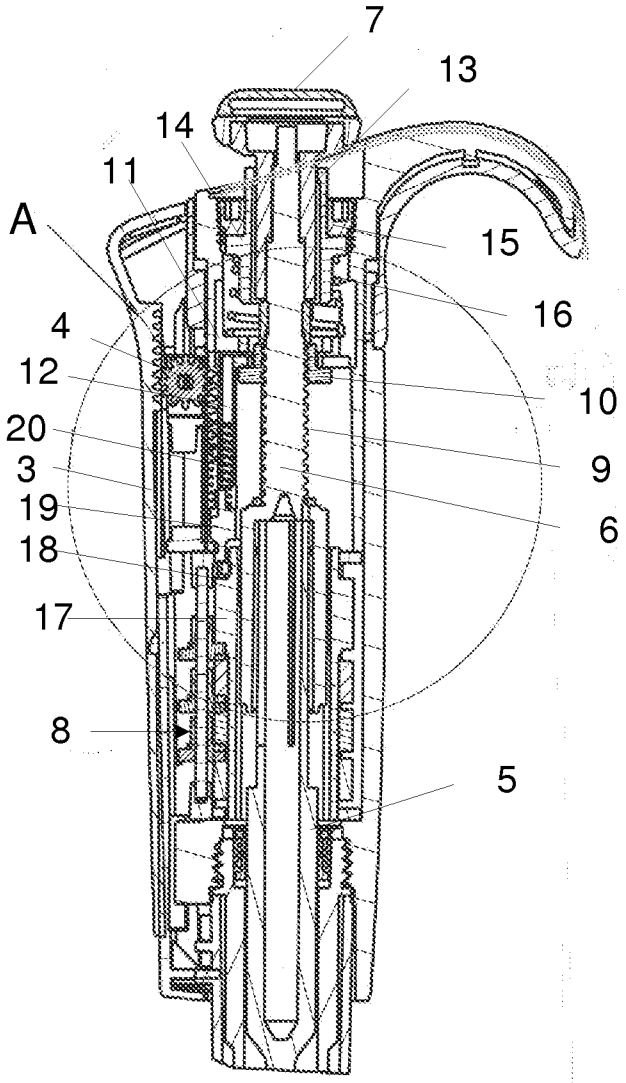


Fig. 2

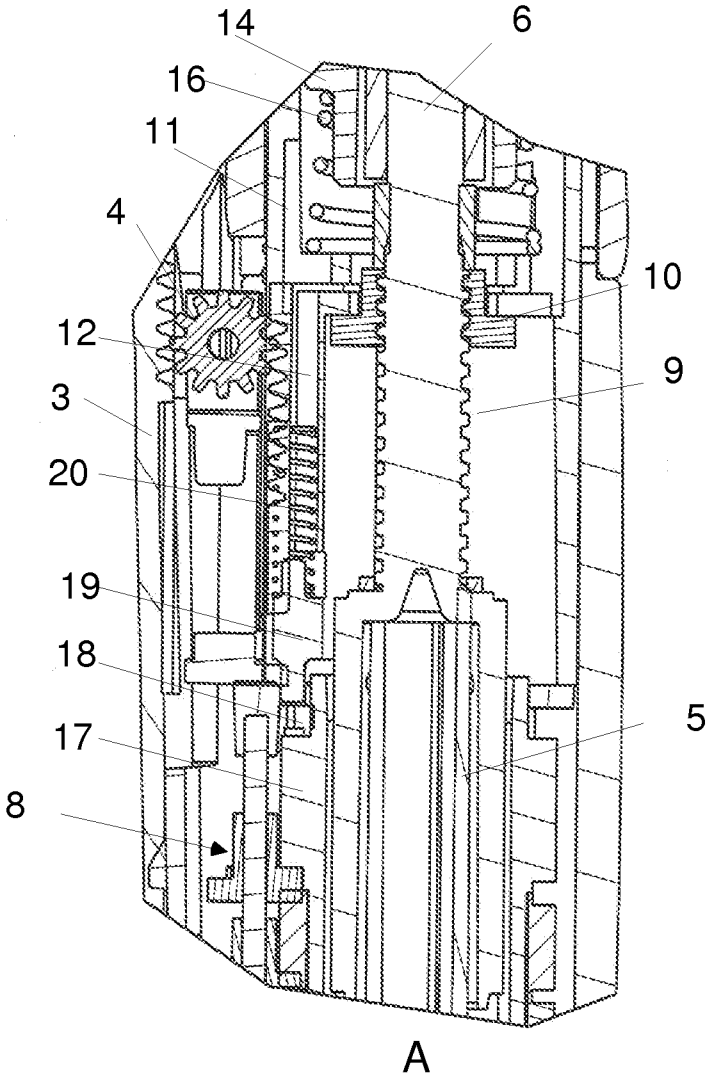


Fig. 3

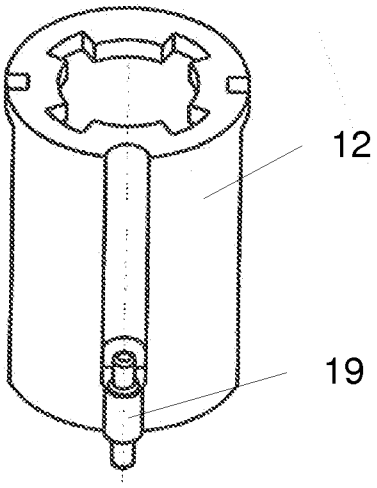


Fig. 4

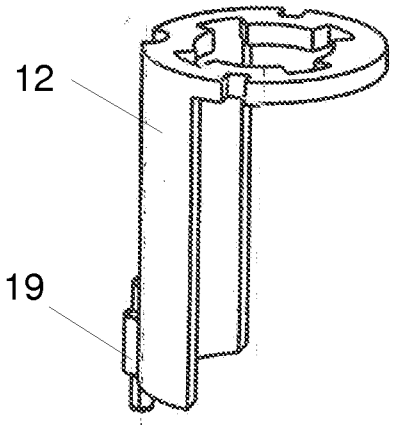


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/FI2012/051003

A. CLASSIFICATION OF SUBJECT MATTER
INV. B01L3/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2009/118456 A1 (THERMO FISHER SCIENTIFIC OY [FI]; LIND MIKAEL [FI]; SALO VESA [FI]; JA) 1 October 2009 (2009-10-01) page 5, lines 24-28; figures	1-7
A	US 5 650 124 A (GILSON WARREN E [US]) 22 July 1997 (1997-07-22) abstract; figures column 3, line 11 - column 4, line 17	1-7
A	WO 91/16976 A1 (BIOHIT OY [FI]) 14 November 1991 (1991-11-14) cited in the application abstract; figures	1-7

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 January 2013	30/01/2013

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/FI2012/051003

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2005/050554 A1 (THERMO ELECTRON OY [FI]; TELIMAA JUHA [FI]; HEINONEN MAUNO [FI]; PULLI) 2 June 2005 (2005-06-02) cited in the application abstract; figures page 4, lines 7-28	1-7
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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