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(54) Title: A REVOLVING DOOR FOR PROVIDING A DRAFT-PROOF PASSAGEWAY THROUGH A BUILDING WALL AND A METHOD FOR DIVIDING TRAFFIC FLOW THROUGH A DRAFT-PROOF REVOLVING DOOR

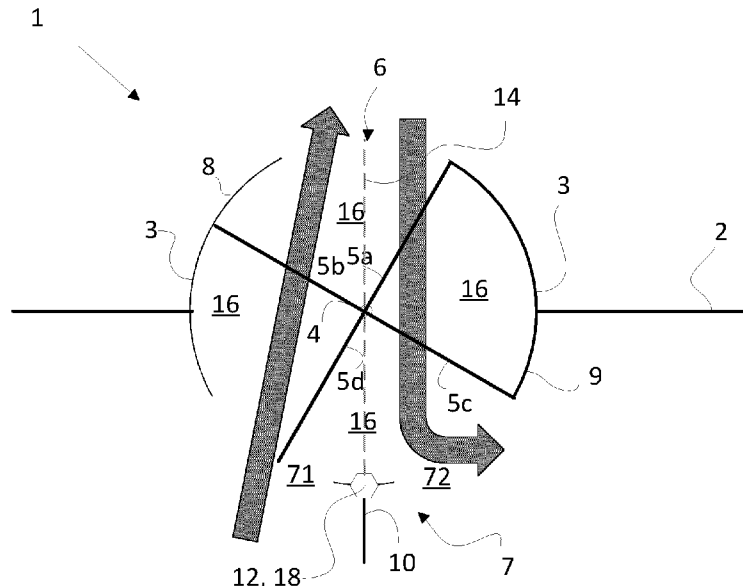


Figure 1

(57) Abstract: The disclosure relates to a revolving door (1) for providing a draft-proof passageway through a building wall (2), the revolving door (1) comprising: a circular outer wall structure (3), a central shaft (4) rotatably arranged in the centre of the circular wall structure (3) and arranged to be rotated by a motor, a number n doors (5a, 5b, 5c, 5d), wherein the circular outer wall structure (3) comprises a first opening (6) and a second opening (7) for allowing users to pass into the revolving door (1), the openings being separated by a first wall section (8) and a second wall section (9), at least one of the first opening (6) and the second opening (7) comprises a separator section (10) dividing the first opening (6) and/or the second opening (7) into two sub-openings (61, 62; 71, 72).

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**A revolving door for providing a draft-proof passageway through a building wall and a method for dividing traffic flow through a draft-proof revolving door**

Field of the invention

The present invention relates to a revolving door for providing a draft-proof passageway through a building wall and a method for dividing traffic flow through a draft-proof revolving door. More specifically, the disclosure relates to a revolving door for providing a draft-proof passageway through a building wall and a method for dividing traffic flow through a draft-proof revolving door as defined in the introductory parts of claim 1 and claim 14.

Background art

Revolving doors are well known since a long time as an efficient door for allowing efficient passage of people into a building while avoiding draft. Buildings in need of being able to receive a large number of people, as e.g. stores, airports, etc. therefore often use revolving doors when they want to avoid draft from the passageways into the building through an outer wall of the building.

Known revolving doors, however, have some problems. When traffic of people going in and out through a revolving door becomes too heavy, the people going in starts to interfere with the people going out and vice versa. The result may be a sort of a traffic jam for persons trying to go into and exit a building.

Many revolving doors are built to stop if someone pushes or touches a door leaf of the revolving door to prevent accidents. When traffic of users through the revolving door gets too heavy, this function may result in that the door is mostly not moving at all.

There is thus a need in the industry for an improved revolving door better equipped to deal with a large number of concurrent users going in and out at the same time through a revolving door.

### Summary

It is an object to mitigate, alleviate or eliminate one or more of the above-identified deficiencies in the art and disadvantages singly or in any combination and solve at least the above mentioned problem. According to a first aspect there is provided a revolving door for providing a draft-proof passageway through a building wall, the revolving door comprising: a circular outer wall structure, a central shaft rotably arranged in the centre of the circular wall structure and arranged to be rotated by a motor, a number  $n$  doors, wherein  $n > 1$ , attached to the central shaft so as to create  $n$  compartments in the circular area where the circumference is defined by the circular outer wall structure, wherein the circular outer wall structure comprises a first opening and a second opening for allowing users to pass into the revolving door, the openings being separated by a first wall section and a second wall section, the first wall section and the second wall section each being a perimeter of a circular sector large enough so as to prevent draft through the revolving door at any angle of the rotational shaft, wherein at least one of the first opening and the second opening comprises a separator section dividing the first opening and/or the second opening into two sub-openings.

When at least one of the first opening and the second opening comprises a separator section dividing the first opening and/or the second opening into two sub-openings the traffic of people passing through the revolving door can be separated in that at least one of the first opening and the second opening. People coming from the other side will exit through the first sub-opening they encounter, leaving the other sub-opening free for people walking the opposite way through the revolving door.

According to some embodiments, the  $n$  compartments are equally sized to make every compartment fit the same amount of users. It also optimizes the draft free properties of the door as every compartment will have an equally long perimeter of a circular sector to be covered by the first wall section and the second wall section so as to create a draft free revolving door.

According to some embodiments, the doors are leaf doors attached radially to the central shaft, and the first wall section corresponds to the perimeter of a circular sector of at least  $360/n$  degrees and the second wall section corresponds to the perimeter of a circular sector of at least  $360/n$  degrees. In that way it is ensured that the door is draft free. The first wall section and the second wall section are both large enough to cover the perimeter of a circular sector of one entire compartment of between two doors.

According to some embodiments, the doors are winged doors. Winged doors is a way to have fewer and larger compartments between two doors than otherwise possible while still providing a draft-free door.

5 According to some embodiments, the first opening and the second opening each comprises a separator section, respectively, dividing the first opening and/or the second opening, respectively, into two sub-openings. The traffic is then possible to separate at both sides of the revolving door so that user going one direction only on half of the circular space of the entire revolving door.

10 According to some embodiments, the revolving comprises a sensor arranged at the separator section for detecting if a user continues past the separator section. The sensor may e.g. detect if a user crosses a line extending from a point on the separator section to the central shaft. If a user is detected the revolving door may deliver a warning by emitting sound or light via a sound or light emitting device arranged to deliver such a warning. The warning could get the attention of users unintentionally being about to cross the line so that fewer  
15 users cross into the wrong traffic flow, thus increasing the efficiency of the revolving door.

According to some embodiments, the revolving comprises markings on floor for marking traffic flow through the sub-openings to make the user aware of the allowed space to use in the revolving door for the direction the user is passing the door in. Further, markings indicating the direction to pass the door may be arranged on the floor. The markings could get  
20 the attention of users unintentionally being about to cross the line so that fewer users cross into the wrong traffic flow, thus increasing the efficiency of the revolving door.

According to some embodiments, the markings on the floor marks the boundary of a traffic flow defined by the line. The revolving may comprises a light projector, wherein the line is marked by projected light from the light projector. The marking may then be changed if  
25 needed and/or change color to warn a user that comes close to pass the line.

According to some embodiments, the revolving comprises a control unit arranged to stop the rotation of the motor and thereby the rotation of the central shaft if the sensor detects a user. It will then be impossible to continue into the traffic flow going the other direction. This may be used to force passage to go in only one direction, keeping the traffic  
30 flows going in and out of a building completely separated from each other

According to some embodiments, at least one of the sub-openings is covered by a further door, the further door having a presence sensor on one side adapted to automatically open the further door. This may be used to protect the compartments from bad weather.

5 According to a second aspect there is provided a method for dividing traffic flow through a draft-proof revolving door according to the first aspect, the method comprising the steps of rotating the central shaft and thereby rotating the doors of the revolving door, detecting that a user continues past the separator section, in response to detecting that a user has continued past the separator section, activating a warning signal.

10 According to some embodiments, the method comprises the step of in response to detecting that a user has continued past the separator section, stopping the rotation of the central shaft.

According to some embodiments, when dependent on the method comprises the step of in response to detecting that a user has continued past the separator section, closing the further door thereby hindering a user to exit through a predetermined sub-opening.

15 Effects and features of the second aspect are to a large extent analogous to those described above in connection with the first aspect. Embodiments mentioned in relation to the first aspect are largely compatible with the second aspect.

20 A further scope of applicability of the present invention will become apparent from the detailed description given below. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only. Various changes and modifications within the scope of the invention will become apparent to those skilled in the art from the detailed description.

25 Hence, it is to be understood that the herein disclosed invention is not limited to the particular component parts of the device described or steps of the methods described since such device and method may vary. It is also to be understood that the terminology used herein is for purpose of describing particular embodiments only, and is not intended to be limiting. It should be noted that, as used in the specification and the appended claim, the articles "a", "an", "the", and "said" are intended to mean that there are one or more of the elements unless the context explicitly dictates otherwise. Thus, for example, reference to "a  
30 unit" or "the unit" may include several devices, and the like. Furthermore, the words "comprising", "including", "containing" and similar wordings does not exclude other elements or steps.

### Brief descriptions of the drawings

The above objects, as well as additional objects, features and advantages of the present invention, will be more fully appreciated by reference to the following illustrative and non-limiting detailed description of example embodiments of the present invention, when taken in conjunction with the accompanying drawings.

Figure 1 shows a top view of the revolving door according to an embodiment of the present disclosure having a separator section at one side of the revolving door.

Figure 2 shows a top view of the revolving door according to an embodiment of the present disclosure having a separator section at both sides of the revolving door.

Figure 3 shows a top view of the revolving door according to an embodiment of the present disclosure having two winged doors.

Figure 4 shows a block chart representing a method according to an embodiment of the invention.

### Detailed description

The present invention will now be described with reference to the accompanying drawings, in which currently preferred example embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the herein disclosed embodiments. The disclosed embodiments are provided to fully convey the scope of the invention to the skilled person.

Figure 1 shows a top view of the revolving door according to an embodiment of the present disclosure having a separator section at one side of the revolving door.

The first aspect of this disclosure shows a revolving door 1 for providing a draft-proof passageway through a building wall 2. The revolving door 1 comprises a circular outer wall structure 3, a central shaft 4 rotably arranged in the centre of the circular wall structure 3 and arranged to be rotated by a motor, a number  $n$  doors 5a, 5b, 5c, 5d, 15a, 15b, wherein  $n > 1$ , attached to the central shaft 4 so as to create  $n$  compartments 16 in the circular area where the circumference is defined by the circular outer wall structure 3. The circular outer wall

structure 3 comprises a first opening 6 and a second opening 7 for allowing users to pass into the revolving door 1. The openings are separated by a first wall section 8 and a second wall section 9, the first wall section 8 and the second wall section 9 each being a perimeter of a circular sector large enough so as to prevent draft through the revolving door 1 at any angle of the rotational shaft 4. The at least one of the first opening 6 and the second opening 7 further comprises a separator section 10 dividing the first opening 6 and/or the second opening 7 into two sub-openings 61,62;71,72.

If the first opening 6 at the top side in the Figure 1 is the entrance to a building or room, the traffic of people going into the entrance will when exiting the revolving door 1 through the sub-opening 72 of the second opening 7 be separated from people exiting the building or room due to the separator section 10. People entering the building through the sub-opening 72 will thereby not have to bother about avoiding people leaving the building or room through sub-opening 71. In Figure 1 the revolving door comprises  $N=4$  compartments 16 that are equally sized as the doors 5a,5b,5c,5d are leaf doors attached radially to the central shaft 4. The first wall section 8 corresponds to the perimeter of a circular sector of at least  $360/N$  degrees and the second wall section 9 corresponds to the perimeter of a circular sector of at least  $360/N$  degrees, i.e. 90 degrees in Figures 1 and 2 when  $n = 4$ .

Figure 2 shows a top view of the revolving door 1 according to an embodiment of the present disclosure having a separator section 10 at both sides of the revolving door. The first opening 6 and the second opening 7 each comprises a separator section 10,11, respectively, dividing the first opening 6 and/or the second opening 7, respectively, into two sub-openings 61,62;71,72. People may then enter the building through the sub-openings 62 and 72 without having to bother with avoiding people leaving the building through the sub-openings 71 and 61 of the revolving door 1.

Figure 3 shows a top view of the revolving door 1 according to an embodiment of the present disclosure having two winged doors 15a, 15b. Winged doors 15a, 15b are a requirement if only having two doors or if the first opening 6 and/or second opening 7 are so large so that the first wall section 8 and the second wall section 9 are too small to prevent draft through the revolving door 1. The wing on the wing door then compensates that and closes the gap so as to a draft free revolving door is achieved. Notably, the revolving door may comprise more than two winged doors.

A winged door may herein be defined as a door comprising a wing, i.e. a section extending adapted to extend at an angle, e.g. tangentially, from a section of the winged door

extending from the central shaft 4. The wing extends from a first end of the section of the winged door extending from the central shaft 4. A second end of said section extending from the central shaft 4 opposite to the first end is connected to the central shaft 4. Such a wing is also known as a rotating wall. The wing may have a curvature matching the perimeter of the first and/or second wall section.

The revolving door 1 may further comprise a control unit (not shown) arranged to stop the rotation of the motor and thereby the rotation of the central shaft 4 if the sensor 12 detects a user.

Referring to all of Figures 1-3, the revolving comprises a sensor 12 arranged at the separator section 10,11 for detecting if a user continues past the separator section 10,11. The sensor 12 detects if a user crosses a line 14 extending from a point on the separator section to the central shaft 4. The revolving comprises a sound or light emitting device arranged to deliver a warning if the sensor detects a user. The revolving door 1 may also have markings on floor for marking traffic flow through the sub-openings 61,62;71,72 to inform users which path to follow through the revolving door. Markings on the floor may also mark the boundary of a traffic flow defined by the line 14 to warn users to not follow the rotation too far and pass into the wrong traffic flow. The line 14 may alternatively be marked by projected light from the light projector 18. The marking may then be made interacting and e.g. only project light when a user is using the revolving door or when a user gets close to the line 14. A constant light could also be used and transform into flashing if someone is close to cross the line 14. Projected light markings and boundaries are preferably controlled by the control unit acting on input from the sensor 12 or other sensors not shown in the Figures.

According to a further embodiment at least one of the sub-openings 61,62;71,72 is covered by a further door 17, the further door 17 having a presence sensor on one side adapted to automatically open the further door 17. The further door may e.g. be a sliding door that opens when a user approaches. The further door 17 may e.g. be used to prevent snow, rain, leaves etc. from the outside environment to enter the compartment areas of the revolving door when the revolving door is inactive for an extended period.

With reference to Figure 4 the second aspect of this disclosure shows a method for dividing traffic flow through a draft-proof revolving door 1 according to the first aspect. The method comprises the steps of rotating S1 the central shaft 4 and thereby rotating the doors 5a,5b,5c,5d of the revolving door 1, detecting S2 that a user continues past the separator section 10,11, in response to detecting that a user has continued past the separator section

10,11, activating S3 a warning signal. The warning signal may be actuated by light from the light projector 18 or any other interactive means of warning a user. The method may further comprise the step of in response to detecting that a user has continued past the separator section 10,11, stopping S4 the rotation of the central shaft 4. In that way users may be actively hindered from entering the incorrect traffic flows. Users may thus be forced to follow the indicated traffic flows and enter and exit through the intended sub-opening.

The method may further comprise the step of in response to detecting that a user has continued past the separator section 10,11, closing S5 the further door 17 thereby hindering a user to exit through a sub-opening 62;72 not intended to exit from.

According to an aspect, a revolving door and a method for dividing flow through a revolving door is provided according to the clauses below.

1. A revolving door 1 for providing a draft-proof passageway through a building wall 2, the revolving door 1 comprising: a circular outer wall structure 3, a central shaft 4 rotably arranged in the center of the circular wall structure 3 and arranged to be rotated by a motor, a number  $n$  doors 5a,5b,5c,5d; 15a, 15b, wherein  $n > 1$ , attached to the central shaft 4 so as to create  $n$  compartments 16 in the circular area where the circumference is defined by the circular outer wall structure 3, wherein the circular outer wall structure 3 comprises a first opening 6 and a second opening 7 for allowing users to pass into the revolving door 1, the openings being separated by a first wall section 8 and a second wall section 9, the first wall section 8 and the second wall section 9 each being a perimeter of a circular sector large enough so as to prevent draft through the revolving door 1 at any angle of the rotational shaft 4, wherein at least one of the first opening 6 and the second opening 7 comprises a separator section 10 dividing the first opening 6 and/or the second opening 7 into two sub-openings 61,62;71,72.

2. The revolving door 1 according to clause 1, wherein the  $n$  compartments 16 are equally sized.

3. The revolving door 1 according to clause 1 or 2, wherein the doors 5a,5b,5c,5d are leaf doors attached radially to the central shaft 4, and the first wall section 8 corresponds to the perimeter of a circular sector of at least  $360/n$  degrees and the second wall section 9 corresponds to the perimeter of a circular sector of at least  $360/n$  degrees.

4. The revolving door 1 according to clause 1 or 2, wherein the doors 5a,5b,5c,5d are winged doors.

5. The revolving door 1 according to any one of the preceding clauses, wherein the first opening 6 and the second opening 7 each comprises a separator section 10,11, respectively, dividing the first opening 6 and/or the second opening 7, respectively, into two sub-openings 61,62;71,72.

5           6. The revolving door 1 according to any one of the preceding clauses, further comprising a sensor 12 arranged at the separator section 10,11 for detecting if a user continues past the separator section 10,11.

7. The revolving door 1 according to clause 6, wherein the sensor 12 detects if a user crosses a line 14 extending from a point on the separator section to the central shaft 4.

10           8. The revolving door 1 according to clause 6 or 7, further comprising a sound or light emitting device arranged to deliver a warning if the sensor detects a user.

9. The revolving door 1 according to any one of the preceding clauses, further comprising markings on floor for marking traffic flow through the sub-openings 61,62;71,72.

15           10. The revolving door 1 according to clause 9 when dependent on clause 7, wherein the markings on the floor marks the boundary of a traffic flow defined by the line 14.

11. The revolving door 1 according to clause 9 or 10 when dependent on clause 7, further comprising a light projector 18, wherein the line 14 is marked by projected light from the light projector 18.

20           12. The revolving door (1) according to any one of the preceding clauses, further comprising a control unit arranged to stop the rotation of the motor if the sensor (12) detects a user.

13. The revolving door 1 according to any one of the preceding clauses, wherein at least one of the sub-openings 61,62;71,72 is covered by a further door 17, the further door 17 having a presence sensor on one side adapted to automatically open the further door 17.

25           14. A method for dividing traffic flow through a draft-proof revolving door 1 according to any one of clauses 6-12, the method comprising the steps of rotating S1 the central shaft 4 and thereby rotating the doors 5a,5b,5c,5d of the revolving door 1, detecting S2 that a user continues past the separator section 10,11, in response to detecting that a user has continued past the separator section 10,11, activating S3 a warning signal.

15. The method according to clause 14, further comprising the step of in response to detecting that a user has continued past the separator section 10,11, stopping S4 the rotation of the central shaft 4.

5 16. The method according to clause 13 when dependent on clause 12, further comprising the step of in response to detecting that a user has continued past the separator section 10,11, closing S5 the further door 17 thereby hindering a user to exit through a predetermined sub-opening 62;72.

10 The person skilled in the art realizes that the present invention is not limited to the preferred embodiments described above. The person skilled in the art further realizes that modifications and variations are possible within the scope of the appended claims. For example, different digital signs and light emitting devices may be controlled by the control unit. Additionally, variations to the disclosed embodiments can be understood and effected by the skilled person in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims.

**CLAIMS**

1. A revolving door (1) for providing a draft-proof passageway through a building wall (2), the revolving door (1) comprising: a circular outer wall structure (3), a central shaft (4) rotably arranged in the center of the circular wall structure (3) and arranged to be rotated by a motor, a number  $n$  doors (5a,5b,5c,5d; 15a, 15b), wherein  $n > 1$ , attached to the central shaft (4) so as to create  $n$  compartments (16) in the circular area where the circumference is defined by the circular outer wall structure (3), wherein the circular outer wall structure (3) comprises a first opening (6) and a second opening (7) for allowing users to pass into the revolving door (1), the openings being separated by a first wall section (8) and a second wall section (9), the first wall section (8) and the second wall section (9) each being a perimeter of a circular sector large enough so as to prevent draft through the revolving door (1) at any angle of the rotational shaft (4), wherein at least one of the first opening (6) and the second opening (7) comprises a separator section (10) dividing the first opening (6) and/or the second opening (7) into two sub-openings (61,62;71,72).

2. The revolving door (1) according to claim 1, wherein the  $n$  compartments (16) are equally sized.

3. The revolving door (1) according to claim 1 or 2, wherein the doors (5a,5b,5c,5d) are leaf doors attached radially to the central shaft (4), and the first wall section (8) corresponds to the perimeter of a circular sector of at least  $360/n$  degrees and the second wall section (9) corresponds to the perimeter of a circular sector of at least  $360/n$  degrees.

4. The revolving door (1) according to claim 1 or 2, wherein the doors (5a,5b,5c,5d) are winged doors.

5. The revolving door (1) according to any one of the preceding claims, wherein the first opening (6) and the second opening (7) each comprises a separator section (10,11), respectively, dividing the first opening (6) and the second opening (7), respectively, into two sub-openings (61,62;71,72).

6. The revolving door (1) according to any one of the preceding claims, further comprising a sensor (12) arranged at the separator section (10,11) for detecting if a user continues past the separator section (10,11).

7. The revolving door (1) according to claim 6, wherein the sensor (12) detects if a user crosses a line (14) extending from a point on the separator section to the central shaft (4).

8. The revolving door (1) according to claim 6 or 7, further comprising a sound or light emitting device arranged to deliver a warning if the sensor detects a user.

9. The revolving door (1) according to any one of the preceding claims, further comprising markings on floor for marking traffic flow through the sub-openings (61,62;71,72).

5        10. The revolving door (1) according to claim 9 when dependent on claim 7, wherein the markings on the floor marks the boundary of a traffic flow defined by the line (14).

11. The revolving door (1) according to claim 9 or 10 when dependent on claim 7, further comprising a light projector (18), wherein the line (14) is marked by projected light from the light projector (18).

10       12. The revolving door (1) according to any one of claim 6 to 11, further comprising a control unit arranged to stop the rotation of the motor if the sensor (12) detects a user.

13. The revolving door (1) according to any one of the preceding claims, wherein at least one of the sub-openings (61,62;71,72) is covered by a further door (17), the further door (17) having a presence sensor on one side adapted to automatically open the further door  
15       (17).

14. A method for dividing traffic flow through a draft-proof revolving door (1) according to any one of claims 6-13, the method comprising the steps of rotating (S1) the central shaft (4) and thereby rotating the doors (5a,5b,5c,5d) of the revolving door (1), detecting (S2) that a user continues past the separator section (10,11), in response to  
20       detecting that a user has continued past the separator section (10,11), activating (S3) a warning signal.

15. The method according to claim 14 for dividing traffic flow through a draft-proof revolving door (1) according to claim 12, further comprising the step of in response to detecting that a user has continued past the separator section (10,11), stopping (S4) the  
25       rotation of the central shaft (4).

16. The method according to claim 14 or 15 for dividing traffic flow through a draft-proof revolving door (1) according to claim 13 when dependent on claim 12, further comprising the step of in response to detecting that a user has continued past the separator section (10,11), closing (S5) the further door (17) thereby hindering a user to exit through a  
30       predetermined sub-opening (62;72).

1/2

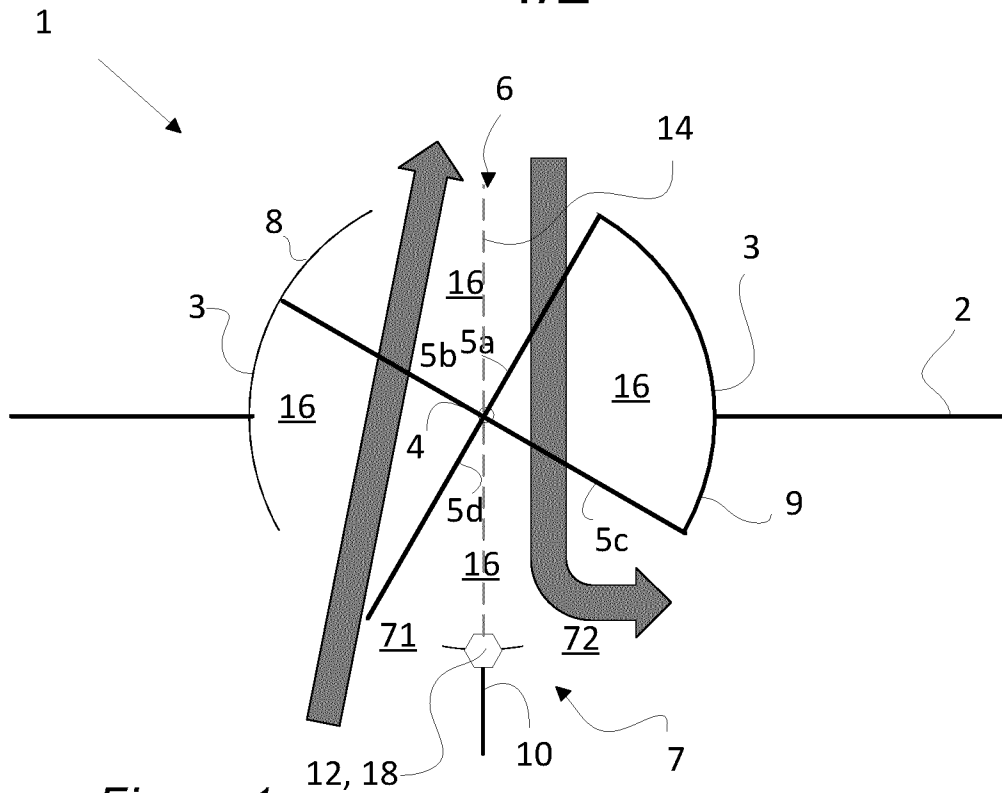


Figure 1

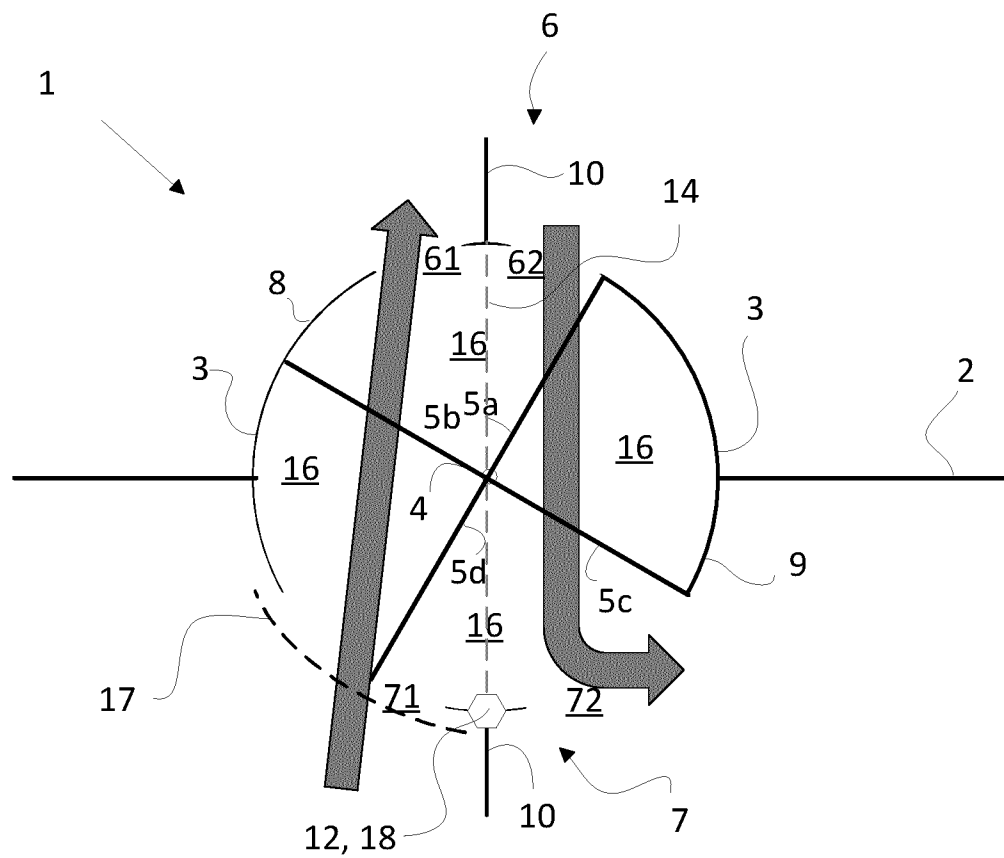
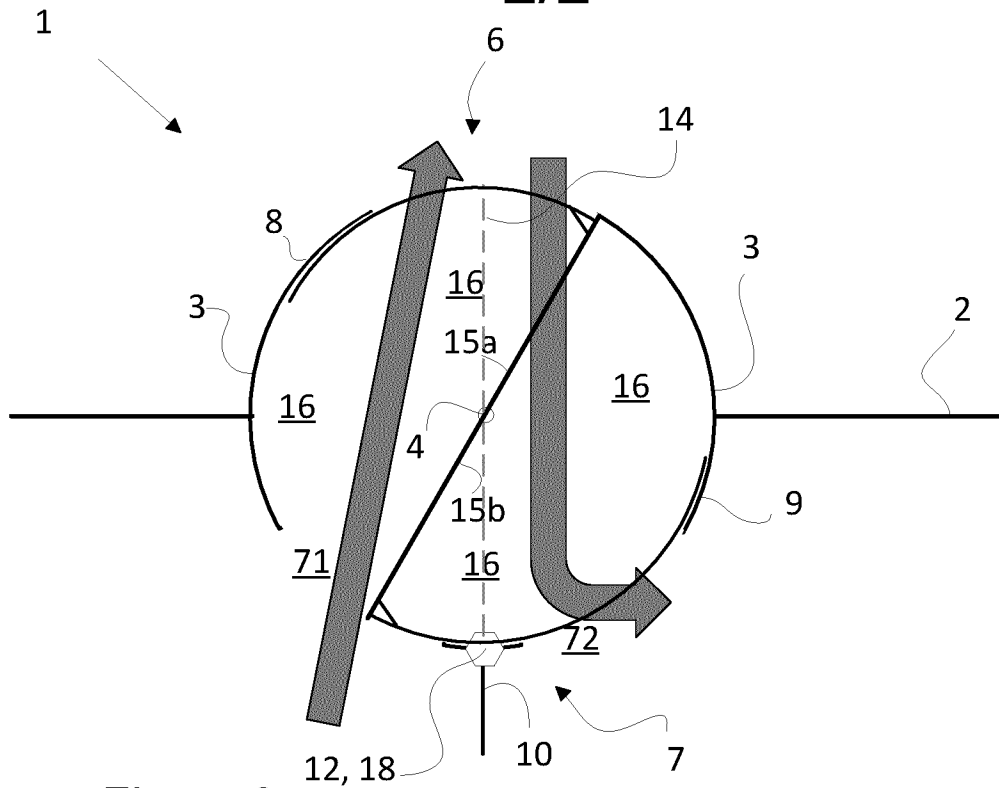
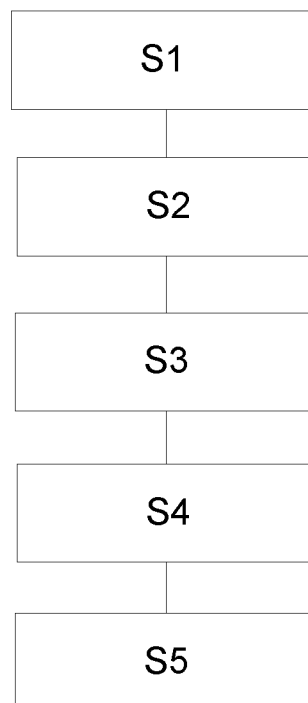


Figure 2



*Figure 3*



*Figure 4*

## INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2020/066945

## A. CLASSIFICATION OF SUBJECT MATTER

INV. E06B3/90 E06B11/08  
ADD.

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)

E06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                       | Relevant to claim No.        |
|-----------|----------------------------------------------------------------------------------------------------------|------------------------------|
| X<br>A    | WO 02/42594 A1 (BOON EDAM BV [NL]; WILD PAUL JOSEPH [US]) 30 May 2002 (2002-05-30) figures 4, 5<br>----- | 1-6,8,9,<br>12-16<br>7,10,11 |



Further documents are listed in the continuation of Box C.



See patent family annex.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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