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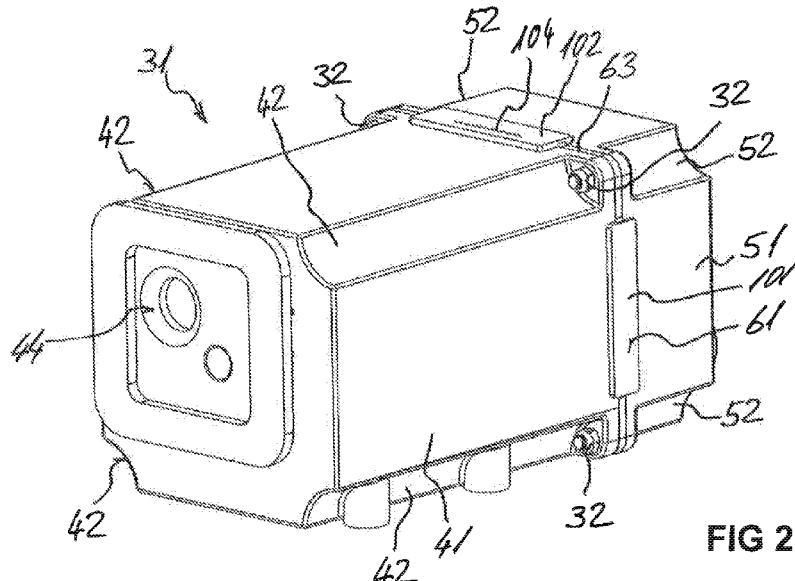


FIG 2

(57) Abstract: Sound-proofing housing (31), which comprises a first housing part (41) having an intake opening (44) and comprises a second housing part (51) having a discharge opening, wherein a shaped part (61) arranged in the housing (31) is also provided, of which the flange seal (63) comes to rest between the housing parts (41, 51) when the housing (31) is put together. The acoustic emission generated by the fan is considerably reduced by a specific embodiment of the shaped part (61) with air passage openings and air-guiding devices.

WO 2013/114345 A1

Sound-proofing housing for a respirator

This application claims benefit of priority to prior U.S. provisional application no. 61/594,345 filed on February 2, 2012, and as a non-provisional thereof; this application also claims benefit of priority to prior European application no. EP12153645 filed on February 2, 2012; the entireties of European application no. EP12153645 and of U.S. application no. 61/594,345 are both expressly incorporated herein by reference, for all intents and purposes, as if identically set forth herein.

The invention relates to a sound-proofing for a respirator according to the preamble of Claim 1. The invention further relates to a respirator comprising such a sound-proofing housing.

A respirator is used to assist a patient when breathing or to take over fully the breathing function. To this end, a fan, which draws in air in an accordingly controlled manner, compresses said air and then provides the compressed air to the patient at a correspondingly high pressure, is normally provided in the respirator. The delivery opening of the respirator is connected via a feed line to a respiratory mask for example, which is fitted on the patient.

The fan, also referred to as an air generator, for example comprises a motor, for example an electric motor, and a compressor driven by the motor, for example an impellor or a turbine. Noise is generated during operation of the fan, both by the fan itself and also by the airflow, and is bothersome for the patient and also for the carers, in particular in the event of a long period of use of the respirator.

There was thus a need to reduce the noise level, in particular in the case of respirators, during operation thereof.

For a ventilation, heating or air-conditioning system of a motor vehicle, it is proposed for example in DE 197 46 185 A1, which is foreign to the classification in question, to provide a separate holder for the fan motor, wherein resiliently yielding support elements directly supporting the motor are provided to decouple vibrations between the motor and the holder.

With this known solution, vibrations generated directly by the fan motor are indeed damped, but the noise level during operation of the ventilation, heating or air-conditioning system only falls to an inconsiderable extent. Since, during operation of

a motor vehicle, further loud noises are produced, the reduction in acoustic emission of the ventilation, heating or air-conditioning system achieved by this solution is sufficient for this purpose. The reduction in acoustic emission achievable by this solution is insufficient for a respirator.

WO 2009/067583 A2 shows a modular powered air purifying respirator comprising a housing having an upper body which has an inlet for the entry of air into the housing. Said air being drawn in by a fan arranged in the housing. The housing has also a lower body which has an outlet for the discharge of the drawn-in air from the housing. Furthermore said housing also comprises a lower body cover arranged in the housing which forms an enclosed space to create a sealed breathing zone that is in fluid communication with the inlet and the outlet. A holder for the motor of the fan is positioned within the sealed breathing zone. This holder encircles the fan, has a fan receptacle and is located between the fan and the lower body. The fan receptacle protrudes from the delivery side facing the delivery region. Air-guiding devices for guiding the air drawn-in by the fan are provided within the housing.

This known solution has comparable disadvantages as pointed out in respect to DE 197 46 185 A1, mainly still loud noise. In the normal use of such an air purifying respirator (shown in the figures 9 and 10 of WO 2009/067583 A2) the reduction in acoustic emission of the air purifying respirator achieved by this solution is sufficient for this purpose. The reduction in acoustic emission achievable by this solution is insufficient for a respirator which is used in hospital or by a patient.

It is proposed in DE 202 13 232 U1 to provide a sound-proofing housing for receiving a fan turbine, said housing consisting of two fully closable chambers. The first chamber has an air intake opening and receives the turbine, which delivers the compressed air into the second chamber having the air outlet opening. Both chambers have a foam lining on all chamber walls. The first chamber additionally has a discharge opening, in which the drive motor of the turbine is resiliently mounted.

A disadvantage of this known solution is that the sound-proofing housing requires a large amount of space in a respirator and thus only allows a compact embodiment of the respirator to a limited extent. In addition, this sound-proofing housing requires a high assembly effort.

A respirator is known from US 7 617 823 B2, in which the fan is arranged in a receptacle of a shaped part made of a resilient material, which is inserted into a first housing part of the respirator. The shaped part additionally has air-guiding channels. To fix the fan in the first housing part, a further damping insert and a cover element, which covers said damping insert and is screwed to the first housing part, are provided.

A disadvantage of this known solution is that the soundproofing requires a large amount of space compared to the desired compact dimensions of the respirator, and the assembly of the respirator is very complicated due to the complexity of this solution. Furthermore, the fan and the components thereof are not cooled sufficiently for long periods of use.

It is proposed in US 7 975 688 B1 to arrange the fan between two damping elements, which are fixed by means of a cover element on a component, which is arranged in the respirator.

The disadvantage of this known solution is that the assembly of the respirator is very complicated due to the complexity and the soundproofing is insufficient in practice due to the constructional embodiment. With this solution too, the fan and components thereof are only cooled insufficiently.

DE 10 2006 034 028 A1 discloses a sound-proofing housing for a respirator, said housing comprising a first housing part with an intake opening for the entry of air into the housing, said air being drawn in by a fan arranged in the housing, and comprising a second housing part, which comprises a discharge opening for the discharge of the drawn-in air from the housing. A shaped part arranged in the housing is also provided and comprises a flange seal, which comes to rest between the first housing part and the second housing part when the housing is put together and divides the housing into an intake region and a delivery region, and comprises a fan receptacle for holding the fan in the housing, said receptacle protruding from the intake side of the flange seal. Air-guiding devices for guiding the air drawn in by the fan are also provided within the housing in the shaped part.

A disadvantage of this known solution is that the sound-proofing housing requires a large amount of space compared to the desired compact dimensions of the

respirator, and assembly of the respirator is also complicated. In this case the cooling of the fan and components thereof is likewise sub-optimal.

The object of the present invention is therefore to create a sound-proofing housing for a respirator that does not have the above-mentioned disadvantages and in particular is of simple design so as to simplify the assembly of the housing. In addition, optimal soundproofing during operation of the fan or the respirator is to be ensured, even in the most confined of spaces.

The object is achieved by the features in independent Claim 1. Advantageous developments are presented in the figures and in the dependent patent claims.

In accordance with the invention, a support flange, which comprises at least one air passage opening for the air drawn in by the fan as well as contact sides contacting the inner side of a housing part when the housing is put together, is provided in the region of the free end of the fan receptacle, and at least one further air passage opening for the air drawn in by the fan is provided in the fan receptacle, preferably adjacent to the intake side of the flange seal.

The shaped part comprising the fan receptacle can be inserted as a whole into a housing part, until the flange seal contacts the corresponding free edge of the housing part. The support flange distanced from the flange seal comes into contact with the inner sides of the housing part and aligns the shaped part in the desired position within the housing, even as said shaped part is being introduced. It is thus ensured in the simplest manner possible that the fan arranged in the substantially sleeve-shaped fan receptacle is completely decoupled from the housing. The other housing part is then arranged so that the shaped part is securely fixed due to the flange seal fixed between the housing parts.

The air drawn in by the fan passes through the intake opening and into the housing, flows through the air passage opening in the support flange past the fan receptacle, and flows through the further air passage opening in the fan receptacle into the fan. This air is compressed in the fan and is delivered through the discharge opening. A sufficient clearance for the air flowing through the housing is created around the advantageously sleeve-shaped fan receptacle and ensures sufficient and advantageous cooling of the fan and in particular of the drive motor thereof.

The sound-proofing housing according to the invention is characterised by a particularly high ease of assembly with a compact embodiment. At the same time, a long period of use of the fan and therefore of the respirator is ensured.

Seal elements are preferably provided on the contact sides of the support flange and prevent an infiltration of air into the contact regions between the contact sides of the support flange and the corresponding inner sides of the housing. The seal elements are advantageously formed as preferably resilient lip seals. Due to the embodiment and positioning of the at least one air passage opening in the support flange, the flow behaviour and therefore in particular also the efficiency of the cooling effect for the fan can be influenced significantly. The seal elements ensure the desired guidance of air within the housing, even in the event of vibrations produced in any case by the operation of the fan.

An intake-side guide element having at least one air passage opening preferably protrudes in the form of an air-guiding device from the support flange and ensures that the airflow is steered within the housing in an advantageous manner in the intake region of the sound-proofing housing. The intake-side guide element is particularly advantageously arranged in the vicinity of, or directly adjacent to, the air passage opening in the support flange. The size of the cross section of the air passage opening advantageously corresponds approximately to 0.8 times to 1.2 times the size of the air passage opening in the support flange.

At least one support portion for the intake-side guide element is preferably provided and ensures the desired alignment of the intake-side guide element within the housing. The at least one support portion advantageously extends from the intake-side guide element to the support flange, which ensures stable support of the intake-side guide element. In spite of the forces that are effective due to the airflow within the housing, the intake-side guide element itself may have a low material thickness. A reduction in the material requirement for the shaped element has an advantageous effect in particular on the production costs and also the handling of the shaped element. At least two support portions for the intake-side guide element are advantageously provided and are arranged at a distance from one another and ensure that the intake-side guide element is aligned in an even more stable manner. For advantageous support of the intake-side guide element, the support portions are each preferably provided adjacent to the two free side edges, running parallel to one another, of the intake-side guide element.

At least one guide receptacle for receiving a portion of the intake-side guide element is preferably provided in the housing part in which the intake-side guide element comes to rest when the housing is put together. The at least one guide receptacle is advantageously formed in such a way that, as the shaped element is introduced into the corresponding housing part, the free ends of the intake-side guide element are surrounded by the shaped element, at least in some regions. Due to the at least one guide receptacle stabilising the intake-side guide element, the intake-side guide element can have a low material thickness in spite of the forces that are effective due to the airflow within the housing.

At least two mutually opposed guide receptacles are particularly advantageously provided and hold the intake-side guide element at the two free side edges thereof running parallel to one another. In addition, the arrangement of a further guide receptacle, which holds the free edge at the end of the intake-side guide element, at least in some regions, is also advantageous.

In a preferred embodiment, the intake-side guide element is fixed in the housing in the desired alignment by means of at least one guide receptacle and also by means of at least one support portion.

One housing part preferably comprises at least one fastening dome protruding from the free edge of the housing part, and the other housing part preferably comprises at least one fastening dome recess for receiving the at least one fastening dome when the housing is put together, so that, when the two housing parts are put together, they are aligned with one another during the assembly process. If the housing parts are asymmetrical in cross section, the correct alignment of the housing parts relative to one another can be ensured in a simple manner by a corresponding arrangement of the at least one fastening dome and the at least one fastening dome recess. A plurality of fastening domes and a corresponding number of fastening dome recesses are advantageously provided.

A stop for the at least one fastening dome is advantageously provided in the fastening dome recess to ensure a defined spacing between the housing parts when the housing is put together, whereby in particular an undesirably heavy compression of the flange seal of the shaped part coming to rest between the housing parts is prevented in a simple manner.

At least one dome through-opening for the passage of the at least one fastening dome is preferably provided in the flange seal, whereby the flange seal and therefore the shaped part are held in the desired alignment relative to the housing parts. The number of dome through-openings in the flange seal advantageously corresponds at least to the number of the fastening domes provided on the corresponding housing part. In this case too, a desired alignment of the shaped part in the housing can be ensured in a simple manner by a corresponding arrangement of the dome through-openings adapted to the geometrical conditions.

The at least one dome through-opening is advantageously peripherally closed, which reliably prevents an undesired displacement of the flange seal and therefore of the entire shaped part when the sound-proofing housing is put together.

A delivery-side guide element is preferably provided in the form of an air-guiding device on the flange seal and protrudes from the delivery side of the flange seal, which is arranged opposite the intake side of the flange seal, which ensures that the airflow is steered within the housing in an advantageous manner in the delivery region of the sound-proofing housing.

At least one support portion for the delivery-side guide element is advantageously provided and ensures the desired alignment of the delivery-side guide element within the housing. The at least one support portion advantageously extends from the delivery-side guide element to the flange seal, which ensures stable support of the delivery-side guide element. In spite of the forces that are effective due to the airflow in the housing, the delivery-side guide element itself can have a low material thickness. As has already been explained, a reduction of the material requirement for the shaped element in particular has an advantageous effect on the production costs and also the handling of the shaped element. A plurality of support portions for the delivery-side guide element are advantageously provided and are arranged at a distance from one another and ensure that the delivery-side guide element is aligned in a more stable manner. For advantageous support of the delivery-side guide element, the support portions are preferably each provided adjacent to the two free side edges, running parallel to one another, of the delivery-side guide element.

At least one cable through-opening for the passage of cables for the wiring of the fan is preferably provided in the flange seal, which enables a simple seal against

false air and against an air short circuit and simultaneously enables simple wiring of the fan.

The at least one cable through-opening is advantageously provided in an encompassing portion, which protrudes from the flange seal, which enables simple constructional assembly that does not make it difficult to put the housing together.

A housing recess for receiving at least one region of the encompassing portion is further advantageously provided in the housing part in which the encompassing portion comes to rest when the housing is put together, which enables accurate, fault-free constructional assembly of the housing and at the same time creates sufficient clearance for the wiring.

At least one cable through-opening for the passage of cables for the wiring of the fan is preferably provided in the support flange and/or in the intake-side guide element so that the corresponding cables for the fan are securely guided and held within the housing. Damage to the cables is thus prevented, even in the event of strong airflows within the housing.

At least one air passage opening, through which the air compressed by the fan can flow from the intake region into the delivery region, is preferably provided in the flange seal. The at least one air passage opening is advantageously spaced from the edge of the flange seal so that it is surrounded peripherally by material of the flange seal. The desired seal in the region of the flange seal is maintained, even under high forces produced for example by the airflow.

A line portion (for example a “swan-neck”) is advantageously provided and connects the air passage opening to a delivery-side outlet (for example the outlet connecting piece) of the fan, whereby an air short circuit between drawn-in air and compressed air is prevented.

A support element for supporting the flange seal is preferably provided and ensures the desired alignment of the flange seal within the housing. In spite of the forces that are effective due to the airflow, the flange seal itself may have a low material thickness. As has already been explained above, a reduction of the material requirement for the shaped element in particular has an advantageous effect on the production costs and also the handling of the shaped element. The support element is advantageously fabricated from a rigid material, for example from sheet metal or a

suitable plastics material. The dimensions are advantageously selected in such a way that, when the sound-proofing housing is put together, said support element comes to rest completely within the corresponding housing part. The support element further advantageously comprises contact portions, which protrude and extend from the plane spanned by the flange seal and can be used to support the inner wall of the corresponding housing part. Displacement of the shaped part in this region is thus limited to the resultant play predetermined by the construction. The support element is advantageously arranged on the intake side of the flange seal, which enables simple assembly of the shaped part and therefore of the housing as a whole.

The shaped part is preferably formed at least in two parts, wherein a first shaped part portion comprises at least the flange seal and the at least one further shaped part portion comprises at least the fan receptacle, wherein a fixing device for connecting the first shaped part portion to the at least one further shaped part portion is provided. A shaped part formed in this way can be fabricated in a simple manner. In particular if the shaped part is a part that is injection-moulded or foamed in a mould, the corresponding mould can thus be designed more simply than in the case of a one-pieced shaped part. The mould can thus be produced more favourably, and demoulding of the produced portion of the shaped part is considerably simplified.

The fixing device preferably comprises at least one fixing cam provided on one of the shaped part portions and at least one fixing cam receptacle provided on the other shaped part portion, the at least one fixing cam being fixable in said fixing cam receptacle, which enables a simple connection of the at least two shaped part portions.

For example, a groove for engagement from behind distanced from the free end of the at least one fixing cam is provided on said at least one fixing cam and the at least one fixing cam receptacle has inner dimensions matched to the dimensions of the groove for engagement from behind or smaller than the corresponding dimensions of the free end of the at least one fixing cam. When joining the shaped part portions, the corresponding part of the fixing cam receptacle snaps into the groove for engagement from behind, whereby the shaped part portions are securely interconnected.

The fixing device is advantageously formed in such a way that, when the shaped part portions have been joined, they are spaced from one another, at least in some regions, so that an intake gap for the air drawn in by the fan remains in the form of at least one further air passage opening. The desired air guidance can be ensured with little effort by means of this embodiment, without a complicated embodiment of the mould for producing the corresponding shaped part portion.

Further advantages, features and details of the invention will emerge from the following description, in which exemplary embodiments of the invention are described with reference to the drawings. The features mentioned in the claims and in the description may each be essential to the invention, either individually or in any combination.

The list of reference signs forms part of the disclosure. The drawings will be described coherently and comprehensively. Like reference signs denote like components.

In the drawings:

Figure 1 shows a perspective illustration of a respirator,

Figure 2 shows a perspective illustration of a sound-proofing housing according to the invention for the respirator,

Figure 3 shows a longitudinal section through the sound-proofing housing,

Figure 4 shows a perspective illustration of a first housing part of the sound-proofing housing,

Figure 5 shows another perspective illustration of the first housing part according to Figure 4,

Figure 6 shows a perspective illustration of a second housing part of the sound-proofing housing,

Figure 7 shows another perspective illustration of the second housing part according to Figure 6,

Figure 8 shows a perspective illustration of a shaped part of the sound-proofing housing,

Figure 9 shows another perspective illustration of the shaped part according to Figure 8,

Figure 10 shows a perspective illustration of a first portion of the shaped part according to Figures 8 and 9,

Figure 11 shows another perspective illustration of the first shaped part portion according to Figure 10,

Figure 12 shows a perspective illustration of a second portion of the shaped part according to Figures 8 and 9, and

Figure 13 shows another perspective illustration of the second shaped part portion according to Figure 12.

A respirator 21, as is shown in Figure 1, is used to assist a patient's breathing or to take on fully a patient's respiratory function. Parameters matched to the patient can be input via an input unit, for example a touchscreen 22. A processor/control unit (not illustrated here), which ensures the desired type of respiration for the patient by controlling accordingly a fan provided in the housing 23, is located within the housing 23. A connecting piece 24, to which a respiration tube (not illustrated here) for guiding air from the respirator 21 to a respiratory mask for patient respiration, is provided on the housing 23. The market for respirators 21 requires a compact design and low acoustic emission, in particular of the fan provided in the respirator 21.

A sound-proofing housing 31 according to the invention for a fan is illustrated in Figures 2 to 13, said housing being of compact construction and demonstrating advantageous soundproofing alongside simple production and ease of assembly of the housing 31. Such a housing 31 is advantageously arranged in a respirator 21, as is shown in Figure 1, to generate the desired airflow for patient respiration.

Figure 2 shows the sound-proofing housing 31 as a whole when put together. The housing 31 comprises a first cup-shaped housing part 41, a second cup-shaped housing part 51, and a shaped part 61 that is arranged in the housing 31 and of which substantially only the flange seal 63 arranged between the two housing parts 41 and 51 can be seen in Figure 2.

The housing parts 41 and 51 are interconnected in the region of four corners by means of connecting elements 32, such as screws and nuts. For easy accessibility of the connecting elements 32 and therefore for simple assembly of the housing 31, the first housing part 41 comprises correspondingly formed depressions 42 along its longitudinal extension, and the second housing part 51 comprises correspondingly formed depressions 52 along its longitudinal extension.

It can be seen from Figure 3 that, besides the shaped part 61, foam inserts 71 and 72 are provided in the region of the base portion 43 of the first housing part 41 and, additionally to the shaped part 61, in particular damp noise in the housing 31 produced by the airflow. It can also be seen here that the shaped part 61 and in particular the flange seal 63 thereof divides the interior of the housing 31 into an intake region 33 and into a delivery region 34.

The features of the first cup-shaped housing part 41 will be described hereinafter with reference to Figures 4 and 5. An intake opening 44 for the entry of air into the housing 31 is provided in the base portion 43 of the first housing part 41. The intake opening 44 has a cross section that tapers from the outer side of the base portion 43. This cross section tapers to an inner diameter of a substantially cylindrical sleeve portion 45, which protrudes from the base portion 43 into the first housing part 41. The tapering region of the intake opening 44 runs in a rounded manner. This embodiment of the intake opening 44 ensures an advantageous airflow into the housing 31 and also ensures that the acoustic emissions when the air flows into the housing 31 are considerably reduced.

Fastening domes 47 each protruding from the free edge 46 are provided in the corner regions of the free edge 46 of the first housing part 41. Through-openings 48 for at least part of the connecting element 32 are provided in each fastening dome 47 and each fully penetrate the corresponding fastening dome 47.

A housing recess 49, of which the function will be described hereinafter in conjunction with the shaped part 61, is also provided in a portion of the free edge 46 of the first housing part 41.

Furthermore, two guide receptacles 76 (Figure 3), of which the function will likewise be described hereinafter in conjunction with the shaped part 61, are provided inside the first housing part 41. Each guide receptacle 76 is formed by at least one of the

plurality of ribs 77 and a retaining tab 78. Each of the ribs 77 protrude perpendicularly from the corresponding side wall 50 of the first housing part 41 and extend, starting from the base portion 43, over regions in the direction of the free edge 46 of the first housing part 41. As can be seen in Figure 3, the individual ribs 77 may extend over different lengths. The retaining tabs 78 are each arranged substantially at the same distance from the inner side 50 of the first housing part 41 and run, starting from the base portion 43, in the direction of the free edge 46 of the first housing part 41. The free ends of the retaining tabs 78 each face one another. The length of the extension of the retaining tabs 78 is advantageously greater than the corresponding extension of the ribs 77. Furthermore, the ribs 77 and/or the retaining tabs 78 do not necessarily have to be connected to the corresponding inner face of the base portion 43. All of these ribs and/or retaining tabs, or at least individual ones thereof, may readily be spaced from the corresponding inner face of the base portion 43.

The features of the second cup-shaped housing part 51 will be described hereinafter with reference to Figures 6 and 7. A discharge opening 54 for the discharge of the drawn-in air from the housing 31 is provided in the base portion 53 of the second housing part 51.

A collar 55 protrudes around the discharge opening 51 from the outer side of the base portion 53. The outer diameter of the collar 55 is advantageously selected in such a way that, with an arrangement of the housing 31 in the respirator 21, this collar 55 comes to rest in the connecting piece 24 of the respirator 21. Struts running radially from the centre of the discharge opening 54 are also provided in said discharge opening and are used as a support for a membrane 116 (Figure 3), such that a check valve is formed at the discharge opening 54.

A relief opening 56, in which a pressure relief valve 57 for example is arranged, is further provided in the base portion 53 of the second housing part 51. In the event of an excessive pressure within the housing 31, this pressure can escape through said relief opening 56. An undesirably high overpressure can build up within the housing 31 for example if no air is drawn by the patient, but the fan 35 continues to compress drawn-in air. To improve the stability of the second housing part 51, a reinforcing rib 59 running from one side wall to the opposite side wall of the second housing part 51 is also provided on the inner side of the base portion 53, wherein

the discharge opening 54 is arranged on one side of the reinforcing rib 59 and the discharge opening 56 is arranged on the other side of the reinforcing rib 59.

Fastening dome recesses 81 for receiving the fastening domes 47 of the first housing part 41 are provided in the corner regions of the free edge 58 of the second housing part 51. The fastening dome recesses 81 are each penetrated by through-openings 80 for at least part of the connecting element 32. The inner diameter of a fastening dome recess 81 is greater than the inner diameter of the corresponding through-opening 80, so that a stop for the fastening dome 47 received in said fastening dome recess 81 is formed in the fastening dome recess 81 to ensure a defined spacing between the free edges 48 and 58 of the housing parts 41 and 51 when the housing 31 is put together.

Figures 8 and 9 show the shaped part 61 as a whole. The details of the shaped part 61 and the individual functions thereof will be described hereinafter with reference to Figures 10 to 13.

The shaped part 61 consists of a first shaped part portion 62 and a second shaped part portion 82, which are interconnected via a fixing device 92. The shaped part 61 and therefore the shaped part portions 62 and 82 are fabricated for example from a plastics material, advantageously from silicone, NBR, FKN or a suitable elastomer. In this case the two shaped part portions 62 and 82 do not necessarily have to be fabricated from the same material, although this is generally advantageous.

The first shaped part portion 62 (in particular see Figures 12 and 13) comprises the flange seal 63. A peripherally closed dome through-opening 64 for the passage of a respective fastening dome 47 of the first housing part 41 is provided in each corner region of the flange seal 63.

Fixing cam receptacles 93, which form a part of the fixing device 92, are provided on the intake side 65 of the flange seal 63. Retaining cams 97, which are used to hold a support element 96 for supporting the flange seal 63, also protrude from the intake side 65 of the flange seal 63 (Figure 8). The support element 96 fabricated from a sheet metal comprises, at its side edges, deflected portions 98, which, when the support element 96 is fixed, protrude in a manner facing away from the intake side 65. The size of the support element 96 is selected in such a way that, when the

housing 31 is put together, the support element 96 comes to rest via its deflected portions 98 within the first housing part 41.

A delivery-side guide element 67, which runs parallel to the side edges of the flange seal 63 and of which each of the ends are spaced from said side edges, protrudes in the form of an air-guiding device from the delivery side 66 of the flange seal 63, which is arranged opposite the intake side 65 of the flange seal 63. When the housing 31 is put together, the free edge of the delivery-side guide element 67 facing the base portion 53 of the second housing part 51 and the free edge of the reinforcing rib 59 in the second housing part 51 are arranged facing one another so that a narrowed air passage region is created therebetween. A plurality of support portions 68 for the delivery-side guide element 67 each spaced from one another and from the ends of the delivery-side guide element 67 are provided and extend from the delivery-side guide element 67 to the flange seal 63.

With reference to Figure 13, an air passage opening 69 spaced from the side edges of the flange seal 63 is provided after the delivery-side guide element 67 in the flange seal 63, which connects the intake region 33 of the housing 31 to the delivery region 34 thereof, and therefore is not visible in this figure. A guide portion 70 with a curved free end is provided on the intake side 65 of the flange seal 63 and connects the air passage opening 69 to an outlet 36, advantageously formed as a connecting piece, of the housing 35 and thus prevents an air short circuit between the intake region 33 and the delivery region 34.

An encompassing portion 101 and 102 is provided on each side edge of the flange seal 63 and extends along the flange seal 63 in a manner distanced from the ends of the corresponding side edge of the flange seal and substantially perpendicular to the plane spanned by the flange seal 63 and over the intake side 65 and the delivery side 66 of the flange seal 63. The encompassing portions 101 and 102 come to rest outside the two housing parts 41 and 51 when the housing 31 is assembled (for example see Figure 2).

A guide portion 103, which, when the housing 31 is put together, comes to rest within the first housing part 41, is provided on the inner side of the encompassing portion 102 at a distance therefrom. A cable through-opening 104 for the passage of cables 37 for the wiring of the fan 35 is provided in the encompassing portion 102. The cable through-opening 104 is formed in such a way that the edges thereof bear

tightly against the cable 37 guided therethrough and prevent an infiltration of moisture and/or dirt into the housing 31. The guide portion 103 comprises a guide through-opening 105 for the cable 37.

When the shaped part 61 is put together with the first housing part 41, at least one region of the encompassing portion 102 and therefore also the cable 37 in the housing recess 49 guided through the cable through-opening 104 comes to rest on the free edge 46 of the first housing part 41, so that said cable 37 is not damaged during the assembly process and simple assembly of the housing 31 is also ensured.

The second shaped part portion 82 comprises a substantially cup-shaped fan receptacle 83 for holding the fan 35 in the housing 31. The fan receptacle 83 comprises a base portion 84 having an air passage opening 85, which, when fixed on the first shaped part portion 62, faces the intake side 65 of the flange seal 63. At the free end remote from the intake side 65 of the flange seal 63, the fan receptacle 83 comprises a support flange 86 surrounding said fan receptacle, at least in some regions. The support flange 86 comprises three contact sides contacting the inner side of the first housing part 41 when the housing 31 is put together. Lip seals 87 are provided as seal elements on these contact sides of the support flange 86. Recesses 88 are formed in each of the corners of the support flange 86 and ensure tight contact against the accordingly rounded inner sides of the first housing part 41 when the housing 31 is put together. The lip seals 87 advantageously also extend along the recesses 88. A cable through-opening 89 for the passage of cables 37 for the wiring of the fan 35 is also provided in the support flange 86.

A plurality of fixing cams 94 protrude in the form of a further part of the fixing device 92 from the base portion 84, the free ends of said fixing cams being fixable in the fixing cam receptacles 93 in the flange seal 63 to connect the first shaped part portion 62 to the second shaped part portion 82. This fixing process is carried out for example via a clip device or by means of a suitable adhesive.

The fixing device 92 or the fixing cams 94 is/are formed in such a way that, when the two shaped part portions 62 and 82 are joined, they are distanced from one another. An intake gap 95 thus remains adjacent to the intake side 65 of the flange seal 63 as a further air passage opening for the air drawn in by the fan 35.

In the case of the side edge 90 of the support flange 86, which, when the housing 31 is put together, does not contact one of the inner sides of the first housing part 41, an intake-side guide element 111 having an air passage opening 112 protrudes from the support flange 86, more specifically from the side thereof remote from the intake side 65 of the flange seal 63. The intake-side guide element 111 has two side edges 113 running parallel to one another and a free edge 114. A support portion 115 for the intake-side guide element 111 is provided at a distance from the side edges 113 and extends in each case from the intake-side guide element 111 to the support flange 86. The free end of the support portions 115 is in each case distanced from the free edge 114.

A possible assembly of the housing 31 will be described hereinafter, which is to be considered as particularly advantageous. The sequence of the individual assembly steps can easily be varied according to the marginal conditions present or the adapted variants of the housing 31.

The two shaped part portions 62 and 82 are first connected to form the shaped part 61. The fan 35 is then inserted into the fan receptacle 83. The fan 35 preferably has an intake opening, which, in the inserted state, faces the air passage opening 85 in the base portion 84 of the fan receptacle 83 and is advantageously directly adjacent thereto. As has already been mentioned, the free end of the line portion 70 is connected to the outlet 36 of the fan 35. The fan 35 is then advantageously also wired by means of the cables 37.

The foam inserts 71 and 72 are then inserted in the first housing part 41. The shaped part 61 is then introduced into the first housing part 41 with the intake-side guide element 111 arranged to the fore. In doing so, the shaped part 61 is aligned in such a way that, as it is introduced, the free end region of the intake-side guide element 111 comes to rest in the guide receptacle 76 in the first housing part 41.

The shaped part 61 is inserted into the first housing part 41 until the flange seal 63 contacts the free edge 46 of the first housing part. In doing so, the dome through-openings 64 are penetrated by the fastening domes 47 at the free edge 46 of the first housing part 41 and the encompassing portion 102 on the flange seal 63 comes to rest, in some regions, in the housing recess 49 in the free edge 46 of the first housing part 41. The remaining peripheral portions 101 of the flange seal 63 in this position encompass the other sides of the free edge 46 of the first housing part 41.

The second housing part 51 is then arranged, wherein the free ends of the fastening domes 47 come to rest in the fastening dome recesses 81. The two housing portions 41 and 51 are fixedly interconnected by means of the connecting elements 32. Due to the contact created in the fastening dome recesses 81, it is ensured that the connection between the two housing parts 41 and 51 is sealed by the flange seal 63, but that the flange seal 63 itself is not compressed excessively during the assembly process.

The sound-proofing housing 31 is then ready for installation in a respirator 21.

If the fan 35 is started, air is drawn in thereby through the intake opening 44 into the intake region 33. The drawn-in air flows through the air passage opening 112, past the second shaped part portion 82, and through the intake gap 95 through the air passage opening 85 in the base portion 84 of the device receptacle 83 and into the fan 35. The drawn-in air flows over the device receptacle 83 on the outer side in the region between the flange seal 63 and the support flange 86 before it flows through the intake gap 95 and likewise infiltrates the fan 35 through the air passage opening 85 in the base portion 84 of the device receptacle 83. Before the drawn-in air flows through the air passage opening 112, it flows over the part of the fan that protrudes from the device receptacle 83 (generally a part of the motor of the fan) and thus continuously calls said part. This embodiment of the shaped part 61 advantageously ensures sufficient cooling of the fan 35 and in particular of the motor thereof.

The drawn-in air is compressed in the fan 35 and is guided through the outlet 36 through the line portion 70 and the air passage opening 69 in the flange seal 63 into the delivery region 34 of the housing 31. The compressed air exits the housing 31 through the discharge opening 54 in the base portion 53 of the second housing part 51.

The intake opening 44 and the discharge opening 54 are offset with reference to a central longitudinal axis of the housing 31 and are not arranged over the same axis running parallel to the inner sides of the housing 31.

Due to the guidance of the airflow by means of the guide elements 61 and 111 as well as the arrangement in particular of the air passage openings 69, 85 and 112 as well as the embodiment of the shaped part 61 *per se*, acoustic emissions occurring during operation of the fan 35 are considerably reduced compared to known

solutions. At the same time, the fan is sufficiently cooled and is therefore suitable for a long period of use, which likewise results in a long period of use of the respirator 21.

List of reference signs

21	respirator	61	shaped part
22	touch screen	62	first shaped part portion
23	housing	63	flange seal
24	connecting piece	64	dome through-opening
		65	intake side of 63
31	housing	66	delivery side of 63
32	connecting element	67	delivery-side guide element
33	intake region	68	support portion for 67
34	delivery region	69	air passage opening
35	fan	70	line portion
36	outlet of 35	71	foam insert
37	cable	72	foam insert
41	first housing part	76	guide receptacle
42	indentation of 41	77	rib
43	base portion of 41	78	retaining tab
44	intake opening		
45	sleeve portion at 44	80	through-opening in 81
46	free edge of 41	81	fastening dome recess
47	fastening dome	82	second shaped part portion
48	through-opening in 47	83	fan receptacle
49	housing recess	84	base portion of 83
50	side wall of 41	85	air passage opening
51	second housing part	86	support flange
52	indentation of 51	87	lip seal
53	base portion of 51	88	recess of 86
54	discharge opening	89	cable through-opening in 86
55	collar at 54	90	side edge of 86
56	relief opening		
57	pressure relief valve		
58	free edge of 51		
59	reinforcing rib		
92	fixing device	111	intake-side guide element
93	fixing cam receptacles	112	air passage opening in 111

94	fixing cams	113	side edge of 111
95	intake gap	114	free edge of 111
96	support element	115	support portion
97	retaining cam	116	membrane
98	deflected portion of 96		
101	encompassing portion		
102	encompassing portion		
103	guide portion		
104	cable through-opening in 102		
105	guide through-opening		

Patent Claims

1. A sound-proofing housing for a respirator (21), said housing comprising a first housing part (41), which has an intake opening (44) for the entry of air into the housing (31), said air being drawn in by a fan (35) arranged in the housing (31), and which also has a second housing part (51), which has a discharge opening for the discharge of the drawn-in air from the housing (31), said housing also comprising a shaped part (61) arranged in the housing (31), the shaped part (61) forming a flange seal (63), which comes to rest between the first housing part (41) and the second housing part (51) when the housing (31) is put together and divides the housing (31) into an intake region (33) and a delivery region (34), said housing further comprising a fan receptacle (83) for holding the fan (35) in the housing (31), said fan receptacle protruding from the intake side (65) of the flange seal (63) facing the intake region (33), and said housing also comprising air-guiding devices for guiding the air drawn in by the fan (35) within the housing (31), **characterised in that** a support flange (86), which comprises at least one air passage opening (112) for the air drawn in by the fan (35) as well as contact sides contacting the inner side of a housing part (41) when the housing (31) is put together, is provided in the region of the free end of the fan receptacle (83), and in that at least one further air passage opening (85) for the air drawn in by the fan (35) is provided in the fan receptacle (83), preferably adjacent to the intake side (65) of the flange seal (63).
2. The housing according to Claim 1, **characterised in that** seal elements, in particular lip seals (87), are provided on the contact sides of the support flange (86).
3. The housing according to Claim 1 or 2, **characterised in that** an intake-side guide element (111) having at least one air passage opening (112) protrudes in the form of an air-guiding device from the support flange (86).
4. The housing according to Claim 3, **characterised in that** at least one support portion (115) for the intake-side guide element (111) is provided and advantageously extends from the intake-side guide element (111) to the support flange (86).

5. The housing according to Claim 3 or 4, **characterised in that** at least one guide receptacle (76) for receiving a portion of the intake-side guide element (111) is provided in the housing part (41) in which the intake-side guide element (111) comes to rest when the housing (31) is put together.
6. The housing according to one of Claims 1 to 5, **characterised in that** one housing part (41) comprises at least one fastening dome (47) protruding from the free edge (46) of the housing part (41), and the other housing part (51) comprises at least one fastening dome recess (81) for receiving the at least one fastening dome (47) when the housing (31) is put together, a stop for the at least one fastening dome (47) advantageously being provided in the fastening dome recess (81) to ensure a defined spacing between the housing parts (41, 51) when the housing (31) is put together.
7. The housing according to Claim 6, **characterised in that** at least one dome through-opening (64) for the passage of the at least one fastening dome (47) is provided in the flange seal (63), the at least one dome through-opening (64) advantageously being peripherally closed.
8. The housing according to one of Claims 1 to 7, **characterised in that** a delivery-side guide element (67) is provided in the form of a further air-guiding device on the flange seal (63) and protrudes from the delivery side (66) of the flange seal, which is arranged opposite the intake side (65) of the flange seal (63), at least one support portion (68) for the delivery-side guide element (67) advantageously being provided and advantageously extending from the delivery-side guide element (67) to the flange seal (63).
9. The housing according to one of Claims 1 to 8, **characterised in that** at least one cable through-opening (104) for the passage of cables (37) for the wiring of the fan (35) is provided in the flange seal (63), the at least one cable through-opening (104) advantageously being provided in an encompassing portion (102), which protrudes from the flange seal (63), and a housing recess (49) for receiving at least a region of the encompassing portion (102) further advantageously being provided in the housing part (41) in which the encompassing portion (102) comes to rest when the housing (31) is put together.

10. The housing according to one of Claims 1 to 9, **characterised in that** at least one cable through-opening (89) for the passage of cables (37) for the wiring of the fan (35) is provided in the support flange (86) and/or in the intake-side guide element.
11. The housing according to one of Claims 1 to 10, **characterised in that** at least one air passage opening (69) advantageously spaced from the edge of the flange seal (63) is provided in the flange seal (63), a guide portion (70) advantageously being provided, which connects the air passage opening (69) to a delivery-side outlet (36) of the fan (35).
12. The housing according to one of Claims 1 to 11, **characterised in that** a support element (96) for supporting the flange seal (63) is provided and is advantageously arranged on the intake side (65) of the flange seal (63).
13. The housing according to one of Claims 1 to 12, **characterised in that** the shaped part (61) is formed at least in two parts, a first shaped part portion (62) comprising at least the flange seal (63) and the at least one further shaped part portion (82) comprising at least the fan receptacle (83), a fixing device (92) for connecting the first shaped part portion (62) to the at least one further shaped part portion (82) being provided.
14. The housing according to Claim 13, **characterised in that** the fixing device (92) comprises at least one fixing cam (94) provided on one of the shaped part portions (82) and at least one fixing cam receptacle (93) provided in the other shaped part portion (62), the at least one fixing cam (94) being fixable in said fixing cam receptacle, the fixing device (92) advantageously being formed in such a way that, when the shaped part portions (62, 82) have been joined, they are spaced from one another, at least in some regions, so that an intake gap (95) for the air drawn in by the fan (35) remains in the form of at least one further air passage opening.
15. A respirator (21) having a sound-proofing housing (31) according to one of Claims 1 to 14.
16. A sound-proofing housing for a respirator comprising:
a first housing part;

said first housing part having an intake opening permitting entry of air into said housing;

a fan arranged in said housing to draw in air;

a second housing part;

said second housing part having a discharge opening;

a shaped part arranged in said housing, said shaped part forming a flange seal resting between said first and second housing parts;

an intake region in said housing;

a delivery region in said housing;

said shaped part dividing said housing into said intake and delivery regions;

said flange seal having an intake side facing said intake region;

a fan receptacle configured to hold said fan, said fan receptacle protruding from said intake side of said flange seal; said fan receptacle having a free end;

air guides configured to guide air drawn into said housing by said fan;

a support flange, said support flange having at least one air passage opening, said support flange having contact sides contacting inside said housing, said support flange being provided in the region of a free end of said fan receptacle; and, at least one further air passage opening for air drawn in by said fan, said at least one further air passage opening being provided in said fan receptacle adjacent to said flange seal intake side.

17. A sound-proofing housing for a respirator as claimed in claim 16 further comprising:

lip seals provided on said support flange contact sides.

18. A sound-proofing housing for a respirator as claimed in claim 16 further comprising:

an intake-side air guide protruding from said support flange, said intake-side air guide having at least one respective air passage opening.

19. A sound-proofing housing for a respirator as claimed in claim 18 further comprising:

said intake-side air guide having a support portion extending between said intake-side air guide and said support flange.

20. A sound-proofing housing for a respirator as claimed in claim 18 further comprising:

a guide receptacle receiving at least a portion of said intake-side air guide, said guide receptacle resting in the same housing part as the intake-side air guide.

21. A sound-proofing housing for a respirator as claimed in claim 16 further comprising:

a respective one of said first and second housing parts includes at least one fastening dome, said at least one fastening dome protruding from a free edge of said respective one of said first and second housing parts;

the respective other one of said first and second housing parts including at least one fastening dome recess configured to receive said at least one fastening dome; and,

a stop for said at least one fastening dome, said stop being provided in said fastening dome recess to define spacing between assembled first and second housing parts.

22. A sound-proofing housing for a respirator as claimed in claim 21 further comprising:

a dome through-opening in said flange seal, said dome through-opening being peripherally closed.

23. A sound-proofing housing for a respirator as claimed in claim 16 further comprising:

a delivery-side air guide, said delivery-side air guide protruding from a delivery side of said flange seal; and,

at least one support portion for said delivery-side air guide extending from said delivery-side air guide to said flange seal.

24. A sound-proofing housing for a respirator as claimed in claim 16 further comprising:

at least one cable through-opening provided in said flange seal, said at least one cable through-opening being provided in an encompassing portion protruding from said flange seal;

a housing recess configured to receive at least a portion of said encompassing portion, said housing recess being provided in the same housing part as said encompassing portion.

25. A sound-proofing housing for a respirator as claimed in claim 16 further comprising:
 - at least one cable through-opening provided in said support flange.
26. A sound-proofing housing for a respirator as claimed in claim 18 further comprising:
 - at least one cable through-opening provided in said intake-side air guide.
27. A sound-proofing housing for a respirator as claimed in claim 16 further comprising:
 - an air passage opening provided in said flange seal; and,
 - a guide portion, said guide portion connecting said air passage opening to a delivery-side outlet of said fan.
28. A sound-proofing housing for a respirator as claimed in claim 16 further comprising:
 - a flange seal support arranged on said intake side of said flange seal.
29. A sound-proofing housing for a respirator as claimed in claim 16 further comprising:
 - a shaped part, said shaped part including a first portion that includes said flange seal, said shaped part including a second portion that includes said fan receptacle; and,
 - a fixation arrangement configured to connect said shaped part first portion to said shaped part second portion.
30. A sound-proofing housing for a respirator as claimed in claim 29 further comprising:
 - said fixation arrangement including at least one fixing cam provided on a respective one of said first and second portions of said shaped part, said fixation arrangement also including at least one fixing cam receptacle provided on the respective other one of said first and second portions of said shaped part; and,
 - said fixation arrangement providing at least some spacing between said first and second portions in assembly, an intake gap being formed by said spacing, said intake gap having the form of at least one additional air passage opening.

31. A sound-proofing housing for a respirator comprising:
 - a first housing part;
said first housing part having an intake opening permitting entry of air into said housing;
 - a fan arranged in said housing to draw in air;
 - a second housing part;
said second housing part having a discharge opening;
 - a shaped part arranged in said housing, said shaped part forming a flange seal resting between said first and second housing parts;
 - an intake region in said housing;
 - a delivery region in said housing;
said shaped part dividing said housing into said intake and delivery regions;
 - said flange seal having an intake side facing said intake region;
 - a fan receptacle configured to hold said fan, said fan receptacle protruding from said intake side of said flange seal; said fan receptacle having a free end;
 - air guides configured to guide air drawn into said housing by said fan;
 - a support flange, said support flange having at least one air passage opening, said support flange having contact sides contacting inside said housing, said support flange being provided in the region of a free end of said fan receptacle;
at least one further air passage opening for air drawn in by said fan, said at least one further air passage opening being provided in said fan receptacle adjacent to said flange seal intake side; and,
 - an intake-side air guide protruding from said support flange.

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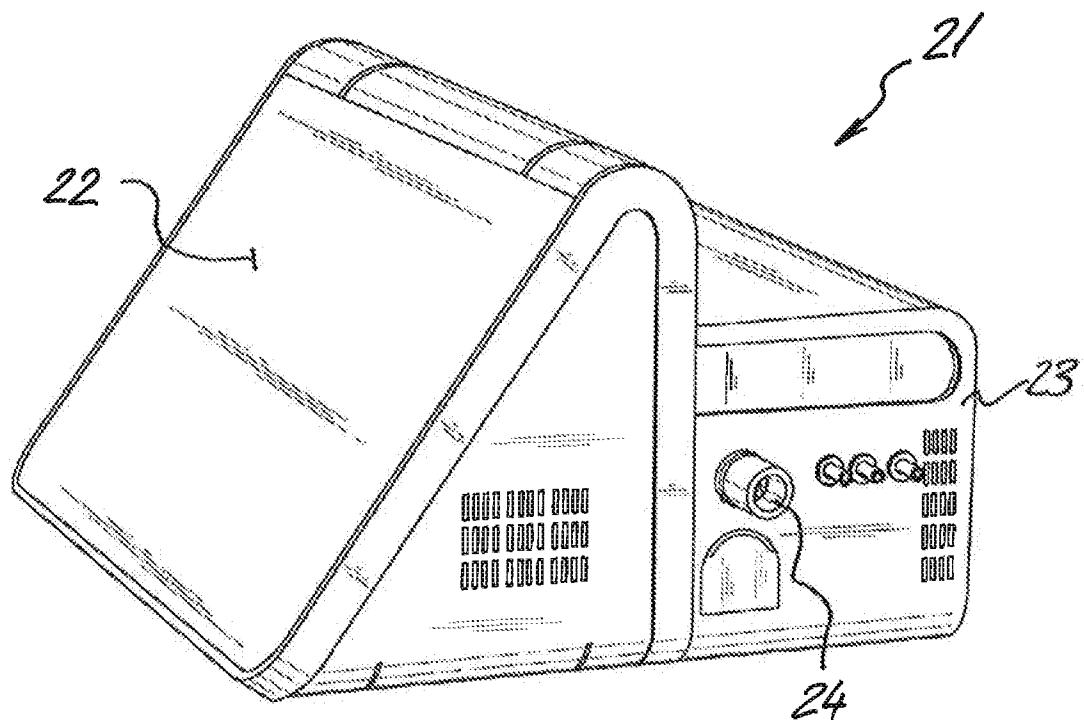


FIG 1

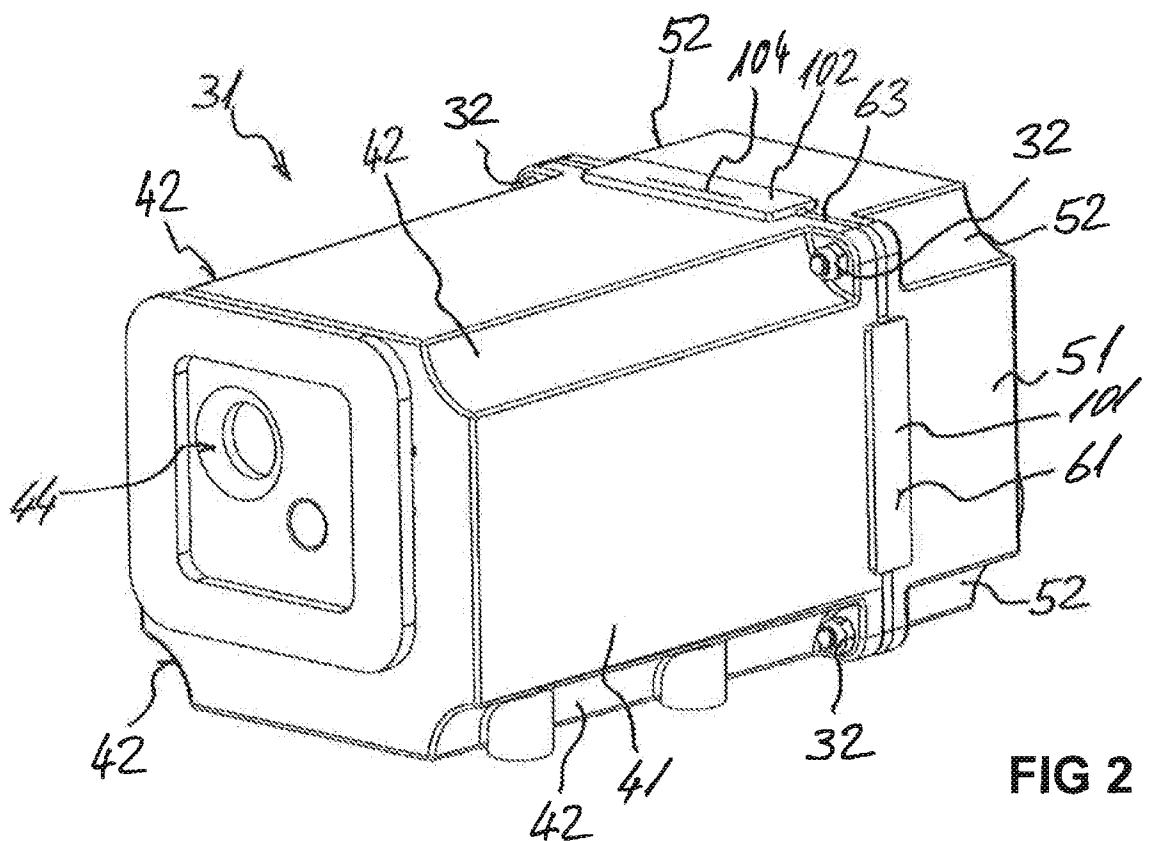


FIG 2

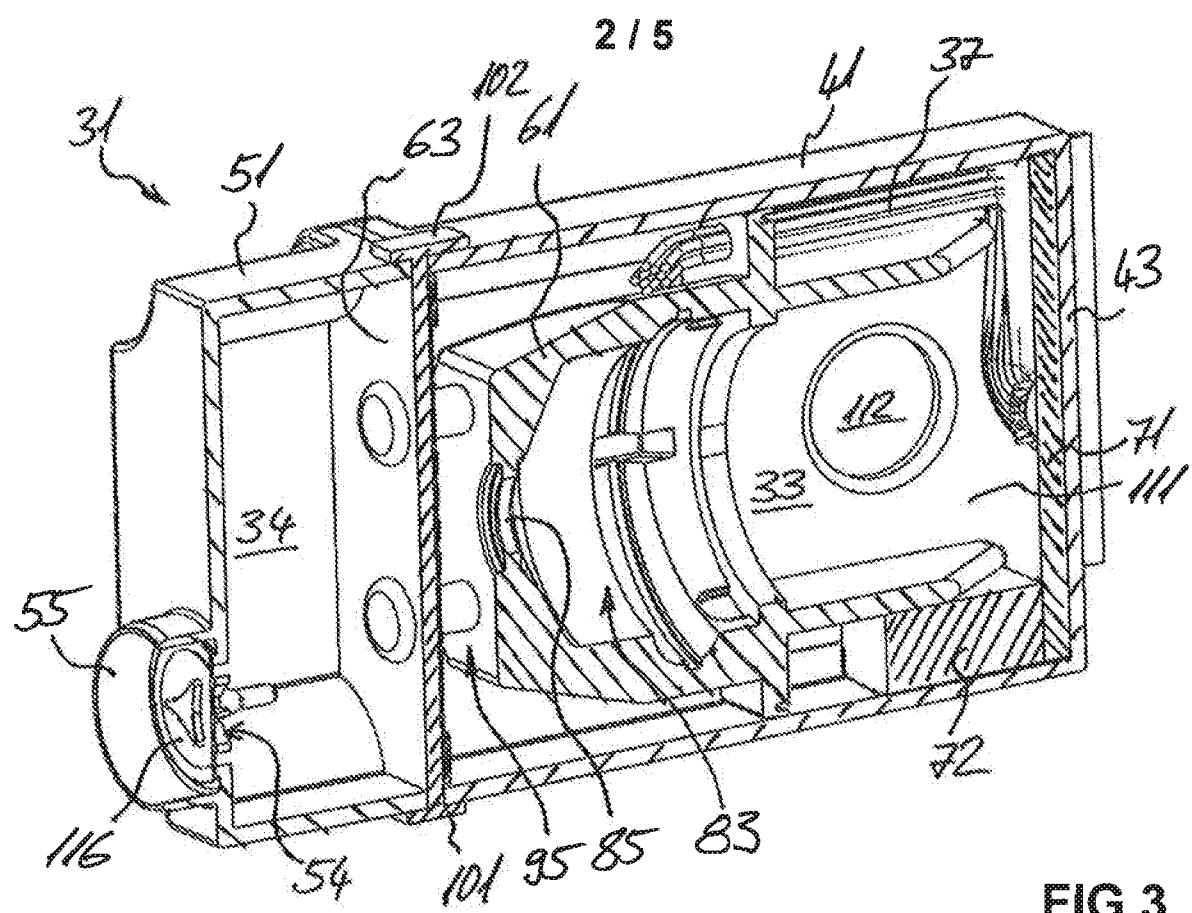


FIG 3

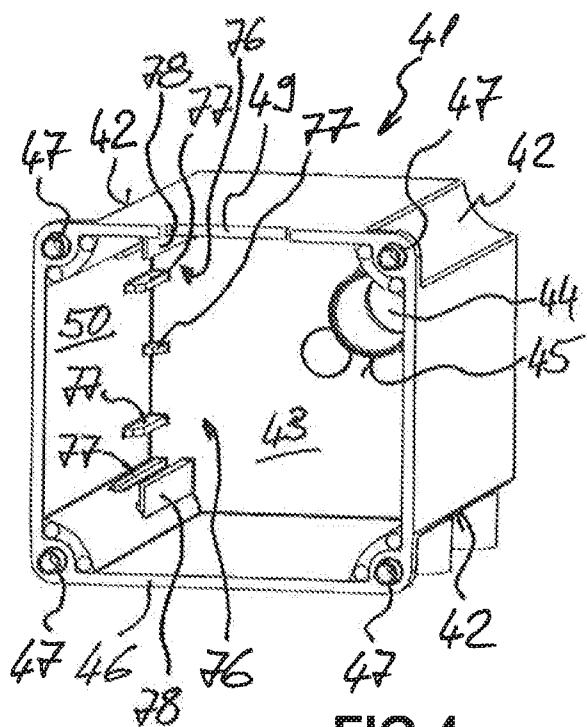


FIG 4

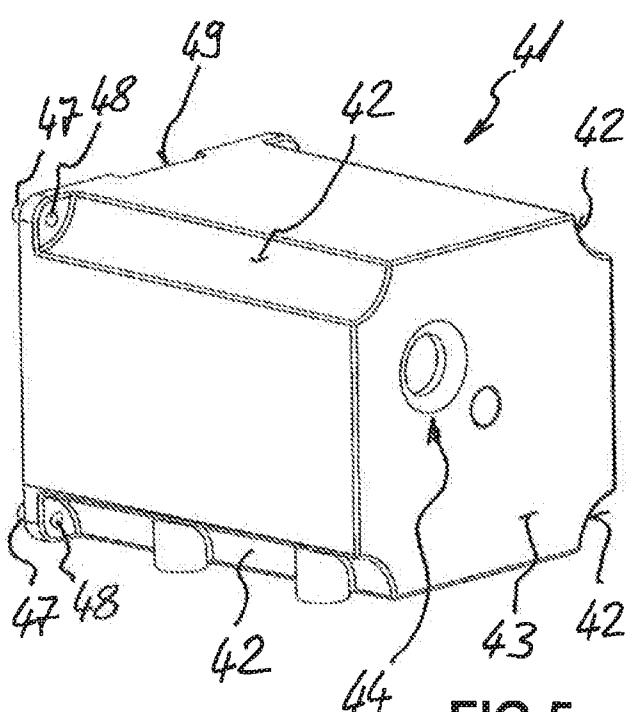
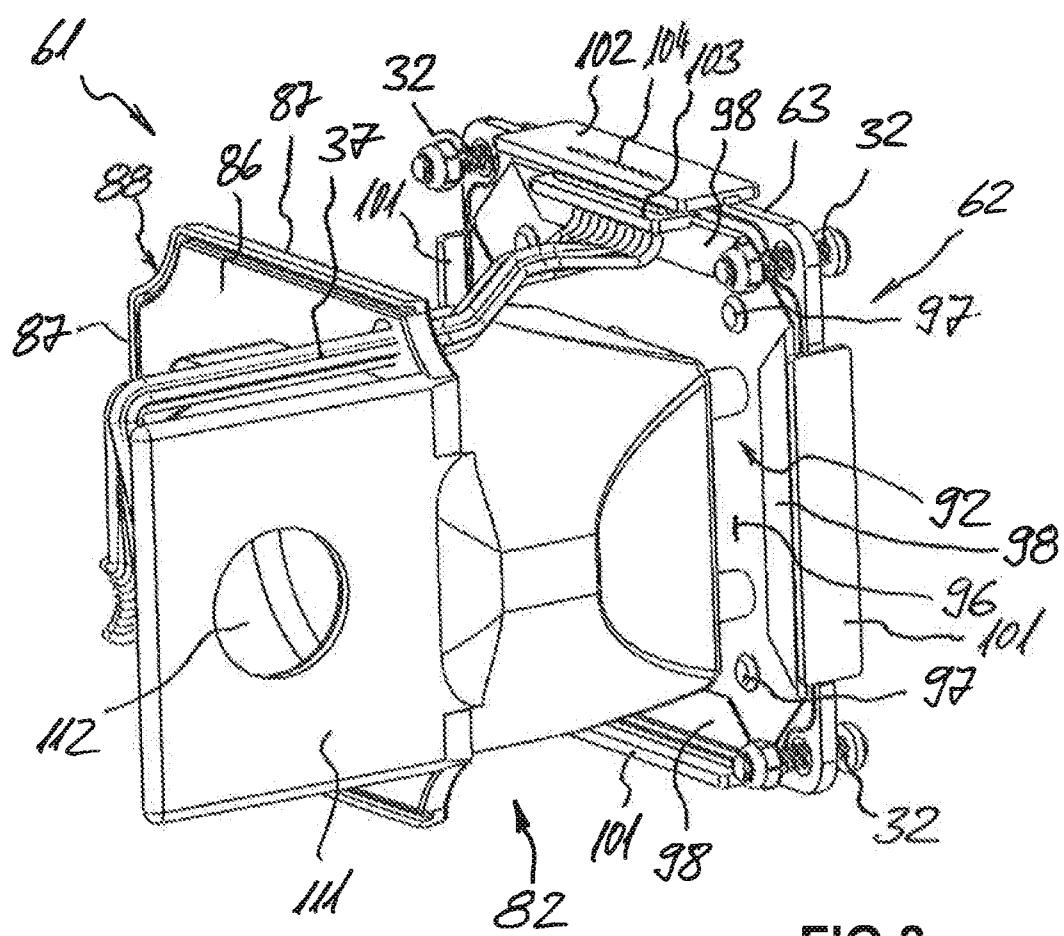
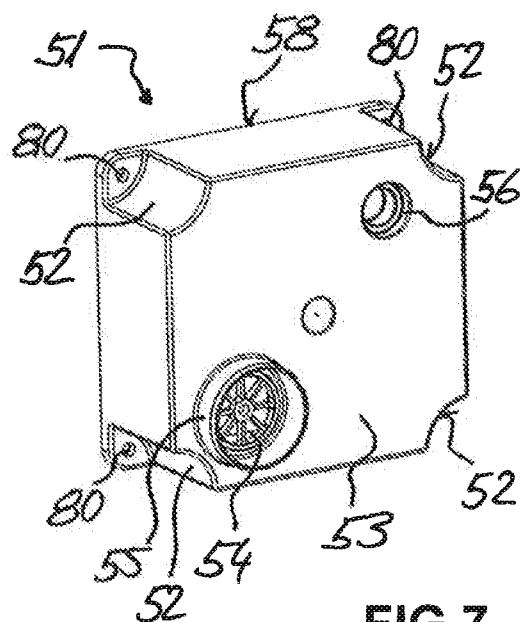
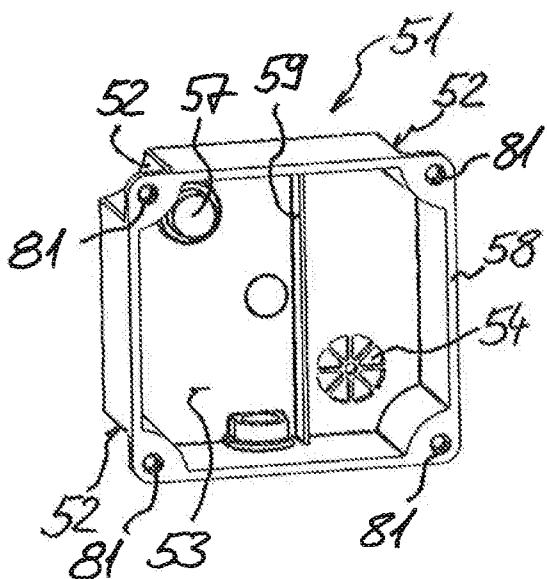


FIG 5

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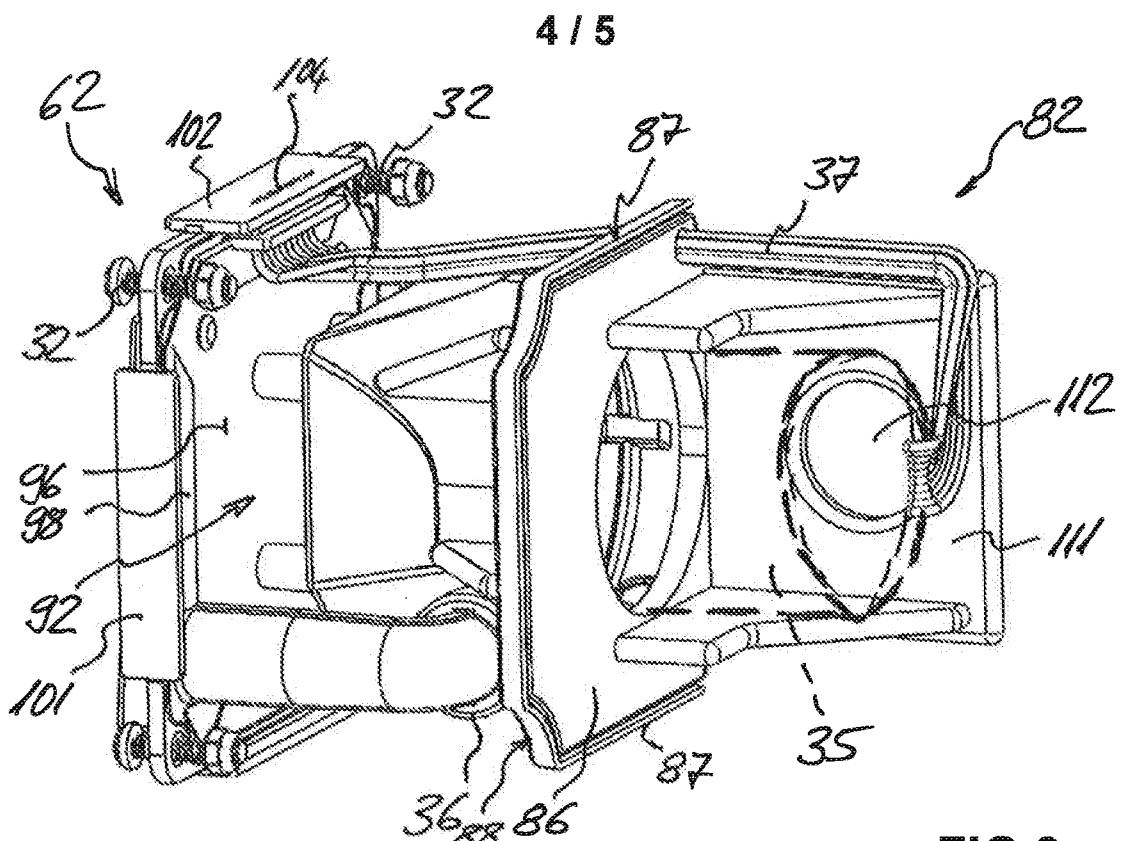


FIG 9

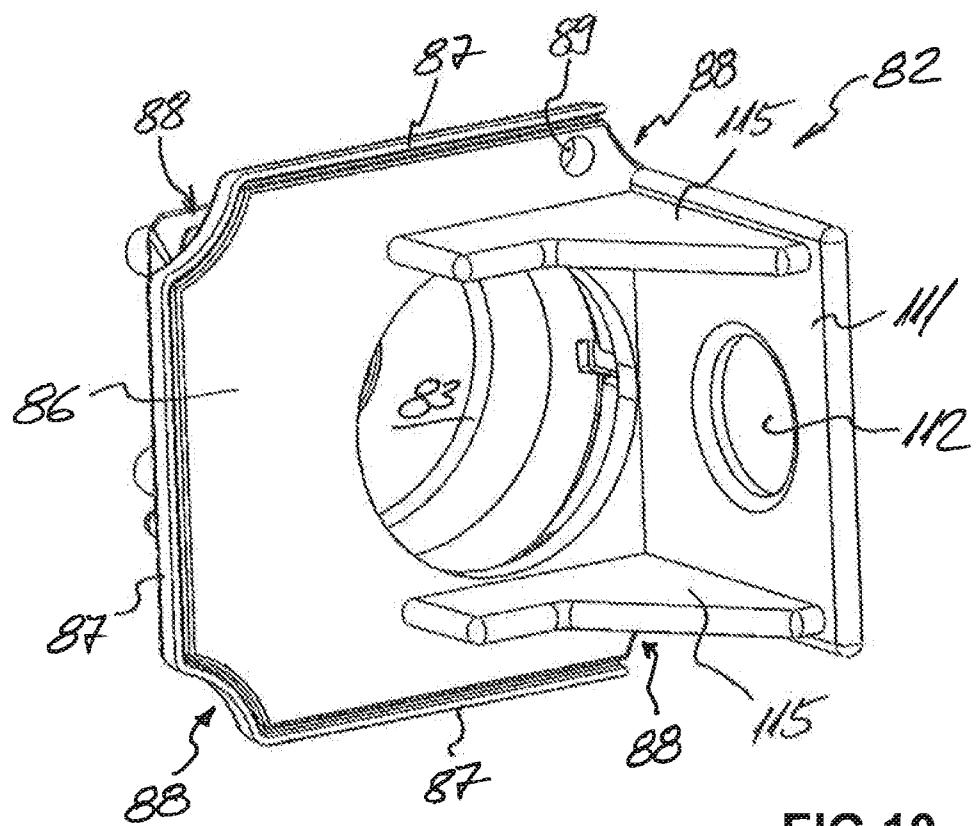
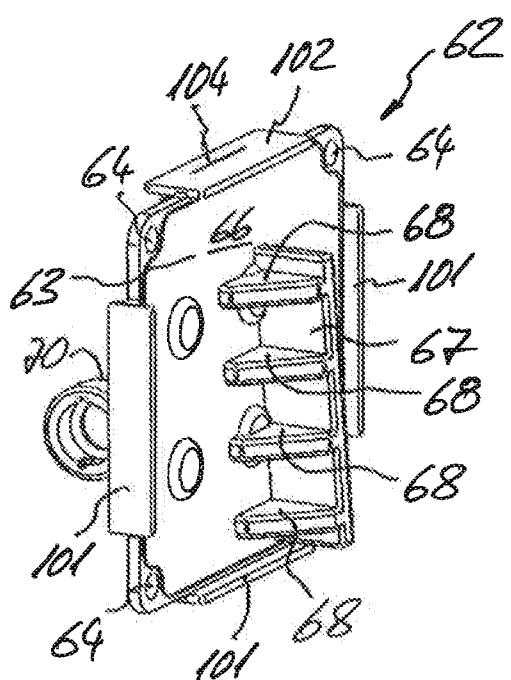
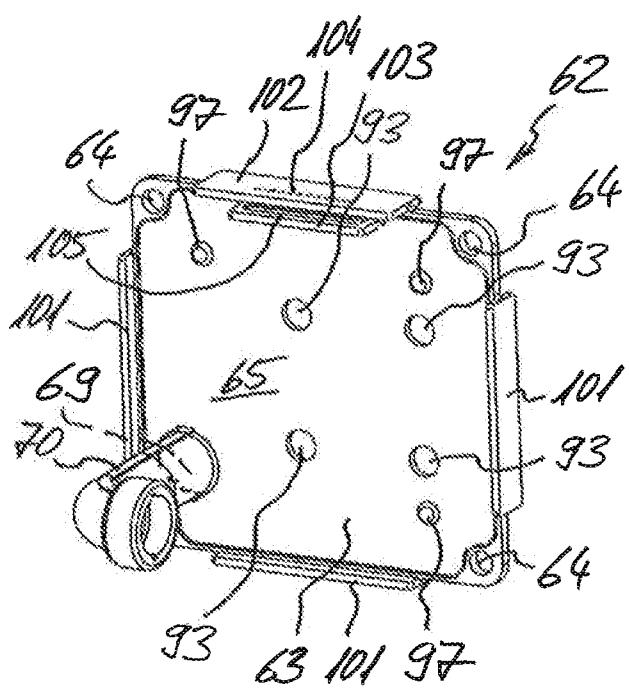
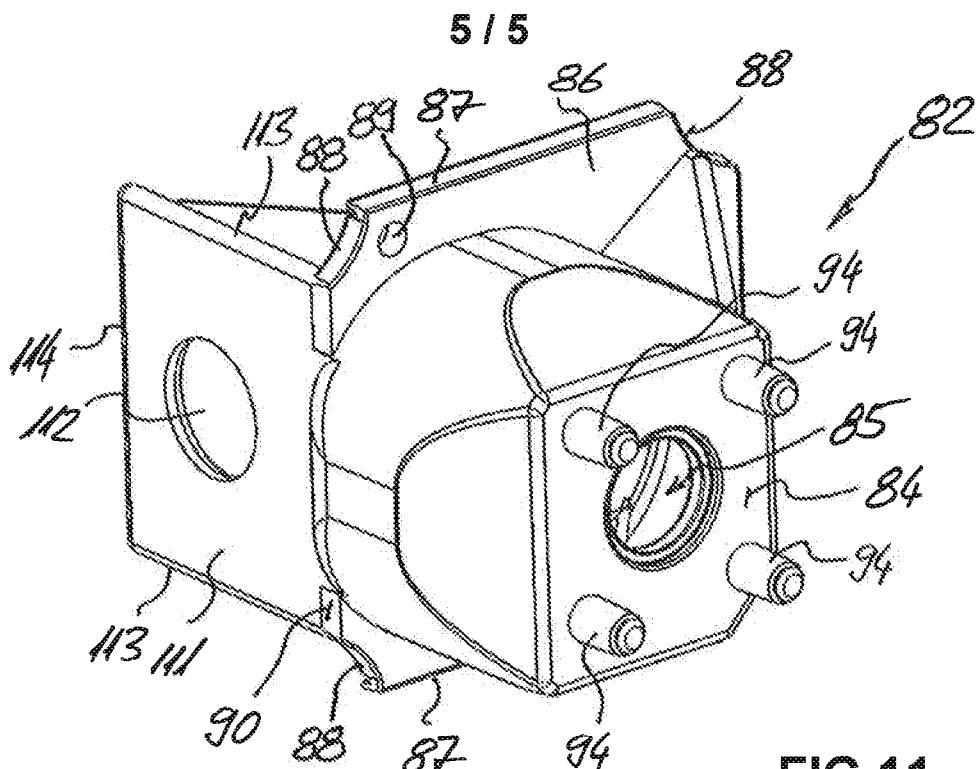


FIG 10



INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2013/050930

A. CLASSIFICATION OF SUBJECT MATTER
INV. F04D29/40
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)
B60H A61M H02K F04D A61B A62B

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	WO 2009/067583 A2 (AVON PROT SYSTEMS INC [US]; TILLEY GREG A [US]; WILCOX JAMES [US]) 28 May 2009 (2009-05-28) paragraphs [0034] - [0038], [0050]; figures 1,2,8	1-13, 15-29, 31
A	----- WO 2011/017763 A1 (RESMED MOTOR TECHNOLOGIES INC [US]; FU TIMOTHY TSUN-FAI [AU]; MARTIN D) 17 February 2011 (2011-02-17) abstract; figures 12,33	14,30
A	----- EP 0 669 141 A2 (ADAHAN CARMELI [IL]) 30 August 1995 (1995-08-30) abstract; figure 1	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search 19 April 2013	Date of mailing of the international search report 07/05/2013
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer de Martino, Marcello

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2013/050930

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