(19) DANMARK

(10) **DK/EP 3251976 T3**

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: ***B 65 D 85/804 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2022-06-20**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2022-04-27**

(86) Europæisk ansøgning nr.: **17172548.4**

(86) Europæisk indleveringsdag: **2017-05-23**

(87) Den europæiske ansøgnings publiceringsdag: **2017-12-06**

(30) Prioritet: **2016-06-03 CH 7152016**

(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**

(73) Patenthaver: **Delica AG, Bresteneggstrasse 4, 5033 Buchs AG, Schweiz**

(72) Opfinder: **AFFOLTER, Roland, Föhrenweg 14, 5103 Möriken, Schweiz**
Schramm, Max, Rheinländerstrasse 5, 4056 Basel, Schweiz

(74) Fuldmægtig i Danmark: **Zacco Denmark A/S, Arne Jacobsens Allé 15, 2300 København S, Danmark**

(54) Benævnelse: **Kapsel til fremstilling af en drik**

(56) Fremdragne publikationer:
EP-A1- 2 891 615
EP-A1- 2 985 240
EP-B1- 2 616 367
WO-A1-2016/075316
CH-A2- 709 273
US-A- 5 656 311
US-A- 5 948 455

Capsule for the preparation of a beverage

The invention relates to a capsule for the preparation of a beverage according to claim 1. Such capsules are widely used in particular for the preparation of coffee. However, they are also used for tea or for mixed drinks. Accordingly, when hot water is passed through the capsule, the substance contained in the closed chamber is either extracted, as in the case of coffee powder, or it is dissolved by the hot water, as in the case of milk powder, for example.

In many capsule systems, the capsules are already opened on the input side when they are inserted into a beverage preparation machine. In the process, mandrels or knives penetrate a capsule wall or the capsule lid to introduce hot water. On the outlet side, the capsule is opened by the build-up of internal pressure and by the rupture of a membrane along at least one line of weakness.

A cartridge for the preparation of a beverage has already become known through DE 27 52 733 A1, which consists of a dense body made of aluminium sheet, which is closed by a membrane. The membrane has a weakening line which defines an opening. The membrane is also made of aluminium and in a preferred embodiment the weakening line is not closed but has the shape of a "C" or horseshoe.

EP 2 891 615 A1 also discloses a capsule for the preparation of a beverage in which the lid of the capsule does not form the outlet side but the inlet side. An outlet nozzle is arranged at the bottom of the capsule, the bottom-side entrance of which is closed with a bursting membrane. The bursting membrane has star-shaped weakening lines starting from the centre in order to form

an opening that is as uniform as possible when the internal pressure rises.

By EP 2 616 367 B1, which discloses a capsule according to the generic term of claim 1, a cartridge for coffee and soluble products for the preparation of a beverage has become known. The cartridge has a tubular container body, the ends of which are closed by a membrane. Each membrane consists of a composite film of, for example, aluminium and plastic film. A plurality of small incisions are provided in the plastic film, which form small openings in the membranes when pressure is applied.

A disadvantage of the known capsules is that the application of weakening lines in relatively thin aluminium foils is difficult or almost impossible. However, if the wall thicknesses are dimensioned too large, a high internal pressure must be built up for bursting. It is therefore a task of the invention to avoid the disadvantages of the known and to create a capsule whose bursting membrane can be manufactured at low cost, whereby the bursting behaviour can be controlled within a large pressure range. According to the invention, this task is solved with a capsule which has the features in claim 1.

The capsule comprises a chamber containing at least one substance such as coffee or tea. The preferably closed chamber has an outlet section which is formed by a membrane which ruptures under internal pressure in the chamber to form an outlet opening. The membrane can directly form the lid or the bottom of the capsule or it can be arranged inside the capsule. The chamber is arranged in or formed by a capsule body. This capsule body can be closed with a lid, which also consists of a foil made of metal or plastic. The chamber is designed to be essentially liquid-tight and airtight with respect to the outside atmosphere, so

that the substance is protected from environmental influences. Depending on the material of the capsule body, the chamber is also aroma-tight against the outside atmosphere, so that oxidation by penetrating oxygen is prevented. The capsule body can be made of plastic material or aluminium.

To define the outlet opening, the membrane is provided with at least one weakening zone, in particular with at least one weakening line, the shape of which can be different. Of course, the membrane may also be provided with a plurality of, for example, 2, 3, 4, 5 or more lines of weakness, which may also be interconnected. According to the invention, the membrane consists of a composite foil comprising at least one metal foil and at least one plastic foil, wherein the weakening zone is arranged only in the plastic foil. The weakening zone may have any geometric outline and may, for example, also consist of a combination of surfaces and lines.

The metal foil, for example made of aluminium, remains completely intact and the tearing behaviour is determined exclusively by the weakening zone arranged in the plastic foil. Surprisingly, it has been shown that the weakening zone in the plastic film is completely sufficient and that in the case of a weakening line, the crack in the metal film follows exactly the weakening line in the plastic film. This means that relatively thin metal foils can also be used, which tear reliably even at a lower internal pressure. A weakening line in the plastic film is much easier to apply than in the metal film.

A membrane consisting of an aluminium foil with a laminated PET (polyethylene terephthalate) layer has proven to be particularly advantageous. Such films are already used in the packaging industry and are available as standard goods. The manufacturing

costs can thus be reduced considerably. Other food-grade plastics are also conceivable.

In addition, on the side of the aluminium layer facing away from the plastic film or the PET layer, a sealing lacquer can be applied for sealing the membrane onto a support structure, in particular onto a support shoulder of the capsule body. In this way, the membrane can be easily installed in the capsule body by heat sealing. The support structure below the surface covered by the membrane can be of any design.

The aluminium layer can have a wall thickness of 6 to 30µm, preferably 15µm. Of course, other wall thicknesses are also conceivable depending on the intended application.

Optimum results are achieved when the plastic film is placed with the weakening zone facing the chamber. Depending on the course of the weakening zone, the tensile stress that builds up under internal pressure causes a tear in the film, either completely or partially, following the weakening zone.

If the weakening zone is at least one weakening line, it can be straight or curved or even angled. For example, a wavy line or a meandering line would be conceivable. The weakening line can run uninterrupted, or an interrupted course is also conceivable. The uninterrupted course of the weakening line on the outlet section has the advantage that the outlet opening can be controlled better and in such a way that the burst membrane does not hinder the outflow of the beverage.

The outlet section is circular in shape and the line of weakening can form a straight line that crosses the outlet section. This creates an elongated crack in the membrane. The membrane is

freely stretched, comparable to an eardrum, and curves convexly outwards when the internal pressure builds up from the closed chamber.

The outlet section is circular and can be supported on the side facing away from the chamber by a preferably circular support structure, whereby the line of weakness forms a chord which intersects the outlet section between the outer circumference and the support structure. Obviously, the membrane is formed as a circular surface which is supported not only at the outer circumference but also in the centre. The weakening line intersects this circular ring surface as a chord. Of course, it would also be conceivable for the weakening line to intersect the annular surface radially outwards, starting from the centre.

Finally, the outlet section is also circular in shape, with the line of weakness forming a tangent to the free-span area of the membrane. This is conceivable with or without central support. In such a case, the weakening line does not cause a weakening in the freely tensioned area of the membrane, but in the immediately adjacent area of the attachment on the outer circumference.

In a further embodiment with a circular outlet section and with a preferably circular support structure on the side facing away from the chamber, the line of weakening can surround the support structure. In this case, the weakening line runs in the free-span area between the support structure and the outer circumference of the outlet section, whereby the configuration of the weakening line can run polygonally, circularly or as any curve.

The membrane can be attached to a preferably circular support shoulder which is formed by the capsule body, and which is thus integral with it. Of course, other arrangements of the membrane

within the capsule would also be conceivable. For example, the membrane could be attached directly to a circumferential outwardly facing collar of the capsule body. In certain cases, it would even be conceivable for the membrane itself to form a component of the capsule body.

The central support structure and the preferably circular support shoulder do not necessarily have to be part of the capsule body but could also be arranged on a separate component. However, if the membrane is supported and fixed not only at its circular periphery but also in the centre, the control of the tearing behaviour at the weakening line is particularly delicate. At the circularly stretched bursting membrane, the edges of the support points also influence the tearing behaviour, because the tearing stress would be greatest there due to the physical conditions without a weakening line. However, a "punching through" of the central support structure by the membrane is not desired because this could hinder the flow of the beverage. This can be reliably prevented by the proposed arrangement of the weakening line.

The at least one weakening line, which preferably forms a straight line, a chord or a tangent, does not necessarily have to be understood as the shortest connection between two points on the membrane. Rather, the general orientation or arrangement of the line of weakness is meant in a generalised sense.

If the beverage produced with the capsule is an extract, such as coffee or tea, the solid components must be retained in the chamber. For this purpose, a filter, in particular a filter fleece, a perforated foil or a perforated filter plate can be arranged between the chamber and the membrane. Such filter means

are already known in the prior art and are not described in detail here.

Depending on the capsule system and the type of preparation machine, an outlet nozzle can be arranged on the side of the membrane facing away from the chamber. This makes it possible for the beverage to be led from the capsule directly into a drinking vessel.

Depending on the desired opening behaviour, the weakening line can be formed as a zigzag line or as a meander line or as a wavy line. It is also conceivable that several side lines of weakening run transversely to the at least one line of weakening. These can either cross the weakening line or only abut it from one side. The proposed variants can be used to create openings during tearing, which reliably prevent their edges from closing again.

In order to create a sufficiently large passage opening, it is particularly advantageous if the diaphragm ruptures under an internal pressure in the chamber between 0.5 and 20 bar in the area of the weakening line in such a way that the diaphragm deforms plastically without restoring properties and that an opening with a clear width of more than 1 mm is formed. The term clear width is understood to mean the distance between the adjacent edges of an opening. It is particularly advantageous to form an opening that is larger than 1 mm^2 in total.

The invention also relates to a method for producing a membrane for a capsule according to the invention or for producing such a capsule. In this process, the weakening zone in the plastic film is created by ablation by means of a laser, in particular by laser cutting. With the aid of a laser, the width and depth of the

weakening zone can be precisely determined without weakening the metal layer.

A particularly optimal process results when the composite film is formed as a windable tape and when first a weakening line is created, preferably extending in the direction of the tape. Of course, several weakening lines can be created next to each other in the direction of the strip. The strip processed in this way forms a semi-finished product from which the membranes for the capsule are then punched out of the strip and inserted into the capsules. The punching is done in such a way relative to the linear weakening line that it passes through the membrane at the desired point.

The overlapping of the unfilled capsules with the prepared tape and the subsequent punching and insertion of the membrane can take place directly one after the other in a continuous work process. Alternatively, it is also conceivable that the weakening line is applied by laser or other means directly at the workstation before punching and sealing.

The described production of the membrane from a coilable tape by subsequent punching and insertion into the capsule could also be particularly advantageous independently of the capsule design. In this case, the semi-finished products can be produced and stored particularly rationally and independently of the capsule production. The coiled tapes can be used particularly optimally in an automated manufacturing process for the capsules.

Further individual features and advantages of the invention will be apparent from the following description of examples of embodiments and from the drawings.

Showing:

Figure 1: A perspective sectional view through a capsule according to the invention with a membrane at the bottom of the capsule;

Figure 2: An enlarged partial view of the membrane of the capsule according to Figure 1;

Figure 3: A schematic representation of the layered structure of a membrane according to the invention;

Figures 4-7: Schematic diagrams showing different courses of the weakening line on the left side and the resulting tearing behaviour on the right side;

Figures 8-11: Schematic representations of alternative designs of a weakening line.

Figure 1 shows a capsule 1 as described in more detail in WO 2015/124558 A1, for example. The rotationally symmetrical capsule body 2 has a capsule base 17 and a capsule side wall 18. The capsule body 2 is closed at a circumferential collar with a lid 19. Integral with the capsule base 17 is a circumferential support shoulder 12, on which an only partially visible membrane 6 is sealed. Also integrally formed with the capsule base 17 is an outlet port 16, in the centre of which an elongate flow element 23 is held. The area of the outlet nozzle facing the inside of the capsule forms a support structure 13 (Figure 2) which is firmly connected to the membrane 6 and supports it.

A cup insert 20 is arranged in the capsule body and locked in place at the base with a snap-in connection 24. Towards the side

of the lid 19, the cup insert 20 is supported by a circumferential collar 21 on the capsule side wall 18. The cup insert contains coffee powder, for example.

The bottom of the cup insert 20 is designed as a perforated filter 14 which retains the coffee grounds during the extraction process. To stiffen the bottom of the filter, stiffening ribs 22 are arranged, one of which is cut along its entire length in Figure 1. The cup insert 20 could also be replaced by another insert or it could be omitted altogether if the substance is a soluble product such as milk powder.

The inside of the capsule body obviously forms a closed chamber 3, the outlet section of which is formed by the aforementioned membrane 6.

Further details of this arrangement can be seen in Figure 2. The cup insert 20 is removed here and the membrane 6 sealed onto the circumferential support shoulder 12 is also only partially shown, so that the underlying support structure 13 is still partially visible. This internal part of the outlet socket 16 has several outlet slots 15 running in the longitudinal direction of the outlet socket. The central section of the support structure 13 is also provided with such slots 15.

The membrane 6 is provided with a linear weakening line 7 which crosses the circular outlet section 4 formed by the membrane off-centre. When the capsule is used in a preparation machine, the lid 19 is pierced by means of a cannula, after which hot water is pumped into the closed chamber. Under the internal pressure that builds up, the membrane 6 ruptures along the line of weakness 7, forming an outlet opening 5. The liquid flows

through this into the area under the membrane 6 and through the slits 15 into the outlet nozzle 16.

Figure 3 schematically shows the structure of a composite film 8 from which the membrane 6 is made. A plastic foil 10, preferably made of PET, is laminated onto a metal foil 9, preferably made of aluminium. A sealing lacquer 11 may be applied to the opposite side so that the composite foil can be fixed in a simple manner. As shown, the weakening zone formed as a weakening line 7 is arranged only in the plastic film 10. The weakening line is thereby lasered out of the plastic layer. The width and depth of the weakening line 7 can thus be optimally determined. The weakening line does not necessarily have to penetrate the entire plastic film. For example, the metal foil made of aluminium can have a wall thickness of 15µ here. The weakening zone could also be much wider in relation to the total wall thickness of the membrane than shown here.

Figures 4 to 7 each show schematically on the left-hand side a composite film 8 in the form of a windable tape, for example as described above. The foil band has a width b depending on the size of the membrane to be produced. At a distance x from an outer edge of the tape an endless weakening line 7 is arranged, which extends linearly in the longitudinal direction of the foil tape. The membrane 6 to be subsequently punched out is shown schematically in the tape, as well as the circumferential support shoulder 12 and the central support structure 13 described in Figure 2.

According to Figure 4, the weakening line 7 runs as a chord between the circumferential support shoulder 12 and the central support structure 13. As shown on the right, an opening 5 in the form of a longitudinal slit is formed when the membrane 6

bursts, which is limited on both sides by the circumferential support shoulder. This is a preferred embodiment because the opening behaviour can be easily controlled.

In the embodiment example shown in Figure 5, the line of weakening runs through the centre of the circumferential support shoulder 12 and the central support structure 13, forming openings 5a, 5b in the freely stretched area of the membrane 6. The membrane, however, remains firmly connected to the support structure 13.

In the example shown in Figure 6, the weakening line 7 also forms a chord similar to the example shown in Figure 4, which intersects the membrane in the freely tensioned area. However, the chord lies far out in the area of the outer diameter, so that the points at which the weakening line 7 intersects with the supporting shoulder 12 are obviously close together. Obviously, this changes the tearing behaviour of the membrane and the tearing stress causes a tear that expands towards the central support structure 13.

In the example shown in Figure 7, the weakening line 7 only runs straight as a tangent to the freely tensioned area of the membrane 6, i.e. practically only above the circumferential support shoulder 12. As shown, this course is the least suitable for controlling the cracking behaviour, because the cracking spreads uncontrollably inwards from the tangential point.

The lines of weakness shown in figures 8 to 10 are not straight lines in the geometric sense. However, the general direction or an imaginary centre line is straight. According to Figure 8, the weakening line 7 is a wavy line which intersects the freely stretched circular ring surface of the diaphragm 6 between the

support shoulder 12 and the central support structure 13. The wavy line is arranged and configured in such a way that it does not touch or overlap the central support structure 13. According to Figure 9, the weakening line 7 is a zigzag line which also runs straight overall. Here, too, a sufficient distance to the central support structure 13 is maintained.

According to Figure 10, the weakening line 7 has several weakening side lines 26 which run transversely, and which cross the weakening line or abut it from one side. The weakening side lines also do not touch or overlap the central support structure 13.

According to Figure 11, the weakening line 7 runs around the central support structure 13 in the shape of a square. The sides of the square are quite close to the outer circumference of the support structure. Of course, the weakening line could also be star-shaped, polygonal, circular or any other configuration around the support structure. It would also be conceivable for a line of weakness surrounding the support structure to be followed by one or more lines of weakness extending to the support shoulder 12.

In all the described embodiments, the central support structure could also be omitted in certain cases. Furthermore, it would be conceivable that the general direction of the at least one weakening line is not straight but curved. However, with regard to the production from a continuous foil belt, a general straight alignment is expedient.

All in all, these embodiments show how crack formation can be optimally controlled and changed with the help of the weakening line. Of course, any other variants of weakening patterns would

be conceivable. Instead of burning out by means of a laser, the weakening zone could also be created by other suitable methods, for example by burning out with the help of a heated tool or by mechanical scribing or ablation.

Patentkrav

1. Kapsel (1) til fremstilling af en drik, omfattende et kammer (3) indeholdende mindst en substans, hvor kammeret har et udløbsafsnit (4), som til dannelse af en udløbsåbning (5) dannes af en membran (6), der rives op under et indvendigt tryk i kammeret, og hvor membranen til definition af udløbsåbningen er forsynet med mindst en svækket linje (7), hvor membranen (6) er en kompositfolie (8) omfattende mindst en metalfolie (9) og mindst en kunststoffolie (10), og hvor den svækkede linje (7) kun er anbragt i kunststoffolien (10), hvor udløbsafsnittet (4) er udformet cirkulært, **kendetegnet ved, at** den svækkede linje (7) danner en uafbrudt linje, som går igennem udløbsafsnittet (4), eller at den svækkede linje (7) omgiver en støttestruktur (13), som er anbragt på siden, der vender væk fra kammeret (3), i et frit spændt område mellem støttestrukturen (13) og et udvendigt omfang af udløbsområdet (4).

2. Kapsel ifølge krav 1, hvor membranen (6) består af en aluminiumsfolie med et kacheret PET-lag.

3. Kapsel ifølge krav 1 eller 2, hvor der på aluminiumsfoliens side, der vender væk fra kunststoffolien, er påført en segllak (11) til påsegling af membranen på en støttestruktur, især på en støtteskulder (12) af kapsellegemet (2).

4. Kapsel ifølge krav 2 eller 3, hvor aluminiumsfolien har en vægtykkelse på 6 til 30 µm, fortrinsvis på 15 µm.

5. Kapsel ifølge et af kravene 1 til 4, hvor kunststoffolien (10) vender mod det lukkede kammer (3).

6. Kapsel ifølge et af kravene 1 til 5, hvor den svækkede linje (7) danner en lige linje, som går igennem udløbsafsnittet.

7. Kapsel ifølge et af kravene 1 til 5, hvor udløbsafsnittet (4) på siden, der vender væk fra det lukkede kammer, er understøttet af en fortrinsvis cirkulær støt-

testruktur (13), hvor den svækkede linje danner en korde, som skærer udløbsafsnittet mellem det udvendige omfang og støttestrukturen.

8. Kapsel ifølge et af kravene 1 til 5, hvor den svækkede linje (7) omgiver støttestrukturen (13) i form af en polygon, en cirkel eller en vilkårlig kurve.

9. Kapsel ifølge et af kravene 1 til 8, hvor kammeret (3) er anbragt i et kapsellegeme (2) eller dannes af dette, som er lukket med et dæksel (19).

10. Kapsel ifølge et af kravene 1 til 9, hvor membranen (6) er fastgjort på en fortrinsvis cirkulær støtteskulder (12), som dannes af kapsellegemet (2).

11. Kapsel ifølge et af kravene 1 til 10, hvor der mellem kammeret (3) og membranen (6) er anbragt et filter (14), især en filtervlies, en hulfolie eller en hullet filterplade.

12. Kapsel ifølge et af kravene 1 til 11, hvor der på membranens (6) side, der vender væk fra kammeret (3), er anbragt en udløbsstuds (16).

13. Kapsel ifølge et af kravene 1 til 12, hvor den svækkede linje er udformet som siksaklinje eller som mæanderlinje eller som bølgelinje.

14. Kapsel ifølge et af kravene 1 til 13, hvor der fra den svækkede linje udgår flere svækkede sidelinjer, som forløber på tværs af denne.

15. Kapsel ifølge et af kravene 1 til 14, hvor membranen rives over under et indvendigt tryk i kammeret mellem 0,5 og 20 bar i området af den svækkede linje på en sådan måde, at membranen deformeres plastisk uden genetableringsegenskab, og at der dannes en åbning med en lysningsvidde på mere end 1 mm.

16. Fremgangsmåde til fremstilling af en kapsel (1) ifølge et af kravene 1 til 15, **kendetegnet ved, at** den svækkede linje (7) i kunststoffolien (10) frembringes ved fjernelse ved hjælp af laser.

17. Fremgangsmåde ifølge krav 16, hvor kompositfolien (8) er udformet som et opvikleligt bånd (25), og hvor der først frembringes en svækket linje (7), idet denne fortrinsvis strækker sig i båndretningen, og membranen derefter udstanes af båndet og indsættes i kapslen.

Fig.1

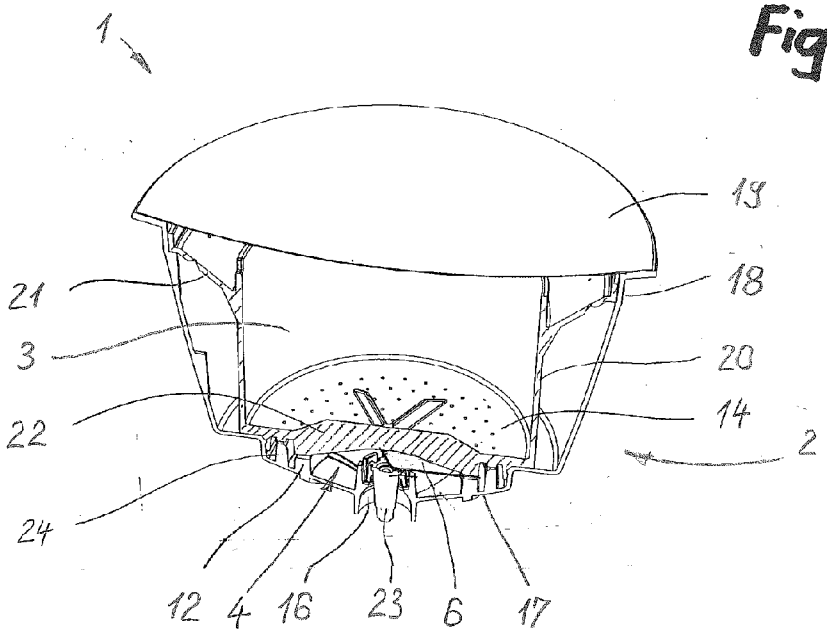


Fig.2

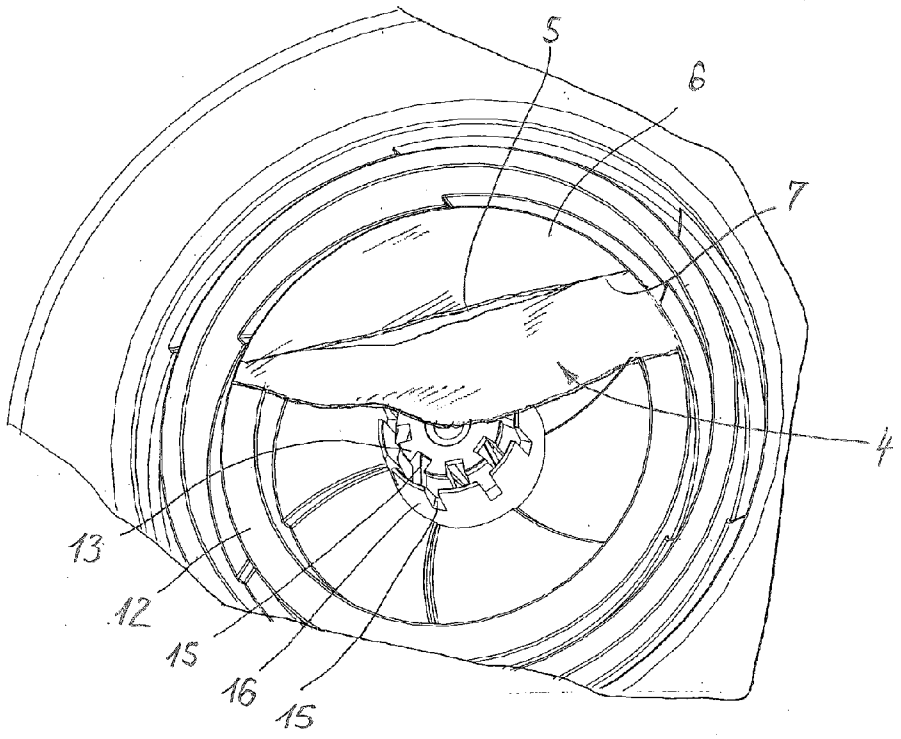


Fig. 3

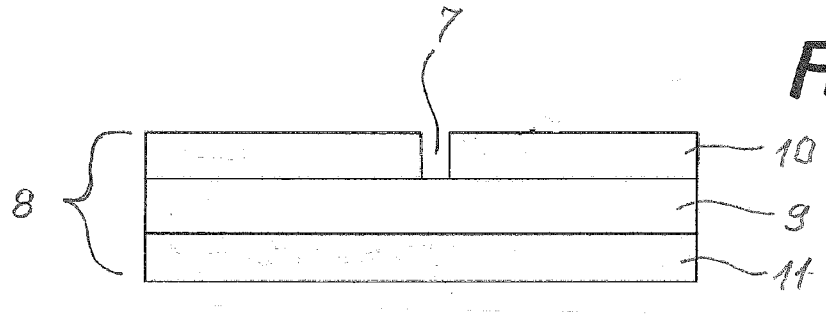


Fig. 4

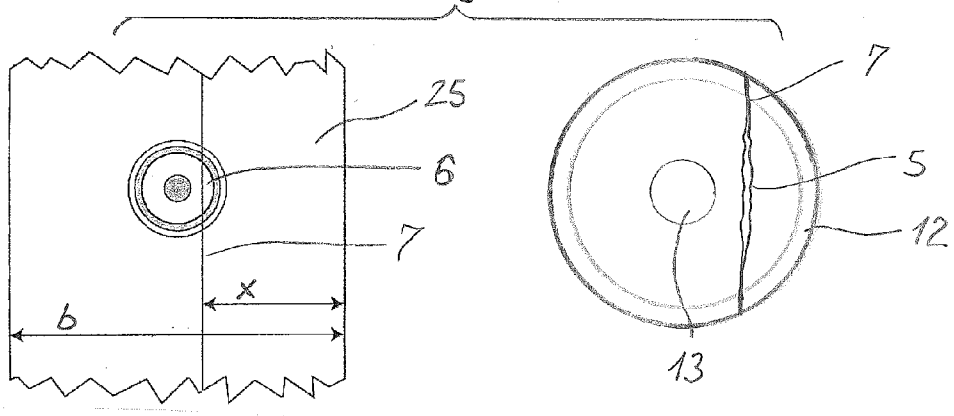


Fig. 5

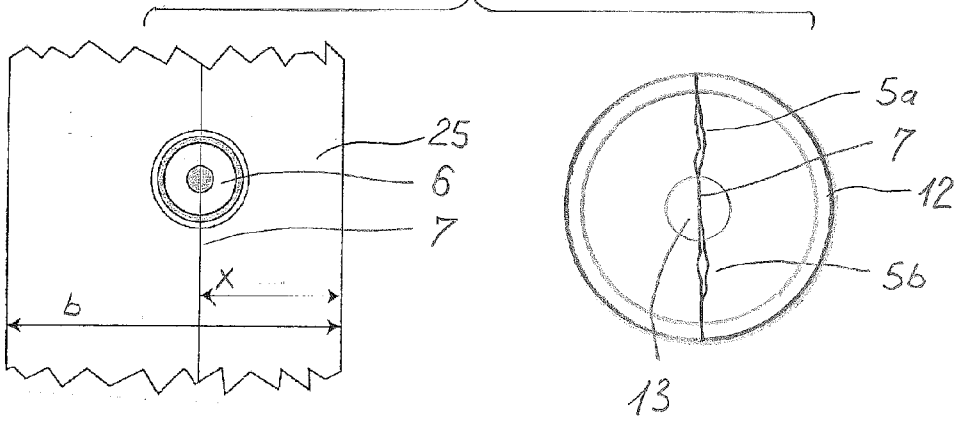


Fig. 6

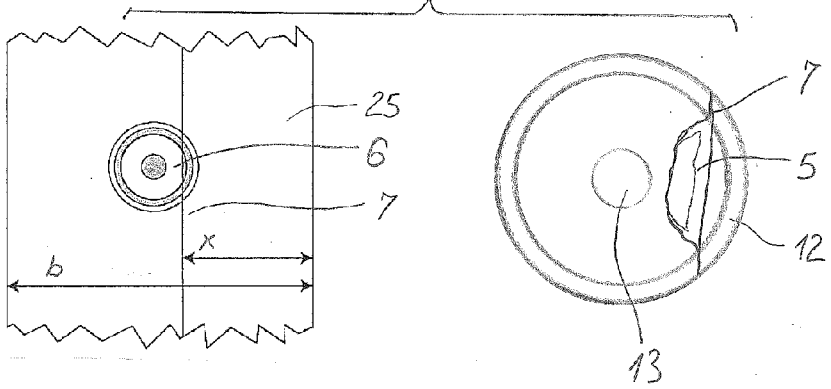


Fig. 7

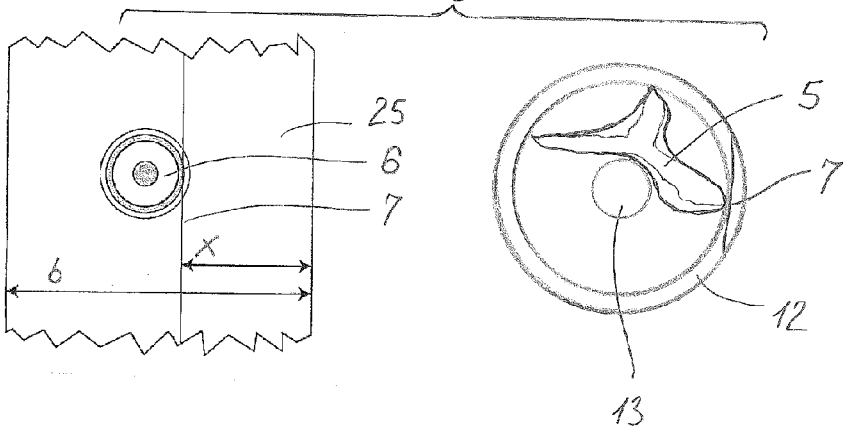
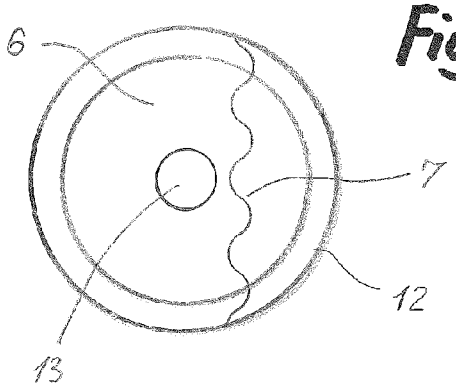


Fig. 8



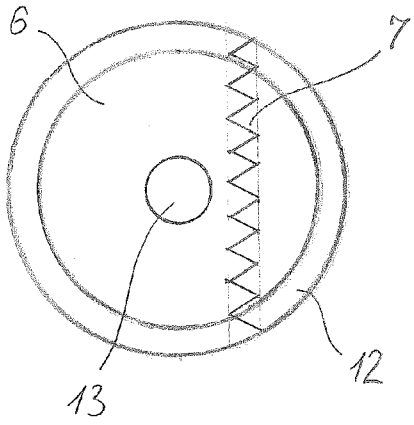


Fig. 9

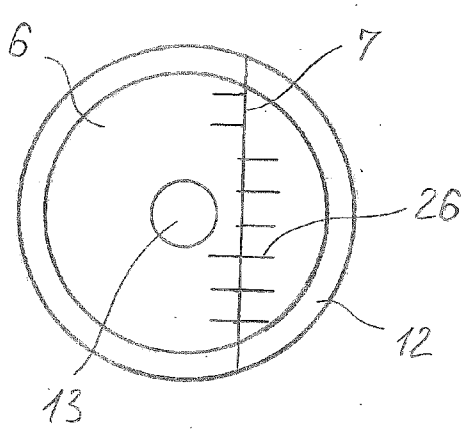


Fig. 10

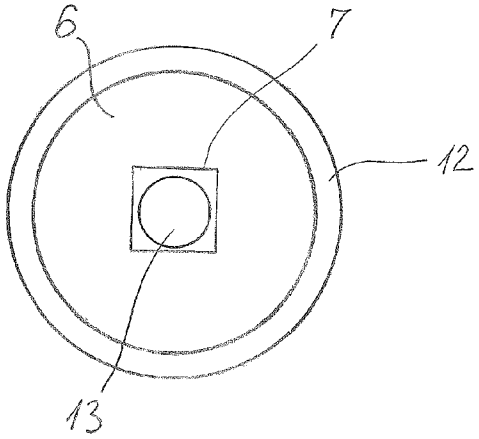


Fig. 11