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(54) **FLOODLIGHT**

(57) Floodlight (1), in particular floodlight for sports lighting, comprising: a first floodlight module (10) having a first group of light sources (11) for light emission, a second floodlight module (20) having a second group of light sources (21) for light emission, and an optical element (30). A peripheral end (16) of the first floodlight module (10) is connected to a first peripheral end (27) of the second floodlight module (20), and a peripheral end (35)

of the optical element (30) is connected to a second peripheral end (26) of the second floodlight module (20) being opposite to the first end (27). Each of the first floodlight module (20) and the optical element (30) are tilted with respect to the second floodlight module (20) in a direction towards each other, such that the optical element (30) is able to optically interact with at least the light emitted from the first group of light sources (11).

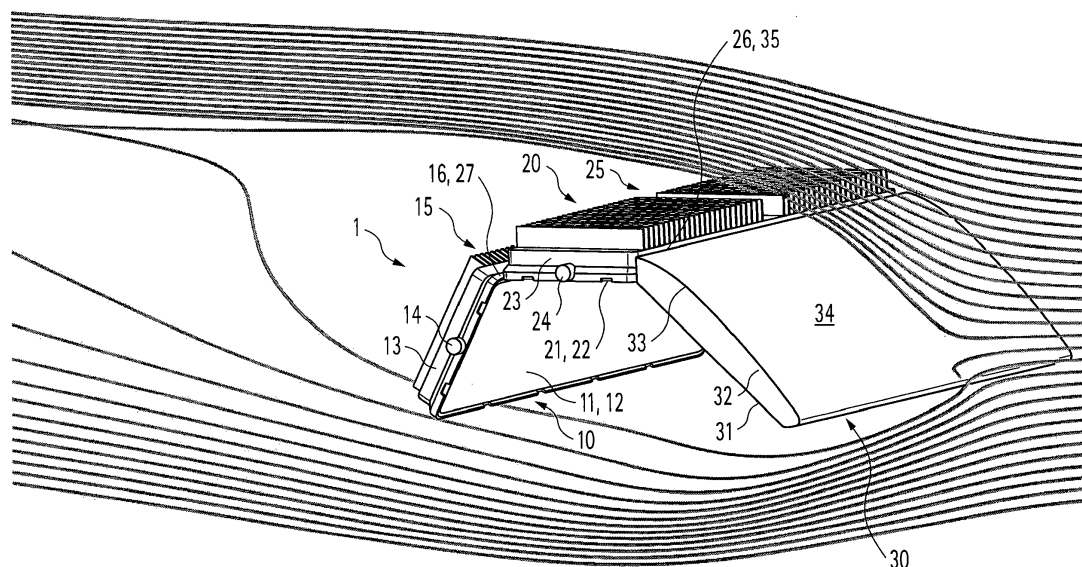


Fig. 1

Description

1. Field of the invention

[0001] The present invention relates to a floodlight, in particular to a floodlight for sports lighting.

2. Technical background

[0002] In the prior art, floodlights are well known. Usually such floodlights hang at high poles in order to achieve a preferably large-area illumination. A big problem of the floodlights is that the flood lights are subject to strong winds due to their high position. Thus, the load acting on these floodlights is very high, which is also due to the large area (e.g., 600mm x 600mm) of the floodlights standing in the wind. This affects also the fastening of these floodlights. For these reasons, the floodlights need to be appropriately dimensioned.

[0003] Usually, there are different options to mount floodlights. A first option is to provide a floodlight, which consists of several modules (e.g., three modules) and to tilt the respective modules at a defined angle (e.g., 30° to 70° tilt with respect to the ground). The inclination relates to the desired direction of light emission. For such inclinations, usually (quasi) symmetrical and, thus, simple lenses may be used. Furthermore, due to the use of symmetrical lenses being mounted downstream of the cover with respect to the direction of light emission, no significant optical influence is achieved, which is advantageous for the light emission. Moreover, a high peak angle is generated. A disadvantage of such a design is, however, that the floodlight stands in the wind and that, thus, the load acting on the floodlight is very high. That is, the aerodynamic of this option is limited. Furthermore, obtrusive light is generated.

[0004] To counter this, another option proposes to provide the floodlight in a flat, i.e., horizontal, manner (e.g., 15° tilt with respect to the ground). In order to achieve a light emission according to the aforementioned first option, asymmetrical lenses are usually used. This in combination with the cover or glass enclosure being provided downstream with respect to the direction of light emission results, however, in unwanted optical influences (reflections and the like), which worsens the efficiency (in particular, the efficiency with respect to illumination) of the floodlight. That is, it is difficult to get a high peak angle due to the reflections onto the cover.

[0005] Therefore, it is an object of the present invention to provide a floodlight, which overcomes the aforementioned drawbacks. In particular, it is an object of the present invention to provide a floodlight, which has an improved efficiency, and which reduces wind loads.

[0006] These and other objects, which become apparent upon reading the following description, are solved by the subject-matter of the independent claim. The dependent claims refer to preferred embodiments of the invention.

3. Summary of the invention

[0007] According to the invention, a floodlight, in particular a floodlight for sports lighting, comprises a first floodlight module having a first group of light sources for light emission, a second floodlight module having a second group of light sources for light emission, and an optical element. A peripheral end of the first floodlight module is connected to a first peripheral end of the second floodlight module. A peripheral end of the optical element is connected to a second peripheral end of the second floodlight module being opposite to the first end. Each of the first floodlight module and the optical element are tilted with respect to the second floodlight module in a direction towards each other, such that the optical element is able to optically interact with at least the light emitted from the first group of light sources.

[0008] In the context of the present invention, "able to optically interact" of an element is preferably to be understood that no opaque elements intersect a straight line connecting a light source and the element.

[0009] With other words, the present invention proposes to provide a floodlight having a streamlined (i.e., in particular, a relatively low c_x (or c_d or c_w or drag coefficient) value) form due to the inclinations and connections between the second floodlight module and the first floodlight module, the optical element, respectively. In particular, due to the inclinations and connections between the second floodlight module and the first floodlight module, the optical element, respectively, the drag force or wind force acting on the thus thin aerodynamic floodlight is reduced compared to a conventional floodlight hanging at high poles and having a large area. The drag force is generally directly proportional to the frontal area (S) and the drag coefficient, in particular to the product $S \cdot c_x$, also known as drag area Sc_x . In the present invention, in particular the frontal area S and the drag coefficient c_x , i.e. in particular the drag area Sc_x , are/is significantly reduced thus resulting in a small drag force, wind force, respectively. E.g., the floodlight may be positioned such that the second floodlight module is substantially parallel to the ground, i.e., such that the second floodlight module is horizontal in a mounting position of the floodlight. Thus, wind does not severely affect the floodlight. And since the wind load of the floodlight is significantly reduced, the floodlight can be made light weighted (in particular, less material, less fastening elements), which, thus, reduces also the costs of manufacturing and assembling. Furthermore, the optical element optically interacting with at least the first floodlight module also improves the efficiency of the floodlight as a whole, i.e., in particular, the efficiency of the first floodlight module. In particular, spill light (in particular, light which gets lost due to unwanted reflections and the like) of the floodlight may be redirected by the optical element to focus the spill light on the area, which needs to be illuminated, i.e., the defined area to be illuminated. Moreover, a high beam efficiency of the floodlight is achieved and the obtrusive light is limited.

Furthermore, since the first and second floodlight module as well as the optical element are serially connected, i.e., connected angularly and along one direction, heat generated by the components of floodlight, in particular by the floodlight modules, is transferred to the outside of the floodlight without affecting the respective other components of the floodlight. Thus, lifetime and maintenance of the floodlight is also improved.

[0010] Preferably, the first floodlight module and/or the optical element is/are pivotably connected with respect to the second floodlight module. With such a configuration, the floodlight may be adapted to various circumstances (wind, space etc.), thus, reducing time and costs of manufacturing and/or assembling.

[0011] The first floodlight module and the optical element may be connected to the second floodlight module by way of connecting means. Preferably, these connecting means are brackets for fixed tilting angles. Alternatively, the connecting means may be hinges for variable tilting angles.

[0012] The first floodlight module may be tilted with respect to the second floodlight module at a first angle α , which may range from about 15° to about 90°, preferably from about 50° to about 70°, and which is, preferably, about 60°. Additionally or alternatively, the optical element may be tilted with respect to the second floodlight module at a second angle β , which may range from about 5° to about 90°, preferably from about 30° to about 50°, and which is, preferably, about 40°.

[0013] The first angle α is preferably an angle between two planes being defined by the groups of light sources of the first and second floodlight module. The second angle β is preferably an angle between two planes being defined by the second group of light sources of the second floodlight module and the optical element. The first and second angle are preferably those angles of intersection of the planes, which lie outside of the side of light emission. In other words, the first and second angle are preferably not those angles of intersection of the planes, which lie between the first group of light sources and the optical element.

[0014] In the aforementioned ranges of the first and/or second angle, the floodlight has a particular advantageous form with respect to wind loads and efficiency of the floodlight. More specifically, in those ranges the wind load is minimized and the efficiency of the floodlight is improved, i.e., the spillage of light is reduced.

[0015] When viewed in a cross-sectional side view comprising the floodlight modules and the optical element, the floodlight modules and the optical element may constitute a substantial V- or U-profile. In other words, the first and second angle are preferably those angles of intersection of the aforementioned planes, such that the planes constitute a substantial V- or U-profile. "Substantial V- or U-profile" is preferably to be understood that the arms having the free ends of the V- or U-profile do not need to have the same length and/or to be symmetric with respect to the arm connecting the arms having the

free ends. Such profiles are particularly advantageous with respect to the wind load and the efficiency of the flood light.

[0016] The optical element may comprises a first side for optically interacting with at least the light emitted from the first group of light sources, and a second side facing away from the first side, wherein at least the second side has a convex shape, preferably a wing profile. The second side is preferably a side of the optical element, which is opposite to the first side with respect to the optical element, i.e., the second side may be a side of the optical element, over which a stream or flow of the wind flows or circulates around. In other words, the second side may have aerodynamic features. Due to the convex shape a relative low flow resistance of the optical element and, thus, of the floodlight as a whole is achieved. Thus, the wind load of the floodlight is even more reduced (i.e., amongst others the c_x value of the floodlight and, in particular, of the optical element is optimized), so that the floodlight may be made even more light weighted. In particular, the c_x and the Sc_x value of the floodlight compared with the c_x value and the Sc_x value of other floodlights is significantly optimized, i.e., reduced. With the second side having a wing profile, this effect is even more increased.

[0017] Preferably, the optical element comprises further components of the floodlight for operating the first floodlight module and/or the second floodlight module. Thus, integrating the further components in the optical element provides an even more compact floodlight. More preferably, the further components are electric and/or electronic components, even more preferably a driver. These components constitute very critical parts with respect to functionality and space of the floodlight, so that with the integration of these components a very high functionality in a very compact layout may be achieved.

[0018] The optical element may comprise a housing for housing the further components, wherein, preferably, the housing comprises the second side of the optical element. As such, a very compact design of the optical element - and also of the floodlight as a whole - can be achieved, while the wind load on the optical element and the floodlight, respectively, is reduced at the same time due to the streamlined form of the second side of the optical element.

[0019] The optical element, preferably at least the first side, may be a reflector. The reflector is very advantageous for redirecting spill light, i.e., in particular, for redirecting spill light to the area of illumination. Therefore, the efficiency of the floodlight is even more increased.

[0020] The first floodlight module may comprise cooling fins, wherein, preferably, the cooling fins are provided on a first side of the first floodlight module facing away from the optical element, more preferably from a second side of the first floodlight module provided for emitting the light of the first flood light module. Additionally or alternatively, the second floodlight module may comprises cooling fins, wherein, preferably, the cooling fins are pro-

vided on a first side of the second floodlight module facing away from the first floodlight module and the optical element, more preferably from a second side of the second floodlight module provided for emitting the light of the second flood light module. This is of particular benefit for the heat transfer between the floodlight and the outside of the floodlight.

[0021] Preferably, the first group of light sources is configured to emit a substantially symmetrical light beam, and/or wherein the second group of light sources is configured to emit an asymmetrical light beam, wherein, more preferably, the first and second light beams are at least partially pointing towards the optical element. "At least partially" is preferably to be understood as "at least one of the symmetrical and asymmetrical light beams". "Pointing towards the optical element" with respect to the light beams is preferably to be understood that the respective light beams may also point towards an elongation of the optical element. By providing the symmetrical or asymmetrical light beam, the efficiency of the flood light is increased. The combination of the symmetrical and asymmetrical light beam even more increases the efficiency of the flood light and provides a more homogeneous light emission of the floodlight. The specification of the direction of the light beams positively affects the efficiency of the floodlight, too.

[0022] The first floodlight module may comprise a first optical element, preferably a lens, more preferably a quasi-symmetric optic, for providing the symmetrical light beam, and/or wherein the second floodlight module may comprise a second optical element for providing the asymmetrical light beam. Thus, a very easy way of providing the respective light beams is provided. Moreover, the first and/or second optical element may seal the respective floodlight module, i.e., in particular, the first and/or second group of light sources.

[0023] The floodlight modules may be LED floodlight modules having LEDs as the light sources. Additionally or alternatively, the floodlight modules may be floodlight modules having conventional illuminants, e.g. gas discharge lamps, in particular a metal-halide lamp, a mercury-vapor lamp, and/or a sodium vapor lamp, as the light sources. In particular due to conventional illuminants, the shape of the floodlight is even more streamlined.

[0024] The first floodlight module and/or the second floodlight module preferably comprise(s) attaching means for attaching the floodlight. As such, the floodlight may be attached over a ground, e.g., a playing field, with the second floodlight module being substantially parallel to the ground.

[0025] The floodlight may further comprises a frame for receiving the floodlight modules, preferably by way of the attaching means. In other words, the floodlight modules may be integrated in the frame. Thus, the weight of the respective floodlight modules does not affect the respective other floodlight module. Moreover, attaching means for attaching the floodlight may be reduced. Op-

tionally the frame may also receive the optical element. Thus, the compactness of the floodlight and the ease of assembly is even more increased. More preferably, the frame comprises further attaching means for attaching the frame to a pole (e.g., a floodlight column).

4. Description of a preferred embodiment

[0026] In the following, the invention is described exemplarily with reference to the enclosed figures, in which

Figure 1 is a perspective view showing an exemplary floodlight according to the invention in a flow field;

Figure 2 is a side view of the floodlight in figure 1 showing the magnitudes of the velocity of the flow; and

Figure 3 is a side view showing a further exemplary floodlight according to the invention.

[0027] Figure 1 is a perspective view showing a floodlight 1 according to the present invention. The floodlight 1 may be used for sports lighting, i.e., for illuminating playing fields and the like. In general, the floodlight 1 may be used for applications, which require, in particular, a high performance of illumination. That is, the floodlight 1 may be also used, e.g., for illuminating an airfield of an airport.

[0028] The floodlight 1 comprises a first floodlight module 10. The first floodlight module 10 may have an elongated shape. As such, the first floodlight module 10 may have a length being the multiple, e.g., two to three times, of its width. The length maybe, e.g., 600 mm. Preferably, in a plan view of the first floodlight module 10, the first floodlight module 10 has a substantially four-sided shape, in particular a substantially rectangular shape.

[0029] The first floodlight module 10 has a first group of light sources 11 for light emission. Preferably, the first group of light sources 11 define a light emission surface being defined by the shape of the first floodlight module 10. The first group of light sources 11 may comprise at least one light source (not shown). Preferably, the first group of light sources 11 comprises a plurality of light sources. The plurality of light sources may be evenly distributed over the first floodlight module 10, i.e., the plurality of light sources may be evenly distributed over the light emission surface. The first floodlight module 10 may comprise a housing 13 for housing the first group of light sources 11. Preferably, the housing 13 houses other components (not shown) for operating the floodlight 1, in particular, the first floodlight module 10. A transparent cover (not shown), e.g., a glass or plastic enclosure, may be provided downstream of the first group of light sources 11 with respect to the direction of light emission. The cover may seal the first floodlight module 10 with respect to the environment, such that the first floodlight module

10 is moisture proof with respect to the environment. The cover may be connected to the housing 13, preferably directly connected to the housing 13.

[0030] The first floodlight module 10 may comprise attaching means 14 for attaching the floodlight 1, e.g., over a ground (playing field, etc.). The attaching means 14 may be provided on an edge of the first floodlight module 10. The attaching means 14 are preferably provided along the width (see Figure 1) and on opposing sides of the first floodlight module 1. The attaching means 14 may be provided as a joint element for facilitating pivoting of the first floodlight module 10 and/or the floodlight 1. In particular, the attaching means 14 may be provided as a protrusion, which may extend in a direction being substantially parallel to the length of the first floodlight module 10.

[0031] The floodlight 1 comprises a second floodlight module 20. The floodlight module 20 may also have an elongated shape. As such, the floodlight module 20 may have a length being the multiple, e.g., two to three times, of its width. The length may be, e.g., 600 mm. The width of the second floodlight module 20 is preferably smaller than the width of the first floodlight module 10. The length of the second floodlight module 20 is preferably substantially the same as the length of the first floodlight module 10. Preferably, in a plan view of the floodlight module 20, the floodlight module 20 has a substantially four-sided shape, in particular a substantially rectangular shape.

[0032] The second floodlight module 20 has a second group of light sources 21 for light emission. Preferably, the second group of light sources 21 define a light emission surface being defined by the shape of the floodlight module 20. The second group of light sources 21 may comprise at least one light source (not shown). Preferably, the second group of light sources 21 comprises a plurality of light sources. The plurality of light sources may be evenly distributed over the second floodlight module 20, i.e., the plurality of light sources may be evenly distributed over the light emission surface of the second floodlight module 20. The second floodlight module 20 may comprise a housing 23 for housing the second group of light sources 21. Preferably, the housing 23 houses components (not shown) for operating the floodlight 1, in particular, the first floodlight module 10 and/or the second floodlight module 20. A transparent cover (not shown), e.g., a glass or plastic enclosure, may be provided downstream of the second group of light sources 21 with respect to the direction of light emission. The cover may seal the second floodlight module 20 with respect to the environment, such that the second floodlight module 20 is moisture proof with respect to the environment. The cover may be connected to the housing 23, preferably directly connected to the housing 23. Preferably, one single cover may constitute both the cover of the first floodlight module 10 and of the second floodlight module 20. That is, the cover of the first floodlight module 10 and the cover of the second floodlight module 20 may be integrally provided.

[0033] The second floodlight module 20 may be substantially the same floodlight module as the first floodlight module 10. In other words, two of the first floodlight modules 10 or of the second floodlight modules 20 may be used for the floodlight 1.

[0034] The second floodlight module 20 may also comprise attaching means 24 for attaching the floodlight 1, e.g., over a ground (a playing field, etc.). The attaching means 24 may be provided on an edge of the second floodlight module 20. The attaching means 24 are preferably provided along the width (see Figure 1) and on opposing sides of the second floodlight module 2. The attaching means 24 may be provided as a joint element for facilitating pivoting of the second floodlight module 20 and/or the floodlight 1. In particular, the attaching means 24 may be provided as a protrusion, which may extend in a direction being substantially parallel to the length of the second floodlight module 20.

[0035] The floodlight 1 comprises an optical element 30. The optical element 30 may also have an elongated shape. As such, the optical element 30 may have a length being the multiple, e.g., two to three times, of its width. The length may be substantially the same length as the first floodlight module 10 and/or the second floodlight module 20. The width of the optical element 30 is preferably greater than the width of the first floodlight module 10. In a particularly preferred embodiment, the width of the optical element 30 is greater than 600mm. Preferably, in a plan view of the optical element 30, the optical element 30 has a substantially four-sided shape, in particular a substantially rectangular shape.

[0036] The optical element 30 may comprise further components (not shown) of the floodlight 1 for operating the first floodlight module 10 and/or the second floodlight module 20. Preferably, the further components are integrated in the optical element 30. The further components may also include components for operating components of the floodlight 1 other than the first floodlight module 10 and the second floodlight module 20. As such, the further components may also include components for operating the optical element 30 (e.g., means for adjusting or varying an optical effect of the optical element). In a particular preferred embodiment, the further components may be electric and/or electronic components, in particular a driver for driving the first group of light sources 11 and/or the second group of light sources 21. In particular, the optical element 30 may comprise or integrate all electric and/or electronic components of the floodlight 1.

[0037] Preferably, the optical element 30 comprises a housing 32 for housing the aforementioned further components. In particular, the housing 32 may have the shape of the optical element 30, i.e., the housing 32 may be an integrated part of the optical element 30.

[0038] The first floodlight module 10 has a first peripheral end 16. Preferably, the first peripheral end 16 extends along the length of the first floodlight module 10. When viewed in a plan view of the first floodlight module 10, i.e., in particular, when viewed perpendicular to a

plane spanned by the length and the width of the first floodlight module 10, the first peripheral end 16 is preferably a part of the periphery (i.e., circumference) of the shape of the first floodlight module 10. E.g., if the first floodlight module 10 has a substantial rectangular shape, the first peripheral end 16 corresponds to a side of the rectangle.

[0039] The peripheral end 16 is connected to a first peripheral end 27 of the second floodlight module 20. Preferably, the first peripheral end 27 extends along the length of the second floodlight module 20. When viewed in a plan view of the second floodlight module 20, i.e., in particular, when viewed perpendicular to a plane spanned by the length and the width of the second floodlight module 20, the first peripheral end 27 is preferably a part of the periphery (i.e., circumference) of the shape of the second floodlight module 20. E.g., if the second floodlight module 20 has a substantial rectangular shape, the first peripheral end 27 corresponds to a side of the rectangle. The connection between the first floodlight module 10 and the second floodlight module 20 may be such that the transition between the respective light emission surfaces is stepless. Preferably, the first floodlight module 10 and the second floodlight module 20 are flush, when viewed in a plan view of the floodlight modules 10 and 20. In particular, other peripheral ends extending from the peripheral end 16 and the first peripheral end 27, respectively, may be flush.

[0040] The first floodlight module 10 may be pivotably connected with respect to the second floodlight module 20. As such, the first floodlight module 10 and the second floodlight module 20 may be connected to one another by way connecting means (not shown), e.g., a joint connection, facilitating pivoting of the first floodlight module 10 and/or the second floodlight module 20. E.g., the connecting means may be a hinge or a plurality of hinges for pivoting and varying the tilting angle. After pivoting and varying the tilting angle, the connecting means may be able to fix the defined angle. Alternatively, the first floodlight module 10 may be also fixedly connected with respect to the second floodlight module 20. As such, the connecting means may be provided as fastening means (e.g., brackets, bolt connections) for fixing the first floodlight module 10 and the second floodlight module 20 in a defined subset of defined tilting angles (exactly one, two, three,... defined tilting angles) with respect to each other. The connecting means may be provided on the housings 13 and 23 of the first floodlight module 10 and the second floodlight module 20, respectively. Preferably, the connecting means are provided at the peripheral end of the first floodlight module 10 and the first peripheral end of the optical element 30.

[0041] Also the optical element 30 has a peripheral end 35. Preferably, the peripheral end 35 extends along the length of the optical element 30. When viewed in a plan view of the optical element 30, i.e., in particular, when viewed perpendicular to a plane spanned by the length and the width of the optical element 30, the peripheral

end 35 is preferably a part of the periphery (i.e., circumference) of the shape of the optical element 30. E.g., if the optical element 30 has a substantial rectangular shape, the peripheral end 35 corresponds to a side of the rectangle.

[0042] The peripheral end 35 is connected to a second peripheral end 26 of the second floodlight module 20 being opposite to the first end 27. Preferably, the second peripheral end 26 extends along the length of the second floodlight module 20. When viewed in the plan view of the second floodlight module 20, the second peripheral end 26 is preferably a part of the periphery (i.e., circumference) of the shape of the second floodlight module 20. E.g., if the second floodlight module 20 has a substantial rectangular shape, the second peripheral end 26 corresponds to a side of the rectangle. Preferably, the optical element 30 and the second floodlight module 20 are flush, when viewed in a plan view of the optical element 30 and the second floodlight module 20. In particular, other peripheral ends extending from the peripheral end 35 and the second peripheral end 26, respectively, may be flush.

[0043] The connection between the optical element 30 and the second floodlight module 20 may be such that the transition between the light emission surface of the second floodlight module 20 and the optical element 30 is stepless. The optical element 30 may be provided integrally with the second floodlight module 20. Preferably, the optical element 30 is detachably connected to the second floodlight module 20.

[0044] The optical element 30 may be pivotably connected with respect to the second floodlight module 20. As such, the optical element 30 and the second floodlight module 20 may be connected to one another by way connecting means (not shown), e.g., a joint connection, facilitating pivoting of the optical element 30 and/or the second floodlight module 20. E.g., the connecting means may be a hinge or a plurality of hinges for pivoting and varying the tilting angle. After pivoting and varying the tilting angle, the connecting means may be able to fix the defined angle. Alternatively, the optical element 30 may be also fixedly connected with respect to the second floodlight module 20. As such, the connecting means may be provided as fastening means (e.g., brackets, bolt connections) for fixing the second floodlight module 20 and the optical element 30 in a defined subset of defined tilting angles (exactly one, two, three,... defined tilting angles) with respect to each other. The connecting means may be provided on the housings 23 and 32 of the second floodlight module 20 and the optical element 30, respectively. Preferably, the connecting means are provided at the peripheral end of the optical element 30 and the second peripheral end of the second floodlight module 20.

[0045] Each of the first floodlight module 20 and the optical element 30 are tilted with respect to the second floodlight module 20 in a direction towards each other, such that the optical element 30 is able to optically interact with at least the light emitted from the first group of light sources 11. E.g., one of the first floodlight module

20 and the optical element 30 may be tilted clockwise with respect to the second floodlight module 20, wherein the other one may be tilted anti-clockwise with respect to the second floodlight module 20. As can be seen, in particular, in Figure 2, the first floodlight module 10 may be tilted with respect to the second floodlight module 20 at a first angle α , which may range from about 15° to about 90°, preferably from about 50° to about 70°, and which is, preferably, about 60°. Additionally or alternatively, the optical element 30 is tilted with respect to the second floodlight module 20 at a second angle β , which may range from about 5° to about 90°, preferably from about 30° to about 50°, and which is, preferably, about 40°. As can be seen exemplarily in Figures 1 to 3, both the optical element 30 and the first floodlight module 10 are tilted with respect to the second floodlight module 20 in the respective preferred ranges.

[0046] When viewed in a cross-sectional side view comprising the floodlight modules 10, 20 and the optical element 30, or as can be seen, in particular, in the side views of Figures 2 and 3, the floodlight modules 10, 20 and the optical element 30 constitute a substantial V- or U-profile. As can be seen exemplarily in Figures 2 and 3, the floodlight modules 10, 20 and the optical element 30 constitute a substantial V-profile, wherein the arm corresponding to the optical element 30 is longer than the arm corresponding to the first floodlight module 10, and wherein both arms are asymmetric (in particular, asymmetric with respect to orientation) with respect to the arm corresponding to the second floodlight module 20.

[0047] As mentioned above, the optical element 30 is able to optically interact with at least the light emitted from the first group of light sources 11. Preferably, optical element 30 is able optically interact with both the light emitted from the first group of light sources 11 and the light emitted from the second group of light sources 21. Also optically interacting with the second group of light sources 21 may further improve the efficiency of the floodlight, since, in particular, spill light of the second floodlight module 20 may also be redirected by means of the optical element 30.

[0048] Furthermore, the optical element 30 may comprise a first side 31 for optically interacting with at least the light emitted from the first group of light sources 11. The first side 31 may comprise an optical structure, e.g., a defined roughness and/or a defined material composition, for defined redirecting light arriving on the first side 31. Preferably, the optical element 30, more preferably the first side 31, is a reflector (i.e., a baffle) or has a reflecting surface.

[0049] The optical element 30 may comprise a second side 34 facing away from the first side 31. That is, the second side 34 is preferably a side of the optical element 30 being opposite to the first side 31 with respect to the optical element 30. As can be seen, in particular, in Figure 1, the second side 34 is a side of the optical element 30 being in direct contact with a flow, e.g., a flow of a wind circulating around the floodlight 1. Preferably, the second

side 34 has a convex shape, wherein the convex shape may have a bulge 33 bulging outwardly in a direction away from the first floodlight module 10, preferably away from the first side 31. More specifically, the optical element 30 may extend away from its peripheral end 32, preferably along the width of the optical element 30, having a first part increasing in thickness and a second part continuously connected to the first part decreasing in thickness, wherein, preferably, the first part is shorter than the second part with respect to the width of the optical element 30.

[0050] Preferably, while the second side 34 has a convex shape or while the optical element 30 varies in its thickness as previously described, the first side 31 remains substantially flat. In a particularly preferred embodiment, the second side 34 has a wing profile. In other words, the second side 34 may have such a shape that the first side 31 and the second side 34 define a wing profile of the optical element 30, when viewed in a cross sectional side view of the optical element 30.

[0051] Preferably, the housing 32 comprises the second side 34. As such, the further components of the floodlight 1, e.g., the driver, maybe housed at a part of the housing 32 corresponding to the convex shape. More specifically, the further components may be housed in the part of the housing 32, which is formed by the bulge 33 of the convex shape.

[0052] The first floodlight module 10 may comprise cooling fins 15. The cooling fins 15 may extend in the width and/or length direction of the first floodlight module 10. In the preferred embodiments shown in Figures 1 and 2, the cooling fins 15, respectively, extend in the width direction of the first floodlight module 10, wherein, preferably, the cooling fins 15 are provided along the length and substantially parallel to each other. Preferably, the cooling fins 15 are provided on a first side of the first floodlight module 10 facing away from the optical element 30. Thus, it can be achieved that heat generated by the first floodlight module 10 flows away from the floodlight 1 to not affect the floodlight 1 and components of the same, in particular, the second floodlight module 20 and the optical element 30. More preferably, the first side faces (also) away from a second side of the first floodlight module 10 provided for emitting the light of the first floodlight module 10, i.e., e.g., the previously mentioned light emission surface of the first floodlight module 10. This particularly increases the effect of not affecting the floodlight 1 by heat generated by the first floodlight module 10. Preferably, as can be seen, in particular, in Figure 1, a flow of air, i.e., e.g., wind, circulates around the cooling fins 15 to facilitate good heat transfer between the first floodlight module 10 and the outside. Preferably, the cooling fins 15 are an integrated part of the housing 13. The material of the cooling fins 15 and/or the housing 13 may comprise materials having a good, i.e., high, thermal conductivity, such as metal or steel.

[0053] The second floodlight module 20 may also comprise cooling fins 25. The cooling fins 25 may extend in

the width and/or length direction of the second floodlight module 20. In the preferred embodiments shown in Figures 1 and 2, the cooling fins 25, respectively, extend in the width direction of the second floodlight module 20, wherein, preferably, the cooling fins 25 are provided along the length and substantially parallel to each other. Preferably, the cooling fins 25 are provided on a first side of the second floodlight module 20 facing away from the first floodlight module 10 and the optical element 30. Thus, it can be achieved that heat generated by the second floodlight module 20 flows away from the floodlight 1 to not affect the floodlight 1 and components of the same, in particular, the first floodlight module 10 and the optical element 30. More preferably, the first side faces (also) away from a second side of the second floodlight module 20 provided for emitting the light of the second floodlight module 20, i.e., e.g., the previously mentioned light emission surface of the second floodlight module 20. This particularly increases the effect of not affecting the floodlight 1 by heat generated by the second floodlight module 20. Preferably, as can be seen, in particular, in Figure 1, a flow of air, i.e., e.g., wind, circulates around the cooling fins 25 to facilitate good heat transfer between the second floodlight module 20 and the outside. Preferably, the cooling fins 25 are an integrated part of the housing 23. The material of the cooling fins 25 and/or the housing 23 may comprise materials having a good, i.e., high, thermal conductivity, such as metal or steel.

[0054] As can be seen in Figure 3, the first group of light sources 11 may be configured to emit a substantially symmetrical light beam 17. The symmetrical light beam 17 may be provided by, e.g., evenly distributing the light sources over the first floodlight module 10. The first floodlight module 10 may also comprise a first optical element 12, preferably a lens, more preferably a quasi-symmetric optic, for providing the symmetrical light beam 17. More specifically, the first optical element 12 may focus the light emitted by the first group of light sources 11 to bundle the light for constituting the symmetrical light beam 17. The first optical element 12 may be directly connected to the first floodlight module 10 and provided downstream of the first floodlight module 10, preferably downstream of its cover, with respect to the direction of light emission. The first optical element 12 may seal together with the cover of the first floodlight module 10 the first floodlight module 10 with respect to the environment. The first optical element 12 may also be integrated in the cover of the first floodlight module 10. Preferably, the light beam 17, i.e., in particular, the bundle of light constituting the light beam 17, points towards the optical element 30 or towards an elongation of the optical element 30. In particular, the symmetrical light beam 17 may bulge towards the optical element 30 or towards an elongation of the optical element 30.

[0055] As can be also seen in Figure 3, the second group of light sources 21 may be configured to emit a substantially asymmetrical light beam 28. The asymmetrical light beam 28 may be provided by, e.g., asymmet-

rically distributing the light sources over the second floodlight module 20. The second floodlight module 20 may also comprise a second optical element 22, preferably a lens, for providing the asymmetrical light beam 28. More specifically, the second optical element 22 may focus the light emitted by the second group of light sources 21 to bundle the light for constituting the asymmetrical light beam 28. The second optical element 22 may be directly connected to the second floodlight module 20 and provided downstream of the second floodlight module 20, preferably downstream of its cover, with respect to the direction of light emission. The second optical element 22 may seal together with the cover of the second floodlight module 20 the second floodlight module 20 with respect to the environment. The second optical element 22 may also be integrated in the cover of the second floodlight module 20. Preferably, the light beam 28, i.e., in particular, the bundle of light constituting the light beam 28, points towards the optical element 30 or towards an elongation of the optical element 30. In particular, the asymmetrical light beam 28 may bulge towards the optical element 30 or towards an elongation of the optical element 30. If the symmetrical light beam 17 is combined with the asymmetrical light beam 28, the floodlight 1 may provide an asymmetrical light distribution.

[0056] The floodlight modules 10, 20 may be LED floodlight modules, wherein the light sources are LEDs. The LEDs may be provided on a circuit board being provided inside of the respective floodlight module, preferably inside of the housing 13, 23 of the respective floodlight module.

[0057] The floodlight 1 may further comprise a frame (not shown) for receiving the floodlight modules 10, 20. Reception of the floodlight modules 10, 20 is preferably done by way of the attaching means 14, 24. As such, the frame may comprise attaching means corresponding to the attaching means 14, 24. Optionally the frame also receives the optical element 30, e.g., also by way of corresponding attaching means provided on the optical element 30 and the frame. Furthermore, the frame may comprise further attaching means for attaching the frame to a pole or the like. The further attaching means may facilitate tilting of the whole floodlight 1.

[0058] With respect to, in particular, Figure 2, it can be seen that the floodlight according to the present invention provides an improved, i.e., in particular, streamlined form of the floodlight. In particular, velocity magnitudes of a flow of air circulating around the first floodlight module 10 are very low, i.e., they range, e.g., from 0 m/s to about 8 m/s. Thus, the wind load on the first floodlight module 10, and therefore on the floodlight 1, becomes significantly reduced. The highest velocities of flow has the flow of air circulating around the second floodlight module 20, i.e., they range, e.g., from 15 m/s to about 38 m/s. In particular, the second floodlight module 20 may be orientated substantially in parallel to the ground and, thus, having a relatively small projected area standing in the flow. As such, the second floodlight module 20 consti-

tutes the highest part of the floodlight 1 with respect to the ground and, thus, transfers a great amount of the heat generated by the floodlight 1 by way of the second floodlight module 20. Moreover, the floodlight modules 10, 20 and the optical element 30 do not thermally influence each other. As a result, heat affecting the floodlight 1 is significantly reduced. Furthermore, due to the relatively small projected area standing in the flow, the wind load affecting the floodlight 1 is significantly reduced, too. In particular, the highest magnitude of the flow velocities may occur at the second peripheral end 26, i.e., they range, e.g., from about 30 m/s to about 38 m/s.

[0059] It should be clear to a skilled person that the embodiment shown in the figures is only a preferred embodiment, but that, however, also other designs of the floodlight 1, the floodlight modules 10, 20 and the optical element 30 are possible.

Claims

1. Floodlight (1), in particular floodlight for sports lighting, comprising:

a first floodlight module (10) having a first group of light sources (11) for light emission, a second floodlight module (20) having a second group of light sources (21) for light emission, and an optical element (30), wherein a peripheral end (16) of the first floodlight module (10) is connected to a first peripheral end (27) of the second floodlight module (20), and wherein a peripheral end (35) of the optical element (30) is connected to a second peripheral end (26) of the second floodlight module (20) being opposite to the first end (27), and wherein each of the first floodlight module (20) and the optical element (30) are tilted with respect to the second floodlight module (20) in a direction towards each other, such that the optical element (30) is able to optically interact with at least the light emitted from the first group of light sources (11).

2. Floodlight (1) according to claim 1, wherein the first floodlight module (10) and/or the optical element (30) is/are pivotably connected with respect to the second floodlight module (20).

3. Floodlight (1) according to claim 1 or 2, wherein the first floodlight module (10) and the optical element (30) are connected to the second floodlight module (20) by way of connecting means, preferably by way of brackets for fixed tilting angles or hinges for variable tilting angles.

4. Floodlight (1) according to any one of the preceding

claims, wherein the first floodlight module (10) is tilted with respect to the second floodlight module (20) at a first angle α , which preferably ranges from about 15° to about 90°, more preferably from about 50° to about 70°, and which is, most preferably, about 60°, and/or wherein the optical element (30) is tilted with respect to the second floodlight module (20) at a second angle β , which preferably ranges from about 5° to about 90°, more preferably from about 30° to about 50°, and which is, most preferably, about 40°.

5. Floodlight (1) according to any one of the preceding claims, wherein when viewed in a cross-sectional side view comprising the floodlight modules (10, 20) and the optical element (30), the floodlight modules (10, 20) and the optical element (30) constitute a substantial V- or U-profile.

6. Floodlight (1) according to any one of the preceding claims, wherein the optical element (30) comprises:

a first side (31) for optically interacting with at least the light emitted from the first group of light sources (11), and

a second side (34) facing away from the first side,

wherein at least the second side (34) has a convex shape, preferably a wing profile.

7. Floodlight (1) according to any one of the preceding claims, wherein the optical element (30) comprises further components of the floodlight (1) for operating the first floodlight module (10) and/or the second floodlight module (20), preferably electric and/or electronic components, more preferably a driver.

8. Floodlight (1) according to claim 7, wherein the optical element (30) comprises a housing (32) for housing the further components, wherein, preferably, the housing (32) comprises the second side (34) of the optical element.

9. Floodlight (1) according to any one of the preceding claims, wherein the optical element (30), preferably at least the first side (31), is a reflector.

10. Floodlight (1) according to any one of the preceding claims, wherein the first floodlight module (10) comprises cooling fins (15), and wherein, preferably, the cooling fins (15) are provided on a first side of the first floodlight module facing away from the optical element (34), more preferably from a second side of the first floodlight module (10) provided for emitting the light of the first flood light module (10), and/or wherein the second floodlight module (20) comprises cooling fins (25), and wherein, preferably, the cooling fins (25) are provided on a first side of the second floodlight module (25) facing away from the

first floodlight module (10) and the optical element (30), more preferably from a second side of the second floodlight module (20) provided for emitting the light of the second floodlight module (20).

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11. Floodlight (1) according to any one of the preceding claims, wherein the first group of light sources (11) is configured to emit a substantially symmetrical light beam (17), and/or wherein the second group of light sources (21) is configured to emit an asymmetrical light beam (28), wherein, preferably, the first and second light beams (17, 28) are at least partially pointing towards the optical element (30). 10
12. Floodlight (1) according to claim 11, wherein the first floodlight module (10) comprises a first optical element (12), preferably a lens, more preferably a quasi-symmetric optic, for providing the symmetrical light beam (17), and/or wherein the second floodlight module (20) comprises a second optical element (22) for providing the asymmetrical light beam (28). 15 20
13. Floodlight (1) according to any one of the preceding claims, wherein the floodlight modules (10, 20) are LED floodlight modules having LEDs as the light sources, and/or wherein the floodlight modules (10, 20) are floodlight modules having conventional illuminants, e.g. gas discharge lamps, in particular a metal-halide lamp, a mercury-vapor lamp, and/or a sodium vapor lamp, as the light sources. 25 30
14. Floodlight (1) according to any one of the preceding claims, wherein the first floodlight module (10) and/or the second floodlight module (20) comprise(s) attaching means (14, 24) for attaching the floodlight (1). 35
15. Floodlight (1) according to any one of the preceding claims, wherein the floodlight (1) further comprises a frame for receiving the floodlight modules (10, 20), preferably by way of the attaching means (14, 24), and for optionally receiving the optical element (30), and wherein, more preferably, the frame comprises further attaching means for attaching the frame to a pole. 40 45

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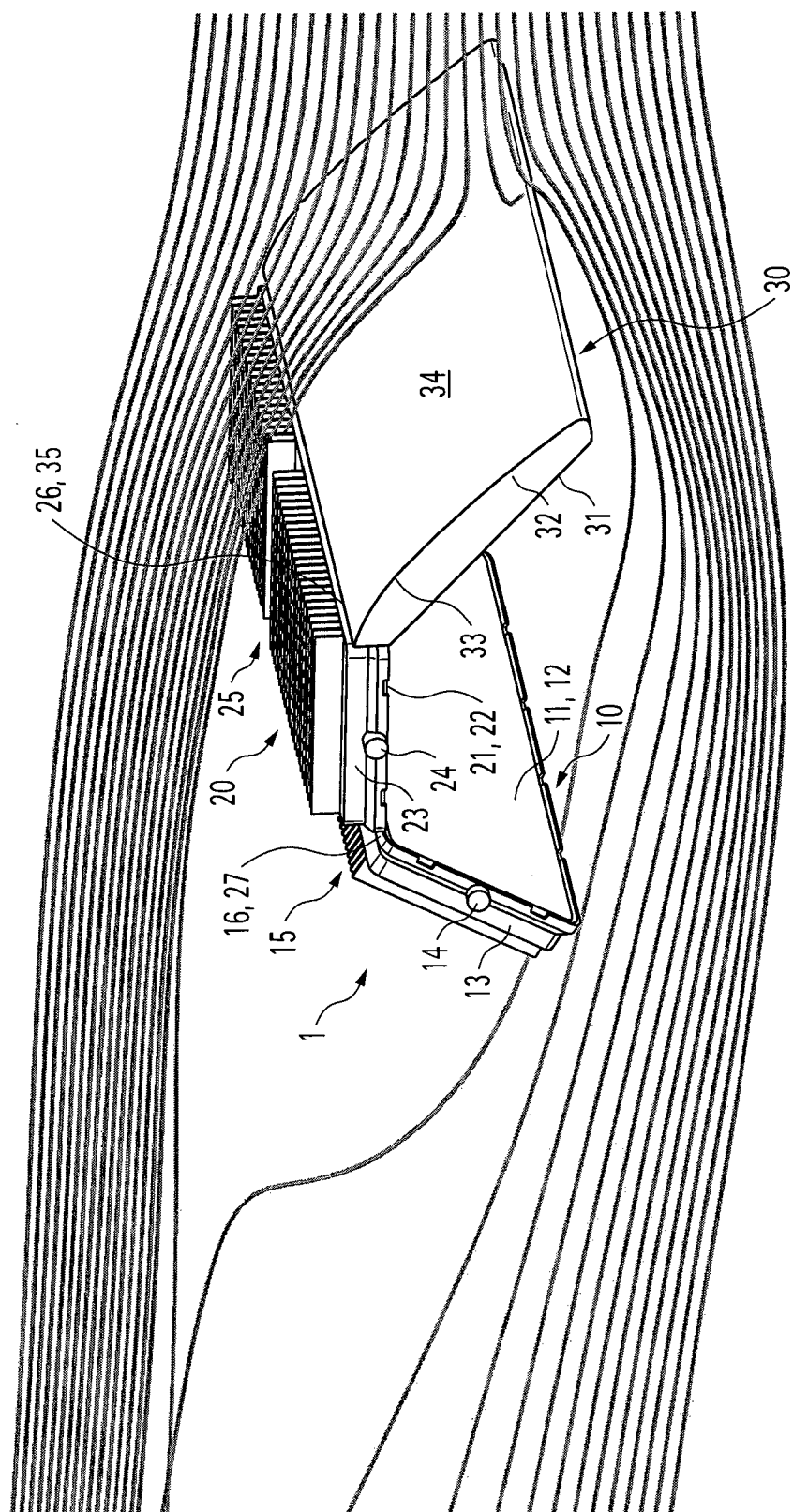


Fig. 1



Fig. 2

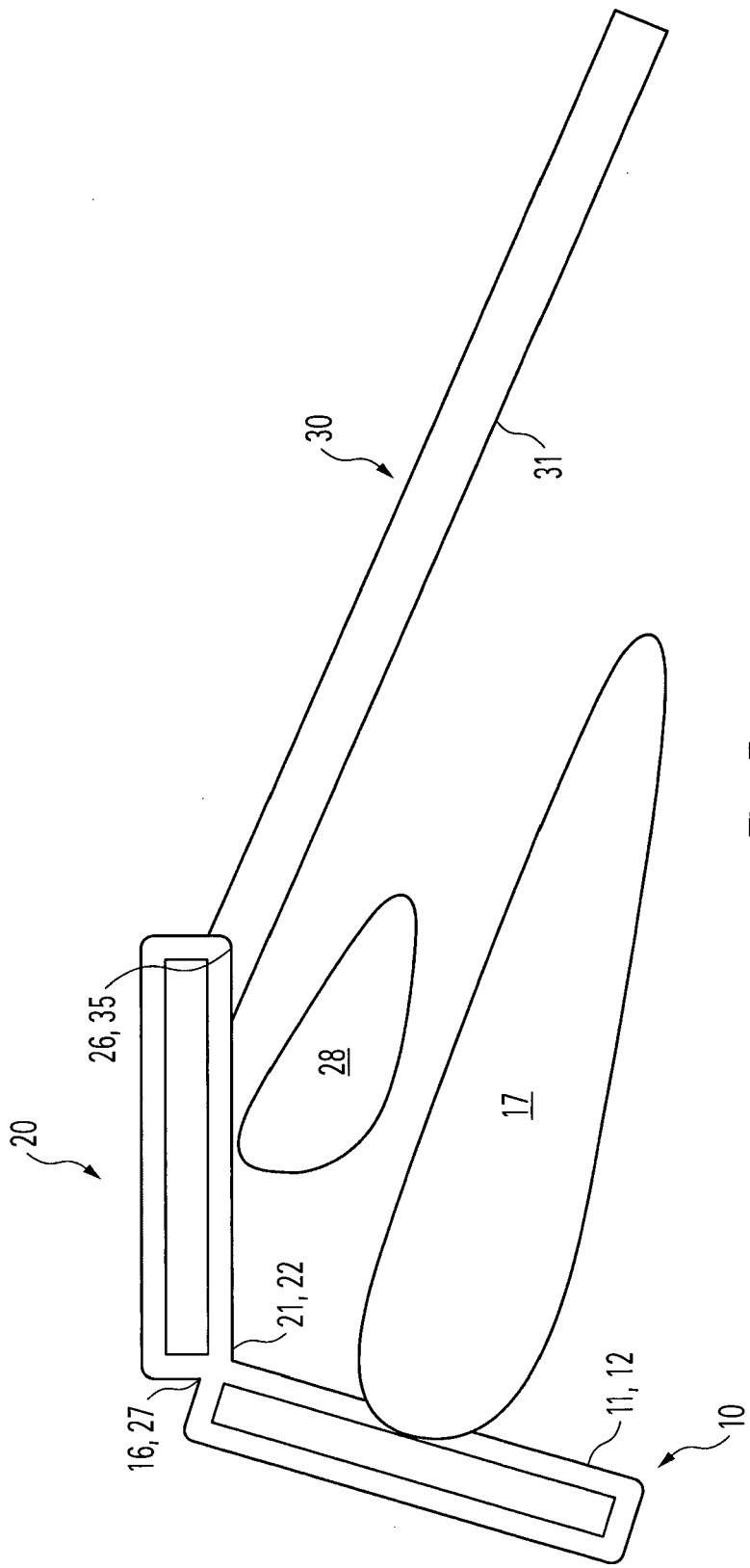


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 17 29 0022

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2010/118534 A1 (LO CHI WAI [HK]) 13 May 2010 (2010-05-13) * paragraphs [0003], [0013], [0042], [0043], [0050], [0051] * * figures 2,11 *	1-5,7-15	INV. F21W131/105 F21V15/00 F21S8/08
X	US 2012/127713 A1 (ISC TECHNOLOGY CO LTD [KR]; LEE JAE HAK [KR]) 24 May 2012 (2012-05-24) * figures 4-6 *	1-8, 10-15	ADD. F21V23/00
Y	----- US 2006/250804 A1 (GINSBURG THOMAS A [US]) 9 November 2006 (2006-11-09) * paragraphs [0030], [0036], [0037], [0038] * * figure 9 *	9	
Y	----- US 2013/250556 A1 (GORDIN MYRON [US] ET AL) 26 September 2013 (2013-09-26) * paragraphs [0041], [0056], [0057], [0067] * * figures 1a, 4a *	9	
A	----- US 2013/250556 A1 (GORDIN MYRON [US] ET AL) 26 September 2013 (2013-09-26) * paragraphs [0041], [0056], [0057], [0067] * * figures 1a, 4a *	1	
A	----- US 2013/250556 A1 (GORDIN MYRON [US] ET AL) 26 September 2013 (2013-09-26) * paragraphs [0041], [0056], [0057], [0067] * * figures 1a, 4a *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			F21S F21V F21W
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 9 June 2017	Examiner Dinkla, Remko
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 29 0022

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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09-06-2017

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010118534 A1	13-05-2010	CN 201297542 Y	26-08-2009
		US 2010118534 A1	13-05-2010
		US 2012063132 A1	15-03-2012

US 2012127713 A1	24-05-2012	KR 100950574 B1	01-04-2010
		US 2012127713 A1	24-05-2012
		WO 2011013913 A2	03-02-2011

US 2006250804 A1	09-11-2006	NONE	

US 2013250556 A1	26-09-2013	NONE	

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82