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(54) **PISTON PIPETTE**

**KOLBENHUBPIPETTE**

**PIPETTE A PISTON**

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• **PATENT ABSTRACTS OF JAPAN, Vol. 13, No.**  
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**29 May 1989 (29.05.89).**

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## Description

### FIELD OF TECHNOLOGY

The invention relates to the handling of liquids and it concerns a hand-held piston pipette.

### TECHNICAL BACKGROUND

Manually operated piston pipettes are usually provided with a knob at the piston rod by which the piston is moved by pressing with the thumb. Such a pipette is known, for example, from publication FI-C-47461 (corresponding to publication US-3810391).

In a so-called step pipette the liquid volume drawn into the pipette cylinder is metered out in several smaller doses. In the step pipette the piston rod usually has teeth and the body has a matching striker always pushing the piston downward over the desired distance during a dosing stroke. One such pipette is known, for example, from publication US-4099548 wherein the top end of the body has a thumb-operated push knob. Publication GB-A-2048712 again presents a similar step pipette, wherein in the side of the top part of the body there is a forefinger-operated dosing push button.

In some step pipettes the striker actuator is a lever journaled in the body in its top part above the striker point. The lever is operated with the thumb. One such step pipette is known, for example, from publication DE-A-2926691 (corresponding to publication GB-A-2057581). This pipette also has a volume control device having a longitudinally moving covering plate above the teeth. The striker always moves over a standard distance, but part of the movement is along the covering plate off the teeth. Thus the distance covered by the piston is dependent on the location of the plate.

In conventional pipettes the pipette is gripped by the hand, so that the pipette must by necessity be made quite long. Dosing liquid to a very small place is difficult with such a pipette and in any case requires a very steady hand and great carefulness.

Known electrically operated pipettes are also gripped with the hand and the operating button is located in the upper part of the body. Such pipettes are described, for example, in publications FI-A-742083 (corresponding to publication US-4058370) and FI-A-932942 (corresponding to publication EP-A-576967).

WO 84/04056 discloses a dosage pipette provided with a piston, a toothed rack connected with the piston, a striking pin resting against the toothed rack, and a dosage lever mounted on the striking pin. A lifting lever is placed at the side of the toothing, with the distance of that lever from the end of the toothed rack being adjustable as desired and that lever permitting the striking pin to push the toothed rack over a specified distance, only. The toothed rack is provided with a second toothing, a cogwheel resting against it and, at the other side, against a second toothed rack whose top end is pro-

vided with a shiftable press knob.

US-A-3 975 960 discloses a manual fluid sampler which maybe hand-held like a pencil and which comprises a longitudinal body provided with a bore and a chamber extending longitudinally therethrough. A piston connected to a plunger is slidably mounted within the bore and provided with pulling - pushing equipment for moving the piston and plunger upwards or downwards in the bore and chamber. An adjustable control is provided in the bore to adjust the stroke of the piston, and a lever is mounted on the body to operate the plunger through the intermediary of the piston whereby fluid may be drawn into or discharged from the chamber. A stroke - overstroke arrangement is operatively coupled with the lever to cooperate with the control to define the limits of a stroke for the piston.

### DESCRIPTION OF THE INVENTION

#### General description

A pipette as defined in claim 1 has now been invented. Its advantageous embodiments are presented in the other claims.

The pipette according to the invention is designed to be gripped like a pencil. Thus liquid can be dosed very precisely with the pipette even to very small places. The pipette is particularly suitable for use in certain laboratory work and in assembly glueing. The pipette may be a step pipette or a one-dose pipette. It may be manually operated or electrically operating.

#### Description in detail

In a manually operated pipette according to the invention there is a gripping means attached to a piston for moving the piston downward, but also allowing the piston to be pulled upward. In the following description, drawings and claims, the top of the pipette is taken as the end opposite the liquid outlet nozzle. Hence a downward movement is towards this nozzle, and an upward movement is away from this nozzle. The pipette has a transfer means extending below the gripping means and joined to this and preferably also associated with a separate push button. The pipette body may have a longitudinal gap partly open at least on one side for the cylinder and the piston.

The transfer means is spring-operated so that it will always return to its original position after the transfer movement.

The transfer means is movable in the longitudinal body direction so that the top position of the transfer means also corresponds with the top position of the gripping means. The transfer means is preferably on one side of the body. Hereby the opposite side of the body may have an open gap through which an exchangeable cylinder and piston can be mounted.

The transfer means is also preferably joined to an

operating lever articulated to the body and articulated to the transfer means.

The pipette also has a stroke length control means.

A point vessel into which liquid is drawn can be used at the cylinder end. However, the cylinder may function at the same time also as a liquid container and both the cylinder and the piston can be exchangeable.

The pipette can be provided, for example, with a spring means for pulling the piston upward. However, a step pipette is preferably only provided with a piston knob for pulling the piston upward by hand. Then the body is preferably provided with a stop to prevent the piston from escaping from the cylinder. In addition, the pipette may have equipment for controlling the liquid volume to be drawn into the pipette.

In a step pipette one transfer movement of the transfer means transfers the piston downward only by a stroke of a certain length out of the entire distance of the piston movement. Thus, the liquid volume drawn into the pipette is discharged from the pipette in several smaller doses. The stroke length control means may have, for example, a stop which moves in the body direction and which limits the upper position of the striker.

In the pipette of the invention a spring is connected to the gripping means for pressing down the moving gripping means against the piston rod. The device is also preferably provided with a releaser automatically to release the gripping means from the piston when the gripping means is in its top position in relation to the piston, whereby the piston can be easily pulled up to its top position.

Some applications of the invention are described in the following as examples. In the drawings of the description

- Figure 1 shows a step pipette according to the invention in the initial dosing position,
- Figure 2 shows the pipette of Figure 1 in the end position,
- Figure 3 shows another step pipette, in accordance with the present invention,
- Figure 4 is a top view of the control equipment of the pipettes in Figures 1 - 3.

The main parts of the pipettes given as examples are body 1, cylinder 2 and therein piston 3 as well as striker 4, which functions as a transfer means, and connected to this gripping means 5 and operating lever 6.

The body has a longitudinal gap 7. At the lower body end the gap is open only to one side of the body, but at the upper end the gap extends through the body forming a sliding slot for the rod of piston 3. At the lower body end hole 8 forms an extension to the gap. At the upper end an end stop 9 closes the gap.

The cylinder and piston 3 are placed in gap 7 so that the cylinder head extends out of hole 8 at the lower body end. At the top end of the cylinder there is a peak-

like flange 10, which at the mid-point of the body is pushed into a transverse groove 11 opening to the open side of the gap. In this way the cylinder is prevented from moving in a longitudinal direction. The piston has a rod emerging at the upper cylinder end which at its end in a sliding slot has a pulling knob 12 with edges extending from the gap to the sides of the body. Liquid is drawn into the cylinder by pulling the piston upward at the knob. Stop 9 at the top end of the sliding slot prevents the piston from being pulled out of the cylinder by mistake. The figures show the piston both in its top and lower positions.

The top end of the striker 4 has gripping means 5 running in a sliding slot, which co-operates with the rod of piston 3 and which when moving downward will grip the piston rod and move it downward, but which when moving upward is free of the piston rod, thus not moving the piston.

In the pipette according to Figures 1 and 2 the rod of piston 3 is provided on the striker side with teeth 13 and the gripping means 5 is a sharp cam pressing obliquely from above into these teeth. In this way the gripping means is made to operate more reliably, but control can only be arranged stepwise. The teeth are made easily at the same time as the piston.

The striker is connected together with a spring 14, which forces the striker upward against end 21 in the sliding slot. This stop end is chamfered at the top and thus it lifts gripping means 5 off the rod of piston 3 when the gripping means is forced to its top position.

In the pipette according to Figures 1 and 2 spring 14 is a draw-spring having one end attached to the striker 4 and the other end to a control rod 20 located at the top body end.

At the lower end of the striker 4 there is also a striker operating lever 6 articulated at point 17 with its other end articulated at a lower point 18 in the body. The free lever end is bent downward before actuating the lever to move the piston downwards. The turning point of the lever in the striker is closer to the body than the support point of the lower end of spring 14. In this way the spring pulls the striker both upward against end 21 and inward against the rod of piston 3. By pressing at operating lever 6 the piston is made to move a step at a time downward.

In the pipette according to Figures 1 and 2 the top body end has a control rod 20 movable lengthwise of the body. Its lower end 21 works as a cam to lift the top end 22 of the striker off the teeth 13 when the striker is in its top position. Gripping means 5 is located on the striker at an interval from its top end. Thus, the position of the control rod determines at which point the gripping means will engage with the teeth. At the top end of the control rod a transverse pin 23 is fitted to move in a cam groove rotating eccentrically in control disc 24. The rod position can thus be controlled - by rotating the disc. The body and control disc are provided with a scale from which the volume corresponding to a dosing stroke

can be read. Plate 16 covers spring 14 and the control rod 20.

Figures 1 and 2 also show the shape of piston 3 which corresponds to the cylinder 2 shape narrowing conically from below sealing point 25. Groove 7 here extends all the way to the lower body end.

In the pipette according to Figure 3 the lower end 21' of control rod 20 functions as a stop for the top position of striker 4. In its top position the striker rises to disengage from teeth 13 with the aid of cam 26 located on one side of the teeth. This gives the advantage that there is no idle motion during the early stroke, because gripping means 5 engages with the teeth at once as the striker leaves its top position. In addition, the position of lever 6 gives a clear picture and feel of the volume to be dosed. In the pipette according to Figures 1 - 3 spring 14 pulls control rod 20 downward. In the groove in control disc 24 there is a recess at each place corresponding to a volume to be set and pin 23 comes to rest in this recess (Fig. 4).

The pipette according to the invention is gripped like a pencil and operating lever 6 is pushed with the forefinger. The pipette can thus be brought very precisely even to a small object. Dosing too is easy.

The pipette is especially suitable for use, for example, in certain immunofluorescence determinations performed with glass plates, where liquid must be dosed onto very small areas. When dosing, the hand may also be supported against the table, which is not possible when using conventional pipettes.

The pipette is also very suitable for glueing requiring high precision, for example, in assembly jobs. Nowadays glue is usually dosed from a compressible bottle in such jobs. Using a pipette according to the invention is much easier and the doses are essentially more exact. Nor will the glue dry in the cylinder as easily as in a bottle.

Decisive factors relating to the general design of the pipette are in particular the pipette size, the desired draw-in volume, the required dosing precision, the special nature of the liquid (for example, viscosity) and on what kind of object and in what doses the liquid will be dosed.

## Claims

1. Piston pipette having a longitudinal body (1) provided with a cylinder space and functioning as a handle and having a top end and a lower end, in the cylinder space a cylinder (2), having a pointed lower end emerging from the lower body end and provided with an opening for liquids; in said cylinder (2) a piston (3); pulling means (12) for moving the piston (3) upward in the cylinder (2), transfer means (4) and attached thereto gripping means (5) for moving the piston (3) downward in the cylinder (2), **characterized** in that said piston (3) has a piston rod emerging at the upper end of said cylinder

space, and in that the pipette further comprises a control rod (20) for determining the position of engagement of said gripping means (5) with said piston rod; and in that a spring (14) is attached to said transfer means (4) and to said control rod (20), which spring (14) is arranged to pull transfer means (4) with gripping means (5) both in the direction of the top end of the body (1) and towards said piston rod as the transfer means (4) are moved towards the lower end of the pipette.

2. Pipette as defined in claim 1, **characterized** in that the piston rod has teeth (13) and that the gripping means (5) is a cam matching with said teeth (13).
3. Pipette as defined in claim 1 or 2, **characterized** in that it has a stop (21; 21') for lifting the gripping means (5) off the piston rod in the top position of the gripping means (5), enabling the piston (3) to be pulled freely to its top position.
4. Pipette as defined in any one of claims 1 to 3, **characterized** in that a movement of the gripping means (5) downward pushes the piston (3) downward only over a part of the entire distance available to the piston (3).
5. Pipette as defined in claim 4, **characterized** in that the body (1) has a stop (9) for limiting the top position of the movement of the piston (3).
6. Pipette as defined in any one of claims 1 to 5, **characterized** in that at least one of the cylinder (2) and the piston (3) are exchangeable.
7. Pipette as defined in claim 6, **characterized** in that there is a longitudinal gap (7) in the side of the pipette body (1).
8. Pipette as defined in claim 7, **characterized** in that said gap (7) is on the body side opposite to the transfer means (4).
9. Pipette as defined in claim 7 or 8, **characterized** in that the top end of said cylinder (2) has a flange (10) and the body (1) has a corresponding transverse groove (11) into which said flange (10) is pushed.
10. Pipette as defined in any one of claims 1 to 10, **characterized** in that the piston rod end is provided with a pulling knob (12).
11. Use of a pipette as defined in any one of claims 1 to 10 for dosing liquid.
12. Use as defined in claim 11 in immunofluorescence determinations.

13. Use as defined in claim 11 wherein said liquid is glue.

#### Patentansprüche

1. Kolbenpipette mit einem langgestreckten Körper (1), der einen zylindrischen Raum aufweist und als Handgriff dient und ein oberes und ein unteres Ende aufweist, wobei in dem zylindrischen Raum ein Zylinder (2) vorgesehen ist mit einem aus dem unteren Ende des Körpers austretenden, zugespitzten unteren Ende, das mit einer Öffnung für Flüssigkeiten versehen ist; einem Kolben (3) im Zylinder (2); einem Zugmittel (12), um den Kolben (3) im Zylinder (2) aufwärts zu bewegen, einem Übertragungsmittel (4) und einem daran angebrachten Eingriffsmittel (5), um den Kolben (3) im Zylinder (2) abwärts zu bewegen, dadurch **gekennzeichnet**, daß der Kolben (3) eine am oberen Ende des zylindrischen Raums austretende Kolbenstange aufweist, und daß die Pipette darüberhinaus eine Steuerstange (20) aufweist, um die Stelle des Eingriffs des Eingriffsmittels (5) mit der Kolbenstange zu bestimmen; und daß eine Feder (14) am Übertragungsmittel (4) und an der Steuerstange (20) befestigt ist, die vorgesehen ist, um das Übertragungsmittel (4) zusammen mit dem Eingriffsmittel (5) in Richtung des oberen Endes des Körpers (1) und gegen die Kolbenstange zu ziehen, wenn das Übertragungsmittel (4) zum unteren Ende der Pipette hin bewegt wird.
2. Pipette nach Anspruch 1, dadurch gekennzeichnet, daß die Kolbenstange eine Verzahnung (13) aufweist und das Eingriffsmittel (5) eine der Verzahnung (13) angepaßte Nocke ist.
3. Pipette nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß sie zum Abheben des Eingriffsmittels (5) in dessen oberster Position von der Kolbenstange einen Anschlag (21; 21') aufweist, wodurch der Kolben (3) frei in seine oberste Stellung gezogen werden kann.
4. Pipette nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß eine nach unten gerichtete Bewegung des Eingriffsmittels (5) den Kolben (3) nur um einen Teil des dem Kolben (3) zur Verfügung stehenden Gesamtweges nach unten schiebt.
5. Pipette nach Anspruch 4, dadurch gekennzeichnet, daß der Körper (1) zur Begrenzung des Kolbenweges an der obersten Stellung einen Anschlag (9) aufweist.
6. Pipette nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß der Zylinder (2) und/oder der Kolben (3) austauschbar ist.

7. Pipette nach Anspruch 6, dadurch gekennzeichnet, daß sich seitlich am Körper (1) der Pipette ein Längsspalt (7) befindet.

- 5 8. Pipette nach Anspruch 7, dadurch gekennzeichnet, daß sich der Spalt (7) an der dem Übertragungsmittel (4) gegenüberliegenden Körperseite befindet.
- 10 9. Pipette nach Anspruch 7 oder 8, dadurch gekennzeichnet, daß das obere Ende des Zylinders einen Flansch (10) und der Körper (1) eine entsprechende Quernut (11) aufweist, in die der Flansch (10) eingeschoben ist.
- 15 10. Pipette nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß das Ende der Kolbenstange mit einem Ziehknopf (12) versehen ist.
- 20 11. Verwendung einer Pipette nach einem der Ansprüche 1 bis 10, zum Dosieren von Flüssigkeit.
- 25 12. Verwendung nach Anspruch 11 zu Immunofluoreszenz-Bestimmungen.
- 25 13. Verwendung nach Anspruch 11, wobei die Flüssigkeit Klebstoff ist.

#### Revendications

- 30 1. Pipette à piston comprenant un corps longitudinal (1) muni d'un espace cylindrique, servant de poignée et ayant une extrémité supérieure et une extrémité inférieure, un cylindre (2) s'étendant dans l'espace cylindrique et ayant une extrémité inférieure pointue sortant de l'extrémité de corps inférieure et munie d'une ouverture destinée aux liquides ; un piston (3) situé dans ledit cylindre (2) ; un moyen de traction (12) permettant de déplacer le piston (3) vers le haut dans le cylindre (2), un moyen de transfert (4) et un moyen de saisie (5) fixé sur celui-ci permettant de déplacer le piston (3) vers le bas dans le cylindre (2), caractérisée en ce que ledit piston (3) présente une tige de piston qui sort au niveau de l'extrémité supérieure dudit espace cylindrique, en ce que ladite pipette comprend en outre une tige de commande (20) permettant de déterminer la position d'engagement dudit élément de saisie (5) avec ladite tige de piston ; et en ce qu'un ressort (14) est fixé audit moyen de transfert (4) et à ladite tige de commande (20), lequel ressort (14) est agencé de façon à tirer le moyen de transfert (4) avec le moyen de saisie (5) à la fois en direction de l'extrémité supérieure du corps (1) et vers ladite tige de piston à mesure que le moyen de transfert (4) est déplacé vers l'extrémité inférieure de la pipette.
- 55 2. Pipette selon la revendication 1, caractérisée en ce

que la tige de piston présente des dents (13) et en ce que le moyen de saisie (5) est une saillie coopérant avec lesdites dents (13).

3. Pipette selon la revendication 1 ou 2, caractérisée en ce qu'elle comprend un butoir (21 ; 21') pour décoller le moyen de saisie (5) de la tige de piston dans la position supérieure du moyen de saisie (5), ce qui permet au piston (3) d'être tiré librement jusqu'à sa position supérieure. 5  
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4. Pipette selon l'une des revendications 1 à 3, caractérisée en ce qu'un mouvement du moyen de saisie (5) vers le bas pousse le piston vers le bas (3) uniquement sur une partie de la distance totale disponible du piston (3). 15
5. Pipette selon la revendication 4, caractérisée en ce que le corps (1) présente une butée (9) pour limiter la position supérieure de la course du piston (3). 20
6. Pipette selon l'une des revendications 1 à 5, caractérisée en ce qu'au moins le cylindre (2) ou le piston (3) est échangeable. 25
7. Pipette selon la revendication 6, caractérisée en ce qu'il y a un interstice longitudinal (7) sur le côté du corps de pipette (1).
8. Pipette selon la revendication 7, caractérisée en ce que ledit interstice (7) se trouve du côté du corps opposé au moyen de transfert (4). 30
9. Pipette selon la revendication 7 ou 8, caractérisée en ce que l'extrémité supérieure dudit cylindre (2) présente une saillie (10) et en ce que le corps (1) présente une rainure transversale correspondante (11) dans laquelle est insérée ladite saillie (10). 35
10. Pipette selon l'une des revendications 1 à 10, caractérisée en ce que l'extrémité de tige de piston est munie d'un bouton de traction (12). 40
11. Utilisation d'une pipette selon l'une des revendications 1 à 10 pour doser un liquide. 45
12. Utilisation selon la revendication 11 pour des déterminations d'immunofluorescence.
13. Utilisation, selon la revendication 11, dans laquelle ledit liquide est de la colle. 50

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