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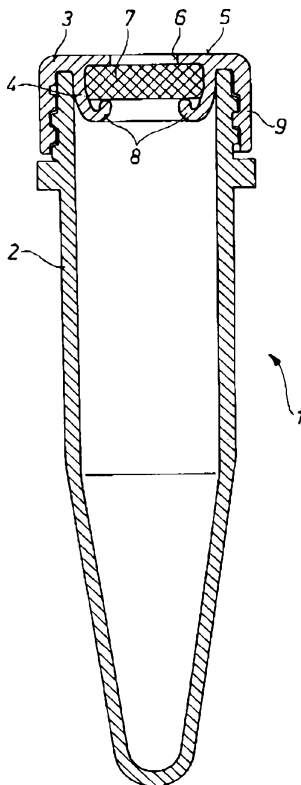
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[Fortsetzung auf der nächsten Seite]

(54) **Title:** SAMPLE VESSEL FOR ACCOMMODATING SMALL AMOUNTS OF LIQUID FOR ANALYSES

(54) **Bezeichnung:** PROBENGEFÄß ZUR AUFNAHME VON KLEINEN FLÜSSIGKEITSMENGEN FÜR ANALYSEN



(57) **Abstract:** In a sample vessel (1) for accommodating small amounts of liquid for analyses, consisting of a tube (2) closed at one end and closable with sealing at the other open end by a closure cap (3) which can be pierced by a tip of a withdrawal cannula, the closure cap (3) is designed with an externally flat, even top wall (5) and a membrane disk (7) which is inserted from the bottom so as to rest on the inner surface of the top wall (5) and is held supported there.

(57) **Zusammenfassung:** Bei einem Probengefäß (1) zur Aufnahme von kleinen Flüssigkeitsmengen für Analysen, bestehend aus einem an seinem einen Ende geschlossenen und an seinem anderen, offenen Ende durch eine von einer Spitze einer Entnahmekanüle durchstechbaren Verschlusskappe (3) abgedichtet verschließbaren Röhrchen (2) ist die Verschlusskappe (3) mit einer außen flachen, ebenen Kopfwand (5) und von unten mit Anlage an die Innenfläche der Kopfwand (5) eingelegter und dort abgestützt gehaltener Membranscheibe (7) ausgebildet ist.

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Veröffentlicht:

- mit internationalem Recherchenbericht
- vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

SPECIMEN TUBE FOR HOLDING SMALL QUANTITIES OF LIQUIDS FOR ANALYSIS

The invention relates to a specimen tube for holding small quantities of liquids for analysis, consisting of a tube that is closed at its one end and that at its other open end can be securely sealed by a cap that can be pierced by the tip of an aspiration needle.

From DE 103 40 538 such specimen tubes or recipients are known in different designs. All the caps by means of which the open end is closed are pierceable sealing plugs extending with a cylindrical sealing section into the open end of the tube and sealed against the inner wall of the tube. They are suitable for a fully automatic withdrawal of analysis samples, where an insert made of rubber/caoutchouc or an elastomer that is mounted from the top and can be pierced by the tip of an aspiration needle is provided inside the sealing plug. This insert of the sealing plug consisting of a material that is completely resilient can be easily pierced by the aspiration needle of the analysis device, the piercing opening that is formed temporarily completely closing itself again after the needle has been pulled out.

Another sealing plug cap is known from the EP 0 445 707 [US 5,394,011]. The closing device that closes the open end of the specimen tube, in particular of blood specimen tubes, comprises a sealing plug cap having a particular sealing plug mounted from the top. For secure fixing of the sealing plug in the cap, a support ring or a securing ring is mounted into the cap from the outer, free front face.

These so-called closed systems are advantageous when working with biological samples since they reduce the danger of infection for the user (e.g. the transmission of germs) or avoid the contamination of the sample by the user (e.g. molecular biological contamination). The samples are labeled and often transported frozen over long distances. The labeling of the samples should preferably be applied such that it is also visible in the case of many specimen tubes tightly grouped in a storage rack.

The closed systems of the state of the art are for example used in the field of blood recovery or blood withdrawal and comprise primary recipients that can retain large quantities of blood, at least 2 ml and in most cases even considerably more. In the direct adaptation, small quantities of samples of few μ l are taken from the closed system. In these primary recipients, it is as well already known to provide screw caps having a pierceable and reclosable diaphragm (see DE 30 49 503 4,449,539). This cap that closes the withdrawal tube at its front end has an axially projecting cylindrical punch having a pierceable sealing plug and mounted from the top, that abuts on a front plate of the punch provided with a central bore and that is supported by a beaded flange. This projecting element prevents the cap surface from being provided with a labeling or a sample label.

The described closed systems of primary recipients of large volumetric capacity are not suitable for handling tubes with sample quantities in secondary recipients that are considerably smaller than 2 ml. For analysis on chromatography devices, it is

therefore common to transfer the sample and the reagent from the original recipient by means of a pipette and thus in the open into the analysis recipient of the chromatography device. In the molecular biological working, the specimen tubes have to be opened repeatedly for adding reagent or for taking out some of the sample.

Each of the three mentioned systems has the disadvantage that the used sealing plugs that are made of elastomeric material are inserted and fixed from the top, i.e. from the front. Due to this fact, no planar front face of the closure suitable for labeling of the sample is present.

The invention therefore has the object of providing a specimen tube of the type described above by means of which a closed system and at the same time, a visible labeling of the sample is possible even in the case of a small quantity of liquid.

This object is attained according to the invention by the fact that the sealing cap has a planar end wall that is flat on its outer face and that has a diaphragm disk inserted from the bottom and bearing on the inner face of the end wall. This way, a closure that is suitable for standard specimen tubes is provided that can be designed as a closure for a screw cap or a sealing plug cap and in which the complete outer surface of the cap or the end wall can be used without limitations, so that it can be provided with a label or a foil or the like without any of problems encountered inevitably in the common diaphragm disks that are inserted into a big opening. The pierceable diaphragm disk that is inserted from the bottom or from inside and is freely accessible for an aspiration needle from the outside, possibly by means of an

piercing opening having a small diameter, that enables easy input or output of samples or reagents, whereby also in the case of repeated removal, the diaphragm disk cannot be pressed out of the closure, since it is firmly held in its position in the closure cap.

5 This support or holding of the diaphragm washer can for example be achieved by means of an inner flange that is beaded over to the inside of the closure cap and/or a punched disk that is inserted into the inner flange and supported by it, both supporting the diaphragm disc. In this case, the diaphragm disk that is
10 preferably made of gum cannot be pressed upward out of the inner flange. The flange can be advantageously fabricated by hot forming of the extremity of the inner flange.

An advantageous design of the invention provides that the end wall of the closure cap is designed with a plastic diaphragm
15 that covers a piercing opening of the end wall of the closure cap. In this design as well, a planar flat outer surface of the closure cap is present that can be fully used and, by means of the thin foil, it is at the same time provided with contamination
protection.

20 Further details and features of the invention are seen the claims and the following description of illustrated embodiments of the invention that are shown in the drawings in an enlarged scale. In the drawings,

25 FIG. 1 shows a longitudinal section of a total view of a specimen tube for small quantities of liquids, closed by a sealed cap, here designed as a screw cap with an internal pierceable diaphragm disk; and

FIG. 2 shows in detail in longitudinal section another design of a screw cap closure.

A specimen tube shown in FIG. 1 consists of a tube 2 that is closed on manufacture at its one end for holding a small quantity of liquid. At its upper end the tube 2 can be closed temporarily by means of a closure cap 3 that can be screwed such that it is hermetically sealed and that is referred to as a screw cap closure in the following.

The screw cap closure 3 has an inner flange 4 and concentrically to the flange a small piercing opening 6 in its end wall 5. From the inside or from the bottom, a pierceable diaphragm disk 7 is inserted into the screw cap closure 3 in the inner flange 4 and abuts the inner face of the end wall 5. It is securely held in position by a rim 8 that is a hot-formed with the inner flange 4.

For sealing the screw cap closure 3, a sealing bead can be provided that maintains a position of the closure due to which it is liquid-tight even in the case of a possible slight overpressure that can e.g. occur when reagents are added.

Alternatively, it is possible to provide a closure that seals against liquids by utilization of O-rings, seal lips, seal disks or the like.

The screw cap closure 3 described in the FIG. 2 is different from the above-described design in that the piercing opening 6 is covered by a thin plastic diaphragm 10 that only has the thickness of a foil or for example a thickness of 0.1 mm.

The screw caps 3 have in common that they close a tube 2 for small quantities of samples that does not have to be opened for the repeated removal of a part or a partial quantity of the sample or for multiple additions of reagents. The insertion position of the highly elastic, resilient diaphragm washer 7 that can be easily pierced by a needle is still tight even in the case of repeated piercing or pulling out of a cannula or needle for taking samples, and the membrane washer 7 can also not be pressed out of the screw cap closing 3. First of all, due to the mounting of the diaphragm disk 7 from the bottom, a planar even outer surface of the end wall is presented, and thus, a sufficiently large surface for the application of a label of the sample. This is also the case in the design as a screw cap closure with a piercing closure that can be covered by a plastic diaphragm.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion
5 of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference to any prior art in this specification is
10 not and should not be taken as an acknowledgement or any form of suggestion that the prior art forms part of the common general knowledge.

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The claims defining the invention are as follows:

5 1. A specimen tube for holding a small quantity
of liquid for analyses, including a tube closed at one
end and having an opposite open end provided with a
closure cap having an inner flange, through which a point
of a withdrawal needle can be pierced, wherein the
closure cap is formed with an outside planar and flat end
10 wall and has a pierceable diaphragm disk inserted from
below into the closure cap and bearing inward and pressed
against an inner face of the end wall, and wherein the
pierceable diaphragm disk is securely held in position by
a border that is flanged by hot forming the inner flange
15 of the cap.

2. A specimen tube according to claim 1, substantially
as hereinbefore described with reference to the
accompanying Figures.

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Fig.1

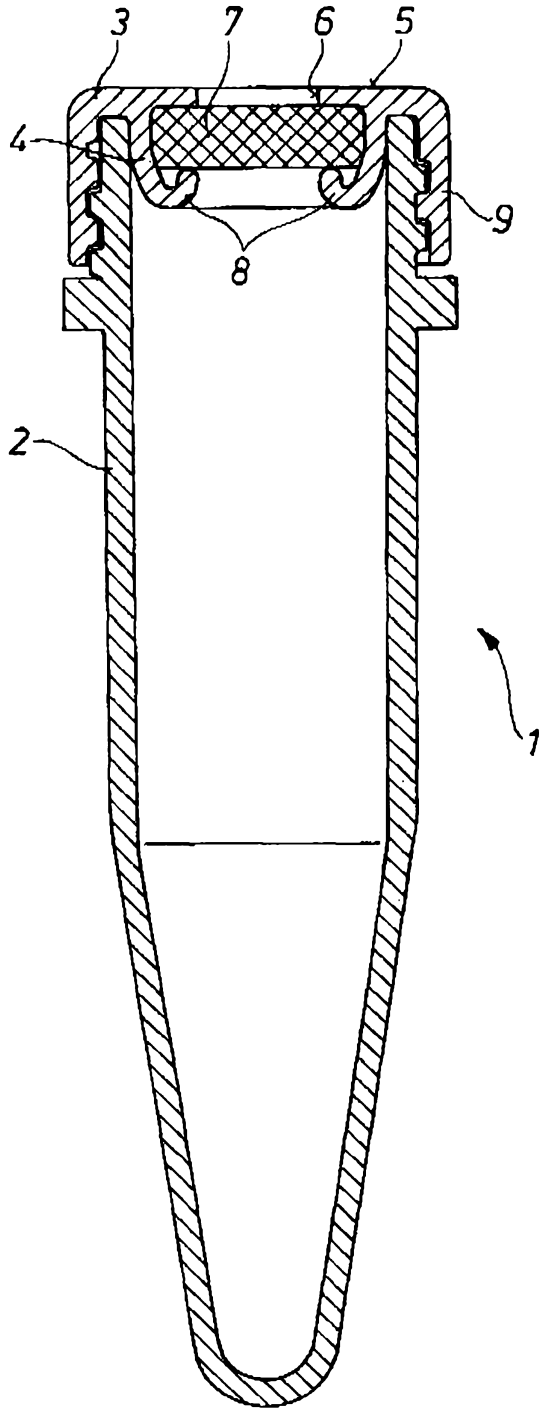


Fig.2

