



(51) International Patent Classification:
A63B 65/00 (2006.01)

(21) International Application Number:
PCT/DK2017/050037

(22) International Filing Date:
10 February 2017 (10.02.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PA 2016 70078 12 February 2016 (12.02.2016) DK

(71) Applicant: NINBEE APS [DK/DK]; Wildersgade 46 B,
2., 1408 København K (DK).

(72) Inventors: ERNST, Christian; Prinsessegade 58 2tv,
1422 København K (DK). NIELSEN, Roy; Kulsviertofte
33, 2800 Kgs Lyngby (DK).

(74) Agent: PATRADE A/S; Fredens Torv 3A, 8000 Aarhus C
(DK).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN,
KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA,
MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG,
NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS,
RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY,
TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN,
ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: AN AERODYNAMIC TOY

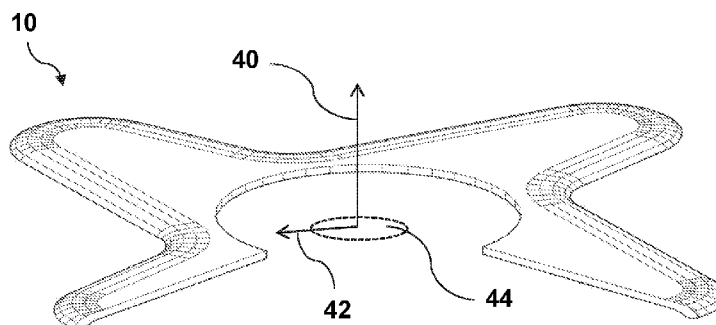


Fig. 5B)

(57) Abstract: An aerodynamic toy (10) for throwing by hand in a motion along a trajectory (102) whilst spinning (104) about a rotational axis (40) of the toy (10) in a rotational plane (44), The aerodynamic toy (10) comprise an aerodynamic body (12) substantially extending radially from the rotational axis (40) to an outer periphery (20). The body (12) is configured with an aperture (18). The body (12) may have an aerodynamic profile (106). The toy (10) have a stabilizer (30) configured to be mounted and demounted in the aperture (18) of the toy (10).



AN AERODYNAMIC TOY

Field of the Invention

The present invention relates to an aerodynamic toy for throwing by hand in a motion
5 along a trajectory whilst spinning about a rotational axis of the toy in a rotational
plane. The aerodynamic toy may comprise an aerodynamic body substantially extend-
ing radially from the rotational axis to an outer periphery. The body may be config-
ured with an aperture. The body may have an aerodynamic profile. The toy may have
stabilizer configured to be mounted and demounted in an aperture of the toy.

10 The toy may have a flight characteristic along a trajectory.

Background of the Invention

Today, common known flying toys such as flying discs (Frisbee), boomerangs, dart
15 arrows are used both as toys and as sport items.

Flying discs and boomerangs are constructed in a rigid material to obtain its flying
characteristics. The dart arrows or similar throwing arrows are constructed with sharp
ends and a rigid body part to obtain the right flight characteristics and to have the abil-
20 ity to bore into a target.

In general the abovementioned items may cause damage if it hits a person off guard or
it hits a fragile item.

25 Other throwing items intended for flying has especially been develop as weapons with
the intention of cutting, stabbing or distract the enemy or for hunting.

A shuriken is a traditional Japanese weapon that was generally used for throwing, and
sometimes stabbing or slashing. Shurikens are sharpened hand-held blades made from
30 a variety of everyday items, such as nails and knives, coins, washers or other flat
plates of metal.

They often have a hole in the center and possess a fairly thin blade sharpened only at the tip. The center hole and the size of the shuriken proved convenient for the shuriken user as the weapons could be concealed when carried and strung on a string or dowel in the belt for transport. The center hole also had aerodynamic and weighting effects that aided the flight of the blade.

Shuriken are commonly known as 'throwing stars' or 'ninja stars' although they were originally designed in many different shapes. Shuriken may be used for any small-bladed object. Shaken is another word used to indicate a 'throwing star'.

As mentioned, a Shuriken is made in metal and with the sharpened blades they are simple weapons, which in many countries are illegal to possess without a permit.

Thus, the Shuriken in the known form is not intended as a toy or sports item.

Object of the Invention

It is an objective to overcome one or more of the before mentioned shortcomings of the prior art.

Description of the Invention

An object is achieved by an aerodynamic toy for throwing by hand in a motion along a trajectory whilst spinning about a rotational axis of the toy in a rotational plane. The aerodynamic toy may comprise an aerodynamic body substantially extending radially from the rotational axis to an outer periphery. The body may be configured with an aperture. The body may have an aerodynamic profile. The toy may have stabilizer configured to be mounted and demounted in an aperture of the toy.

The toy has a flight characteristic along a trajectory.

The flight characteristic may be described by lift in positive direction or up-drift, which refers to that the toy lifts parallel to the direction of the rotational axis and upwards. A lift in negative direction or down-drift may also be a characteristic, which refers to that the toy falls downwards parallel to the direction of the rotational axis.

The flight characteristics may for example depend on the aerodynamic profile of the body, on the velocity achieved when launched, the angle at which it is launched or a combination of any of these.

5 The aerodynamic toy is thrown by hand in a single continuous motion with the effect that it may obtain a flight characteristics described by a trajectory and a spinning motion. The spinning motion may be about a rotational axis of the toy itself in a rotational plane which gives the advantage of a stabilizing effect of the toy when flying through the air.

10 Mounting a stabilizer in the aperture of the toy further stabilizes the toy when holding and launching the toy and when flying through the air. This may be advantageous in regard to obtaining an easier launch.

The stabilizer may be adjusted to adjust the flight characteristics.

15

Because of the flight characteristics described by a trajectory and a spinning motion of the aerodynamic toy it may also be used as a sports item. The trajectory may be dependent on the exact form of the toy and the motion by which it is thrown. The motion may cover both the length of the movement of the hand, the force with which it is thrown and the angle of the motion and release. Thus, the aerodynamic toy may be used as a sporting item for competition. The user may improve their skills of throwing the toy for a more precise or longer trajectory, for hitting a target, hitting a target with a given force or direction or other criteria. The toy may be used for competing against oneself or against others.

20

25 The aperture of aerodynamic body may have the effect of reducing the center weight and thereby advantageously increasing the aerodynamic properties of the toy as the weight of the slow accelerating part of the toy is eliminated while maintaining the outer fast accelerating part which may stabilize the flight of the toy.

30

In an aspect of the aerodynamic toy, the aerodynamic body is configured with a set of wings with each individual wing extending substantial radially outwards from the annular body part away from the aperture.

A set of wings may comprise a pair of wings or multiple wings.

5 An effect of the aerodynamic toy with a set of wings is that it resembles a Shuriken or Shaken, which is traditional Japanese weapon also known as a throwing star, however, with the advantage of being a toy or sports item and not a weapon.

10 The toy may be configured in a wide range of configurations and shapes depending on the number of wings, thereby achieving different flight characteristics. One construction may give longer range, another construction may improve precision and yet another may result of increased impact at landing or when hitting a target. Thus, the toy may be configured adapted for specific uses.

15 In an aspect of the aerodynamic toy, the aerodynamic body and stabilizer constitutes an assembly kit which can be assembled and disassembled manually.

20 An effect of this aspect is that the different configurations of the aerodynamic toy may be achieved by switching from one stabilizer to another or by switching from one aerodynamic body to another while maintaining the same stabilizer. As the assembly and disassembly may be done manually this advantageous change of configuration may be achieved on the spot when the toy is used and without additional aids.

25 A further effect of aerodynamic toy constituting an assembly kit may be, that you may trade or exchange parts with or borrow parts from other users. Thereby, changing and adapting your own toy according to your skills and process.

The stabilizer may be a one-part item or a multiple-part item.

30 The stabilizer may be constructed with an outer periphery adapted to the shape of the aperture periphery of the aerodynamic body.

One-part items may be monoliths.

The stabilizer may be configured with an aperture, it may be constructed as a solid disc, or it may comprise an outer frame holding a foil, a cover or a similar structure.

The stabilizer may further be configured with blades extending from the stabilizer in a downward direction, extending from the stabilizer in an upward direction or extending inwards toward the rotational axis. The blades may extend in any direction between downwards, inwards and upwards. The direction of the blades may be tilted compared to the rotational plane in a clockwise or anti-clockwise direction. The blades may be constructed as flat blades or blades with a 3-D profile. The blades may be configured as a combination of all the above.

10 In an aspect of the aerodynamic toy, the stabilizer comprises a top part and a bottom part which bottom and top part is configured with means to interlock and to be inserted in the aperture from respective sides of the aperture.

The means to interlock the bottom part and the top part may be a click function where the two parts are configured with wedges, grooves slots or similar features by which the two parts interlock when pushed together.

The means to interlock the bottom part and the top part may be a screw function in which the two parts are configured with screw threads and are screwed together.

20

The stabilizer may be configured with a rim into which the aerodynamic body may be attached simply by pulling the aerodynamic body to be inserted into the rim. The rim may also be a feature arising when a stabilizer kit is assembled and thus, the aerodynamic body may simply be placed on the rim of either the top part or the bottom part before assembling and interlocking the stabilizer kit and thereby also interlocking the aerodynamic body between the top and bottom part.

25

For the one-part stabilizer the rim may comprise a protrusion to hold the aerodynamic body in place.

30

An effect if this aspect is that the different configurations of the stabilizer may be achieved by one top part with another top part and vice versa with the bottom part with the advantage of changing the configuration of your toy. And this change may even be achieved on the spot as the toy is used and without additional aids. An addi-

tional effect of the click function may also be that the stabilizer may be disassembled for more compact transport.

5 In an aspect of the aerodynamic toy, the aerodynamic body is made from a flexible or semi-flexible material.

10 An aerodynamic body made of flexible or semi-flexible material may have the effect that it causes less damage at impact because of deformation of the toy at impact. This is advantageous both in regard to the extent of damage caused if a person is hit off guard or if inventory or fragile items is hit. This makes the toy suited for both indoor and outdoor use.

15 A further effect of using a flexible or semi-flexible material for the aerodynamic body is that the toy when disassemble may be rolled or folded without losing its shape for more compact transport.

In an aspect of the aerodynamic toy, the stabilizer is made from a rigid or semi-rigid material.

20 An effect of this aspect is to obtain stabilizing effects of the aerodynamic toy with the advantages previous described in regard to stabilizing the toy when holding and launching the toy and when flying through the air. Furthermore, an additional effect of the stabilizer is that the form of the stabilizer may influence the aerodynamic performance or flight characteristics according to the configuration of the stabilizer

25 In an aspect of the aerodynamic toy, the outer periphery of a wing in the radial plane comprises a first periphery part, which curves outwards from the rotational axis, and which first periphery part interconnects a first substantially linear side and a second substantially linear side comprising the sides of the wing, and that the individual
30 wings are interconnected to an adjacent wing by a second periphery part.

An effect of this aspect is that the aerodynamic toy comprises a set of wings configured with a wing tip and wing sides which may be adapted for different configurations of the toy. Furthermore the outer periphery of the aerodynamic toy comprises wings

which in a continuous matter are interconnected to the adjacent wings. The advantage of this construction is that the wing tips as the toy is spinning in the rotational plane spans an area of a annular disc extending from the aperture to the wing tips.

5 Another effect of this aspect is that the aerodynamic toy may be configured with the wings extending outwards from the rotational axis in a left-hand rotational or anti-clockwise direction, right-hand rotational or clockwise direction or a symmetric wing configuration in which the wings extend has mirror symmetry around an axis extending from the wing tip to the rotational axis. The rotational direction of the wings referred to is when the toy is seen from a top view.

10 A left-hand rotational direction or anti-clockwise direction of the wings is when the wings has a profile given by a second line longer than the first line, and where the second line constitutes the right hand side of the wing and the first line constitutes the left hand side of the wing when the aerodynamic toy is seen from the top.

15 A right-hand rotational direction or clockwise direction of the wings is when the wings has a profile given by a second line, the wing side on the right-hand is shorter than the first line, which constitutes the wing side on left-hand side of the wing when the aerodynamic toy is seen from the top.

A symmetric wing configuration describes the configuration of the aerodynamic toy where the wing sides on the right-hand and the left-hand side are equal in length.

25 An embodiment of the aerodynamic toy may also be found in a flip-mode edition. For example, if an embodiment of the aerodynamic toy has an outer periphery of the aerodynamic toy comprising wings extending outwards from the rotational axis in a clockwise direction, the flip-mode edition has an outer periphery of the aerodynamic toy comprising wings extending outwards from the rotational axis in the anti-clockwise direction. Thus, the flip-mode edition when seen from top view is rotated 180 degrees around the rotational plane.

The advantage of having different modes of the toy is that the toy may be configured for a clockwise or anti-clockwise spinning direction. Additionally, the depending on

the optimal spinning direction and the configuration-mode toy the toy may be launched using different techniques. The toy may be thrown with the right hand by moving the hand from the body and out or by moving the hand from outside and in towards the body. The toy may also be throw with the left hand by moving the hand
5 from the body and out or by moving the hand from outside and in towards the body.

The linear side which is downstream from the wind during flight may have a non-linear outline. This may give the toy a characteristic profile resembling a flying animal, insect, car or other items.

10

In an aspect of the aerodynamic toy, the aerodynamic body has rotational symmetry in the radial plane.

The aerodynamic toy has rotational symmetry around the rotational axis. The symmetry is given by the number of wings. For example, if the embodiment of the toy
15 comprises five wings the symmetry is given by a rotation of $2/5 * \pi$ radians.

An effect of rotational symmetry around the rotational axis is that the weight of the toy is distributed with rotational symmetry. This also has the effect that the center mass point may be in the center of the aperture and thus, provide for the rotational
20 axis in the center of the aperture. This may give the advantage of a stable flight characteristic of the toy. A further advantage is that the wear of the toy may be homogeneous for the individual wings.

25 In an aspect of the aerodynamic toy, the outer periphery of the aerodynamic body has a downward-curved profile perpendicular to the rotational plane.

An effect of a downward profile of the wing tips may be that during flight of the toy the body may curve upwards perpendicular to the rotational plane and the tips downwards thereby creating up drift when flying. This resembles the curvature of a flying
30 disc. However, with a semi-flexible or flexible body of the aerodynamic the extent of curvature may have an increased degree of freedom. In combination with a semi-rigid stabilizer the aperture form in the rotational plane may change while maintaining the shape of the aperture edge in the perpendicular direction.

In an aspect of the aerodynamic toy, the stabilizer comprises a set of blades for generating lift when spinning during motion.

5 The set of blades may comprise multiple blades arranged toward the center of the rotational axis. The blades may be arranged essentially perpendicular to the radial plane. The blades may be designed according to known aerodynamic properties from rotors or fans and a person skilled in the art will be able to design or choose amongst a breadth of designs to explore flight aspects of particular chosen designs. Some of those designs
10 may be found in the detailed description. In particular the blades may be so arranged to generate positive lift, whilst other arrangements may be configured to generate negative lift. In an aspect the stabilizer may be configured so that it can be turned up-side-down.

15 In an aspect of the aerodynamic toy, the aerodynamic body has one or more holes.

One or more holes may be comprised in the aerodynamic body. The holes may have the effect of reducing the weight of the inner part of the aerodynamic body and thereby advantageously increasing the aerodynamic properties of the toy as the weight of
20 the slow accelerating part of the toy is reduced while maintaining the outer fast accelerating part which may stabilize the flight of the toy.

The holes may be distributed with rotational symmetry with the same effect and advantage of the rotational symmetry of the aerodynamic body as a whole.

25

In an aspect of the aerodynamic toy the stabilizer comprises at least one flap essentially extending out of the rotational plane. The flap may be on a top part of a stabilizer or on a bottom part of a stabilizer. The flap may introduce drag and slow down the speed during flight. The flap may encircle the rotational axis or be symmetric about the rotational axis thereby resulting in little or no air resistance whilst rotating or spinning and
30 thus not lose energy from the spinning motion.

The flap may be adjustable enable variable flight speed. A person skilled in the art will appreciate freedom of choice in particular sizes or lengths of flaps.

5 An objective is achieved by an assembly kit for an aerodynamic toy. The assembly kit may comprise a toy as disclosed herein and at least having a first aerodynamic body with a first aerodynamic profile and a second aerodynamic body with a second aerodynamic profile. The assembly kit may have a stabilizer configured to be mounted and demounted in the aperture of either of the first and second aerodynamic bodies.

10 The toy may have a first flight characteristic with the stabilizer mounted in the first aerodynamic body. The toy may have a second flight characteristic with the stabilizer mounted in the second aerodynamic body.

15 An effect of this aspect is that the toy may be altered for different trajectories and different achievements simply by replacing the stabilizer, with the advantage to the user of having two versions of the aerodynamic toy from only one aerodynamic body and two stabilizers. This is advantageous in regards to costs and more compact transport.

20 An objective is achieved by an assembly kit for an aerodynamic toy. The assembly kit may comprise a toy as disclosed herein and at least having an aerodynamic body with an aerodynamic profile. The assembly kit may have a first stabilizer with a first aerodynamic profile configured to be mounted and demounted in the aperture of the aerodynamic body and a second stabilizer with a second aerodynamic profile configured to be mounted and demounted in the aperture of the aerodynamic body. The toy may have a first flight characteristic with the first stabilizer mounted in the aerodynamic body. The toy may have a second flight characteristic with the second stabilizer mounted in the aerodynamic body.

30 An effect of this aspect is that the toy may be altered for different trajectories and different achievements simply by replacing the aerodynamic body to the same stabilizer, with the advantage to the user of having two versions of the aerodynamic toy from only two aerodynamic bodies and one stabilizer. This is advantageous in regards to costs and more compact transport.

An objective is achieved by an assembly kit for an aerodynamic toy. The assembly kit may comprise a toy as disclosed herein and at least a first aerodynamic body with a first aerodynamic profile and a second aerodynamic body with a second aerodynamic profile. The assembly kit may have a first stabilizer with a first aerodynamic profile and a second stabilizer with a second aerodynamic profile. The two or more stabilizers are configured to be individually mounted and demounted in the aperture of any of the two or more aerodynamic bodies for different flight characteristics.

An effect of this aspect is that an assembly kit of the toy may comprise a wide range of versions of the aerodynamic toy for different trajectories and different achievements simply by combining different aerodynamic bodies with different stabilizers. One advantage is that the user with a limited kit may hold a many versions of the toy achieved with less costs and for more compact transport compared to having a single toy for each version.

Another effect is that the toy may be combined for optimal rotational spin clockwise or anti-clockwise depending on the combination of aerodynamic body and stabilizer and for a trajectory with a curvature to the right, left or for at substantially straight direction.

This is advantageous in regard to using the toy for both right-hand and left-hand launch or for launch using an outwards movement or inwards movement with the hand and obtaining the characteristics desired for the trajectory.

An addition advantage is that some combinations of an aerodynamic body and a stabilizer may show different flight aspects or characteristics which may be advantageous in regard to learning about aerodynamic. The learning is not only from the exploration of different flight characteristics, but also from achieving a desired trajectory from the combination used in the assembly kit and the launch. Some combinations of assemblies may essentially not fly or fly with such poor or undesirable characteristics, but still the combination provides learning as to why this is the case.

Description of the Drawing

Figure 1 illustrates an embodiment of the aerodynamic toy configured with five wings. Figure A: top view. Figure B: side/top view.

5 Figure 2 illustrates an embodiment of the aerodynamic toy configured with five wings, top view.

Figure 3 illustrates an embodiment of the aerodynamic toy configured with two wings. Figure A: top view. Figure B: side/top view.

10

Figure 4 illustrates an embodiment of the aerodynamic toy configured with three wings. Figure A: top view. Figure B: side/top view.

15 Figure 5 illustrates an embodiment of the aerodynamic toy configured with four wings. Figure A: top view. Figure B: side/top view.

Figure 6 illustrates an embodiment of the aerodynamic toy configured with four symmetric wings and peripheral apertures. Figure A: top view. Figure B: side/top view.

20 Figure 7 illustrates an embodiment of the aerodynamic toy configured with five wings. Figure A: top view. Figure B: side/top view.

Figure 8 illustrates an embodiment of the aerodynamic toy configured with six wings. Figure A: top view. Figure B: side/top view.

25

Figure 9 illustrates an embodiment of the aerodynamic toy configured with seven wings. Figure A: top view. Figure B: side/top view.

30 Figure 10 illustrates an embodiment of a one-part stabilizer configured with blades. Figure A and B: perspective view. Figure C: bottom view. Figure D: top view.

Figure 11 illustrates an embodiment of a one-part stabilizer. Figure A and B: perspective view. Figure C: bottom view. Figure D: top view.

Figure 12 illustrates three embodiments of a one-part stabilizer configured with blades. Figure A and B: perspective view of one embodiment. Figure C: bottom view. Figure D: top view. Figure E and F: perspective view of two other embodiments.

5 Figure 13 illustrates an embodiment of a stabilizer kit. Figure A and B: perspective view. Figure C: bottom view. Figure D: top view.

Figure 14 illustrates in perspective view three embodiment of a stabilizer kit configured with blades. One bottom part may be combined with anyone of three different
10 top parts.

Figure 15 illustrates in perspective views a stabilizer with a flap.

Figure 16 illustrates two embodiments of one-part stabilizers.

15

Figure 17 illustrates two embodiments of a stabilizer kit.

Figure 18 illustrates two further embodiments of a stabilizer kit.

20 Figure 19 illustrates an embodiment of an assembly kit.

Figure 20 illustrates an embodiment of an assembly kit.

25 Figure 21 illustrates one embodiment where the aerodynamic toy is thrown by hand in a motion along a trajectory.

Figure 22 illustrates an embodiment of an aerodynamic toy with one aerodynamic body and a stabilizer kit.

Detailed Description of the Invention

No	Item
10	aerodynamic toy
12	aerodynamic body
14	annular body

16	wing
18	aperture
20	outer periphery
22	hole
30	stabilizer
30A	first stabilizer
30B	second stabilizer
32	stabilizer kit
34	top part
36	bottom part
38	means to interlock
40	rotational axis
44	radial plane
50	assembly kit
60	blade
70	rim
80	flap
100	flight characteristic
100A	first flight characteristic
100B	second flight characteristic
102	trajectory
104	spinning
106	aerodynamic profile
106A	first aerodynamic profile
106B	second aerodynamic profile
112	Aerodynamic body
112A	first aerodynamic body
112B	second aerodynamic body
160	first linear side
162	second linear side
164	first periphery part
166	Second periphery part
180	aperture periphery

Figure 1 illustrates an embodiment of the aerodynamic toy 10 configured with five wings 16. The embodiment shows the aerodynamic toy 10 with the wings in an anti-clockwise rotational direction and is illustrated from a top view in figure 1A. Figure 1B illustrates the aerodynamic toy 10 in perspective from a side/top view. In figure 1B the illustrated embodiment is shown with a section cut A-A indicated in figure 1A.

The aerodynamic toy 10 comprises an aerodynamic body 12 with a center aperture 18 and annular body part 14 with an inner periphery given by the outer periphery 180 of the center aperture 18. The aerodynamic body 12 is configured with a set of five wings 16 extending substantially radially outwards from the annular body part 14 away from the center aperture 18.

The center aperture 18 is placed on the rotational axis 40 in the mass center of the aerodynamic body 12. The aerodynamic toy 10 when in use is spinning 104 about the rotational axis 40 of the toy 10 in the rotational plane 44. The aerodynamic body 12 extends substantially radially from the center aperture 18 to an outer periphery 20.

From the perspective side /top view it is seen that the outer periphery 20 of the aerodynamic body 12 has a downward-curved profile perpendicular to the rotational plane 44.

The aerodynamic toy 10 has rotational symmetry around the rotational axis 40. The symmetry is given by the number of wings 16 thus, for this embodiment with five wings 16 the symmetry is given by a rotation of $2/5 * \pi$ radians.

Figure 2A illustrates an embodiment of the aerodynamic toy 10 configured with five wings 16 and a center aperture 18 with an outer periphery 180. The embodiment shows the aerodynamic toy 10 with the wings in an anti-clockwise rotational direction and is illustrated from a top view. The outer periphery 20 of the aerodynamic toy 10 configured by the wings 16 in the radial plane 44 comprises for each wing a first substantially linear side 160 and a second substantially linear side 162. The linear sides 160, 162 are interconnected by a first periphery part 164 which curves outwards from

the rotational axis 40. The individual wings are interconnected by a second periphery part 166, which in this embodiment curves inwards towards the rotational axis 40. The aerodynamic toy 10 comprises wings in the anti-clockwise rotational direction when the wings 16 has a profile given by a second line 162 longer than the first line 160, and where the second line 162 constitutes the right hand side of the wing and the first line 160 constitutes the left hand side of the wing when the aerodynamic toy 10 is seen from the top.

Figure 2B illustrates an embodiment of the aerodynamic toy 10 configured with an aerodynamic body 12 comprising, the annular body part 14, three wings 16 and a center aperture 18 with an outer periphery 180. The three wings 16 extend substantially radially outwards and away from the aperture 18. The embodiment shows the aerodynamic toy 10 from a top view.

Figure 3 illustrates an embodiment of the aerodynamic toy 10 configured with two wings in ordinary mode. Figure 3A illustrates the embodiment from the top view and figure 3B illustrates the aerodynamic toy 10 in perspective from a side/top view. The perspective view is shown with a section cut A-A indicated in figure 3A.

The aerodynamic toy 10 comprises an aerodynamic body 12 with a center aperture 18 and annular body part 14 with an inner periphery given by the outer periphery 180 of the center aperture 18. The aerodynamic body 12 is configured with a set of two wings 16 extending substantially radially outwards from the annular body part 14 away from the center aperture 18.

The center aperture 18 is placed on the rotational axis 40 in the mass center of the aerodynamic body 12. The aerodynamic toy 10 when in use is spinning 104 about the rotational axis 40 of the toy 10 in the rotational plane 44. The aerodynamic body 12 extends substantially radially from the center aperture 18 to an outer periphery 20.

From the perspective side /top view it is seen that the outer periphery 20 of the aerodynamic body 12 has a downward-curved profile perpendicular to the rotational plane 44.

The outer periphery 20 of the aerodynamic toy 10 configured by the wings 16 in the radial plane 44 comprises for each wing a first substantially linear side 160 and a second substantially linear side 162. The linear sides 160,162 are interconnected by a first periphery part 164 which curves outwards from the rotational axis 40. The individual wings are interconnected by a second periphery part 166, which in this embodiment curves outwards from the rotational axis 40. The aerodynamic toy 10 is in ordinary mode when the wings 16 has a profile given by a second line 162 shorter than the first line 160, and where the second line 162 constitutes the right hand side of the wing and the first line 160 constitutes the left hand side of the wing when the aerodynamic toy 10 is seen from the top.

Figure 4 illustrates an embodiment of the aerodynamic toy 10 configured with three wings in ordinary mode. Figure 4A illustrates the embodiment from the top view and figure 4B illustrates the aerodynamic toy 10 in perspective from a side/top view. The perspective view is shown with a section cut A-A indicated in figure 4A.

Aspects from the previous figures may pertain to the details disclosed in the embodiment in figure, where the linear sides 160,162 are interconnected by a first periphery part 164 which curves outwards from the rotational axis 40. The individual wings are interconnected by the second periphery part 166, which in this embodiment curves inwards towards the rotational axis 40. The wings 16 has a profile given by that the second line 162 is shorter than the first line 160.

Figure 5 illustrates an embodiment of the aerodynamic toy 10 configured with four wings in ordinary mode. Figure 5A illustrates the embodiment from the top view and figure 5B illustrates the aerodynamic toy 10 in perspective from a side/top view. The perspective view is shown with a section cut A-A indicated in figure 5A.

Aspects from the previous figures may pertain to the details disclosed in the embodiment in figure, where the linear sides 160,162 are interconnected by a first periphery part 164 which curves outwards from the rotational axis 40. The individual wings are interconnected by the second periphery part 166, which in this embodiment curves

inwards towards the rotational axis 40. The wings 16 has a profile given by that the second line 162 is shorter than the first line 160.

5 Figure 6 illustrates an embodiment of the aerodynamic toy 10 configured with four wings in symmetric mode. Figure 6A illustrates the embodiment from the top view and figure 6B illustrates the aerodynamic toy 10 in perspective from a side/top view. The perspective view is shown with a section cut A-A indicated in figure 6A.

10 Aspects from the previous figures may pertain to the details disclosed in the embodiment in figure, where in addition to the center aperture 18, this embodiment comprises four peripheral apertures 22. The peripheral apertures are placed such that the aerodynamic toy 10 has rotational symmetry around the rotational axis 40.

15 The linear sides 160,162 are interconnected by a first periphery part 164 which curves outwards from the rotational axis 40. The individual wings are interconnected by the second periphery part 166, which in this embodiment curves inwards towards the rotational axis 40. The wings 16 have a symmetric profile in which the first line 160 and the second line 162 are equal in length. In case that the peripheral apertures 22 or parts thereof are considered part of the wings, the peripheral apertures 22 are placed such
20 that the wings 16 symmetric profile is maintained.

Figure 7 illustrates an embodiment of the aerodynamic toy 10 configured with five wings in ordinary mode. Figure 7A illustrates the embodiment from the top view and figure 7B illustrates the aerodynamic toy 10 in perspective from a side/top view. The
25 perspective view is shown with a section cut A-A indicated in figure 7A.

Aspects from the previous figures may pertain to the details disclosed in the embodiment in figure, where this embodiment especially resembles that of figure 1. However, the embodiment shown in figure 1 has wings in the anti-clockwise rotational direction
30 while this embodiment comprises wings in a clockwise rotational direction and thus, one of the embodiments is the flip-mode of the other. The linear sides 160,162 are interconnected by a first periphery part 164 which curves outwards from the rotational axis 40. The individual wings are interconnected by the second periphery part 166, which in this embodiment curves inwards towards the rotational axis 40. Thus, for this

embodiment configured with five wings in ordinary mode, the wings 16 has a profile given by that the second line 162 is shorter than the first line 160.

5 Figure 8 illustrates an embodiment of the aerodynamic toy 10 configured with six wings in ordinary mode. Figure 8A illustrates the embodiment from the top view and figure 8B illustrates the aerodynamic toy 10 in perspective from a side/top view. The perspective view is shown with a section cut A-A indicated in figure 8A.

10 Aspects from the previous figures may pertain to the details disclosed in the embodiment in figure, where, the linear sides 160,162 are interconnected by a first periphery part 164 which curves outwards from the rotational axis 40. The individual wings are interconnected by the second periphery part 166, which in this embodiment curves inwards towards the rotational axis 40. The wings 16 has a profile given by that the second line 162 is shorter than the first line 160.

15 Figure 9 illustrates an embodiment of the aerodynamic toy 10 configured with seven wings in ordinary mode. Figure 9A illustrates the embodiment from the top view and figure 9B illustrates the aerodynamic toy 10 in perspective from a side/top view. The perspective view is shown with a section cut A-A indicated in figure 9A.

20 Aspects from the previous figures may pertain to the details disclosed in the embodiment in figure, where the linear sides 160,162 are interconnected by a first periphery part 164 which curves outwards from the rotational axis 40. The individual wings are interconnected by the second periphery part 166, which in this embodiment curves inwards towards the rotational axis 40. The wings 16 has a profile given by that the second line 162 is shorter than the first line 160.

30 Figure 10 illustrates an embodiment of a bottom part 36 of a stabilizer kit 32. Figure 10A illustrates the bottom part 36 in perspective top/side view. Figure 10B illustrates the same perspective of the embodiment but shown with a section cut B-B indicated in figure 10A. The bottom part 36 is configured with blades 60 extending downwards from the bottom part 36. The blades 60 when seen from the top are inclined in anti-clockwise direction and thus, the stabilizer may be used for an aerodynamic toy to spin with a clockwise rotation. The rim 70 of the stabilizer 30 into which the aerody-

5 namic body 12 may be attached is seen from the perspective view. The aerodynamic body 10 may be inserted onto the rim simply by placing the aerodynamic body 10 on the rim or by applying a small force to stretch or pull the aerodynamic body 10 onto the rim 70. Figure 10C illustrates the embodiment from the bottom view, which shows the configuration of the blades 60. The blades are comprised on the lower side of the bottom part 36 and have a substantially triangular form extending substantially from the inner periphery of the stabilizer 30 to the outer periphery of the stabilizer 30. The tip of the blades 60 at the inner periphery of the stabilizer 30 has an acute angle. At the outer periphery the side of the blades attached to the body of the bottom part 36 ends in an obtuse angle and thus, the blades extends down- and outwards from the body of the bottom part 36 ending in a blade tip with an acute angle. Figure 10D illustrates the embodiment from the top view. The illustrated embodiment shows a bottom part 36 of a stabilizer kit 32 to be mounted onto the aerodynamic body 12 from below. Figure 10C and 10D further illustrates that the embodiment comprises means to interlock 38 the bottom part 36 with a top part 34 to comprise a stabilizer kit 32. In this embodiment the interlock means 38 are screw threads for screwing the top 34 and bottom part 36 together with the aerodynamic body 12 placed on the rim 70 and locked in place by the stabilizer kit 32.

20 Figure 11 illustrates an embodiment of a one-part stabilizer 30. Figure 11A illustrates the stabilizer 30 in perspective top/side view. Figure 11B illustrates the same perspective of the embodiment but shown with a section cut B-B indicated in figure 11A. Figure 11C illustrates the embodiment from the bottom view and figure 11D illustrates the embodiment from the top view. The stabilizer is symmetric in clockwise and anti-clockwise direction. The rim 70 of the stabilizer 30 into which the aerodynamic body 12 may be attached is seen from the perspective view in figure 11B. The illustrated embodiment shows a stabilizer 30 to be mounted onto the aerodynamic body 12 from above. The stabilizer may be mounted by simply applying a small force to stretch or pull the aerodynamic body 12 onto the rim 70 of the stabilizer. For the one-part stabilizer the rim 70 is constructed with a protrusion to hold the aerodynamic body 12 in place.

30

Figure 12 illustrates three embodiments of a one-part stabilizer 30 configured with blades 60. Figure 12A illustrates the stabilizer 30 in perspective top/side view. Figure

12B illustrates the same perspective of the embodiment but shown with a section cut B-B indicated in figure 12A. Figure 12C illustrates the embodiment from the bottom view and figure 12D illustrates the embodiment from the top view. The rim 70 of the stabilizer 30 into which the aerodynamic body 12 may be attached is seen from the perspective view in figure 12B. The illustrated embodiment shows a stabilizer 30 to be mounted onto the aerodynamic body 12 from above. The stabilizer may be mounted by simply applying a small force to stretch or pull the aerodynamic body 10 onto the rim 70 of the stabilizer 30. For the one-part stabilizer the rim 70 is constructed with a protrusion to hold the aerodynamic body 12 in place.

The illustrated embodiment of the stabilizer 30 comprises a frame and a set of six blades 60. The blades 60 extend from the inner periphery of the stabilizer and inwards towards the center of the stabilizer. The blades have a non-symmetric profile and thus, the stabilizer is non-symmetric in clockwise and anti-clockwise direction.

Figure 12E and 12F illustrates two other embodiments in perspective view. The embodiments are similar to that of figure 12A however, with the blades extending inwards and downwards in a slight angle to the rotational plane in the embodiment of figure 12E, and with the blades extending inwards and upwards in a slight angle to the rotational plane in the embodiment of figure 12F.

Figure 13 illustrates an embodiment of a stabilizer kit 32. Figure 13A illustrates the stabilizer 30 in perspective top/side view. Figure 13B illustrates in the same perspective the assembly of the embodiment. The assembly is shown with a section cut B-B indicated in figure 13A. Figure 13C illustrates the embodiment from the bottom view and figure 13D illustrates the embodiment from the top view. The stabilizer is symmetric in clockwise and anti-clockwise direction and thus may be used for both clockwise and anti-clockwise rotation. The rim 70 of the stabilizer 30 into which the aerodynamic body 12 may be attached is seen from the perspective view in figure 13B. The illustrated embodiment shows a stabilizer top part 34 to be mounted onto the aerodynamic body 12 from above. The stabilizer may be mounted by simply applying a small force to stretch or pull the aerodynamic body 12 onto the rim 70 of the stabilizer.

The bottom part 36 may be interlock with the top part 34 from below to comprise a stabilizer kit 32. In this embodiment the interlock means 38 may be a simple click-function by which the top 34 and bottom part 36 is interlock by pushing the parts together with the aerodynamic body 12 placed on the rim 70 and thereby the aerodynamic body 12 is locked in place by the stabilizer kit 32.

Figure 14 illustrates three embodiments of a stabilizer 30 substantially similar to the embodiments illustrated in figure 12. However, the embodiments illustrated here in figure 14 illustrate the three embodiments configured as a stabilizer kit. The embodiments are illustrated in perspective view shown with a section cut B-B indicated in figure 12A.

The stabilizer kit comprises three top parts 34 and one bottom part 36. The aerodynamic body 12 is mounted onto the bottom part 36 by inserting the bottom part 36 into the aperture 18 of the aerodynamic body 12 from below. The bottom part comprises external screw threads onto which the top part may be screwed to interlock the top 34 and bottom part 36 with the aerodynamic body 12 locked in place.

The three embodiments of the stabilizer 30 are configured with a set of six blades 60 similar to the embodiments in figure 12.

Figure 15 illustrates configurations of a flap 80 on a stabilizer 30 with a top part 34 and a bottom part 36. Figure 15 A illustrate a flap 80 on a bottom part 36 of a stabilizer 30. The flap 80 extends downwardly and circulates the outer periphery of the bottom part 36. The flap 80 is here symmetrical about the rotational axis. The stabilizer is a stabilizer kit 32.

Figure 15 B illustrates a flap 80 on a bottom part 36 of a stabilizer 30. The flap 80 extends downwardly and slightly towards the centre of the stabilizer 30. The stabilizer is a stabilizer kit 32.

Both embodiments of the flap 80 provide little drag whilst spinning or rotating about the rotational drag, but provide drag or altered aerodynamic properties during flight and thus alter the flight characteristics.

Figure 16 illustrates two embodiments of one-part stabilizers 30. Figure 16A illustrates one stabilizer 30 in perspective top/side view and the same perspective of the embodiment but shown with a section cut B-B to illustrate the rim 70 of the stabilizer 30 into which the aerodynamic body 12 may be attached. The illustrated stabilizer 30 has a flat upper and lower profile.

Figure 16B illustrates another embodiment of a stabilizer 30 also in perspective top/side view and the same perspective of the embodiment but shown with a section cut B-B to illustrate the rim 70 of the stabilizer 30 into which the aerodynamic body 12 may be attached. The illustrated stabilizer 30 has a flat upper profile and a downward bending lower profile.

Both embodiments of the stabilizer 30 are symmetric in clockwise and anti-clockwise direction. The illustrated embodiment shows a stabilizer 30 to be mounted onto the aerodynamic body 12 from below. The stabilizer may be mounted by simply applying a small force to stretch or pull the aerodynamic body 12 onto the rim 70 of the stabilizer. For the one-part stabilizer the rim 70 is constructed with a protrusion to hold the aerodynamic body 12 in place.

Figure 17 illustrates two embodiments of a stabilizer kit 32 comparable to the embodiments illustrated in figure 13. However, the embodiments illustrated here in figure 17 have different upper and lower profiles compared to the embodiment in figure 13. The embodiments are illustrated in perspective view showing a stabilizer kit 32 unassembled with the top part 34 and the bottom part 36, and as an assembled stabilizer kit 32 working as a stabilizer 30 with the rim 70 into which the aerodynamic body 12 may be attached which is seen from the section cut B-B.

Both embodiments in figure 17 have a flat upper profile and a downward bending lower profile. The downward bending profile in figure 17B has a flap extending downwards and outwards from the centre in an approximately 45 degree angle.

Figure 18 illustrates two further embodiments of a stabilizer kit 32 comparable to the embodiments illustrated in figure 17. However, the embodiments illustrated here in

figure 18 have different upper and lower profiles compared to the embodiment in figure 17. The embodiments are illustrated in perspective view showing a stabilizer kit 32 unassembled with the top part 34 and the bottom part 36, and as an assembled stabilizer kit 32 working as a stabilizer 30 with the rim 70 into which the aerodynamic body 12 may be attached which is seen from the section cut B-B.

The embodiments in figure 18 have a flat upper profile and a downward bending lower profile with flaps. The downward bending profile in figure 18A has a flap extending downwards and outwards from the centre in an approximately 45 degree angle and comprising wings 60. The downward bending profile in figure 18B has a flap extending downwards substantially perpendicular to the radial plane.

Figure 19 illustrates an embodiment of an assembly kit 50 with a first aerodynamic body 112A with a first aerodynamic profile 106A, a second aerodynamic body 112B with a second aerodynamic profile 106B, and a stabilizer. The stabilizer is arranged to be mounted and demounted in the aperture 18 of either of the aerodynamic bodies 112 and thereby achieving an assembly kit 50 by which two different configurations of the aerodynamic toy 10 may be formed. The embodiment is illustrated with a one-part stabilizer.

Figure 20 illustrates an embodiment of an assembly kit 50 with one aerodynamic body 112, a first stabilizer 30A with a first aerodynamic profile 106A, and a second stabilizer body 30B with a second aerodynamic profile 106B. The stabilizers are arranged to be mounted and demounted in the aperture 18 of the aerodynamic body 112 and thereby achieving an assembly kit 50 by which two different configurations of the aerodynamic toy 10 may be formed. The embodiment is illustrated with the first stabilizer 30A configured as a stabilizer kit 32, and second stabilizer 30B configured as a one-part stabilizer.

Figure 21 illustrates an embodiment where the aerodynamic toy 10 is thrown by hand in a motion along a trajectory 102 with an increase in altitude in the beginning, reaching a top and then decreasing in altitude. The embodiment is illustrated with a flight characteristic 100 along the trajectory 102. Here the flight characteristic 100 is illustrated as a spinning 104 motion about a rotational axis of the toy 10. Figure 21A illus-

trates an embodiment where the aerodynamic toy 10 has a trajectory 102 where the toy has a landing point away from the thrower of the toy 10. Figure 21B illustrates an embodiment where the aerodynamic toy 10 has a trajectory 102 with a decrease in altitude in the beginning, reaching a low and then increasing in altitude before later landing at a point away from the thrower of the toy. Thus figure 21 may also illustrate an embodiment of an assembly kit 50 by which two different configuration of the aerodynamic toy 10 may be formed. The two different configurations may result in a first configuration of the aerodynamic toy 10 with a first flight characteristic 100A and a second configuration of the aerodynamic toy 10 with a second flight characteristic 100B. The assembly kit 50 may comprise three parts as illustrated in figure 19 and 20 or more.

The trajectory 102 may also be in an S-shaped curve, a screw-shaped curve, snake-like curve or the like. The illustrated trajectories 102 and the above mentioned examples are only examples, and thus the shape of the trajectory 102 may not be limited to these.

Figure 22 illustrates yet another embodiment of an aerodynamic toy 10 with one aerodynamic body 112, and a stabilizer 30 being a stabilizer kit 32 with an aerodynamic profile 106. The stabilizer 30 is arranged to be mounted and demounted in the aperture 18 of the aerodynamic body 112. The embodiment is illustrated with the top part 34 and the bottom part 36 of the stabilizer kit 32 being mounted in the aperture 18 of the aerodynamic body 112.

CLAIMS

1. An aerodynamic toy (10) for throwing by hand in a motion along a trajectory (102) whilst spinning (104) about a rotational axis (40) of the toy (10) in a rotational plane (44), and the aerodynamic toy (10) is **characterized in** comprising:

- 5 - an aerodynamic body (12) substantially extending radially from the rotational axis (40) to an outer periphery (20) and configured with an aperture (18) and an aerodynamic profile (106); and
- a stabilizer (30) configured to be mounted and demounted in the aperture (18)

for a flight characteristic (100) along a trajectory (102).

10

2. The aerodynamic toy (10) according to claim 1 **characterized in** that the aerodynamic body (12) is configured with a set of wings (16) with each individual wing (16) extending substantial radially outwards from the annular body part (14) away from the aperture (18).

15

3. The aerodynamic toy (10) according to any of the preceding claims **characterized in** that the aerodynamic body (12) and stabilizer (30) constitutes an assembly kit (50) which can be assembled and disassembled manually.

20

4. The aerodynamic toy (10) according to any of the preceding claims **characterized in** that the stabilizer (30) is configured as a stabilizer kit (32) comprising a top part (34) and a bottom part (36) which bottom (62) and top (34) part is configured with means to interlock (38) and to be inserted in the aperture (18) from respective sides of the aperture (18).

25

5. The aerodynamic toy (10) according to any of the preceding claims **characterized in** that the aerodynamic body (12) is made from a flexible or semi-flexible material.

30

6. The aerodynamic toy (10) according to any of the preceding claims **characterized in** that the stabilizer (30) is made from a rigid or semi-rigid material.

7. The aerodynamic toy (10) according to any of the preceding claims **characterized in** that the outer periphery (20) of a wing (16) in the radial plane (44) comprises a first

periphery part (164), which curves outwards from the rotational axis (40), and which first periphery part (164) interconnects a first substantially linear side (160) and a second substantially linear side (162) comprising the sides of the wing (16), and that the individual wings (16) are interconnected to an adjacent wing (18) by a second periphery part (166).

8. The aerodynamic toy (10) according to any of the preceding claims **characterized in** that the aerodynamic body (12) has rotational symmetry in the radial plane (44).
9. The aerodynamic toy (10) according to any of the preceding claims **characterized in** that the outer periphery (20) of the aerodynamic body (12) has a downward-curved profile perpendicular to the rotational plane (44).
10. The aerodynamic toy (10) according to any of the preceding claims **characterized in** that the stabilizer (30) comprises a set of blades (60) for generating lift when spinning (104) during motion.
11. The aerodynamic toy (10) according to any of the preceding claims, **characterized in** that the aerodynamic body has one or more holes (22).
12. The aerodynamic toy (10) according to any of the preceding claims, **characterized in** that the stabilizer (30) comprises at least one flap (80) essentially extending out of the rotational plane (44).
13. An assembly kit (50) for an aerodynamic toy (10) according to any of the preceding claims, comprising at least:
- a first aerodynamic body (112A) with a first aerodynamic profile (106A);
 - a second aerodynamic body (112B) with a second aerodynamic profile (106B);
 - a stabilizer (30) configured to be mounted and demounted in the aperture (18) of either of the first and second aerodynamic bodies (112A, 112B)
- for a first flight characteristic (100A) with the stabilizer (30) mounted in the first aerodynamic body (112A) and a second flight characteristic (100B) with the stabilizer (30) mounted in the second aerodynamic body (112B).

14. An assembly kit (50) for an aerodynamic toy (10) according to any of the preceding claims 1 to 12, comprising at least:

- an aerodynamic body (112) with an aerodynamic profile (106);
- a first stabilizer (30A) with a first aerodynamic profile (106A) configured to be mounted and demounted in the aperture (18) of the aerodynamic body (112);
- a second stabilizer (30A) with a second aerodynamic profile (106A) configured to be mounted and demounted in the aperture (18) of the aerodynamic body (112) for a first flight characteristic (100A) with the first stabilizer (30A) mounted in the aerodynamic body (112) and a second flight characteristic (100B) with the second stabilizer (30B) mounted in the aerodynamic body (112).

15. An assembly kit (50) for an aerodynamic toy (10) according to any of the preceding claims 1 to 12, comprising at least:

- a first aerodynamic body (112A) with a first aerodynamic profile (106A);
 - a second aerodynamic body (112B) with a second aerodynamic profile (106B);
 - a first stabilizer (30A) with a first aerodynamic profile (106A) configured to be mounted and demounted in the aperture (18) of the aerodynamic body (112);
 - a second stabilizer (30A) with a second aerodynamic profile (106A) configured to be mounted and demounted in the aperture (18) of the aerodynamic body (112),
- wherein the two or more stabilizers (30) are configured to be individually mounted and demounted in the aperture (18) of any of the two or more aerodynamic bodies (112) for different flight characteristics (100).

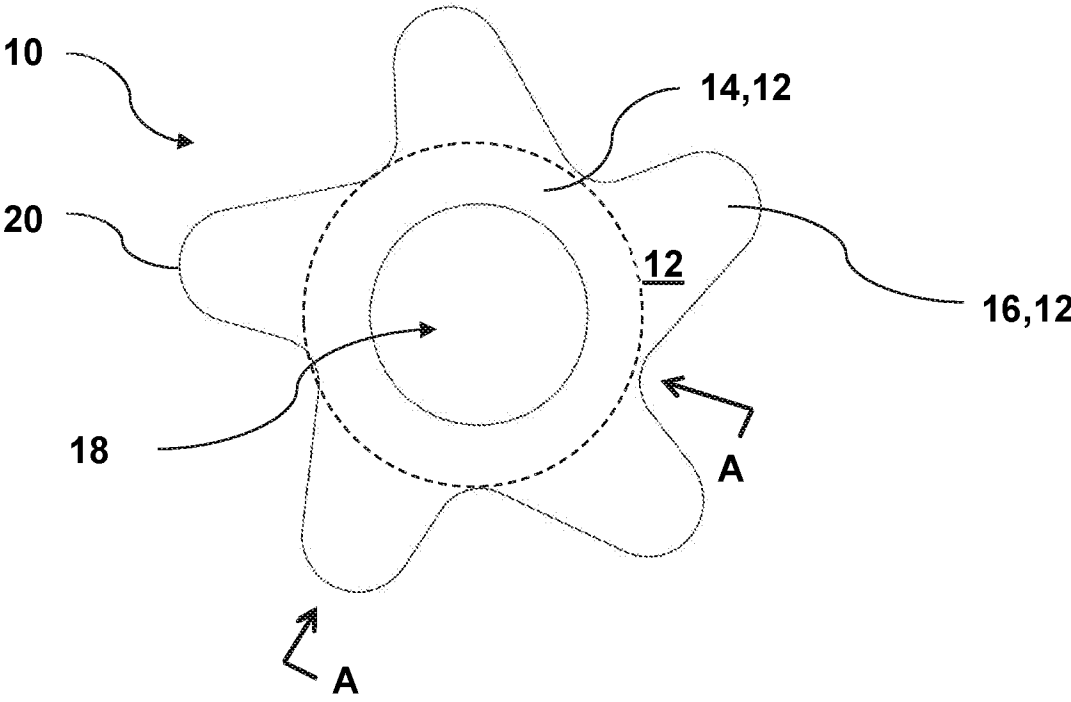


Fig. 1A)

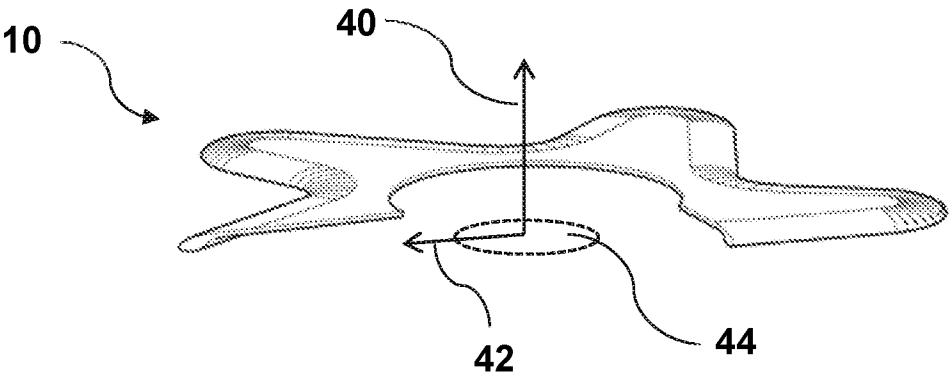


Fig. 1B)

Fig. 1

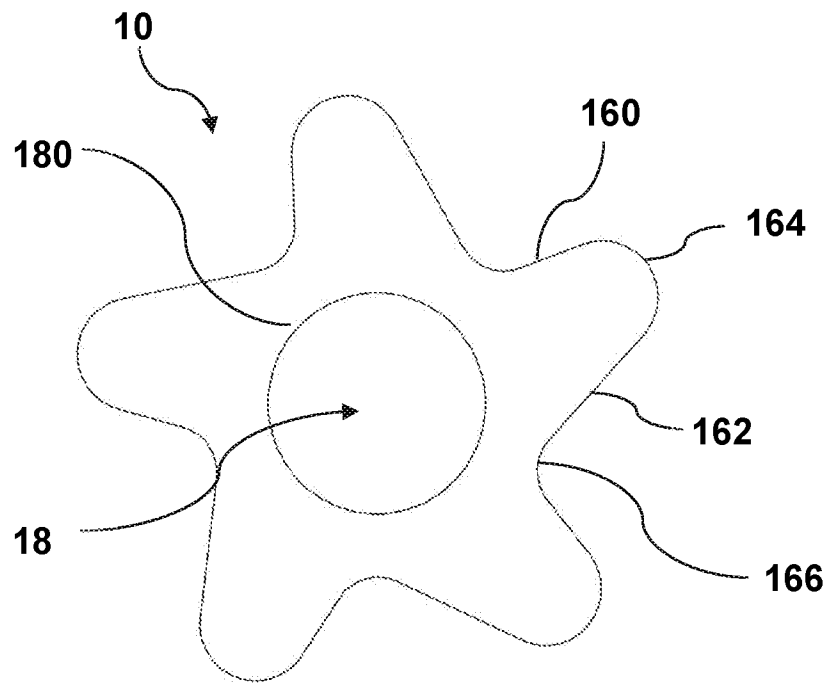


Fig. 2A)

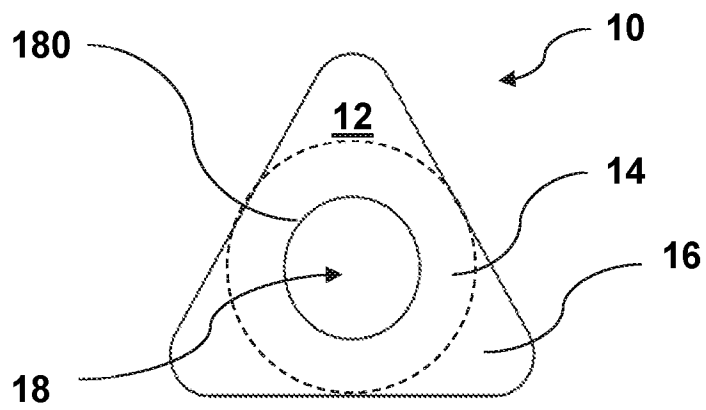


Fig. 2B)

Fig. 2

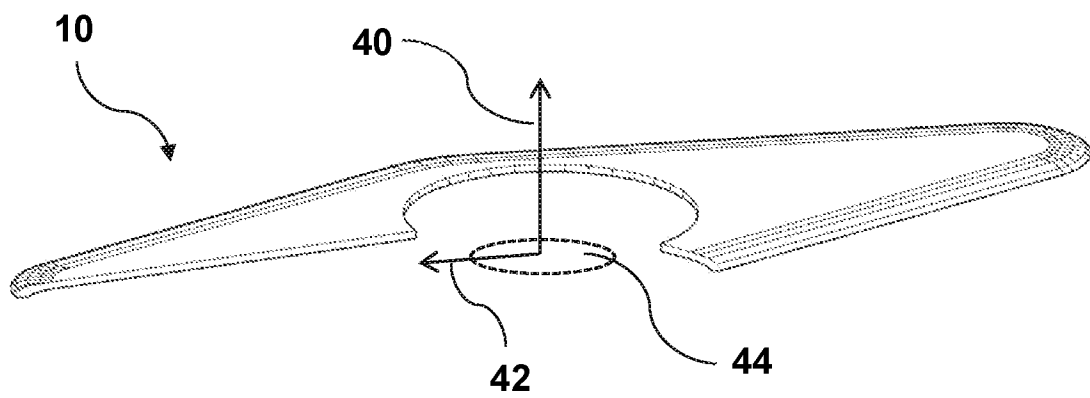
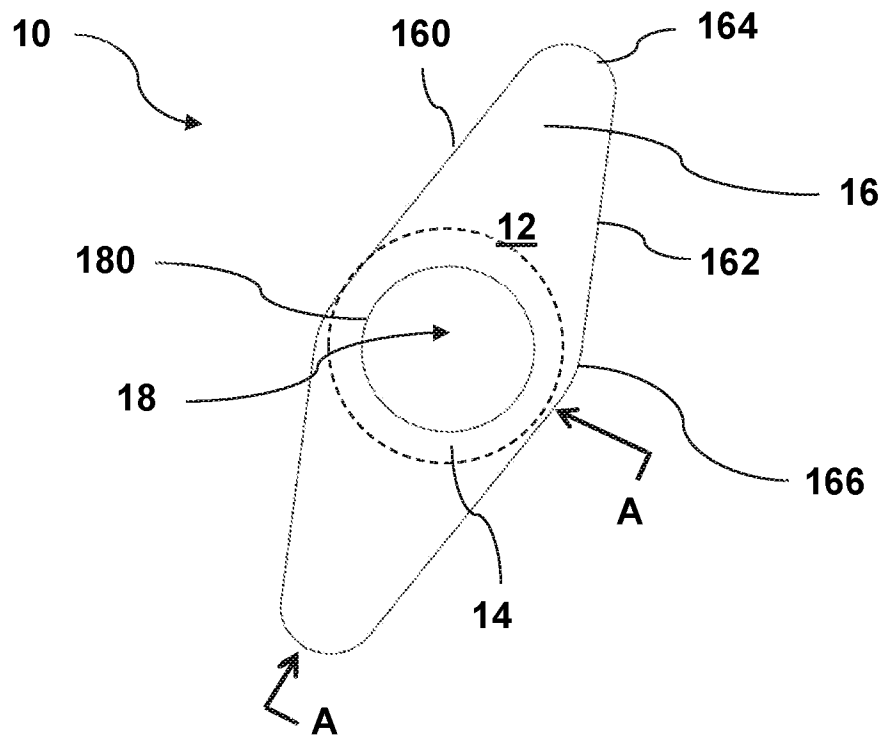


Fig. 3

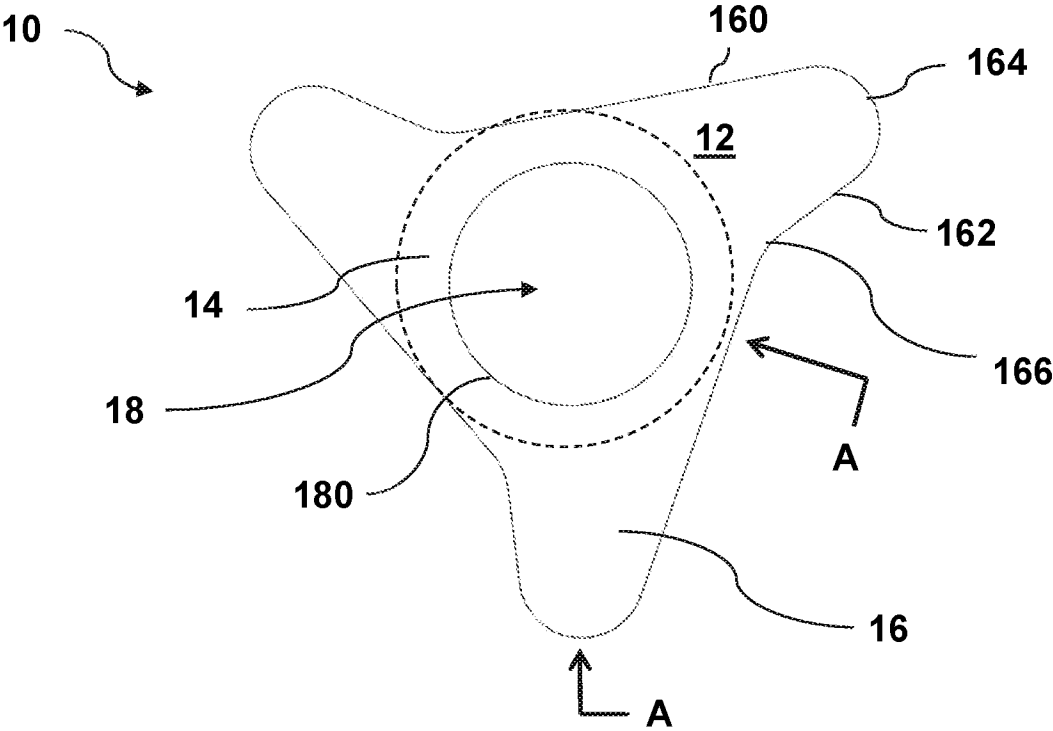


Fig. 4A)

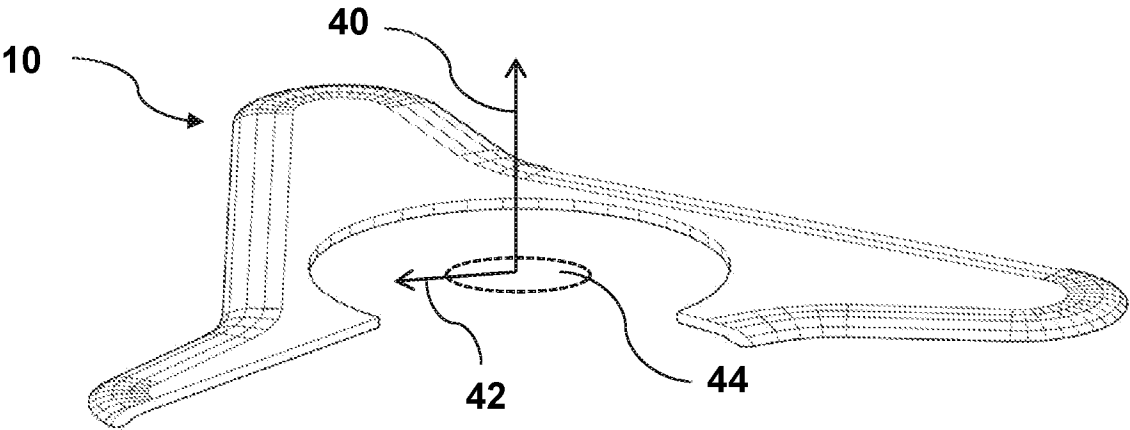


Fig. 4B)

Fig. 4

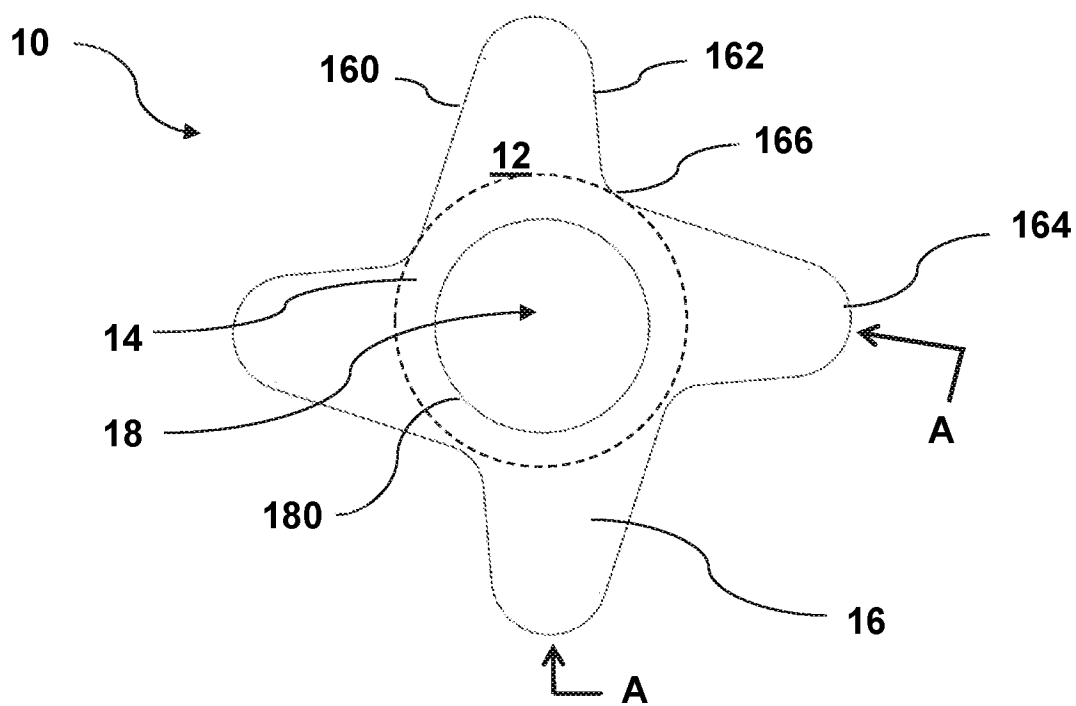


Fig. 5A)

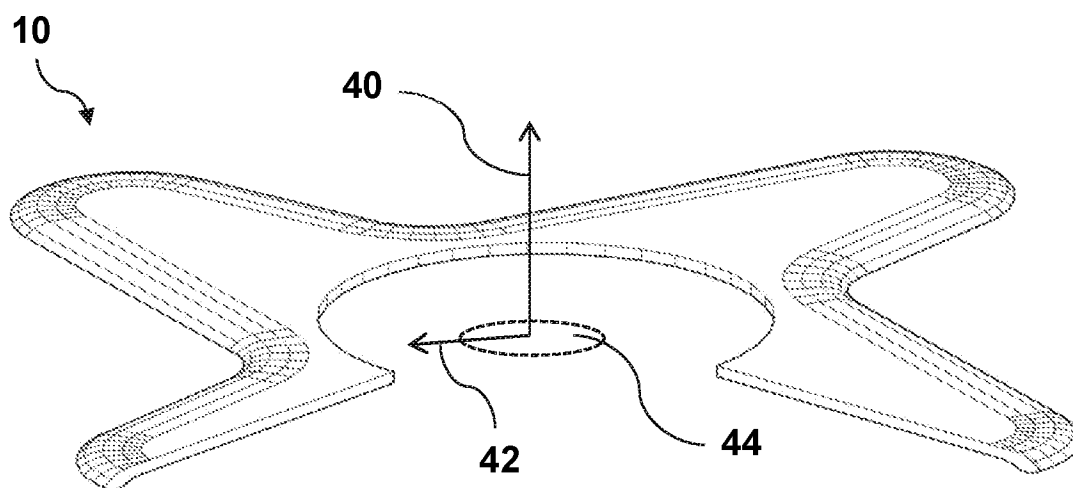


Fig. 5B)

Fig. 5

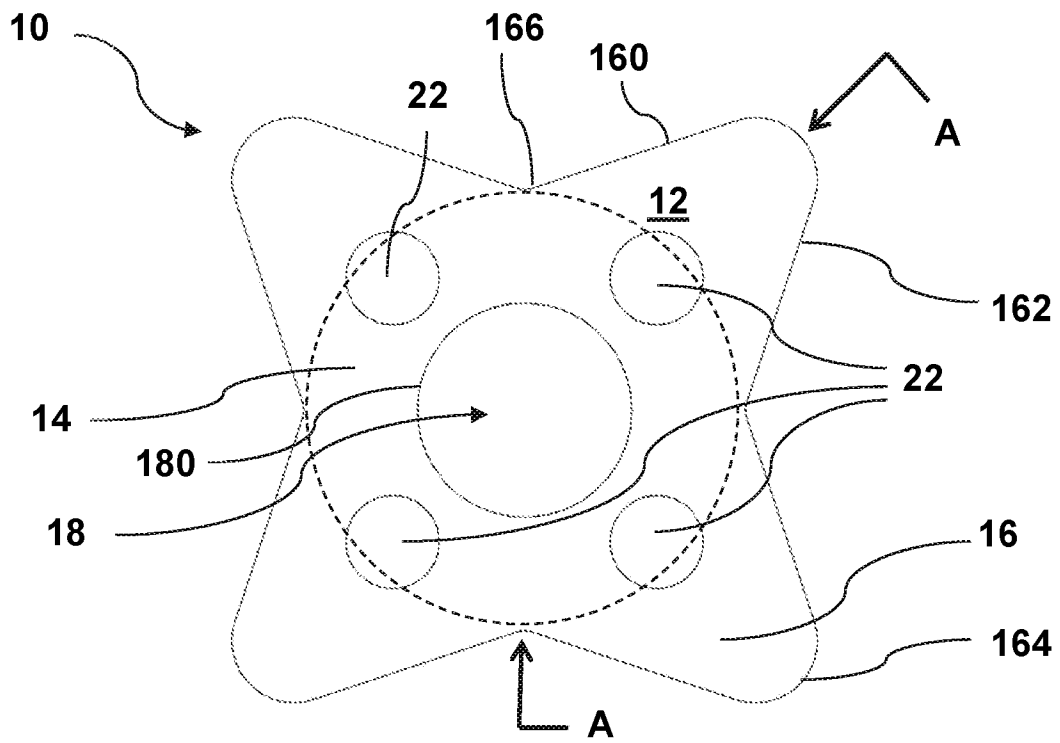


Fig. 6A)

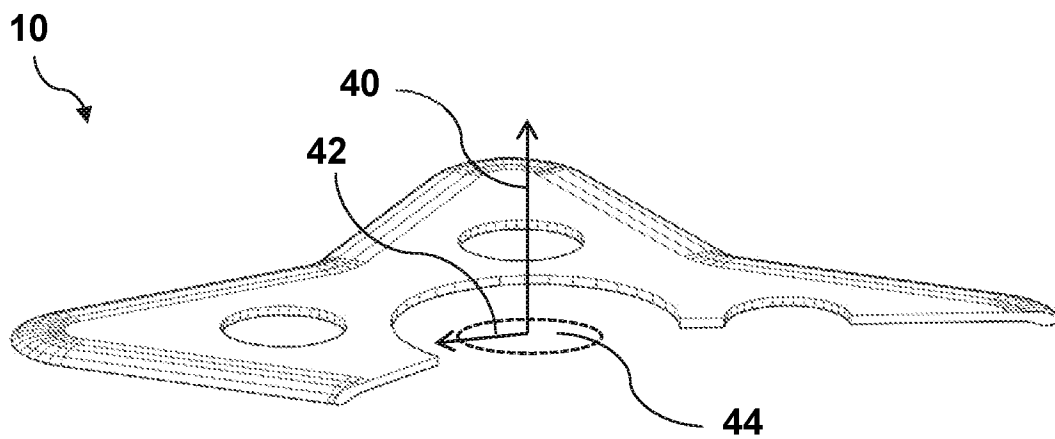


Fig. 6B)

Fig. 6

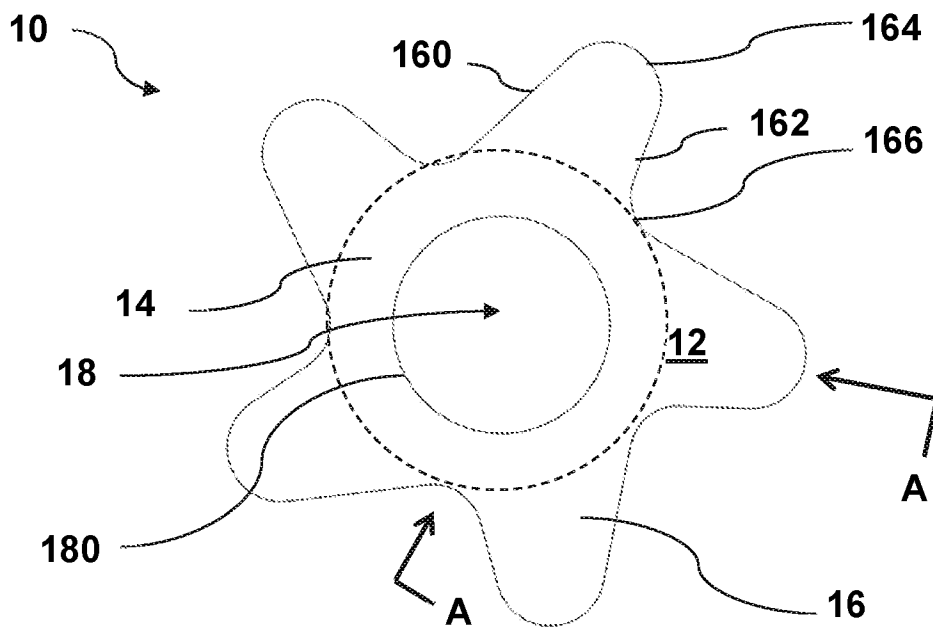


Fig. 7A)

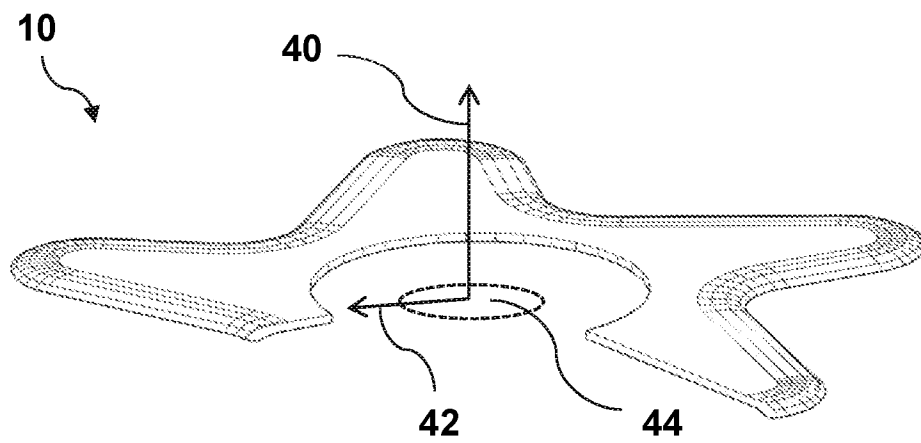


Fig. 7B)

Fig. 7

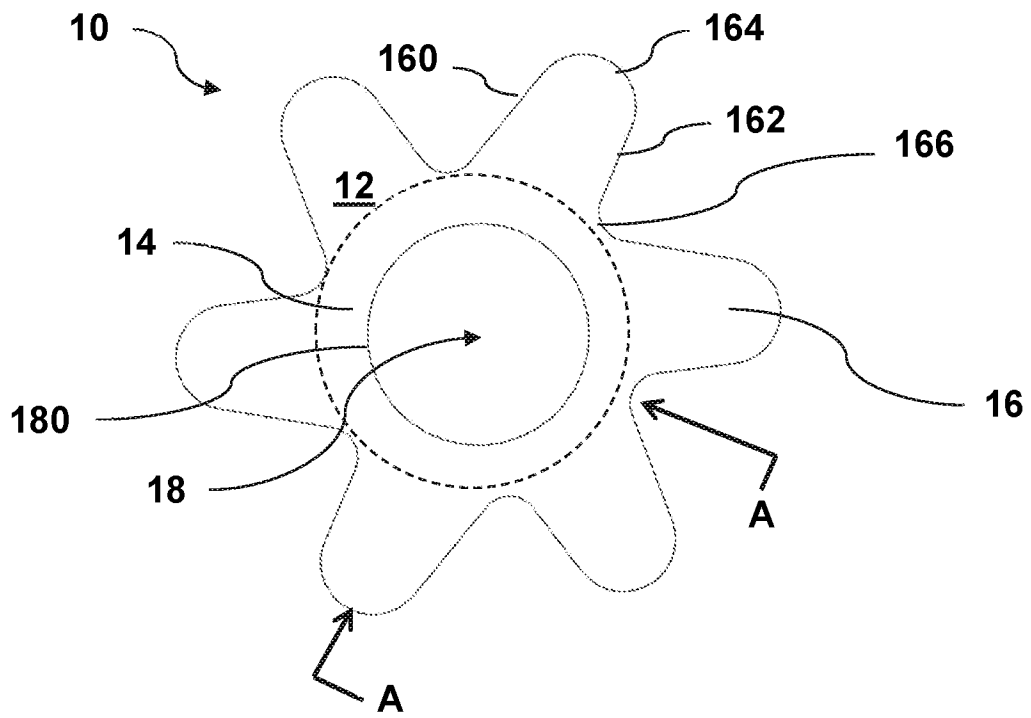


Fig. 8A)

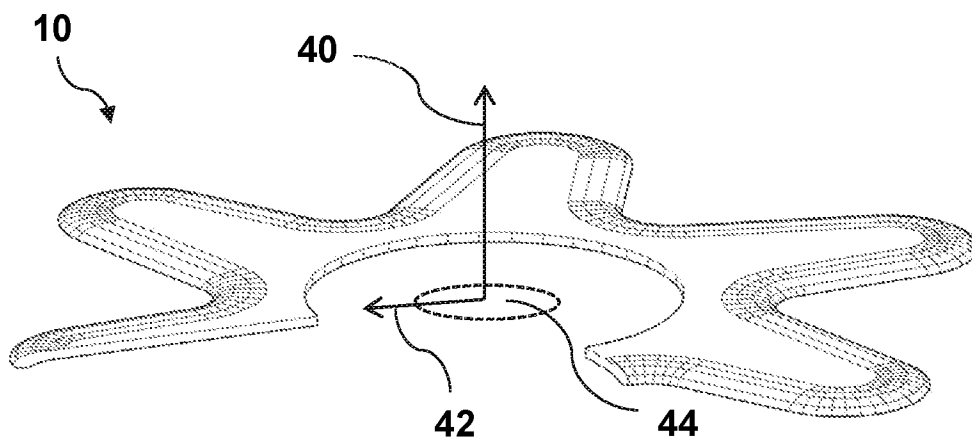


Fig. 8B)

Fig. 8

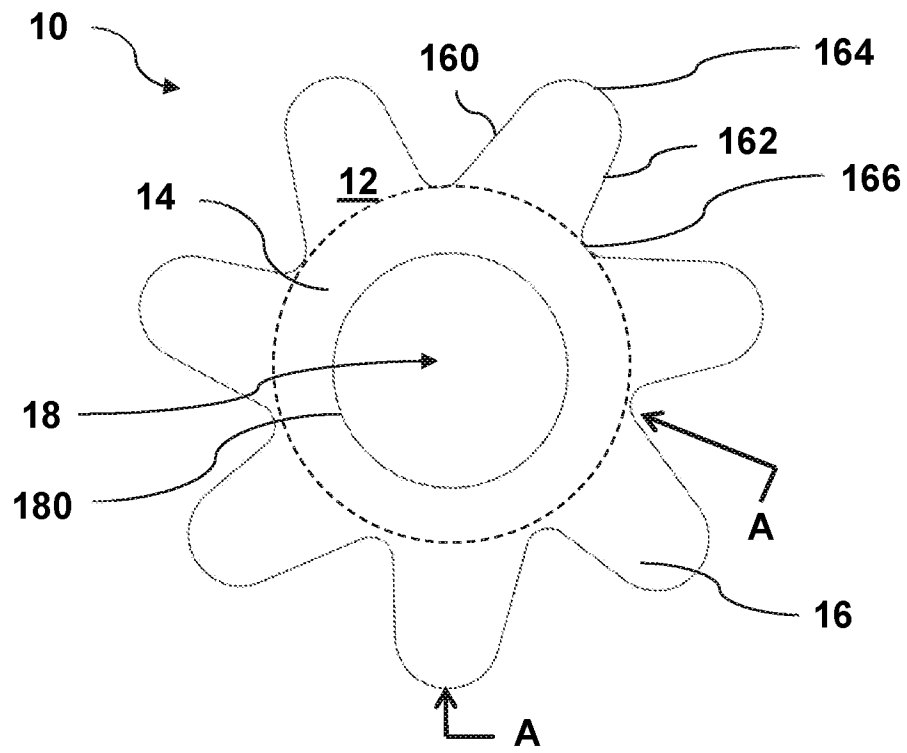


Fig. 9A)

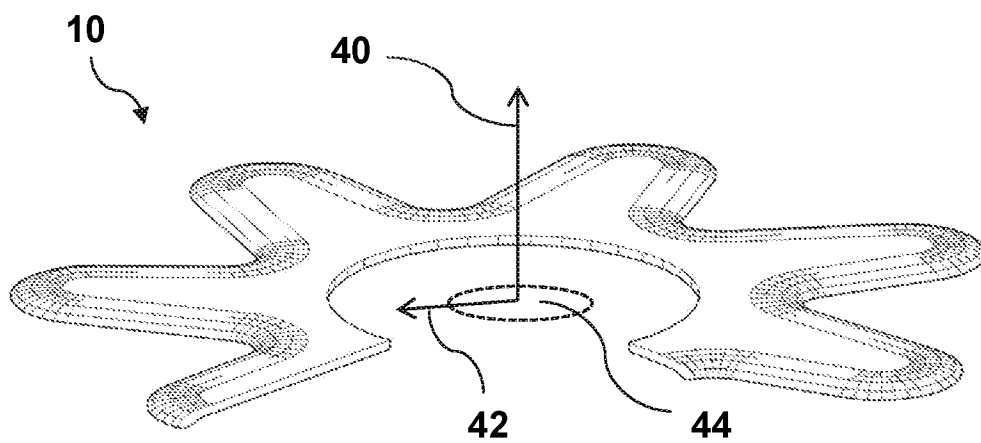


Fig. 9B)

Fig. 9

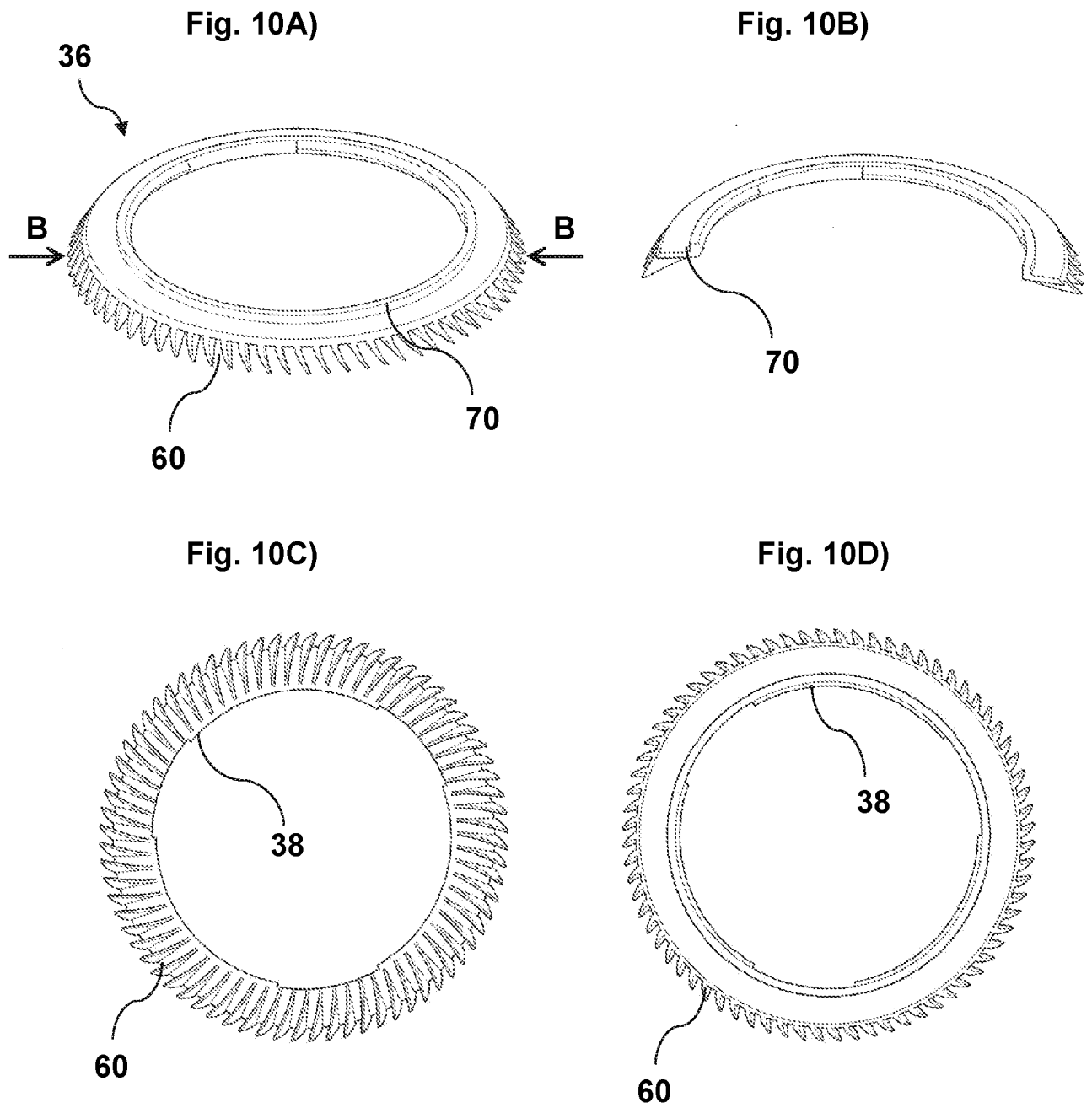


Fig. 10

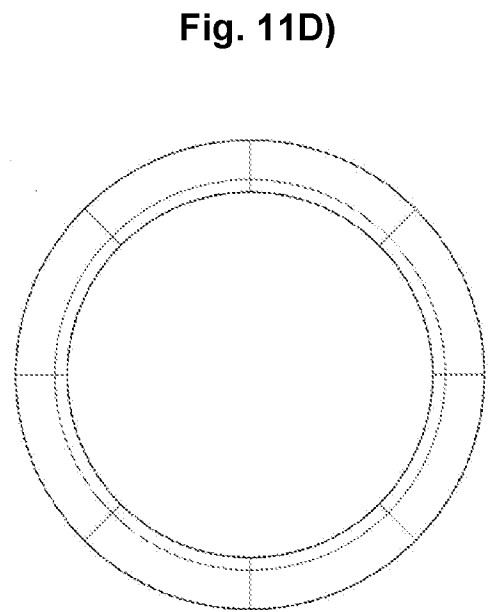
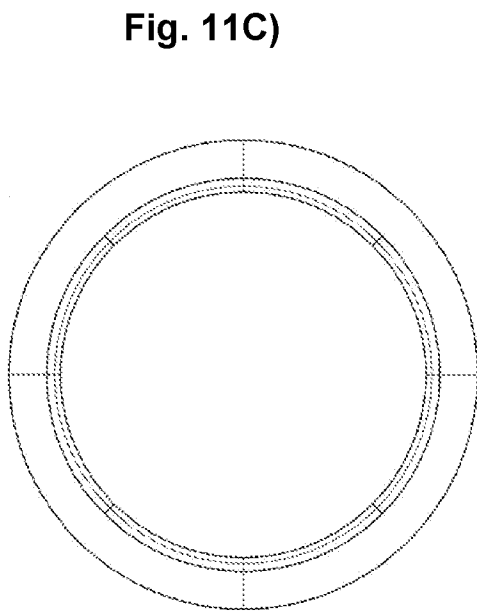
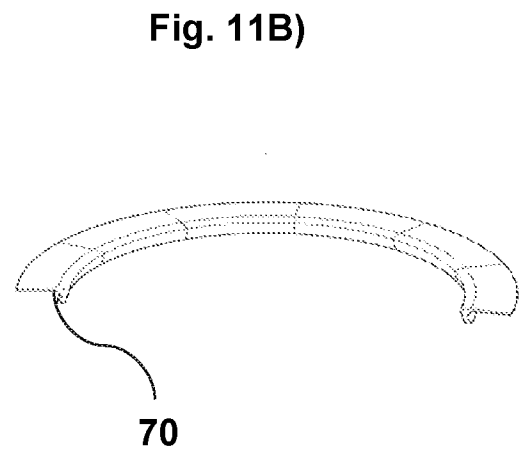
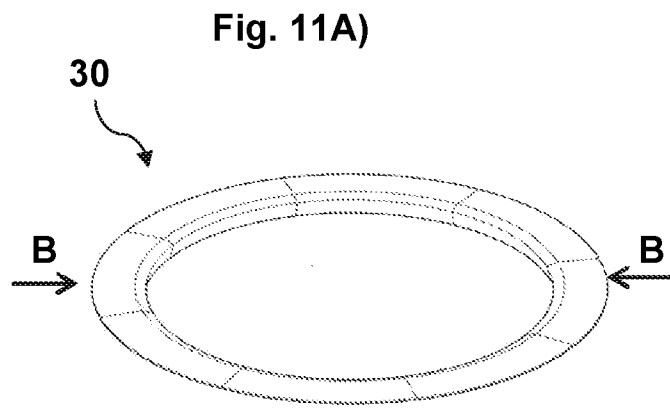


Fig. 11

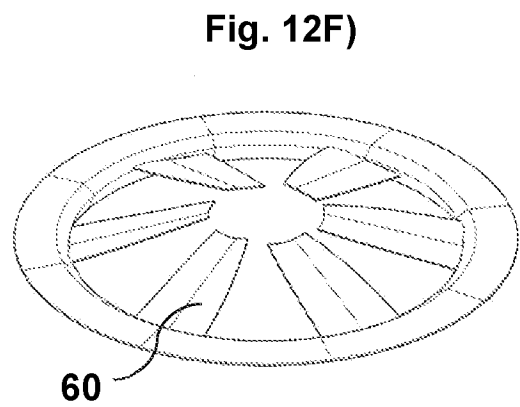
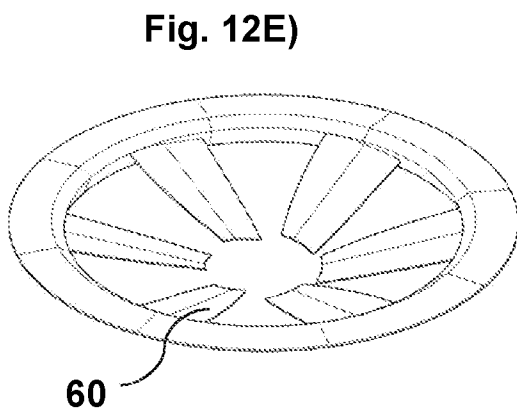
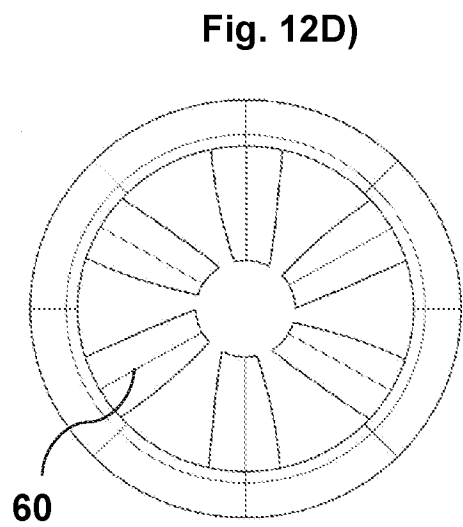
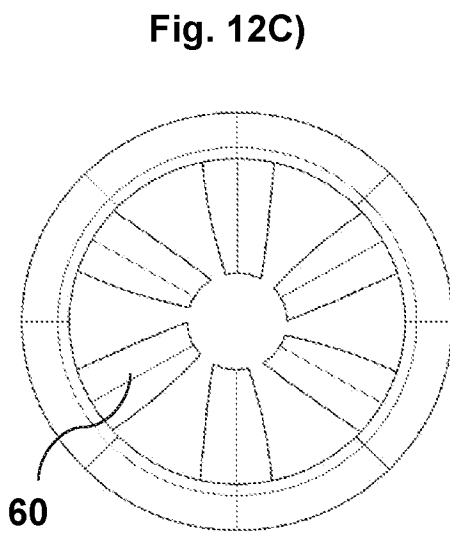
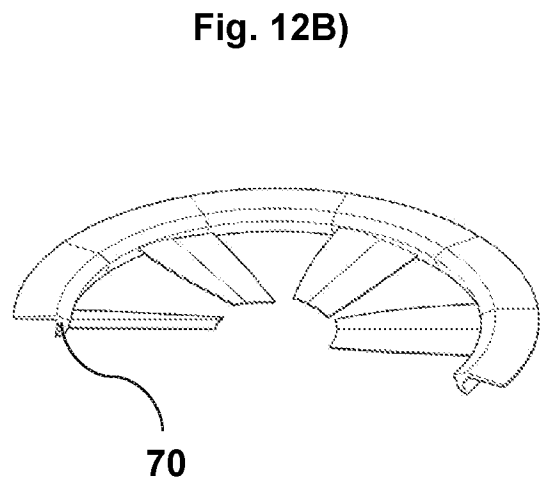
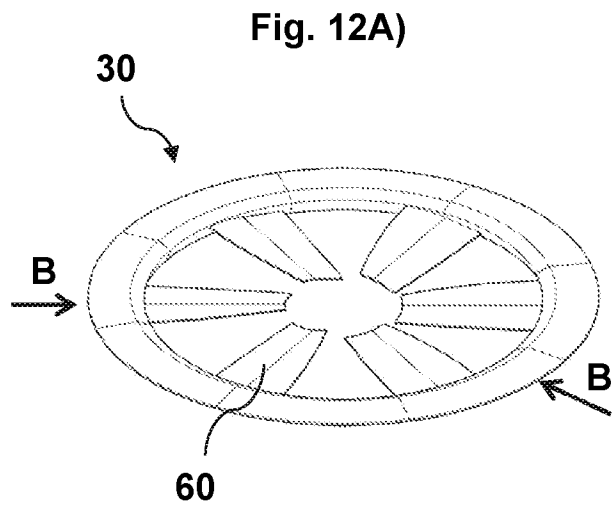


Fig. 12

Fig. 13A)

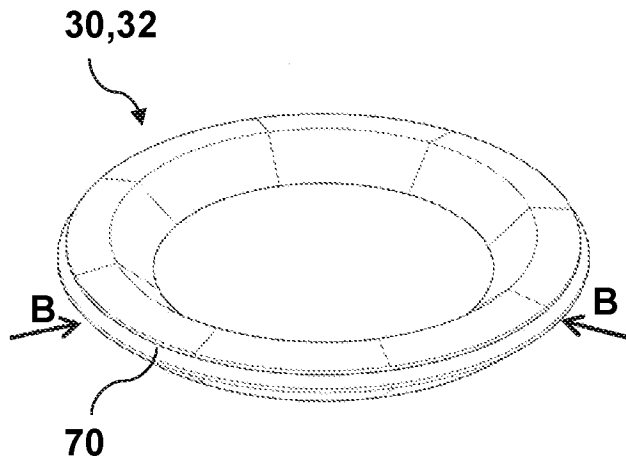


Fig. 13B)

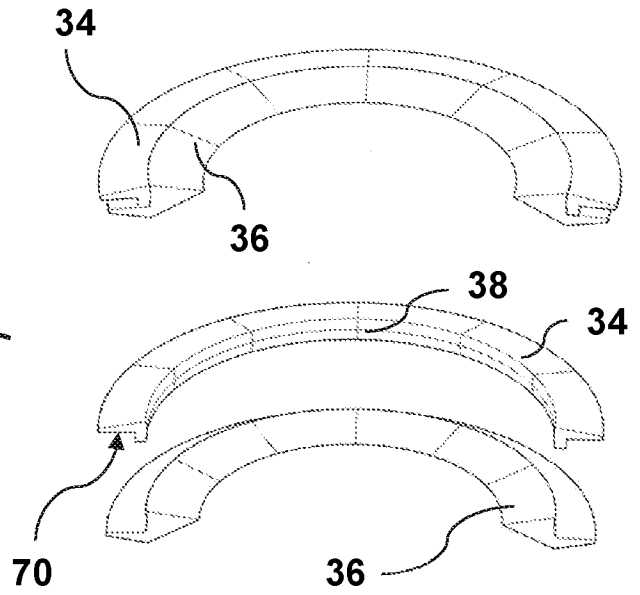


Fig. 13C)

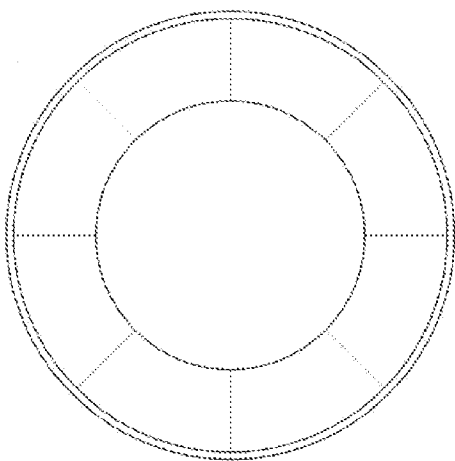


Fig. 13D)

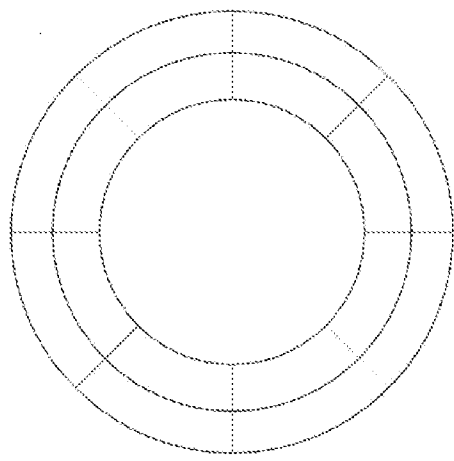


Fig. 13

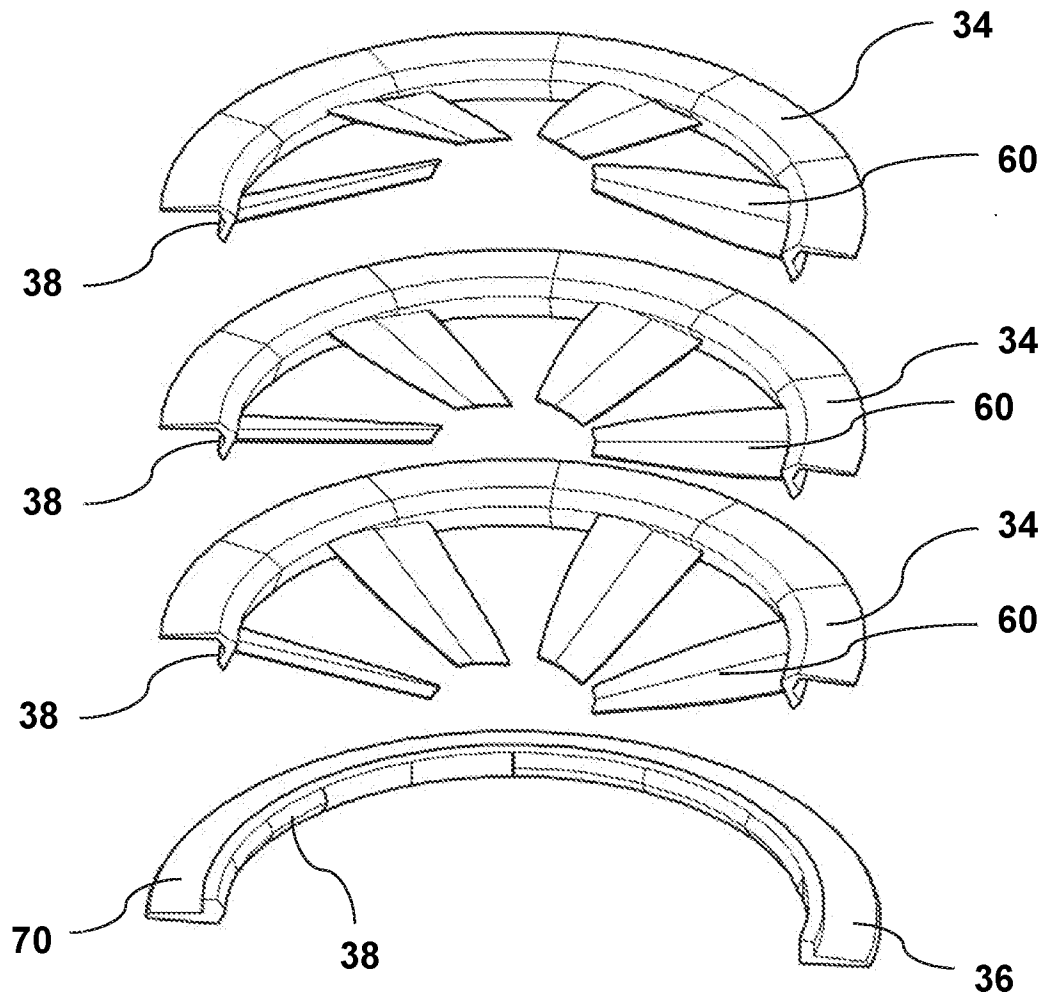


Fig. 14

Fig. 15A)

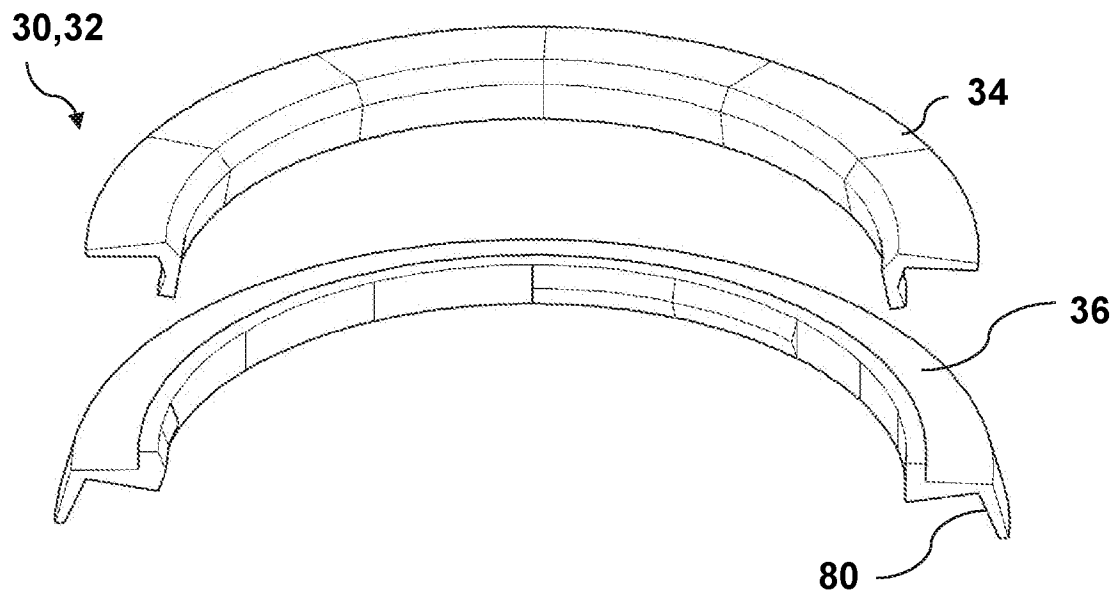


Fig. 15B)

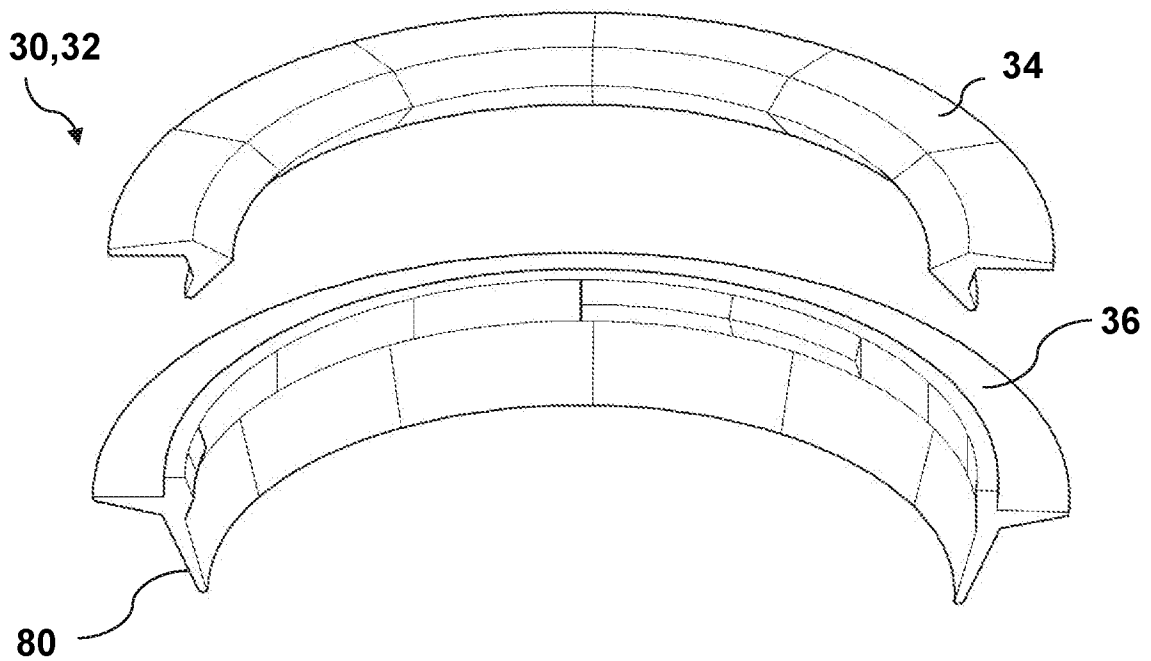


Fig. 15

Fig. 16A)

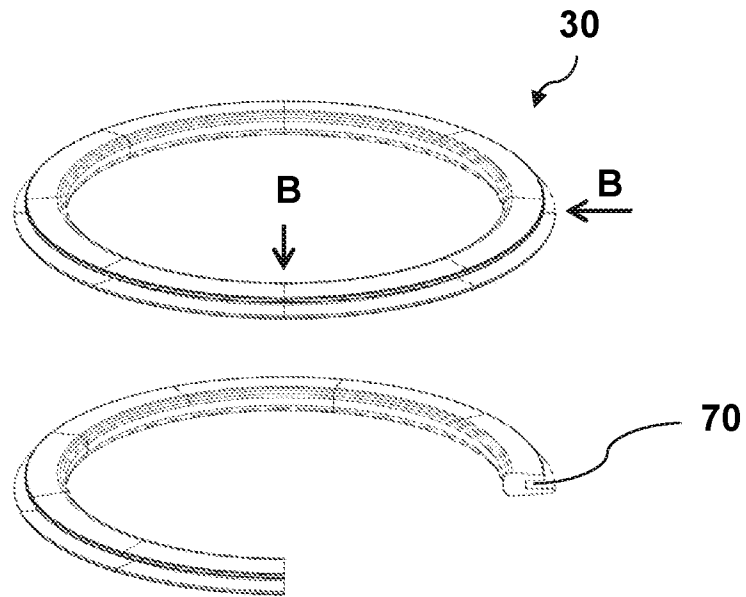


Fig. 16B)

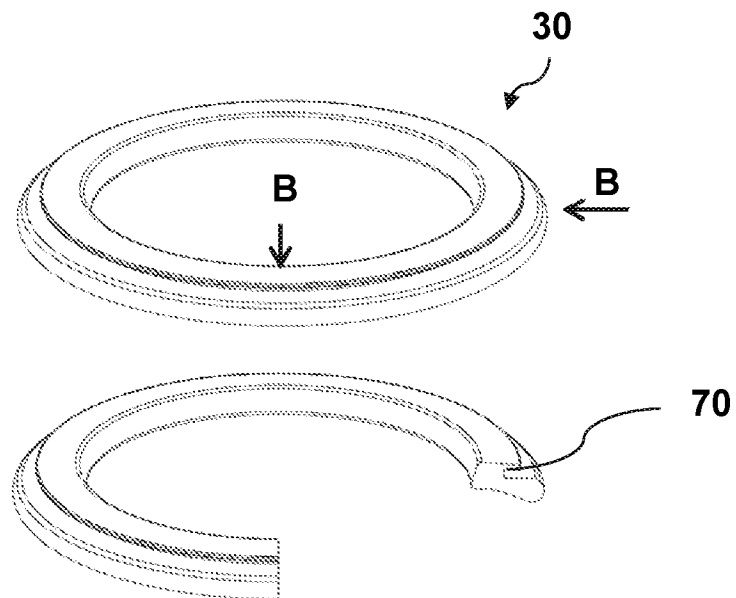


Fig. 16

Fig. 17A)

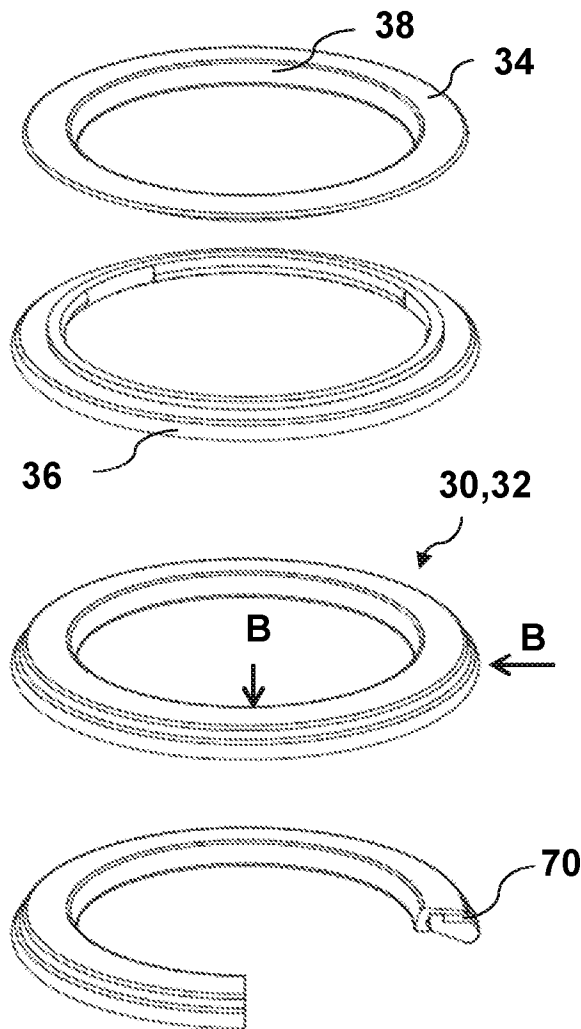


Fig. 17B)

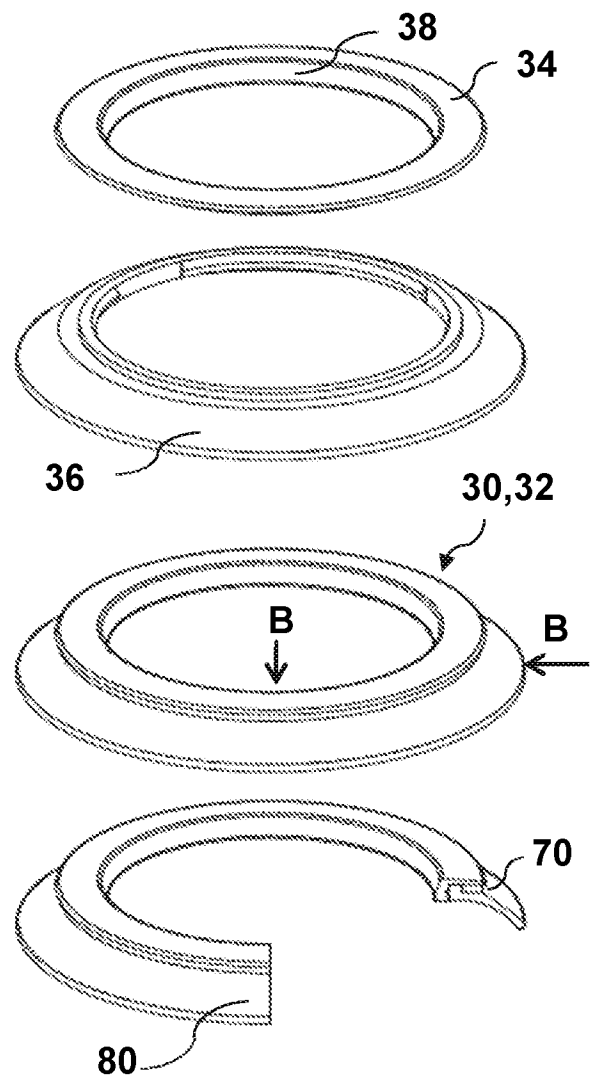


Fig. 17

Fig. 18A)

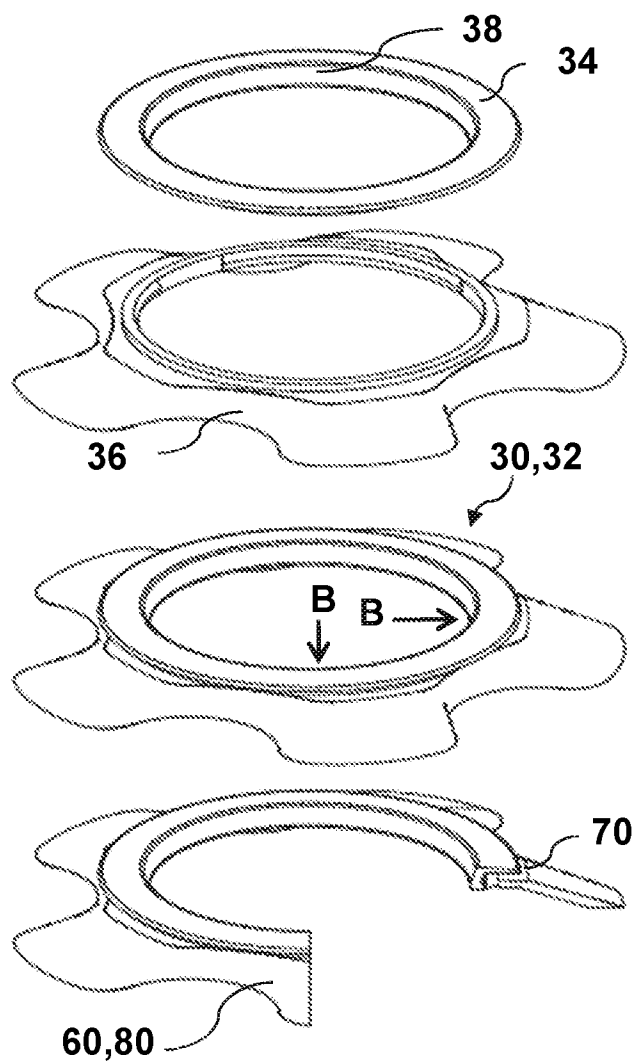


Fig. 18B)

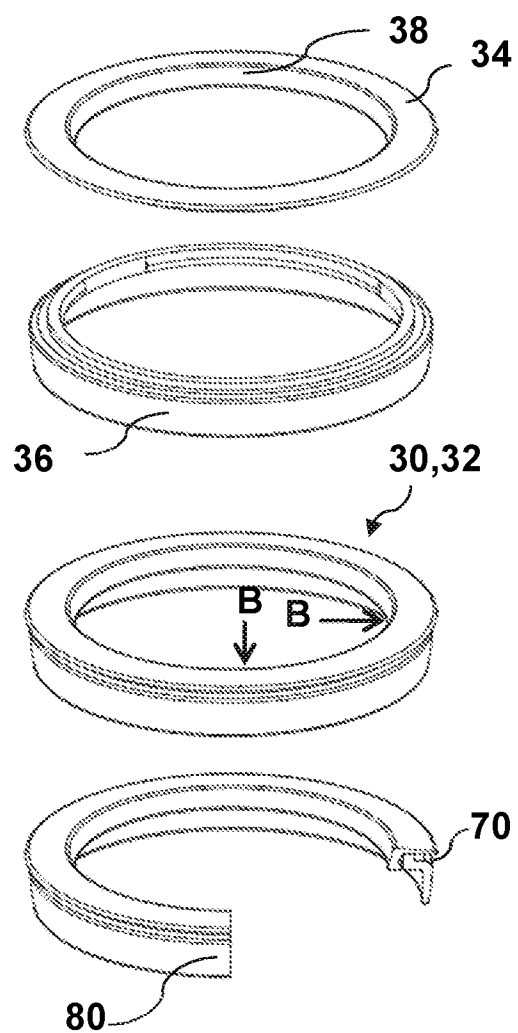


Fig. 18

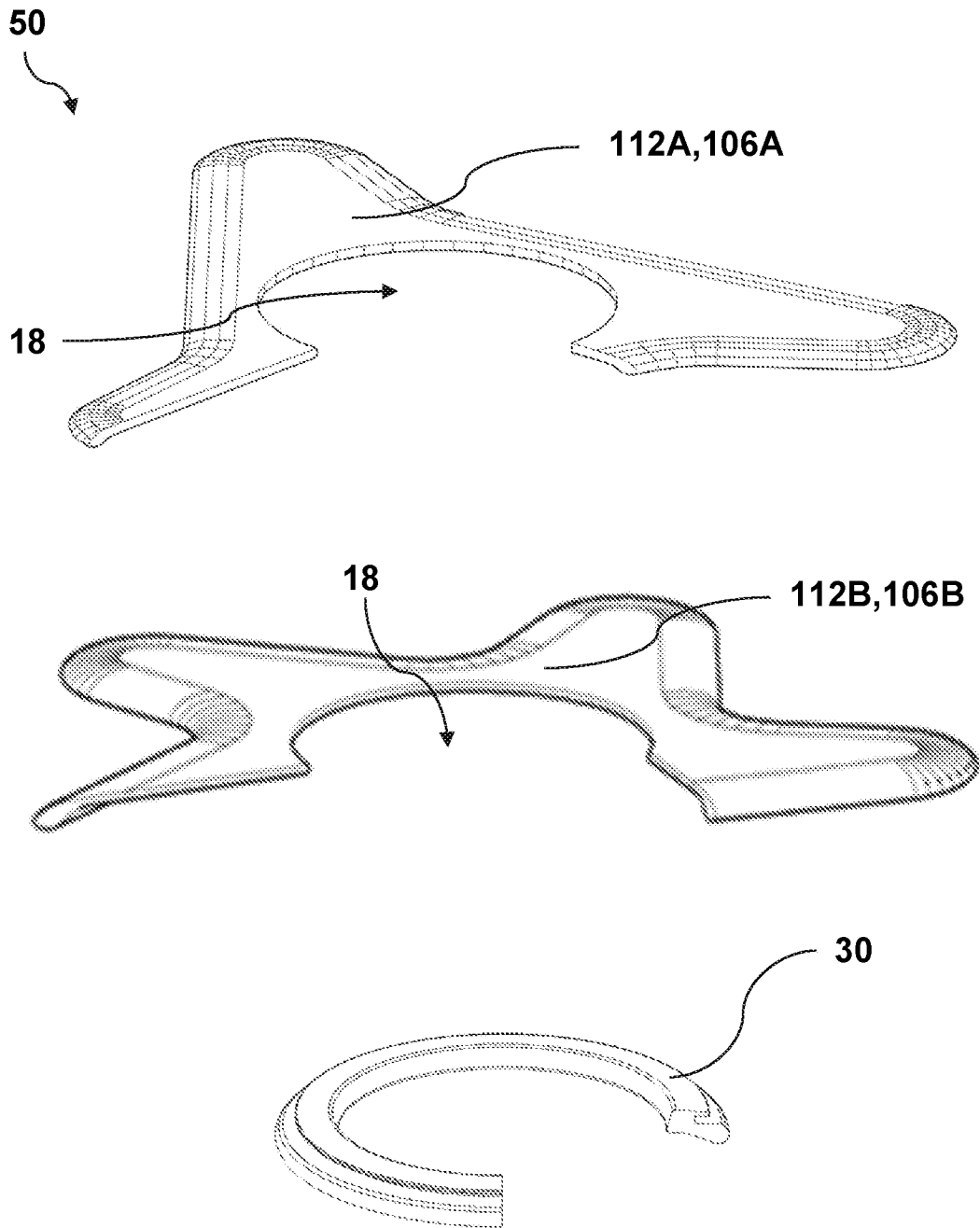


Fig. 19

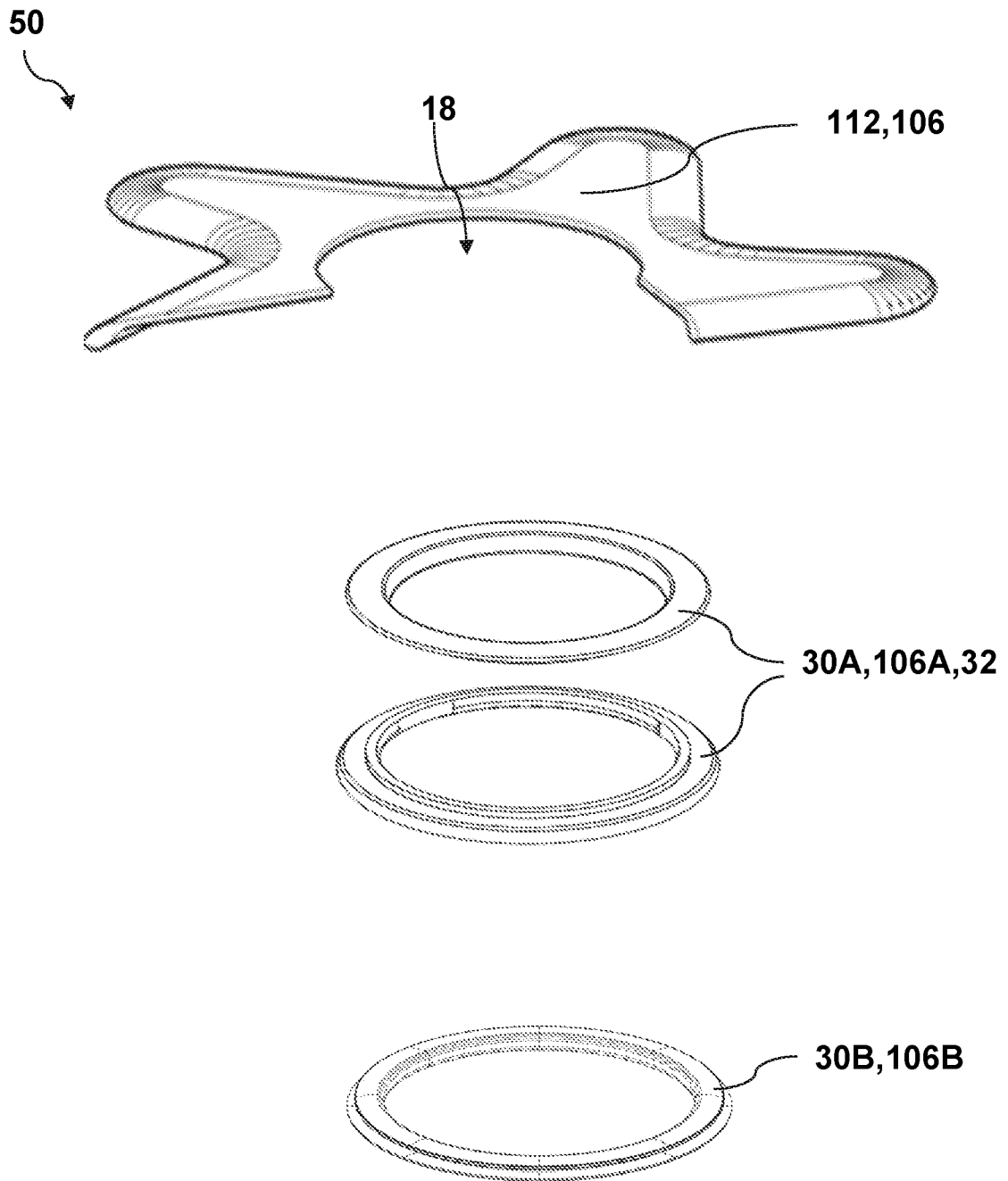


Fig. 20

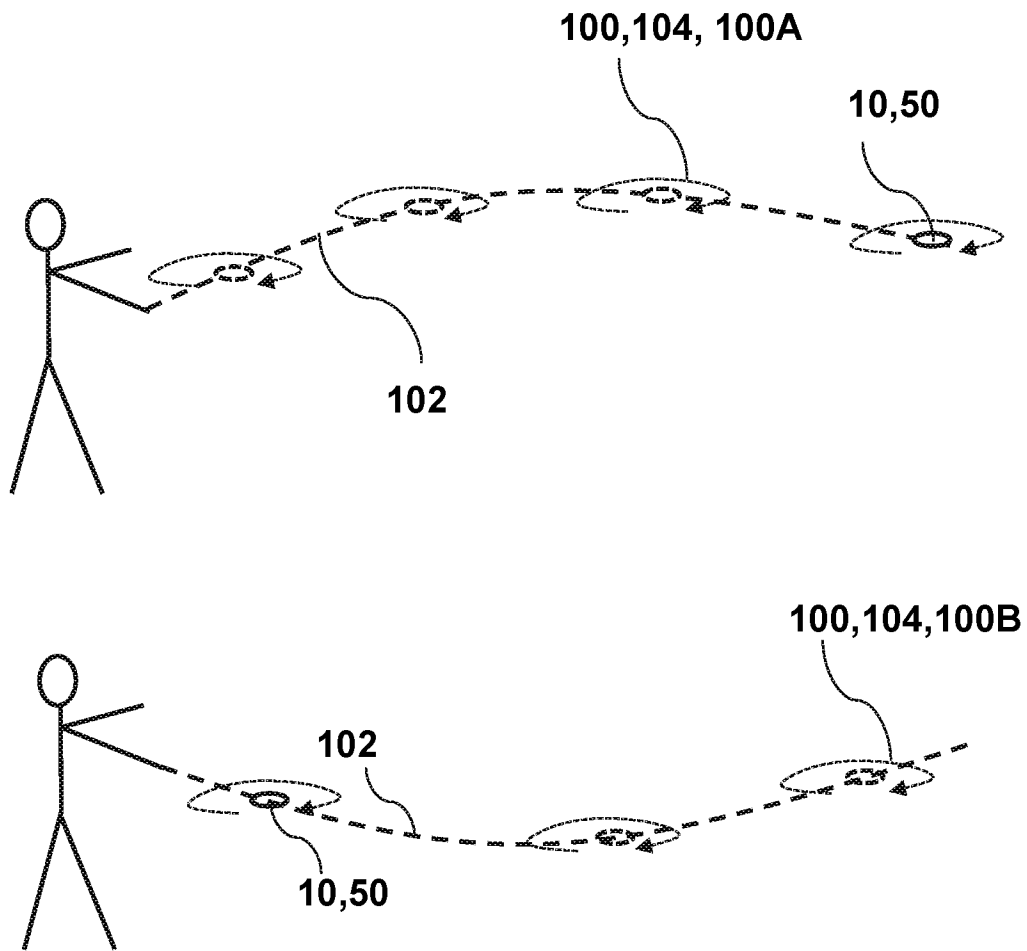


Fig. 21

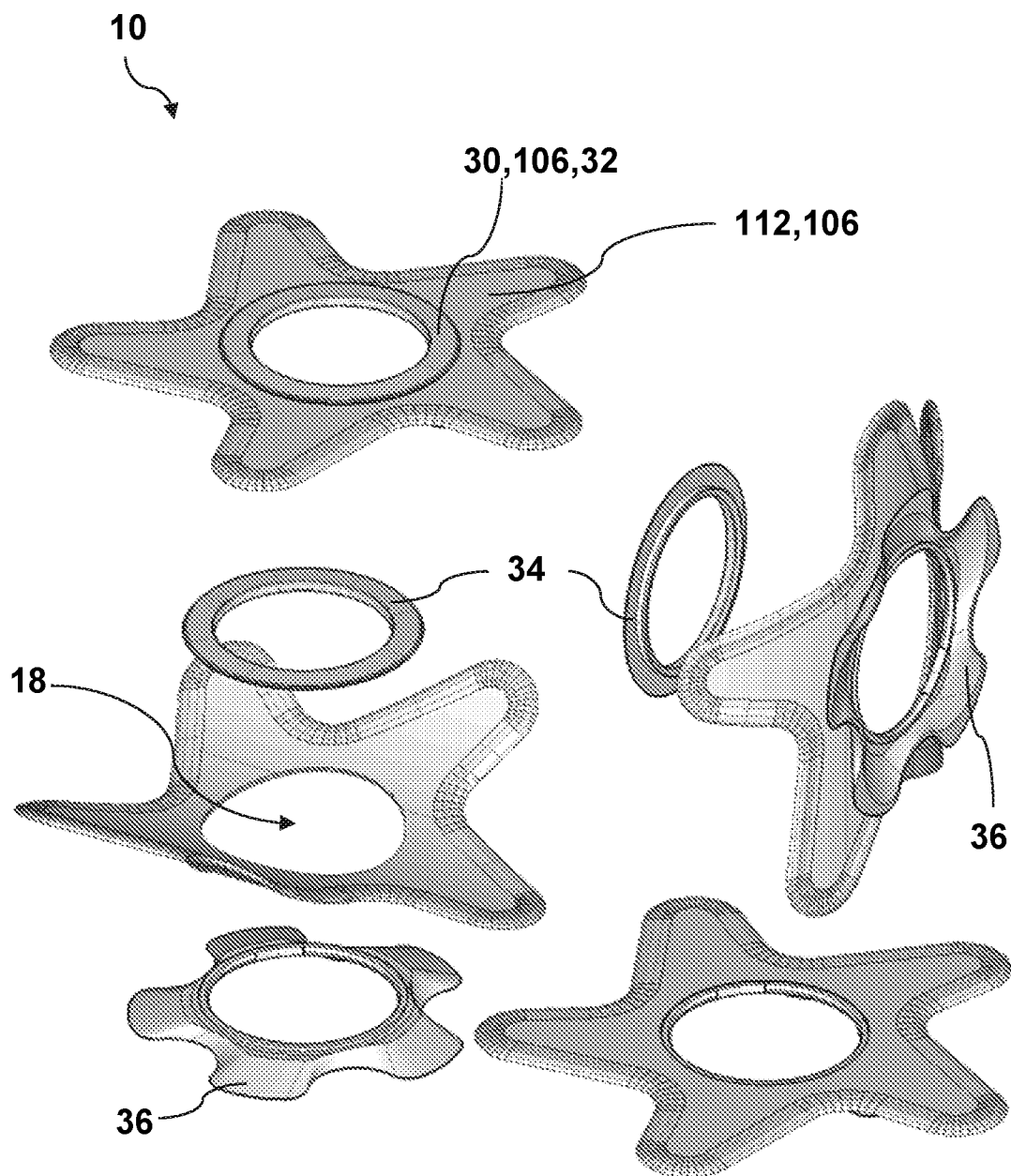


Fig. 22

INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK2017/050037

A. CLASSIFICATION OF SUBJECT MATTER A63B 65/00 (2006.01) According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) CPC, IPC: A63B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched DK, NO, SE, FI: Classes as above.		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPODOC, WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 4940441 (NOVINSKY) 10 July 1990, see figures and column 3, lines 3-9.	1-3, 5-9, 11-15 4, 10
X A	GB 2303311 A (PROMOULD LIMITED) 19 February 1997, see page 2, line 5- page 3, line 1 and figures.	1-3, 5-9, 11, 13-15 4, 10, 12
X A	US 2005/0239366 A1 (NUCCIO et al.) 27 October 2005, see figures and abstract.	1-3, 5-9, 11, 13-15 4, 10, 12
X A	US 2011/0130229 A1 (WILLIAMS) 2 June 2011, see [0029] and figures.	1-3, 5-9, 11, 12 4, 10, 13-15
X A	US 4176843 A (DEWITT, JR) 4 December 1979, see figures.	1-3, 5-9, 11 4, 10, 12-15
X A	US 2003/0022587 A1 (CALCO) 30 January 2003, see figures.	1-3, 5-9, 11 4, 10, 12-15
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: “A” document defining the general state of the art which is not considered to be of particular relevance “E” earlier application or patent but published on or after the international filing date “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “O” document referring to an oral disclosure, use, exhibition or other means “P” document published prior to the international filing date but later than the priority date claimed “T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention “X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone “Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art “&” document member of the same patent family		
Date of the actual completion of the international search 30/03/2017		Date of mailing of the international search report 06/04/2017
Name and mailing address of the ISA Nordic Patent Institute Helgeshøj Allé 81 DK - 2630 Taastrup, Denmark. Facsimile No. + 45 43 50 80 08		Authorized officer Anders Budtz-Olsen Telephone No. +45 43 50 83 34

INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK2017/050037

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3881729 A (BLOCK et al.) 6 May 1975, see column 4, lines 60-68 and column 5, lines 1-4 and figures.	1, 2, 5, 7, 8
A	US 2001/0024923 A1 (STREIT) 27 September 2001, see [0026], [0030] and figures.	1, 2, 5, 7, 8

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/DK2017/050037

Patent document cited in search report / Publication date	Patent family member(s) / Publication date
US 4940441 A 1990.07.10	NONE
GB 2303311 A 1997.02.19	NONE
US 2005/0239366 A 2005.10.27	NONE
US 2011/0130229 A1 2011.06.02	NONE
US 4176843 A 1979.12.04	NONE
US 2003/0022587 A1 2003.01.30	NONE
US 3881729 A 1975.05.06	NONE
US 2001/0024923 A1 2001.09.27	EP 1127600 A2 2001.08.29 EP 1127600 A3 2003.11.19 AU 2323601 A 2001.08.30 DE 10009230 A1 2001.09.06