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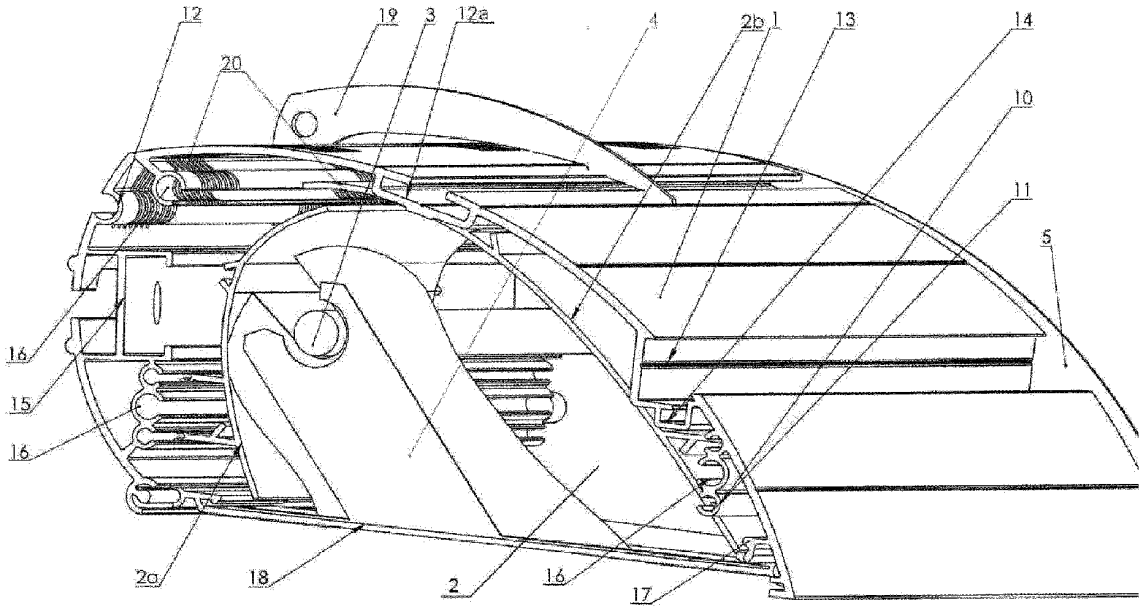
(54) **Ventilation system for radiant heater, in particular with an infrared tube emitter, and a radiant heater with such a system**

(57) Ventilation system of a radiant heater, in particular the one with an infrared tube emitter, comprising ventilation gaps (20) arranged in the heater casing and longitudinal ventilation gap in the reflector, is characterised in that the longitudinal ventilation gap (6) in the reflector (2) is arranged horizontally or obliquely with reference to the horizontal axis of the emitter (3), whereas the ventilation gap (6) is created by two overlapping arms (2a) and (2b) of the reflector (2), whereas cross-sections of such arms are shaped as curves, preferably with a common focal length.

The radiant heater with an infrared emitter, comprising a casing (1), a reflector (2), and a ventilation system with ventilation holes in the casing and the reflector, as well as possibly equipped with other parts that do not serve for heating purposes, is characterised in that it comprises a ventilation system of the presented invention.

Fig. 1



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Description

[0001] The present invention relates to a ventilation system of a radiant heater, in particular the one with an infrared tube emitter, and a radiant heater with such a system. The present invention relates also to infrared radiant heaters combined with devices that serve additional functions such as lighting, water mist spraying, and other auxiliary functions.

[0002] The problem is that in electric radiant heaters, wherein energy flux is directed by a reflector towards the lower surface, wherein a linear emitter having considerable power is the source of energy, high temperature is generated around the emitter and on its surface. The problem is presented by the fact that the reflector is located closely above the emitter and due to its continuous design, wherein such a design surrounds the emitter, retains convective outflow of hot air with the result that cooling is hindered to a great extent, while high temperature exerts an adverse influence on the lifetime of the emitter and its filter, electrical connections, surface of reflectors, and silicone seals. Radiant heaters for outdoor use are becoming more common. In such an application, heaters must be of adequate sealing class. Electrical components and the emitter are often sealed by means of flexible silicone gaskets. In known solutions, in order to lower the temperature of the emitter tube in the place where it is fastened and sealed, the tube at the emitter is extended considerably even by 50%, and thus the fastening with sealing is moved away from the hot radiant part of the emitter and the so-called cold ends are formed.

[0003] Various solutions of radiant heaters are known, wherein the infrared emitter is arranged in an open-bottom casing with protective grate, if any, wherein casings of the heaters are cooled by holes created in the outer enclosure.

[0004] For instance, it is known to have an infrared radiant heater equipped with a reflector designed in accordance with the patent application no. PL341500. The heater is of uniform design in the shape of an oblong housing with two symmetrical parabolic curves connected with each other in an arc-like manner by a formed recess and walls perpendicular to the axis. The reflector spreads over the emitter from the top and there is no manner of carrying away heat accumulated above the emitter. In such a radiant heater, ventilation holes are located in the outer casing. The said design enables carrying away heat only from the space between the reflector and the outer casing. Thus, ventilation of the heater is insufficient with the result that the lifetime of its elements is reduced. No ventilation between the reflector and the emitter also causes dust accumulation on the emitter that releases unpleasant odour when burnt and creates visible heat marks on the emitter.

[0005] Patent no. EP127496 knows a solution for generating and reflecting infrared radiation consisting in a plate with several tube emitters parallel to one another, and behind them, there is a reflector in the form of concave grooves, whereas every groove is determined by a combination of two longitudinal elements having the V cross-section, where both arms are concave in the outer direction. A vertical gap between the adjacent V-elements is covered by a screen that reflects radiation. The V-elements are doubled, empty inside, so that blown air as the cooling medium can flow through them. The adjacent V elements compose a longitudinal ventilation gap created by flanges of such elements. The gap is placed symmetrically to the vertical axis of the emitter and perpendicularly to its horizontal axis. Such a shape and arrangement of the gap necessitates an additional reflector above the gap, where the reflector prevents radiation from escaping out of the reflector zone to the limited extent (due to dissipation and multiple reflections). At the same time, the flow of hot air is hindered, the directional efficiency of energy flux is reduced, and casing dimensions become larger, and as such, manufacturing costs are higher.

[0006] In every mentioned example of the prior art relating to radiant heaters, the ventilation system for high-power emitters is insufficient, and the symmetric curvature of the reflector limits the preferable arrangement of the radiation field, in particular if the reflector is mounted on the side wall. In such a case, if thermal radiation is to be directed at the centre of a room, the heater has to be positioned properly, and then the emitter is visible, which is not preferable as the emitter causes glare that is excessive and unpleasant to the eye. In addition, for radiant heaters with one emitter, there is also a problem associated with replacing used elements due to difficult access and the need to dismount the casing.

[0007] It is an object of the present invention to devise a ventilation system for a radiant heater that can ensure that as much heat as possible can be carried away from the heater casing as well as the area above the emitter, and eliminate problems associated with overheating elements inside the casing to great extent. Another objective of the present invention is to devise an infrared heater equipped with a ventilation system according to the invention, and additionally, the one that improves the directional efficiency of thermal radiation distribution, reduces glare to great extent, and is more functional in use.

[0008] A ventilation system of a radiant heater, in particular with an infrared tube emitter, comprising ventilation gaps arranged in the heater casing and a longitudinal ventilation gap in the reflector, according to the invention, is **characterised in that** the longitudinal ventilation gap in the reflector is arranged horizontally or obliquely with reference to the horizontal axis of the infrared emitter, whereas the ventilation gap is created by two overlapping arms of the reflector, the cross-section of which is in the form of curves, preferably with a common focal length.

[0009] The ventilation system, is **characterised in that** the longitudinal ventilation gap in the reflector is preferably moved with reference to the vertical axis of the infrared emitter.

[0010] The ventilation system is **characterised in that**

the upper part of one of the reflector arms has a longitudinal profile.

[0011] The ventilation system is **characterised in that** the longitudinal profile in one of the reflector arms is shaped as a vault and preferably includes additional ventilation holes arranged outside the surface of reflection.

[0012] The ventilation system is **characterised in that** the longitudinal profile in one of the reflector arms is shaped as an arc bend the convexity of which is directed towards the infrared emitter and which preferably comprises additional ventilation holes arranged outside the surface of reflection.

[0013] The ventilation system is **characterised in that** the top ends of the arms of the reflector are connected with each other by at least one fastener.

[0014] The ventilation system is **characterised in that** between the top ends of the arms of the reflector, there are through holes in the fastener or between such fasteners.

[0015] The radiant heater, in particular with an infrared emitter, comprising a casing, a reflector, and a ventilation system with ventilation holes in the casing and the reflector, as well as other parts, if any, that are not for heating purposes, is **characterised in that** it comprises a ventilation system in accordance with the invention.

[0016] The heater is **characterised in that** reflector arms are in the form of profiled plates suitable for inserting into the casing of the heater.

[0017] The heater is **characterised in that** the reflector arms have preferably longitudinal profiled guiding elements arranged on the outer side of the reflector.

[0018] The heater is **characterised in that** the casing on the outer side has several profiled sections, including preferably guides for the reflector arms.

[0019] The heater is **characterized in that** the casing is shaped as an asymmetrical dish with an outline at the cross-section limited by two arcs of various curvatures.

[0020] The heater is **characterised in that** the casing is preferably connected with the reflector in a demountable manner.

[0021] The heater is **characterised in that** the casing on the outer side is preferably profiled for a heater holder.

[0022] The heater is **characterised in that** the casing on the outer side is preferably profiled for a nozzle spraying water mist.

[0023] The heater is **characterised in that** the casing on the outer side has preferably profiled sections for inserting a bar that serves for decoration or providing information.

[0024] The heater is **characterised in that** the casing on the inner side has preferably profiled sections for fixing conductors.

[0025] The heater is **characterised in that** the casing on the inner side has preferably profiled sections for fixing side covers.

[0026] The heater is **characterised in that** the casing on the inner side has catches, preferably snap ones, for fixing bottom plates that cover leads to emitter ends.

[0027] The heater is **characterised in that** the infrared emitter assembly with plates locking the emitter and bottom plates is mounted in the casing in a rotating manner.

[0028] The heater is **characterised in that** transverse plates locking the emitter, from the side of the reflector, have preferably a surface that reflects radiation.

[0029] The heater is **characterized in that** the transverse plates locking the emitter are preferably made of the same piece of metal.

[0030] The heater is **characterized in that** the bottom plates have profiled sections for inserting the transverse plates locking the emitter.

[0031] Application of the ventilation system of the presented invention improves cooling of the emitter, the casing, and heater elements implemented inside to a great extent. Location of the ventilation gap at the overlapping between the reflector arms results in that the parabolic dish that reflects radiation does not pass the rays, and as such, thermal loss is limited, and at the same time, allows for carrying away the accumulated heat above the emitter that such heat is detrimental to other elements placed in the casing. Air passing rapidly around the emitter towards the gap catches dust particles and prevents their accumulation on the emitter. The presented shape of the reflector allows for directing radiation properly downwards without blinding because the glare protection angle is ensured, whereas the angle of energy beam distribution at the cross-section is between the plane approximately perpendicular to the floor and the inclined plane. In the presented solution, there is no need to rotate the casing as particularly important for heaters mounted on building side walls, where for traditional symmetrical reflectors, the shape of radiation energy flux necessitates to tilt the heater and uncover the emitter so as not to heat up the wall on which the heater is mounted, where such a situation causes blinding. The solution according to the invention, due to the applied cooling system, allows the lamp to operate in a horizontal position with emitters having greater power than those used so far. Application of only two segments with the ventilation gap allows for reducing overall dimensions of the heater and results in material savings. Withdrawable segments of the reflector and the emitter enclosure that can be leaned backwards allow for easy access to all heater elements that require replacement or maintenance, if any, without any need of taking the heater off the wall.

[0032] Example embodiments of the said invention are presented in the drawing, wherein Fig. 1 shows the heater with the ventilation system in the isometric projection; Fig. 1a shows a cross-section of the same heater illustrating inclination of the emitter enclosure, for instance to maintain the heater; Fig. 2 shows a cross-section of the heater casing, configured with the reflector arms, the bottom cover plate and the holder; Fig. 3 shows a ventilation system in the radiant heater with the flow of cooling medium indicated; Figs. 4-7 show schematic views of the reflector arms configured with the emitter in various variants, whereas such variants can be used in the said ven-

tilation system; Fig. 8 shows a schematic view of the reflector, wherein the arms 2a and 2b are connected by means of the fastener; Fig. 9 shows a schematic view of the reflector, wherein the longitudinal profile section in one of the reflector arms is shaped as an arc-like bend the convexity of which is directed at the emitter; Fig. 10 shows a schematic view of the reflector, wherein the longitudinal profile section in one of the reflector arms is shaped as a vault; Fig. 11 shows a schematic view of the reflector with the fastener, wherein examples of holes are presented, whereas only one type or a combination of such holes can be applied; Fig. 12 and Fig. 13 show sections of the reflector arms in the isometric projection, which are visible on the outer side.

[0033] In one embodiment, the infrared radiant heater comprises the casing **1** connected with the reflector **2** and the infrared tube emitter **3.** Ends of the infrared tube emitter **3** are mounted at the transverse locking plates **4,** while the casing **1** ends on both sides with side walls **5,** and as such, the scope of the subject patent is not limited. The reflector **2** consists of two asymmetrical arms **2a** and **2b** arranged so that they overlap with one another and create the ventilation gap **6,** whereas every arm **2a** and **2b** at the cross-section is shaped as a curve, where such curves are of various curvatures, and preferably the common focal length where the infrared emitter **3** is placed. Curvatures of the parabola are selected so that they do not pass rays from the infrared emitter **3** in the direction of the created ventilation gap **6.** The ventilation gap **6,** depending on the inclination of curves of the arms **2a** and **2b,** is parallel or oblique to the vertical axis of the infrared emitter **3.** The ventilation gap **6** can be designed as continuous along the entire length of the arms **2a** and **2b,** and then the reflector **2** is a reflector consisting of two separate plates. In another embodiment, the arm **2a** of the reflector just above the infrared emitter **3** has the longitudinal profile **2c** that is bent inwards and creates an arc-like bend, the convexity of which is directed at the emitter **3.** Additionally, the arm **2a** is equipped with the ventilation holes **7** located outside the reflector surface to avoid radiation dissipation. In another embodiment, the arm **2a** of the reflector **2** has longitudinal profile that is bent inwards and creates an arc-like vault just above the surface of the infrared emitter **3.** Additionally, the arm **2a** is equipped with the ventilation holes **7** located outside the reflector surface to avoid radiation dissipation.

[0034] The arms **2a** and **2b** of the reflector **2** can also be connected with each other in a non-demountable manner by at least one fastener **8,** in which there are gap holes **9** of any shape. The gap holes **9** can also be created between individual fasteners **8.** One of the embodiments of the heater can comprise a reflector **2** mounted permanently to the casing **1** as well as with a withdrawable reflector **2.** For the withdrawable reflector, the arms **2a** and **2b** are fitted with guiding elements **10** on the outer side, whereas the casing **1** has guides **11** profiled on the inner side. The casing **1** of the infrared radiant heater is shaped as an asymmetrical dish with an outline at the cross-section limited by two arcs **1a** and **1b** of various curvatures. The casing **1** on the outer side has profiled sections **12a** and **12b** for the holder locking the heater and the profile section **13** for the nozzle spraying water mist that is configured with the profile **14** for inserting the decorative and information bar. On the inner side, the casing **1** has the profile section **15** for connecting conductors and the profile section **16** for fastening the side walls **5.** In addition, the casing **1** on the inner side is fitted with snap catches **17** and **17a** for mounting the bottom plates **18** that cover leads to the ends of the infrared tube emitter **3.** Assembly of the infrared emitter **3** with the plates **4** locking the emitter and the bottom plates **18** from the side of the catch **17a** is mounted in the casing **1** in a rotating manner so that access into the heater is easy, e.g. for replacing the emitter or maintaining the reflector surface. The transverse plates **4** locking the emitter **3** from the side of the reflector **2** have a smooth metallic surface that reflects radiation. The casing **1** is equipped with the holder **19** and the ventilation holes **20** arranged at the top of the dish. The bottom plates **18** have the profiled sections **21** for inserting the transverse plates **4** locking the emitter.

Claims

1. The ventilation system of a radiant heater, in particular the one with an infrared tube emitter, comprising ventilation gaps **(20)** arranged in the heater casing and longitudinal ventilation gap in the reflector, is **characterised in that** the longitudinal ventilation gap **(6)** in the reflector **(2)** is arranged horizontally or obliquely with reference to horizontal axis of the emitter **(3),** whereas the ventilation gap **(6)** is created by two overlapping arms **(2a)** and **(2b)** of the reflector **(2),** whereas cross-sections of such arms are shaped as curves, preferably with a common focal length.

2. The ventilation system, according to claim 1, is **characterised in that** the longitudinal ventilation gap **(6)** in the reflector **(2)** is preferably moved with regard to vertical axis of the infrared emitter **(3).**

3. The ventilation system, according to claim 1, is **characterised in that** the ends of the reflector arms **(2a)** and **(2b)** have longitudinal profiled sections **(2c).**

4. The ventilation system, according to claim 3, is **characterised in that** the longitudinal profile section **(2c)** of one of the arms **(2a)** and **(2b)** of the reflector **(2)** is shaped as a vault, and preferably includes additional ventilation holes **(7)** arranged outside the surface of reflection.

5. The ventilation system, according to claim 3, is **characterized in that** the longitudinal profile of one of the arms **(2a)** or **(2b)** of the reflector **(2)** has a shape

of an arc-like bend the convexity of which is directed towards the infrared emitter **(3),** and preferably has additional ventilation holes **(7)** arranged outside the surface of reflection.

6. The ventilation system, according to claim 1 or 2, is **characterised in that** the top ends of the arms **(2a)** and **(2b)** of the reflector **(2)** are connected with each other by at least one fastener **(8).**

7. The ventilation system, according to claim 6, is **characterised in that** between ends of the arms **(2a)** and **(2b)** through holes **(9)** are arranged in the fasteners **(8)** or between the fasteners **(8).**

8. The radiant heater with an infrared emitter, comprising a casing, a reflector, and a ventilation system with ventilation holes in the casing and the reflector, as well as possibly equipped with other parts that do not serve for heating purposes, is **characterised in that** it comprises a ventilation system in accordance with claims 1 to 7.

9. The heater, according to claim 8, is **characterised in that** the arms **(2a)** and **(2b)** of the reflector **(2)** are in the form of profiled plates suitable for inserting into the casing **(1)** of the heater.

10. The heater, according to claim 9, is **characterised in that** the arms **(2a)** and **(2b)** of the reflector **(2)** have preferably longitudinal guiding elements **(10)** arranged on the outer side of the reflector **(2).**

11. The heater, according to claim 9, is **characterised in that** the casing **(1)** on the inner side has several profiled sections, including preferably the guides **(11)** for the arms **(2a)** and **(2b)** of the reflector **(2).**

12. The heater, according to claim 8, is **characterised in that** the casing **(1)** is shaped as an asymmetrical dish with an outline at the cross-section limited by two arcs **(1a)** and **(1b)** of various curvatures.

13. The heater, according to claim 8, is **characterised in that** the casing **(1)** is preferably connected with the reflector **(2)** in a demountable manner.

14. The heater, according to claim 8, is **characterised in that** the casing **(1)** on the outer side has preferably profile sections **(12)** and **(12a)** for the heater holder **(19).**

15. The heater, according to claim 8, is **characterised in that** the casing **(1)** on the outer side has preferably the profile section **(13)** for the nozzle spaying water mist.

16. The heater, according to claim 8, is **characterised in that** the casing **(1)** on the outer side has preferably the profiled section **(14)** for inserting a decorative and information bar.

17. The heater, according to claim 8, is **characterised in that** the casing **(1)** on the inner side has preferably the profiled section **(15)** for fastening conductors.

18. The heater, according to claim 8, is **characterised in that** the casing **(1)** on the inner side has preferably the profiled section **(16)** for mounting side covers **(5).**

19. The heater, according to claim 8, is **characterised in that** the casing **(1)** on the inner is equipped with catches **(17)** and **(17a),** preferably snap ones, for mounting the bottom plates **(18)** that cover leads of ends of the infrared emitter **(3).**

20. The heater, according to claim 8, is **characterised in that** assembly of the infrared emitter **(3)** with the transverse plates **(4)** locking the emitter and the bottom plates **(18)** is mounted in the casing **(1)** in a rotating manner.

21. The heater, according to claim 20, is **characterised in that** that transverse plates **(4)** locking the emitter **(3),** from the side of the reflector **(2),** have preferably a surface that reflects radiation.

22. The heater, according to claim 20, is **characterised in that** the transverse plates **(4)** locking the emitter are preferably made of the same piece of metal.

23. The heater, according to claim 20, is **characterised in that** the bottom plates **(18)** have profiled sections **(21)** for inserting the transverse plates **(4)** locking the emitter **(3).**

Fig. 1

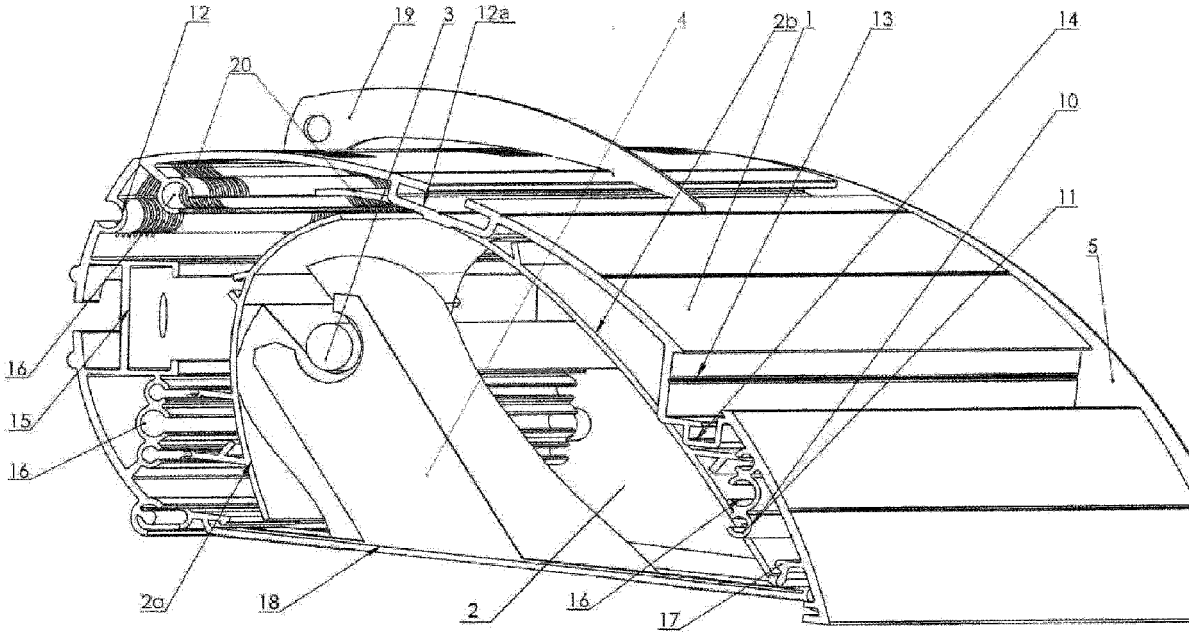


Fig. 1a

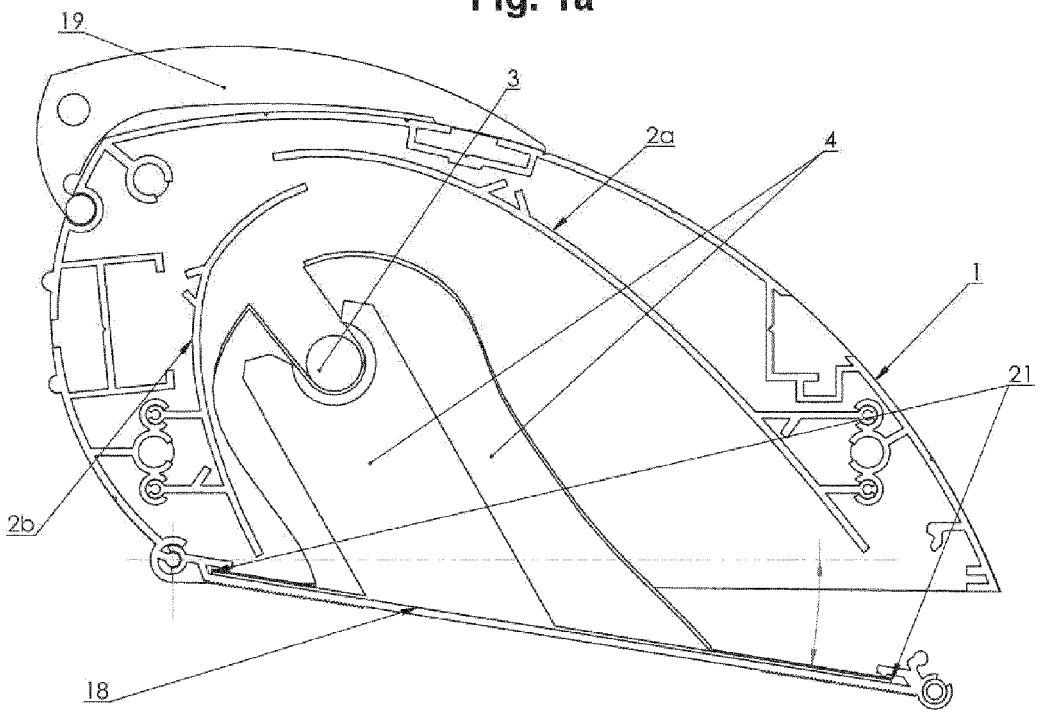


Fig. 2

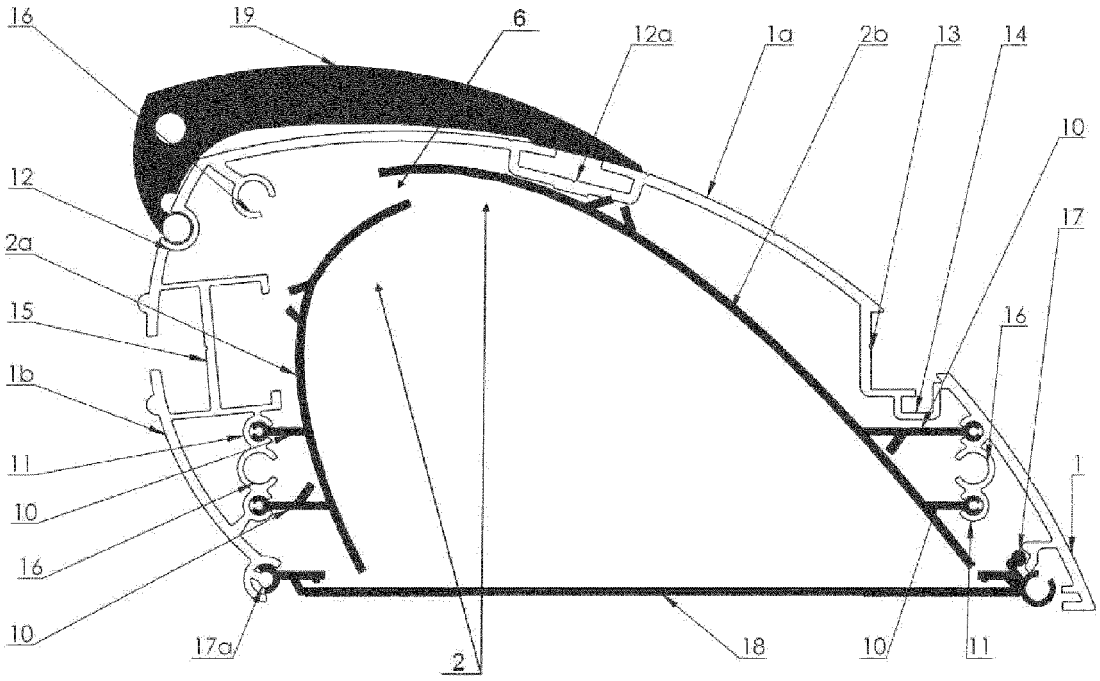


Fig. 3

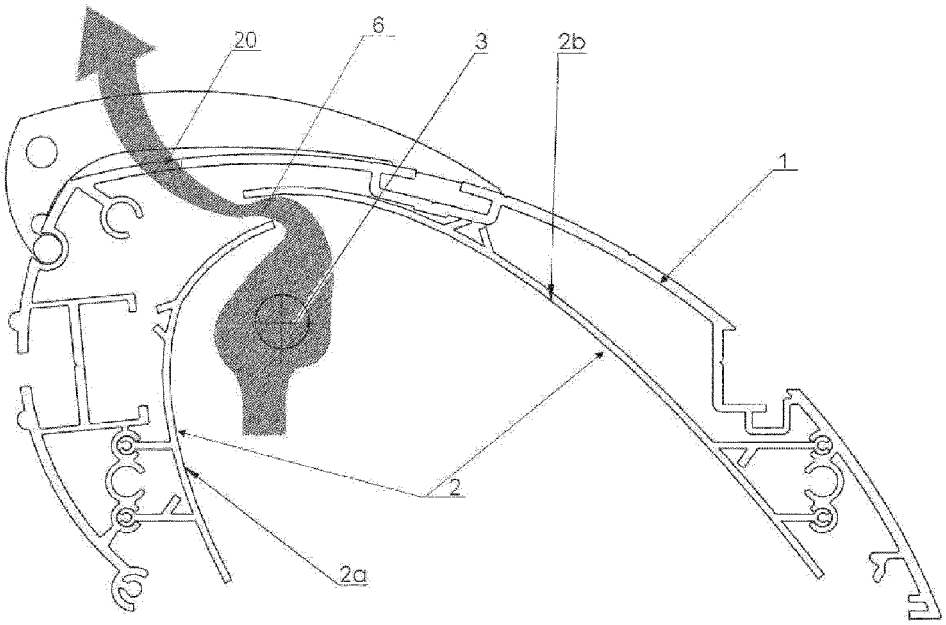


Fig. 4

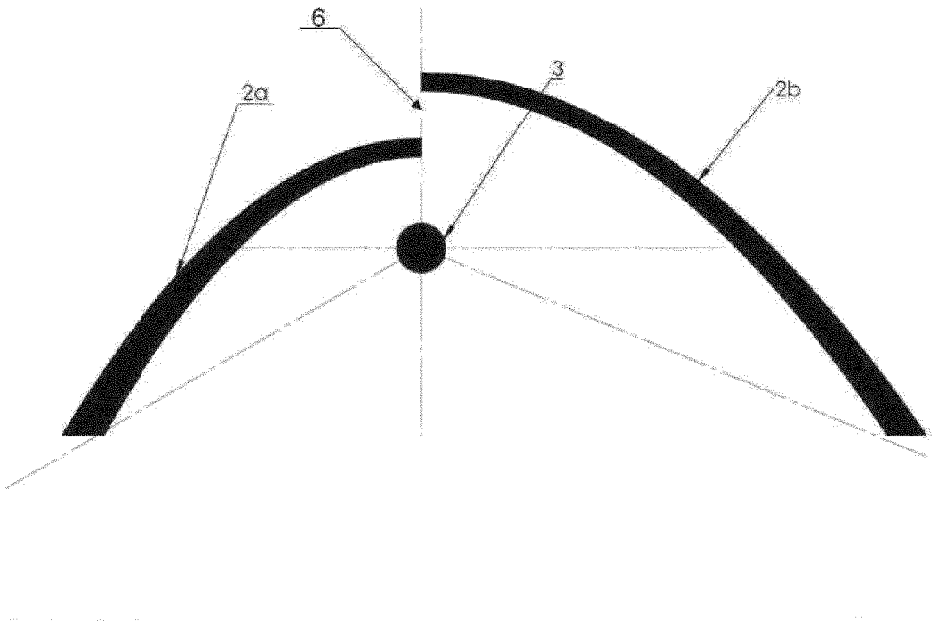


Fig. 5

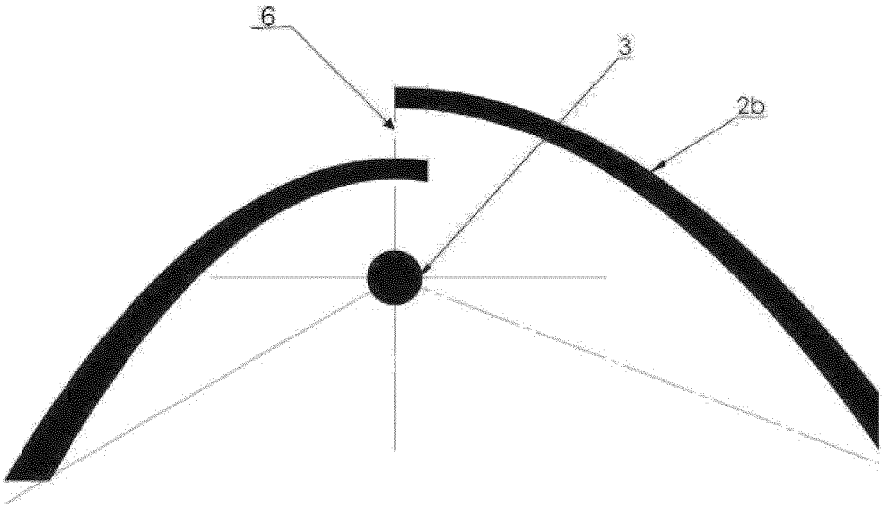


Fig. 6

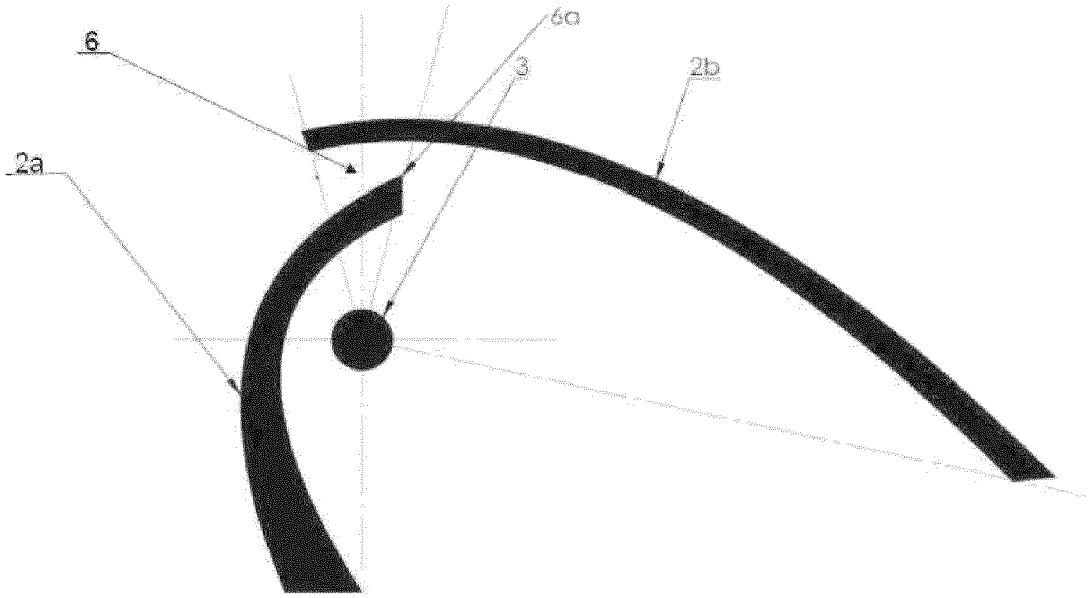


Fig. 7

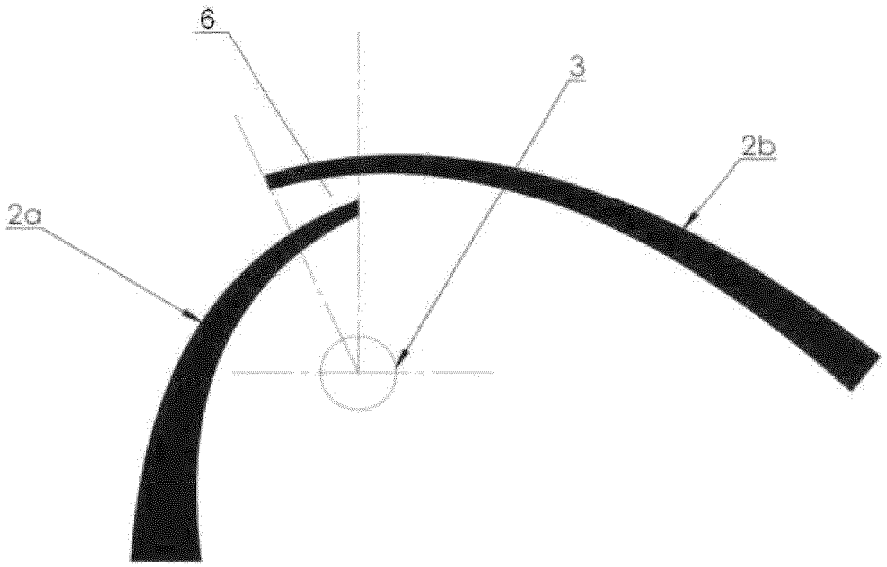


Fig. 8

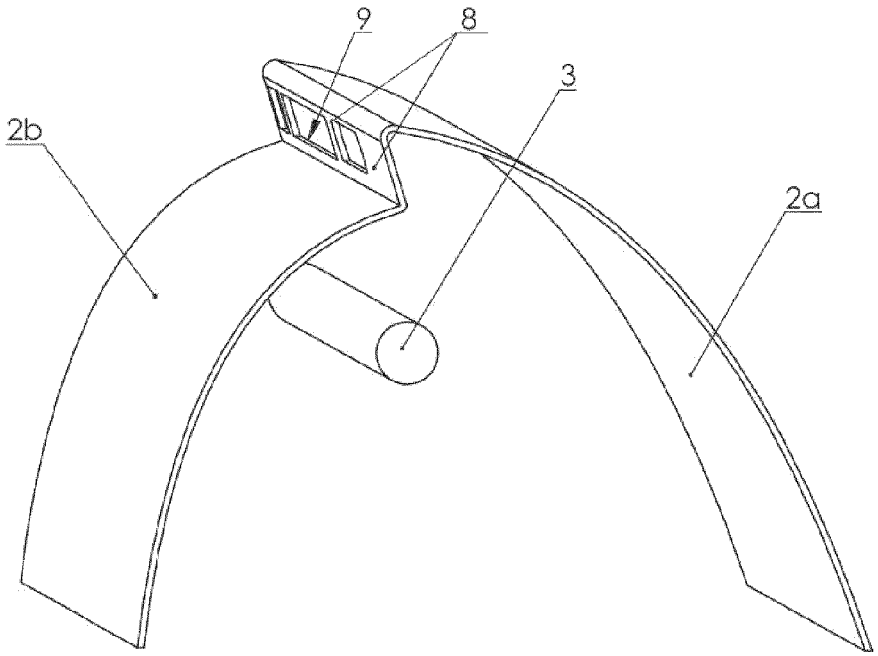


Fig. 9

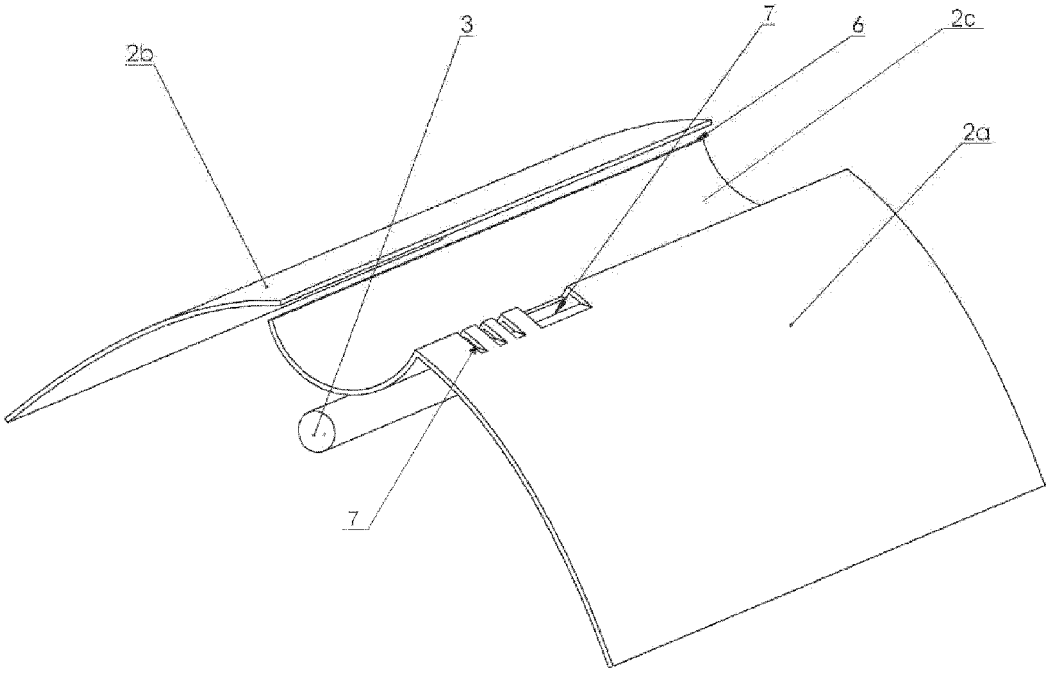


Fig. 10

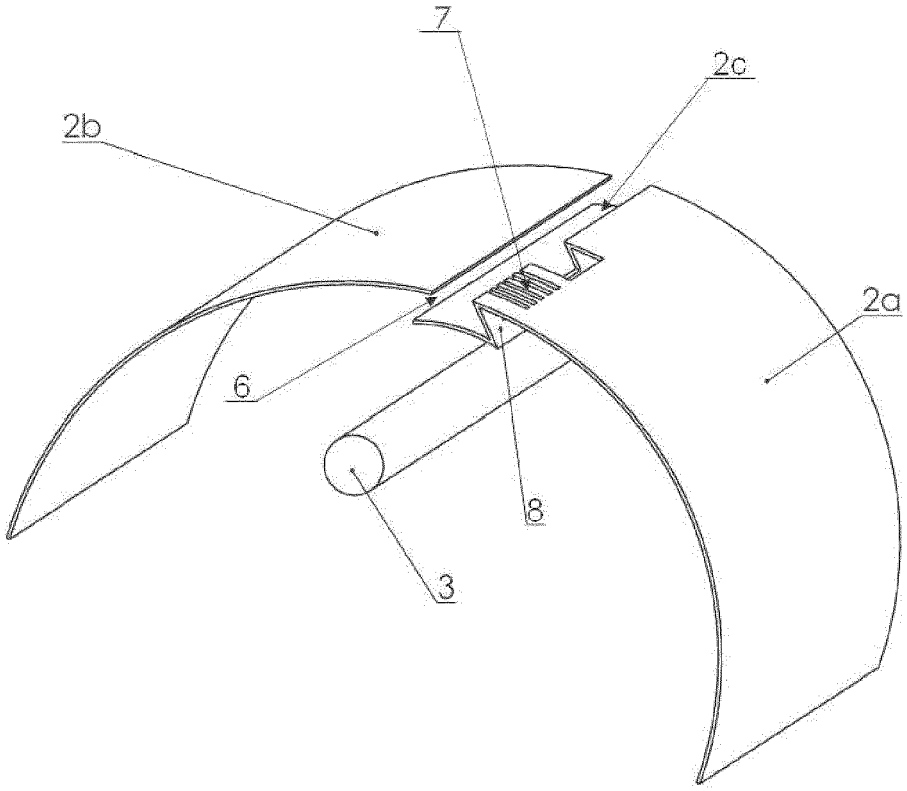


Fig. 11

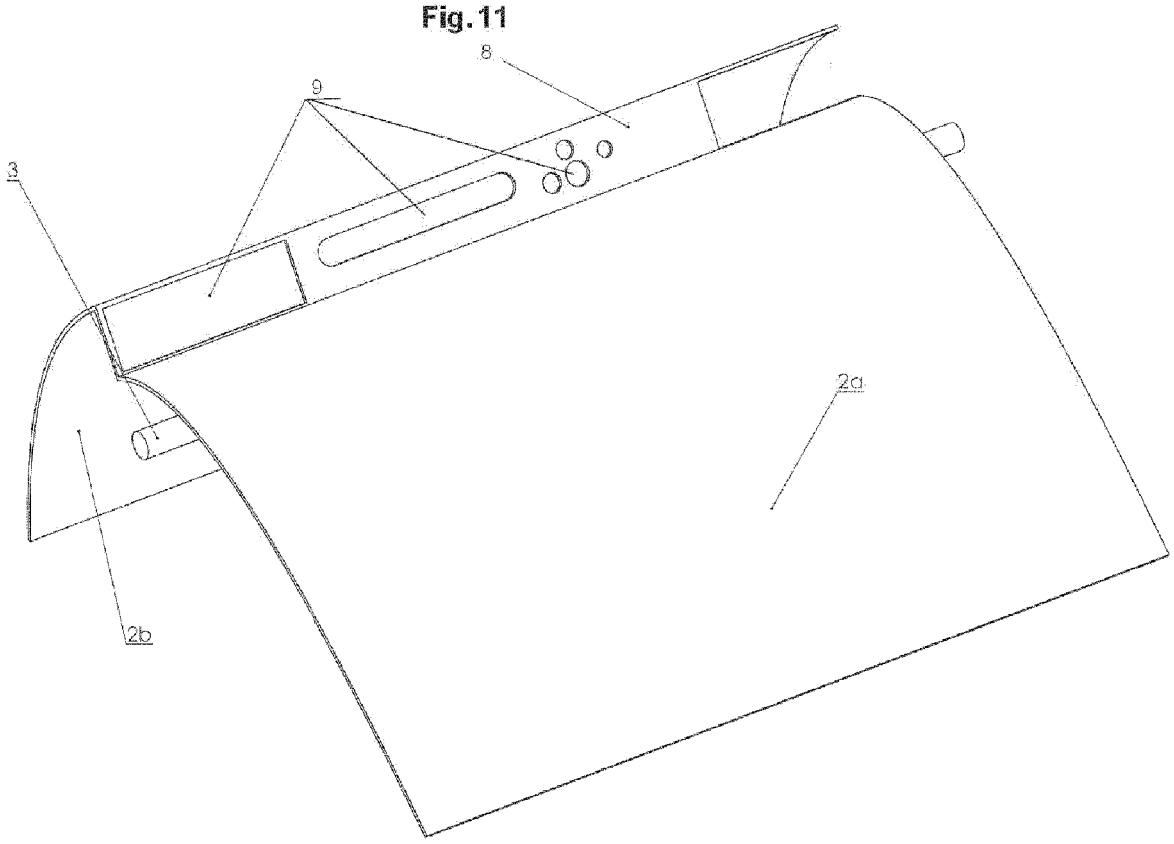


Fig.12

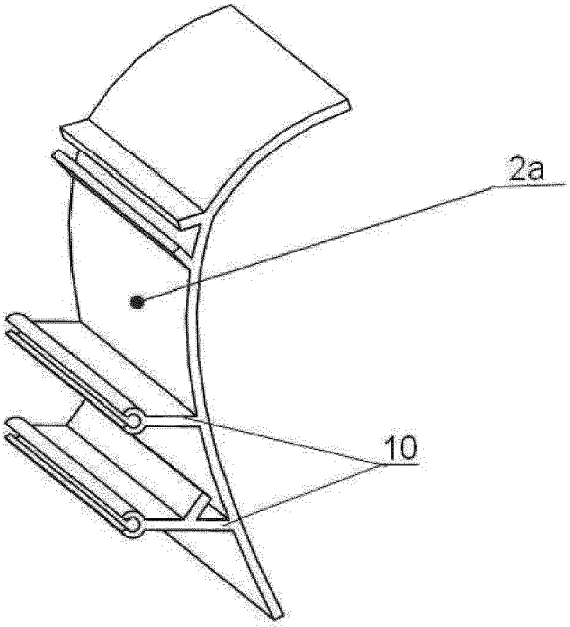
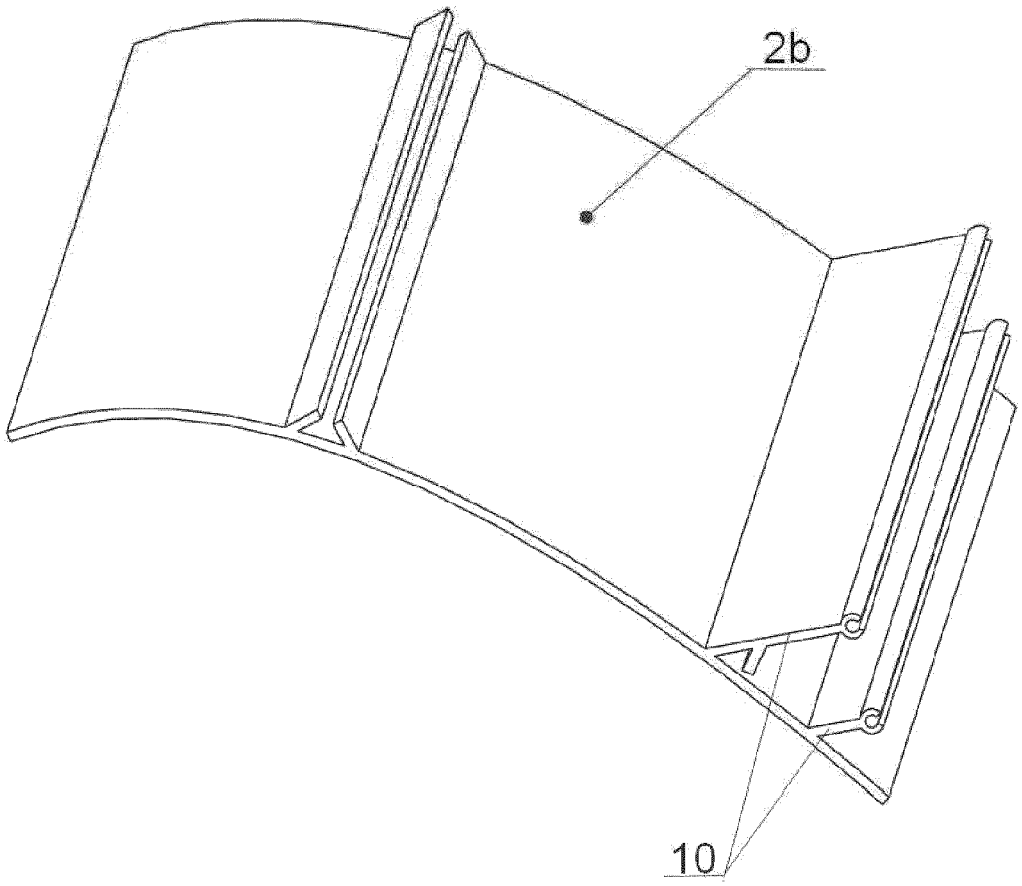


Fig. 13



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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