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[Continued on next page]

(54) Title: PIPETTE ADJUSTEMENT WHEEL

(57) Abstract: The object of the invention is an adjustment wheel for a pipette, which adjustment wheel solution comprises members for returning the adjustment wheel to its initial position when the wheel is released.

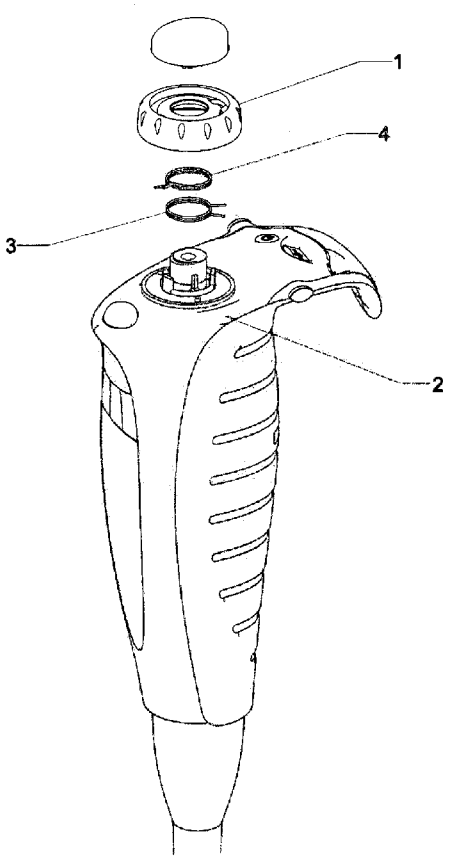

Figure 1

WO 2013/144456 A1

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Published:

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PIPETTE ADJUSTMENT WHEEL

Background

Electronic pipettes are traditionally adjusted and controlled by pressing keys. For example volume adjustment is often implemented in this way. A standard implementation is arrow keys with which the volume can be adjusted to be increased or decreased. Almost without exception, the same arrow keys are also used for other functions, for example for advancing in a menu. Conventionally a single touch of an arrow key causes a change of one adjustment step, and pressing the key for a longer period will result in an accelerated change of the reading. However, an adjustment carried out in this way has its drawbacks. The adjustment is not very fast at least in case the adjustment target value is far from the initial reading. Moreover the keys are often in connection with the display and can thus be ergonomically poorly located. There are designs where functions are adjusted using adjustment wheels, but they have not as yet brought any improvement to the speed or ease of the adjustment.

In document WO 2010/034290 A2, an electronic pipette is described, which comprises an adjustment wheel that also functions as push key. With the adjustment wheel one can select the volume, control calibration and proceed in the menu.

In document EP 1 878 500 A1, a pipette is described that has an adjustment wheel that allows, by rotating it, the selection of mode of use, for example manual pipetting, pipetting and mixing, titration and so on. This function is not connected to a push key but resides in a separate adjustment wheel.

EP 1 632 840 A1 describes a pipette having a display on its hook in front of which there is an adjustment wheel. With the adjustment wheel functions can be selected, such as the volume of the liquid to be pipetted, proceeding in the menu, calibration of the pipette, etc.

The solutions mentioned above are such in which the adjustment wheel is of the incrementally rotating type. There are also solutions having a touch screen with a touch wheel. In existing, such as those mentioned above, adjustment wheel solutions of this

type the adjustment wheel is of the same type as the adjustment wheel of a car radio. This solution does not offer good control sensitivity especially when the reading needs to be changed much at once and to an accurate specific value. To speed up the adjustment in this case the wheel needs to be rotated fast in pulses for a fast change of the reading. This will easily lead to exceeding or falling short of the wanted reading, and setting the accurate reading will cause additional iteration.

Description of the invention

The system according to the invention solves the above mentioned problems with a new solution that comprises members for returning the adjustment wheel to its initial position when released. This can be achieved with a spring return adjustment wheel solution. The spring return is implemented in two stages. When the adjustment wheel is first rotated, there is initially a brief, rather light adjustment wheel movement. After this brief and light adjustment wheel movement, the spring force at first increases stepwise after which it increases towards the extreme of the movement.

With this solution the advantage is achieved that the stepwise or very slowly progressing adjustment and on the other hand the fast, and especially the adjustment occurring at an accelerating speed can be separated within the same member as two distinctly separate events. The angle of rotation of the adjustment wheel can be detected for example by a magnetic sensor or an optic reader head arrangement.

When the rotation angle of the adjustment wheel has been brought into electronic form, different speed response profiles can be developed in the control program of the pipette for optimal implementation of the turning of the adjustment wheel and the function which is to be adjusted.

When an adjustment wheel is used for programming a pipette, the adjustment is simultaneously both sensitive and very fast and interactive. The interactivity is emphasized when combined with visual feedback, for example in the form of a bar increasing with the adjustment or a sound effect.

Another significant advantage of the invention in addition to the fast, controlled adjustment is the possibility to use the adjustment wheel for directly driving the pipette in so called manual/measurement mode. This means that the operating machinery, i.e. the piston is driven freely up-and-down by the adjustment wheel. The two-step adjustment also enables the best possible touch e.g. in the so-called titration mode, in which the pipette must be able to move in a controlled manner at various speeds, but during the same run also by the smallest possible adjustment step in a stepwise manner.

The adjustment wheel is preferably situated in the upper part of the pipette, most preferably at the top of the pipette where it is ergonomic and easy to use with one hand. That is, the adjustment wheel can be moved by a single movement of the thumb of the hand holding the pipette. This also means that all adjustments and choices made in the menu can be made easily without releasing the grip on the pipette or changing the grip and at the same time the display easily remains visible at all times.

In a preferred embodiment of the invention the movement of the piston is also controlled by the adjustment wheel. This means, therefore, that there is no need to change the grip between adjustment and pipetting.

In another preferred embodiment the operating key which is used for dispensing the liquid and which controls the movement of the piston is separate, and the adjustment wheel is set around it, functioning independently from the operating key.

In figures 1-3, a technical solution for achieving the function of the present invention is shown.

Figure 1 illustrates parts of the adjustment wheel including the adjustment wheel 1, the primary spring 3 and the secondary spring 4 and their attachment point to the body 2 of the pipette.

In figure 2 the adjustment wheel 1 is installed in the body 2 of the pipette such, that it can be turned in both directions in respect of the axis. There are two torsion springs

inside the wheel; the primary spring 3 and the secondary spring 4. The primary spring is installed thus, that the outward bent arms of the spring are pressed to both sides of a first shoulder 5 in the body and at the same time center the adjustment wheel to its center position. Correspondingly, the secondary spring is installed such, that the second guide 6 of the adjustment wheel is situated symmetrically in respect to a second shoulder 7 of the body.

When the adjustment wheel is turned clockwise as shown in figure 3, the first guide 8 engages the primary spring claw 3a that resists the rotational movement lightly until the second shoulder of the body hits the spring claw 4a of the secondary spring. Then the greater force of the biased secondary spring is initially felt as a distinct stop, and as the wheel is turned further a growing force is directed to the wheel until the movement is halted in its end position against the stop pins 9 of the body. When the wheel is released, the springs return the wheel to its original central position.

The figures also show the detection of the angle of rotation implemented by magnets 10 and a magnetic sensor 11.

The sensitivity of the adjustment wheel and the threshold between the two different adjustment areas can be adjusted by selecting the spring constants of the spring material to be suitable for the purpose.

Instead of using torsion springs, a spring-loaded cam mechanism can be used. In this implementation the turning part has two cams, the first one immediately engaging the spring-loaded member and the second one slightly later engaging the stiffer spring-loaded member. The spring-loaded member may for example be spring steel wire, which is bent by the cam as the adjustment wheel is turned.

According to another embodiment of the invention, a spring-loaded roller is fastened at the turning part, and on the opposite side is a shape which provides an accurate two-phase centering torque profile. The spring-loaded roller can also be on the side of the body and the shape that the spring-loaded roller follows can be on the adjustment wheel side.

Claims

1. Adjustment wheel for an electrical pipette, characterized in that the adjustment wheel solution comprises members for returning the adjustment wheel to its original position when the wheel is released.

2. The adjustment wheel of claim 1, characterized in, that the adjustment wheel solution is spring returned.

3. The adjustment wheel for an electrical pipette of claim 1 or 2, wherein the force increases with the angle at which the adjustment wheel is turned.

4. The adjustment wheel for an electrical pipette of claim 1 or 2, characterized in that it comprises two adjustment areas.

5. The adjustment wheel for an electrical pipette of claim 4, characterized in that within the first adjustment area the rotation angle of the wheel is short and the required force is essentially smaller than within the second adjustment area which is longer and the force increases in relation to the rotation angle.

6. The adjustment wheel for an electrical pipette of any of claims 1 to 5, which adjustment wheel has a linear response.

7. The adjustment wheel for an electrical pipette of any of claims 1 to 5, which adjustment wheel has a non-linear response.

8. The adjustment wheel for a an electrical pipette of any of claims 1 to 7, wherein the adjustment wheel also controls the movement of the piston.

9. The adjustment wheel for an electrical pipette of any of claims 1 to 7, wherein the adjustment wheel functions independently from the operating key controlling the movement of the piston.

10. The adjustment wheel for an electrical pipette of claim 5, characterized in that the different responses of the adjustment areas are produced using two torsion springs in the structure.

11. The adjustment wheel for an electrical pipette of claim 10, characterized in that the threshold between the two adjustment areas can be adjusted by selecting the materials of the springs.

12. The adjustment wheel for an electrical pipette of any of claims 1 to 11, characterized in that the rotational angle of the adjustment wheel is detected using a magnetic sensor.

13. The adjustment wheel for an electrical pipette of any of claims 1 to 11, characterized in, that the rotational angle of the adjustment wheel is detected using an optical reader head arrangement.

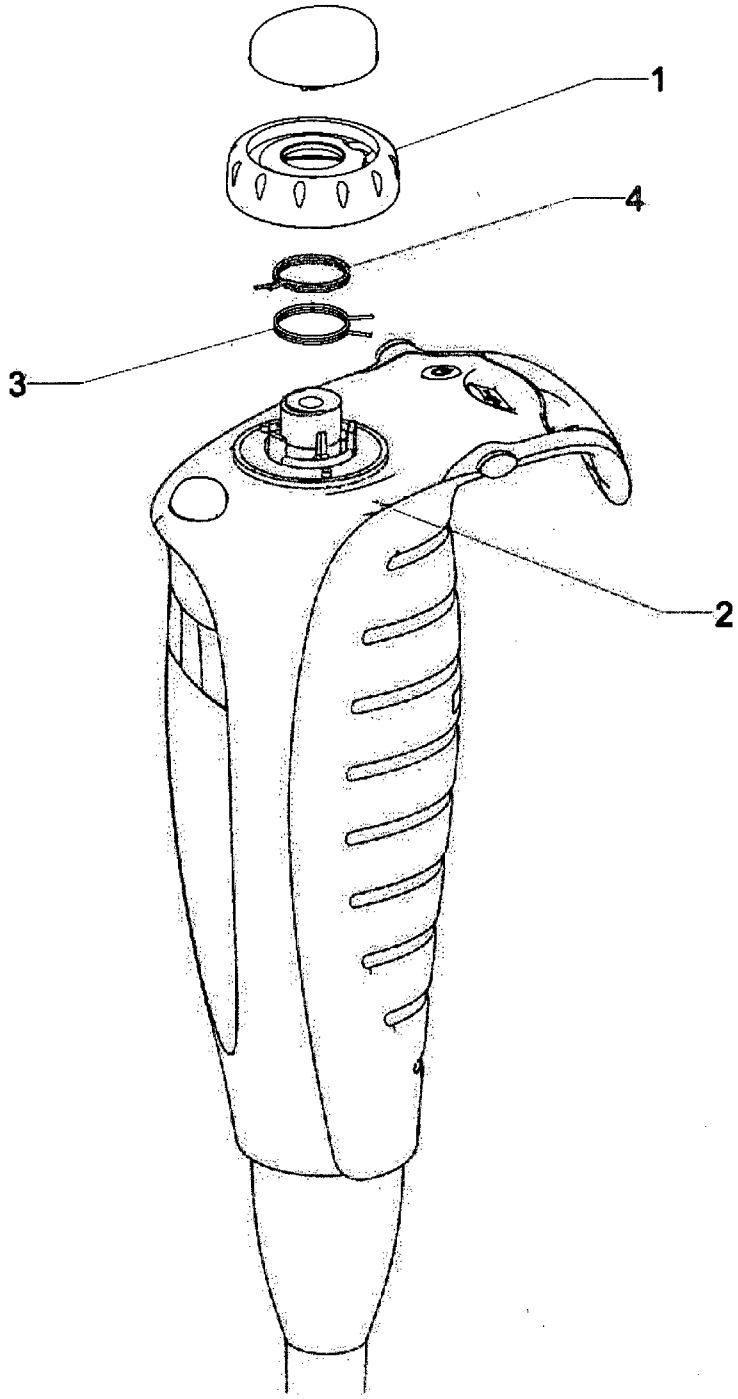

Figure 1

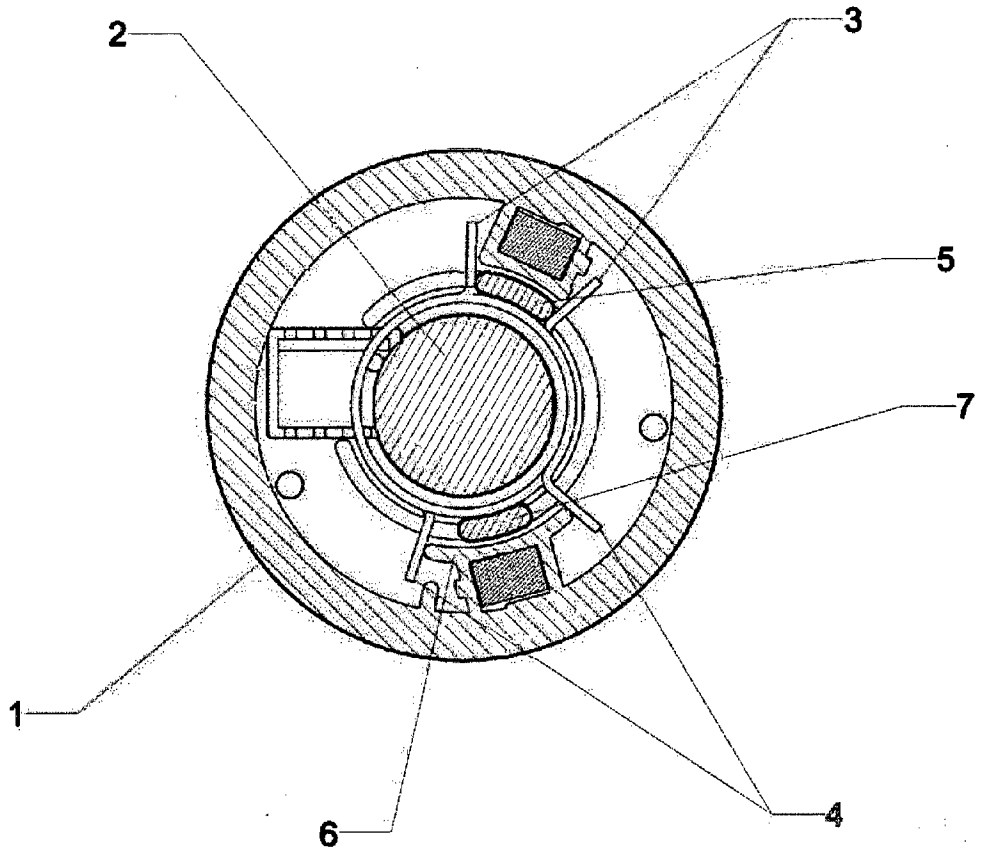

Figure 2

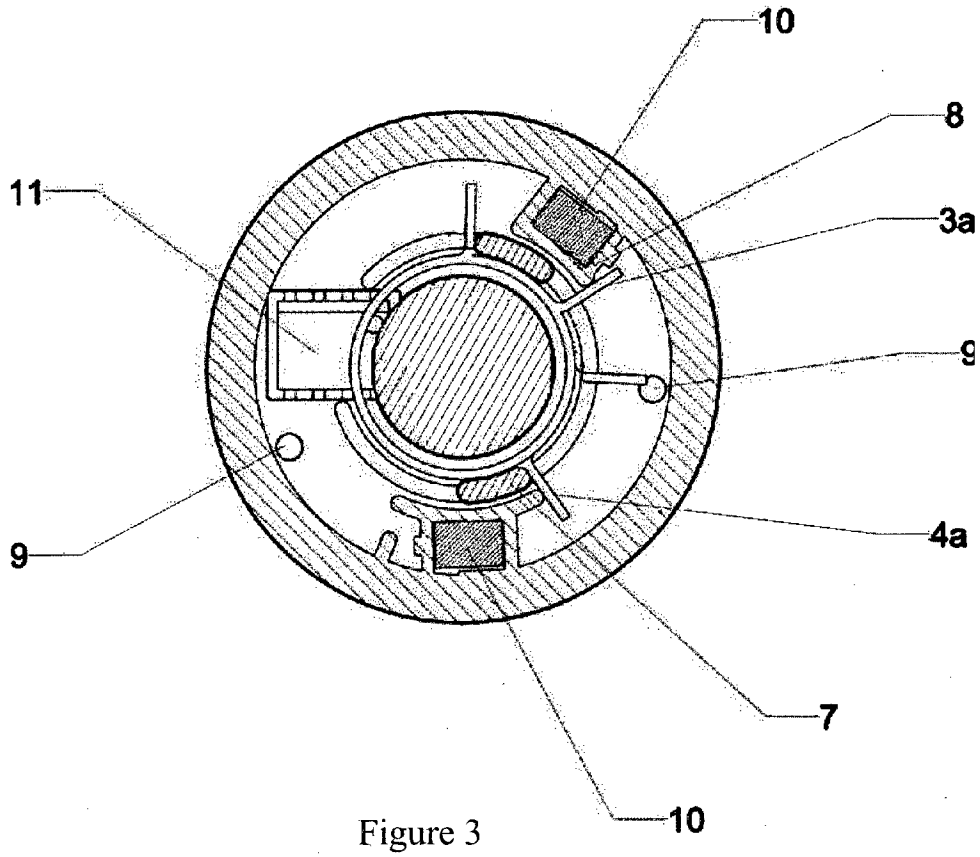

Figure 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2013/050358

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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)

IPC: B01L, H01H

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

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1632840 A1 (GILSON SAS), 8 March 2006 (2006-03-08); whole document	1, 2, 6-9
A	--	3-5, 10-13
X	EP 1543879 A1 (GILSON SAS), 22 June 2005 (2005-06-22); whole document	1, 2, 6-9
A	--	3-5, 10-13
A	US 5613600 A (YOKOJI SHIGERU ET AL), 25 March 1997 (1997-03-25); whole document	1-13
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☒ Further documents are listed in the continuation of Box C. ☒ 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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"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 when the document is taken alone

"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

Date of the actual completion of the international search	Date of mailing of the international search report
09-07-2013	10-07-2013

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

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20110214518 A1 (HOFFMANN MARCEL ET AL), 8 September 2011 (2011-09-08); whole document --	1-13
A	US 20080011042 A1 (MOLITOR PETER ET AL), 17 January 2008 (2008-01-17); whole document -- --------	1-13

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International Patent Classification (IPC)

B01L 3/02 (2006.01)
H01H 19/00 (2006.01)

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