

(19) **DANMARK**



Patent- og
Varemærkestyrelsen

(12)

Oversættelse af europæisk patentskrift

(10) **DK/EP 2858568 T3**

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- (51) Int.Cl.: **B 23 K 26/38 (2014.01)** **A 61 B 5/00 (2006.01)** **A 61 B 5/145 (2006.01)**
A 61 B 5/1455 (2006.01) **G 01 J 5/02 (2006.01)** **B 29 C 51/08 (2006.01)**
B 29 K 67/00 (2006.01) **B 29 K 105/00 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2016-11-14**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2016-07-13**
- (86) Europæisk ansøgning nr.: **13731024.9**
- (86) Europæisk indleveringsdag: **2013-05-24**
- (87) Den europæiske ansøgnings publiceringsdag: **2015-04-15**
- (86) International ansøgning nr.: **AT2013050112**
- (87) Internationalt publikationsnr.: **WO2013181681**
- (30) Prioritet: **2012-06-08 AT 6622012**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **Afdækningshætte og måleapparat**
- (56) Fremdragne publikationer:
EP-A1- 1 262 753
EP-A2- 0 928 969
US-A- 4 207 160
US-A- 4 303 076
US-A1- 2001 034 479
US-A1- 2007 058 692
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The invention relates to a covering cap, in particular for placing on a skin analyzer according to the preamble of claim 1. Furthermore, the invention relates to a measurement device, in particular for skin analysis according to claim 15. Furthermore, the invention relates to a method for manufacturing a covering cap according to the preamble of patent claim 23.

The background to the invention is the use of covering caps, also called hygienic caps to cover sensors of a measurement device. Such covering caps are essential for the measurement of sterile or non-sterile clean people, animals or materials without contaminating the sensors covered by the covering caps, or the measurement devices covered by the covering caps. Such covering caps are used in the prior art, such as with an infrared thermo-measurement device, wherein the infrared sensor is covered with a covering cap to protect it against contamination.

The use of covering caps serves to avoid transmitting diseases to other people or body parts. Documents US 2010/328851 and EP 1262753 disclose such covering caps and measurement devices.

However, covering caps according to the prior art suffer many disadvantages. On the one hand, there is the problem that known covering caps require a lot of space and are difficult to fold. Further, there is also a problem in hygienically handling covering caps, and achieving a perfect fit of the hygienic cap, in particular, the tensioning of the covering cap to protect sensitive parts of a measurement device. Furthermore, there is a problem in the disposal of a covering cap without touching it.

It is known from the prior art that hygienic caps are manufactured from material that is as uniform and equally thick as possible, preferably polyethylene or polypropylene, wherein the upper surface region of each covering cap is thinned in the region of the end wall, through which the infrared beam characterizing the respective temperature penetrates by means of a Mikroton measurement device or by means of laser.

Furthermore, the thinning of the surface in the region of the end wall may also be effected by extrusion of a melt with subsequent insertion of a film.

5 The covering caps thus obtained are very stiff, making it difficult on the one hand, to tension the covering caps over the measurement device, while also making it impossible for space-saving recycling through folding and squeezing into a flat-shaped object.

10 Thus, the object of the invention is to provide a covering cap that advantageously covers the measurement device, is optimally adapted to the shape of the measurement device, and may be disposed of easily and with little volume. The invention solves this problem with a cap of the aforementioned type with the characterizing features of claim 1.

15 Another object of the invention is to provide an advantageous method for manufacturing a covering cap. The invention solves this problem with the method of the aforementioned type with the characterizing feature of claim 23.

20 It is a further object of the invention to provide a measurement device with a covering cap according to the invention that enables advantageous and non-contact disposal. The invention solves this problem with a measurement device of the aforementioned type with the characterizing features of claim 15.

25 According to the invention, a covering cap, in particular for placing on a skin analyzer, comprises an end wall bounded by a circumferential edge as well as a casing wall connecting to the circumferential edge of the end wall, wherein the end wall is designed to be gas-permeable.

30 A special development of the invention provides that the casing wall has at least a circumferential section whose thickness is less than the thickness of the casing wall in the section of the end of the casing wall facing away from the end wall.

A certain flexibility in the region of the circumferential portion results from this measure, enabling the optimal adaptation of the covering cap to the respective measurement device.

- 5 Generally speaking, it is advantageous with any type of covering cap, in particular for all the above-mentioned embodiments of the invention, if the end wall comprises, at least at one point, a thickness in the range of less than 100 μm , preferably between 0.1 μm and 20 μm , particularly between 5 μm and 10 μm . This makes it possible to create an end wall through which the gases may diffuse,
10 while a covering cap may also protect the sensor against harmful substances, without affecting the overall operation of the measurement device, as, due to the form of the end wall, the substances to be measured may diffuse through this.

- In particular, it may be provided that the end wall in particular has a constant
15 thickness. This enables particularly accurate measurements.

- To increase the stability as well as the resistance of the covering cap, it may be provided that a base wall extends to the casing wall at the end facing the end wall, in particular continues in one piece and preferably parallel or inclined out-
20 wards from the casing wall towards the end wall at an angle of at most 10° , in particular at an increasing standard distance to the end wall, wherein the base wall is preferably of a circular ring-shaped form, and in particular comprises an outer radius of between 2 mm and 50 mm and/or an inside radius between 1 mm and 45 mm and/or a circular ring width of 0.55 mm to 35 mm.

- 25 A particularly advantageous adaptation to measurement devices with an ejection device or discharge element provides that the casing wall in the area of the circumferential edge of the end wall protrudes outwards to the end wall at an angle (0) of between 20° and 95° , in particular between 60° and 80° , wherein preferably
30 the casing wall (2), widens, in particular conically.

An advantageous aspect of the connection of the covering cap to a measurement device provides that the covering cap in which the end of the casing wall facing

away from the end wall is provided with catch recesses and/or catch projections for releasable attachment to a measurement device, and/or

- that, in particular, the individual catch recesses and/or catch projections respectively have the same standard distance to the end wall and/or are evenly distributed in the circumferential direction of the casing wall, and/or wherein the total number of catch recesses and/or catch projections is two or four, and/or
- that, in particular, the catch recesses and/or catch projections protrude at an angle of 5° to 40° and/or at most 2 mm, in particular at most 0.3 mm from the casing wall or penetrate into the latter. This also makes it possible to remove the covering cap from the measurement device easily and automatically.

A further preferred aspect of the invention provides that the end wall is formed to be permeable to radiation, vapor, moisture, particles, and/or light and/or has a number of, in particular, vapor permeable or gas permeable, micro-holes. This makes it possible for the thus-formed covering cap to be used with a variety of different measurement devices.

A particularly adaptable, robust and resilient development of the invention provides that the covering cap is designed to be materially uniform and/or in one piece, and, in particular, consists of thermo-plastically or plastically deformed or deformable synthetic material, preferably of one of the following materials or a mixture thereof:

- PETG (polyethylene terephthalate glycol),
- PP (polypropylene),
- PE (polyethylene),
- PC (polycarbonate)
- PVC (polyvinyl chloride)
- PS (polystyrene)
- ABS (acrylonitrile butadiene styrene)
- HDPE (high density polyethylene)
- LDPE (low density polyethylene)
- PET (polyethylene terephthalate),
- PMMA (polymethyl methacrylate),

- ECOTERM S 900 T1,
- PETG/copolyester 67639,

wherein the material of the covering cap (10), in particular, additionally contains one or several of the following components:

- 5 - additives,
- stabilizers,
- colorants,
- filler materials,
- reinforcing materials,
- 10 wherein, in particular, the material of the covering cap comprises a colorant and the end wall is designed opaquely or absorbingly for certain, particularly visible, wave length components.

- A particularly simple development for the production of a covering cap that allows
- 15 easy folding or collapsing, provides that the thickness of the casing wall preferably increases continuously from the end wall to the end of the casing wall remote from the end wall, in particular over at least a portion of the casing wall.

- A particularly robust covering cap in the area of the end wall that allows easy
- 20 handling when putting it on the measurement device, provides that the casing wall in the area adjacent to the end wall comprises, especially at the circumferential edge, a first thickening section wherein the thickness of the casing wall exceeds the thickness of the end wall,
 - that the casing wall has an intermediate section adjoining the first thickening
 - 25 section, wherein the thickness of the casing wall in the intermediate section is less than the thickness of the casing wall in the first thickening section,
 - that the casing wall has a second thickening section adjoining the intermediate section and extending to the end of the casing wall remote from the end wall, and
 - that the thickness of the casing wall in the second thickening section is greater
 - 30 than the thickness of the casing wall in the intermediate section.

Simple production is thus made possible by the thickness of the casing wall, in particular in the axial or radial direction, having a continuous, kink-free and edge-

free course across the casing wall, and/or has the average thickness in the respective section of the casing wall as its thickness, and/or

- that the casing wall, in particular with the exception of the area of the catch projections and/or catch recesses, is formed to be rotationally symmetrical.

5

Particularly advantageous variants and embodiments of the invention provide that the thicknesses of the first thickening section, the intermediate section and the second thickening section are in the following relation to each other:

$2 < d_1: d_2 < 5$ and/or $2 < d_3: d_2 < 5$ and/or $0.8 < d_1: d_3 < 1.25$

10 and/or that the thicknesses of the first thickening section, the intermediate section and the second thickening section are defined as follows:

$150 \mu\text{m} < d_1 < 250 \mu\text{m}$ and/or $50 \mu\text{m} < d_2 < 100 \mu\text{m}$ and/or $150 \mu\text{m} < d_3 < 250 \mu\text{m}$.

In this way, the covering cap is formed in a particularly advantageous manner
 15 that is particularly stable and robust in the end area remote from its end face, wherein it provides increased stability in the area of the end face, and offers good elasticity and compressibility in the intermediate region between the two thickening sections.

20 A particularly advantageous choice of the individual heights of the thickening sections, and the intermediate section provides that the height of the first thickening section, the height of the intermediate section and the height of the second thickening section, are in the following relationship:

$0.2 < h_1: h_2 < 0.6$ and/or $0.8 < h_3: h_2 < 1.25$ and/or $0.2 < h_1: h_3 < 0.6$.

25 To cover typical measurement devices, in many cases it is advantageous if the casing wall has a height of 2mm to 80mm and/or

- that the ratio between the height and the maximum dimension, in particular, the diameter or the diagonals, of the end wall (1) is between 0.01 and 55.

30 In order to enable particularly careful measuring of the object to be measured or the person to be measured, it may be provided that the end wall has a circular shape, in particular with a diameter of 1 mm to 50 mm, or that the end wall is

square or rectangular and wherein the side edges of the end wall have a length of between 2 mm and 40 mm.

Furthermore, the invention relates to a measurement device, in particular, for skin
5 analysis, which is coverable with a covering cap with catch recesses and/or catch
projections. In particular, the measurement device may be covered with a cover-
ing cap according to the invention and may be interlocked with this. The measu-
rement device comprises a housing and a sensor arranged therein, wherein the
housing has a conically tapering body section with a front end wall on which a
10 number of catch recesses and/or catch projections are arranged to interlock with
the catch recesses and/or catch projections of the covering cap, particularly in
such a way that, in the interlocked state, the end wall of the covering cap abuts
the front end wall. With this measurement device, it is very easy to dispose of
covering caps hygienically and to eject or discharge the covering cap easily into
15 an appropriate container. In particular, it is not necessary to touch the covering
cap in the area in which it is placed on the object to be measured, or on the living
organisms to be measured, during the measurement.

According to a structurally advantageous embodiment for ejecting the covering
20 cap, an ejection element is arranged in the end of the conically tapering housing
part remote from the front end wall and that is further away from the front end
wall than the catch recesses and/or catch projections,
- wherein the ejection element is configured to push an engaged covering cap by
applying pressure to the covering cap in the direction of the front end wall, and/or
25 - wherein the ejection element is mounted on the housing to be displaceable in
the direction of the front end wall.

In order to achieve a defined ejection and disposal of the covering cap with the
measurement device, it may be provided that a lever extension is connected to
30 the ejection element, or a lever extension extends from the ejection element, or
the ejection element is connected to a lever extension,

- wherein the lever extension is pivotally connected to the housing in its central area to form a two-armed lever, wherein the ejection element is arranged at one of its ends,

- wherein the lever extension connected to the housing presses the ejection element towards the front end wall upon pivoting,

In order to allow completely non-contact removal of the covering cap from the measurement device, it may be provided that an ejection element is arranged at the end of the conically tapering housing part remote from the front end wall and further away from the front end wall than the catch recesses and/or catch projections, and

- wherein the ejection element is designed to push an engaged covering cap by applying pressure to the covering cap in the direction of the front end wall, and/or
- wherein the ejection element is mounted on the housing to be displaceable in the direction of the front end wall (22). In this case, in particular, manual removal of the covering cap from the measurement device is not required, and removal may be effected instead by pressing the ejection element.

The ejection may be effected particularly easily when the ejection element is ring-shaped, in particular circular ring cylinder-shaped and surrounds the conically tapering housing part.

A particularly advantageous operation of the ejection element provides that a lever extension adjoins the ejection element, or a lever extension extends from the ejection element, or the ejection element is connected to a lever extension,
- wherein the lever extension is pivotably connected in its middle area with the housing, so that a two-armed lever results, with the ejection element arranged at one end,
- wherein an actuating element is provided at its other end in particular,
- wherein the lever extension hinged on the housing pushes the ejection element in the direction of the front end wall during its pivoting motion by the application of force of the actuating element.

To further improve operability and usability, it may be provided that the ejection element and/or the lever extension is subjected to force or preload by a spring element, which pushes or pulls the ejection element away from the front end wall.

- 5 A particularly simple and effective ejection of the covering cap provides that the individual catch recesses and/or catch projections in each case have the same standard distance to the end face and/or are evenly distributed in the circumferential direction of the casing wall, and/or the total number of the catch recesses and/or catch projections is two or four, and/or
- 10 - that the catch recesses and/or catch projections protrude from the casing wall at an angle of 10° to 30° and/or at most 1 mm, in particular at most 0.5 mm, and/or
- that two catch recesses and/or catch projections are provided, which have the same distance to a point in the area at which the lever extension connects to the ejection element or branches off from the latter.

15

A covering cap with a particularly thin end wall may be manufactured with the inventive method. In this case, it is provided:

- a) that a plastic film, in particular a film consisting of PETG (polyethylene terephthalate glycol), preferably having a thickness between 0.04 mm and 0.5 mm, is
- 20 used as raw material for a thermo-forming process
- b) that a punch with a number of separately-movable partial punches abutting each other is pressed onto the plastic film, wherein the individual partial punches are moved normal to the plane of the plastic film, and wherein the plastic film (31) is pressed by the pressure of the partial punches into a counter-form and is de-
- 25 formed into a cap form,
- c) that the individual partial punches of the punch are spaced apart from each other during or after step b), wherein each of the partial punches is moved radially outwards from the position of the punch, whereby an end wall is formed in the plastic film, in particular with a thickness in the range of less than 100 µm, pre-
- 30 ferably between 3 µm and 20 µm, in particular between 5 µm and 10 µm.

The invention uses a modification of a deep drawing process in order to achieve particularly thin wall thicknesses of the end wall. In particular, the rotational component of the formation of the covering caps allows the formation of very thin wall thicknesses.

5

For the formation of covering caps with different thicknesses of the casing wall, it may be provided that, subsequent to step c), the partial punch is removed from the cap form so formed and a further punch with a level end face and an expanding punch body is introduced into the volume of the plastic film formed by the partial punches, wherein the plastic film is shaped into a cap form between the further punch and a second counter-form,

10

- wherein, preferably, the plastic film, the further punch or the second counter-form is fed forward after the heating of the plastic film to a temperature between 50°C and 90°.

15

To be able to set the respective thickness of the casing wall branching off from the end wall, the feed velocity and/or temperature of the partial punches, of the further punch and/or the temperature of the plastic film and/or the temperature of the first or second counter-form is set,

20

- wherein to reduce the wall thickness in the edge region of the recess formed by the further punch, an increase of the temperatures mentioned as well as an increase of the feed velocity is effected, and

- wherein to increase the wall thickness in the edge area of the recess formed by the further punch, a reduction of the temperatures mentioned as well as a reduction

25

tion of the feed velocity is effected.

A particularly advantageous covering cap that may be well folded after its use and may be advantageously removed from a measurement device, provides for the temperature of the further punch and/or of the plastic film as well as the feed velocity of the further punch to be set in such a way,

30

- that during a first feed time period of the further punch, a section of the casing wall is formed with a preset thickness, in particular of 50 µm to 100 µm, and

- that during a second feed time period of the further punch following the first feed time period, a section of the casing wall is formed with a preset thickness, in particular of 150 μm and 250 μm , which is thicker than the thickness of the casing wall created in the first feed time period.

5

In this way, it may be advantageously provided that the wall thickness during the first feed time period of the further punch is set to a value that corresponds to the doubling to quintupling of the wall thickness of the casing area that was formed during the shaping of the end wall by the introduction of the partial punches.

10

To create covering caps with circular end walls, it may be provided that the partial punches during their radial movement directed away from the center in step c), are rotatingly moved along a curve that runs spirally outwards and widens about a central axis.

15

A particularly adaptable, robust and resilient development of the invention provides that the plastic film consists of thermo-plastically or plastically deformed or deformable synthetic material, preferably of one of the following materials or a mixture thereof:

- 20 - PETG (polyethylene terephthalate glycol),
- PP (polypropylene),
- PE (polyethylene),
- PC (polycarbonate)
- PVC (polyvinyl chloride)
- 25 - PS (polystyrene)
- ABS (acrylonitrile butadiene styrene)
- HDPE (high density polyethylene)
- LDPE (low density polyethylene)
- PET (Polyethylene terephthalate),
- 30 - PMMA (polymethyl methacrylate),
- ECOTERM S 900 T1,
- PETG/copolyester 67639,

wherein the material of the covering cap, in particular, additionally contains one or several of the following components:

- additives,
- stabilizers,
- 5 - colorants,
- filler materials,
- reinforcing materials,

wherein, in particular, the material of the covering cap has a colorant and the end wall is designed opaquely or absorbingly for certain, particularly visible, wave
10 length components.

For the formation of characteristics, in particular of catch recesses in the inner area of the outer surface as well as on the end wall, it may be provided that, after the partial or complete formation of the casing wall, the partial punches or the
15 further punch are driven back and the formed volume is subjected, in particular, to heated compressed air, while the further punch is subsequently, if necessary, introduced into the formed volume to implement the next forming step, wherein, in particular, catch recesses are formed in the inner casing of the casing wall by the application of compressed air.

20

To remove the covering caps made from the body of the plastic film, it may be provided that, after formation of the casing wall, the remaining plastic film connected to the casing wall is separated from the casing wall along a preset cutting line, wherein the cutting line is selected, in particular, so that a sub-section of the
25 remaining plastic film connected to the casing wall lies inside the cutting line and forms a base wall.

To set the permeability of the film, it may be provided that the plastic film, in particular after its formation, is heated for a preset time period, in particular for at
30 least 3 seconds, to a preset temperature between 30°C to 120°C, in particular to a temperature between 50°C and 90°C, and/or

that the partial punches and/or the further punch and/or the counter-forms used before the processing of the plastic film are heated to a temperature between

30°C to 120°C, in particular to a temperature between 50°C and 90°C, and are maintained at such a temperature during the processing.

5 In this way, it may, in particular, be provided that the plastic forming the plastic film is deformed by heating, wherein it, in particular, loses its thermoplastic properties and/or the molecular chains forming the plastic film are preferably split under the action of the heat.

10 To permit improved diffusion of substances through the end wall, it may be provided that, in particular, micro-holes or nano-holes are formed in the end wall by means of a laser or a heated micro-needle or nano-needle or by means of etching.

15 Several embodiments of the invention are illustrated by the following figures

Fig. 1a shows a first embodiment of a covering cap according to the invention in cross-section.

20 Fig. 1b shows the covering cap illustrated in Fig. 1 from the side.

Fig. 2 shows a covering cap according to a particularly simple embodiment of the invention in cross-section.

25 Fig. 3 shows an inventive measurement device.

Fig. 4 shows an inventive measurement device with attached covering cap.

Fig. 4a shows ejection of the covering cap from the measurement device.

30 Fig. 5 shows a plastic film with which the covering cap is formed.

Fig. 5a shows the end wall of the punch and its partial punch.

Fig. 6 shows the pressing of the partial punches in the plastic film.

Fig. 7 shows the widening of the partial punches and the formation of the end wall of the covering cap.

5

Fig. 7a shows the movement of the partial punches in the forming of a rectangular end wall.

Fig. 7b shows the movement of the partial punches in the forming a ring-shaped
10 end wall.

Fig. 8 and 9 show the formation of different thickness casing wall sections of the covering cap.

15 Fig. 10 shows the completion of the covering cap by separating the plastic film.

Fig. 1a shows a first embodiment of an inventive covering cap 10 in cross-section (section line 1a in Fig. 1b). The same covering cap 10 is shown in Fig. 1b from below according to the section line 1b shown in Fig. 1. This covering cap 10 has
20 a circular end wall 1 which is bounded by a circumferential edge 4. On the circumferential edge 4, the end wall 1 connects to a casing wall 2, which faces away from the end wall at its one end and is continued from a base wall 3. The casing wall 2 widens approximately conically in the following embodiment, and is inclined outwards from the end wall 1 at an angle α of 75° in the area of the circumferential
25 edge 4.

The end wall 1 comprises a very thin wall thickness d_s of $10\text{ }\mu\text{m}$, wherein the wall thickness d_s may advantageously lie in a range between $0.05\text{ }\mu\text{m}$ and $20\text{ }\mu\text{m}$, in particular in a range from $3\text{ }\mu\text{m}$ to $20\text{ }\mu\text{m}$. In the present case, the end wall 1
30 comprises a diameter of 5 mm . Basically, this diameter may lie within a very wide range, wherein, in particular, the diameter may preferably lie in the range between 2 mm and 20 mm , wherein, depending on the use, larger diameters up to 100 mm may certainly be used.

An alternative embodiment of the invention (not shown) comprises a square end wall 1 instead of a circular construction of the end wall 1, but which comprises a substantially equal wall surface area, as shown in the embodiment in Fig. 1, and comprises an edge length of about 10 mm. Alternatively, the end wall 1 may also
5 be rectangular, square or elliptical in shape, wherein the side edges of the end wall 1 may, for example, comprise a length between 2 mm and 40 mm, in particular, between 5 mm and 8 mm.

In the embodiment shown in Fig. 1, the casing wall 2 of the covering cap 10 is
10 constructed in three parts and comprises a first thickening section 7 having a thickness d_1 in the area close to the end wall 1 connected to the circumferential edge 4. In the present embodiment, a thickness d_1 in the range between 150 and 250 μm is selected for the first thickening section. The thickness d_1 of the casing wall 2 in the first thickening section 7 exceeds the thickness d_s of the end wall 1
15 and, in the present embodiment, is 5 μm to 8 μm . The first thickening section 7 is formed circumferentially, wherein the first thickening section 7 is delimited circularly at the end remote from the end wall 1, and wherein an intermediate section 8 connects the first thickening section 7 in this delimiting area.

20 In the intermediate section 8, the casing wall 2 has a thickness d_2 , which is smaller than the thickness d_1 of the casing wall 2 in the first thickening section 7. In the present embodiment, a thickness of 50 to 150 μm is selected as the thickness d_2 of the casing wall 2 at the intermediate section 8. The intermediate section 8 is delimited at its end remote from the first thickening section 7 in a ring-
25 shape, wherein a second thickening section 9 is connected to this ring-shaped boundary, wherein the thickness d_3 of the casing wall 2 is greater than the thickness d_2 of the casing wall 2 in the intermediate section 8. In the present embodiment, a thickness d_3 is selected in the range between 150 and 250 μm for the first thickening section. In the present case, the second thickening section 9 is
30 connected to the end of the casing wall 2 remote from the end wall 1, in particular it abuts against the second thickening section 9 immediately adjacent to the base wall 3.

Due to this special design, the casing wall 2 comprises a circumferential section 8 in the form of the intermediate section 8, wherein the thickness d_2 is smaller than the thickness d_3 of the casing wall 2 in the area of the end of the casing wall 2 facing away from the end wall 1. The thickness of the casing wall 2 steadily or
 5 continuously increases in the axial or radial direction, starting from the thickness d_1 in the first thickening section 7 and reaching a minimum in the intermediate section 8, wherein the thickness of the casing wall 2 in the second thickening section 9 increases up to the end of the casing surface remote from the end wall 1.

10

The thickness of the casing wall 2 comprises a continuous, kink-free and edge-free course across the casing wall 2. Insofar as is necessary to take into account the considerations given below, the thickness of the casing wall 2 in the relevant section 7, 8, 9 of the casing wall 2, is understood to refer to the average thickness
 15 in this section.

To obtain a particularly advantageous adaptation of the end wall 1 to the end surface 21 (Fig. 4) of a measurement device 20, the thickness of the casing wall 2 is formed to be thinner than in the other two thickening sections 7, 9 in the area
 20 of the intermediate section 8. The ratio of the thickness d_2 in the intermediate section 8 to the thickness d_1 in the first thickening section 7 is between approximately 2 and 5. The ratio of the thickness d_2 in the intermediate section 8 to the thickness d_3 in the second thickening section 9 is between approximately 2 and 5. The thickness d_1 of the casing area 2 in the first thickening section and the
 25 thickness d_3 of the casing surface 2 in the second thickening section 9 is about equally large. The relationship between these two thicknesses d_1 , d_3 lies approximately between the values 0.8 and 1.25.

In the present embodiment, the casing wall 2 comprises a mean thickness in the
 30 individual sections 7, 8, 9 of the following values:

$$d_1 = 0.18 \text{ mm} \quad d_2 = 0.08 \text{ mm} \quad d_3 = 0.22 \text{ mm}$$

In the present embodiment, the height h of the casing wall 2 is 20 mm, but, depending upon the shape and the structure of the measurement device 20 to be covered, different values may typically lie between 15 mm and 35 mm. The ratio between the height h of the casing wall 2 and the maximum dimension of the front wall 1 is in the range 0.02 and 5.

The first thickening section 7 is formed in the area of the end wall 1 and has a height of about 4 mm in the present embodiment. The remaining two sections of the casing wall 2, i.e. the intermediate section 8 and the second thickening section 9 have approximately the same height, which is about 10 mm in this case. Typically, the height h_1 of the first thickening section 7, the height h_2 of the intermediate section 8, and the height h_3 of the second thickening section 9 are in the following relationship to one another:

$$2 < h_1 : h_2 < 0.6 \text{ and/or } 0.8 < h_3 : h_2 < 1.25 \text{ and/or } 0.2 < h_1 : h_3 < 0.6$$

A particular further embodiment of the invention allows improved handling and a lower susceptibility to cracks or fracturing of the covering cap 20 during handling. To ensure better handling, a stiffening element is arranged in the covering cap 10 in the area of the second thickening section 9 or in its lower end section remote from the end wall 1. Such a stiffening element is connected to the inner or outer casing of the casing surface 2, and is in the form of a sheath whose surface contour corresponds to the surface profile of the inner or outer casing. This sheath is preferably made of stiffened plastic or a plastic which has a higher inner stiffness than the plastic forming the covering cap 10.

The base wall 3, which continues the casing wall 2 at the end facing away from the end wall 1, runs parallel to the end wall 1 in the present embodiment. Alternatively, the base wall 3 may also be at an angle of 10° to the end wall 1 as well as extending outwards from the end wall 1. Preferably, the base wall 3 protrudes outwards from the casing wall 2, wherein, with increasing radial distance, the standard distance of the base wall 3 from the end wall increases.

In the present embodiment, the base wall 3 is circular ring-shaped, runs parallel to the end wall 1, and has an outer diameter of 21 mm and an inner diameter of 18 mm. The circular ring width in this case is 1.5 mm.

- 5 Furthermore, the covering cap 10 comprises catch recesses 5a on the inside of the casing wall 2, which allow releasable fastening to a measurement device 20 (Fig. 4). In the present embodiment, two catch recesses 5b are so arranged that they lie opposite one another on the lateral wall of the covering cap 10. Alternatively, catch projections (not shown) may be provided instead of catch recesses
- 10 5a and 5b. In principle, the purpose of the catch recesses 5a and catch projections 5b is to achieve engagement with a measurement device 20 and/or with the catch recesses 25a and/or catch projections 25b arranged on the measurement device 20.
- 15 In the present embodiment, the two catch recesses 5a are in the form of recesses on the inside of the casing wall 2 in the area of the second thickening section 9 and extend approximately at an angle β_1, β_2 of 20° with respect to the casing wall 2. The recesses 5a protrude about 60 μm into the second thickening section 9.
- 20 Alternatively, it is possible to provide the catch projections 5a instead of the catch recesses 5b. These are inclined inwards at an angle β_1, β_2 of 10° to 30° from the inside of the casing wall 2 and are about 1.5 mm in from the casing wall 2. The catch projections 5a face each other at the same respective height, are at the same standard distance from the end wall 1, and are evenly distributed in the
- 25 circumferential direction of the casing wall 2, wherein, in the present embodiment, they are at 180° to one another.

Alternatively there is also the possibility that the catch projections 5a or the catch recesses 5b are present in greater numbers. In particular, a number of four catch

30 projections 5b or catch recesses 5a proves advantageous, wherein these are mutually spaced at 90° in the circumferential direction.

In a particular embodiment of the invention, it may be provided that in each case two of the four catch elements are in the form of catch recesses 5a, while the remainder are in the form of catch projections 5b, wherein each two catch recesses 5a and two catch projections 5b lie circumferentially opposite one another at 180°. In this case, the covering cap 10 (Fig. 4) may be advantageously held in position with respect to the measurement device 20, wherein the casing wall 2, particularly in the area of the intermediate section 8, is subject to an elastic stretching and particularly good adaptation to an end surface 21 (Fig. 4) of the measurement device 20 to be covered, due to the thin thickness d_2 of the end wall 1. The degree of stretching as well as the stretchability of the casing wall 2 as well as of the intermediate section 8, depends on the plastic used and the thickness d_2 of the casing wall 2 in the area of the intermediate section 8.

Furthermore, there is also the possibility of providing circumferential catch elements in the form of catch projections or catch recesses, either on the measurement device 20 or on the covering cap 10, wherein a circumferential catch element is advantageously provided only on either the covering cap 10 or on the measurement device, in order to ensure an optimum ejection of the covering cap 10 from the measurement device 20.

In the present embodiment, the entire covering cap 10 is formed integrally and consists of plastic. PETG mixed with a small amount of colorant was used in the present case. The use of colorant for the covering caps 10 allows different covering caps with different material properties to be distinguished, in particular with different thicknesses d_s of the end wall 1. However, by adding colorant, it is also possible to make the end wall opaque or absorbing for certain wavelength components.

Instead of PETG (polyethylene terephthalate glycol), plastics known from the prior art, such as polyethylene or polypropylene or mixtures thereof, may also be used.

In alternate embodiments according to the invention, the covering cap may be made from one of the following substances or a mixture of the following substances: PETG (polyethylene terephthalate glycol), PP (polypropylene), PE (polyethylene), PC (polycarbonate), PVC (polyvinyl chloride), PS (polystyrene), ABS
5 (acrylonitrile butadiene styrene), HDPE (high density polyethylene), LDPE (low density polyethylene), PET (polyethylene terephthalate), PMMA (polymethyl methacrylate), ECOTERM S 900 T1.

In this case, the material of the covering cap 10 may, in particular, also have one
10 or more of the following substances added: additives, stabilizers, colorants, filling materials, reinforcing materials, PETG/copolyester 6763.

By the specific selection of the chain length of the individual molecular chains of polyethylene, polypropylene or PETG, it may be defined to which chemical com-
15 pounds the end wall 1 is permeable or to which chemical compounds the end wall 1 is impermeable. It is thus possible to measure certain samples such as blood, urine, sweat or feces and living specimens, such as skin, wherein only certain desired substances may be diffused by the end wall 1 for measurement, such as sodium, potassium, chlorine, magnesium, vitamins, hormones, glucose,
20 alcohol, trace elements and water vapor, while other components of the sample, such as water, blood, urine or feces, can not be diffused through the end wall 1, or only after a very long time of some hours. By selecting shorter chains, holes are formed in the respective plastic or in the respective plastic structure so that larger molecules may be diffused through the end wall 1. The longer the chain
25 molecules selected, the tighter the plastic structure and the smaller the molecules must be in order to be able to penetrate the end wall 1. Furthermore, as decisive as the thickness d_s of the front wall 1, is also the permeability since molecules may easily diffuse through a thinner end wall 1 as through a thicker end wall 1. Alternatively, if a certain thickness is required because of the requirements con-
30 cerning the stability of the end wall 1, micro-holes or nano-holes 6 with a diameter of 0.1 nm to 5 μm , at most up to 400 μm , may be created in the end wall 1, for example, by means of a micro-needle or a laser beam.

Alternatively, holes 6 in the end face 1 may also be obtained by etching, such as with chemical processes. In order to avoid further damage to the end wall 1, this is cleaned, in particular rinsed, of all etchant subsequent to the creation of the holes.

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Since the molecular size of water is 0.3 nm and the molecular size of water vapor is 0.1 nm, water can not penetrate the end wall by providing holes with a diameter of less than 0.3 nm. In the case of holes or pores with a diameter of 1 nm, water slowly passes through the end wall 1 into the interior of the hygienic covering cap.

- 10 In the case of a measuring time of 3 seconds, the holes or pores with a diameter of 3 - 4 nm may also be chosen because water diffuses less rapidly through the end wall than vapor. A covering cap 10 with holes having a thickness of about 3-4 nm and with the end face 1 having been previously immersed in water, it requires about 1 minute for it to penetrate the end wall 1 as a function of the thick-
- 15 ness of the end wall 1.

- Due to the uniformity of materials, the individual parts of the covering cap 10 exhibit substantially the same properties. Only by the respective thickness d_s of the end wall 1, the casing wall 2 and the base wall 3, may special permeabilities
- 20 for certain substances or radiation be obtained. Thus, the end wall 1 in the course of the manufacturing process, may be made particularly thin to allow the diffusion or flow of certain materials, such as gases, liquids, atoms, molecules, compounds.

- 25 The embodiment shown in Fig. 2 substantially corresponds to the embodiment shown in Fig. 1a and Fig. 1b, so that only the differences between the two embodiments are illustrated in detail. The height h_1 of the section 8 adjoining the end wall corresponds approximately to the height h_2 of the thickening section 7 remote from the end wall 1.

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In the present embodiment, the casing wall 2 is divided in two sections 7, 8, wherein both sections 7, 8 are formed circumferentially and the sections 7, 8 are adjacent to each other, while a circular delimiting line extending between these

two sections 7, 8 comprises points that have the same respective standard distance from the end wall 1. The thickness of the casing wall 2 increases from the front wall 1, as seen in the axial or radial direction, and is continuous towards to the end of the casing wall 2 remote from the end wall 1.

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Fig. 3 shows an embodiment of a measurement device 20 according to the invention in more detail. This measurement device 20 comprises a housing 26 which comprises a conically tapering housing part 21, which is to be subsequently covered by the covering cap 10 shown above (Fig. 4). A front end face 22 is arranged on or behind the end of the tapering housing part 21 on which a sensor 23 is located. In the present embodiment, the conically tapering housing part 21 in the area of the front end face 22 has an opening that leads to the sensor 23, so that the gases and/or substances to be measured may flow directly to the sensor 23. It may be ensured that the sensor 23 is kept free of dirt by means of a covering cap 10 (Fig. 4) mounted on the conical housing part 21.

A plurality of catch projections 25b is located on the conically tapering housing part 21, while, alternatively or additionally, a number of catch projections 25a may be arranged on the casing surface of the conically tapering housing part 21. As shown in Fig. 4, the covering cap 10 may be placed on the conically tapering housing part 21, so that the catch projections 25b protruding from the conically tapering housing part 21 engage the catch recesses 5a of the covering cap 10. To achieve this covered state of the measurement device 20, the covering cap 10, is advantageously gripped by two fingers at the lower thickening section 9 and mounted on, or slipped over, the conically tapering housing part 21, so that the catch projections 25b of the conically tapering housing part 21 of the measurement device engage in the catch recesses of the casing wall 2 of the covering cap 10. The covering cap 10 is so adapted to the conically tapering housing part 21, that the catch projections or catch recesses 5a, 5b, 25a, 25b are located in positions adapted to each other so that the covering cap 10 and the conically tapering housing part 21 are so arranged in the engaged state that the front end face 1 is slipped over the end wall 22 and the catch recess located on the front end face 22 of the conically tapering housing part 21 is completely obscured or

covered in front of the sensor 23 by the end wall 1. This is achieved, in particular, wherein the covering cap 10 with a small thickness d_2 in its respective section 8 is subject to a particularly strong elastic deformation to form a perfect fit for the respective measurement device 20 or its conically tapering housing part 21.

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The location and position of the catch recesses 25a and catch projections 25b on the conically tapering housing part 21 correspond to the position of the catch recesses 5a and/or catch projections 5b on the covering cap 10a. In particular, the catch recesses 25a and the catch projections 25b are each arranged and advantageously distributed evenly in the circumferential direction at the same standard distance from the front end face 22 on the conically tapering housing part 21. The total number of catch recesses 25a and/or catch projections 25b is two in the present embodiment. Alternatively, however, three or four or even more catch recesses and/or catch projections may also be provided. The shape of the catch recesses 25a or catch projections 25b is respectively adapted to the shape of the covering caps 10 or the catch recesses 5a and catch projections 5b of the covering cap 10. The catch recesses 25a and catch projections 25b are at an angle of 10° to 30° , and at most at 1 mm, particularly at most 0.5mm, from the casing wall of the conically tapering housing part 21.

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The measurement device 20 also has an ejection element 24 which is arranged at the end of the conically tapering housing part remote from the front end face 22. This ejection element 24 is farther from the front end wall 22 than the catch projections 25 of the conically tapering housing part. In the present embodiment, the ejection element 24 is ring-shaped, i.e. circular ring-cylindrical shaped, and surrounds the conically tapering housing part 21. As shown in Fig. 4, the base wall 3 of the covering cap 10 lies flat on the ejection element 24. Pressurization of the ejection element 24 towards the front end face 22, causes the covering cap 10 to be pushed out of its engagement, wherein the covering cap is subject to elastic deformation in the area of its catch recess 5a during displacement from its engagement. Due to the angled construction of the catch recess 5a as well as the catch projection 25b, the energy resulting from the elastic deformation of the covering cap 10 is converted into kinetic energy of the covering cap 10, which

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accordingly accelerates the covering cap in a direction from the ejection element 24 to the end wall 21.

In the present embodiment, the ejection element 24 is integrally formed with a lever extension 27. The lever extension 27 connects to the ejection element 24 or disconnects from this and enables a displacement or pivoting of the ejection element 24 to the end wall 22. The lever extension 27 is pivotally connected in its middle area to the housing 26, wherein the lever extension 27 acts as a two-armed lever. The ejection element 24 is arranged at one end of this two-armed lever, while an actuating element 28 in the form of a push button is arranged at the other end of the two-armed lever. When the push button is pressed, the end of the lever extension 27 remote from the ejection element 24 is pivoted counter-clockwise as shown in Fig. 4a, and the ejection element 24 is pressed towards the front end face 22 due to this pivotal movement. Due to this pressurization of the covering cap 10, the engaged catch recesses or catch projections 25a, 5b are disengaged from their engaged position, and the covering cap 10 is ejected in the direction of the front end face 22.

As a result of the specific deflection of the ejection element 24 due to the pivotal movement, the trajectory of the covering cap 10 may be adjusted very precisely. As a result of the special pivoting concept of the ejection element 24 in this embodiment, the combinations of catch recesses and catch projections that are adapted to each other, are triggered at different times. In this way, the covering cap 10 is not only ejected but undergoes a deviating trajectory which is directed downwards in the normal hand-held position of the measurement device, and facilitates the disposal of used covering caps.

A further advantageous arrangement of catch recesses or catch projections 25a, 5b, as shown below, may be implemented by providing only two recesses or catch projections 25a, 5b, which are at the same distance from the point at which the lever extension 27 connects or disconnects to/from the ejection element 24. This ensures that the engagement of the covering cap 10 with the measurement

device 20 along with all the catch recesses and catch projections 5b, 25a engaged together, are disengaged simultaneously, and there is no slowing down through a re-engagement of another catch projection in a catch recess.

- 5 Thus, the largest possible ejection width of covering caps with each measurement device 20 may be obtained. This has the advantage that disposal of the covering cap over a greater distance is possible and, due to the greater ejection force, offers an improved operation feeling when disposing of the covering cap, while, in general, increasing the motivation to use as well as user satisfaction.

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In order to prevent premature or inadvertent ejection or removal of a covering cap from the engaged state with the measurement device 20 in the present embodiment, a spring 29 is provided in the form of a wire spring, which subjects the lever extension 27 to a preload that pushes the ejection element 24 forwards towards
15 the front end face 22. Only when the pressure on the actuating element 28 exceeds the preload generated by the spring 29, will the ejection of the covering cap 10 take place. In all events, this prevents an accidental ejection or discharge of the covering cap.

- 20 Alternatively, the action of this spring 29 may also be applied to the part of the lever extension 27 facing the ejection element 24, or even directly to the ejection element 24 itself in order to move it away from the front end face 22.

An embodiment of an inventive method for the production of a covering cap 10
25 from a plastic film 31 is shown below, wherein the production of a covering cap according to an embodiment according to the invention is explained. in Fig. 1a and Fig. 1b.

Fig. 5 shows a plastic film 31 as a starting material with which the covering cap
30 10 is to be formed. In its initial state, the plastic film 31 has a thickness d of 0.4 mm and is made of polyethylene terephthalate glycol (PETG).

To form an end wall 1 having a thickness d_s of about 1 μm to 10 μm , a punch 32 comprising a number of multiple partial punches 33 is used. In the present embodiment, the punch 32 comprises four partial punches 33. The punch 32 is cylindrical has a circular end surface with a radius of 1 mm. Each partial punch 33
 5 has a circular-segmental end face in the form of a quarter circle with a radius of 1 mm. All the partial punches 33 are movable and pivotable separately from one another. Fig. 5a shows a view of the partial punch 33 of the plastic film 31, as indicated by the section line V.

10 In a first forming step, the partial punches 33 lie adjacent to one another, and the quarter-circular end faces of the partial punches 33 together form a circular end surface. The partial punches 33 are advanced together in this arrangement into the area of the plastic film 31. As shown in Fig. 6, the plastic film 31 is deformed in this way. A volume 39 is formed, which is limited to that side of the plastic film
 15 31 on which the partial punches 33 previously penetrated the plastic film 31. The outer shape of the form formed from the plastic film 31 is defined by a first counter-form (not shown) abutting the outer casing wall 2 as well as the covering cap 10 formed from the plastic film 31 on the end wall 1.

20 In the next step, shown in Fig. 7, the partial punches 33 are moved radially outwards. In this case, the plastic film 31 is simultaneously heated in the area of the partial punches 33 to a temperature of 40 °C. In this way, the plastic film 31 is strongly drawn and thinned in the intermediate area between the partial punches 33, resulting in an end wall 1 thickness d of about 4 μm .

25 Basically, it is provided that the partial punches 33 first perform an axial movement normal to the plane of the plastic film 31 (Fig. 6), and only when the partial punches 33 have reached an end position in this direction, are the partial punches 33 moved in the radial direction (Fig. 7) in order to form the end surface 1.

30 Alternatively, it is of course possible to combine the axial movement normal to the plane of the plastic film 31 and the radial outwards movement of the partial

punches 33 with each other in order to obtain a superposition of the two movements of the partial punches 33.

If a rectangular or square end wall 1 is to be produced, it is sufficient if the individual partial punches 33 are respectively guided to a corner of the end wall 1 to be formed, as shown in Fig. 7a. If, however, a circular end surface 1 is to be produced, the partial punches 33 may additionally be set in rotational movement about the common axis X as shown in Fig. 7b. The rotational movement is superposed on the radially outwardly directed movement of the partial punches 33. The individual partial punches 33 thus move along a spiral motion path, wherein the circular cylindrical casing surfaces of the partial punches 33 are respectively in contact with the plastic film 31.

As previously described in connection with the formation of rectangular or square end walls 1, a combined axial and radial movement of the partial punches 33 in the formation of circular end faces 1 is possible. In this case, the partial punches 33 perform a movement along a spiral-shaped path of movement, wherein the widening spiral runs downwards and represents a superposition of an axial and radial movement as well as a rotational movement about the axis X.

As shown in Fig. 7, a volume 39 is formed opposite to an imaginary continuation of the top edge of the plastic film 31 with a height h_1 . This height is determined by the feed length of each partial punch 33 axially in the direction of the axis X. Through the feed rate of the partial punches 33, as well as by setting the temperature of the partial punches 33 and the plastic film 31 in the axial direction, the thickness of the casing wall 2 laterally delimiting the volume 39 is set; in particular, the thickness in the area in which the plastic film 31 passes into the casing wall 2 depends particularly strongly on the respective feed rate and the respective temperature.

The thickness of the casing wall 2 may be set by selecting the temperature of the plastic film 31 as well as the partial punches 33 and the feed rate of the partial punches 33 in the axial direction. The thickness d_1 of the casing wall 2 in the

formed casing wall section 7 may be continuously monitored, wherein in the event that the thickness d_1 is too small, the feed rate of the partial punches 33 is reduced in the axial direction or the temperature of the plastic film 31 or the partial punches 33 is reduced. If the thickness d_1 is too large, the feed rate of the partial punches 33 is increased in the axial direction, or the temperature of the plastic film 31 or the partial punches 33 is increased.

In the present embodiment, a plastic film 31 with a thickness of 0.4 mm is heated during processing to 40 °C. The partial punches 33 have a temperature of 45 °C and form a volume 39 with a height h_1 of 4 mm. Then, the partial punches 33 shown in Fig. 7a, move radially outwards, wherein, first, a rectangular end surface is formed with a side length of about 4 mm. In a further step shown in Fig. 7b, the partial punches 33 are offset in a rotational movement, wherein the partial punches rotate about the X axis. The circular cylindrical surfaces of the partial punches 33 lie against the inner wall of the formed casing wall.

Fig. 8 and Fig. 9 show the formation of further casing wall sections 8, 9 of the covering cap 2 with different thicknesses d_2 , d_3 . Instead of the partial punches 33, a further punch 36 or more additional punches is/are used in the following steps, which corresponds to the outer form of the shape of the respective covering cap 10.

As shown in Fig. 8, the further punch 36 is advanced into the formed volume 39, wherein the respective wall thickness d_2 of the area of the casing wall 2 formed in this process step, hereinafter referred to as the intermediate section 8, is thinner than the wall thickness d_1 of the area of the casing wall 2, hereinafter referred to as the first thickening section 7. The thickness d_2 of the casing wall 2 in the intermediate section 8 is, as already stated in the production of the first thickening section 7, determined by the feed rate of the further punch 36 as well as by the temperature of the further punch 36 and the temperature of the plastic film 31.

The outer shape of the section of the covering cap 10 formed from the plastic film 31, in particular of the intermediate section 8, is defined by a second counter-

form (not shown), which abuts the outer casing wall 2 as well as the end wall 1 of the covering cap 10 formed out of the plastic film 31.

In the present embodiment, the plastic film 31 retains its deformation at a temperature of about 40°C to 50°C, and then the other punch 36 is introduced into the second counter-form. The second counter-form is heated to a temperature of about 40°C to 50°C. The intermediate area between the further punch 36 and the second counter-form corresponds to the desired shape of the covering cap 10 in the first thickening section 7 as well as in the intermediate section 8; in the present embodiment, the wall thickness in the intermediate section 8 is less than in the first thickening section 7.

Then the further stamp 36 is subsequently further advanced, as shown in Fig. 9, wherein a second thickening section 9 is formed, whose thickness d_3 is greater than the thickness d_2 in the intermediate section.

The outer shape of the section of the covering cap 10 formed out of the plastic film 31, in particular the second thickening section 9 adjoining the intermediate section 8, is defined by a third counter-form shape (not shown) which abuts the covering cap 10 formed from the plastic film 31 at the outer casing wall 2 as well as at the end wall 1.

In the present embodiment, the plastic film 31 retains its deformation at a temperature of about 40°C to 50°C, and then the further punch 36 is introduced into the second counter-form. The third counter-form is heated to a temperature of about 40°C to 50°C. The intermediate area between the further punch 36 and the third counter-form corresponds to the desired shape of the covering cap 10 in the first thickening section 7, in the intermediate section 8, and in the second thickening section.

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Fig. 10 shows the completion of the covering cap by separation from the plastic film. After the shaping and profiling of the entire casing wall 2, the casing wall is still connected to the plastic film 31. In a final step, the plastic film 31 is separated

along a predetermined cutting line 37; in the present embodiment, the plastic film 31 is punched along the casing wall.

In this way, the covering cap 10 is separated from the remainder of the plastic
5 film 31.

In the present embodiment, the cutting line 37 runs circularly and coaxially to the hollow truncated cone-shaped casing wall 2. By cutting along the cutting line 37, a base wall 3 of the covering cap 10 is formed, which runs radially from the end
10 face of the end remote from the casing wall 2 parallel to the end face. Alternatively, there is also the possibility that through a further forming process, the base wall 3 facing away from the end wall 1 is formed to protrude radially outwards from the casing wall 2 at an angle of up to 20°, in particular up to 10°.

15 After the end of the shaping, either before or after the cutting off of the covering cap 10 along the cutting line 37, the plastic film 31 forming the covering cap 10 is heated for a predetermined period of 3 to 4 seconds at a temperature of between 50 and 120°C depending on the plastic used, while it is heated to 75°C in the present case. During this process, the plastic forming the plastic film 31 is de-
20 formed by the heating. The plastic film 31 loses its thermoplastic properties. By the action of heat, the molecular chains forming the plastic film 31 are broken, wherein a greater permeability of the covering cap 10, particularly in the area of the end wall 1 is created. The longer the application of the heat on the plastic film 31 and the more intense it is, in particular, the higher the selected temperature,
25 the shorter will be the molecular chains forming the plastic film 31 and the higher the permeability of the end wall 1.

Alternatively, instead of heating the covering cap 10, holes 6, in the present case micro-holes or nano-holes, are formed in the end wall 1, preferably exclusively in
30 the end wall 1, in order to achieve increased permeability for molecules of a certain size. The formation of micro-holes and nano-holes may be effected by using a laser beam as well as through perforation through puncturing with a heated micro-needle.

It is particularly advantageous if the covering cap 10 in the area remote from the circumferential edge 4 has a very high stiffness, which serves for the stability of the covering cap. The stiffness of the covering cap 10 increases towards the center of the casing wall 2, wherein the casing wall 2 in the area surrounding the end wall 1, in turn, has a greater stiffness. The elasticity of the casing wall 4 is greatest in the area of its thinnest point, or the area at its point with the least stiffness.

Preferably, the stiffness or elasticity of the casing wall 4 is circumferentially and homogeneously distributed and only varies with the distance from the end wall 1.

10

Patentkrav

1. Afdækningshætte (10), især til anbringelse på et hudanalyseapparat, omfattende en af en periferikant (4) afgrænset endevæg (1) samt en op til endevæg-
5 gens (1) periferikant (4) stødende kappevæg (2), hvorved endevæggen (1) er tildannet gasgennemtrængelig,
kendetegnet ved, at afdækningshætten (10) i den modsat endevæggen (1) værende ende af kappevæggen (2) har indgrebsfordybninger (5a) og/eller indgrebsfremspring (5b) til aftagelig fastgørelse på et måleapparat, og
10 at kappevæggen (2) i umiddelbar nærhed af endevæggen (1) har et, især op til periferikanten (4) stødende, første fortykkelsesafsnit (7), hvor kappevæggen (2) tykkelse (d_1) er større end endevæggen (1) tykkelse (d_s),
at kappevæggen (2) har et op til det første fortykkelsesafsnit (7) stødende mellemafsnit (8), hvor kappevæggen (2) tykkelse (d_2) i mellemafsnittet (8) er mindre
15 end kappevæggen (2) tykkelse (d_1) i det første fortykkelsesafsnit (7),
at kappevæggen (2) har et til mellemafsnittet (8) stødende og frem til den fjernt fra endevæggen (1) beliggende ende af kappevæggen (2) forløbende andet fortykkelsesafsnit (9), og
at kappevæggen (2) tykkelse (d_3) i det andet fortykkelsesafsnit (9) er større end
20 kappevæggen (2) tykkelse (d_2) i mellemafsnittet (8).

2. Afdækningshætte ifølge krav 1, **kendetegnet ved**, at endevæggen (1) på i det mindste et sted har en tykkelse (d_s) i området fra mindre end 100 μm , fortrinsvis imellem 0,1 μm og 20 μm , især imellem 5 μm og 10 μm , hvorved endevæggen (1) især har en over sit forløb konstant tykkelse (d_s), og/eller
25 at kappevæggen (2) inden for området af endevæggen (1) periferikant (4) udgår under en vinkel (α) fra imellem 20 og 95°, især imellem 60° og 80°, i forhold til endevæggen (1) i retning udad, hvorved kappevæggen (2) fortrinsvis udvider sig især konisk, og/eller
30 at især de enkelte indgrebsfordybninger (5a) og/eller indgrebsfremspring (5b) hver for sig har samme normalafstand fra endevæggen (1) og/eller er ensartet fordelt i kappevæggen (2) periferiretning, og/eller hvorved det totale antal af indgrebsfordybninger (5a) og/eller indgrebsfremspring (5b) er to eller fire, og/eller

- at især indgrebsfordybningerne (5a) og/eller indgrebsfremspringene (5b) rager ud fra eller trænger ind i kappevæggen (2) under en vinkel (β_1 , β_2) på fra 5° til 40° og/eller højst 2 mm, især højst 0,3 mm, og/eller
- at endevæggen (1) er tildannet stråle-, damp-, fugt-, partikel- og/eller lysgennemtrængelig og/eller har et antal af, især dampgennemtrængelige eller gasgennemtrængelige, mikrohuller (6), og/eller
- at kappevæggens (2) tykkelse (d_2) tiltager, fortrinsvis kontinuert, fra endevæggen (1) til den fjernt fra endevæggen (1) værende ende af kappevæggen (2), især i det mindste over et delområde af kappevæggen (2), og/eller
- 10 at endevæggen (1) er cirkelformet tildannet og især har en diameter på fra 1 mm til 50 mm, eller at endevæggen (1) er tildannet kvadratisk eller rektangulært, og hvorved endevæggens (1) sidekanter har en længde på imellem 2 mm og 40 mm.

3. Afdækningshætte (10) ifølge krav 1 eller 2, **kendetegnet ved** en basisvæg
- 15 (3), som fortsætter, især ud i ét tildannet, kappevæggen (2) på den væk fra endevæggen (1) vendende ende og strækker sig fortrinsvis parallelt med eller under en vinkel på højst 10° udad væk fra kappevæggen (2) i forhold til endevæggen (1), især med stigende normalafstand fra endevæggen (1), hvorved basisvæggen (3) fortrinsvis er cirkelringformet tildannet og især har en ydre radius på imellem
- 20 2 mm og 50 mm og/eller en indvendig radius på imellem 1 mm og 45 mm og/eller har en cirkelringsbredde på fra 0,5 mm til 35 mm.

4. Afdækningshætte (10) ifølge et af de foregående krav, **kendetegnet ved**, at afdækningshætten (10) er tildannet af samme materiale og/eller ud i ét og især
- 25 er af termoplastisk eller plastisk deformeret eller deformerbart plast, fortrinsvis af et eller følgende materialer eller en blanding heraf:

- PETG (polyethylenterephthalatglycol),
- PP (polypropylen),
- 30 - PE (polyethylen),
- PC (polycarbonat),
- PVC (polyvinylchlorid),
- PS (polystyrol),

- ABS (acrylonitrilbutadienstyren),
- HDPE (høj-tæthed-polyethylen),
- LDPE (lav-tæthed-polyethylen),
- PET (polyethylenterephthalat),
- 5 - PMMA (polymethylmethacrylat),
- ECOTERM S 900 T1,
- PETG / copolyester 67639,

hvorved afdækningshættens (10) materiale, især som supplement, indeholder et
 10 eller flere af følgende bestanddele:

- additiver,
- stabilisatorer,
- farvemiddel,
- 15 - fyldstoffer,
- forstærkningsstoffer,

hvorved især afdækningshættens (10) materiale har et farvestof, og endevæggen
 (1) til bestemte, især synlige, bølgelængdeandele er tildannet uigennemsigtig el-
 20 ler absorberende.

5. Afdækningshætte (10) ifølge et af de foregående krav, **kendetegnet ved**, at
 kappevæggens (2) tykkelse især i aksial eller radial retning har et over kappe-
 væggen (2) kontinuerligt, knæk- og kantfrit forløb, og/eller
 25 som tykkelse (d_1 , d_2 , d_3) gælder den respektive gennemsnitlige tykkelse i det re-
 spektive afsnit (7, 8, 9) af kappevæggen (2), og/eller
 at kappevæggen (2), især med undtagelse af området med indgrebsfremspring
 (5a) og/eller indgrebsfordybninger (5b), er rotationssymmetrisk tildannet, og/eller
 tykkelsen (d_1 , d_2 , d_3) af det første fortykkelsesafsnit (7), mellemafsnittet (8) og det
 30 andet fortykkelsesafsnit (9) har følgende forhold i forhold til hinanden:

$$2 < d_1 : d_2 < 5 \text{ og/eller } 2 < d_3 : d_2 < 5 \text{ og/eller } 0,8 < d_1 : d_3 < 1,25$$

og/eller at tykkelserne (d_1 , d_2 , d_3) af det første fortykkelsesafsnit (7), det andet fortykkelsesafsnit (8) og det tredje fortykkelsesafsnit (9) er fastsat som følger:

5 $150 \mu\text{m} < d_1 < 250 \mu\text{m}$ og/eller $50 \mu\text{m} < d_2 < 100 \mu\text{m}$ og/eller $150 \mu\text{m} < d_3 < 250 \mu\text{m}$, og/eller

at højden (h_1) af det første fortykkelsesafsnit (7), højden (h_2) af mellemafsnittet (8) samt højden (h_3) af det andet fortykkelsesafsnit (9) har følgende forhold:

10 $0,2 < h_1 : h_2 < 0,6$ og/eller $0,8 < h_3 : h_2 < 1,25$ og/eller $0,2 < h_1 : h_3 < 0,6$ og/eller

- at kappevæggen (2) har en højde på fra 2 mm til 80 mm og/eller

- at forholdet imellem endevæggens (1) højde og maksimale dimension, især diameteren eller diagonalen, ligger imellem 0,01 og 55.

15 6. Måleapparat (20), især til hudanalyse, og som er afdækkelig med en afdækningshætte (10), hvorved afdækningshætten (10) har indgrebsfordybninger (5a) og/eller indgrebsfremspring (5b), hvorved afdækningshætten (10) fortrinsvis er tildannet ifølge et af kravene 1 til 3,

hvorved måleapparatet (20) omfatter et hus (26) og en heri anbragt sensor (23),
20 hvorved huset (26) har en konisk indsnævrende husdel (21) med en forreste endeflade (22), hvorpå der er anbragt et antal af indgrebsfordybninger (23a) og/eller indgrebsfremspring (25b) til indgreb med afdækningshættens indgrebsfordybninger (5a) og/eller indgrebsfremspring (5b),

især på en sådan måde, at i indgrebstilstanden ligger afdækningshættens (10)
25 endevæg (1) an imod den forreste endeflade (22),

- hvorved måleapparatet (20) har et udkastningsselement, som er anbragt i den længst væk fra den forreste endevæg (22) værende ende af den konisk indsnævrende husdel (21), og som er længere væk fra den forreste endevæg (22) end indgrebsfordybningerne (25a) og/eller indgrebsfremspringene (25b),
30

- hvorved udkastningselementet (24) er indrettet til at skubbe en i indgreb værende afdækningshætte (10) i retning af den forreste endevæg (22) ved trykpåvirkning af afdækningshætten (10), og/eller
- hvorved udkastningselementet er forskydeligt lejret på huset i retning af den forreste endevæg (22),
- hvorved der op til udkastningselementet (24) støder en vægtstangsforlængelse (27) eller udgår en vægtstangsforlængelse fra udkastningselementet (24), eller udkastningselementet (24) er forbundet med en vægtstangsforlængelse (27),
- hvorved vægtstangsforlængelsen (27) er svingbart forbundet med huset (26) i sit midterområde, således at der fremkommer en toarmet vægtstang, ved hvis ene ende udkastningselementet (24) er anbragt,
- hvorved den til huset hængslet vægtstangsforlængelse (27) som følge af sin svingning trykker udkastningselementet (24) i retning af den forreste endevæg (22),

kendetegnet ved, at udkastningselementet (24) er tildannet ringformet, især cirkelringcylinderformet og omgiver den konisk indsnævrende husdel (21).

7. Måleapparat (20) ifølge krav 6, **kendetegnet ved**, at den på huset hængslede vægtstangsforlængelse (27) trykker udkastningselementet (24) i retning af den forreste endevæg (22) ved sin svingning ved hjælp af kraftpåvirkning af aktiveringselementet (28).
8. Måleapparat (20) ifølge et af kravene 6 eller 7, **kendetegnet ved**, at udkastningselementet (24) er anbragt på en ende af den toarmede vægtstang, og på den anden ende af den toarmede vægtstang er der tilvejebragt et aktiveringselement, hvorved især udkastningselementet (24) og/eller vægtstangsforlængelsen (27) er påvirket med en kraft eller forspænding ved hjælp af et fjederelement (29), hvor denne kraft eller forspænding trykker eller trækker udkastningselementet (24) væk fra den forreste endevæg (22).

9. Måleapparat (20) ifølge et af kravene 6 til 8, **kendetegnet ved**, at de enkelte indgrebsfordybninger (25a) og/eller indgrebsfremspring (25b) hver for sig har samme normalafstand fra endevæggen (22) og/eller er ensartet fordelt i kappevæggens (2) periferiretning, og/eller det totale antal af indgrebsfordybninger (25a) og/eller indgrebsfremspring (25b) er to eller fire, og/eller at indgrebsfordybningerne (25a) og/eller indgrebsfremspringene (25b) rager ud fra kappevæggen (2) under en vinkel på 10° til 30° og/eller højst 1 mm, især højst 0,5 mm fra kappevæggen (2), og/eller at der er tilvejebragt to indgrebsfordybninger (25a) og/eller indgrebsfremspring (25b), som har samme afstand til et punkt, og er i det område, hvori vægtstangsforlængelsen (27) støder op til eller udgår fra udkastningselementet (24).

10. Fremgangsmåde til fremstilling af en afdækningshætte (10) især ifølge et af kravene 1 til 5,

15

a) at der antrækkes en plastfolie (31), især en folie bestående af PETG (polyethylenterephthalatglycol) som udgangsmateriale til en dybtrækningsproces, hvilken folie har en tykkelse på imellem 0,04 mm og 0,5 mm,
b) at et stempel (32) med et antal af separat bevægelige an imod hinanden beliggende delstempler (33) presses an imod plastfolien (31), hvorved de enkelte delstempler (33) bevæges vinkelret på plastfoliens (31) plan, og hvorved plastfolien (31) trykkes via delstemplernes (33) tryk ind i en modform og deformeres til en hætteform, **kendetegnet ved**,
c) at stemplets (32) enkelte delstempler (33) bringes i afstand fra hinanden under eller efter trinnet b), hvorved hver delstempel (33) bevæges radialt udad fra stemplets (32) position, hvorved der i plastfolien (31) dannes en endevæg (1), især med en tykkelse i området fra mindre end 100 µm, fortrinsvis imellem 3 µm og 20 µm, især imellem 5 µm og 10 µm.

11. Fremgangsmåde ifølge krav 10, **kendetegnet ved**, at efter trinnet c) fjernes delstemplerne (33) fra den tildannede hætteform, og et yderligere stempel (36) med en plan endeflade (35) og et stempellegeme, som udvider sig, føres ind i det ved hjælp af delstemplerne (33) dannede volumen (39) i plastfolien (31), hvorved

plastfolien (31) bringes i en hætteform imellem det yderligere stempel (36) og en anden modform, hvorved fortrinsvis plastfolien (31), det yderligere stempel (36) eller de to modforme efter opvarmning af plastfolien (31) til en temperatur på imellem 50°C og 90°C skubbes frem.

5

12. Fremgangsmåde ifølge krav 10 eller 11, **kendetegnet ved**, at til indstillingen af de respektive tykkelser (d_1 , d_2 , d_3) af den kappevæg (2), som udgår fra endevæggen (1), indstilles fremskydningshastigheden (v) og/eller temperaturen i forbindelse med delstemplerne (33) og det yderligere stempel (36) og/eller plastfo-
- 10 liens (31) temperatur og/eller den første eller anden modforms temperatur, hvorved til redueringen af vægtykkelsen i randområdet (36) af den ved hjælp af det yderligere stempel dannede fordybning foretages en øgning af den nævnte temperatur samt en øgning af fremskydningshastigheden, og/eller hvorved der til øgningen af vægtykkelsen i randområdet (36) af den ved hjælp af det yderligere
- 15 stempel dannede fordybning foretages en reduering af den nævnte temperatur samt en reduering af fremskydningshastigheden.

13. Fremgangsmåde ifølge et af kravene 10 til 12, **kendetegnet ved**, at det yderligere stempels (36) og/eller plastfoliens (31) temperatur samt det yderligere
- 20 stempels (36) fremskydningshastighed indstilles på en sådan måde, at under et første fremskydningstidsrum for det yderligere stempel (36) dannes et afsnit af kappevæggen (2) med en på forhånd givet tykkelse (d_2), især fra 50 μm til 100 μm , og
- at under et efter det første fremskydningstidsrum følgende andet fremskydnings-
- 25 tidsrum for det yderligere stempel (36) dannes et afsnit af kappevæggen (2) med en på forhånd given tykkelse (d_3), især på 150 μm og 250 μm , som er tykkere end tykkelsen (d_2) af den under det første fremskydningstidsrum fremstillede kappevæg (2), hvorved især vægtykkelsen (d_2) under det yderligere stempels (36) første fremskydningstidsrum indstilles på en værdi, som svarer til det dobbelte op
- 30 til det femdobbelte af vægtykkelsen (d_1) af det kappeområde, som blev tildannet ved udformningen af endevæggen (1) ved indføringen af delstemplerne (33).

14. Fremgangsmåde ifølge et af kravene 10 til 13, **kendetegnet ved**, at plastfolien (31) består af termoplastisk eller plastisk deformeret eller deformerbart plast, fortrinsvis af et af følgende materialer eller en blanding heraf:

- 5 - PETG (polyethylenterephthalatglycol),
- PP (polypropylen),
- PE (polyethylen),
- PC (polycarbonat),
- PVC (polyvinylchlorid),
- 10 - PS (polystyrol),
- ABS (acrylonitrilbutadienstyren),
- HDPE (høj-tæthed-polyethylen),
- LDPE (lav-tæthed-polyethylen),
- PET (polyethylenterephthalat),
- 15 - PMMA (polymethylmethacrylat),
- ECOTERM S 900 T1,
- PETG / Copolyester 67639,

hvorved afdækningshættens (10) materiale, især som supplement, indeholder et
20 eller flere af følgende bestanddele:

- additiver,
- stabilisatorer,
- farvemiddel,
- 25 - fyldstoffer,
- forstærkningsstoffer,

hvorved især afdækningshættens (10) materiale har et farvestof, og endevæggen
(1) til bestemte, især synlige, bølgelængdeandele er tildannet uigennemsigtig el-
30 ler absorberende.

15. Fremgangsmåde ifølge et af kravene 10 til 14, **kendetegnet ved**,

- at delstemplerne (33) under deres radialt væk fra deres centrum rettede bevægelse under trin c) bevæges roterende langs en omkring en central akse (X) spiralformet udad forløbende kurve, som udvider sig, og/eller
 - at efter den delvise eller fuldstændige udformning af kappevæggen (2) føres delstemplerne (33) og det yderligere stempel (36) tilbage, og det tildannede volumen (39) påvirkes med især opvarmet trykluft, og at det yderligere stempel (36) derpå eventuelt føres ind i det udformede volumen (39) til gennemføringen af det næste udformningstrin, hvorved især indgrebsfordybningerne (5b) i kappevæggens (2) indre kappe dannes ved påvirkning med trykluft, og/eller at efter kappevæggens (2) udformning adskilles den op til kappevæggen (2) stødende tilbageværende plastfolie fra kappevæggen (2) langs en på forhånd givet snitlinje (37), hvorved snitlinjen (37) især er således valgt, at et delafsnit af den op til kappevæggen (2) stødende tilbageværende plastfolie (31) ligger inden for snitlinjen og danner basisvæggen (3), og/eller
 - at plastfolien (31), især efter dens udformning, opvarmes for et givet tidsrum, især for i det mindste 3 sekunder, til en på forhånd givet temperatur på imellem 30°C til 120°C, især en temperatur på imellem 50°C og 90°C, og/eller
- at delstemplerne (33) og/eller det yderligere stempel (36) og/eller de anvendte modforme før plastfoliens (31) bearbejdning opvarmes til en temperatur på imellem 30°C til 120°C, især til en temperatur på imellem 50°C og 90°C, og under bearbejdningen holdes på en sådan temperatur, og/eller at, især ved hjælp af en laser eller en opvarmet mikronål eller nanonål eller ved hjælp af ætsninger, dannes især mikrohuller (6) eller nanohuller (6) i endevæggen (1).

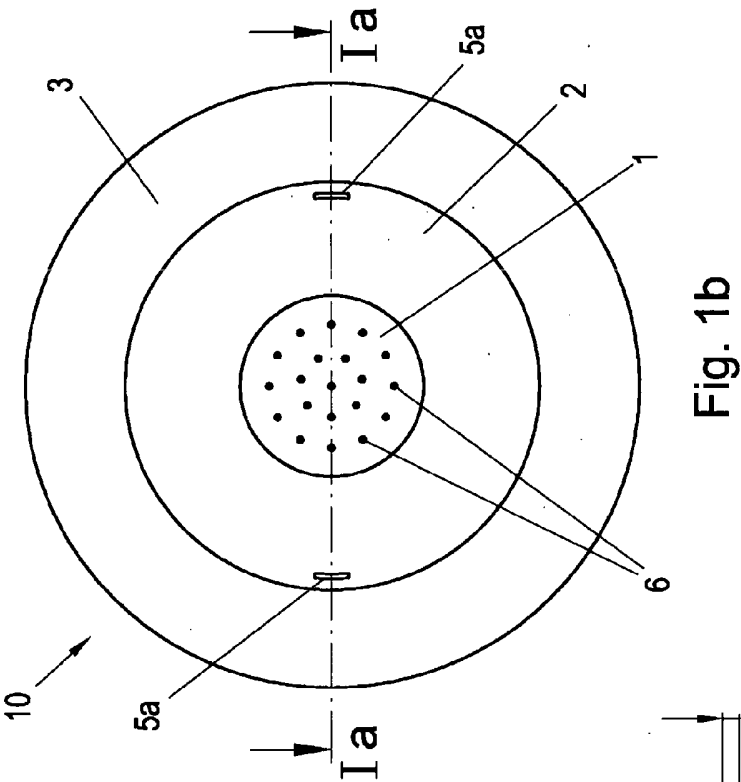


Fig. 1b

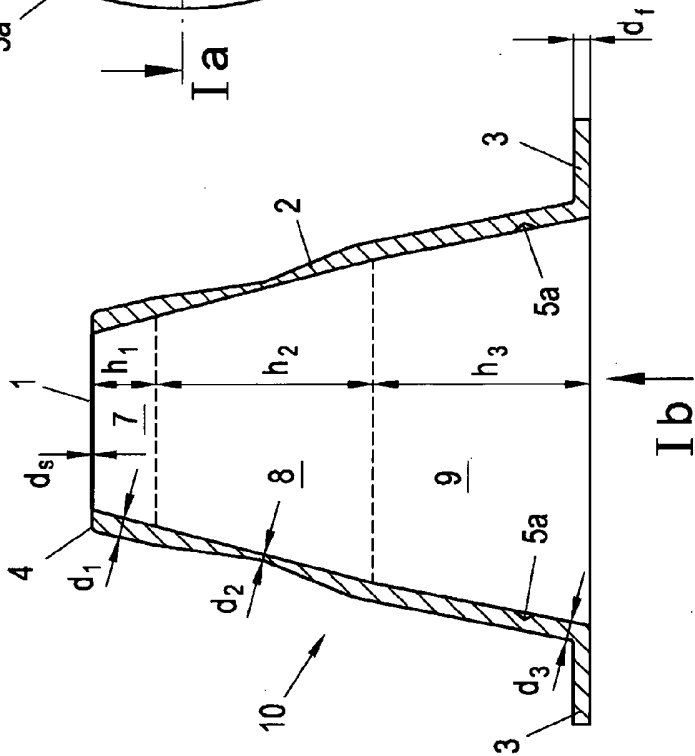


Fig. 1a

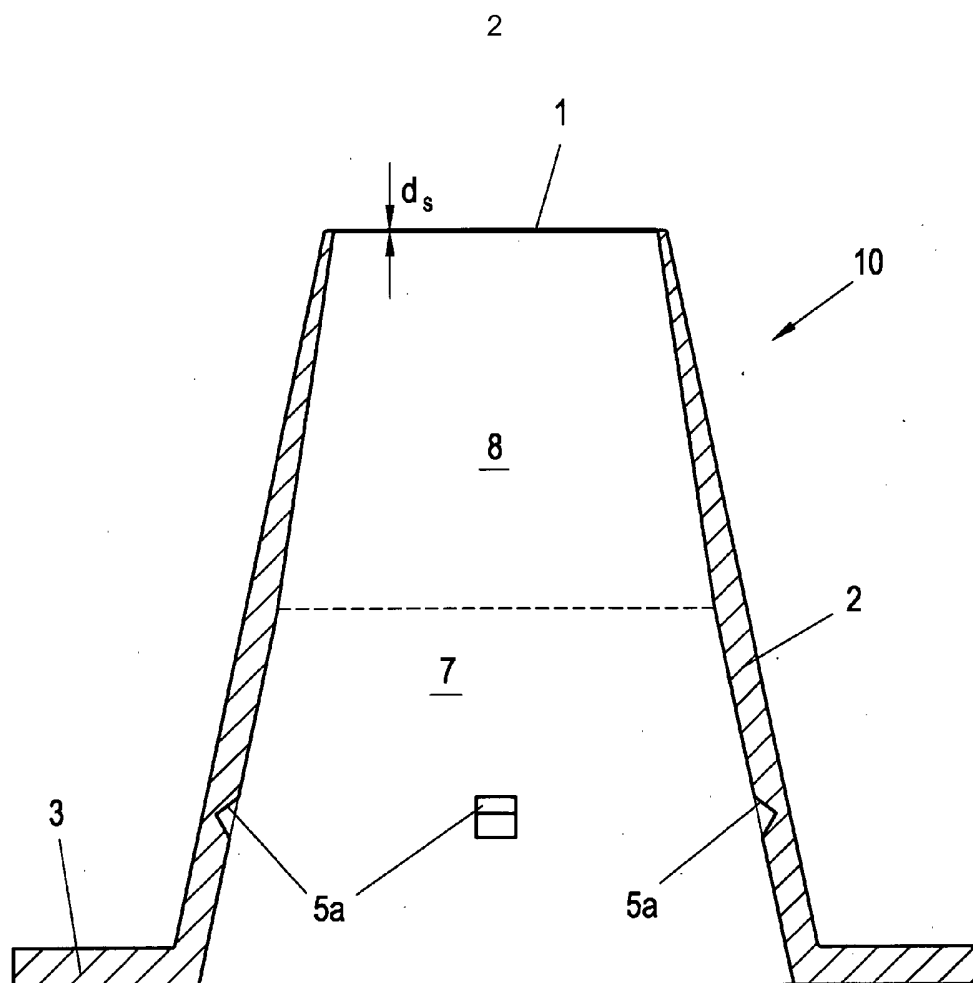


Fig. 2

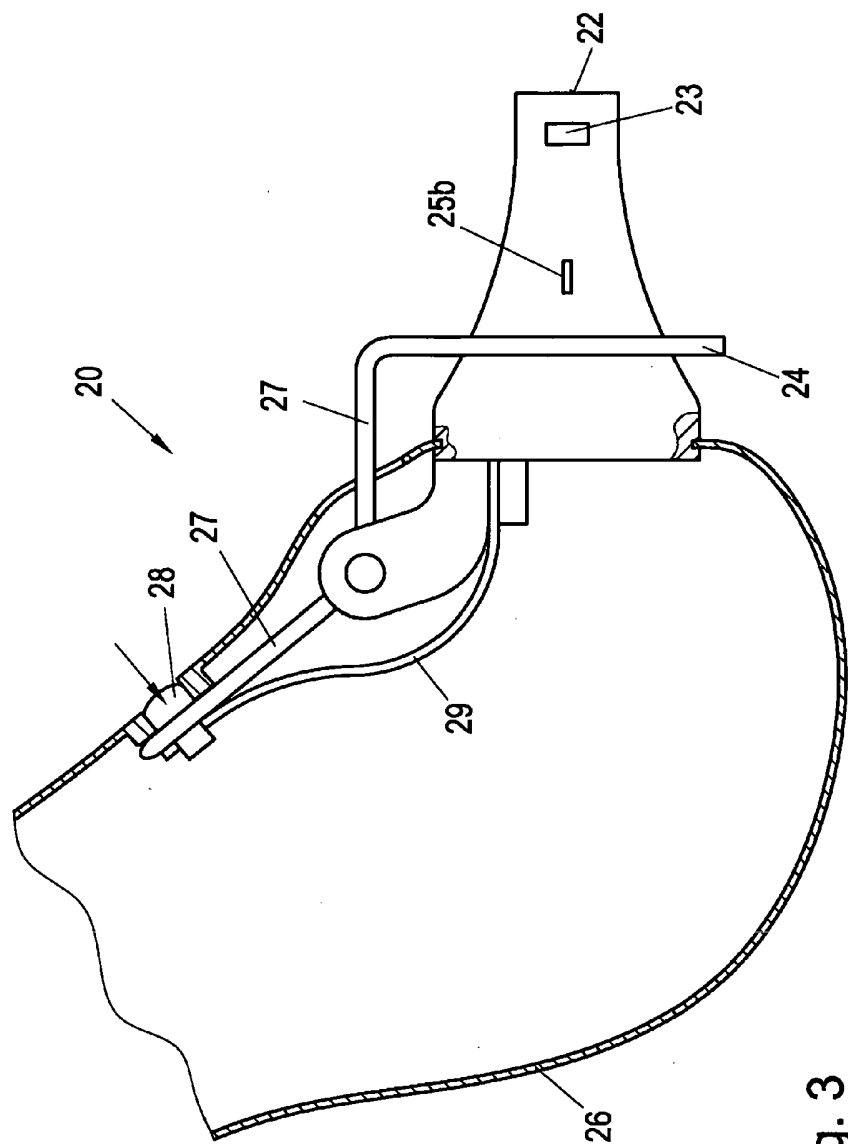


Fig. 3

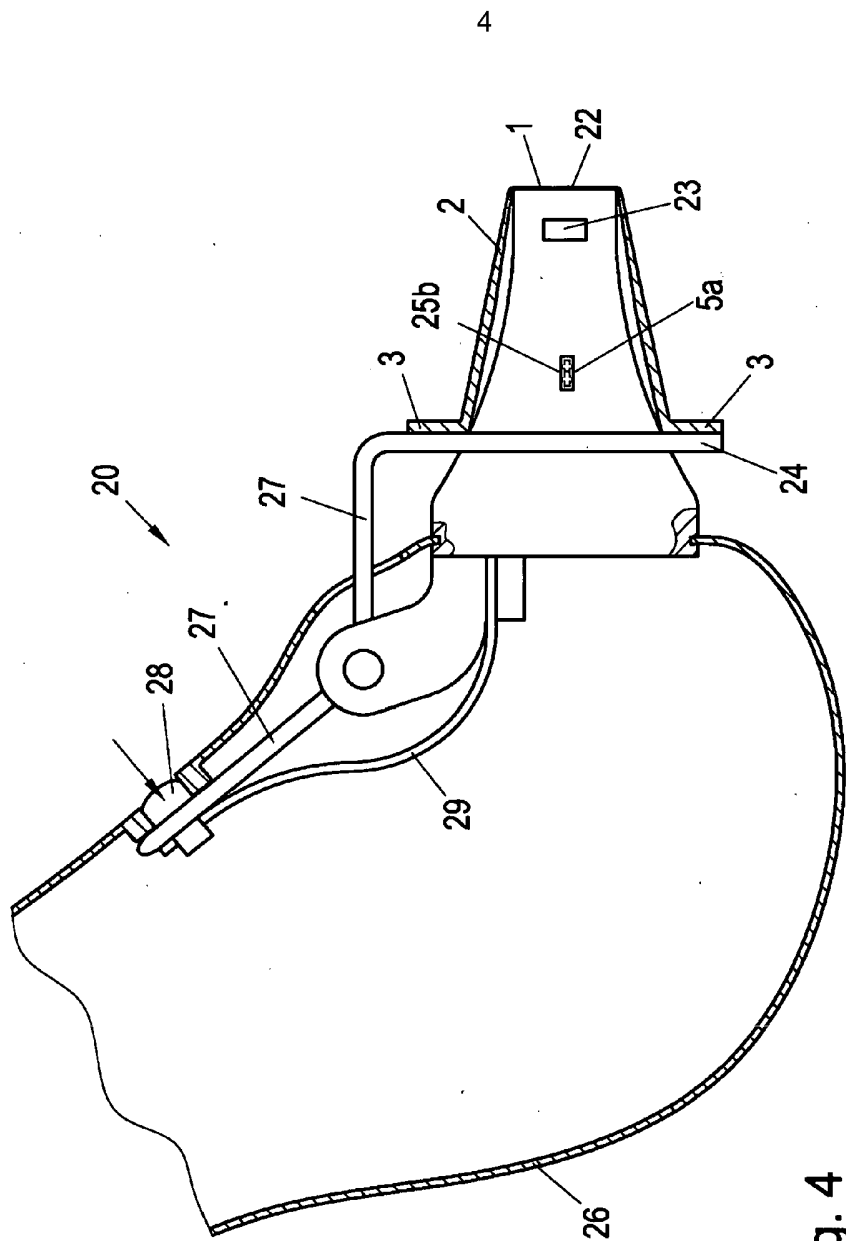


Fig. 4

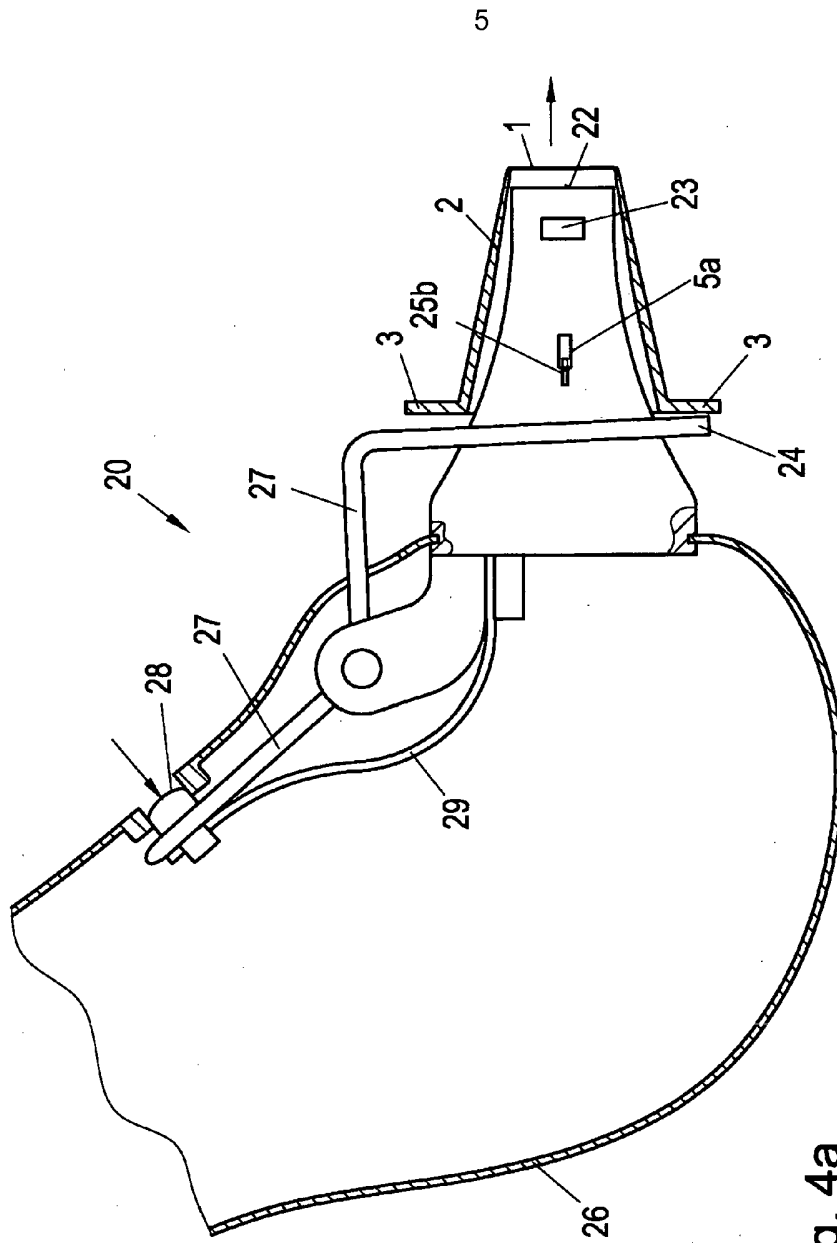


Fig. 4a

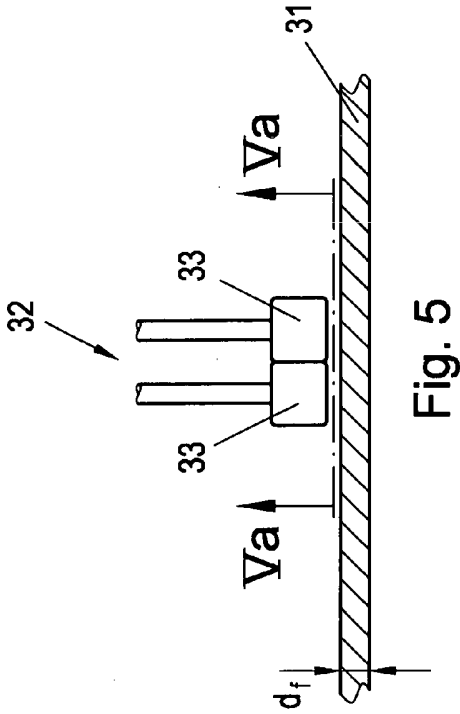


Fig. 5

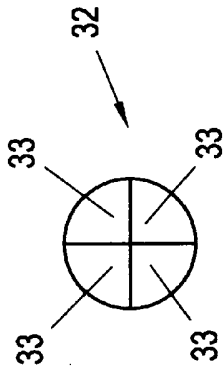


Fig. 5a

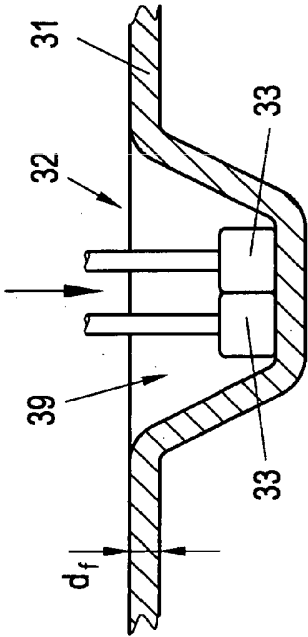


Fig. 6

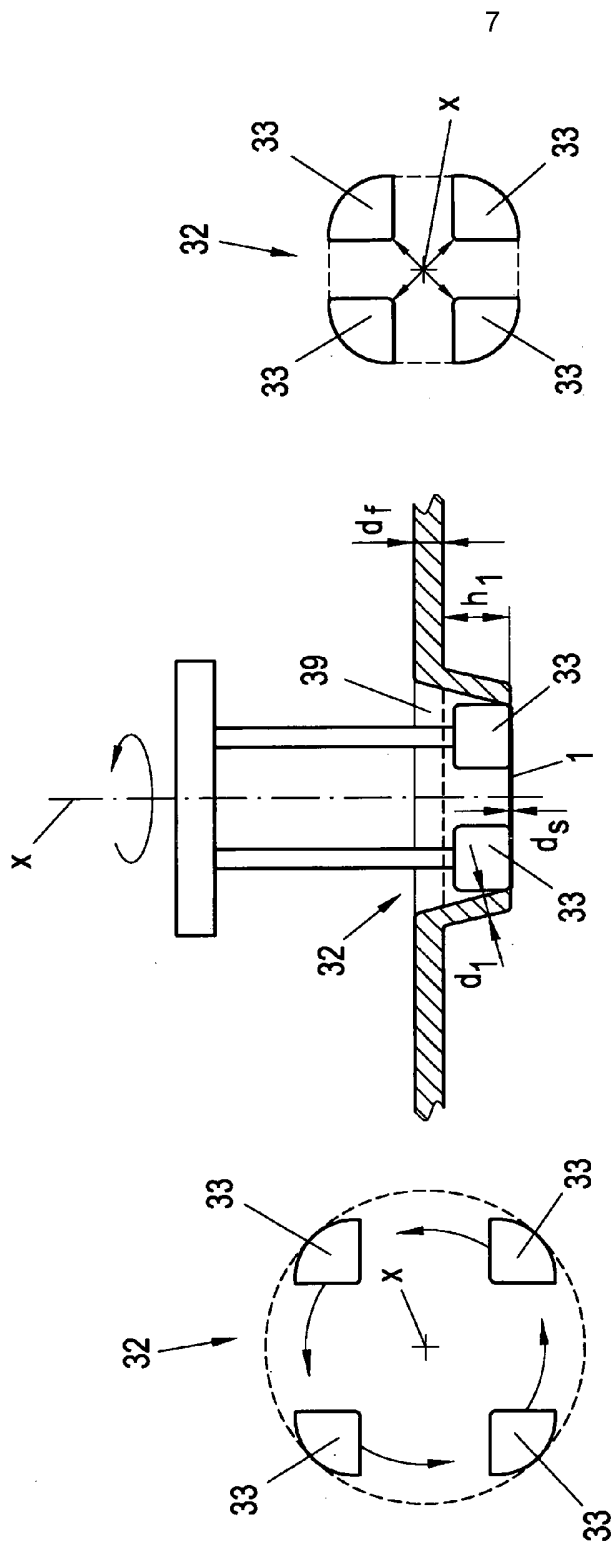


Fig. 7a

Fig. 7

Fig. 7b

8

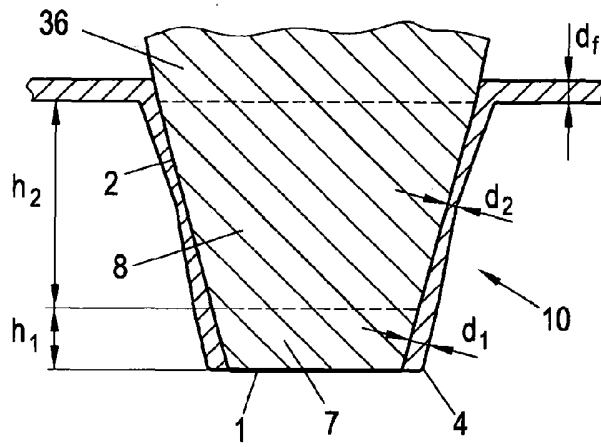


Fig. 8

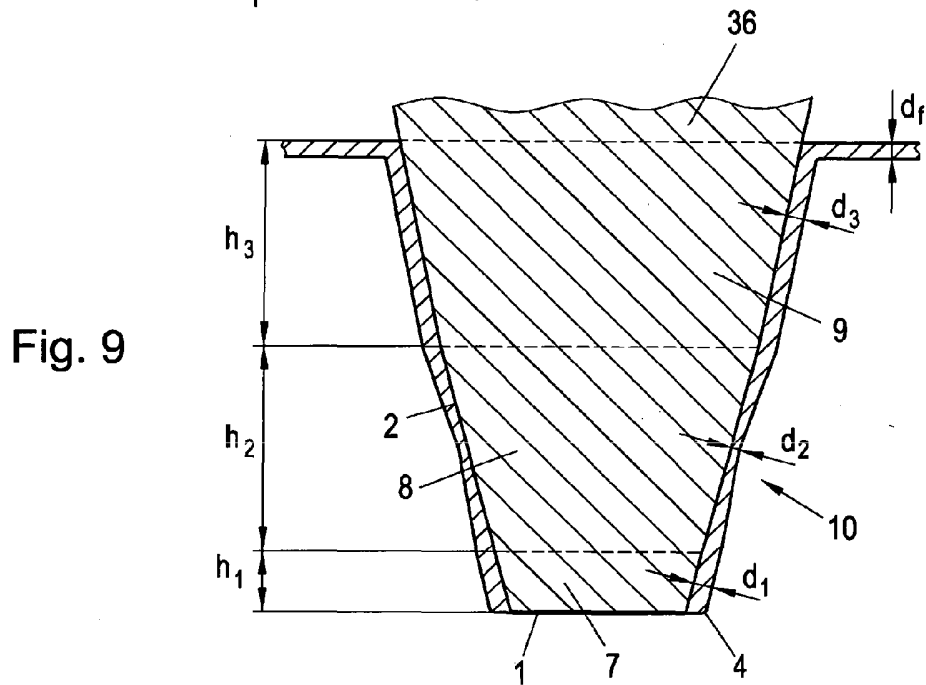


Fig. 9

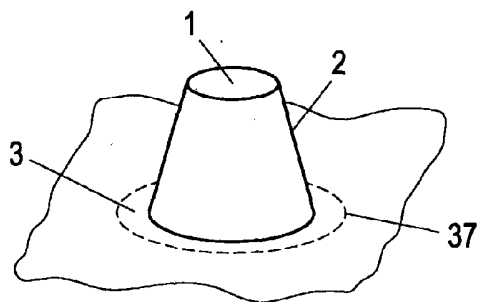


Fig. 10