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(54) **MODULAR EXTENSIBLE LAMP AND MODULAR HEAT SINK**

(57) A modular heat sink 1 includes a heat radiating plate 11, a housing 12, a lateral latching portion 14, and a lateral connecting member 17. The housing is connected to the heat radiating plate 11, the heat radiating plate 11 and the housing 12 are provided with fins 13. The latching portion 14 and the lateral connecting member

17 are positioned on a middle position of the housing 12, when two modular heat sinks 1 are connected together, the lateral latching portion 14 of one modular heat sink 1 is configured to be fastened to the lateral connecting member 17 of the other modular heat sink via a lateral fastener 5. A modular extensible lamp is further provided.

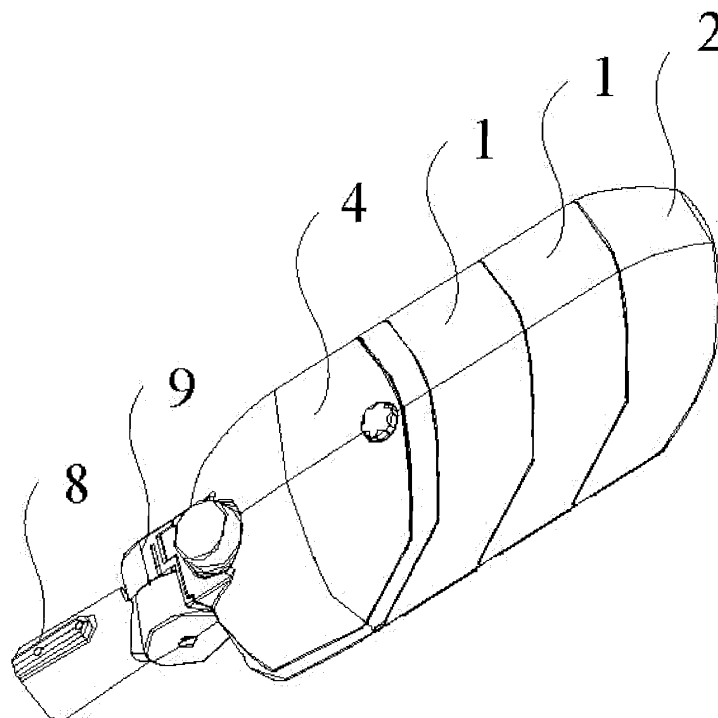


FIG. 1

EP 3 064 826 A1

Description

FIELD OF THE INVENTION

[0001] The present disclosure relates to a field of lighting technology, and more particularly relates to a modular extensible lamp and a modular heat sink.

BACKGROUND OF THE INVENTION

[0002] LED street lamp is widely applied in daily life, and innovative products are constantly supplied to the market. The conventional LED street lamp mainly is a street lamp integrally formed by LED and a lamp body, or a street lamp formed by a modularization LED. Generally, assembly/production procedure and after-sale maintenance are complicated. A fixing structure of a modular heat sink is generally secured by screws. The screws rust easily, and assembly and disassembly procedure are complicated, an operation thereof is inconvenient. Further, in a vibration environment besides the street for a long time, the screws loose easily. Thus, safety hazards emerge easily and a maintenance cost is increased.

[0003] Further, accompanying to a large scale popularization and application of the LED street lamp, the street lamps manufactured by most of enterprises have a constant power or a fixed shape. When the power is required to be changed, it is necessary to redevelop a mould and redesign an electric circuit. LED street lamp casing is a heat sink body, thus when the power of the street lamp is changed, it is necessary to redevelop a mould, the cost of developing a mould is high. A common company is unable to bear a great deal of cost for developing a large scale of moulds. At the same time, the casing serving as a heat sink body cannot obtain a desirable result. In a poor environment, dusts are accumulated on the casing which is configured for heat dissipating, causing the heat cannot dissipate out. The LED works under such environments, reliability and service life of the LED street lamp is sharply reduced, seriously restricting a development and application of the LED street lamp, causing the energy conservation and emission reduction cannot be promoted in a large scale. Further, the modularization extensible LED lamp in the current market generally adopts aluminum for extrusion molding, fins expose outside, resulting in an ugly appearance.

SUMMARY OF THE INVENTION

[0004] Therefore, it is necessary to provide a modular extensible lamp with a simple structure which is easy to assembly and disassembly, and a modular heat sink of the modular extensible lamp.

[0005] A modular heat sink includes a heat radiating plate, a housing, a lateral latching portion, and a lateral connecting member. The housing is connected to the heat radiating plate, the heat radiating plate and the hous-

ing are provided with fins. The latching portion and the lateral connecting member are positioned on a middle position of the housing, when two modular heat sinks are connected together, the lateral latching portion of one modular heat sink is configured to be fastened to the lateral connecting member of the other modular heat sink via a lateral fastener.

[0006] A modular extensible lamp includes a base, at least one above described modular heat sink, and a light source module. The base includes a substrate, the substrate is provided with a lateral connecting portion. The base and one modular heat sink are fixedly connected via one lateral fastener extending through the lateral connecting portion and the lateral connecting member. The number of the light source module is equal to that of the modular heat sink, and one light source module is connected to one modular heat sink.

[0007] The modular extensible lamp of the invention includes two or more light source modules and at least two modular heat sinks connected to the light source modules, and one modular heat sink is corresponding to one light source module, the heat dissipation effect is good. The modular heat sinks are connected sequentially via the lateral fasteners and the vertical fasteners, the structure is simple, and operation is convenient. The modular extensible lamp can be manufactured with different number of light source modules (the length of the lamp is different) according to a requirement of lighting due to different places, the number can be increased, reduced, it is flexible and environment-friendly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] These and other features of the present invention will become readily apparent upon further review of the following specification and drawings. In the drawings, like reference numerals designate corresponding parts throughout the views. Moreover, components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present disclosure.

FIG. 1 is a perspective view of a modular extensible lamp according to an embodiment;

FIG. 2 is another perspective view of the modular extensible lamp according to an embodiment;

FIG. 3 is another perspective view of the modular extensible lamp according to an embodiment;

FIG. 4 is an exploded view of the modular extensible lamp of FIG. 1;

FIG. 5 is a sectional view of the modular extensible lamp of FIG. 2, taken along line A-A;

FIG. 6 is a partial, enlarged view of the modular extensible lamp according to an embodiment;

FIG. 7 is a partial, enlarged view of the modular extensible lamp according to an embodiment;

FIG. 8 is a perspective view of a spirit level according to an embodiment;

FIG. 9 is a perspective view of the modular heat sink according to an embodiment;

FIG. 10 is a partial, perspective view of the modular extensible lamp according to an embodiment; and

FIG. 11 is an enlarged view of circled portion XI of FIG. 5.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0009] Embodiments of the invention are described more fully hereinafter with reference to the accompanying drawings. The various embodiments of the 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. Elements that are identified using the same or similar reference characters refer to the same or similar elements.

[0010] It will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, if an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present.

[0011] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein

[0012] Referring to FIG. 1 through FIG. 4, as one of the important parts of a modular extensible lamp, an embodiment of a modular heat sink 1 is configured to be connected with a light source module 3, and dissipate heat for the light source module 3 and the whole modular extensible lamp. Multiple modular heat sinks 1 can be connected to each other sequentially. The modular heat sink 1 includes a heat radiating plate 11, a housing 12 connected to the heat radiating plate 11, and fins 13 (see FIG. 7) connected to the heat radiating plate 11 and the housing 12.

[0013] In an embodiment, the housing 12 extends upward from joining portions of the heat radiating plate 11 and the housing 12, and leans forward (along direction B as shown in FIG. 4) to form an anteverted arch shape. The housing 12 is provided with a cross beam 121 (as shown in FIG. 7) and is connected to the heat radiating plate 11. The housing 12, the cross beam 121, and the heat radiating plate 11 cooperatively forms a receiving chamber for receiving the fins 13. Specifically, referring to FIG. 7, the fins 13 includes first fins 131 and second

fins 132. A number of first fins 131 are horizontally arranged on the heat radiating plate 11, a number of the second fins 132 match with the arch shape housing 12 and are located within the receiving chamber formed by the housing 12, the cross beam 121, and the heat radiating plate 11. When the housing 12 in an anteverted arch shape, the number of second fins 132 match with the anteverted shape, and are inclined upward. Specifically, the cross beam 121 is additionally connected to the housing 12, and also can be integrally formed with the housing 12. Each modular heat sink 1 is used cooperatively with one light source module 3. The receiving chamber formed by the housing 12 and the heat radiating plate 11 and the fins 13 arranged within the receiving chamber can dissipate heat effectively. Preferably, the heat radiating plate 11 and/or the housing 12 and/or the fin 13 is casted from aluminum alloy material which has a high thermal conductivity and a high strength, further enhancing the heat dissipation effect.

[0014] Referring to FIGs. 4-6 and FIG. 9, two or more modular heat sinks 1 can be connected together sequentially by fasteners. In the illustrated embodiment, the cross beam 121 of each modular heat sink 1 is provided with a lateral latching portion 14 and a lateral connecting member 17 (as shown in FIG. 11). The lateral latching portion 14 of one modular heat sink 1 is positioned on a position of the cross beam 121 which corresponds to a position of the lateral connecting member 17 of another one modular heat sink 1 on the cross beam 121, the two modular heat sinks 1 are connected with each other, i.e. when connecting, one lateral fastener 5 extends through the lateral latching portion 14 of one modular heat sink 1 and one lateral connecting member 17, and is fixedly locked, thereby the two modular heat sinks 1 are connected together. Specifically, the lateral latching portion 14 can be a latching member positioned on the cross beam 121, and also can be a latching hole defined on the cross beam 121. The lateral connecting member 17 is a connecting hole defined on the cross beam 121. Preferably, when the modular heat sink 1 includes only one lateral latching portion 14 and one lateral connecting member 17, the lateral latching portion 14 and the lateral connecting member 17 are positioned on the middle portion of the cross beam 121. Preferably, the number of the lateral latching portions 14 and the lateral connecting members 17 are two or more. Preferably, the lateral latching portion 14 and the lateral connecting member 17 of each modular heat sink 1 are arranged at a same height level. During the actual operation, it can be operated via an installation tool as shown in FIG. 7. Adopting such structures, the lateral latching portion 14 can fix the lateral fastener 5 well, avoiding loosening between the number of modular heat sinks 1

[0015] Referring to FIG. 11, in an embodiment, the housing 121 is provided with a first latching portion 18 and a second latching portion 19. The first latching portion 18 and the second latching portion 19 are positioned at the front and rear ends of a central line along a connection

expansion direction of the modular heat sink 1, respectively. When the two modular heat sinks 1 are connected, the first latching portion 18 of one modular heat sink 1 latches with the second latching portion 19 of another modular heat sink 1, thereby enabling to establish a much more stable connection between the two modular heat sinks 1. Specifically, the second latching portion 19 is in a stepped shape and extends along the connection expansion direction of the modular heat sink 1. The first latching portion 18 is in a reversed stepped shape matching with the stepped shape second latching portion 19. Preferably, the first latching portion 18 is close to an upper of the lateral latching portion 14, and the second latching portion 19 is close to an upper of the lateral connecting member 17. Preferably, the first latching portion 18 is provided with an L-shaped latching position 181. When the two modular heat sinks 1 are connected, the L shaped latching position 181 is configured for latching with an edge of the lateral connecting member 17.

[0016] Referring to FIG. 4, FIG. 5 and FIG. 9, in an embodiment, the modular heat sink 1 is further provided with a vertical latching portion 15 and a vertical connecting member 16. When connecting, a vertical fastener 6 matches with the vertical latching portion 15 of one modular heat sink 1 and the vertical connecting member 16 of another modular heat sink 1 to connect the two modular heat sinks 1. Specifically, the vertical latching portion 15 and the vertical connecting member 16 are respectively arranged at the front and rear ends of a connection expansion longitudinal direction of the modular heat sink 1. More concretely, the vertical latching portion 15 is positioned on an end of the heat radiating plate 11 which is adjacent to another modular heat sink 1. Further, the vertical latching portion 15 is can be a latching member positioned on the heat radiating plate 11, and also can be a latching hole defined on the heat radiating plate 11. Specifically, the position of the vertical connecting member 16 on the heat radiating plate 11 corresponds to the position of the vertical latching portion 15 which is connected to the vertical connecting member 16. Further, the vertical connecting member 16 can be a connecting hole which is defined on an edge of the heat radiating plate 11 and matches with another one modular heat sink 1, the vertical connecting member 16 can also be a connecting sheet extending from the heat radiating plate 11, and the connecting sheet defines a connecting hole. Preferably, when the number of the vertical latching portion 15 and the vertical connecting member 16 are only one, the vertical latching portion 15 and the vertical connecting member 16 are arranged on a central line of the heat radiating plate 11 along a connecting direction of the modular heat sinks 1. Probably, the number of the vertical latching portion 15 and the vertical connecting member 16 of each one heat radiating plate 11 are two or more. The matching between vertical connecting member 16 and the vertical latching portion 15 allows a stable connection between two or more modular heat sinks 1, providing a high vibration resistance, avoiding a loose and

a weak connection between the modular heat sinks 1.

[0017] Referring to FIG. 1, the modular extensible lamp of the invention includes at least one modular heat sink 1, a light source module 3 connected to the modular heat sink 1, and a base 4 connected to the modular heat sink 1.

[0018] Specifically, referring to FIG. 3 and FIG. 4, in an embodiment, the number of the light source module 3 is equal to that of the modular heat sinks 1. Two or more modular heat sinks 1 are connected sequentially via the lateral fastener 5 or the vertical fastener 6, one modular heat sink 1 is connected to base 4. Each modular heat sink 1 is corresponding to one light source module 3, specifically, the light source module 3 is connected to a bottom of the heat radiating plate 11. Specifically, the light source module 3 includes a substrate plate and a number of light sources arranged on the substrate plate. Preferably, the light source is a LED lamp. Preferably, the light source is a high power light source.

[0019] Referring to FIG. 4 and FIG. 10, specifically, in an embodiment, the base 4 includes a substrate 41, a cover 42, and a fixing member 43 connecting the cover 42 to the substrate 41. Specifically, the cover 42 and the substrate 41 each defines a connecting hole connected together by the fixing member 43. The cover 42 covers the substrate 41, and forms a confined space. Specifically, the substrate 41 is provided with a lateral connecting portion 411 received within the confined space formed by the cover 42 and the substrate 41. When the substrate 41 is connected to one modular heat sink 1, one lateral fastener 5 extends through the lateral connecting portion 411 and fixedly locks with the lateral connecting member 17 of the modular heat sink 1 which is connected to the base 4, thereby connecting the base 4 with the modular heat sink 1. In alternative embodiment, the substrate 41 is further provided with a vertical connecting portion 412, when the base 4 is connected to one modular heat sink 1, the lateral fastener 5 is locked, at the same time, one vertical fastener 6 extends through the vertical connecting portion 412 and fixedly locks with one vertical connecting member 16 of one modular heat sink 1 which is connected to the base 4, thereby more firmly securing the base 4 to the modular heat sink 1. Specifically, the structure of the vertical connecting portion 411 is the same as the vertical latching portion 14, the vertical connecting portion 412 is the same as the vertical latching portion 15. Preferably, the shape and size of the base 4 match with or are similar to the modular heat sink 1. Specifically, the substrate 41 includes a substrate body 413 and a connecting body 414 extending from the substrate body 413, and the size and the shape of the substrate body 413 is same as that of the heat radiating plate 11, the vertical connecting portion 412 is positioned on the substrate body 413. The size and the shape of the connecting body 414 is same as that of the housing 12, the lateral connecting portion 411 is positioned on the connecting body 414. Therefore, the assembled modular extensible lamp seems much more attractive. Preferably, the fixing member 43 is a hand tight-

ens screw or a hand tighten bolt, therefore, the connecting can be achieved by hand without using other tool.

[0020] In other embodiment, two or more modular heat sinks 1 are connected to each other sequentially as described in above embodiments. In above embodiment, two or more modular heat sinks 1 are connected or the base 4 is connected to the modular heat sink 1, after connection, the lateral fastener 5 and the vertical fastener 6 both are hidden in the chamber formed by the heat radiating plate 11 and the housing 12, and are shielded by the housing 12, i.e. after the whole modular extensible lamp is assembled, the lateral fastener 5 and the vertical fastener 6 cannot be seen from the outer of the lamp.

[0021] Referring to FIG. 4 and FIG. 5, in the embodiment, among two or more modular heat sinks 1, one modular heat sink 1 is the head modular heat sink 2. The head modular heat sink 2 has a structure same as other modular heat sinks 1, the difference is that, other modular heat sink 1 defines two openings at the left and the right sides thereof, the housing 12 of the head modular heat sink 2 is further connected to a shielding sheet 21, leaving an opening facing the modular heat sink 1 which is connected head modular heat sink 2, the side opposite to the opening is sealed. In another embodiment, the housing 12 of the head modular heat sink 2 can be integrally formed during the manufacturing procedure, and is not formed by connecting one shielding sheet 21 to the arched shape housing 12.

[0022] In an embodiment, the modular extensible lamp further includes a handle 8 connected to the base 4. Preferably, the handle 8 is constructed to a shape facilitating to be held by hand. Preferably, the handle 8 can be provided with patterns, improving an appearance and providing a skid resistance.

[0023] Generally, when the street lamp is assembled, it is difficult to realize a horizontal mounting of the street lamp at the left and the right ends, when merely depending upon worker's visual inspection on a shop truck which works high above the ground. If the street lamp does not keep along a horizontal direction, it causes the light to directly entry into the eyes of pedestrians or drivers on a travelling vehicle, leaving a potential safety hazard. In order to overcome such shortcomings, under normal circumstances, when assembling the street lamp, a person is designated on the road to guide the assembly procedure according to visual inspection, or the worker who works high above the ground carries a spirit level to assist the assembly. However, the two processing ways are inconvenient, and it is hard to guarantee a better horizontal mounting effect.

[0024] In order to effectively solve the problem, in an embodiment, the modular extensible lamp further includes a spirit level 9, configured to detect whether the modular extensible lamp remains in a balance state when assembly. Specifically, referring to FIG. 8, the spirit level 9 includes a main body 91, liquid 93, a level bubble 94, and a transparency window 95. The main body 91 defines a chamber 92, the liquid 93 and the level bubble 94 are

received in the chamber 92. The spirit level 9 is assembled to the modular extensible lamp, thus, the worker can observe the position of the level bubble 94 through the transparency window 95. Seen from the transparency window 95, if the level bubble 94 is located on the middle portion, it indicates that the modular extensible lamp is not in a balance state, an adjustment should be conducted further. Preferably, the size of the transparency window 95 is a bit greater than a width of the level bubble 94. Thus, when assembling, if only the level bubble 94 can be seen from the transparency window 95, it indicates that the modular extensible lamp is in a balance state.

[0025] The spirit level 9 is assembled to the modular extensible lamp in the invention, when assembly, whether the modular extensible lamp is assembled along a horizontal direction can be determined by observing whether the level bubble 94 is located at the middle portion of the chamber 92. It can be implemented easily, and a horizontal mounting of the modular extensible lamp can be ensured. Preferably, the spirit level 9 is horizontally mounted to a middle position between the handle 8 and the base 4.

[0026] In an embodiment, referring to FIG. 4, the modular extensible lamp further includes a controlling module 7 assembled to the modular extensible lamp. The controlling module 7 is electrically connected to light source module 3, serving as a control device of the light source module 3, such as controlling the open and close of the light source of the light source module 3, or adjusting the luminance of the light source. Preferably, the controlling module 7 is assembled to the base 4.

[0027] In an embodiment, preferably, the head modular heat sink 2, the light source module 3, the base 4, the lateral fastener 5, and the vertical fastener 6 are manufactured by aluminium alloy with a high thermal conductivity and a high strength.

[0028] In above embodiment, the modular extensible lamp of the invention further includes a shielding device (not shown). The shielding device is assembled to an external edge of the light source module 3, for shielding the light which is emitted from the edge of the light source module 3 and irradiates obliquely upward or toward a periphery. Therefore, the modular extensible lamp can be applied to the airport road for lighting, preventing the light which is ejected obliquely upward from influencing the safety of the airplane when taking off and landing. The modular extensible lamp adopting such structures can prevent the light which is ejected obliquely from influencing the safety of the vehicle driver on the road, and also can avoid a light disturbing the inhabitant on the periphery of the road.

[0029] Although the invention is illustrated and described herein with reference to specific embodiments, the invention is not intended to be limited to the details shown. Rather, various modifications may be made in the details within the scope and range of equivalents of the claims and without departing from the invention.

Claims**1.** A modular heat sink, comprising:

a heat radiating plate; 5
 a housing connected to the heat radiating plate, the heat radiating plate and the housing being provided with fins;
 a lateral latching portion; and
 a lateral connecting member, wherein the lateral latching portion and the lateral connecting member are positioned on a middle position of the housing, when two modular heat sinks are connected together, the lateral latching portion of one modular heat sink is configured to be fastened to the lateral connecting member of the other modular heat sink via a lateral fastener. 10 15

2. The modular heat sink according to claim 1, further comprising a vertical latching portion and a vertical connecting member positioned on the heat radiating plate, wherein the lateral latching portion is perpendicular to the vertical latching portion, when two modular heat sinks are connected, the vertical latching portion of one modular heat sink is configured to be fastened to the vertical connecting member of the other modular heat sink via a vertical fastener. 20 25**3.** The modular heat sink according to claim 2, wherein both the number of the lateral latching portion and the lateral connecting member are two or more. 30**4.** The modular heat sink according to claim 2, wherein both the number of the vertical latching portion and the vertical connecting member are two or more. 35**5.** The modular heat sink according to any one of claim 2 to claim 4, wherein the housing extends upward from joining portions of the heat radiating plate and the housing, and leans forward horizontally to form an anteverted arch shape. 40**6.** A modular extensible lamp, comprising:

a base comprising a substrate, the substrate being provided with a lateral connecting portion; 45
 at least one modular heat sink according to any one of claim 1 to claim 5, the base and one modular heat sink being fixedly connected via a lateral fastener extending through the lateral connecting portion and the lateral connecting member; and 50
 a light source module, wherein the number of the light source module is equal to that of the modular heat sink, and one light source module is connected to one modular heat sink. 55

7. The modular extensible lamp according to claim 6,

wherein the light source module is connected to a bottom of the heat radiating plate.

8. The modular extensible lamp according to claim 6, wherein the at least one modular heat sink comprises a head modular heat sink, the housing of the head modular heat sink extends upward from joining portions of the heat radiating plate and the housing, and leans forward horizontally to form an anteverted arch shape, the head modular heat sink further comprises a shielding sheet, the shielding sheet is positioned on a side of the housing away from the base, the shielding sheet is connected to the housing and the heat radiating plate to form a receiving chamber, the fin is positioned within the receiving chamber.**9.** The modular extensible lamp according to claim 6, wherein the substrate further comprises a cover connected to the substrate via a fastener, the cover covers the substrate and forms a confined space cooperatively with the substrate, the lateral connecting portion is received within the confined space.**10.** The modular extensible lamp according to claim 6, further comprising a spirit level horizontally assembled to the substrate, wherein the spirit level defines a chamber for receiving liquid, and comprises a level bubble placed upon the liquid.

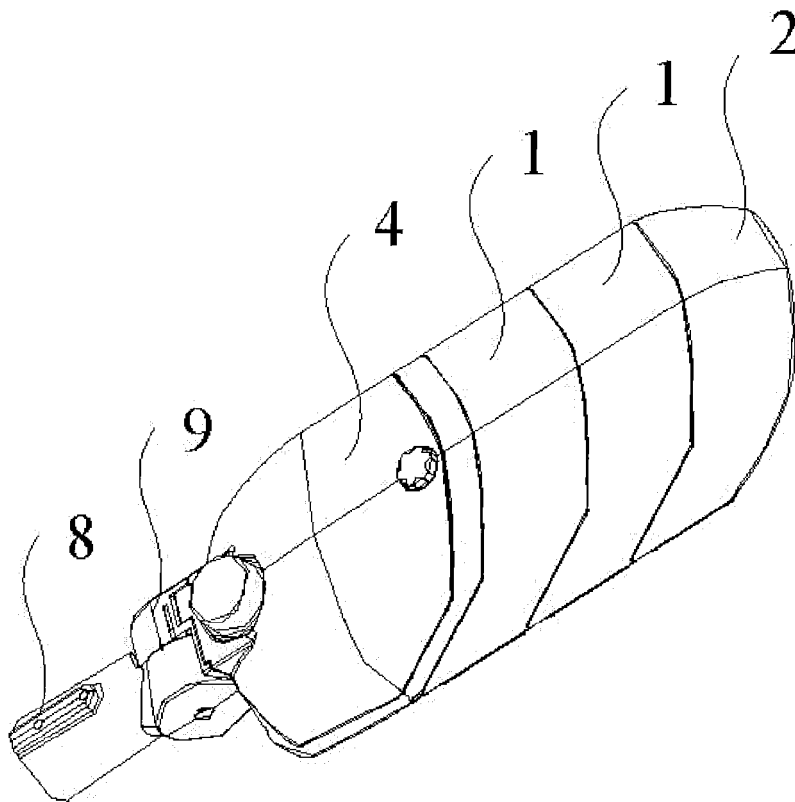


FIG. 1

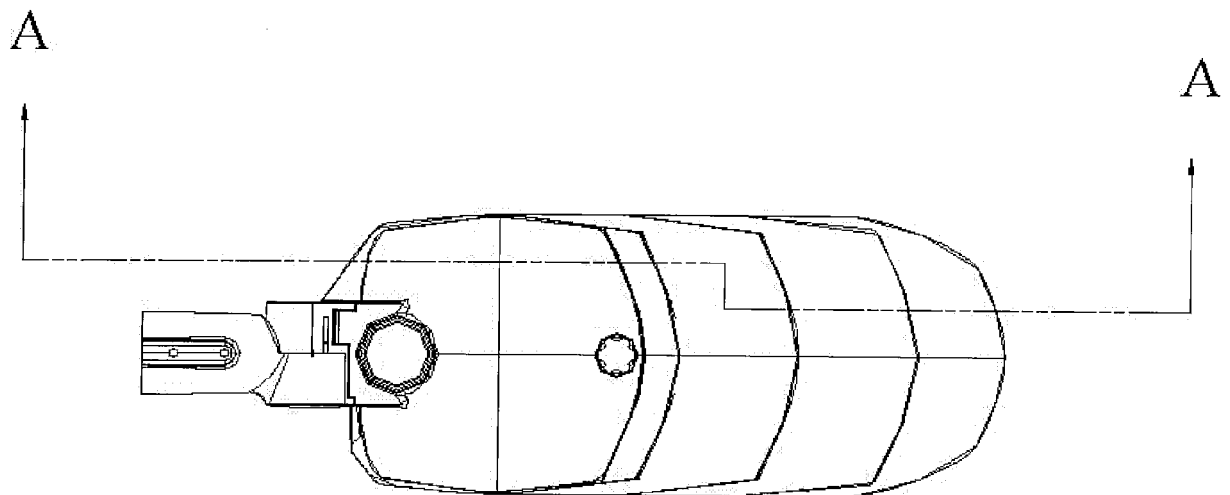


FIG. 2

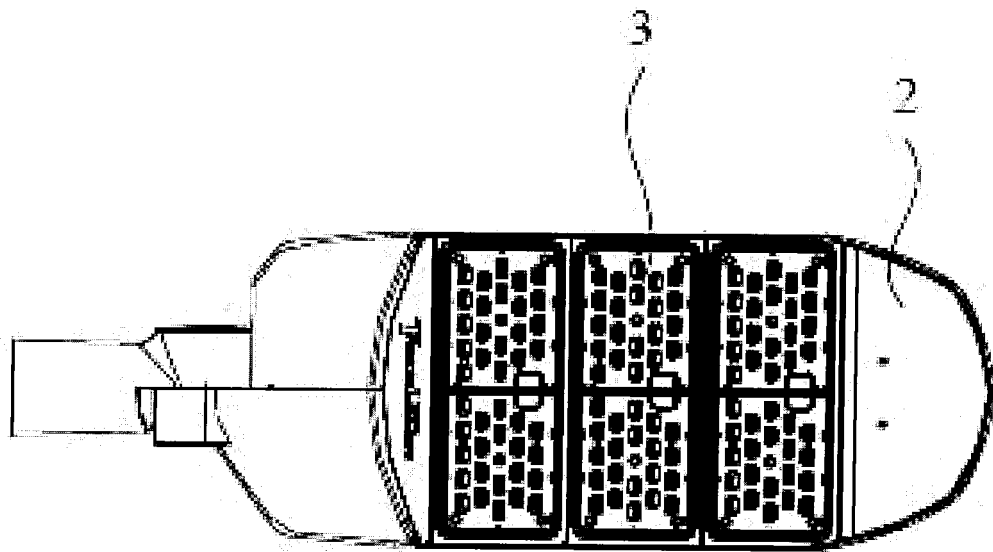


FIG. 3

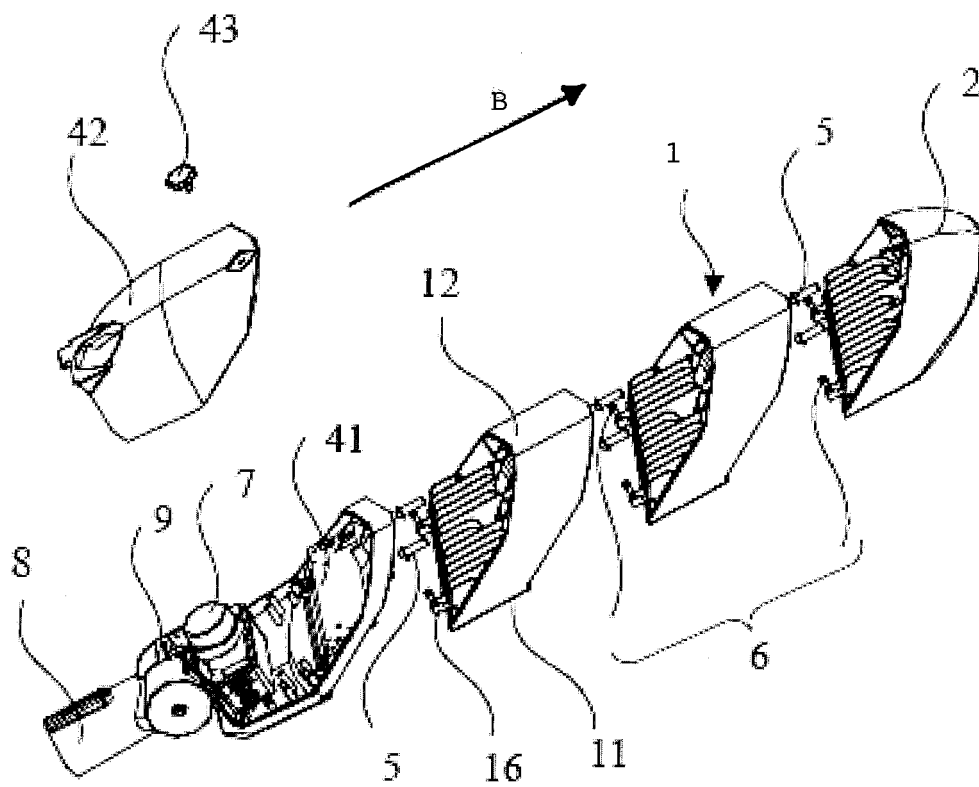


FIG. 4

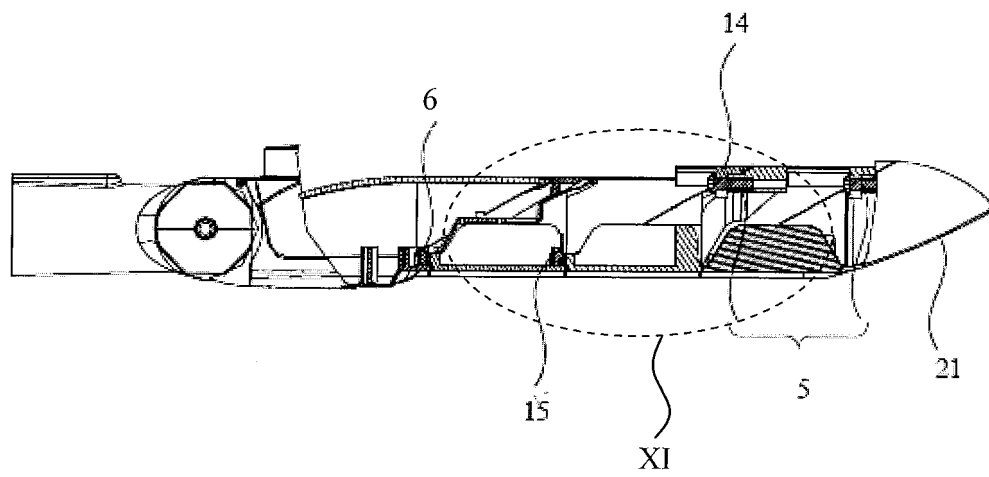


FIG. 5

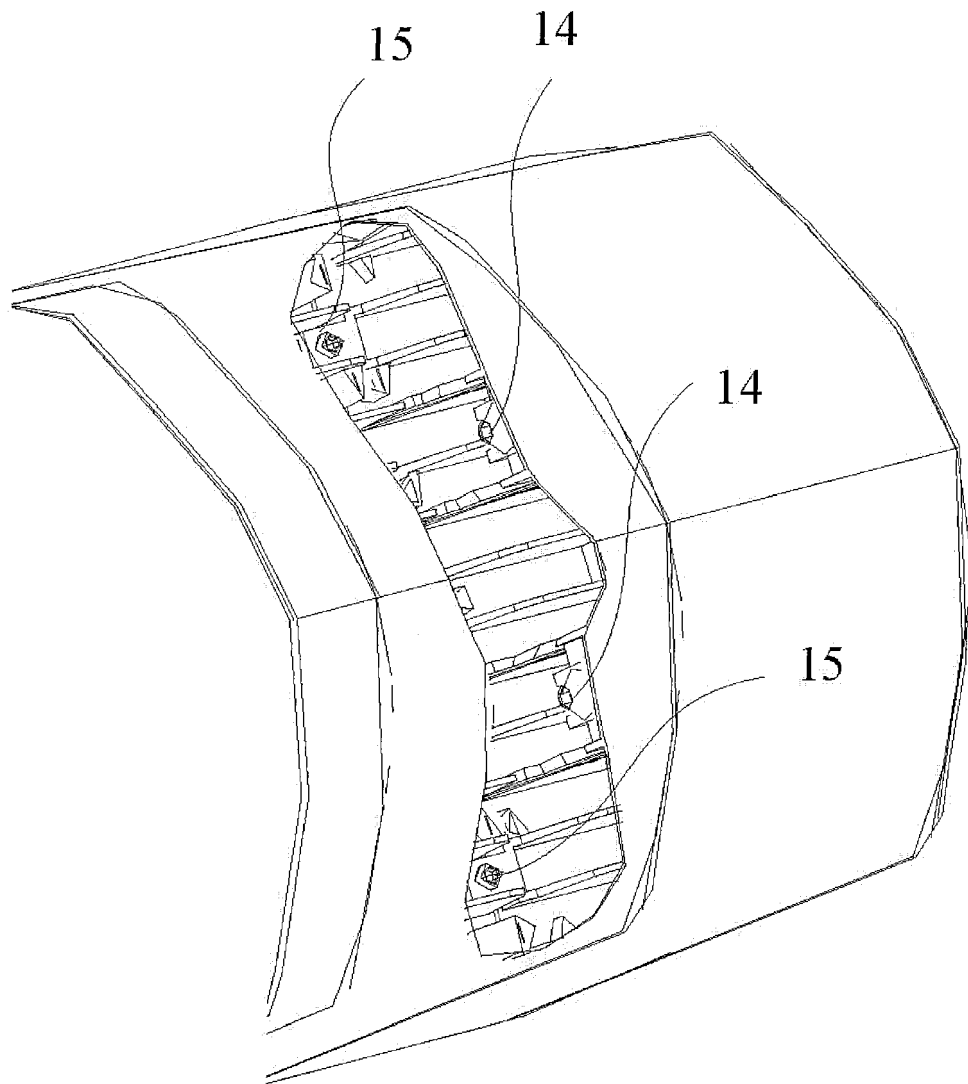


FIG. 6

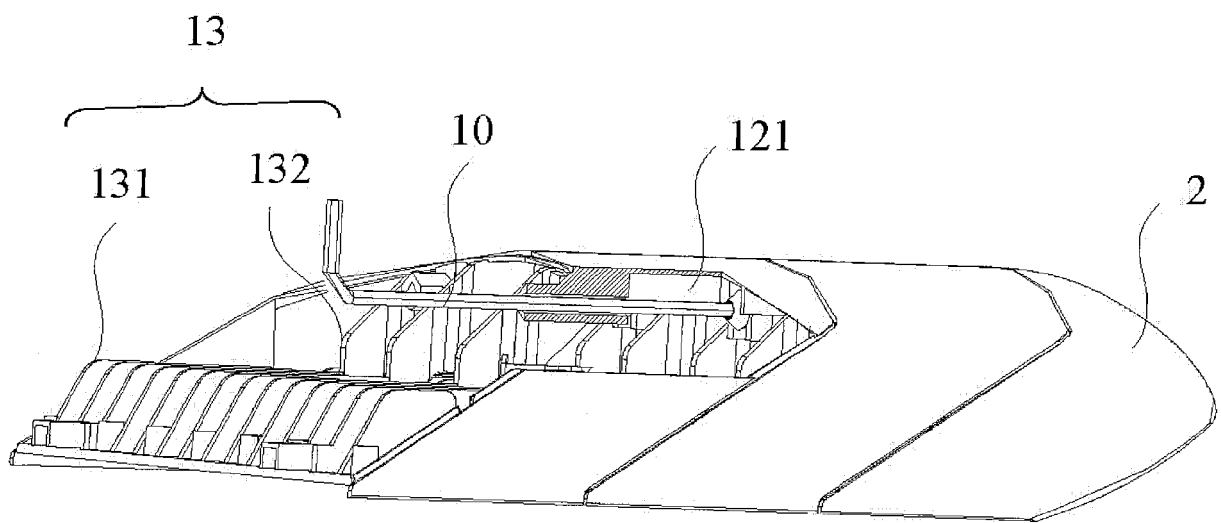


FIG. 7

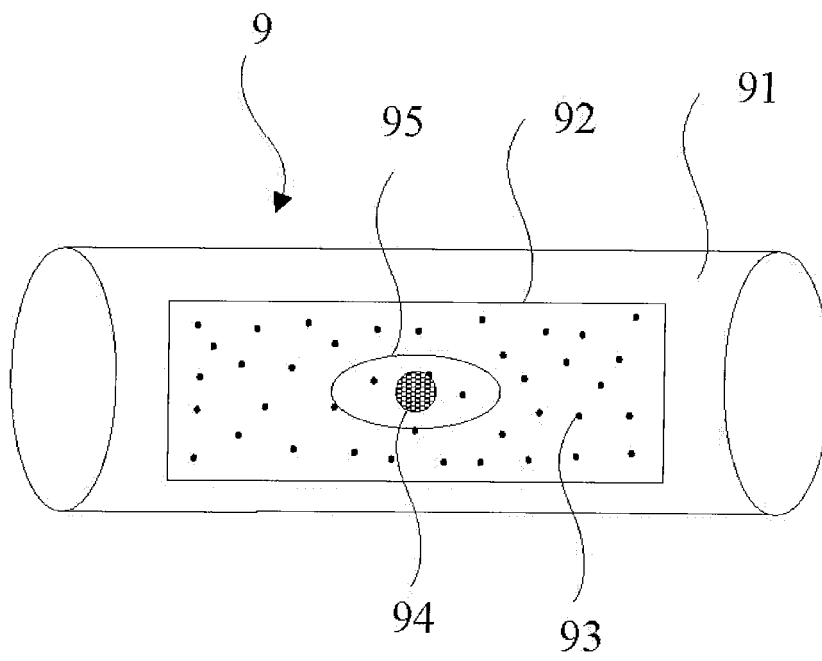


FIG. 8

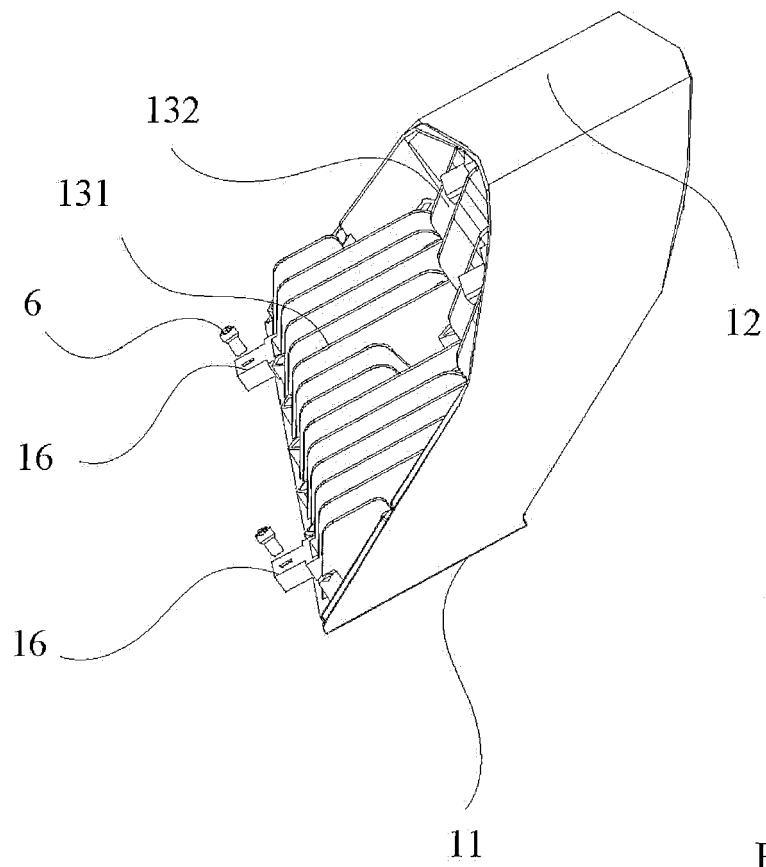


FIG. 9

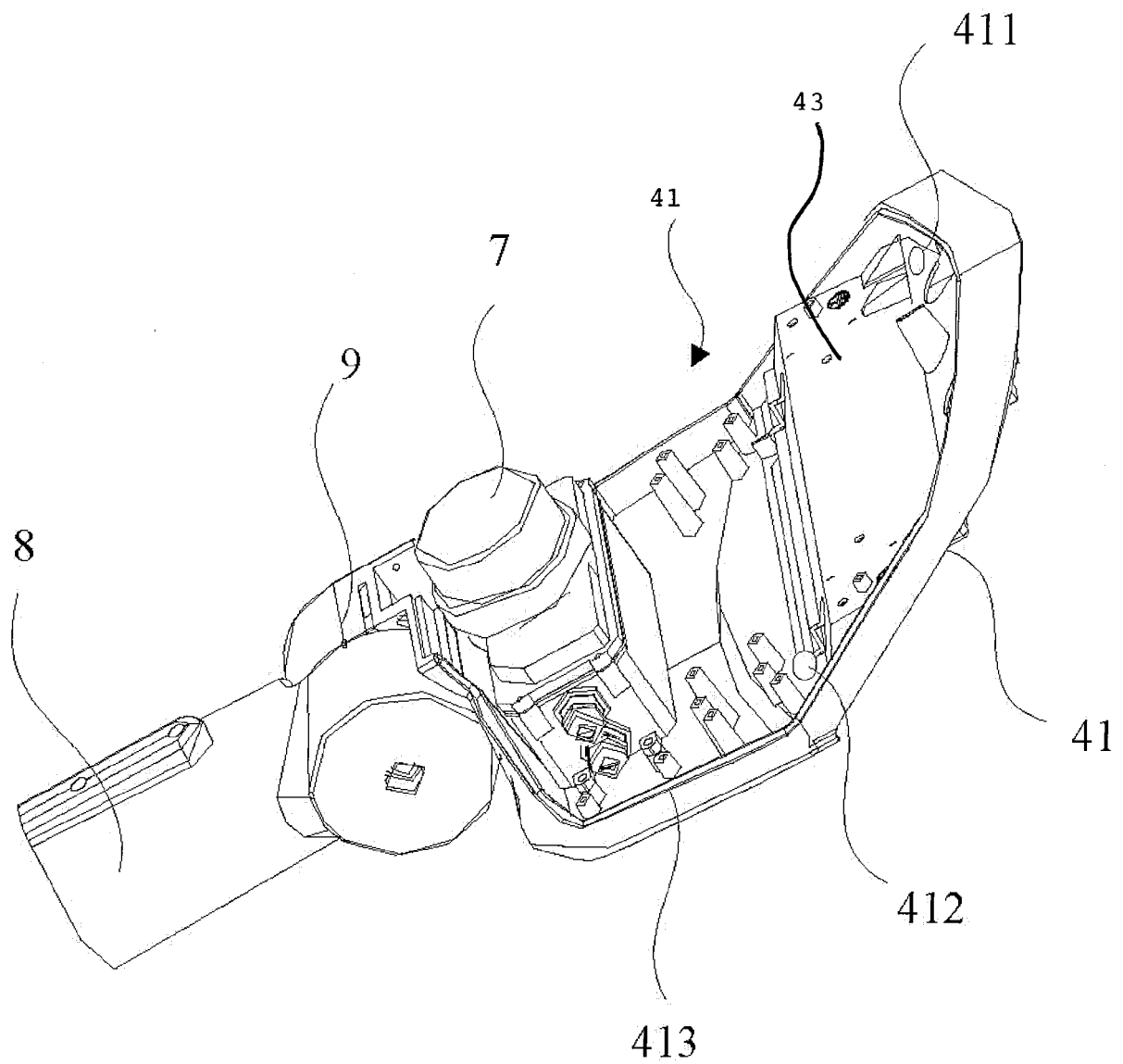


FIG. 10

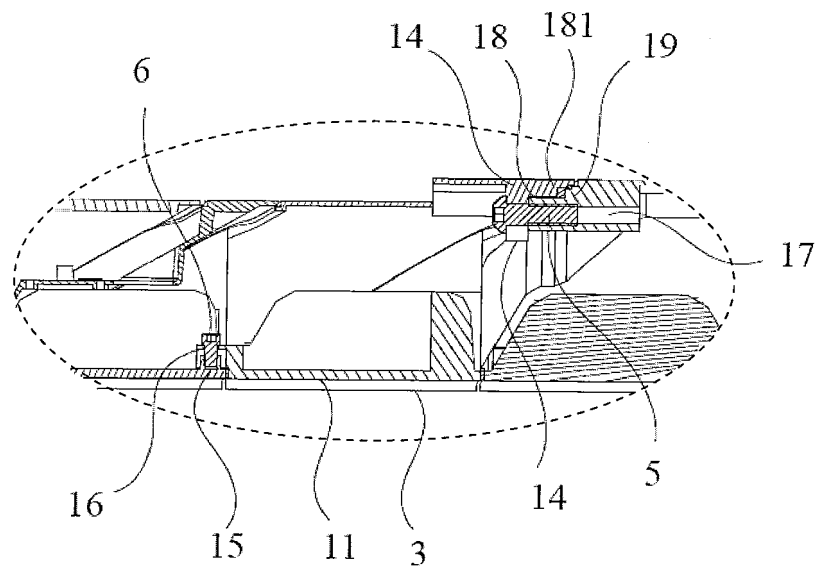


FIG. 11



EUROPEAN SEARCH REPORT

 Application Number
 EP 16 15 0105

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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A	* the whole document *	8,10	F21S8/08
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		4 February 2016	Kebemou, Augustin
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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