(12) UK Patent Application (19) GB (11) 2 075 672 A

(21) Application No **8012597**
(22) Date of filing
17 Apr 1980
(43) Application published
18 Nov 1981
(51) **INT CL³ G01N 1/14**
(52) Domestic classification
G1B CM
(56) Documents cited
GB 1435374
GB 1321568
(58) Field of search
G1B
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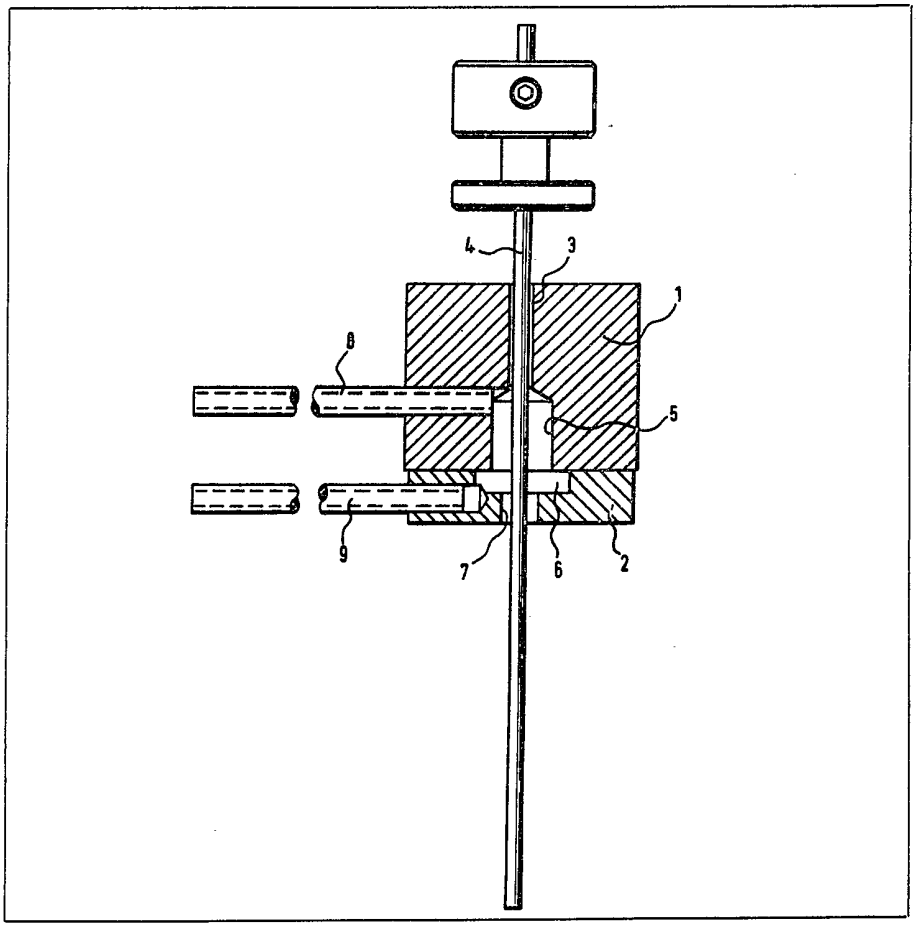
(54) **Washpot for use with sampling probe**

(57) A washpot has a wash chamber 5 into which a reciprocable sampling probe 4 may be retracted so as to aspirate wash liquid into the probe and also to rinse the outside of the probe. To avoid the necessity for a seal on the outside of the probe to prevent leakage of the wash chamber 5 is so dimensioned that in use wash liquid fed *via* a line 8 will bridge the gap between the open end of the probe 4 and the end of line 8 when the probe is in the wash or upper position. The chamber 5 thus does not run in the wash mode. The clearance round the probe 4 in the upper passage 3 is minimal to prevent significant upward leakage of the wash liquid and an enlarged connecting chamber 6 connected to an aspirating exhaust line 9 prevents downward leakage. Passage 7 is large enough to allow droplets of sample on the outside of the probe 4 to be carried into the wash chamber.



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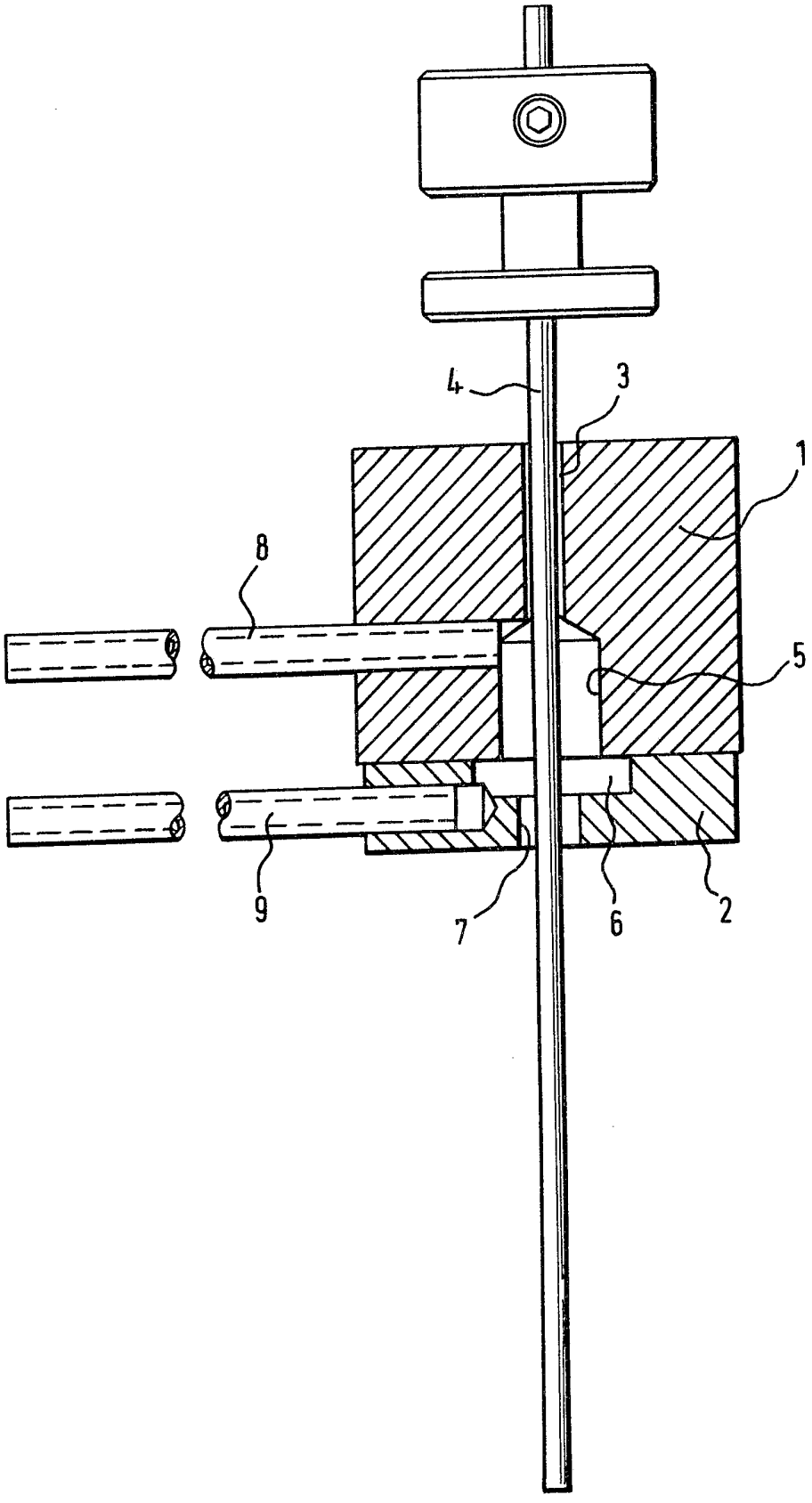

SPECIFICATION

Washpot

This invention relates to washpots for supplying probes of the type comprising a small bore tube or cannula intended to have a section applied at one end and to have the other end exposed alternately to a sample in a sample container and to a wash liquid so that sample and wash liquid are drawn alternately through the cannula. This prevents intermixing and cross contamination of the samples.

The successive samples are subjected to analysis and testing.

One prior form of such a sampling probe, which is still in commercial use on a substantial scale, includes mechanism for reciprocating the cannula axially alternately to dip into and withdraw from a sample cup or a wash container and also for swing it bodily about an axis to translate it between the sample cup and the wash container. Such a motion requires a complex mechanical drive and also entails a comparatively long time between successive sampling actions.

In order to provide a simpler mechanical action, and reduce the time interval between samples, we have been using a wash container or washpot in the form of a reservoir chamber having an inlet for washing liquid and a upper and lower outlets, the cannula extending through the upper outlet and being axially reciprocable between a wash position in which its lower end is within the reservoir chamber and a sample position in which the lower end extends through the lower outlet so as to extend into a sample cup when such is located below the said lower outlet. A sealing member is slidably carried on the cannula to seal the upper outlet in the wash position and the lower outlet in the sample position of the cannula, and a suction zone is provided below the lower outlet adapted to be connected to a source of vacuum to prevent washing liquid passing from the lower outlet into a sample cup below the lower outlet.

This arrangement has worked satisfactorily in commercial use, but the provision of a slidable seal, in the form of a small O-ring on the cannula, leads to some degree of operating constraint since the seal is liable to wear or deteriorate in use and needs to be replaced periodically so that the interior of the wash pot has to be accessible and therefore at least theoretically liable to leakage. Also, in practice, the arrangement necessitates the use of a suction line to draw off wash liquid passing through the lower outlet and an overflow line to take off surplus wash liquid passing through the upper outlet during the wash part of the cycle. An important function of the pot is also to wash the outside of the cannula so that adhering droplets of sample are washed off and are not carried into the next sample.

The washing of the outside of the cannula, as distinct from aspiration of wash liquid into the interior thereof, has been achieved by means of sample washpots having a liquid feed line and a suction line to draw off the fed in liquid without allowing any of it to fall out through a lower outlet. In such arrangements only a limited flow of wash liquid has to be provided since more is aspirated into the cannula and hence the risk of surplus liquid overflowing from the washpot when such aspiration is not taking place is not so great.

According to the present invention, there is provided a wash pot for use with a cannula axially reciprocable between a sample position in which the cannula extends axially through the wash pot and a wash position in which it aspirates wash liquid from the wash pot, the wash pot comprising a wash chamber communicating with an upper passage through which the cannula is arranged to pass with minimal clearance, a wash liquid supply lines communicating with an upper region of the wash chamber, a collection chamber formed as a continuation of the lower end of the wash chamber, a wash liquid draw-off line communicating with the collection chamber and a lower passage to accommodate movement of the cannula, in which the dimensions of the wash chamber are chosen so that while the cannula is in the upper or wash position the flow of wash liquid is able to bridge the gap between the outlet from the supply line and the lower end of the cannula without filling the wash chamber.

The collection chamber may be an annular chamber of larger diameter than the wash chamber and coaxial therewith so that the wash liquid tends to flow down the walls of the wash chamber and outwardly towards the wall of the collection chamber for drawing off by the suction in the draw off line.

The lower passage preferably has rather more than minimal clearance round the cannula to avoid droplets adhering to the outside of the cannula being wiped off as the cannula is drawn into the wash chamber.

The invention further includes the combination of the wash pot according to the invention as set forth above and the cooperating cannula.

The invention will be further described with reference to the accompanying drawing of which the single figure is a sectional view somewhat oversize of a preferred form of wash pot, with its cannula, according to the present invention.

The drawing shows a body 1 of the washpot which may for instance be made of polyvinylchloride. Securely bonded to the body 1 or possibly ultrasonically welded to it in a coaxial relationship is an end cap 2 of the same material. The body 1 has an upper passage 3 which receives a cannula 4 with minimal clearance. This passage is of considerable

length so that it represents a considerable barrier to leakage. The passage 3 opens out into a wash chamber 5 substantially coaxial with the cannula 4 and extending to the bottom edge of the body. The end cap is formed with an annular collecting chamber 6 which is of rather larger diameter than the wash chamber 5 and in continuation of it, and this is in communication with a lower passage 7 which has a substantial clearance round the cannula 4. A wash liquid supply tube 8 is securely bonded with a suitable adhesive into a radial passage in the body 1 and communicates with the upper end of the wash chamber 5. A wash liquid draw-off tube 9 is securely bonded within a radial passage in the end cap 2 and communicates with the lower end of the collecting chamber 6. In use, the wash pot illustrated will normally be connected to a peristaltic or other pumping arrangement so that wash liquid is supplied along the tube 8 and a more than adequate suction is applied at the tube 9 to draw-off the whole of the flow of liquid supplied along the tube 8. A suction will also be applied at the upper end of the cannula 4 which is reciprocated by means not shown between the position illustrated in which the lower end of the cannula will be in a sample cup to draw a sample for passage to automated analysis equipment. When the sample has been drawn, the cannula will be lifted to a position in which the lower end of the cannula 4 is substantially level with the tube 8 in the upper end of the wash chamber 5. During this upward movement, the wash liquid being circulated through the wash chamber 5 between the tubes 8 and 9 will wash the outside of the cannula, and it is to be noted that the passage 7 is of such dimension that droplets of sample which may cling to the outer surface of the cannula will not be wiped off as the cannula is drawn upwards into the wash chamber. However, the size of the passage 7 is such that the liquid flowing in the wash chamber does not leak downwards through it but is drawn-off *via* the collecting chamber 6. This effect is assisted by the enlargement of the diameter of the chamber 6 as compared with the chamber 5 as this slows down the liquid flow rate and also surface tension of the liquid tends to draw it outwardly into the annulus. As the end of the cannula enters the collection chamber and wash chamber, the suction in it aspirates wash liquid into the cannula rather than allowing it to be drawn off *via* the collection chamber and tube 9, and the wash chamber is of such small dimension that the liquid being fed in along the tube 8 tends to bridge straight across into the cannular 9 without filling the chamber, under the combined influences of the suction in the cannula and the surface tension of the liquid. Occasional droplets tend to fall and run down the wall of the chamber 5 and into the collecting chamber 6.

On subsequent downward movement of the cannula, the chamber 5 refills and the wash liquid flows out through the tube 9.

As an indication of the dimensions which are to be used, it is envisaged that the clearance between the cannula 4 and the wall of the wash chamber 5 should be in the region of .008 inches (0.20 mm) as opposed to the conventional washpot which had a clearance of about twelve times this. The overall height of the body and end cap would for instance be in the region of 0.625 inches (15.9 mm) and its diameter would be substantially similar. The axes of the tubes 8 and 9 would for instance be spaced by 0.25 inches (6.35 mm) and the outside diameters of the tubes 8 and 9 could be .074 inches (1.89 mm).

A further operating advantage of this wash pot, in addition to the avoidance of the use of an O-ring which increases the maintenance problems and makes it necessary for the end cap to be removable, is the fact that it is now no longer necessary when starting up to ensure that the washpot is full in order to be certain that aspiration of wash liquid into the cannula 4 will take place. Also, it is no longer necessary to make the wash pot of transparent or translucent material as inspection for fullness is not required.

Various modifications may be made within the scope of the invention.

CLAIMS

1. A washpot for use with a cannula axially reciprocable between a sample position in which the cannula extends axially through the washpot and a wash position in which it aspirates wash liquid from the washpot, the washpot comprising a wash chamber communicating with an upper passage through which the cannula is arranged to pass with minimal clearance, a wash liquid supply line communicating with an upper region of the wash chamber, a collection chamber formed as a continuation of the lower end of the wash chamber, a wash liquid draw-off line communicating with the collection chamber and a lower passage to accommodate movement of the cannula, in which the dimensions of the wash chamber are chosen so that while the cannula is in the upper or wash position the flow of wash liquid is able to bridge the gap between the outlet from the supply line and the lower end of the cannula without filling the wash chamber.

2. A washpot as claimed in claim 1, in which the collection chamber is an annular chamber of larger diameter than the wash chamber and coaxial therewith so that the wash liquid tends to flow down the wall of the wash chamber and outwardly towards the wall of the collection chamber for drawing off by the suction in the draw off line.

3. A washpot as claimed in claim 1 or 2

in which the lower passage has a sufficient clearance round the cannula to avoid droplets adhering to the outside of the cannula being wiped off as the cannula is drawn into the wash chamber.

4. A washpot substantially as hereinbefore described with reference to the accompanying drawing.

5. A washpot as claimed in any of claims 1 to 4, in combination with an axially reciprocable cannula.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1981.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.