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(54) **Air flow adjustment device**

(57) The present invention relates to an air flow adjustment device (1) for arrangement in an air ventilation arrangement, wherein the device comprises an outer tube (10), an inner tube (20) arranged inside the outer tube and rotationally and axially moveable relative to the outer tube, and a twist tube (30) with an axial opening through which air is adapted to flow, wherein the twist tube (30) in a first end (31) is fixed relative to the outer tube (10) and in a second end (32) is attached to the inner tube (20). The inner tube (20) is adapted to be rotated and axially displaced relative to the outer tube (10), such that when the inner tube is rotated the twist tube (30) is twisted and the size of the axial opening is changed. The outer tube (10) comprises a helical slot (13), and the inner tube (20) is provided with an adjustment handle (24) that extends radially through the helical slot (13) of the outer tube, such that the adjustment handle (24) is adapted to be moved along the helical slot (13) to rotate the inner tube (20) and move the inner tube axially relative to the outer tube (10).

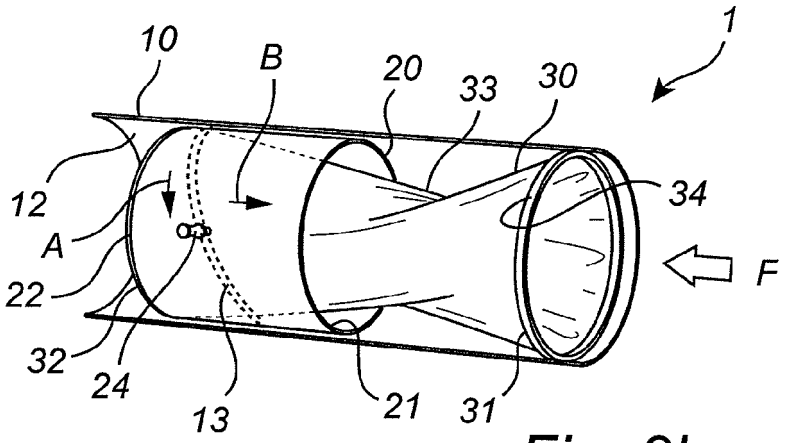

Fig. 2b

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Description

Technical Field

[0001] The present disclosure relates to an air flow adjustment device for regulating the air flow in an air ventilation arrangement.

Background

[0002] Many devices are known for regulating the air flow in a ventilation arrangement. One solution comprises a turnable plate with a cross-sectional area corresponding to the cross-sectional area of the ventilation tube it is located in. By turning the plate the air flow through the ventilation tube may be regulated. However, such solution causes a large amount of noise in the ventilation arrangement. Further, when the air flow is regulated by the plate, the air flow is disturbed and directed by the plate, actions which are not desired.

[0003] One way of solving the above mentioned disturbance problem is disclosed in US2649272. An iris shaped regulator device changes the size of an opening through the iris. Thin plates constitute the iris shape. Such solution still causes a large amount of noise in the ventilation arrangement. Further, an iris shaped regulator is complex to manufacture for ventilation arrangements of large dimensions.

[0004] The patent application W010039100 discloses an air flow adjustment device comprising a twistable sleeve of flexible material that, when twisted, reduces an air flow opening through the device. The flexible material in the twist sleeve attenuates noise in the device. However, the disclosed arrangement for twisting the twist sleeve is complex. Such complex arrangement is costly to manufacture and is not reliable over a long period of time.

[0005] Consequently, there is a need for an air flow adjustment device that does not cause noise in the ventilation arrangement it may be located in, and that is reliable and cost-efficient.

Summary

[0006] It is an object of the present invention to provide an improved solution that alleviates the mentioned drawbacks with present devices. Furthermore, it is an object to provide a reliable and cost-efficient air flow adjustment device that has a good sound-attenuating function.

[0007] This is achieved by providing an air flow adjustment device for arrangement in an air ventilation arrangement, wherein the device comprises an outer tube, an inner tube arranged inside the outer tube and rotationally and axially moveable relative to the outer tube, and a twist tube with an axial opening through which air is adapted to flow, wherein the twist tube in a first end is fixed relative to the outer tube and in a second end is attached to the inner tube. The inner tube is adapted to be rotated and axially displaced relative to the outer tube, such that when the inner tube is rotated the twist tube is twisted and the size of the axial opening is changed. Further the outer tube comprises a helical slot, and the inner tube is provided with an adjustment handle that extends radially through the helical slot of the outer tube, such that the adjustment handle is adapted to be moved along the helical slot to rotate the inner tube and move the inner tube axially relative to the outer tube.

[0008] Thereby, a simple, cheap and reliable construction for enabling adjustment of the air flow by turning the inner tube and twisting the twist tube may be provided. The adjustment handle may be reliable since the handle is directly connected to the inner tube and extends out through the helical slot. There may be no moving parts in between the handle and the inner tube. The handle may be easily accessible for a user to adjust the air flow through the device. The helical slot may guide the handle and thereby also the inner tube in both a rotational movement and an axial movement at the same time. The twist tube may thereby be twisted such that the opening through the twist tube is reduced, which may reduce the air flow. When the twist tube is twisted, its axial length may be reduced. This length reduction may be compensated for by the axial movement of the inner tube. The inner tube may have an axial length that is at least as long as the axial extension of the helical slot in the outer tube. Alternatively, the inner tube may have a short axial length, only to provide attachment to the twist tube and the adjustment handle. With a short inner tube less material may be used for manufacturing the air flow adjustment device. The diameter of the inner tube may be slightly smaller than the diameter of the outer tube. The inner tube and the outer tube may be arranged coaxially.

[0009] The twist tube may be produced of a flexible material. By flexible it may be meant that the twist tube is twistable around its own axle. The flexible material may be a material such as fabric, plastic, rubber or the like. Such twist tube may further provide good sound-attenuating properties to the air flow adjustment device. No external sound-attenuating device may thereby be needed. The twist tube may be fixed relative to the outer tube such that the cross-sectional area of the twist tube at that end is substantially equal to the cross-sectional area of the outer tube. At that end of the twist tube, all air adapted to flow through the outer tube may thereby enter into the twist tube. When the twist tube is twisted, the cross-section at a middle portion of the twist tube may be changed. The air flow adjustment device may be adapted to be used for other gases or fluids. The materials in the tubes may thereby be adapted for functioning with a specific gas or fluid.

[0010] In one embodiment the air flow adjustment device may comprise locking means adapted to, in a locked state, prevent movement of the adjustment handle along the helical slot, and in an unlocked state enable movement of the adjustment handle along the helical slot.

[0011] Thereby, the inner tube may be prevented from

rotational and axial movement relative to the outer tube when the locking means is in the locked state. A secure positioning of the inner tube may thereby be provided. By preventing movement of the inner tube relative to the outer tube, accidental or unintentional movement may be prevented. Without any locking means, if only basic friction is used for keeping the inner tube in place, there may be a large risk for unintended movement of the inner tube. The unintended movement may be caused by, for instance, unintended movement of the adjustment handle or vibrations caused by the air flow through the air flow adjustment device.

[0012] In a further embodiment, the locking means may be provided on the adjustment handle.

[0013] A locking means on the adjustment handle may provide an easy access to a locking or unlocking operation. The locking means may be provided as means such that the adjustment handle may be adapted to be lifted in a radial direction to a lifted position, such that the inner tube may be pressed towards the outer tube, and means adapted to hold the adjustment handle in the lifted position. When the inner tube is pressed towards the outer tube, an increased friction between the inner and the outer tube may cause the locking function. The locking function may be adapted to be operated by a user. The locking means may be provided as threads on a portion of the adjustment handle and a nut adapted to be screwed on the threads, wherein the nut may be adapted to abut an outer surface of the outer tube when screwed on the threads, thereby lifting the inner tube. Alternatively, the locking means may be provided as a turnable adjustment handle with a portion that is adapted to abut an outer surface of the outer tube and which portion may be formed to lift the adjustment handle radially relative to the outer tube when the adjustment handle is turned. Further alternatively, the locking means may be provided on the adjustment handle as an extending member extending in parallel with an outer surface of the outer tube, wherein the connection point between the adjustment handle and the extending member may be adjustable in the radial extension direction of the adjustment handle. In a locking position the connection point between the adjustment handle and the extending member may be fixed such that the extending member may abut the outer surface of the outer tube and lift the adjustment handle in the radial direction. In an unlocking position the connection point between the adjustment handle and the extending member may be moved along the radial extension of the adjustment handle.

[0014] In another embodiment, the inner tube and the outer tube may be made of a rigid material, and wherein the twist tube may be made of a flexible, twistable material.

[0015] The rigid material may be metal such as steel. The flexible, twistable material may be fabric, plastic, rubber or the like.

[0016] In one embodiment, the inner tube and/or the outer tube may be provided with an air sealing arrangement for preventing air flow through the helical slot in the outer tube.

[0017] By providing an air sealing, air leakage through the helical slot may be prevented. The air sealing arrangement may be arranged on the inner tube, the outer tube or on a combination of the two. With an air sealing arrangement, the development of noise in the air flow adjustment device may be prevented. By preventing air flow through the helical slot, disturbance of the air flow through the device may be prevented.

[0018] In another embodiment, the inner tube may have a first end and a second end, and the inner tube at respective first and second end may be provided with a sealing ring around the circumference of an outer surface of the inner tube, wherein the sealing rings, the inner tube and the outer tube delimits a space that is air sealed from the air adapted to flow through the air flow adjustment device, and wherein the helical slot in the outer tube faces said space.

[0019] Thereby, the helical slot in the outer tube may be sealed from the air flow adapted to flow through the device. The inner tube may be positioned such that the helical slot in the outer tube is located between the two sealing rings at all axial positions of the inner tube. The sealing rings may be fixed relative to the inner tube, but moveable relative to the outer tube. The inner tube may thereby still be rotationally and axially moveable relative to the outer tube.

[0020] In yet another embodiment, an outer surface of the inner tube may at least partly be provided with a sealing material, and wherein the sealing material may be adapted to be pressed towards an inner surface of the outer tube at the location of the helical slot in the outer tube, such that air adapted to flow through the air flow adjustment device may be prevented from flowing through the helical slot.

[0021] By providing at least a part of the outer surface of the inner tube with a sealing material, the helical slot may be sealed from the air flow adapted to flow through the device if the inner tube is pressed towards the part of the outer tube wherein the helical slot is located. The pressing function of the inner tube towards the outer tube may be performed by the adjustment handle. The adjustment handle may be provided with a locking function providing a locked and an unlocked state of the adjustment handle. In the locked state the handle may press the inner tube towards an inner surface of the outer tube. The sealing material may thereby seal the helical slot in the locked state. In the locked state the adjustment handle may further prevent rotational and axial movement of the inner tube relative to the outer tube. In the unlocked state rotational and axial movement of the inner tube may be enabled. The inner tube may in the unlocked state of the adjustment handle further be released from the pressing function towards the inner surface of the outer tube.

[0022] In one embodiment, the inner tube may be provided with an axial slit along its entire axial length such that the cross-sectional area of the inner tube is expand-

able and contractible, wherein the adjustment handle may be attached to the inner tube such that the adjustment handle in a first state may be adapted to contract the cross-sectional area of the inner tube, enabling rotational and axial movement of the inner tube, and in a second state may be adapted to expand the cross-sectional area of the inner tube such that an outer surface of the inner tube presses against an inner surface of the outer tube.

[0023] The inner tube may thereby expand such that it provides an air seal around the helical slot. The outer surface of the inner tube may be provided with a sealing material. When the cross-sectional area of the inner tube is expanded, the sealing material may thereby provide a sealing between the inner tube and the outer tube. The inner tube may further in the expanded state provide a locking function such that movement of the inner tube relative to the outer tube may be prevented in a locked state. In an unlocked state, when the inner tube is contracted, movement of the inner tube relative to the outer tube may be enabled.

[0024] In another embodiment, the outer tube may be provided with a slot sealing arrangement surrounding the helical slot for preventing air flow through the helical slot.

[0025] By providing a slot sealing arrangement surrounding the helical slot, the inner tube may be left unaffected of the sealing arrangement. The dimensions of the inner tube may thereby be less critical. For instance, the axial length of the inner tube may be less than the axial extension distance of the helical slot. A shorter inner tube may save material and provide a possibility of an axially shorter air flow adjustment device. The inner tube may only need to have an axial length suitable for arranging the adjustment handle on it, and to support the second end of the twist tube. Such inner tube may for instance have an axial length of a few centimetres, resulting in material savings during manufacturing of the device. The slot sealing arrangement may enable the adjustment handle to extend through the helical slot at its present location, but may prevent air flow through the complete extension of the helical slot.

[0026] In yet another embodiment, the slot sealing arrangement may have an open state and a closed state, wherein the slot sealing arrangement in the open state may be adapted to enable the adjustment handle to be moved along the helical slot and in the closed state may be adapted to prevent air from flowing through the helical slot.

[0027] A tight slot sealing arrangement may be provided by an arrangement that may lock the adjustment handle. In the open state the slot sealing arrangement may enable the adjustment handle movement, and thereby also enable air flow through the helical slot. In the closed state the adjustment handle movement may be prevented as well as air flow through the helical slot.

[0028] In one embodiment, the adjustment handle on one side in a direction along the extension of the helical slot may be attached to a first sealing curtain, and on an opposite side in an opposite direction along the extension of the helical slot may be attached to a second sealing curtain, wherein the first and the second sealing curtains further are attached to the outer tube such that they are expandable and contractible along with a movement of the adjustment handle along the helical slot.

[0029] By attaching expandable and contractible curtains to the adjustment handle air flow may be prevented through the complete helical slot. Each sealing curtain may in one end be attached to the adjustment handle, and in the opposite end be attached to the outer tube at an end of the helical slot. Alternatively, the first and second sealing curtain may be attached to the inner surface of the outer tube at locations separate from the helical slot. The sealing curtains may be attached to the adjustment handle in an air tight manner.

[0030] In another embodiment, the outer tube may comprise an extension house radially extending the position of the helical slot on the outer surface of the outer tube.

[0031] The air flow adjustment device may thereby be covered with insulation without preventing the adjustment handle to be reached. Still, the inner tube may be moved in a reliable way since the handle is directly connected to the inner tube. The insulation may be used for temperature control of the air adapted to flow through the device.

[0032] In a further embodiment, the adjustment handle may be adapted to be operated by an electric motor.

[0033] The air flow adjustment device may be provided with an electric motor for adjusting the position of the inner tube. The electric motor may be connected to the adjustment handle such that the movement of the adjustment handle along the extension of the helical slot is controlled by the electric motor. The electric motor operation may be controlled by a regulator unit that may use various input values for the control of the electric motor.

[0034] In one embodiment, the helical slot may extend over 90-180 degrees of the outer tube circumference, preferably over 120-140 degrees, and more preferably over substantially 130 degrees of the outer tube circumference.

[0035] By changing the extension degree of the helical slot, the maximum reduction of the air flow through the air flow adjustment device may be adjusted. A helical slot extension degree of about 180 degrees may correspond to an end position of the inner tube wherein the twist tube is closed. By reducing the extension degree of the helical slot to approximately 130 degrees, a suitable maximum air flow reduction may be achieved. Depending on the medium adapted to flow through the device, and the material used for the twist tube, the circumferential extension degree of the helical slot may vary. Further, in some applications only a small change in air flow through device may be wanted, providing that only a small circumferential extension degree of the helical slot may be needed.

Brief Description of the Drawings

[0036] The invention will in the following be described in more detail with reference to the enclosed drawings, wherein:

Fig 1 shows a perspective view of an air flow adjustment device according to an embodiment of the invention.

Fig 2a shows a perspective exploded view of an air flow adjustment device according to an embodiment of the invention.

Fig 2b shows a perspective exploded view of an air flow adjustment device according to an embodiment of the invention.

Fig 2c shows a perspective exploded view of an air flow adjustment device according to an embodiment of the invention.

Fig 3 shows a cross-sectional side view of an air flow adjustment device according to an embodiment of the invention.

Fig 4a shows a cross-sectional side view of an air flow adjustment device according to an embodiment of the invention.

Fig 4b shows a cross-sectional side view of an air flow adjustment device according to an embodiment of the invention.

Fig 5 shows a perspective view of an air flow adjustment device according to an embodiment of the invention.

Fig 6 shows a perspective view of an air flow adjustment device according to an embodiment of the invention.

Fig 7 shows a perspective view of an air flow adjustment device according to an embodiment of the invention.

Fig 8 shows a perspective view of an air flow adjustment device according to an embodiment of the invention.

Description of Embodiments

[0037] The present invention will be described more fully hereinafter with reference to the accompanying drawings, in which preferred 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 embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, like numbers refer to like elements.

[0038] Figs 1 and 2 illustrate an air flow adjustment device 1 according to an embodiment. The device 1 comprises an outer tube 10, an inner tube 20 and a twist tube 30. The cross-sectional area of the inner tube 20 is only slightly smaller than the cross-sectional area of the outer tube 10. An outer surface 23 of the inner tube 20 faces an inner surface 12 of the outer tube 10. At a first end 31 of the twist tube 30 it is fixed relative to the outer tube 10. The first end 31 of the twist tube 30 may be attached to the outer tube 10, or arranged such that movement of the first end 31 relative to the outer tube 10 is prevented. The first end 31 of the twist tube 30 may be fixed relative to the outer tube 10 by means of a fixation ring 34. The fixation ring 34 is a metal ring adapted to prevent the first end 31 from moving. The inner tube 20 has a first end 21 and a second end 22. The twist tube 30 extends axially through the inner tube 20 and is attached to the second end 22 of the inner tube 20. An adjustment handle 24 is attached to the inner tube 20. The attachment handle 24 extends radially from an outer surface 23 of the inner tube 20 through a helical slot 13 in the outer tube 10. The helical slot 13 guides the adjustment handle 24. The helical slot 13 extends in both an axial direction and a circumferential direction on the outer tube 10. When the adjustment handle 24 is moved along the helical slot 13, it thereby causes both a rotational and axial movement of the inner tube 20. The shape and location of the helical slot corresponds to a rotational and axial movement of the inner tube 20 for adjusting the air flow F through the device 1. The helical slot 13 extends over approximately 130 degrees of the circumference of the outer tube 10.

[0039] Fig 2a illustrates an open state of the device 1 wherein the twist tube 30 is in a fully open state enabling maximum air flow F through the device 1. The cross-sectional area of the opening through the twist tube 30 is substantially the same along the twist tube's 30 entire axial length. The adjustment handle 24 is in a first end position along the helical slot 13.

[0040] Fig 2b illustrates the air flow adjustment device 1 in an air flow reducing state. The inner tube 20 has been rotated and moved axially relative to the outer tube 10. The adjustment handle 24 has been moved along the helical slot 13 in the direction A. This causes the inner tube 20 to rotate and move axially in the direction B. When the inner tube 20 is rotated, the twist tube 30 is twisted. This is due to the twist tube's 30 fixation to the outer tube 10 at the first end 31 and attachment to the inner tube 20 at the second end 32. When the twist tube 30 is twisted, the cross-sectional opening at a middle portion 33 of the twist tube 30 is reduced. Thereby the air flow F through the twist tube 30 is reduced. The axial movement of the inner tube 20 is performed for compensating for the reduced axial length of the twist tube 30 due to the twisting. The twist tube 30 preferably comprises a fabric material or any other material that is correspondingly flexible for enabling the twisting of the twist tube 30.

[0041] As illustrated in fig 2c, when the adjustment handle 24 is moved to a second end position along the helical slot 13, the twist tube 30 is twisted such that the cross-sectional opening at the middle portion 33 of the twist tube 30 is more reduced, further limiting air flow F through the twist tube 30. With a helical slot 13 that extends over a larger part than 130 degrees of the circumference of the outer tube 10, an even more limited air

flow F through the twist tube 30 could be achieved. If the helical slot 13 would extend over approximately 180 degrees of the circumference of the outer tube 10 the cross-sectional opening at the middle portion 33 of the twist tube 30 would be substantially closed.

[0042] Fig 3 illustrates an embodiment of the invention wherein the air flow adjustment device 1 is provided with a sealing arrangement for preventing air from flowing through the helical slot 13 in the outer tube 10. The inner tube 20 is provided with a first sealing ring 41 at the first end 21 of the inner tube 20, and with a second sealing ring 42 at the second end 22 of the inner tube 20. The sealing rings 41, 42 provides sealing between the outer surface 23 of the inner tube 20 and the inner surface 12 of the outer tube 10. The sealing rings 41, 42 are mounted fixed to the inner tube 20 but moveable relative to the outer tube 10. The inner tube 20 is thereby still rotationally and axially moveable relative to the outer tube 10. The sealing rings 41, 42 together with the outer surface 23 of the inner tube 20 and the inner surface 12 of the outer tube 10 delimits a space 40 that is air sealed from the air flow F flowing through the device 1. The air sealed space 40 is located at the same location as the helical slot 13 in the outer tube 10. The helical slot 13 faces the air sealed space 40 at all positions of the inner tube 20 between axial end positions of the inner tube 20.

[0043] Fig 4 illustrates an embodiment with an alternative sealing arrangement wherein the outer surface 23 of the inner tube 20 is provided with a sealing layer 43. The sealing layer 43 comprises a layer of a flexible, resilient sealing material. The sealing layer 43 is provided on a part of the outer surface 23 of the inner tube 20 that faces the helical slot 13. Thereby, if the inner tube 20 is pressed towards the outer tube 10, as illustrated in fig 4b, such that the outer surface 23 of the inner tube 20 is pressed towards the inner surface 12 of the outer tube 10 in the direction C, the sealing layer 43 prevents air from flowing through the helical slot 13. The pressing function of the inner tube 20 towards the outer tube10 could be performed by the adjustment handle 24. In that case, the adjustment handle has a locked state and an unlocked state. In the locked state the adjustment handle 24 presses the inner tube 20 towards the outer tube 10. In the locked state the adjustment handle 24 further is prevented from moving along the helical slot, i.e. the rotation and movement of the inner tube 20 is prevented. In the unlocked state the adjustment handle has released the pressing function and enables rotational and axial movement of the inner tube 20. The extension of the part of the inner tube 20 covered by the sealing layer 43 provides that the entire helical slot 13 faces the sealing layer 43 at all possible positions of the inner tube 20.

[0044] Fig 5 illustrates an embodiment with an alternative sealing arrangement wherein the helical slot 13 is provided with two sealing flanges 44, 45. The sealing flanges 44, 45 are adapted to prevent air from flowing through the helical slot 13. The sealing flanges 44, 45 abut the adjustment handle 24 at the present location of the handle 24. Otherwise the sealing flanges 44, 45 abut each other. The sealing flanges 44, 45 are preferably made of a rubber material. In an alternative embodiment (not shown), at least one of the sealing flanges 44, 45 is moveable providing a locked state and an unlocked state, wherein in the unlocked state, the sealing is opened and the adjustment handle 24 is moveable along the helical slot 13. In the locked state the sealing is closed, preventing air from flowing through the helical slot 13, and preventing the adjustment handle 24 from moving along the helical slot 13.

[0045] Fig 6 illustrates an embodiment with an alternative sealing arrangement comprising a slot sealing arrangement wherein a first sealing curtain 46 is in one end attached to the adjustment handle 24 and in another end attached to the outer tube 10 at a first end 14 of the helical slot 13. A second sealing curtain 47 is in one end attached to the adjustment handle 24 and in another end attached to the outer tube 10 at a second end 15 of the helical slot 13. The sealing curtains 46, 47 are provided in a flexible material that is expandable and contractible along the extension of the helical slot 13. When the adjustment handle 24 is moved along the helical slot 13, the sealing curtains 46, 47 will expand and contract, following the adjustment handle's 24 movements and seal the helical slot 13 such that air flow through the helical slot 13 is prevented. The flexible material of the sealing curtains 46, 47 may be a rubber or fabric material, for instance an air impermeable fabric. In another embodiment, only one sealing curtain may cover the entire helical slot 13.

[0046] Fig 7 illustrates an embodiment wherein the outer tube 10 comprises an extension house 16. The extension house 16 radially extends the location of the outer surface 11 of the outer tube 10. The helical slot 13 is located at the radially extended part of the outer surface 11 of the outer tube 10. In a case wherein the outer tube 10 needs to be covered with insulation, the extension house 16 enables the adjustment handle 24 to be reached. The radial extension of the extension house 16 should correspond to the thickness of the insulation arranged on the outer tube 10. Typically, the extension house 16 radially extends the outer surface 11 of the outer tube 10 approximately 50 mm. An air flow adjustment device 1 comprising an extension house 16 should be provided with any sealing arrangement to prevent air flow through the helical slot 13.

[0047] Fig 8 illustrates an embodiment wherein the outer tube 10 comprises an extension plate 17. The extension plate 17 extends along the extension of the helical slot 13. The extension plate 17 extends radially from the outer surface 11 of the outer tube 10. The extension plate 17 comprises a locking slot 18 provided with teeth 19. The adjustment handle 24 extends through the helical slot 13 and radially along the radial extension of the extension plate 17 to the locking slot 18. The adjustment handle 24 is provided with a locking pin 25 adapted to extend through the locking slot 18. The locking slot 18 and the locking pin 25 are adapted to integrate to form a

locking means. In a locked state the locking pin 25 integrates with the teeth 19 in the locking slot 18. In an unlocked state the adjustment handle 24 is moved such that the locking pin 25 is removed from the locking slot 18 and the adjustment handle 24 may move radially towards the helical slot 13. Thereby the adjustment handle 24 is moveable along the helical slot 13 providing rotational and axial movement of the inner tube 20. When the adjustment handle 24 is moved to the wanted position, the adjustment handle 24 can be lifted such that the locking pin 25 can integrate with the teeth 19 in the locking slot 18. By use of the extension plate 17 the outer tube 10 may be covered with insulation without interfering with the possibility of operating the adjustment handle 24.

[0048] In the drawings and specification, there have been disclosed preferred embodiments and examples of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for the purpose of limitation, the scope of the invention being set forth in the following claims.

Claims

1. Air flow adjustment device (1) for arrangement in an air ventilation arrangement, the device comprising
an outer tube (10),
an inner tube (20) arranged inside the outer tube and rotationally and axially moveable relative to the outer tube, and
a twist tube (30) with an axial opening through which air is adapted to flow, wherein the twist tube in a first end (31) is fixed relative to the outer tube (10) and in a second end (32) is attached to the inner tube (20), wherein the inner tube (20) is adapted to be rotated and axially displaced relative to the outer tube (10), such that when the inner tube is rotated the twist tube (30) is twisted and the size of the axial opening is changed,
characterized in that
the outer tube (10) comprises a helical slot (13), and wherein the inner tube (20) is provided with an adjustment handle (24) that extends radially through the helical slot (13) of the outer tube (10), such that the adjustment handle (24) is adapted to be moved along the helical slot (13) to rotate the inner tube (20) and move the inner tube axially relative to the outer tube (10).

2. Air flow adjustment device according to claim 1, wherein the air flow adjustment device comprises locking means adapted to, in a locked state, prevent movement of the adjustment handle (24) along the helical slot (13), and in an unlocked state enable movement of the adjustment handle along the helical slot.

3. Air flow adjustment device according to claim 2, wherein the locking means is provided on the adjustment handle (24).

4. Air flow adjustment device according to any of the preceding claims, wherein the inner tube (20) and the outer tube (10) are made of a rigid material, and wherein the twist tube (30) is made of a flexible, twistable material.

5. Air flow adjustment device according to any of the preceding claims, wherein the inner tube (20) and/or the outer tube (10) is provided with an air sealing arrangement for preventing air flow through the helical slot (13) in the outer tube.

6. Air flow adjustment device according to any of the preceding claims, wherein the inner tube (20) has a first end (21) and a second end (22), and the inner tube at respective first and second end is provided with a sealing ring (41, 42) around the circumference of an outer surface (23) of the inner tube, wherein the sealing rings (41, 42), the inner tube (20) and the outer tube (10) delimits a space (40) that is air sealed from the air adapted to flow through the air flow adjustment device, and wherein the helical slot (13) in the outer tube faces said space (40).

7. Air flow adjustment device according to any of the preceding claims, wherein an outer surface (23) of the inner tube (20) at least partly is provided with a sealing material (43), and wherein the sealing material is adapted to be pressed towards an inner surface (12) of the outer tube (10) at the location of the helical slot (13) in the outer tube (10), such that air adapted to flow through the air flow adjustment device is prevented from flowing through the helical slot (13).

8. Air flow adjustment device according to any of the preceding claims, wherein the inner tube (20) is provided with an axial slit along its entire axial length such that the cross-sectional area of the inner tube is expandable and contractible, wherein the adjustment handle (24) is attached to the inner tube such that the adjustment handle in a first state is adapted to contract the cross-sectional area of the inner tube, enabling rotational and axial movement of the inner tube, and in a second state is adapted to expand the cross-sectional area of the inner tube such that an outer surface (23) of the inner tube (20) presses against an inner surface (12) of the outer tube (10).

9. Air flow adjustment device according to any of the preceding claims, wherein the outer tube (10) is provided with a slot sealing arrangement surrounding the helical slot (13) for preventing air flow through the helical slot.

10. Air flow adjustment device according to claim 9, wherein the slot sealing arrangement has an open state and a closed state, wherein the slot sealing arrangement in the open state is adapted to enable the adjustment handle (24) to be moved along the helical slot (13) and in the closed state is adapted to prevent air from flowing through the helical slot.

11. Air flow adjustment device according to any of the preceding claims, wherein the adjustment handle on one side in a direction along the extension of the helical slot (13) is attached to a first sealing curtain (46), and on an opposite side in an opposite direction along the extension of the helical slot (13) is attached to a second sealing curtain (47), wherein the first and the second sealing curtains (46, 47) further are attached to the outer tube (10) such that they are expandable and contractible along with a movement of the adjustment handle (24) along the helical slot (13).

12. Air flow adjustment device according to any of the preceding claims, wherein the outer tube (10) comprises an extension house (16) radially extending the position of the helical slot (13) on the outer tube (10).

13. Air flow adjustment device according to any of the preceding claims, wherein the adjustment handle (24) is adapted to be operated by an electric motor.

14. Air flow adjustment device according to any of the preceding claims, wherein the helical slot (13) extends over 90-180 degrees of the outer tube (10) circumference, preferably over 120-140 degrees, and more preferably over substantially 130 degrees of the outer tube (10) circumference.

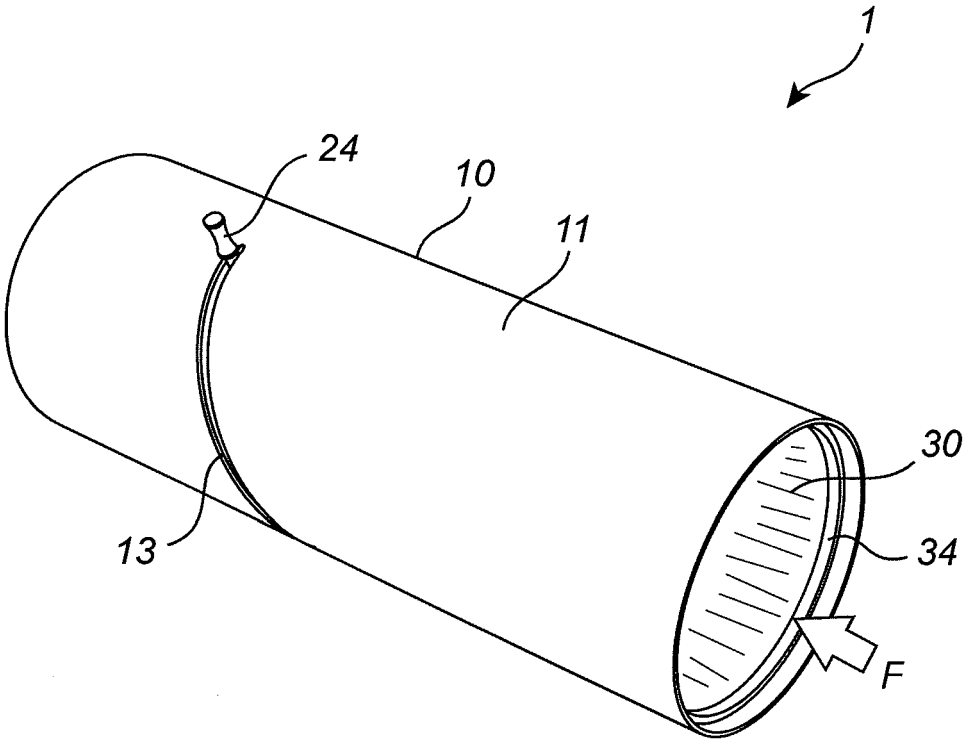

Fig. 1

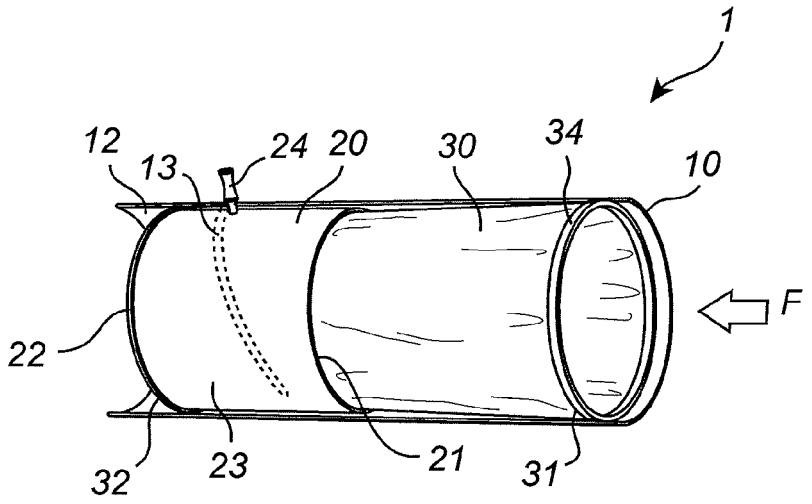

Fig. 2a

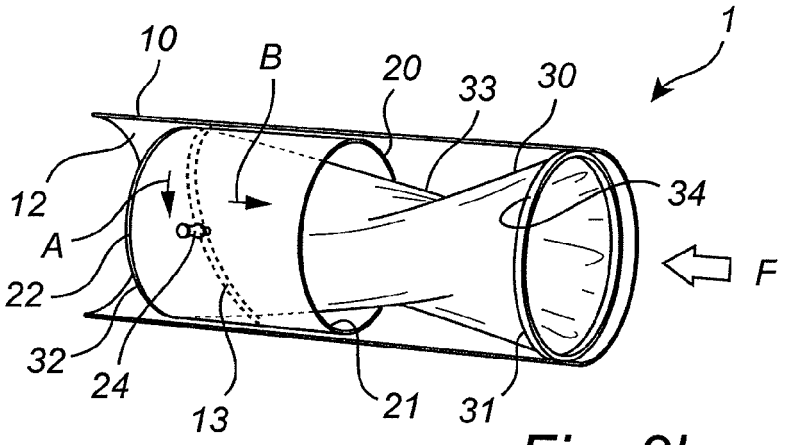

Fig. 2b

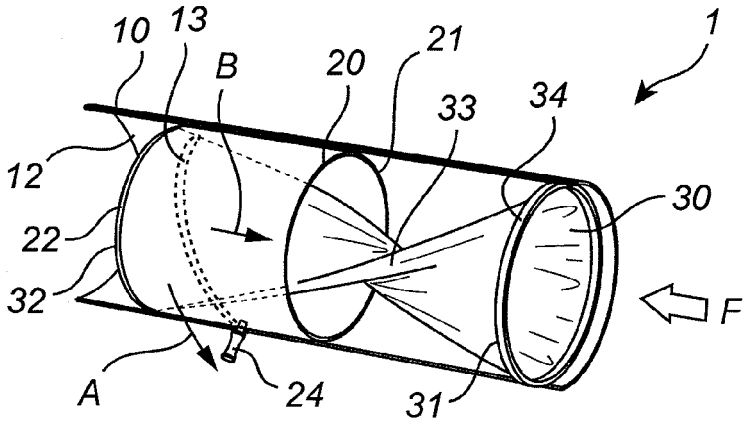

Fig. 2c

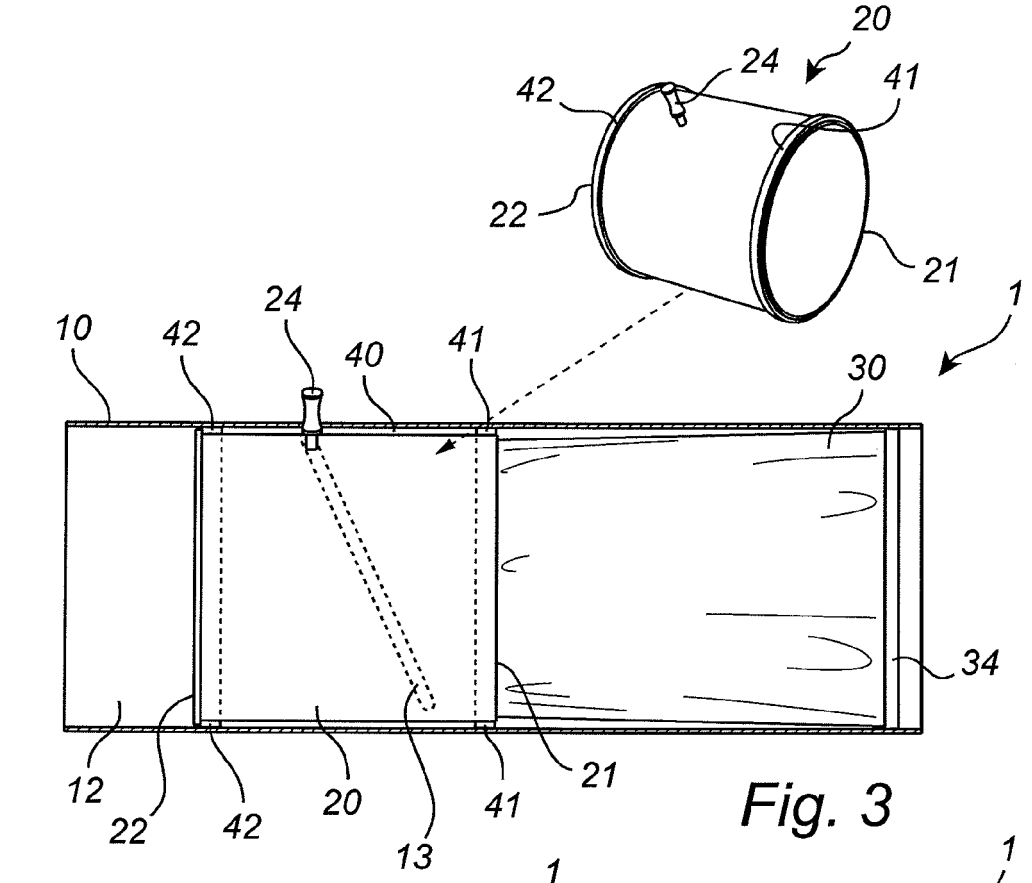

Fig. 3

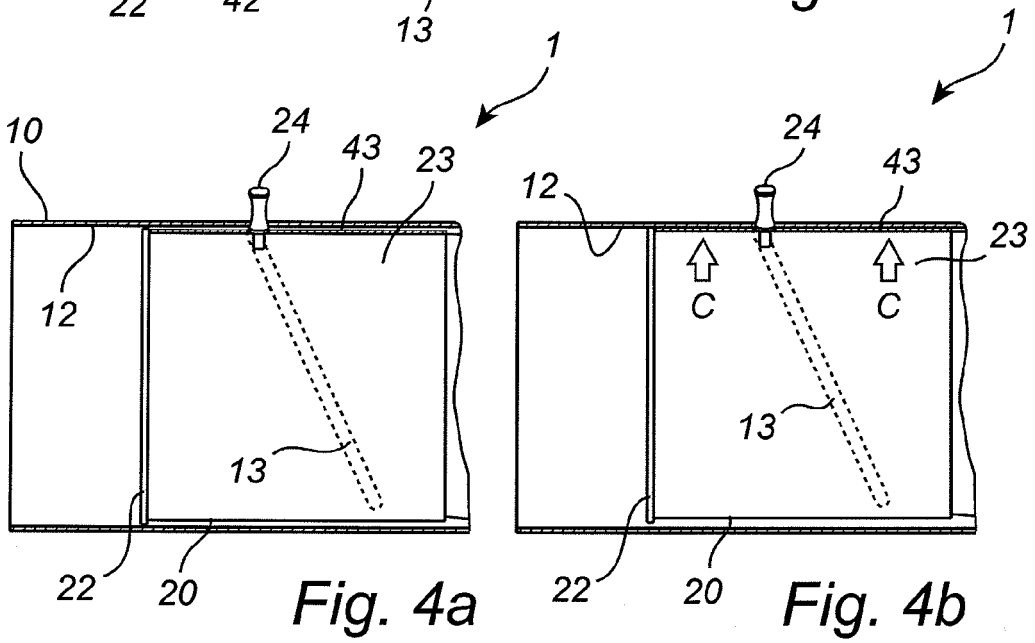

Fig. 4a

Fig. 4b

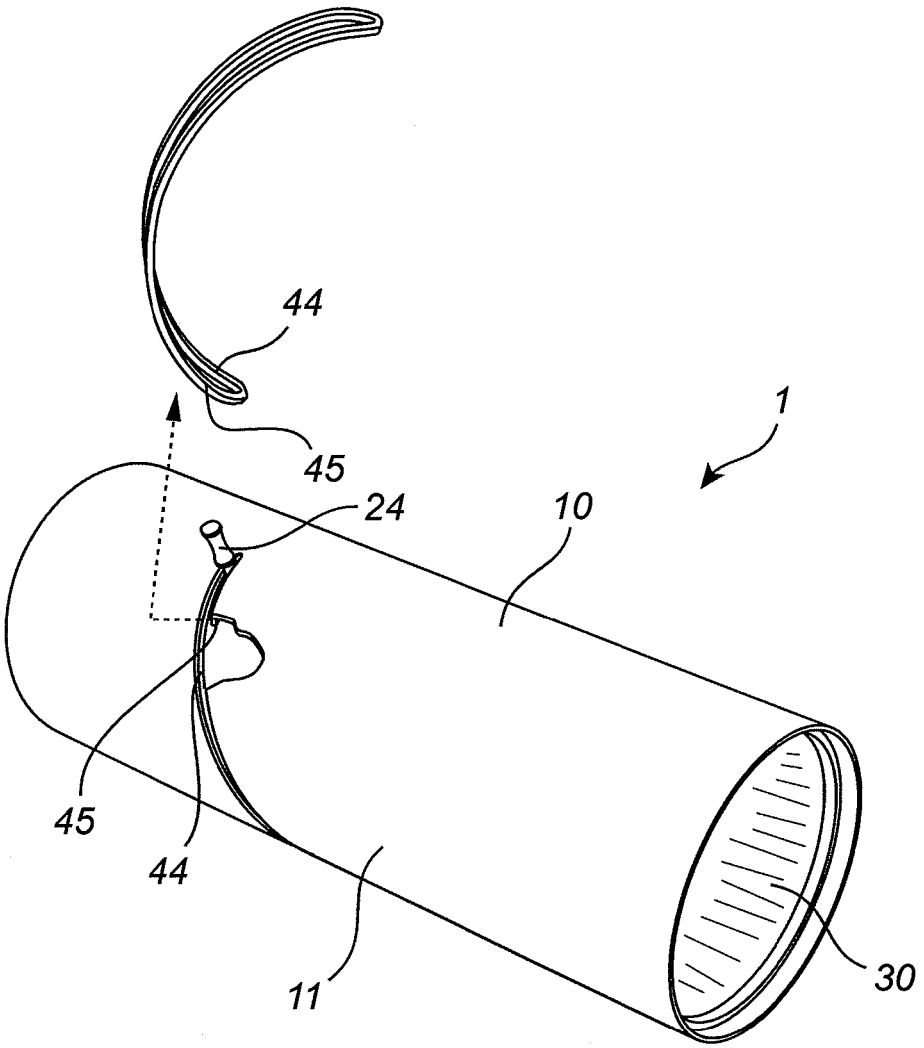

Fig. 5

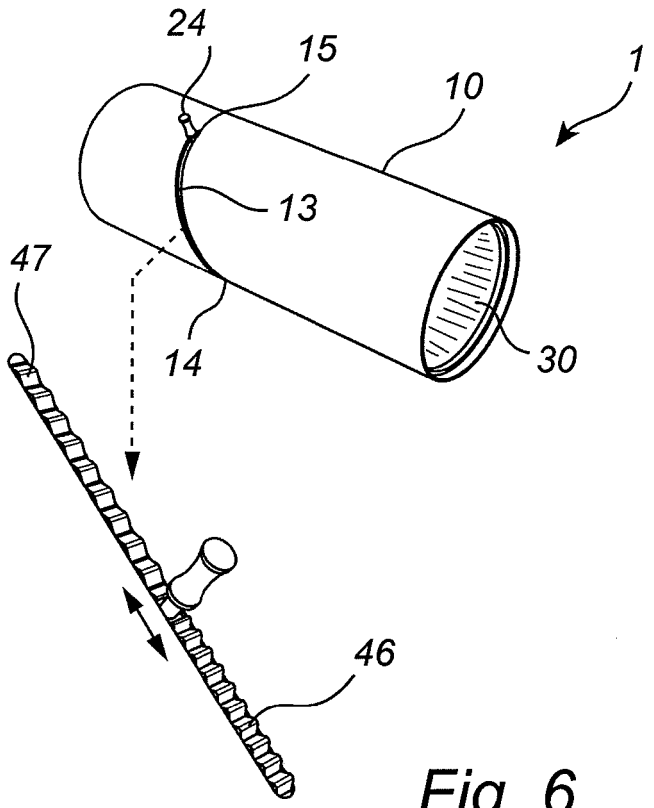

Fig. 6

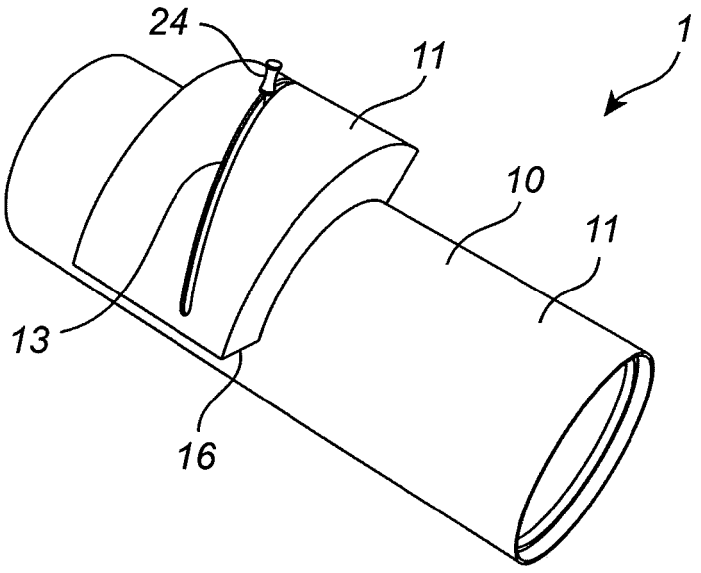

Fig. 7

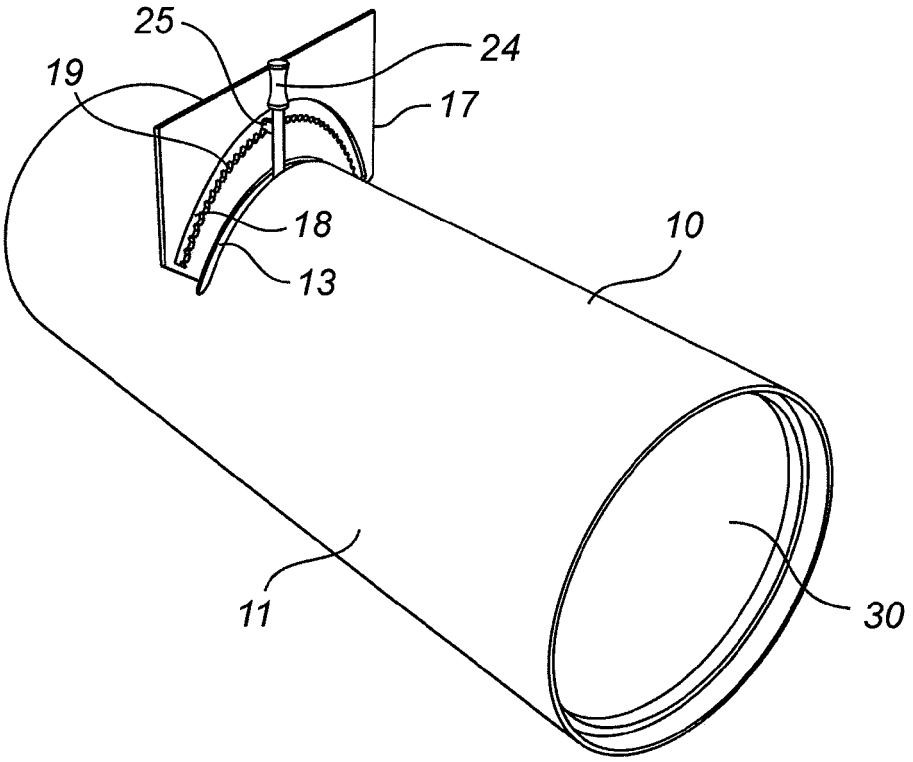

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 6241

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	JP 58 206412 A (NISSAN MOTOR) 1 December 1983 (1983-12-01) * the whole document *	1-14	INV. F24F13/10
Y	JP 49 072031 U (NIPPON LIGHT METAL CO) 22 June 1974 (1974-06-22) * figures *	1-14	
A,D	WO 2010/039100 A1 (BORANDER JERRY [SE]) 8 April 2010 (2010-04-08) * page 6, line 11 - page 9, line 26; figures 1-8 *	1-14	
A	WO 01/13046 A1 (WALKER MARK A [US]) 22 February 2001 (2001-02-22) * abstract; figures *	1	

TECHNICAL FIELDS SEARCHED (IPC)

F24F
B60H
F16K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	28 July 2011	González-Granda, C

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28-07-2011

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