(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 823 862 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.01.2015 Bulletin 2015/03

(21) Application number: **13175930.0**

(22) Date of filing: **10.07.2013**

(51) Int Cl.:
A62C 2/06 *(2006.01)* ***A62C 2/12*** *(2006.01)*
A62C 2/24 *(2006.01)* ***F24F 13/10*** *(2006.01)*
F24F 11/00 *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **EKOVENT AB**
235 32 Vellinge (SE)

(72) Inventors:
- **Brändström, Michael**
  SE-216 18 Limhamn (SE)
- **Engman, Erik**
  SE-244 36 Kävlinge (SE)
- **Jönsson, Björn**
  SE-235 31 Vellinge (SE)

(74) Representative: **Ström & Gulliksson AB**
Box 4188
203 13 Malmö (SE)

(54) Damper assembly for ventilation system

(57) A fire damper for ventilation system has a damper body (2) defining a flow channel and a fire damper blade (4) movable between a first position in which the flow channel is open, and a second position in which the flow channel is closed. The fire damper blade (4) has seal means (14) configured to seal against the inner wall of the damper body (2) in the closed position. The fire damper (2) further comprises an arrangement (12, 13, 15) configured to stop and lock the fire damper blade (4) in the closed, sealed position so that movement of the fire damper blade (4) towards the open position is prevented.

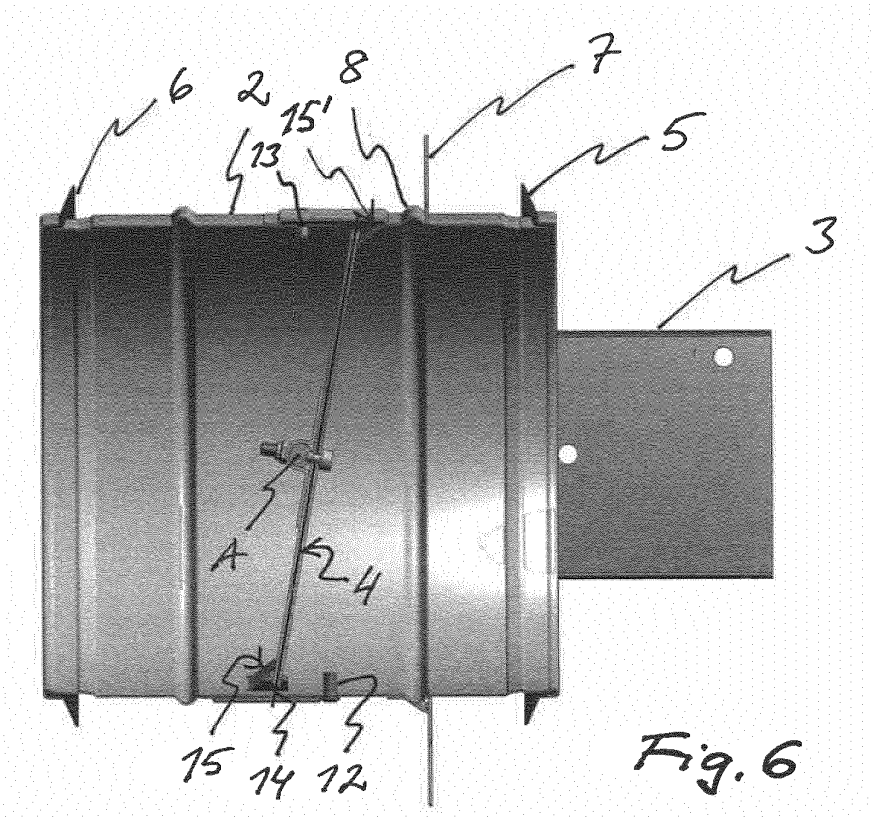

Fig. 6

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Description

TECHNICAL FIELD

[0001] The present invention relates to fire damping in ventilation systems, and more precisely the invention concerns a fire damper having a movable fire damper blade

BACKGROUND

[0002] Various kinds of fire dampers are used in ventilation systems in order to prevent fire and flue gases to spread in the ventilation system. A common type of fire damper has a circular damper body defining a flow path in which is accommodated a circular fire damper blade which in its open position allows air flow through the damper body and which in its closed position closes the flow path. The fire damper plate is pivotable about a central axis which extends across the flow path. The periphery of the fire damper blade has seal means which in the closed position seals against the inner wall of the damper body.

[0003] An example of a fire damper of this kind is disclosed in GB-A-2,350,295. Furthermore, another type of fire damper blade with peripheral seal is known from WO 2007/068786.

[0004] When a fire occurs in a ventilation system which includes a fire damper, the fire damper blade is closed in order to prevent fire and flue gases to spread in the system. In the closed position, the damper blade is stopped by two diametrically opposed stopping pins which project from the inner wall of the damper body and which abut against one side of the peripheral portion of the damper blade.

[0005] Closing of the damper blade is triggered by sensor means which detect a rise of temperature and/or smoke in the system. In order to avoid leaks in the closed position, it is important that the interface between the periphery of the damper blade and the inner wall of the damper body is properly sealed.

[0006] During fire conditions negative air pressures or vacuum of the order 300 Pa occur on one side of the closed damper blade. Since most damper blades consists of rather thin sheet metal, this vacuum strives to push the damper blade to its open position which may lead to leakage. Furthermore, large diameter fire dampers often have damper blades with a diameter of about 500 mm or more. In such fire dampers the vacuum tends to bend that peripheral portion the damper blade which is not held by the stopping pins. This problem is accentuated by the fact that the strength of the fire blade material is weakened by the heat of the fire, which increases the risk of bending of the damper blade which in turn may lead to leakage. For instance, a commonly used type of damper blade sheet metal has a modulus of elasticity (E-module) of 200 N/mm2 at room temperature but only 100 N/mm2 at a temperature of about 1000 C which can occur at fire conditions. Then the risk of undesired bending of the damper blade is considerable.

[0007] Attempts have been made by fire damper designers to solve this problem, but hitherto no realistic solution has been developed. One simple way of dealing with the problem is to increase the wall thickness of the damper blade. However, this is not a commercially acceptable solution since it increases the overall weight of the fire damper and it also adds on costs which leads to a price the market cannot afford. In another attempt to find a solution, stiffening ribs have been provided on either or both sides of the damper blade. However, this attempt has failed for the same reason since the stiffening ribs add on to weight and costs.

[0008] From the above it is understood that there is room for improvements.

SUMMARY

[0009] An object of the present invention is to provide a new type of fire damper which is improved over prior art and which eliminates or at least mitigates the drawbacks discussed above.

[0010] This object has now been achieved by a fire damper which is defined in appended claim 1 and with preferred embodiments set forth in the dependent claims.

[0011] In a first aspect of the invention, there is provided a fire damper for ventilation system which comprises: a damper body defining a flow channel and a fire damper blade movable between a first position in which the flow channel is open, and a second position in which the flow channel is closed. The fire damper blade has seal means configured to seal against the inner wall of the damper body in the closed position. The fire damper further comprises an arrangement configured to stop and lock the fire damper blade in the closed, sealed position so that movement of the fire damper blade towards the open position is prevented. Since the fire damper blade is locked in this position, the risk of flue gas leakage is eliminated or at least reduced to acceptable levels. The idea behind the invention is thus to not only stop the damper blade in the closed position, but also to lock the same so that leakage is prevented.

[0012] In an embodiment, the stopping and locking arrangement comprises a least one locking means which is arranged in the wall of the damper body and which is configured to be activated by a rise of temperature triggering a portion of the locking means to move out from the inner wall of the damper body into locking engagement with the closed fire damper blade. This combined stopping and locking features makes it possible to mechanically lock the fire damper blade in a secure manner so that bending of the blade is avoided and thereby leakage.

[0013] Preferably, the blade locking means comprises a thermally swelling material configured to move said portion of the locking means into said locking engagement with the closed fire damper blade. Hereby favorable tem-

perature sensitivity is achieved, and most preferred is the use of intumescent material.

[0014] The thermally swelling material may be disposed in a recess of the damper body wall and covered by the locking portion of the blocking means. Hereby the blade locking means can be efficiently integrated in the damper body.

[0015] In an embodiment the blade locking portion comprises a tongue which upon activation of the thermally swelling material is configured to be bent out from the inner surface of the damper body and inwardly towards the flow channel. Preferably, the tongue is defined by a slotted section of the damper body wall. This type of blade locking means can efficiently be formed in the manufacturing process of the fire damper, which is cost efficient.

[0016] In a preferred embodiment, a number of blade locking means are disposed around the inner periphery of the damper body at locations where the fire damper blade is closed.

[0017] In a second aspect of the invention, the fire damper blade comprises at least one locking means configured to be activated by a rise of temperature triggering a portion of the locking means to move into locking engagement with the inner wall of the damper body or matching engagement means on the inner wall in order to lock the fire damper blade in its closed position. This alternative location of the damper blade locking means may be suitable for certain types of damper blades and damper bodies, which increases the flexibility of the inventive concept.

[0018] The locking means provided on the fire damper blade may comprise a thermally swelling material, preferably an intumescent material, which is configured to move the locking portion of the locking means into the locking engagement. Again, this favorably temperature sensitivity is achieved which is directly associated to the active flow channel closing component of the fire damper. There may be a number of locking means of this kind disposed around the peripheral portion of the fire damper blade.

[0019] In all embodiments of the invention, the stopping and locking arrangement may comprise at least one stationary stopping means configured to stop the fire damper blade in the closed position. Each stationary stopping means preferably comprises a protusion from the inner damper body wall, and the protusion is directed towards the flow channel and configured to abut against and stop the fire damper blade in the closed position. This blade stopping means are favorably in that they are easy to provide in the manufacturing process.

[0020] Preferably, the seal means of the fire damper blade extends around the periphery of the damper blade and is configured to seal against the inner wall surface of the damper body in the closed and locked position. Hereby efficient sealing is achieved in the interface between the inner surface of the damper body and the periphery of the damper blade which prevents leakage.

[0021] One aspect of the invention is based on the idea to use thermally swelling material, preferably an intumescent material, for permanently locking a fire damper blade in a closed position in a fire damper, so that movement of the damper blade towards an open position is prevented. This part of the inventive concept makes it possible to design ventilation systems in which security is improved over prior art systems.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Embodiments of the invention will be described in the following; references being made to the appended diagrammic drawings which illustrate non-limiting examples of how the inventive concept can be reduced into practice.

Fig. 1 is a perspective view of a fire damper which is designed in accordance with an embodiment of the present invention and which is shown in open position.

Fig. 2 is an end view of the fire damper of Fig. 1.

Fig. 3 shows the open fire damper on a larger scale and in a section along line III-III in Fig. 2.

Fig. 4 corresponds to the end view of Fig. 2 but shows a closed position of the fire damper.

Fig. 5 corresponds to Fig. 3 but shows the fire damper in a closed position in a section along line V-V in Fig. 4.

Fig. 6 corresponds to Figs 3 and 5 but shows the fire damper in a closed and locked position.

Fig. 7 shows on larger scale and in partial cross section a damper blade before the closed and locked position of Fig. 6 is established (cf. Fig. 5).

Fig. 8 shows on a larger scale the closed and locked position illustrated in Fig. 6.

Fig. 9 is a schematic view of a fire damper which is designed in accordance with an alternative embodiment of the invention and which is shown in closed position.

DETAILED DESCRIPTION OF EMBODIMENTS

[0023] With reference to Fig. 1 a fire damper 1 in accordance with an embodiment of the invention is shown it its open position, that is when the ventilation system is in its normal mode of operation. The fire damper 1 - also referred to as fire gas damper or flue gas damper - has a tubular damper body 2, a mounting bracket 3 and a pivotable fire damper blade 4. Either end portion of the

damper body 2 is equipped with an annular seal lip 5, 6 for sealing against the inside of ventilation ducts (not shown) of the ventilation system. Hence, the damper body 2 defines an air flow path or flow channel between the ventilation ducts. The tubular body 2 also has an annular reinforcement plate 7 in connection with an annular bead 8.

[0024] The damper blade 4 is pivotable about an axis A perpendicular to and intersecting the center axis of the damper body 2 as is best seen in Fig. 2 illustrating the open position. Two opposite pivot means 9 and 10 secure the pivoting movement of the damper blade 4, and the rotation thereof is accomplished by a rod or shaft portion 11 journalled in the mounting bracket 3.

[0025] On the inside of the damper body 2, there are two opposite, stationary pins 12, 13 which are directed towards the center axis C of the damper body 2 and which are configured to stop the damper blade 4 in the closed position (see Figs 4-5). In this closed position, the blade stopping pins 12, 13 are in engagement with and abutting against either side of the damper blade 4 at its periphery.

[0026] Seal means 14 is provided on the periphery of the damper blade 4 in order to seal against the inner wall surface of the damper body 2 in the closed position. The seal means 14 may consist of a cloth of glass fibre or silicate material sandwiched between two sheet metal plates building up the fire damper blade 4. Alternatively, the seal means may comprise thermally swelling material, like intumescent material.

[0027] In Figs 4-5 the fire damper 1 is shown in its closed position where the fire damper blade 4 closes the flow channel of the damper body 2. For better understanding of this example of how the inventive concept works, let's assume that this closed position has been triggered by a fire which has sent flue gases into the ventilation system. The sensor system (not shown) has detected the fire and/or smoke and triggered closing of the damper blade 4 by pivoting movement about the axis A. The stopping pins 12, 13 have stopped the movement of the damper blade 4 in this position and the peripheral seal means 14 of the blade 4 seals against the inside of the damper body 2. In the closed position of shown in Fig. 5 and as the temperature rises due to the fire, an increasing pressure is built up on one side of the damper blade 4 which pulls the blade 4 back from the closed position (that is clockwise about the axis A in Fig. 5). If this movement of the blade 4 towards open position continues, the sealing effect in the interface between the peripheral seal means 14 and the inner surface of the damper body 2 is lost and leakage will occur.

[0028] Thanks to mechanical locking means depicted 15, 15' in the Figures leakage can be avoided in the way illustrated in Fig. 6. Each locking means 15, 15' comprises a portion or tongue 16 of the duct body wall accomplished by a U-shaped slot 17 in the same. In a recess 18 of the duct body 2 there is provided a thermally swelling material 19 which is disposed radially outside the tongue 16 with respect to the center axis of the duct body 2 (see Fig. 7). When the temperature rises in the flow channel of the duct body 2, the swelling material 19 is activated and expanded which pushes the tongue 16 to an inclined position where it abuts against one side of the damper blade 4 at its peripheral portion. Thus, the tongue 16 is bent from its idle position flush with the inner surface of the duct body 2 to an active position where the free end of the tongue 16 is configured to engage and lock the damper blade 4. In this way, the damper blade 4 is not only stopped by the stopping pins 12, 13 in this position, but also mechanically locked by the tongue 16. In other words, the fire damper 1 is equipped with a combined blade stopping and blade locking arrangement (pins 12, 13 and tongues 16).

[0029] The damper blade 4 is locked between the stopping means 12, 13 and the locking means 15, 15' at two opposite locations of the periphery of the closed damper blade 4. At either side, the stopping means 12, 13 and the locking means 15, 15' are axially spaced a certain distance on the inner surface of the duct body 2 in parallel with the center axis C of the same. As can be seen in Fig. 6, the damper blade 4 can be slightly tilted in the closed and locked position but still maintained between the axially spaced stopping and locking means. The peripheral seal means 14 of the damper blade 4 secures efficient sealing also in the tilted position, so that flue gas leakage is prevented.

[0030] In its closed and locked position, the blade 4 cannot move and the risk of leakage in the gap between the periphery of the blade 4 and the inner wall of the damper body 2 is prevented. This means that the damper blade 4 is permanently locked. After a fire has occurred triggering a locking operation of this kind, the fire damper 1 is always removed and replaced by a new one.

[0031] Although not illustrated here, there may be further blade locking means 15 arranged on the inside of the damper body 2; depending for instance on the diameter of the fire damper 1. Preferably, there are at least two locking means 15, 15' arranged in diametrically opposite position in connection with the two stopping pins 12, 13.

[0032] Preferably, the thermally swelling material 19 accommodated in the recess 18 comprises an intumescent material having suitable swelling properties with respect to different temperature and fire condition which may occur.

[0033] In Fig. 9 there is schematically shown a fire damper 100 according to another embodiment of the invention. The main components of this alternative fire damper 100 are basically the same as described above, namely a damper body 200 and a fire damper blade 400 pivotably movable about an axis A. The damper blade 400 is shown somewhat thicker in Fig. 9 and it consists of two sheet metal plates 401 and 402 between which a peripheral seal element 403 is sandwiched. The seal element 403 may consist of a cloth of glass fibre or silicate material.

[0034] The fire damper 100 has blade stopping means

in the shape of pins 120, 130 of the same type as in the first embodiment. However, in this second embodiment the blade locking means 150, 151 are provided at the peripheral portion of the damper blade 400. The locking means 150, 151 are disposed on either side of the blade 400 and in opposite positions. As in the previous embodiment, each locking means 150, 151 contains a thermally swelling material which - when the temperature rises due to a fire - either pushes a tongue of blade material (not shown) in locking engagement with the inner surface of the damper body 200 or is expanded directly against this surface for locking purposes. The favorable combined stopping and locking of the damper blade 400 in the closed position is achieved also with this structure. In an embodiment (not shown), there may be recesses or shoulders on the inner wall of the damper body 200 which match the expanding portion of the blade periphery.

[0035] It should be appreciated that the inventive concept is by now means limited to the embodiments described herein, but modification are feasible without departing from the inventive idea defined in the appended claims. Although the invention is in particular applicable to large diameter ventilation systems (say 500 mm diameter and above), it is also applicable to smaller diameters. Furthermore, the invention is not limited to circular ventilation duct system but the inventive principles can be applied also to other kinds of ventilations systems; for instance rectangular. Although the examples herein concern damper blades pivotable about a central axis perpendicular to the center axis of the fire damper, the invention is not limited to that structure. Rather the inventive concept is generally applicable to different kinds of damper assemblies having a damper blade movable from an open position, which is the normal mode of operation, and a closed portions triggered by a fire or the like in the ventilation system. As mentioned above, the number of stopping and locking means can vary depending on the size and design of the fire damper.

Claims

1. A fire damper for ventilation system, comprising:

a damper body defining a flow channel; and
a fire damper blade movable between a first position in which the flow channel is open, and a second position in which the flow channel is closed;
said fire damper blade having seal means configured to seal against the inner wall of the damper body in the closed position; and
said fire damper further comprising an arrangement configured to stop and lock the fire damper blade in the closed, sealed position so that movement of the fire damper blade towards the open position is prevented.

2. A fire damper as claimed in claim 1, wherein said stopping and locking arrangement comprises a least one locking means which is arranged in the wall of the damper body and which is configured to be activated by a rise of temperature triggering a portion of the locking means to move outwards from the inner wall of the damper body into locking engagement with the closed fire damper blade.

3. A fire damper as claimed in claim 2, wherein said locking means comprises a thermally swelling material configured to move said portion of the locking means into said locking engagement with the closed fire damper blade.

4. A fire damper as claimed in claim 3, wherein the thermally swelling material is disposed in a recess of the damper body wall and covered by said portion of the locking means.

5. A fire damper as claimed in claim 4, wherein said locking portion comprises a tongue which upon activation of the thermally swelling material is configured to be bent out from the inner surface of the damper body and inwardly towards the flow channel, said tongue preferably being defined by a slotted section of the damper body wall.

6. A fire damper as claimed in any one of the claims 2-5, wherein the thermally swelling material comprises an intumescent material.

7. A fire damper as claimed in any one of claims 2-6, comprising a number of said locking means disposed around the inner periphery of the damper body at locations where the fire damper blade is closed.

8. A fire damper as claimed in claim 1, wherein the fire damper blade comprises at least one locking means configured to be activated by a rise of temperature triggering a portion of the locking means to move into locking engagement with the inner wall of the damper body or matching engagement means on said inner wall in order to lock the fire damper blade in its closed position.

9. A fire damper as claimed in claim 8, wherein the locking means comprises a thermally swelling material, preferably an intumescent material, which is configured to move said portion of the locking means into said locking engagement.

10. A fire damper as claimed in claims 8 or 9, comprising a number of said locking means around the peripheral portion of the fire damper blade.

11. A fire damper as claimed in any one of the preceding claims, wherein said stopping and locking arrange-

ment comprises at least one stationary stopping means configured to stop the fire damper blade in the closed position.

12. A fire damper as claimed in claim 11, wherein said stationary stopping means comprises a protusion from the inner damper body wall, said protusion being directed towards the flow channel and configured to abut against and stop the fire damper blade in the closed position.

13. A fire damper a claimed in claim 10 or 11, comprising a number of said stationary stopping means disposed around the inner periphery of the damper body at locations where the fire damper blade is closed.

14. A fire damper as claimed in any one of the preceding claims, wherein said stopping and locking arrangement is configured to permanently stop and lock the fire damper blade in closed position in case of a fire in the ventilation system.

15. A fire damper as claimed in any one of the preceding claims, wherein said seal means of the fire damper blade extends around the periphery of the damper blade and is configured to seal against said inner wall surface of the damper body in said closed and locked position.

16. A ventilation system comprising at least one fire damper as claimed in any one of the preceding claims.

17. Use of a thermally swelling material, preferably an intumescent material, for permanently locking a fire damper blade in a closed position in a fire damper, so that movement of the damper blade towards an open position is prevented.

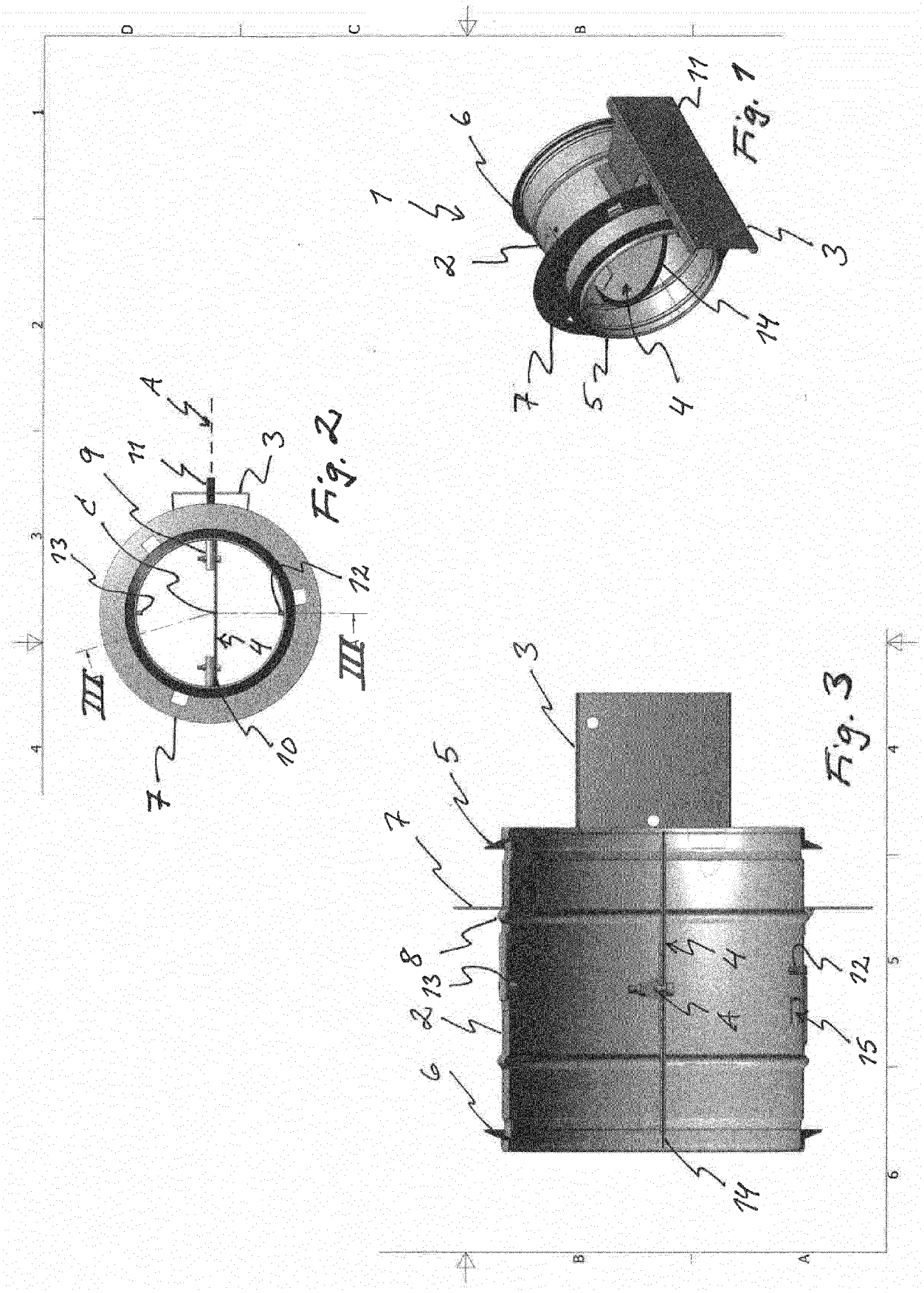

Fig. 1

Fig. 2

Fig. 3

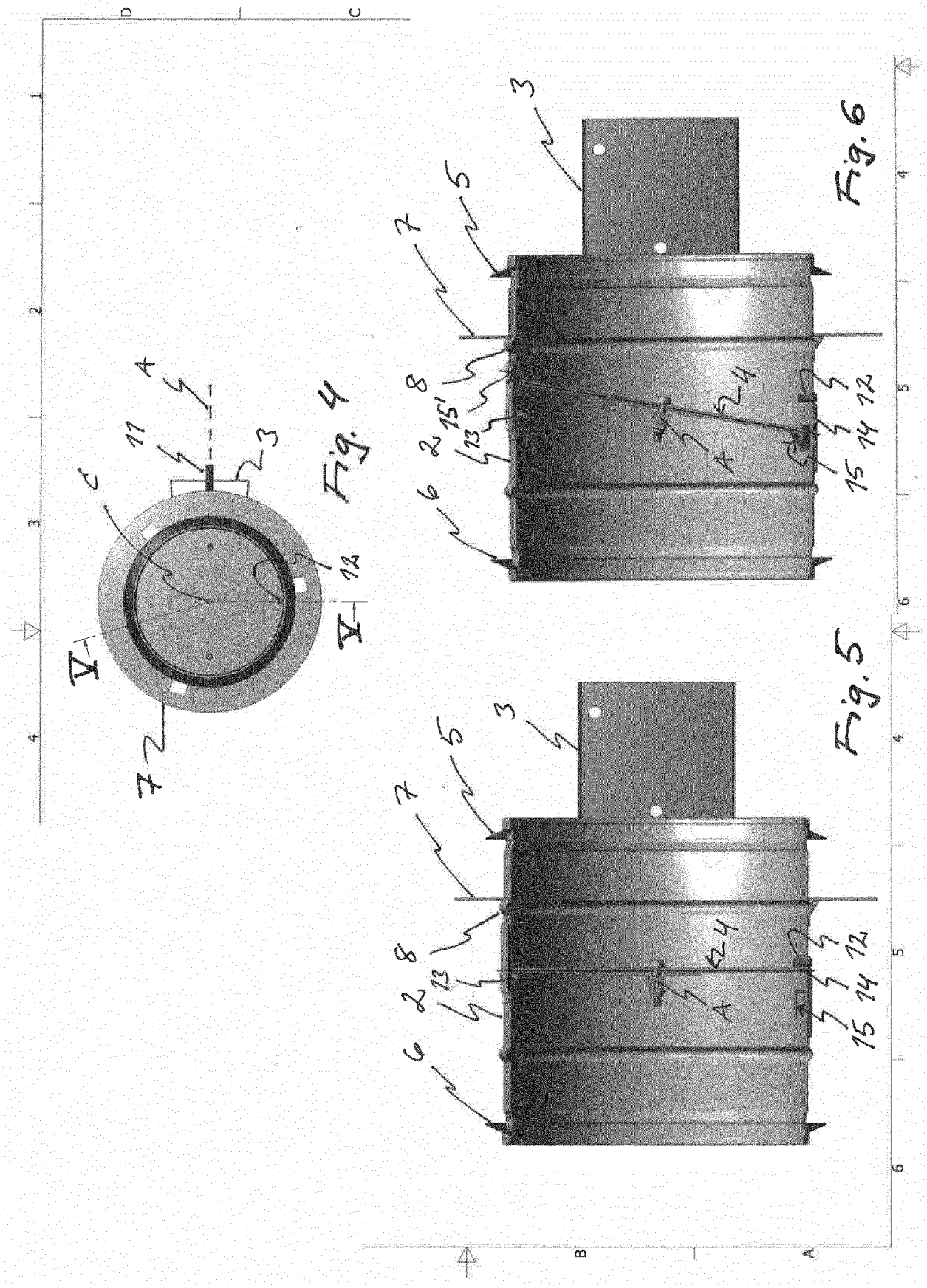

Fig. 4

Fig. 5

Fig. 6

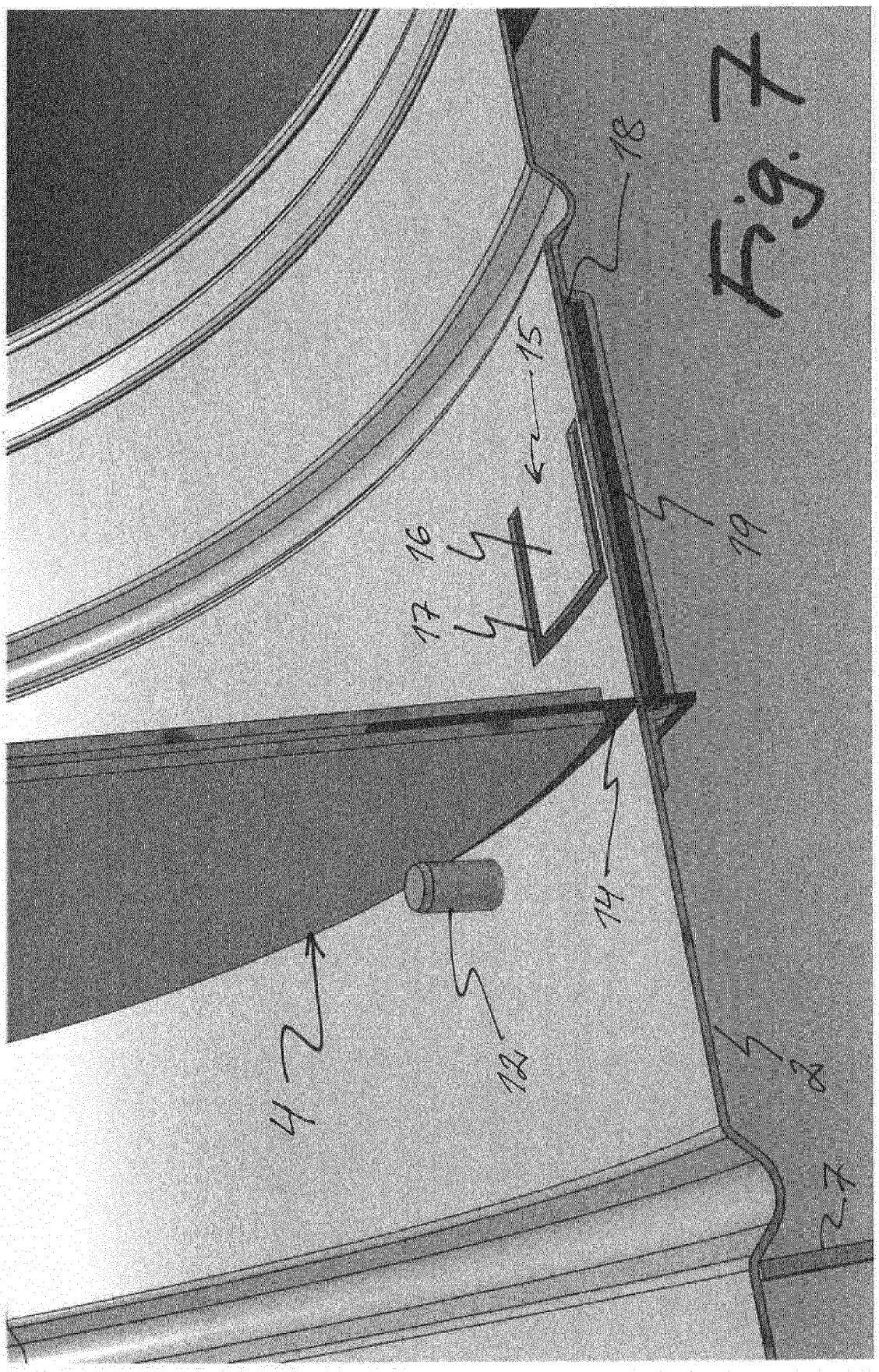

Fig. 7

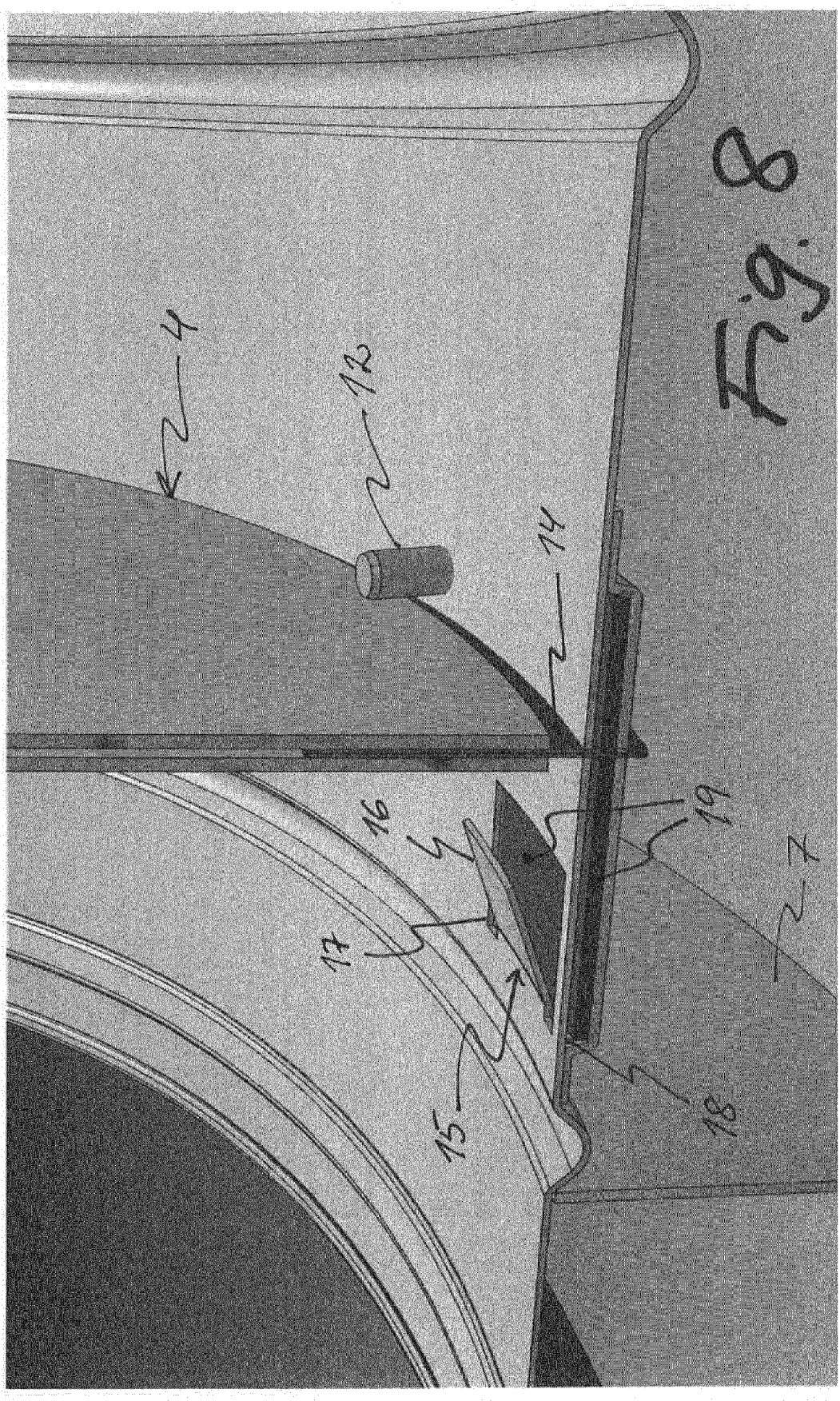

Fig. 8

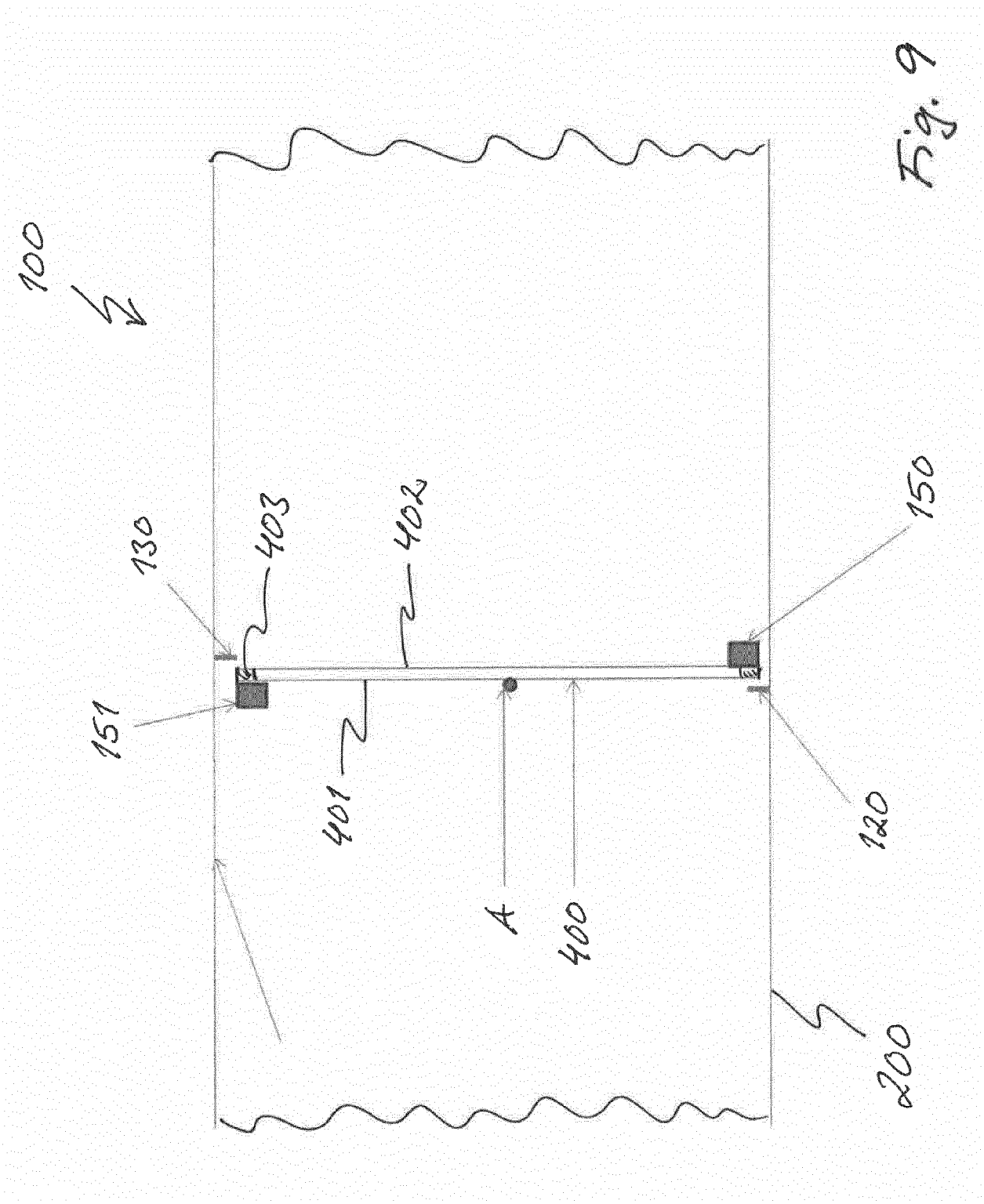

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
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A62C
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 December 2013	Zupancic, Gregor

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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EUROPEAN SEARCH REPORT

Application Number
EP 13 17 5930

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 December 2013	Zupancic, Gregor

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 17 5930

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

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