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(54) **Reflector assembly for use in a luminaire**

Reflektoranordnung zur Verwendung in einer Leuchte

Ensemble réflecteur destiné à être utilisé dans un luminaire

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Description

[0001] The present invention relates to a reflector assembly for use in a luminaire provided to brightly illuminate a target area wherein said luminaire can be used for floodlight, sport and area lighting applications. Further, the present invention is directed to a method for adapting the light emitting characteristics of a reflector assembly.

[0002] Lighting devices with incandescent or arc discharge lamps are routinely used to illuminate the exterior areas of commercial businesses for purposes of enhancing the appearance of the business at night and for promoting interest in the goods and services of the business by actual and potential customers. Restaurants and shopping malls represent just a few of the business types for which exterior luminaires play an important role in marketing and facilitating product sales. However, also other facilities such as parking areas, outdoor sports stadiums or indoor arenas usually require intensive illumination of specific areas, e.g. in order to provide lighting that allows a sport to take place safely and provide good viewing conditions, both in visibility of the sports action and comfort of the audience.

[0003] For lighting applications as mentioned above, reflectors are commonly used to reflect light emitted from at least one light source. The reflectors have a dome shaped configuration and focus the reflected light in desired patterns and with desired levels of intensity so that energy costs are minimized while maximum lighting is achieved. Reflectors also serve to protect the light source, with some reflectors providing a protective enclosure to protect the light source from weather, dust, moisture, and the like.

[0004] In particular in floodlighting systems used for applications as mentioned above, a reflector is usually the only - or at least the most relevant - optical element of a luminaire which is available for shaping the light emitted into a desired pattern. Since depending on the application a luminaire is used for often a very specific light distribution with respect to the beam aperture and the peak intensity is desired, floodlighting systems are commonly offered with a large variety of reflectors which then are specifically selected to meet the requirements of the application.

[0005] Obviously, producing and storing a high number of different types of reflectors is not desirable. Due to their hollow, bulky shape, reflectors typically require specialized equipment for their manufacture, and take up considerable amounts of room after manufacture, making them expensive to manufacture, store and/or ship. Particularly in industrial-type reflectors or reflectors for floodlighting systems where the light sources and associated reflectors are often relatively large, shipping and storage becomes a major cost but also the equipment for manufacturing such reflectors like injections moulds or the like is expensive.

[0006] US 707,982 discloses a reflector assembly in accordance with the preamble of claim 1 which comprises a plurality of reflector segments which are arranged to form together the dome shaped structure, said reflector segments comprising one central reflector segment and at least two periphery reflector segments extending from the central reflector segment to the opening of the dome shaped structure. To adapt the light emission characteristic of the reflector, the periphery reflector elements can be pivoted by means of an adjustment mechanism. This additional adjustment mechanism obviously results in a complex overall structure of the adjustable reflector assembly.

[0007] Further, reflectors being formed from a plurality of reflector segments are also known from US 5,287,259, US 6,203,176 B1, US 2009/0268456 A1, US 5,971,569 or US 6,382,803 B1.

[0008] There is thus a need to provide a solution for facilitating the manufacture of a reflector which can be used in particular in a floodlighting system and provides a desired specific light emission characteristic.

[0009] In accordance with the present invention, the above object is solved by a reflector assembly as defined in independent claim 1 and by a method as defined in claim 8. Preferred embodiments and further developments of the present invention are subject matter of the dependent claims.

[0010] The inventive solution is based on the concept of using a reflector which includes multiple segments assembled to each other in order to finally form the reflective surface. By providing segments having different reflection characteristics, the emission of the luminaire can be easily and efficiently adapted to meet the lighting requirements of multiple applications. In particular, the "construction kit" solution proposed in accordance with the present invention allows manufacturing reflectors having different emission characteristics by simply selecting a specific combination of reflector segments with appropriate reflection characteristics. Even more, the resulting reflectors - though they emit light in different ways - always have identical shapes and thus can be used with identical luminaire housings and/or supporting structures and preferably also with identical light sources. Accordingly, luminaires for floodlighting applications can be obtained with a wide variety of light emission characteristics and thus suitable for different applications at reasonable costs.

[0011] Thus, in accordance with the present invention a reflector assembly for use in a luminaire in particular for floodlight, sport and area lighting applications is provided wherein said reflector assembly forms a dome shaped structure for accommodating at least one light source therein and emitting the light of said light source via an opening of said dome shaped structure wherein said reflector comprises a plurality of reflector segments which are arranged to form together the dome shaped structure. The reflector segments comprise one central reflector segment and four periphery reflector segments having a substantial identical shape and extending from the central reflector segment to the opening of the dome shaped structure, wherein at least two of said reflector segments have different reflection characteristics and wherein two opposed periphery reflector segments have identical reflection characteristics. Further, two of the

periphery reflector segments are at their sides adjacent to the central reflector segment provided with a recess having approximately the form of a semi-circle, said recesses forming together with corresponding recesses provided at the central reflector segment two openings, which are arranged opposite to each other in the bottom region of the dome shaped structure.

[0012] Preferably, the reflector segments are adapted to form a continuously shaped reflective surface at the inner surface of the dome shaped structure. In particular, the reflector segments can have a shape and means to connect to a neighboring segment in such a way that a continuous and smooth transition between both segments is obtained. In this way, the resulting reflector assembly is almost identical to a one-piece reflector regarding the quality of the reflective surface but obviously can be manufactured in a much easier and more cost efficient way.

[0013] As mentioned above, the reflector segments comprise one central reflector segment and four periphery reflector segments which extend from the central reflector segment to the light emitting opening of the dome shaped structure. The central reflector segment thus forms the basic element of the inventive reflector assembly and provides a reflective surface which is located behind the light source. In contrast to this, the periphery reflector segments form reflective surfaces at the sides and in front of the light source and are mainly responsible for shaping the emitted light into the desired form. By selecting periphery reflector segments with specific reflection characteristics, the light distribution can be adapted in an extremely efficient way.

[0014] In almost all applications of the inventive reflector assembly, it is desired that the light is emitted symmetrically to both sides of a luminaire. This characteristic is obtained by providing two opposed periphery reflector segments which form lateral reflective surfaces and are identical with respect to their reflection characteristics. In contrast to this, the other periphery reflector segments form a top reflective surface and a bottom reflective surface and are individually selected to finally shape the emitted light beam. The reflection characteristics of these two further segments can differ from each other but also from the reflection characteristics of the two lateral segments.

[0015] Similar to a classical one-piece reflector, the longitudinal light source is preferably located within the reflector such that it extends through the bottom region of the dome structure. The two openings arranged in the bottom region of the reflector allow the light source to extend with their ends to lamp holders which are provided in the surrounding area of the reflector. Alternatively, a holding structure for holding the light source can extend through the opening(s) in the interior of the reflector dome to safely hold the light source there.

[0016] In the following, the present invention and advantages thereof are explained in more detail with reference to the accompanying drawings.

Figures 1 to 3 show the inventive concept of a multi-part reflector assembly;

Figures 4 to 7 show different views of a periphery reflector segment used in the inventive reflector assembly;

Figures 8 and 9 show exploded views of the final reflector assembly;

Figures 10 and 11 show the inventive reflector in an assembled form;

Figure 12 shows as floodlighting luminaire comprising the inventive reflector assembly.

[0017] The inventive concept is at first explained with reference to Figures 1 to 3 which show different views of a rotational, dome shaped reflector assembly comprising five separate reflector segments - and one further optional reflector segment - which are assembled to the dome structure. In these Figures, only the light source and the reflector segments are shown but no further elements serving to connect the segments to each other. These further elements for finally forming the reflector are shown in the following figures and explained further below.

[0018] As mentioned above, the inventive concept is based on the idea of using a reflector which includes multiple segments assembled to each other in order to finally form the reflective surface. By using reflector segments with different optical characteristics, a wide range of lighting distributions for different floodlighting applications can be obtained.

[0019] In the embodiment shown in Figures 1 to 3, the reflector 1 consists of an assembly of five different parts or segments 2-5 made preferably in high reflective aluminum. In particular, the reflector 1 comprises a center portion formed by one central reflector segment 2 and a surrounding reflective surface extending from the center portion to the opening of the reflector 1 which is formed by four periphery reflector segments 3-5. In the assembled form, these reflector segments 2-5 provide a continuous concave shape similar to a conventional one-piece reflector. If required, a sixth reflector segment 6 can be added which extends through the interior of the dome structure and forms a deflector. This optional deflector segment 6 is for example used in case a strong asymmetric light distribution is desired.

[0020] In the preferred embodiment shown in the Figures, the four periphery reflector segments 3-5 have an almost identical shape wherein one reflector segment is shown in isolated form in Figures 4 to 7. It forms a quarter of the rotational dome structure and thus shows a rotational symmetry with respect to an axis I extending through the center

of the reflector assembly perpendicular to the reflector opening (see Figure 2). In this way, the four periphery reflector segments 3-5 form in the finally assembled form a smooth and continuous reflective surface for distributing the light emitted by the light source 100 in a desired manner.

[0021] When it was explained above that the periphery reflector segments 3-5 have an almost identical shape, it should be clarified that this explanation refers to the general form of the reflective surface of the segments. As shown Figures 1 to 3, the reflector segments 3-5 can slightly differ from each other in the portion adjacent to the central reflector segment 2. In particular, preferably two of the periphery reflector segments are at their sides adjacent to the central segment 2 provided with a recess 7 (see Figures 4 to 6) having approximately the form of a semi-circle. Together with corresponding recesses provided at the central reflector segment 2, they form two circular openings 8 which are arranged opposite to each other in the bottom region of the reflector dome and can be used to insert the light source 100 or allow that supporting elements extend from an exterior of the reflector 1 through the openings 8 in the interior of the reflector 1 for holding the light source 100 there. Preferably, these semi-circular recesses 7 are cut into the reflector segments after their production requiring only one single die-cast form for manufacturing the periphery reflector segments.

[0022] Although the four periphery reflector segments have an - almost - identical shape, they are usually made from different materials and thus have different optical characteristics. By combining reflector segments of different materials, the light distribution and intensity finally obtained can be adapted in order to meet the requirements of a floodlighting application.

[0023] The effect of changing the reflector material for the different segments can be seen from the following Table which shows the peak intensity (in cd/klm) at a target area and the resulting beam shape for different material combinations. In all examples, an identical light source was used:

material → resulting beam ↓	Anodized 87%	Miro4 Extra Bright	Miro7 Matt	Miro9 Hammered	Miro20 Bright Diffuse
Intensive 25000 cd/klm	R	S / T / B / D			
Semi-Intensive 18000 cd/klm	R	D	S / T / B		
Semi-Extensive 11600 cd/klm	R	D	T / B		S
Extensive 8000 cd/klm	R	D			S / T / B
Elliptical 5500 cd/klm	R	D		S / T / B	

[0024] The letters in the table above refer to the different reflector segments as follows:

R: central reflector segment (2)
 S: side reflector segment (3)
 T: top reflector segment (4)
 B: bottom reflector segment (5)
 D: deflector reflector segment (6)

[0025] The results summarized in this table clearly show that the selection of the material for the different reflector segments has a significant influence on the resulting light distribution. It is thus indeed possible to adapt the characteristics of a reflector by specifically combining different materials although the shape of the reflector segments is always identical. Even more, not only the shape of the reflector segments does not change but also the resulting shape of the finally assembled reflector is always the same. Accordingly, all further elements of the luminaire, in particular the means for connecting the reflector segments to each other and also a holding structure for holding the reflector within a luminaire are generally the same and can be used in all cases independent from the actual reflector characteristics. Floodlighting luminaires having very different characteristics can thus be obtained in a cost efficient way on the basis of the present invention.

[0026] Whereas the figures so far only showed the general concept of combining the reflector elements to the final reflector dome, Figures 8 to 11 show in more detail how the segments are connected to each other.

[0027] In particular, the exploded views of Figures 8 and 9 show that two adjacent periphery reflector segments 3-5 are interconnected by a connection element 10 which extends over the entire connection region at the outer surface of the two segments 3-5. The connection elements 10 ensure that the reflector segments 3-5 are secured in the adjacent position and that no gaps occur between two segments 3-5. In this way, the desired smooth and continuous reflective surface is obtained.

[0028] At the reflector opening, an end plate 12 is provided having in the shown example a quadratic outer shape and a circular opening corresponding to the opening of the dome formed by the peripheral reflector segments 3-5. This end plate 12 stabilizes the dome structure and is connected to the reflector segments 3-5 as well as to end portions of the connecting elements 10. In this regard, the peripheral reflector segments 3-5 preferably have flanged end portions 9

allowing to fix the reflector segments 3-5 to the end plate 12 by bolts or screws 13.
[0029] At the bottom portion of the reflector 1, the central reflector segment 2 is covered by a bottom cap 15 stabilizing this bottom area of the reflector 1 by slightly extending with a flanged end portion 16 over the end regions of the peripheral reflector segments 3-5. The flanged end portion 16 is also adapted for a connection with the four connecting elements 10 by using further bolts or screws 13 and comprises two lateral openings 17 aligned with the openings 8 in the reflector dome. The finally obtained reflector 1 is shown in the assembled form in Figures 10 and 11 and exhibits stability sufficient for its further use in floodlighting luminaires as well as an excellent optical reflective surface. It can be finally inserted in a casing or holding structure to form a floodlighting luminaire 110 as shown in Figure 12.

[0030] Several alternatives to the preferred embodiment shown in the figures are possible. In particular, the means for interconnecting the segments and stabilizing the reflector structure can of course be designed in an alternative way.

[0031] Further, the dome structure of the reflector could be formed by alternatively shaped reflector segments. Further, the resulting reflector structure could differ from the one shown in the figures and could for example be more similar to truncated pyramid or the like.

[0032] Obviously, the possibilities to adapt the optical characteristics of the resulting reflector are increased in case a higher number of reflector segments is used to form the reflector dome. On the other hand, assembling the segments to the final structure is then more complicate and care should be taken that no gaps occur which could significantly impair the optical characteristics of the reflector. In this regard, the shown embodiment provides a perfect compromise since the effort to manufacture the reflector is still low while the optical characteristics of the reflector can nevertheless be adapted in a relatively wide range.

Claims

1. Reflector assembly (1) for use in a luminaire (110) in particular for floodlight, sport and area lighting applications, said reflector assembly (1) forming a dome shaped structure for accommodating at least one light source (100) therein and emitting the light of said light source (100) via an opening of said dome shaped structure, wherein said reflector comprises a plurality of reflector segments (2-5) which are arranged to form together the dome shaped structure, said reflector segments (2-5) comprising one central reflector segment (2) and four periphery reflector segments (3-5) having a substantial identical shape and extending from the central reflector segment (2) to the opening of the dome shaped structure, wherein at least two of said reflector segments (2-5) have different reflection characteristics, and wherein two opposed periphery reflector segments (3) have identical reflection characteristics,
characterized in that
two of the periphery reflector segments (3-5) are at their sides adjacent to the central reflector segment (2) provided with a recess (7) having approximately the form of a semi-circle, said recesses (7) forming together with corresponding recesses provided at the central reflector segment (2) two openings (8), which are arranged opposite to each other in the bottom region of the dome shaped structure.
2. Reflector assembly according to claim 1, wherein the reflector segments (2-5) form a continuously shaped reflective surface.
3. Reflector assembly according to any one of the preceding claims, comprising further means for connecting the reflector segments (2-5) to each other.
4. Method for manufacturing a dome shaped reflector (1) comprising assembling a plurality of reflector segments (2-5) to form together the dome shaped structure, wherein said reflector segments (2-5) comprise one central reflector segment (2) and four periphery reflector segments (3-5) having a substantial identical shape and extending from the central reflector segment (2) to the opening of the dome shaped structure, wherein at least two of said reflector segments (2-5) have different reflection characteristics, and wherein two opposed periphery reflector segments (3) have identical reflection characteristics,
characterized in that
two of the periphery reflector segments (3-5) are at their sides adjacent to the central reflector segment (2) provided with a recess (7) having approximately the form of a semi-circle, said recesses (7) forming together with corresponding recesses provided at the central reflector segment (2) two openings (8), which are arranged opposite to each other

in the bottom region of the dome shaped structure.

5. Method for manufacturing a dome shaped reflector according to claim 4, wherein the reflector segments (2-5) form a continuously shaped reflective surface.

Patentansprüche

1. Reflektoranordnung (1) zur Verwendung in einer Leuchte (110), insbesondere für Flutlicht-, Sport- und Bereichsbeleuchtungsanwendungen, wobei die Reflektoranordnung (1) eine domförmige Struktur zum Aufnehmen mindestens einer Lichtquelle (100) darin und Emittieren des Lichts der Lichtquelle (100) durch eine Öffnung der domförmigen Struktur bildet, wobei der Reflektor eine Mehrzahl von Reflektorsegmenten (2-5) umfasst, die so angeordnet sind, dass sie zusammen die domförmige Struktur bilden, wobei die Reflektorsegmente (2-5) ein mittiges Reflektorsegment (2) und vier umfängliche Reflektorsegmente (3-5) umfassen, die eine im Wesentlichen identische Form aufweisen und sich vom mittigen Reflektorsegment (2) zur Öffnung der domförmigen Struktur erstrecken, wobei mindestens zwei der Reflektorsegmente (2-5) verschiedene Reflexionscharakteristiken aufweisen, und wobei zwei gegenüberliegende umfängliche Reflektorsegmente (3) identische Reflexionscharakteristiken aufweisen,
dadurch gekennzeichnet, dass zwei der umfänglichen Reflektorsegmente (3-5) an ihren Seiten benachbart zum mittigen Reflektorsegment (2) mit einer Aussparung (7) versehen sind, die ungefähr die Form eines Halbkreises aufweist, wobei die Aussparungen (7) zusammen mit entsprechenden Aussparungen, die am mittigen Reflektorsegment (2) vorgesehen sind, zwei Öffnungen (8) bilden, die einander gegenüberliegend in der unteren Region der domförmigen Struktur angeordnet sind.
2. Reflektoranordnung nach Anspruch 1, wobei die Reflektorsegmente (2-5) eine durchgehend geformte Reflexionsfläche bilden.
3. Reflektoranordnung nach einem der vorhergehenden Ansprüche, ferner umfassend Mittel zum Verbinden der Reflektorsegmente (2-5) miteinander.
4. Verfahren zur Herstellung eines domförmigen Reflektors (1), umfassend ein derartiges Zusammensetzen einer Mehrzahl von Reflektorsegmenten (2-5), dass sie zusammen die domförmige Struktur bilden, wobei die Reflektorsegmente (2-5) ein mittiges Reflektorsegment (2) und vier umfängliche Reflektorsegmente (3-5) umfassen, die eine im Wesentlichen identische Form aufweisen und sich vom mittigen Reflektorsegment (2) zur Öffnung der domförmigen Struktur erstrecken, wobei mindestens zwei der Reflektorsegmente (2-5) verschiedene Reflexionscharakteristiken aufweisen, und wobei zwei gegenüberliegende umfängliche Reflektorsegmente (3) identische Reflexionscharakteristiken aufweisen,
dadurch gekennzeichnet, dass zwei der umfänglichen Reflektorsegmente (3-5) an ihren Seiten benachbart zum mittigen Reflektorsegment (2) mit einer Aussparung (7) versehen sind, die ungefähr die Form eines Halbkreises aufweist, wobei die Aussparungen (7) zusammen mit entsprechenden Aussparungen, die am mittigen Reflektorsegment (2) vorgesehen sind, zwei Öffnungen (8) bilden, die einander gegenüberliegend in der unteren Region der domförmigen Struktur angeordnet sind.
5. Verfahren zur Herstellung eines domförmigen Reflektors nach Anspruch 4, wobei die Reflektorsegmente (2-5) eine durchgehend geformte Reflexionsfläche bilden.

Revendications

1. Ensemble de réflecteur (1) pour une utilisation dans un luminaire (110) en particulier pour des applications de projecteur et d'éclairage sportif et de zone, ledit ensemble de réflecteur (1) formant une structure en forme de dôme pour loger au moins une source de lumière (100) dans celle-ci et émettant la lumière de ladite source de lumière (100) à travers une ouverture de ladite structure en forme de dôme,

dans lequel ledit réflecteur comprend une pluralité de segments de réflecteur (2 à 5) qui sont agencés pour former ensemble la structure en forme de dôme, lesdits segments de réflecteur (2 à 5) comprenant un segment de réflecteur central (2) et quatre segments de réflecteur de périphérie (3 à 5) ayant des formes sensiblement identiques et s'étendant du segment de réflecteur central (2) jusqu'à l'ouverture de la structure en forme de dôme,

dans lequel au moins deux desdits segments de réflecteur (2 à 5) ont des caractéristiques de réflexion différentes, et dans lequel deux segments de réflecteur de périphérie (3) opposés ont des caractéristiques de réflexion identiques, **caractérisé en ce que**

deux des segments de réflecteur de périphérie (3 à 5) sont, au niveau de leurs côtés adjacents au segment de réflecteur central (2), pourvus d'un évidement (7) ayant à peu près la forme d'un demi-cercle, lesdits évidements (7) formant avec des évidements correspondants prévus au niveau du segment de réflecteur central (2) deux ouvertures (8), qui sont agencées l'une en face de l'autre dans la région de fond de la structure en forme de dôme.

2. Ensemble de réflecteur selon la revendication 1,

dans lequel les segments de réflecteur (2 à 5) forme une surface de réflexion de forme continue.

3. Ensemble de réflecteur selon l'une quelconque des revendications précédentes,

comprenant en outre des moyens pour relier les segments de réflecteur (2 à 5) les uns aux autres.

4. Procédé pour fabriquer un réflecteur en forme de dôme (1) comprenant l'assemblage d'une pluralité de segments de réflecteur (2 à 5) pour qu'ils forment les uns avec les autres la structure en forme de dôme, dans lequel lesdits segments de réflecteur (2 à 6) comprennent un segment de réflecteur central (2) et quatre segments de réflecteur de périphérie (3 à 5) ayant des formes sensiblement identiques et s'étendant du segment de réflecteur central (2) jusqu'à l'ouverture de la structure en forme de dôme,

dans lequel au moins deux desdits segments de réflecteur (2 à 5) ont des caractéristiques de réflexion différentes, et dans lequel deux segments de réflecteur de périphérie (3) opposés ont des caractéristiques de réflexion identiques, **caractérisé en ce que**

deux des segments de réflecteur de périphérie (3 à 5) sont, au niveau de leurs côtés adjacents au segment de réflecteur central (2), pourvus d'un évidement (7) ayant à peu près la forme d'un demi-cercle, lesdits évidements (7) formant avec des évidements correspondants prévus au niveau du segment de réflecteur central (2) deux ouvertures (8), qui sont agencées l'une en face de l'autre dans la région de fond de la structure en forme de dôme.

5. Procédé pour fabriquer un réflecteur en forme de dôme selon la revendication 4,

dans lequel les segments de réflecteur (2 à 5) forment une surface de réflexion de forme continue.

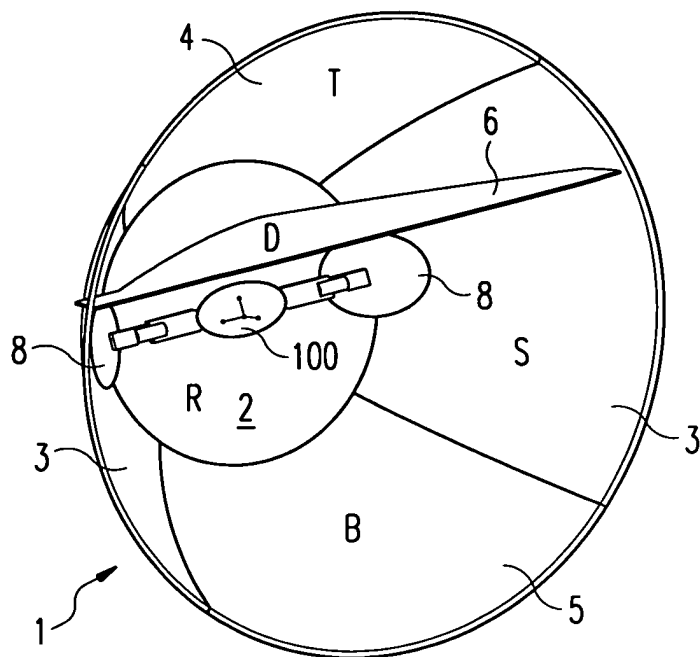


Fig. 1

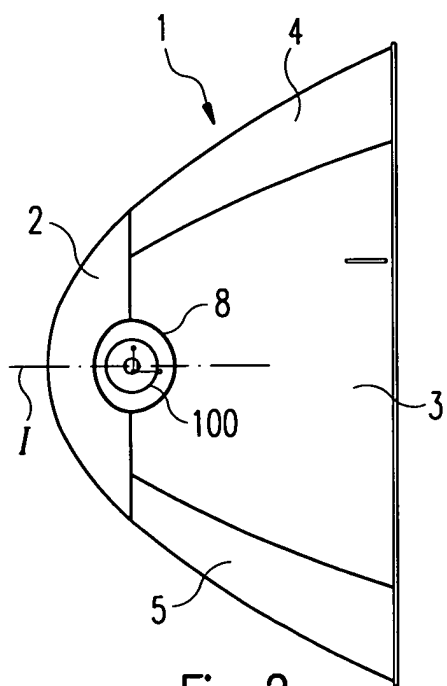


Fig. 2

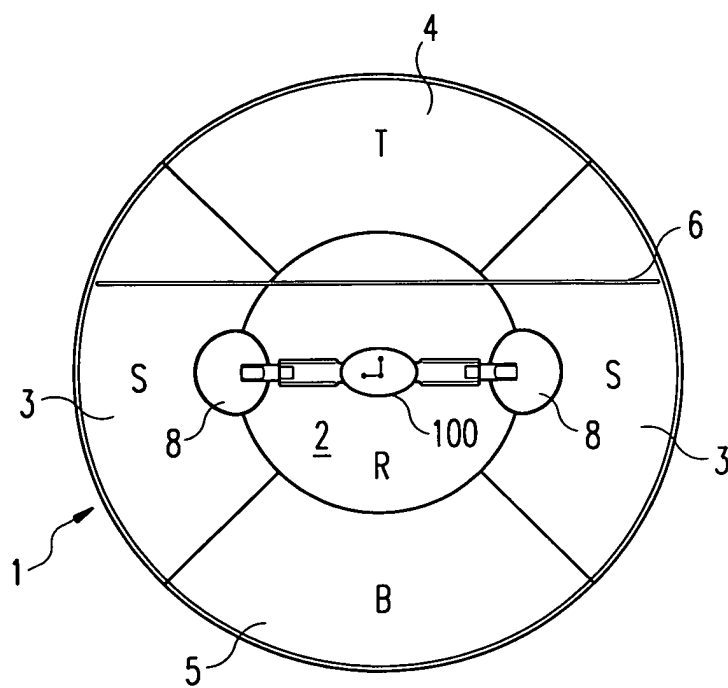
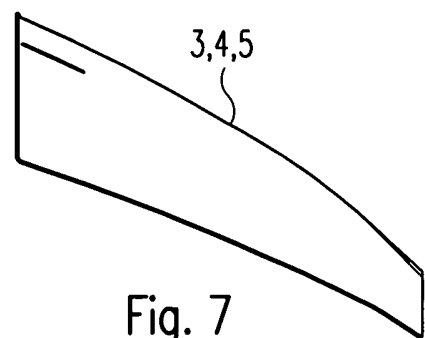
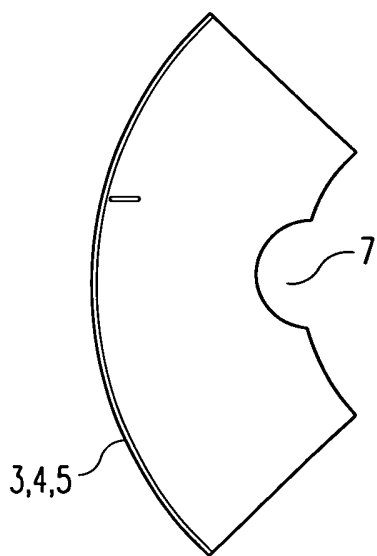
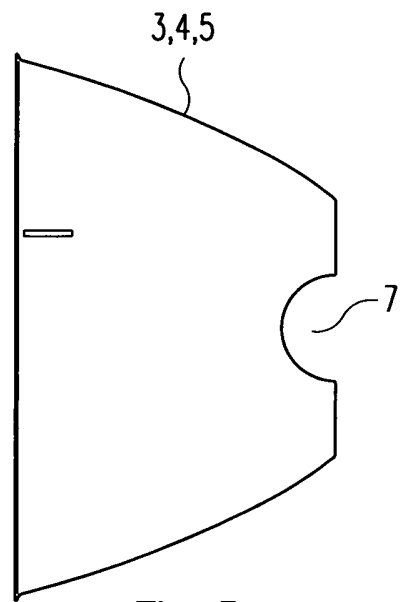
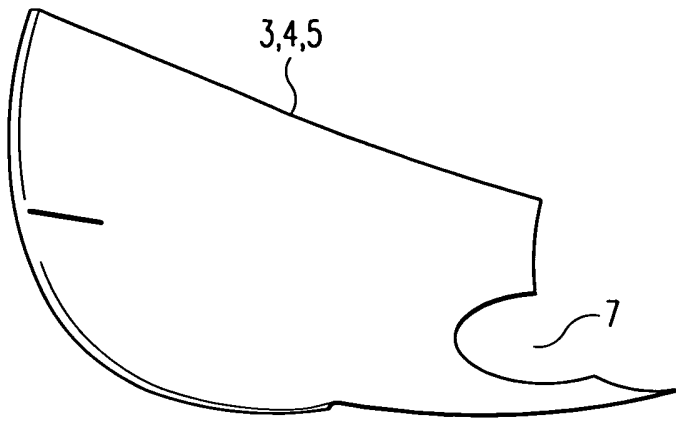


Fig. 3



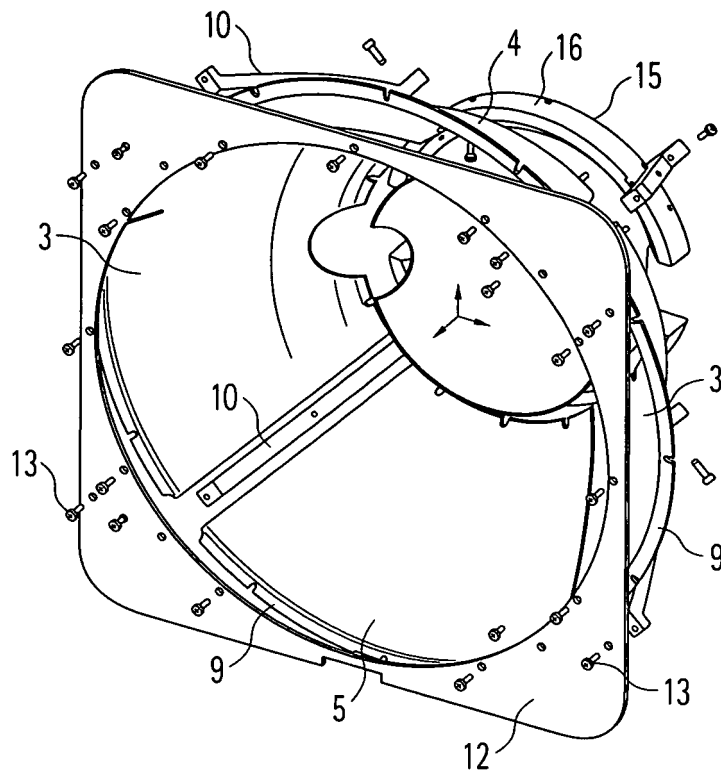


Fig. 8

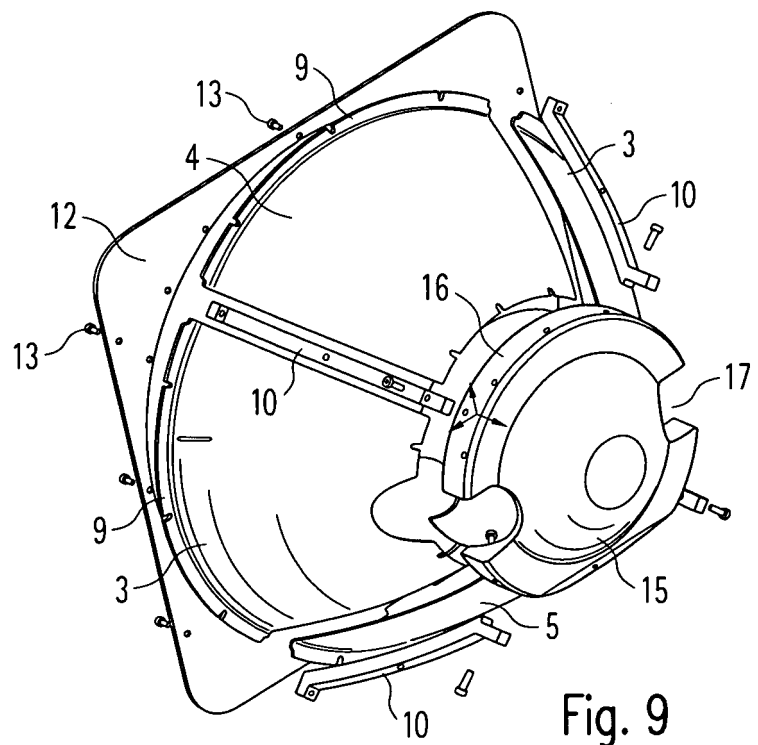


Fig. 9

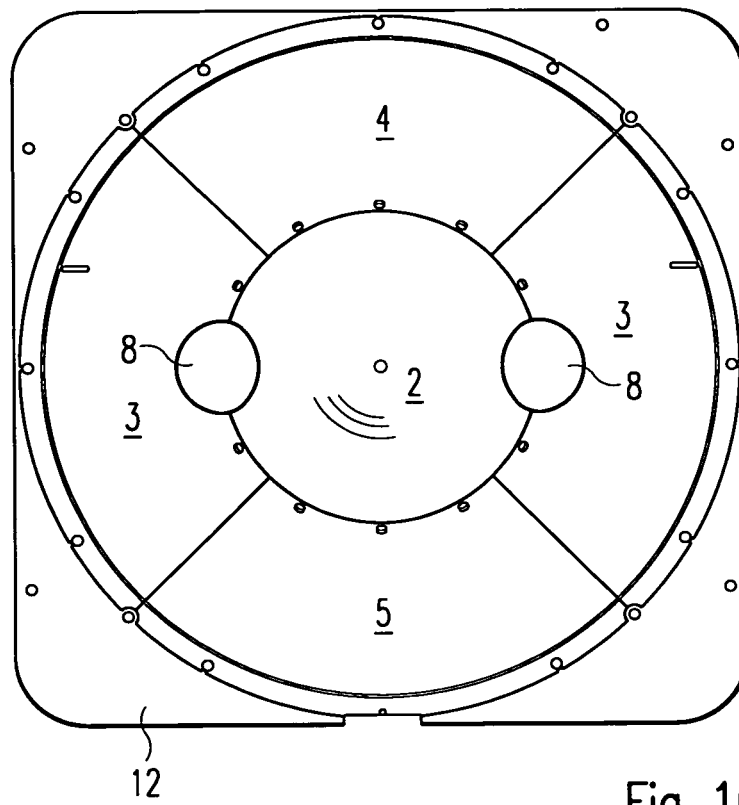


Fig. 10

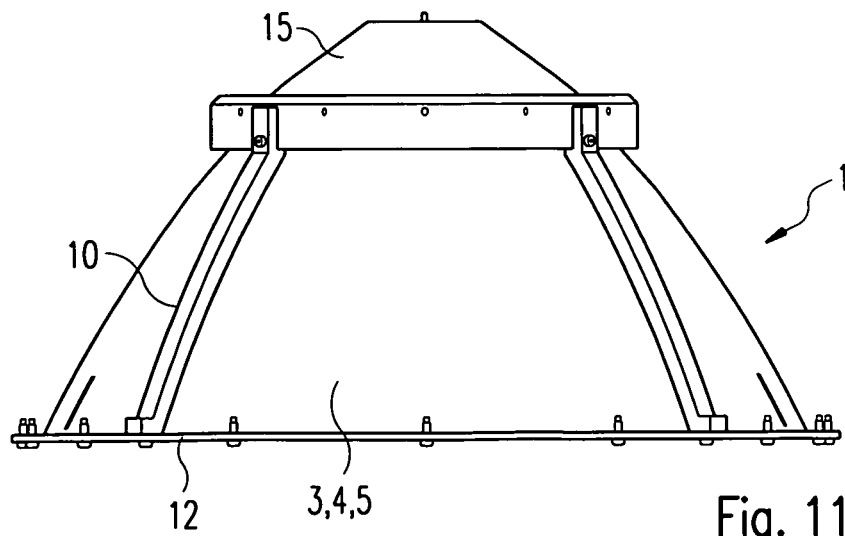


Fig. 11

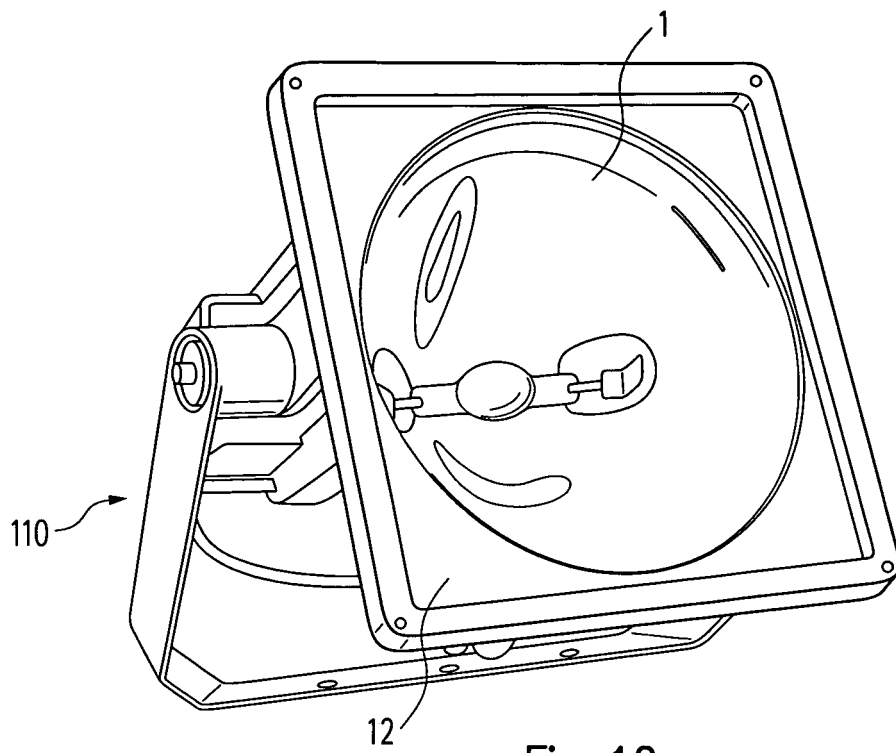


Fig. 12

REFERENCES CITED IN THE DESCRIPTION

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