



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**27.12.2017 Bulletin 2017/52**

(51) Int Cl.:  
**B26B 19/14 (2006.01)**

(21) Application number: **17075010.3**

(22) Date of filing: **21.06.2017**

(84) Designated Contracting States:  
**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**  
Designated Extension States:  
**BA ME**  
Designated Validation States:  
**MA MD**

(71) Applicant: **Severn Innovation Ltd**  
**Droitwich, Worcestershire WR9 7SB (GB)**

(72) Inventor: **The designation of the inventor has not  
yet been filed**

(30) Priority: **24.06.2016 IE 20160175**

(54) **FOIL FOR AN ELECTRIC RAZOR AND AN ELECTRIC RAZOR COMPRISING SUCH A FOIL**

(57) A foil for a razor such as an electric razor wherein the foil 1 is curved in at least two orthogonal planes. The foil 1 may be hemi-toroidal or have the shape of part of a torus or donut. A razor comprising such a foil has an array of blades (8, figure 11) arranged to move in a circular path. At least one of the blades 8 may have a pos-

itive rake angle. The blades 8 may be shaped and arranged to cause an airflow in through the apertures in the foil 1 to enhance shaving effect. The upper surface of the blades 8 may have the shape of a segment of a toroidal form. The razor may also include a disk motor (9, figure 14) for driving the blades.

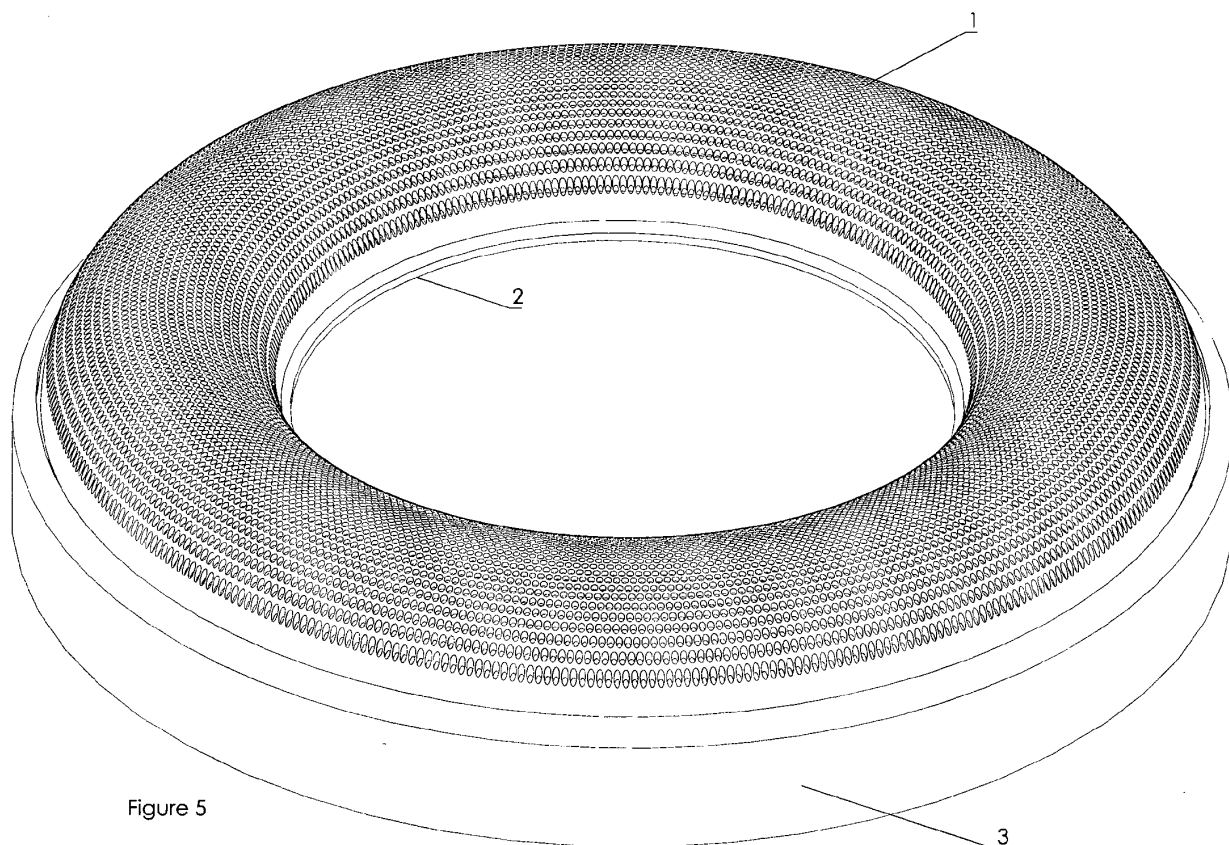


Figure 5

## Description

### Background of the present invention

**[0001]** The reciprocating action of the conventional foil-type razor causes a great deal of undesirable noise and vibration. This vibration, apart from being inconvenient to the user, reduces the effectiveness of hair engagement. The reciprocating action of the blade assembly causes the body of the razor to vibrate and consequently the foil is caused to vibrate. Attempting to insert a hair into a vibrating foil aperture is more difficult than inserting into a non-vibrating aperture thus reducing its effectiveness.

**[0002]** The reciprocating action also means the cutting plates or blades must be flat and thin. Hair follicles are cut by being pushed by the cutting plates against the edge of the foil aperture. This results in a blunt cut causing the remaining follicle to be crushed and rather than cut cleanly. Not using a sharp cutting edge also requires more force. It is not practical to use a sharp cutting edge with a conventional foil-type razor due to the reciprocating action and space available.

**[0003]** The single aspect of curvature of the conventional razor foil (the foil is curved around a straight line) means the razor is only really effective being moved backwards and forwards along one direction, a direction perpendicular to the width of the foil. Due to the various contours of the user's face and the varying direction of growth of hair follicles, the conventional foil razor must be constantly moved in different directions across the same area of the user's face. This is time consuming and requires a degree of manual dexterity that not all users may have.

### Aim of the present invention.

**[0004]** The present invention provides a razor which is quieter in operation, does not vibrate significantly, is more efficient and is more effective thereby reducing the time required for shaving.

### Summary of the present invention

**[0005]** The present invention provides a foil for a razor and a razor comprising such a foil as defined by the accompanying claims.

**[0006]** The present invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 a is a side view of a razor in accordance with the present invention

Figure 1b is a front view of a razor in accordance with the present invention

Figures 2a and 2b are perspective views of the razor shown in figures 1 a and 1 b

Figure 3 is a shaded perspective view of the exem-

plary razor

Figure 4 is an exploded view of the head section of the exemplary razor

Figure 5 is a perspective view of the foil assembly

Figure 6 is a shaded view of the foil assembly

Figure 7 is a plan view of the foil assembly with detail A

Figure 8 is a plan view of the foil assembly with cross-section B and detail C

Figure 9 is a plan view of the inner 2 and outer 3 collars with cross-section D and detail E

Figure 10 is a front view of the assembled razor with cross-section F and detail G

Figure 11 is a perspective view of the blade assembly

Figure 12a is a plan view of the blade carrier 6

Figure 12b is a side view of the blade carrier 6

Figures 13a to 13d are side, upper perspective, plan and lower perspective views of the central retainer 4 respectively with cross-section H and detail I

Figure 14 is an exploded view of the disk motor 9

### Detailed description of the present invention.

**[0007]** An exemplary razor of the present invention comprises a foil assembly, a central retainer 4, a head 5, a blade assembly, a motor 9, a body 10, a switch 11 and a central mount 12. The foil assembly comprises a foil 1, an inner collar 2 and an outer collar 3. The blade assembly comprises a blade carrier 6, blade supports 7 and blades 8.

**[0008]** The foil is substantially hemi-toroidal. That is it is the surface of half a circular cross-section toroidal form, that torus being divided in half by a plane perpendicular to the axis of revolution of the torus and passing through the center of revolution of the torus. It can also be described as the surface of a donut cut in half through its thickest part. It therefore has an inner and an outer edge, both circular in form, and a hole through the middle. It is curved in the circumferential direction to form a ring and it is curved in the radial direction between the inner and outer edge to form an arc in cross-section. It is therefore curved in two orthogonal planes. Alternatively the shape is formed by a curve and a point on a plane, the point being at a distance from the curve. The surface of the foil is created by sweeping the curve 360 degrees around the point, the point being the center of rotation. The foil is spaced radially from the center of rotation.

**[0009]** The surface of the foil 1 is provided with holes of a size and shape suitable for permitting hair follicles to pass through, such as is known in the art. The holes may be substantially circular, substantially triangular or any other suitable form. The hole shapes may be a mixture of circles, triangles, squares, pentagons, hexagons, heptagons, octagons or irregular shapes. The array of holes leaves a mesh of the material of the foil 1. The axes of the holes in the exemplary embodiment are parallel but may alternatively be perpendicular to the local surface of the foil 1 i'e' all pointing in different directions.

**[0010]** The foil 1 may be made from metal, preferably a form of steel, but may be made from any other suitable material.

**[0011]** The shape of the foil is suitable for engaging a large surface area of the user's face in order to perform efficient shaving. The three dimensional curvature of the foil is complementary to the three dimensional curvature of the face. The continuously varying curvature of the foil permits hair follicles to be engaged at a wide variety of directions and surface incidence angles permitting more effective shaving.

**[0012]** Suitable methods of manufacture of the foil are known in the art but may include hot or cold pressing of flat annular blanks. The hole array may be pressed before, during or after the pressing of the flat blank.

**[0013]** The inner 2 and outer 3 collars are bonded to the inner and outer edges of the foil 1. The inner collar 2 is circular and is provided with a circular groove 2a in its upper surface suitable for receiving the inner edge of the foil 1. The inner edge of the upper surface of the inner collar 2 is provided with a bevelled surface 2b for engaging with the outer edge 4b of the lower surface of the central retainer 4.

**[0014]** The outer collar 3 is circular and is provided with a circular groove 3a in its upper surface for receiving the outer edge of the foil 1. The outer collar 3 engages with the upper rim of the head 5. In the illustrated example the engagement is provided by threads on the lateral engagement surfaces, male thread on the head and female thread 3b on the outer collar. Alternatively a press-button release means may be provided as is known in the art.

**[0015]** The central retainer 4 is circular and has a concave upper surface 4a. This permits convexly curved features of the face, e.g. the chin, to pass into the center of the foil which permits enhanced engagement of hair follicles around the convexly curved feature during shaving. The outer edge 4b of the underside of the central retainer 4 is shaped for complimentary engagement of the bevelled surface 2b of the inner collar 2, as can be seen in figure 10. Therefore when assembled, the central retainer 4 retains the inner collar 2 and as the inner collar is bonded to the inner edge of the foil 1 in its groove 2a, the inner edge of the foil is retained to the razor. The central retainer has a threaded shaft 4c projecting downwards from its lower surface. The threaded shaft 4c engages with a complementary threaded hole 12a in the central mount 12 when assembled.

**[0016]** The central mount 12 can be seen in figure 4. The central mount is generally circular with a threaded hole 12a in the center of its upper surface. The upper surface 12b of the central mount 12 is recessed to receive and mount the disk motor 9. The lower housing 9b of the disk motor 9 is fixedly mounted to the central mount 12 by suitable means. The outer edge of the central mount is attached to the inner surface of the head 5 by suitable means. The central mount may be co-formed with the head 5 and therefore integral to it.

**[0017]** The disk motor 9 is formed from upper and lower housings 9a and 9b respectively. The upper and lower housings are annular in form and are held apart and permitted to rotate relatively by bearings 9c. Permanent magnets are provided in the lower surface of the upper housing 9a. Corresponding electromagnets 9d are provided in the upper surface of the lower housing 9b. Interaction between the magnets causes rotation of the motor about the common axis of the upper and lower housings. The lower housing 9b is mounted upon and fixed to the central mount 12. The upper housing is provided with holes 9e in its upper surface which receive complementary lugs 6a in the lower surface of the blade carrier 6. As the lower housing 9b is fixed, relative rotation of the upper and lower housings causes rotation of the upper housing 9a with respect to the head 5. As the blade carrier 6 is locked in relative rotation by the interaction of the holes 9e and lugs 6a, rotation of the upper housing 9a causes rotation of the blade carrier and consequently the blades 8 relative to the foil 1. The advantages of using a disc motor include quieter operation due to minimising the number of moving parts and part-to-part mechanical engagement. Suitable electrical connections, magnet types and controllers for the motor 9 are known in the art.

**[0018]** Alternatively a more conventional motor may be used in the razor. Such a motor might drive a shaft with a toothed cog on its end. The toothed cog may engage with teeth formed on the inner edge or lower surface of the blade carrier thereby causing it to rotate when the motor is active. A biasing arrangement may be incorporated to press the blade carrier upwards to cause the blades 8 to engage with the lower surface of the foil 1. Two or more motors each driving a cog wheel or two or more cog wheels driven by one or more motors may be used to balance the upward force on the blade carrier 6.

**[0019]** The blade carrier 6 is annular and is provided with lugs 6a on its lower surface. The lugs 6a may incorporate springs arranged to press against the bottom surface of the holes 9e to cause the blade assembly to be pushed upwards from the motor 9 and consequently for the blades 8 to be pressed against the lower surface of the foil 1. Alternatively a single large diameter spring may be provided between the motor 9 and blade carrier 6 for this purpose.

**[0020]** Four lugs 6a are provided in the exemplary embodiment but any suitable number, size and form may be used. Many other suitable means of providing releasable and biased engagement are known. Angularly spaced radiating grooves 6b are provided in the upper surface of the blade carrier 6. The grooves 6b radiate from the center of the annulus. The blade carrier 6 may be provided with cylindrical sides extending upward from the inner and outer edges of its upper surface. Such sides create an annular trough for collecting shavings. Such an arrangement makes cleaning easier and helps prevent shavings entering other areas of the razor. Suitable seals may be provided between moving and stationary parts to prevent problems related to ingress of shavings.

**[0021]** Blade supports 7 are bonded into the grooves 6b such that they stand vertical to the plane of the blade carrier 6. The blade supports 7 have a shape suitable for engaging with the grooves 6b at their lower end and engaging with the blades 8 at their upper end. Consequently the blades 8 are arranged angularly spaced in a circular formation in an arrangement suitable for simultaneous engagement with the lower surface of the foil 1. Circular holes 7a are provided through the center of the blade supports 7 to reduce weight and permit air to flow through to reduce air resistance and therefore energy consumption. Alternatively the blade carrier and blade supports may be integrally formed.

**[0022]** The upper surface of the blades 8 are curved to complement the curvature of the lower surface of the foil 1 with which they are in contact. The upper surface therefore has the form of a segment of part of a toroidal surface, as the foil 1 itself is part-toroidal. The foil and blades are therefore complementary in form. The cutting edges have a positive rake angle. A positive rake angle means surfaces forming the cutting edge meet at an included angle of less than a right angle. This creates a sharper cutting edge than in conventional foil razors and results in a cleaner cut. As the blades only rotate in one direction, only one cutting edge is required on each blade 8. Alternatively each blade may have two cutting edges in order to be effective in either direction of rotation. This may be determined by what type of motor is used. The direction of rotation of some simpler motors may be determined by the relative position of the magnets at the instant the motor is activated.

**[0023]** As the blades 8 are pressed lightly against the lower surface of the foil 1 by the biasing arrangement between the blade carrier and the upper housing 9a, there will be slight wearing over time. As the cutting edges of the blades 8 have a positive rake angle, this wearing will keep the blades sharp. The relative hardness of the materials of the foil 1 and blades 8 may be chosen to maximize the advantage of this effect.

**[0024]** The blade arrangement is purely exemplary and many alternative arrangements may be used. For example, the blades 8 may attach directly to the blade carrier and may be arch-like in form such that they have a curved blade edge for engaging with the foil and two parallel legs to connect with the blade carrier. Consequently no blade support is required. Such a blade would have an airgap through it. Such an airgap would reduce air resistance to the movement of the blade assembly. Alternatively the blade supports may be extensible in the vertical direction and spring loaded so instead of the biasing being between the motor and the blade carrier, the upward bias is between the blade carrier and the blades.

**[0025]** Conventional flat blades may alternatively be used with the foil however they would naturally be less effective.

**[0026]** As the blade edge is angled into the direction of motion, rotation of the blade assembly will cause a downward movement of air through the apertures in the

foil. This downward flow of air will have a slight sucking effect on hair follicles causing them to be drawn into the apertures and enhance shaving. Such induced air will escape through apertures near the inner and outer edges of the foil 1 but allowance may be made for air to escape elsewhere. The foil curvature or depth of pressing may be increased to make additional allowance for such airflow.

**[0027]** To disassemble the razor for cleaning, first the central retainer 4 is rotated by the user's thumbs to cause it to unscrew and disengage from the threaded hole 12a in the central mount 12. The foil assembly by the outer collar 3 is disengaged from the head by rotating it on its threads or released depending on the retention mechanism. The foil assembly comes away as a unit. The blade assembly can then be removed from the motor 9 as the lugs 6a are not retained in the holes 9e.

**[0028]** Throughout the description "upper" and "lower" are intended to refer to the orientation generally expected for the razor when used i'e' when handheld, the foil 1 being uppermost and the body being lowermost.

**[0029]** Other features such as a battery, electronic control means, charging means, signal lights and electrical connections are not shown as they are conventional and suitable arrangements are known in the art.

**[0030]** The embodiments described are exemplary only and do not define the scope of the invention. The scope of the invention is defined by the appended claims. Any exemplary or alternative feature may be combined with any other exemplary or alternative feature providing the resulting embodiment falls within the scope of the claims. etc' is a contraction of et cetera  
e'g' is a contraction of exempli gratia  
i'e' is a contraction of id est

**[0031]** The foil may be defined as:

characterised by the shape of the foil being part of the surface of a toroid;

having a center of rotation and the foil is spaced radially from the center of rotation;

having an inner and an outer edge and those edges are circular;

being is substantially hemi-toroidal;

provided with an array of apertures and the shape of the apertures is substantially circular, substantially polygonal or a mixture of different shapes.

**[0032]** A razor comprising such a foil may be defined as:

comprising blades arranged to move in a substantially circular path;

the cutting edge of at least one of the blades has a

positive rake angle;

comprising moving parts characterised by at least one of the moving parts having a shape which causes a flow of air into the razor during operation.

5

**[0033]** Also defined is:

a disk motor for use in a razor;

10

a razor comprising a disk motor;

a blade for use in a razor characterised by the cutting edge of the blade having a positive rake angle;

15

a component suitable for use only with a razor as previously defined; and

a foil for a razor wherein the foil comprises an array of holes and characterised by the array comprising holes of two or more different shapes.

20

## Claims

25

1. A foil for a razor wherein at least part of a surface of the foil has the shape of part of a surface of a toroidal form and wherein the part-toroidal surface is curved through at least 45 degrees in the radial direction. 30
2. A foil as claimed in claim 1 wherein the part-toroidal surface of the foil has a portion which is convex in the radial direction and the minimum diameter of the convex portion is at least a third of the maximum diameter of the convex portion. 35
3. A foil for an electric razor as claimed in claim 2 wherein a central surface extends from the convex portion and wherein the central surface is substantially concave and the central surface is at least one sixth as deep as it is wide at its deepest. 40
4. A foil as claimed in any preceding claim wherein the part-toroidal surface of the foil is substantially hemi-toroidal. 45
5. A razor comprising a foil as claimed in any preceding claim.
6. A razor as claimed in claim 5 wherein a central surface extends from an inner perimeter of the part-toroidal surface of the foil, the majority of the central surface defining a hollow, the hollow being at least one sixth as deep as it is wide at its deepest. 50
7. A razor as claimed in claim 6 wherein the central surface is a surface of a part separable from the foil. 55

8. A razor as claimed in any of claims 5 to 7 comprising cutting blades wherein at least part of the cutting edge of at least one of the blades has a positive rake angle.

9. A razor comprising a disk motor.

10. A component suitable for use only with a razor as defined by any of claims 5 to 8.

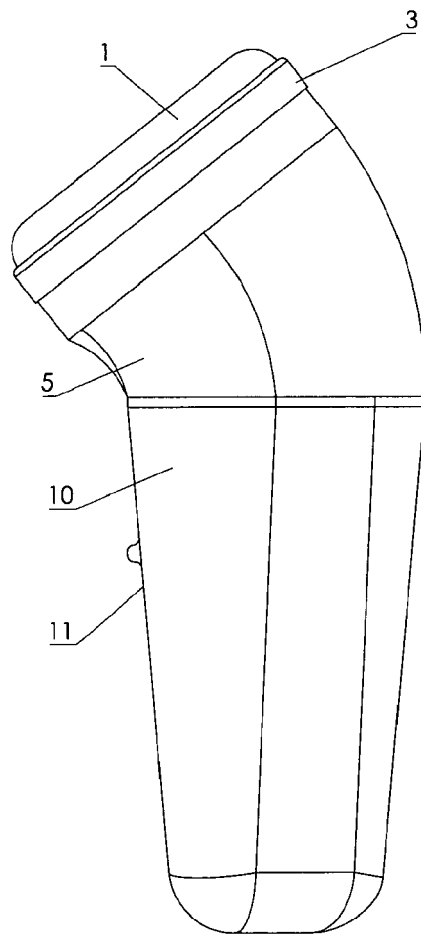


Figure 1a

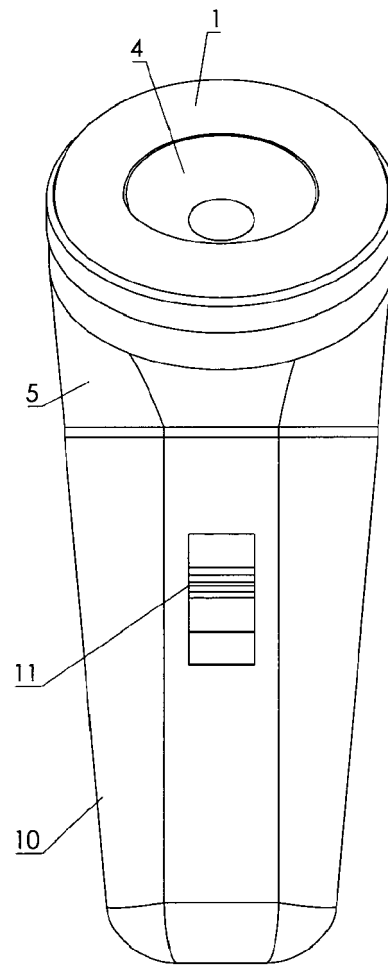


Figure 1b

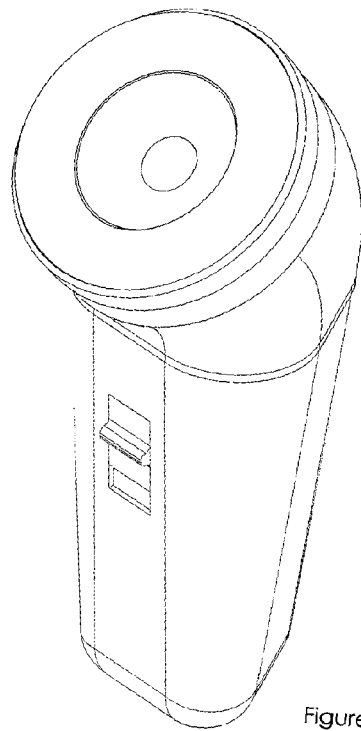


Figure 2a

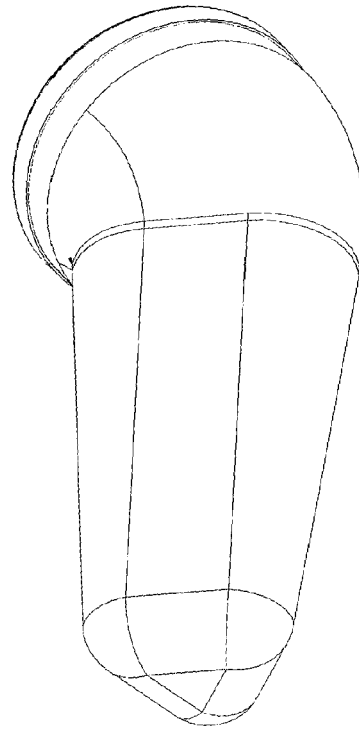


Figure 2b

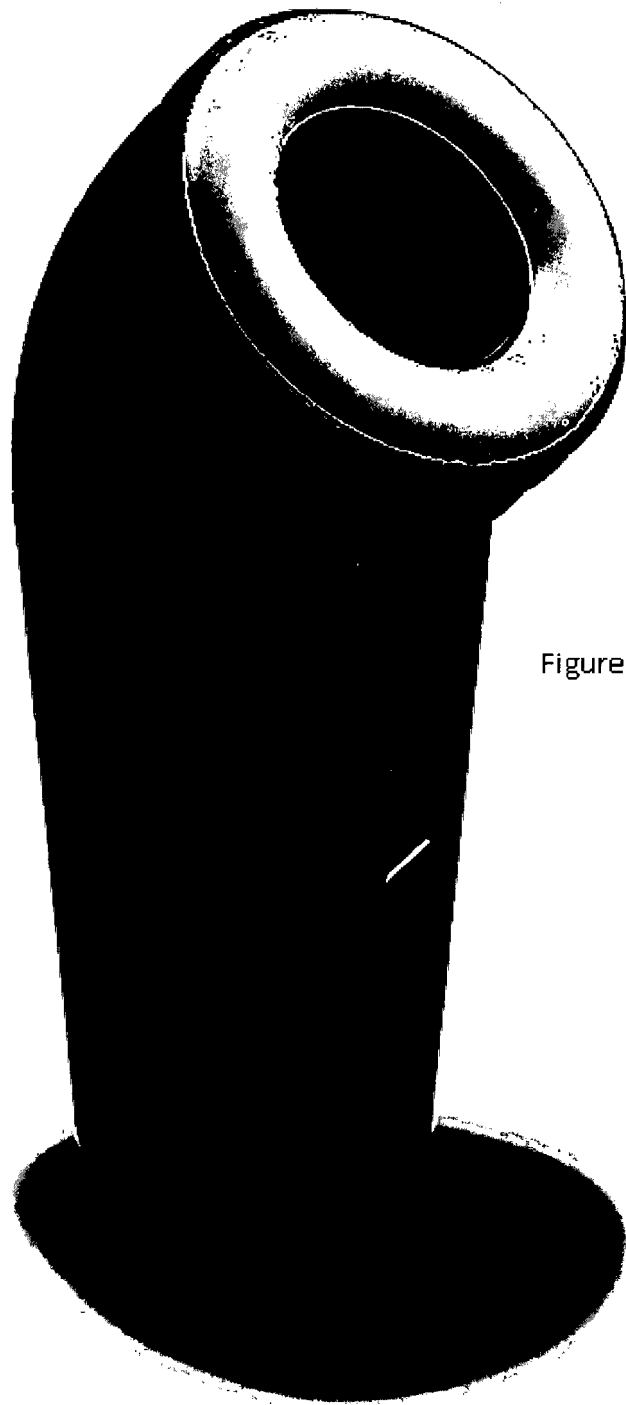


Figure 3

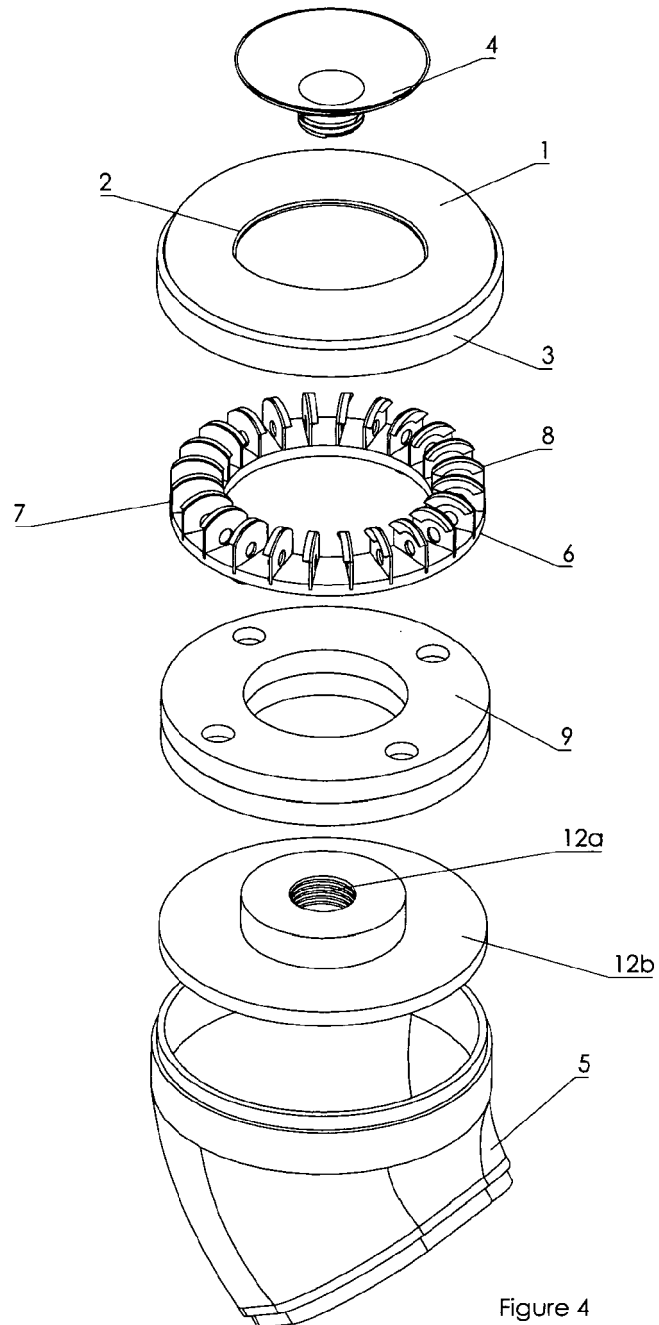


Figure 4

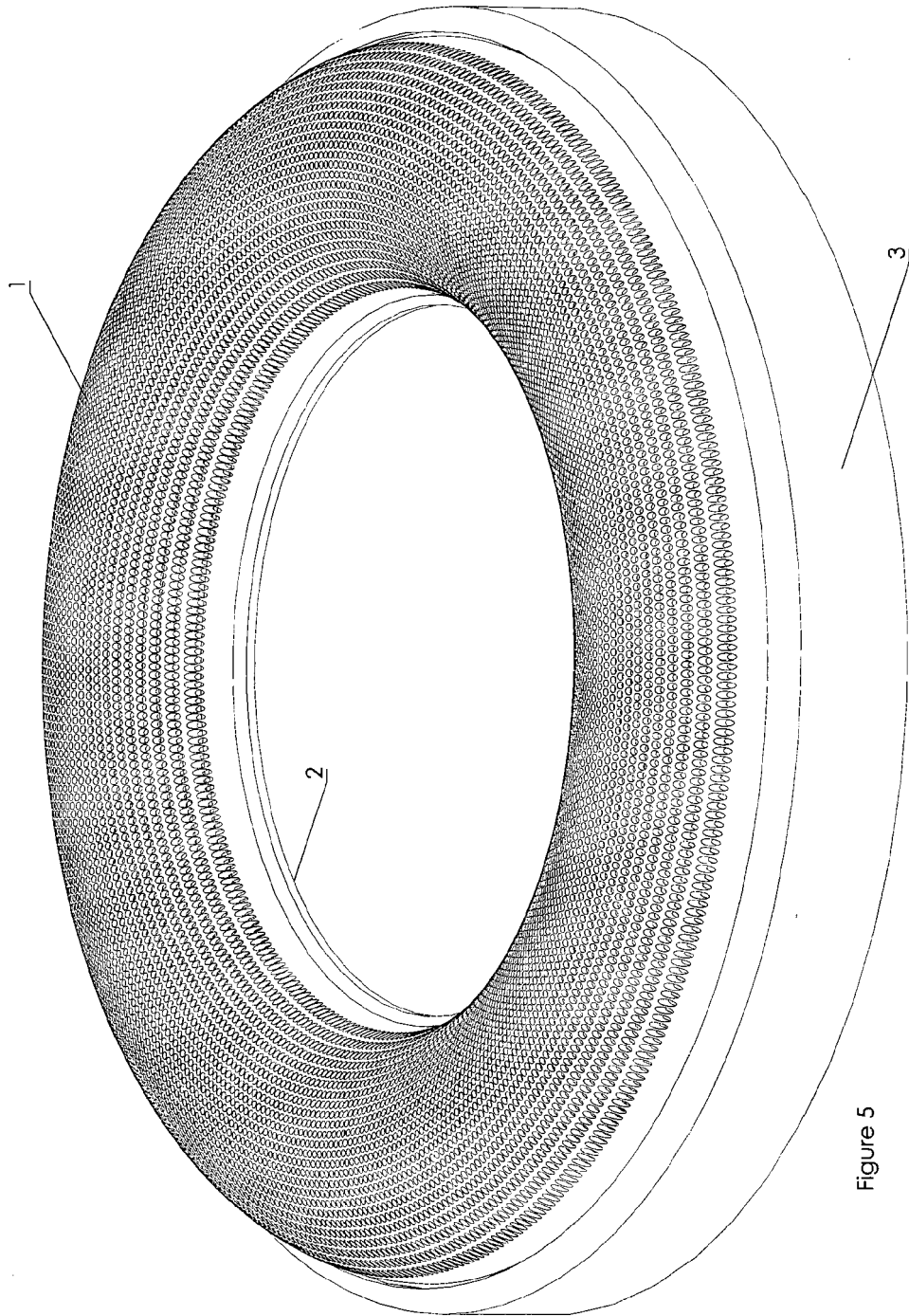


Figure 5

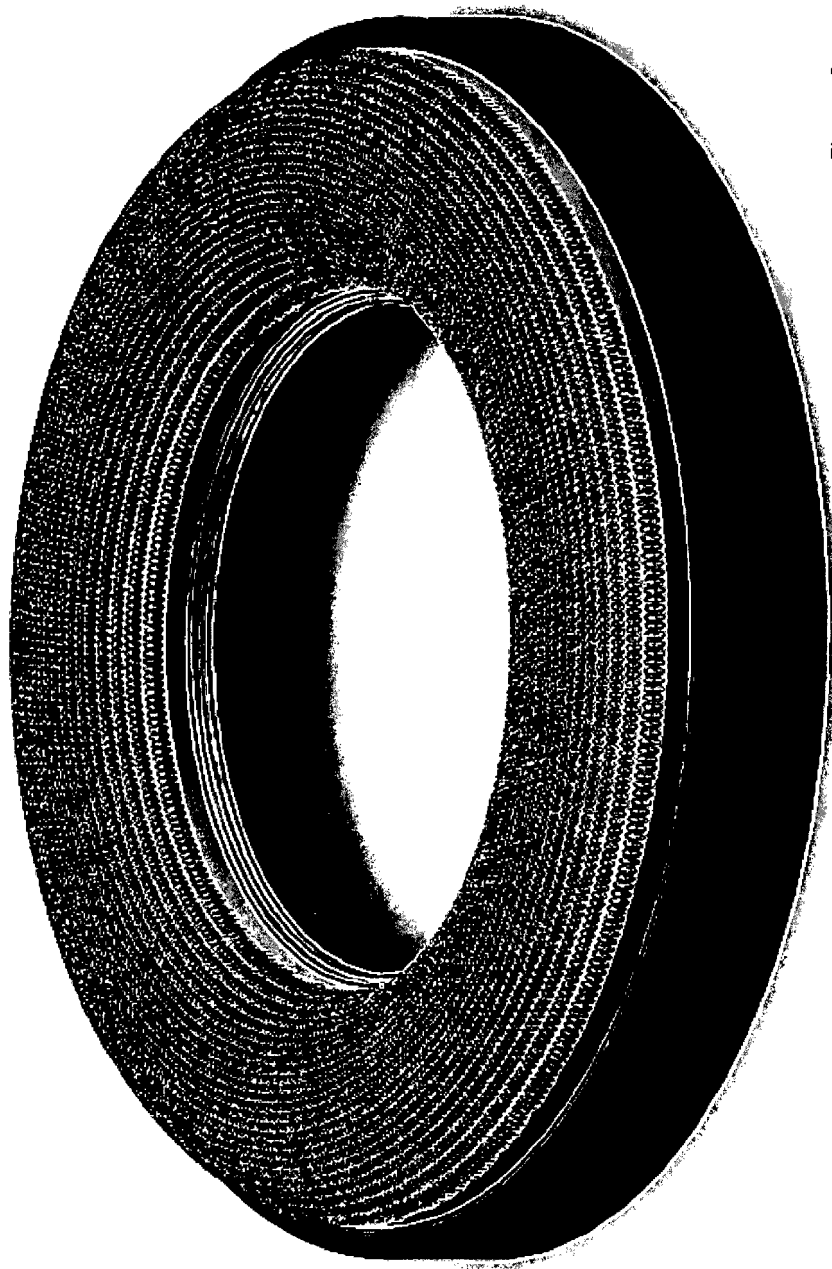
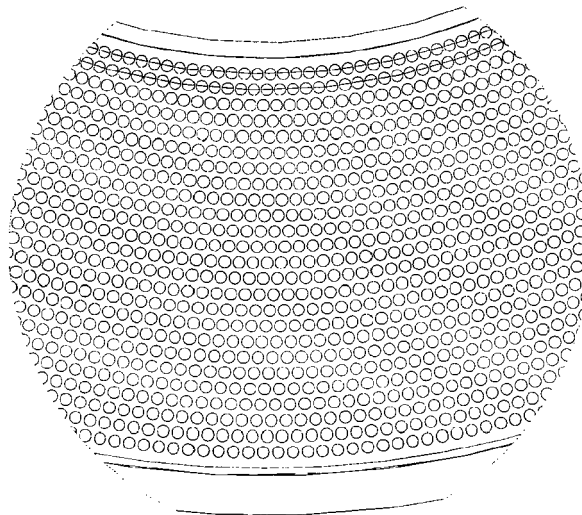
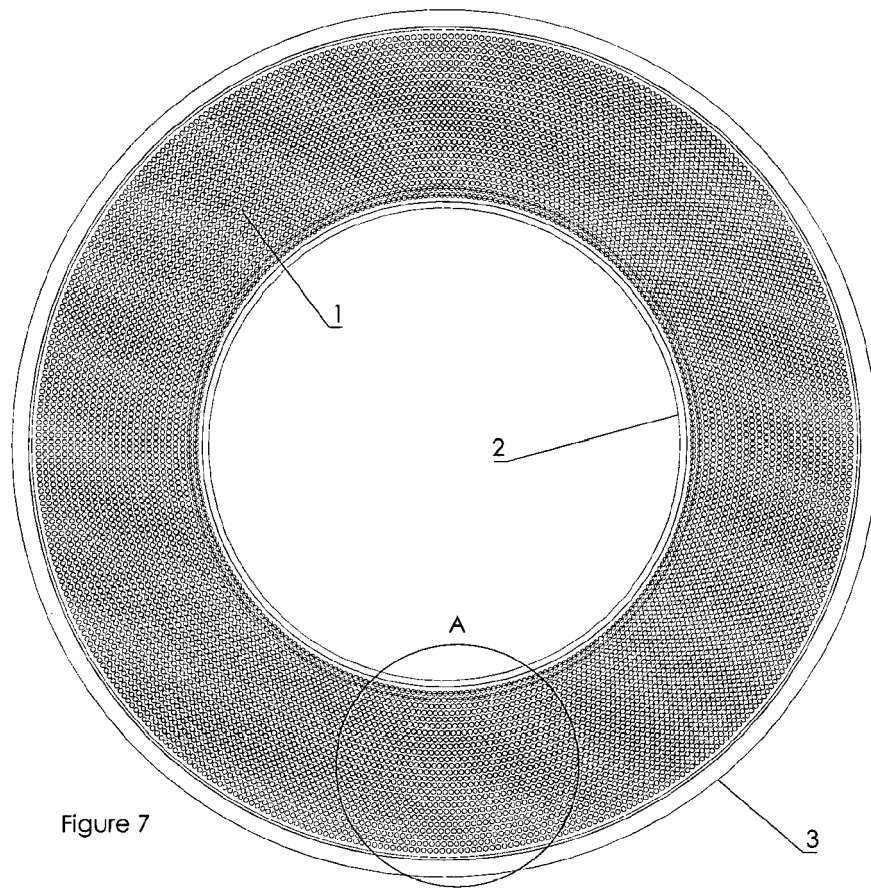


Figure 6



DETAIL A

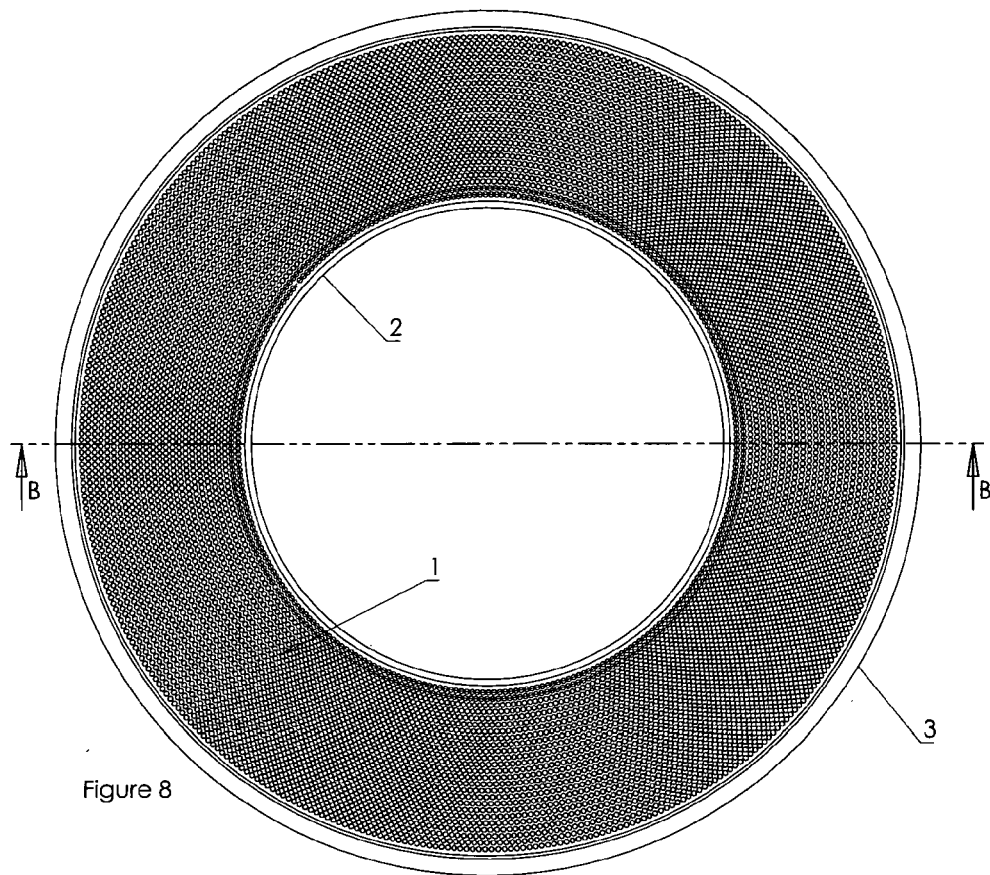
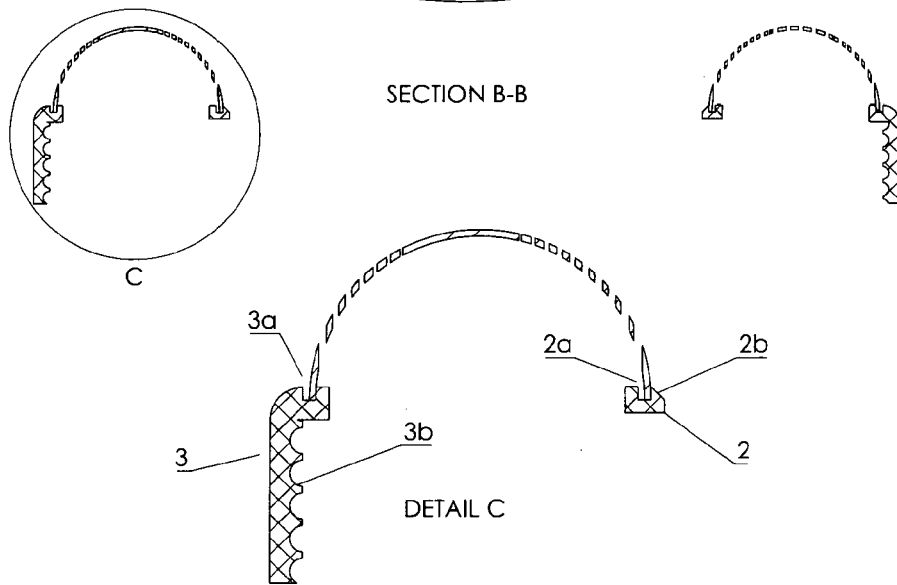


Figure 8



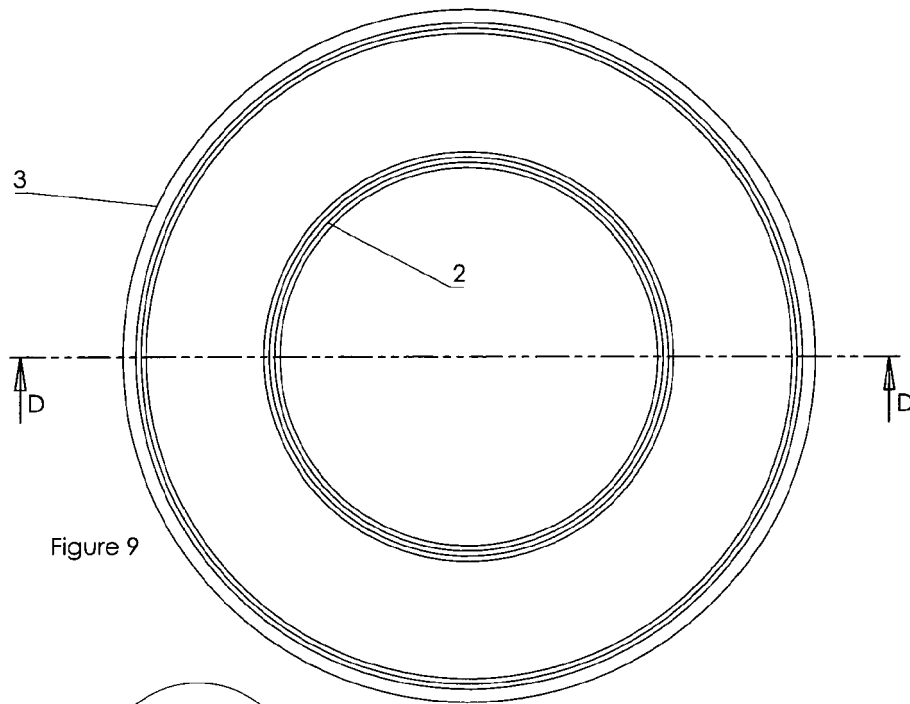
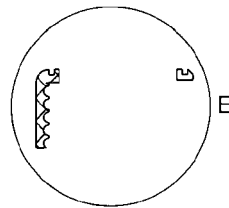
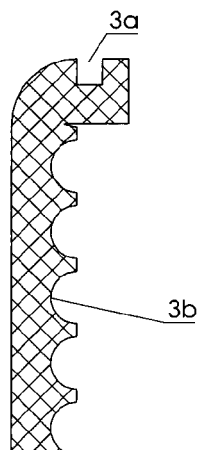


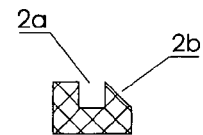
Figure 9



SECTION D-D



DETAIL E



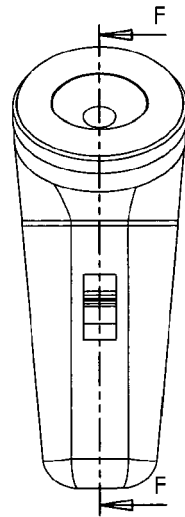
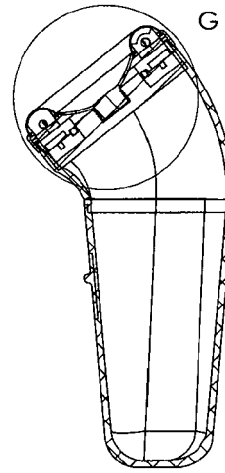
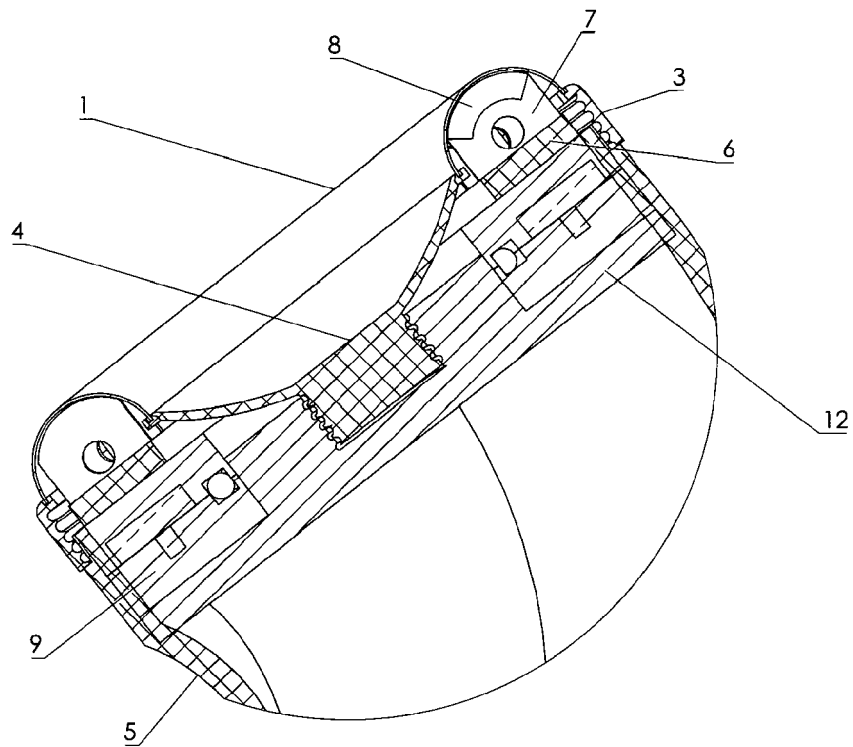


Figure 10



SECTION F-F



DETAIL G

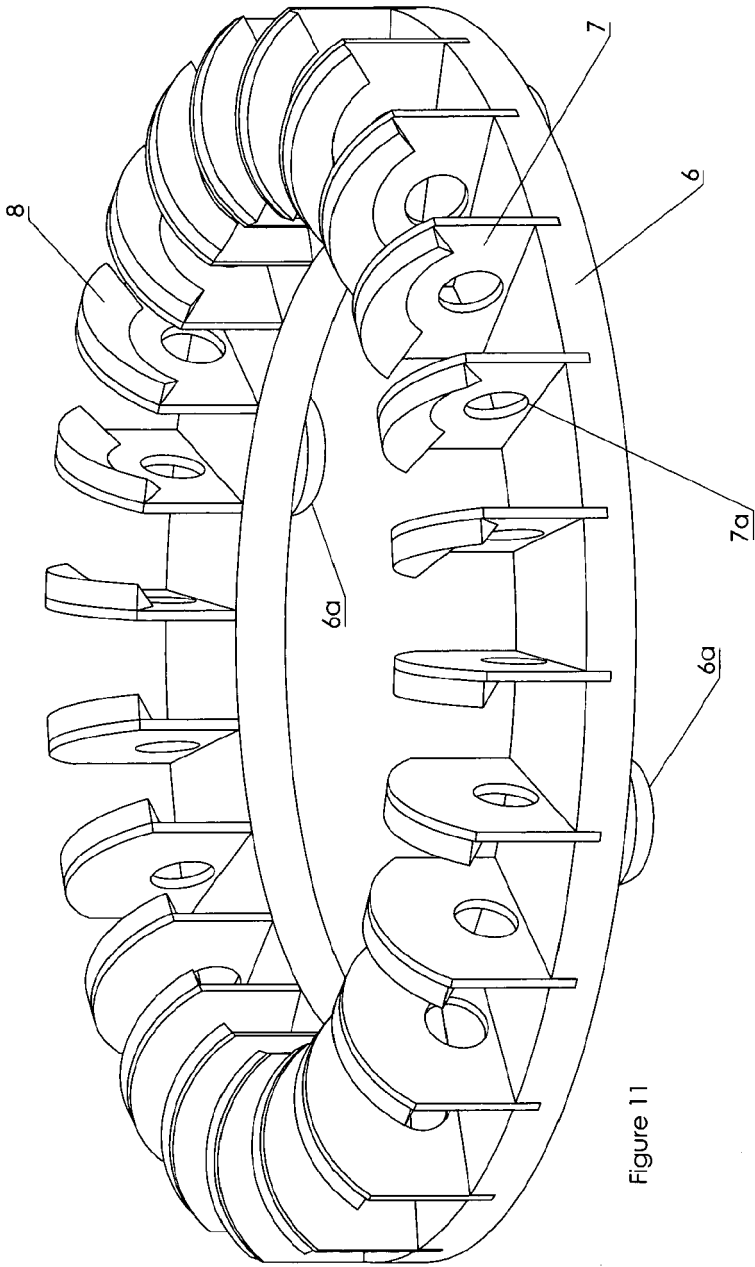


Figure 11

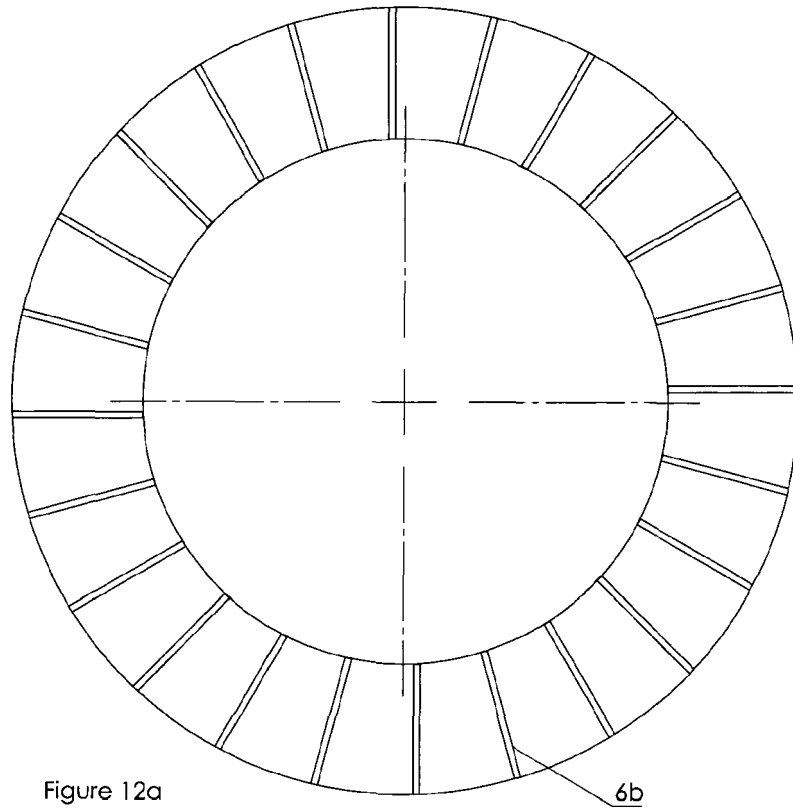


Figure 12a

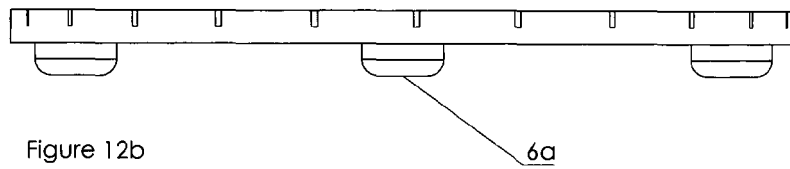


Figure 12b

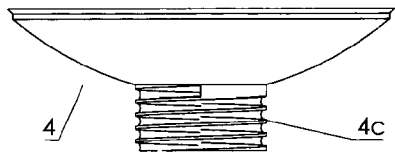


Figure 13a

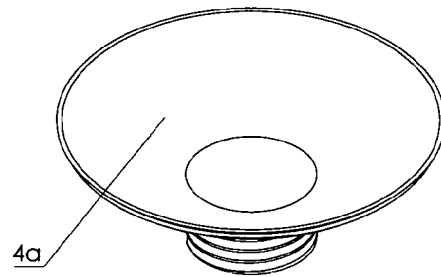


Figure 13b

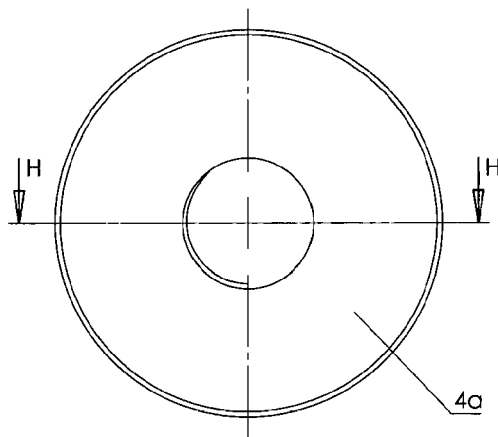


Figure 13c

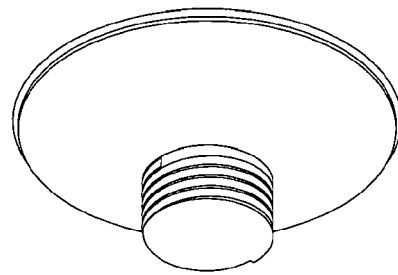
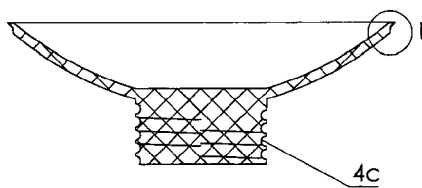
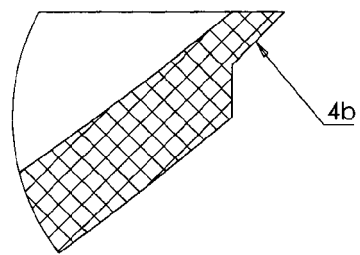


Figure 13d



SECTION H-H



DETAIL I

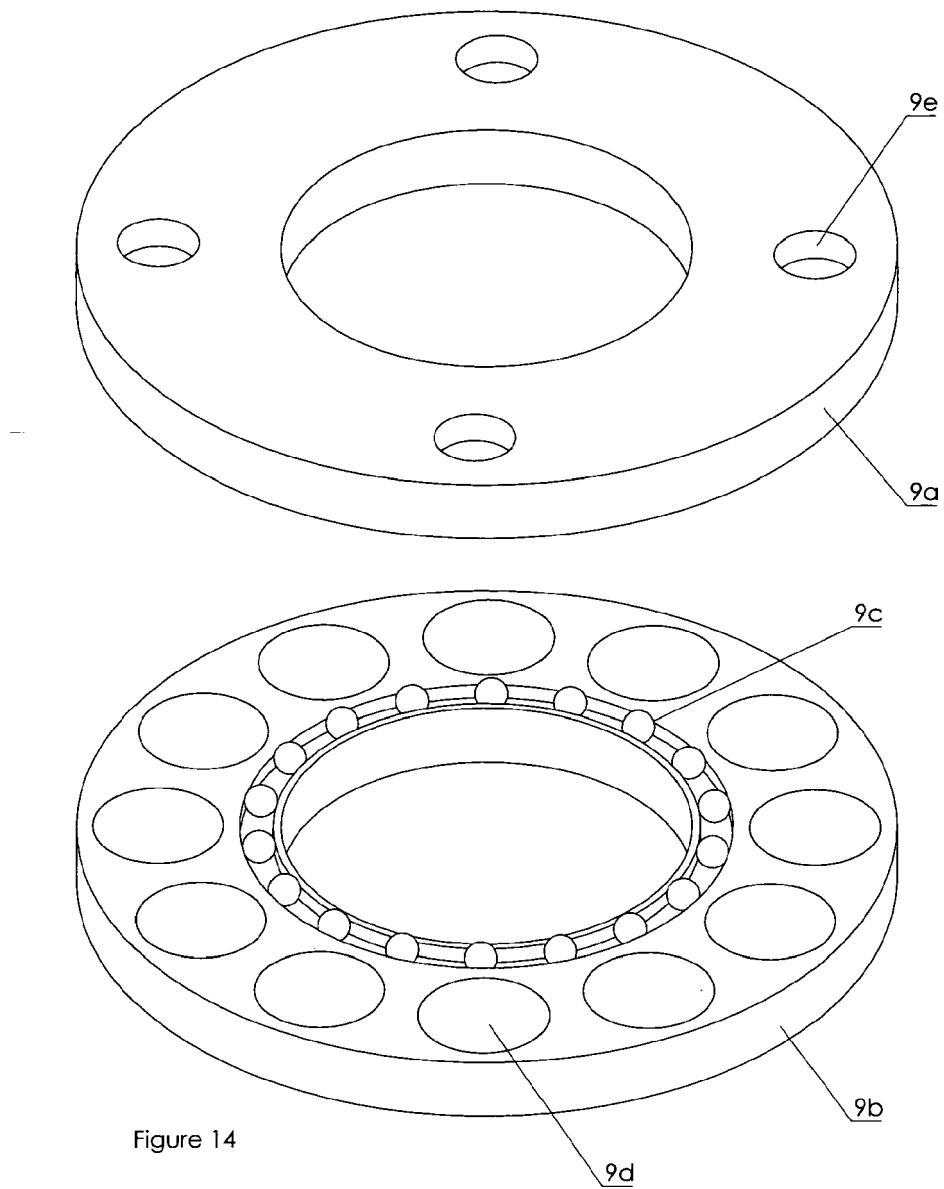


Figure 14



## EUROPEAN SEARCH REPORT

 Application Number  
EP 17 07 5010

5

10

15

20

25

30

35

40

45

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                           |                                                      |                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                             | Relevant to claim                                    | CLASSIFICATION OF THE APPLICATION (IPC)    |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | FR 2 207 443 A5 (BISSELL INC [US])<br>14 June 1974 (1974-06-14)<br>* page 3, line 6 - page 6, line 20;<br>figures 1-6 *                   | 1-10                                                 | INV.<br>B26B19/14                          |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 3 019 525 A (JOHN BRUECKER)<br>6 February 1962 (1962-02-06)<br>* column 2, line 65 - column 4, line 74;<br>figures 1-5 *               | 1-10                                                 |                                            |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 3 119 180 A (JOHN BRUECKER)<br>28 January 1964 (1964-01-28)<br>* column 2, line 38 - column 4, line 60;<br>figures 1-6 *               | 1-10                                                 |                                            |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 6 515 256 B1 (BATTAGLIA VINCENT P [US])<br>4 February 2003 (2003-02-04)<br>* column 6, line 16 - column 10, line 38;<br>figures 1-16 * | 1-10                                                 |                                            |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 2003/070304 A1 (CURELLO ZACHARY [US])<br>17 April 2003 (2003-04-17)<br>* paragraph [0035] - paragraph [0060];<br>figures 1-11 *        | 1-10                                                 | TECHNICAL FIELDS<br>SEARCHED (IPC)<br>B26B |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DE 23 09 208 A1 (MEYER HANS OTTO)<br>5 September 1974 (1974-09-05)<br>* page 6 - page 9; figures 1-4 *                                    | 1-10                                                 |                                            |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 3 618 210 A (ZUURVEEN FRANS)<br>9 November 1971 (1971-11-09)<br>* column 3, line 22 - column 4, line 23;<br>figures 1-4 *              | 1-10                                                 |                                            |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 3 639 979 A (ZUURVEEN FRANS)<br>8 February 1972 (1972-02-08)<br>* column 2, line 55 - column 3, line 37;<br>figures 1-5 *              | 1-10                                                 |                                            |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                           |                                                      |                                            |
| Place of search<br>Munich                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                           | Date of completion of the search<br>13 November 2017 | Examiner<br>Klintebäck, Daniel             |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                           |                                                      |                                            |

 2  
EPO FORM 1503 03.82 (P04C01)

50

55

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 07 5010

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-11-2017

10

15

20

25

30

35

40

45

50

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)  | Publication<br>date         |
|-------------------------------------------|---------------------|-----------------------------|-----------------------------|
| FR 2207443                                | A5                  | 14-06-1974                  | AT 333619 B 10-12-1976      |
|                                           |                     | AU 6159673 A 24-04-1975     |                             |
|                                           |                     | CA 996735 A 14-09-1976      |                             |
|                                           |                     | CH 565019 A5 15-08-1975     |                             |
|                                           |                     | DE 2357374 A1 22-05-1974    |                             |
|                                           |                     | FR 2207443 A5 14-06-1974    |                             |
|                                           |                     | GB 1406140 A 17-09-1975     |                             |
|                                           |                     | JP S4982452 A 08-08-1974    |                             |
|                                           |                     | NL 7315501 A 21-05-1974     |                             |
| -----                                     |                     |                             |                             |
| US 3019525                                | A                   | 06-02-1962                  | NONE                        |
| -----                                     |                     |                             |                             |
| US 3119180                                | A                   | 28-01-1964                  | NONE                        |
| -----                                     |                     |                             |                             |
| US 6515256                                | B1                  | 04-02-2003                  | AT 334773 T 15-08-2006      |
|                                           |                     | AU 6673401 A 06-05-2002     |                             |
|                                           |                     | CN 1471449 A 28-01-2004     |                             |
|                                           |                     | DE 60121982 T2 26-07-2007   |                             |
|                                           |                     | EP 1328371 A1 23-07-2003    |                             |
|                                           |                     | JP 2004512179 A 22-04-2004  |                             |
|                                           |                     | US 6515256 B1 04-02-2003    |                             |
|                                           |                     | US 2003116543 A1 26-06-2003 |                             |
|                                           |                     | WO 0234454 A1 02-05-2002    |                             |
| -----                                     |                     |                             |                             |
| US 2003070304                             | A1                  | 17-04-2003                  | US 2003070304 A1 17-04-2003 |
|                                           |                     |                             | WO 03033221 A1 24-04-2003   |
| -----                                     |                     |                             |                             |
| DE 2309208                                | A1                  | 05-09-1974                  | AT 344540 B 25-07-1978      |
|                                           |                     |                             | BE 811032 A 29-05-1974      |
|                                           |                     |                             | CH 571389 A5 15-01-1976     |
|                                           |                     |                             | DD 109560 A5 12-11-1974     |
|                                           |                     |                             | DE 2309208 A1 05-09-1974    |
|                                           |                     |                             | ES 423520 A1 16-05-1976     |
|                                           |                     |                             | FR 2218976 A1 20-09-1974    |
|                                           |                     |                             | GB 1417812 A 17-12-1975     |
|                                           |                     |                             | IT 1008818 B 30-11-1976     |
|                                           |                     |                             | JP S5047754 A 28-04-1975    |
|                                           |                     |                             | JP S5712637 B2 11-03-1982   |
|                                           |                     |                             | NL 7401738 A 26-08-1974     |
| -----                                     |                     |                             |                             |
| US 3618210                                | A                   | 09-11-1971                  | BE 703736 A 11-03-1968      |
|                                           |                     |                             | DE 1553776 A1 19-08-1971    |
|                                           |                     |                             | GB 1197997 A 08-07-1970     |
|                                           |                     |                             | NL 6612851 A 14-03-1968     |
|                                           |                     |                             | US 3618210 A 09-11-1971     |
| -----                                     |                     |                             |                             |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

55

ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 17 07 5010

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-11-2017

10

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| US 3639979 A                              | 08-02-1972          | BE 703737 A                | 11-03-1968          |
|                                           |                     | DE 1553778 A1              | 19-08-1971          |
|                                           |                     | GB 1202247 A               | 12-08-1970          |
|                                           |                     | NL 6613222 A               | 21-03-1968          |
|                                           |                     | US 3639979 A               | 08-02-1972          |
| -----                                     |                     |                            |                     |

15

20

25

30

35

40

45

50

EPO FORM P0459

55

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82