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(54) **FLAT LUMINAIRE BODY WITH INTEGRAL MOUNTING SECTION**

(57) The present invention is directed to a flat, three-dimensional luminaire body (2) for a flat luminaire (1), like an outdoor luminaire, the luminaire body (2) being made from a single metal sheet (2') by forming and comprises: a lighting section (3) which defines a flat three-dimensional lamp space (LS) for receiving lighting elements (5) at least comprising a light source (6) for emitting light, the lighting section (3) extending substantially along an extension plane (P), and a mounting section (4) which

extends integrally from the lighting section (3) along an extension axis (X), wherein the mounting section (4) has a circumferentially closed cross-section (C) when viewed along the extension axis (X), to delimit an attachment space (AS) for receiving a support structure to attach the luminaire body (2). The present invention is further directed to a flat luminaire (1) comprising the said luminaire body (2), and a method for manufacturing the said luminaire body (2).

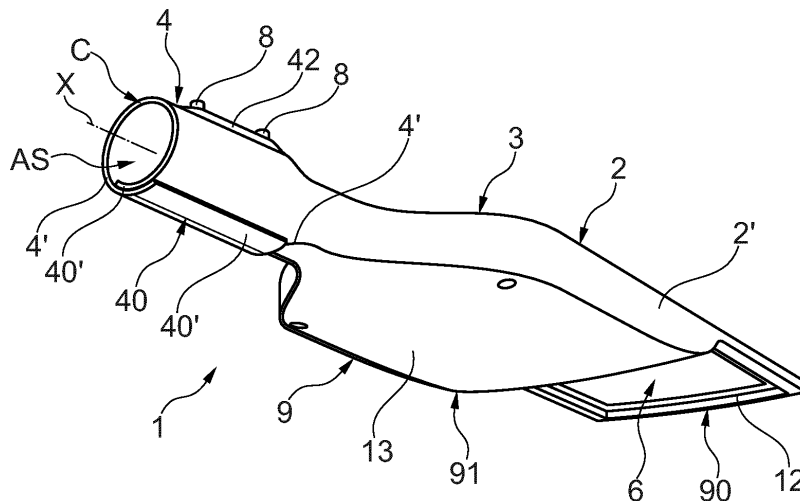


Fig. 2

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Description

[0001] The present invention is directed to a flat luminaire body for a flat luminaire, like an outdoor luminaire, e.g. for streetlights, a flat luminaire comprising said luminaire body, and a method for manufacturing said luminaire body.

[0002] Flat luminaires having flat luminaire bodies are known in the prior art and usually used as outdoor luminaires in many applications, lighting road infrastructures, public areas and many more. The current flat luminaire solutions are typically composed of die casted parts, particularly including the luminaire housing. Such die casted parts are expensive and require global shipment. As they are difficult to stack or not stackable at all, they require quite a lot of volume for shipping, which makes further impact to the environment. Due to the vast range of requirements, luminaire bodies made by die casting often result in the requirement to provide many tools and components needed to fulfil the market needs. Moreover, die casted parts for luminaires, particularly for outdoor use, are prone to cracking, e.g., when being tightly fastened to a street light pole, which though require a tight fit due to air streams and other external influences. There also exist luminaire bodies made from metal sheets. These luminaire bodies are, however, usually limited to their protection function. For fixing such luminaire bodies, additional fixing components often made by die casting are needed, which are then supplementary attached to the luminaire body in an additional assembly step.

[0003] It is thus an object of the present invention to provide low-cost but robust flat luminaire bodies, e.g. for outdoor luminaires, and flat luminaires comprising such luminaire bodies which are easy to assemble, as well as a comparably simple method of manufacturing such luminaire bodies.

[0004] These and other objects, which will become apparent from the following description, are obtained by the subject-matter of the independent claims. The dependent claims study further the central idea of the present invention.

[0005] According to a first aspect, the present invention is directed to a flat, three-dimensional luminaire body for a flat luminaire, like an outdoor luminaire. The luminaire body is made from a single metal sheet by forming. The luminaire body comprises a lighting section which defines a flat three-dimensional lamp space for receiving lighting elements at least comprising a light source for emitting light. The lighting section extends substantially along an extension plane (i.e. having a generally flat but three-dimensional layout; see "flat" definition herein below). The luminaire body further comprises a mounting section which extends integrally from the lighting section along an extension axis. The mounting section has a circumferentially closed cross-section when viewed along (i.e. in) the extension axis, to delimit an attachment space for receiving a support structure (e.g. a top end of a street pole) to attach the luminaire body or the flat luminaire

equipped with said luminaire body.

[0006] The luminaire body is thus easily made from (i.e. also of) a metal sheet. The raw material of the blank is thus in sheet form, which takes up minimal space when compared to a directly finished three-dimensional casting body.

[0007] The luminaire body being made from/of a metal sheet simply by forming allows for an easy, flexible and economic production of the luminaire body. As the luminaire body is made from/of a metal sheet, smooth and flat outer surfaces are provided for an easier surface enhancement. These flat surfaces allow for an easy wrapping or branding by simply painting, printing or attaching stickers or the like. Due to its three-dimensional layout, even though being made from/of a metal sheet, the luminaire body still has sufficient form stability. As the luminaire body still has a flat layout, its exposure to external influences/forces, can be minimized, thus reducing, e.g., influence of drag forces effected by wind. On the other hand, the flat luminaire body provides a large area for heat dissipation - this being even more increased by the integral mounting section - while also providing a large area for lumen output. As metal sheets can be easily machined, any flat but three-dimensional layout can be easily obtained to allow for production of a wide range of desired shapes to fulfil customer's technical and aesthetical needs. Hence, a form factor flexibility can be obtained with minimal investment, i.e. at low costs. The luminaire body can thus be easily made to order, which has key advantages for economic production; not least because no excess stock is needed. The metal sheet can be easily configured to the specification of the desired product (i.e. luminaire body), thus minimizing waste.

[0008] The production by forming compared to die casting not only requires less material, but is also less energy intensive. Moreover, the use of a metal sheet versus die casted parts enables greater torques without bending or cracking. The luminaire body being made from/of a metal sheet is also easier to store and transport, thus having a reduced environmental impact than die casted parts. In addition, a luminaire body made from/of metal sheet can be better optimized regarding the amount of material used when compared to die cast products, which in turn reduces the weight of the product and this reduces the carbon impact of shipping. The use of sheet metal over casting may also provide better corrosion resistance because of the possible use of other materials, e.g. a purer aluminium alloy. Also, metal sheet components are usually less prone to porosity issues compared to parts being made by casting.

[0009] As the mounting section (e.g. spigot) is integrally made with the lighting section (e.g. main housing), mounting stability can be enhanced, while the number of parts and assembly steps can be reduced. The luminaire body (or a luminaire equipped with said luminaire body) can thus be easily attached to a support structure - like a pole or post, e.g. a lamppost for a street light - by simply inserting the support structure into the attachment space.

The luminaire body can thus be easily mounted without the need of providing a separate fixing area/device at the luminaire body. Also, due to the integral layout with the mounting section, the overall heat dissipation area of the luminaire body can be enhanced, so that heat can be more easily and more effectively be transferred. This positively affects the life span of the luminaire body itself due to reduced material stresses, as well as of the luminaire due to conservative operation of the electric or electronic components.

[0010] The term "flat" as understood in the present application means that the related element/device has two of its dimensions (say length and width) being significantly larger (say at least two-times or preferably even at least five-times or at least ten-times) than its third dimension (say height). The related element/device (e.g. the luminaire body or its lighting section) extending substantially along an extension plane thus means that the two larger dimensions generally define the extension plane.

[0011] The circumferentially closed cross-section can have any shape, and preferably is circular, oval, angular, square, rectangular, and the like.

[0012] The extension axis preferably extends straight, but may also extend in any other way, e.g. along a curve as being arched or the like.

[0013] The mounting section may be made from two wing sections of the single metal sheet, which wing sections extend away from each other and are formed around the extension axis into a tube shape having the circumferentially closed cross-section. Hence, the metal sheet can be easily provided, while the overall layout of the blank and the resulting luminaire body can be facilitated. The mounting section can thus be easily made, while having a high form stability.

[0014] Opposite end sections of the respective wing sections, when being formed into the tube shape, may overlap with each other when viewed in a radial direction with respect to the extension axis to form an overlapping region. This overlapping region may even increase the form stability of the luminaire body, and particularly of the mounting section. Also, this overlapping region allows for creating a mounting section or its tube shape with differing dimensions or diameters, dependent on how far the end sections overlap. This allows for easily providing luminaire bodies individually according to the customer's needs.

[0015] The end sections may be connected to each other. They can, for instance, be connected at front face regions thereof. Alternatively or additionally, they may also be connected at the overlapping region. This results in a high form stability of the mounting section, and thus of the luminaire body as such. Moreover, a permanently stable connection via the mounting section can be enhanced.

[0016] The end sections can be connected, e.g., temporarily or permanently. A temporary connection can be obtained, e.g., by frictional connection and/or form fit connection, for instance by use of a clamping means or a

screw connection. A permanent connection can be obtained, e.g., by material bonding. In the latter case, the end sections can be connected to each other by material bonding, for instance by fusing or welding or soldering. While temporary connections allow for more flexibility in assembly and maintenance, permanent connections result in a more stable connection and thus overall luminaire body.

[0017] The mounting section may comprise a fixing section adapted to receive and/or support a fixing element for fixing the luminaire body to the support structure received in the attachment space. The fixing section may be a support surface of the mounting section, e.g. on its inside facing towards the attachment space. The fixing section may also be a section for holding the fixing element, e.g. a through hole or a screw hole for receiving a screw or stud as the fixing element. The fixing element may thus be arranged moveably towards and away from the attachment space, preferably along a radial direction with respect to the extension axis. The fixing element can thus be positioned at any desired extension into the attachment space, which allows for a secure and firm connection with different sizes and shapes of the support structure (partially) received inside the attachment space. Hence, the luminaire body can be easily fixed to the support structure by easily and effectively providing a fixing element; e.g. by tightening screws.

[0018] The inner surface of the mounting section may alternatively or additionally comprise a connection area which at least partially delimits the attachment space, and which connection area may be adapted to connect to the support structure, e.g., by simple frictional connection when inserting the support structure into the attachment space. The connection area may preferably be a roughened surface area.

[0019] The mounting section may comprise a bulged section formed into the metal sheet (material) to be bulged away from the extension axis so as to define a fixing space between the attachment space and the fixing section for receiving at least part of the fixing element. This allows for providing a larger fixing element, which results in a more effective fixing ability. For instance, the fixing element may comprise a screw or stud, which carries a pressure plate facing the attachment space. The pressure plate can thus be securely housed. By screwing action of the screw or stud, the pressure plate can approach the attachment space to get in frictional and/or form fit connection with a support structure (partially) received inside the attachment space. This connection may be reversible, e.g. by simple screwing action in a counter-direction.

[0020] The fixing section and/or the bulged section on the one hand and the overlapping region on the other hand may be arranged opposite to each other with respect to the attachment space. This results in an effectively increased stability of the mounting section and thus the overall luminaire body. Alternatively, the fixing section and/or the bulged section may also be arranged at the

overlapping region. For instance, the end sections may comprise the or part of the fixing section and/or the bulged section.

[0021] The extension axis may extend parallel to the extension plane (i.e. $\alpha = 0^\circ$). Hence, the luminaire body may have an overall compact layout. Alternatively, the extension axis may also be inclined relative to the extension plane by a defined angle α . This allows for applying any desired mounting angle to the luminaire body. Hence, a high mounting flexibility of a luminaire equipped with said luminaire body can be obtained. As the luminaire body is simply made by forming a single metal sheet, the respective mounting angle can be easily provided; preferably during a single forming step. The angle may, for instance, be in a range of $0^\circ < \alpha \leq 110^\circ$, preferably $0^\circ < \alpha \leq 90^\circ$, while the application is not limited to a specific angle α . For instance, in case the luminaire body shall be attached to a substantially horizontally extending support structure (so-called (post) side entry), the angle α may be in a range of $0^\circ \leq \alpha \leq 20^\circ$, preferably $0^\circ \leq \alpha \leq 15^\circ$, to both sides of the extension plane. For instance, in case the luminaire body shall be attached to a substantially vertically extending support structure (so-called (post) top entry), the angle α may be in a range of $60^\circ \leq \alpha \leq 110^\circ$, preferably $75^\circ \leq \alpha \leq 105^\circ$, most preferred 90° to both sides of the extension plane but preferably below the extension plane. It is thus possible that the angle α can be factory set, e.g., based on customer's needs and request.

[0022] The lighting section may comprise a base section substantially extending parallel to the extension plane. Such a base section allows for a flat layout of the luminaire body while providing sufficient space for receiving - e.g. providing or attaching - the lighting elements, or other components.

[0023] The lighting section may further comprise at least one or a plurality of side wall sections, each extending from the base section so that the base section and the side wall section(s) together define the lamp space. Hence, the lighting section has a simple and compact but form stable layout. The respective layout can also be easily obtained by the forming of the metal sheet.

[0024] The at least one or plurality of side wall sections each preferably extend from the base section obliquely or perpendicularly to the extension plane and/or parallel to the extension axis. Hence, the luminaire body can be designed according to the technical and aesthetical needs of the customer. For instance, the lighting section may have two side wall sections extending from opposite sides of the base section and/or the extension section. The (at least) two side wall sections are thus laterally flanking the base section. These two side wall sections may extend parallel to each other and/or parallel to the extension axis. This results in a very simple but form stable layout of the luminaire body. The side wall section(s), particularly in connection with the base section, thus preferably give the luminaire body an advantageous but simple three-dimensional layout resulting in a desired/high

form stability.

[0025] In a preferred embodiment, the lighting section may have a substantially U-shaped cross-section or even a U-shaped layout. Hence, the luminaire body can be easily manufactured upon simply forming the single metal sheet, while resulting in a simple and thus easily producible layout, which still gives the luminaire body a high form stability.

[0026] The luminaire body can be made of a metal sheet material having a high thermal conductivity. Preferably, the luminaire body is made of aluminium or an aluminium alloy, like 1050 aluminium alloy. Hence, the luminaire body can effectively function as a heat sink. This even more as the luminaire body extends into the mounting section, thus even further increasing the heat transfer area. Hence, no additional heat sink elements or structures are required when equipping a luminaire with said luminaire body. Due to the flat layout, air can easily stream along the outer surface of the luminaire body, thus facilitating the heat dissipation especially during operation of a so equipped luminaire. The use of aluminium is also favourable with respect to corrosion issues.

[0027] The luminaire body can be made from the single metal sheet by bending and/or by deep-drawing of the metal sheet. Hence, the metal sheet can be transferred into many desired shapes by use of well-known, easy, effective and flexible forming methods, thus further increasing the flexibility of the luminaire body and satisfying many aesthetical demands. The metal sheet (material) may preferably be further processed by punching and/or cutting (e.g. stamping or laser-cutting) the metal sheet. Hence, the aesthetical flexibility can be even more increased. Moreover, functional structures, like through-holes for attaching components or guiding cabling and the like, can be easily provided according to the customer's needs.

[0028] According to another aspect, the present invention is directed to a flat luminaire, like a flat outdoor luminaire. The luminaire comprises a flat, three-dimensional luminaire body according to the present invention as also described herein above. The luminaire further comprises lighting elements at least comprising a light source for emitting light, wherein the lighting elements are at least partially or completely received in the lamp space.

[0029] The advantages of the luminaire body are thus transferred into a so equipped luminaire. The luminaire according to the invention thus inter alia being easily producible, lightweight but form stable, providing an integral mounting ability, reducing the number of components, having an effective heat transfer ability, and being easily formable into various aesthetical and technically desired shapes.

[0030] The light source may comprise an LED or preferably is or comprises an LED-module. The LED-module preferably comprises a PCB (printed circuit board) being equipped with at least one or a plurality of LEDs or LED chips. Hence, a low-cost, efficient and long-lasting light

source can be provided.

[0031] The light source can be provided to be in flat contact with the luminaire body, preferably its base section. This allows for good heat dissipation from the light source to the luminaire body, the latter preferably being exposed to the surrounding air and, if provided as outdoor luminaire, preferably being exposed to strong air streams thus further increasing heat dissipation.

[0032] The lighting elements may further comprise a lighting electronic being operably connected to the light source for operating the light source. Hence, the luminaire can be equipped with related electronics, so that preferably a ready-to-operate luminaire can be obtained. The lighting electronic may be at least partially or completely received in the lamp space, so that it can be easily and securely stored while still having an overall compact and flat layout of the luminaire. Also the lighting electronic may be provided to be in flat contact with the luminaire body, preferably its base section, for an increased heat dissipation to the luminaire body.

[0033] The luminaire may further comprise a luminaire cover. The luminaire cover may preferably be attached to the luminaire body or its lighting section to cover at least part of the lamp space. Hence, a defined part of the lamp space can be easily protected.

[0034] The luminaire cover may comprise a light transmission section which delimits or even (e.g. sealingly) encloses, preferably together with the lighting section, a lighting space within the lamp space for receiving the light source, so that light of the light source can be emitted through the light transmission section (i.e. to an outside of the luminaire for light emission of the luminaire). The luminaire cover may thus be attached to the luminaire body such that the light transmission section covers the light source so that light of the light source can emit through the light transmission section. Hence, light emission can be optimized. Moreover, the light sources can be provided in an easy and secure manner. As the light source can be securely provided within the lighting space, it can be well protected against external influences, like wind or any impacts. The lighting space may further be sealingly enclosed by the luminaire cover; preferably together with the lighting section. When being sealingly enclosed, the light source can further be protected against dust and water.

[0035] Alternatively or additionally, the luminaire cover may comprise a receiving section which delimits or even (e.g. sealingly) encloses, preferably together with the lighting section, a receiving space within the lamp space for receiving at least part of the lighting elements, like the lighting electronic if present. Like for the lighting space with respect to the light source, the same advantages can be obtained for the lighting electronic with the corresponding receiving space, so that the lighting elements can thus be provided in an easy and secure and preferably also well protected manner.

[0036] If both are present, the light transmission section and the receiving section can be separately or inte-

grally formed. If being provided separately, higher flexibility, e.g. for maintenance purposes, can be given. When being integrally formed, manufacturing costs can be reduced and assembly facilitated.

5 **[0037]** If both are present, the lighting space and the receiving space can be connected to form a connected luminaire space. This may result in production as well as assembly be facilitated. When being provided so as to sealingly enclose the housed parts (i.e. light source and/or other lighting elements), a connected and sealed luminaire space for receiving all lighting elements, e.g. both the lighting electronic and the light source, can be easily provided.

10 **[0038]** The luminaire cover may comprise a rim section at least partially and preferably circumferentially surrounding the light transmission section and/or the receiving section. Hence, the luminaire cover can comprise a kind of flange-like section, e.g. for easily attaching the luminaire cover to the luminaire body. Also, the rim section may give the luminaire cover more form stability. In a preferred embodiment, the luminaire cover also has a flat, three-dimensional layout.

15 **[0039]** The rim section may extend within a plane. Hence, attachment to the luminaire body can be facilitated; particularly in a case where the luminaire body comprises the base section substantially extending in parallel to the extension plane. The planes can thus be identical.

20 **[0040]** The luminaire cover may comprise at least one cover section for selectively closing, preferably sealingly closing, at least part of the lamp space, preferably the lighting space and/or the receiving space if present. The luminaire cover, preferably the receiving section, may comprise a storage cover section for selectively opening and closing, preferably sealingly closing, the receiving section, preferably the receiving space. Alternatively or additionally, the luminaire cover, preferably the light transmission section, may comprise a lighting cover section for selectively opening and closing, preferably sealingly closing, the light transmission section, preferably the lighting space. These cover sections, if both are present, are preferably provided as separate parts. It may, however, also be possible that the light transmission section and the receiving section share a common and integral cover section. In any case, the respective section (i.e. light transmission section and receiving section) can be easily accessed, e.g. for maintenance reasons. Also, components can be easily replaced. If desired, also the light emission can be adjusted if the replaceable lighting cover section comes along with optical features, like (e.g. integrally formed) lenses, (e.g. integrated) optical materials (e.g. light defusing materials or light conversion materials) or (e.g. applied) optical structures and the like.

25 **[0041]** The luminaire cover, at least the light transmission section or the lighting cover section, can be made of a translucent material, preferably plastic, glass or any other optical material. If desired, any parts of the luminaire cover which should not allow light passing through

can, for instance, be opaque, e.g. by being provided with an opaque (e.g. black) coating or the like.

[0042] The luminaire cover can at least partially be made by injection moulding. Hence, the luminaire cover can be produced easily and economically. Moreover, when being made by injection moulding, the luminaire cover can be made, for instance, by a light-weight material, like plastic. Hence, the overall weight of the luminaire can be minimized. Also, the overall costs for such a luminaire can be reduced and assembly be facilitated.

[0043] The luminaire may comprise at least one or a plurality of sealing elements for sealingly enclosing at least part of the lamp space, preferably at least the lighting space and/or the receiving space if present. The sealing elements may be provided, for instance, between the luminaire cover on the one hand and the luminaire body on the other hand. More specifically, sealing elements may be provided, for instance, between the luminaire cover on the one hand and the lighting section (e.g. its base section and/or its side wall section(s)) on the other hand. The sealing elements may also be provided, for instance, between, the luminaire cover on the one hand and the mounting section on the other hand. Also, the sealing elements may be provided between at the cover section (e.g. the first and/or second cover section) to seal against the luminaire cover itself and/or the luminaire body. For example, the luminaire cover, preferably the rim section, on the one side and the luminaire body, preferably the lighting section or its base section, on the other side can sandwich a sealing element. Therefore, the luminaire cover and/or the luminaire body may comprise a (circumferential) groove for receiving the sealing element. The sealing element can, for instance, be a cord seal or the like. By providing a sealing element accordingly, preferably sealing between the luminaire body and the luminaire cover can be easily provided. Thus, at least part of the lamp space, like a corresponding lighting space and/or receiving space, preferably in the form of a connected luminaire space, if present, can be easily sealed.

[0044] According to another aspect, the present invention is directed to a method of manufacturing a flat, three-dimensional luminaire body according to the invention, as also described herein above. The method comprises providing a single metal sheet, and forming the single metal sheet to obtain the lighting section and the mounting section. The forming can preferably be bending and/or deep-drawing. By forming the single metal sheet, preferably the bulged section may also be obtained. The method may preferably further comprise connecting the end sections to each other, preferably at the overlapping region and/or preferably by material bonding, to further increase stability and durability.

[0045] By using a single metal sheet for producing the luminaire body, the latter can be produced easily and cost-efficiently. As the so produced luminaire body also comprises the mounting section, the overall manufacturing method can be facilitated when compared to known

methods which require a separate and often distinguishing manufacturing for the fixing components. Due to the three-dimensional but still flat layout, the luminaire body is made with compact dimensions while still having a high form stability. This allows for a permanently stable fixing of the luminaire through the mounting section, and a permanently stable carrying of the luminaire components, like lighting elements and luminaire cover. Hence, the stable but compact layout allows for a so equipped luminaire to be easily used as an outdoor luminaire with increased flow properties.

[0046] In a preferred embodiment, luminaire bodies with different lengths may be produced with the same (forming) tool. This can be achieved, e.g., by providing the different luminaire bodies with identical mounting sections, but different lengths of the lighting section extending from the mounting section. Particularly in a case in which the side wall sections extend parallel to the extension axis, the tool can be easily provided to simply have lateral bending sections adapted to receive single metal sheets with different lengths at the to-be-formed mounting section.

[0047] Further aspects, advantages and features of the present invention will now be described with reference to the drawings of the enclosed Figures.

- Fig. 1 shows a perspective bottom view of a flat luminaire according to a first embodiment of the present invention,
- Fig. 2 shows another perspective bottom view of the flat luminaire according to Fig. 1,
- Fig. 3 shows a perspective top view of the flat luminaire according to Fig. 1,
- Fig. 4 shows a side view of the flat luminaire according to Fig. 1,
- Fig. 5 shows a bottom view of the flat luminaire according to Fig. 1,
- Fig. 6 shows a front view of the flat luminaire according to Fig. 1,
- Fig. 7 shows the perspective bottom view of the flat luminaire according to Fig. 1 in partial exploded configuration (i.e. with removed first and second cover),
- Fig. 8 shows a perspective bottom exploded view of the flat luminaire according to Fig. 1,
- Fig. 9 shows a perspective bottom view of a flat luminaire body according to an embodiment of the present invention of the flat luminaire according to Fig. 1,
- Fig. 10 shows a perspective top view of the flat luminaire body according to Fig. 9,
- Fig. 11 shows a detail of the flat luminaire body according to Fig. 10 in a perspective top view,
- Fig. 12 shows a comparison of the flat luminaire body according to Fig. 9 (bottom) and a flat luminaire body according to a second embodiment of the present invention with elongated lighting section, both in bottom view,

- Fig. 13 shows a perspective bottom view of a flat luminaire according to a third embodiment of the present invention,
- Fig. 14 shows a side view of the flat luminaire according to Fig. 13,
- Fig. 15 shows a bottom view of the flat luminaire according to Fig. 13,
- Fig. 16 shows a front view of the flat luminaire according to Fig. 13,
- Fig. 17 shows a perspective side view of a pivot accessory (in erected configuration) as part of a support structure for mounting the flat luminaire body, e.g., to a lamppost,
- Fig. 18 shows a perspective side view of the pivot accessory of Fig. 17 (in angled configuration),
- Fig. 19 shows a perspective bottom view of the flat luminaire according to Fig. 1 being mounted to a horizontal end of a lamppost by use of the pivot accessory according to Fig. 17,
- Fig. 20 shows a perspective bottom view of the flat luminaire according to Fig. 1 being mounted to a vertical end of a lamppost by use of the pivot accessory according to Fig. 18,
- Fig. 21 shows a side view of the luminaire arrangement of Fig. 19 at different tilt angles upon use of the pivot accessory, and
- Fig. 22 shows a side view of the luminaire arrangement of Fig. 20 at different tilt angles upon use of the pivot accessory.

[0048] Figures 1 to 8, 13 to 16 and 19 to 22 show different embodiments of a flat luminaire 1 and particularly a flat outdoor luminaire 1 according to the present invention. The flat luminaire 1 is particularly made for outdoor use. It can, for instance, be used as a streetlight. Therefore, the flat luminaire 1 may be attached to a support structure S, like a lamppost 110 (see, e.g., Fig. 19 to 22), as will be described in more detail herein below.

[0049] The flat luminaire 1 comprises a flat, three-dimensional luminaire body 2 as also shown in Figures 1 to 8, 13 to 16 and 19 to 22 and as further depicted individually in Figures 9 to 12. The luminaire body 2 for a flat luminaire 1, like an outdoor luminaire 1, forms an individual part of the present invention, and will be discussed as such in more detail herein below.

[0050] The luminaire body 2 is made from (and thus of) a single metal sheet 2' by forming, as exemplarily shown in Figures 8 to 12. The luminaire body 2 is preferably made of a material having a high thermal conductivity. Preferably, the luminaire body 2 is made of aluminium or an aluminium alloy, like 1050 aluminium alloy. Such materials have a high thermal conductivity, high corrosion resistance, and a high workability, while being comparably lightweight.

[0051] As can be seen with reference to Figures 8 to 12, the luminaire body 2 can be made from the single metal sheet 2' by bending and/or by deep-drawing of the metal sheet 2'; here to produce its general three-dimen-

sional layout as being clearly derivable from Figures 9 and 10. The luminaire body 2 or its single metal sheet 2' (material) can be further processed or machined, e.g., by punching and/or cutting the metal sheet 2' (material). Cutting can be obtained, e.g., by stamping and/or laser-cutting. By the said further processing /machining, contours and/or through-holes can be produced in the luminaire body 2 or its metal sheet 2' (material). The through holes may be used for different purposes, e.g., for insertion of screws for fixture reasons or insertion of other elements, like sensors, or leading-through external cables or the like for electrical (connection) purposes, and many more.

[0052] The luminaire body 2 being made from or of a metal sheet 2' results in smooth and flat outer surfaces of the luminaire body 2, which in turn allows for an easier surface enhancement. These flat surfaces allow for an easy wrapping or branding by simply painting, printing or attaching stickers and the like.

[0053] Moreover, as can be clearly seen in Figures 8, 9 and 12, additional fixing features 20 can be provided at the luminaire body 2 to allow for attachment of luminaire features, e.g., within the luminaire body 2. The fixing features 20 can, for instance, be bolts or stud bolts attached to the luminaire body 2, e.g., by stud welding or the like.

[0054] The luminaire body 2 comprises a lighting section 3 which defines a flat three-dimensional lamp space LS for receiving lighting elements 5 at least comprising a light source 6 for emitting light, as is exemplarily shown in Figure 9. The lighting section 3 extends substantially flat along an extension plane P, as is derivable from Figure 12 and also exemplarily shown in Figures 4, 6, 14 and 16.

[0055] As is exemplarily shown in all Figures and in detail in Figure 11, the luminaire body 2 made from a single metal sheet 2' by forming further comprises, thus as an integral part to the lighting section 3, a mounting section 4. The mounting section 4 extends integrally from the lighting section 3 along an extension axis X. The mounting section 4 has a circumferentially closed cross-section C when viewed along the extension axis X (see, e.g., Figures 2, 3, 10, 11, 13 and 15), to delimit an attachment space AS for receiving a support structure S to attach the luminaire body 2 or the luminaire 1 equipped therewith (see, e.g., Figures 19 to 22).

[0056] As is exemplarily shown in Figures 1 to 5 and 7 to 12, the extension axis X may preferably extend parallel to the extension plane P. In an alternative embodiment, as exemplarily shown in Figures 13 to 16, the extension axis X may also be inclined relative to the extension plane P by a defined angle α , wherein the angle preferably is in a range of $0^\circ < \alpha \leq 110^\circ$ or $0^\circ < \alpha \leq 90^\circ$ to both sides of the extension plane P, as desired. With the luminaire body 2 in an operational position - e.g. with the lamp space LS facing downwards - the extension axis X and thus the mounting section 4 may extend from the lighting section 3 (obliquely) downwards (or upwards).

This allows obtaining any desired mounting angle. For instance, in case the luminaire body 2 shall be attached to a substantially horizontally extending support structure S (so-called (post) side entry), the angle α may be in a range of $0^\circ \leq \alpha \leq 20^\circ$, preferably $0^\circ \leq \alpha \leq 15^\circ$, to both sides of the extension plane P, as desired. For instance, in case the luminaire body 2 shall be attached to a substantially vertically extending support structure (so-called (post) top entry), the angle α may be in a range of $60^\circ \leq \alpha \leq 110^\circ$, preferably $75^\circ \leq \alpha \leq 105^\circ$, most preferred 90° , to both sides of the extension plane P, as desired, but preferably below the extension plane P. In the embodiment shown in Figures 13 to 16, the extension axis X is here exemplarily inclined relative to the extension plane P by a defined angle α of 90° angled downwards with respect to the extension plane P.

[0057] A pivot accessory 100 to connect the luminaire 1 or luminaire body 2 to a lamppost 110 may be used. The lamppost 110 and the pivot accessory 100 together form the supporting structure S. As exemplarily shown in Figures 17 and 18, the pivot accessory may have two opposite assembly sections 101, 102. The first assembly section 101 is configured to be received (and preferably fixed) in the attachment space AS. The second assembly section 102 is configured to be attached (received in or put over or otherwise attached), e.g., to a top end section of a lamppost 110 or the like. The pivot accessory 100 allows for attachment of the luminaire 1 or luminaire body 2 to any kind of support structure S.

[0058] In a preferred embodiment, as exemplarily shown in Figures 17 to 22, the two assembly sections 101, 102 can be connected by a pivot section 103 therebetween, to allow the assembly sections 101, 102 be pivotally adjusted with respect to each other. Hence, a mounting angle β between the mounting section 4 or the extension axis X on the one hand and at least part of the support structure S (here the top end of the lamppost 110) on the other hand can be adjusted, as desired. In Figures 17, 19 and 21, the mounting angle β is exemplarily set at around 180° . In Figures 18, 20 and 22, the mounting angle β is exemplarily set at around 90° . Any other desired mounting angle β is possible, as desired.

[0059] As is further exemplarily illustrated in Figures 21 and 22, the pivot section 103 may allow for adjusting the mounting angle β such that the orientation of the luminaire 1 or luminaire body 2 can be adjusted with respect to the area to be illuminated, to allow for an optimized illumination. This adjustment ability may preferably applied once the pivot accessory 100 is fixed. In a preferred embodiment, the adjust ability can be stepless/continuous or gradual. For instance, the angle β may be gradually adjusted in 5° steps to both sides of the extension plane P; e.g. up to 15° or 20° to both sides of the extension plane P, as exemplarily illustrated in Figures 21 and 22. The adjustment can be factory set based on customer's request or can be done by the customer itself.

[0060] The extension axis X preferably extends

straight, but may also extend differently, e.g., in a curved or arcuate manner.

[0061] The lighting section 3 may comprise, as exemplarily shown in Figures 8 to 12, a base section 31 here preferably substantially extending parallel to the extension plane P (i.e. having a flat or plane or laminar layout). The lighting section 3 may further comprise at least one side wall section (in the shown embodiments there are shown four side wall sections) 32, 33 extending from the base section 31 so that the base section 31 and the side wall section(s) 32, 33 together define the lamp space LS. The at least one (or here the four) side wall sections 32, 33 preferably each extend from the base section 31 obliquely or, as derivable from all Figures, perpendicularly to the extension plane P. Alternatively or additionally, the at least one (or here two of the four) side wall sections 32, 33 preferably each extend from the base section 31 parallel to the extension axis X, as exemplarily derivable from Figure 12. As can be seen in Figures 8 and 9, the here shown two lateral of the four side wall sections 32 are preferably laterally flanking the base section 31. The lighting section 3 may have a substantially U-shaped cross section or even be U-shaped at all. The other two of the four side wall sections 33 here integrally connect the two lateral side wall sections 32 with the mounting section 4 so as to delimit a rear section of the lamp space LS.

[0062] The mounting section 4 can be made from two wing sections 4' of the single metal sheet 2' extending away from each other and being formed around the extension axis X into a tube shape having the circumferentially closed cross-section C, as is exemplarily shown in Figures 1 to 5, 7 to 16, 19 and 20. Opposite end sections 40' of the respective wing sections 4', when being formed into the tube shape, may preferably overlap with each other when viewed in a radial direction with respect to the extension axis X to form an overlapping region 40, as is exemplarily shown in Figures 2, 11 and 15.

[0063] The end sections 40' may be connected to each other, preferably at the overlapping region 40. They can be temporarily connected to each other, e.g. by frictional connection and/or form fit connection, like with a screw penetrating the two end sections 40' at the overlapping region 40 to connect and fix them. The end sections 40' may also be permanently connected to each other, e.g. by material bonding or riveting and the like. For material bonding, the end sections 40' may be connected to each other by fusing, welding and/or soldering.

[0064] As is exemplarily shown in Figures 3, 4, 10, 11, 14 and 15, the mounting section 4 may comprise a fixing section 41 adapted to receive and/or support a fixing element 8 for fixing the luminaire body 2 to the support structure received in the attachment space AS. Therefore, the mounting section 4 may comprise a bulged section 42 as exemplarily shown in detail in Figure 11. The bulged section 42 is formed into the metal sheet 2' to be bulged away from the extension axis X so as to define a fixing space FS between the attachment space

AS and the fixing section 41 for receiving at least part of the fixing element 8. Hence, the bulged section 42 is also an integral part of the luminaire body 2, and easily obtained by correspondingly forming the metal sheet 2' (material). The bulged section 42 and the overlapping region 40 may preferably be arranged opposite to each other with respect to the attachment space AS, as is exemplarily shown in Figure 11.

[0065] As mentioned herein above, the flat luminaire 1 according to the present invention comprises the discussed luminaire body 2, as is exemplarily shown in Figures 1 to 8.

[0066] Moreover, the flat luminaire 1 further comprises the lighting elements 5, which at least comprise the light source 6 for emitting light, as exemplarily shown in Figures 1, 7, 8, 13, 19 and 20. The lighting elements 5 are at least partially or, as exemplarily shown in Figures 1, 7, 13, 19 and 20, completely received in the lamp space LS.

[0067] The light source 6 may comprise an LED (light-emitting diode) 61 or an LED-module 60 usually being made up of a PCB (printed circuit board) 62 carrying one or a plurality of LEDs 61, as exemplarily illustrated in Figures 1, 7, 8 and 13.

[0068] As can be exemplarily derived from Figure 8 in combination with Figures 1 and 7 and also Figure 13, the light source 6 preferably is in flat contact with the luminaire body 2 or its lighting section 3 or its base section 31, to allow for an efficient heat dissipation.

[0069] As is exemplarily shown in Figures 7 and 8, the lighting elements 5 may further comprise a lighting electronic 7, which is operably connected to the light source 6 for operating the light source 6. Therefore, the light source 6 and the lighting electronic 7 can, for instance, be connected by wiring to allow for operation of the light source 6 by the lighting electronic 7. The lighting electronic 7 may comprise a driver 70 or any other means for driving the luminaire 1. The lighting electronic 7 preferably is at least partially or, as exemplarily shown for the driver 70 in Figure 7, completely received in the lamp space LS.

[0070] The lighting electronic 7 may also comprise any other electronic means, like sensors (not shown). These electronic means may be attached, e.g., on top of the luminaire body 2, i.e. on an outer surface thereof, particularly of the base section 31. The sensor can be any type of sensor, like a light sensor or a motion sensor or any other kind of sensor. The sensor is preferably operably connected to the lighting electronic 7 for operating the luminaire 1. Therefore, the sensor can be attached to the luminaire body 2 and connected to the lighting electronic 7 via a through-hole (not shown) in the luminaire body 2, e.g. in the base section 31. The sensor is preferably sealingly connected to the through-hole to provide a sealed connection of the cooperating elements.

[0071] Moreover, the luminaire 1 and preferably the lighting electronic 7 can be further provided with wireless technology like NFC (near field communication) technol-

ogy preferably operably coupled to the lighting electronic 7 to thus allow for an easy wireless communication with the luminaire 1, e.g. for configuration of the lighting electronic 7. For instance, NFC drivers enable an installer to program the luminaire 1 - e.g. by an external NFC device or smartphone - without the need to open the luminaire 1.

[0072] The lighting electronic 7 can be supplied with power by a battery and/or external power supply.

[0073] The luminaire 1 may preferably further comprise a luminaire cover 9 as exemplarily shown in Figures 1, 2, 5 to 8, 13 to 16, 19 and 20. The luminaire cover 9 may be attached to the luminaire body 2 or its lighting section 3 (here the base section 31) to cover or enclose at least part of the lamp space LS.

[0074] The luminaire cover 9 may have a light transmission section 90 which delimits or (sealingly) encloses, preferably together with the lighting section 3, a lighting space 92 within the lamp space LS for receiving the light source 6, as exemplarily shown in Figures 1 and 13, so that light of the light source 6 can be emitted - i.e. pass - through the light transmission section 90. By the use of LEDs as light source 6, a very flat layout of the flat luminaire 1 can be obtained.

[0075] Alternatively or additionally, the luminaire cover 9 may have a receiving section 91 which delimits or (sealingly) encloses, preferably together with the lighting section 3, a receiving space 93 within the lamp space LS for receiving at least part of the lighting elements 5, like the lighting electronic 7 as exemplarily derivable from Figures 1 and 13 in combination with Figure 7.

[0076] The luminaire cover 9 may comprise at least one (removable) cover section (here a cover element) 12, 13 for selectively opening and closing, preferably sealing closing, at least part of the lamp space LS. The cover section 12, 13 may thus be designed to selectively close the whole lamp space LS, only part of it, the lighting space 92, the receiving space 93 and/or both the lighting space 92 and the receiving space 93.

[0077] In a preferred embodiment, the luminaire cover 9 may comprise a plurality (i.e. two or more) cover sections. As exemplarily shown in Figures 1 to 8 and 13 to 16, the luminaire cover 9 may, for instance, comprise two cover sections, namely a lighting cover section 12 for selectively opening and closing, preferably sealing closing, the lighting space 92, and a storage cover section 13 for selectively opening and closing, preferably sealing closing, the receiving space 93. According to the customer's needs, the luminaire cover 9 may also comprise only one of the lighting cover section 12 and the storage cover section 13.

[0078] "Emit through" is to be understood, in the context of the present invention, such that the light transmission section 90 comprises an opening 94 through which the light of the light source 6 may exit the luminaire 1 for light emission. This opening 94 can, for instance, be closed by the lighting cover section 12 through which the light of the light source 6 can emit. The luminaire cover 9 or at least its light transmission section 90 or its lighting

cover section 12, can be made of a translucent material, preferably plastic, glass or another optical material. The luminaire cover 9 can at least partially be made by injection moulding, if made of a corresponding material. The light transmission section 90, preferably the lighting cover section 12, may comprise optical features 11, like (e.g. integrally formed) lenses, (e.g. integrated) optical materials (e.g. light defusing materials or light conversion materials) or (e.g. applied) optical structures and the like to allow for a desired light emission. The optical features 11 may also, as exemplarily shown in Fig. 8, be separately provided and, e.g., arranged on the light source 6 (here on the PCB 62 of the LED-module 60) to be positioned between the light source 6 and the lighting cover section 12; i.e. in the light path of the light.

[0079] To allow for external power supply, the receiving section 91 may comprise a cable guiding section or element 97 through which wiring for external power supply or even data transfer can be led through. The cable guiding section or element 97 can comprise a sealing element for sealingly receiving the cable to provide a sealing of the receiving space 93 to the outside even in case wiring is provided from the outside. As exemplarily shown in Figure 7 and also derivable from Figure 8, the cable guiding section or element 97 here extends through the luminaire cover 9 and towards the mounting section 4, more precisely towards and/or into the attachment space AS. Hence, any cabling which is led through, e.g., a pole or lamppost 110 or the like and/or the pivot accessory, if present, as (part of) the support structure S being received in the attachment structure AS can directly and effectively be guided through the (sealed) guiding section or element 97 into the lamp space LS or -here - the receiving space 93 to feed the lighting elements 5 and/or provide data for operating the luminaire 1.

[0080] The light transmission section 90 and the receiving section 91 can be separately provided or formed. Alternatively, the light transmission section 90 and the receiving section 91 can be at least partially integrally provided or formed as, for instance, shown in Figures 1 to 8 and 13 to 16. In either case, the lighting space 92 and the receiving space 93 can be connected. If so, the lighting space 92 and the receiving space 93 may thus form a connected luminaire space 10 in which preferably the whole lighting elements 5 (i.e. the light source 6 and, if present, also the lighting electronic 7 and electric parts) of the luminaire 1 can be housed.

[0081] The luminaire cover 9 may comprise a rim section 95 at least partially surrounding the light transmission section 90 and/or the receiving section 91. In the shown embodiments, the rim section 95 completely (i.e. circumferentially) surrounds the light transmission section 90 and the receiving section 91, as exemplarily derivable from Figure 8. The rim section 95 may extend within a plane. In case the base section 31 also substantially extends parallel to extension plane P, a flat contact between the luminaire cover 9 via the rim section 95 and the luminaire body 2 via the base section 31 can be obtained

to thus allow for a tight and secure fit between these two elements. The fixing elements 20 can be used to cooperate with corresponding fixing elements 99 of the luminaire cover 9 for secure attachment of the luminaire cover 9 to the luminaire body 2 (e.g., see Figures 1, 5 and 8 as well as Figures 13 and 15).

[0082] The luminaire cover 9, preferably the rim section 95, on the one side and the luminaire body 2, preferably its lighting section 3 or its base section 31, on the other side may sandwich a sealing element (not shown). Therefore, a sealing receiving section (not shown), like a circumferential groove, can be provided at the luminaire cover 9 and/or the luminaire body 2. By means of the sealing element, the lighting space 92 and/or the receiving space 93 can be sealingly enclosed as described herein above.

[0083] If the luminaire cover 9 comprises the storage cover section 13 for sealingly closing the receiving section 91 or the receiving space 93, a sealing element (not shown) may be provided to allow for the receiving section 91 be sealingly enclosed. The sealing element may be provided to be sandwiched between the storage cover section 13 and the corresponding part of the receiving section 91 cooperating with each other for closing the receiving space 93. Therefore, a corresponding (circumferential) groove (not shown) may be provided to receive the sealing element in a manner similar to the sealing element as described herein above.

[0084] If the luminaire cover 9 comprises the lighting cover section 12 for sealingly closing the light transmission section 90 or the lighting space 92, a sealing element (not shown) may be provided to allow for the light transmission section 90 be sealingly enclosed. The sealing element may be provided to be sandwiched between the lighting cover section 12 and the corresponding part of the light transmission section 90 cooperating with each other for closing the lighting space 92. Therefore, a corresponding (circumferential) groove (not shown) may be provided to receive the sealing element in a manner similar to the sealing elements as described herein above.

[0085] In case the light transmission section 90 and the receiving section 91 are (at least partially) integral, they may share the same sealing element towards the luminaire body 2. In case the luminaire cover 9 is integral for covering different spaces, like the lighting space 92 and receiving space 93 or the whole lamp space LS, one sealing element may be used to seal all the respective spaces.

[0086] As already described herein above, the lighting cover section 12 is preferably made of a light translucent material, while the other parts of the luminaire cover 9 can be made of any type of material and are preferably opaque. Therefore, the luminaire cover 9 can, for instance, be coated with an opaque material.

[0087] In the following, a method of manufacturing a flat, three-dimensional luminaire body 2 is described.

[0088] In a first step, a single metal sheet 2' is provided. The metal sheet 2' is preferably made of a heat conduc-

tive material, like aluminium or an aluminium alloy.

[0089] In a second step, the single metal sheet 2' is formed to obtain the lighting section 3 and the mounting section 4, i.e. to obtain the flat, three-dimensional luminaire body 2 according to the invention. The step of forming may optionally also obtain the bulged section. The step of forming can be performed, e.g., by bending and/or deep-drawing of the single metal sheet 2'.

[0090] The step of forming can be preceded and/or followed by an optional step of further processing and/or machining the metal sheet 2' (material). This may comprise, for instance, punching and/or cutting, like laser-cutting, of the metal sheet 2' (material).

[0091] In an optional step, the end sections 40' may be connected to each other. They may preferably be connected at the overlapping region 40. The end sections 40' may be connected by material bonding or other means.

[0092] As can be derived from Figure 12, the luminaire body 2 design may be made such that different luminaire bodies 2 - here having different lengths - can be manufactured with the same (forming) tool. Here, the mounting section 4 is identical for both depicted luminaire body 2 models, while the lighting section 3 simply has different lengths. As exemplarily shown, as the layout of the lighting section 3 is comparably simple by preferably having straight and parallel side wall sections 32 towards its end opposite to the mounting section 4, the area of the base section 31 related to the light transmission section 90 can simply be provided at the required lengths in the metal sheet 2'. The tool can then have a length, which at least corresponds to the largest (i.e. longest) luminaire body 2. This allows for forming luminaire bodies 2, which even have a shorter length. Dependent on the lengths of the metal sheets 2', the tool then automatically forms the luminaire body 2 at the desired length according to customer's demands. Hence, different luminaire bodies 2, e.g. for luminaires 1 with an LED-module 60 having 36 (thirty-six) LEDs 61 (see Figure 12; bottom) or having 72 (seventy-two) LEDs 61 (see Figure 12; top), can be easily obtained with the same tool. This facilitates manufacturing of different types (e.g. lengths) of luminaire bodies 2 without the need of different forming tools, thus severely reducing production costs, while still allowing to offer many different luminaire 1 models.

[0093] The so produced luminaire body 2 can then be equipped with the luminaire components, like the lighting elements 5 and the luminaire cover 9, to assemble the flat luminaire 1.

[0094] The luminaire 1 can then be attached to a support structure S, like a lamppost 110, by inserting, e.g., a top end of the lamppost 110 or an intermediate pivot accessory 100 into the attachment space AS, and then preferably fixing the luminaire 1 to the support structure S by using the fixing means 8. In case of using the pivot accessory 100, the mounting angle β may additionally be adjusted, as desired.

[0095] The present invention is not limited by the em-

bodiments as described herein above as long as being covered by the appended claims.

5 Claims

1. A flat, three-dimensional luminaire body (2) for a flat luminaire (1), like an outdoor luminaire, the luminaire body (2) being made from a single metal sheet (2') by forming and comprises:

- a lighting section (3) which defines a flat three-dimensional lamp space (LS) for receiving lighting elements (5) at least comprising a light source (6) for emitting light, the lighting section (3) extending substantially along an extension plane (P), and
- a mounting section (4) which extends integrally from the lighting section (3) along an extension axis (X), wherein the mounting section (4) has a circumferentially closed cross-section (C) when viewed along the extension axis (X), to delimit an attachment space (AS) for receiving a support structure to attach the luminaire body (2).

2. The luminaire body (2) according to claim 1, wherein the mounting section (4) is made from two wing sections (4') of the single metal sheet (2') extending away from each other and being formed around the extension axis (X) into a tube shape having the circumferentially closed cross-section (C), wherein preferably opposite end sections (40') of the respective wing sections (4'), when being formed into the tube shape, overlap with each other when viewed in a radial direction with respect to the extension axis (X) to form an overlapping region (40).

3. The luminaire body (2) according to claim 2, wherein the end sections (40') are connected to each other, preferably at the overlapping region (40), wherein preferably the end sections (40') are connected to each other by material bonding.

4. The luminaire body (2) according to any one of the preceding claims, wherein the mounting section (4) comprises a fixing section (41) adapted to receive and/or support a fixing element (8) for fixing the luminaire body (2) to the support structure received in the attachment space (AS).

5. The luminaire body (2) according to claim 4, wherein the mounting section (4) comprises a bulged section (42) formed into the metal sheet (2') to be bulged away from the extension axis (X) so as to define a fixing space (FS) between the attachment space (AS) and the fixing section (41) for receiving at least part of the fixing element (8), wherein preferably the

bulged section (42) and the overlapping region (40) are arranged opposite to each other with respect to the attachment space (AS).

6. The luminaire body (2) according to any one of the preceding claims,

wherein the extension axis (X) extends parallel to the extension plane (P), or
 wherein the extension axis (X) is inclined relative to the extension plane (P) by a defined angle α , wherein the angle preferably is in a range of $0^\circ < \alpha \leq 110^\circ$ or $0^\circ < \alpha \leq 90^\circ$.

7. The luminaire body (2) according to any one of the preceding claims, wherein the lighting section (3) comprises

- a base section (31) substantially extending parallel to the extension plane (P), and
- at least one side wall section (32, 33) extending from the base section (31) so that the base section (31) and the side wall section (32, 33) together define the lamp space (LS),
 wherein the at least one side wall section (32, 33) preferably extends from the base section (31) obliquely or perpendicularly to the extension plane (P) and/or parallel to the extension axis (X), and/or
 wherein the lighting section (3) has a substantially U-shaped cross-section.

8. The luminaire body (2) according to any one of the preceding claims,

wherein the luminaire body (2) is made of aluminium or an aluminium alloy, preferably 1050 aluminium alloy, and/or
 wherein the luminaire body (2) is made from the single metal sheet (2') by bending and/or by deep-drawing, and preferably further processed by punching and/or cutting the metal sheet (2').

9. Flat luminaire (1), like a flat outdoor luminaire, comprising:

the luminaire body (2) according to any one of the preceding claims, and
 lighting elements (5) at least comprising a light source (6) for emitting light, wherein the lighting elements (5) are at least partially or completely received in the lamp space (LS).

10. The flat luminaire (1) according claim 9,

wherein the light source (6) comprises an LED (61) or an LED-module (60), and/or
 wherein the light source (6) is in flat contact with

the luminaire body (2), preferably in flat contact with the base section (31) if present.

11. The flat luminaire (1) according to claim 9 or 10, wherein the lighting elements (5) further comprise a lighting electronic (7) being operably connected to the light source (6) for operating the light source (6), wherein preferably the lighting electronic (7) is at least partially or completely received in the lamp space (LS).

12. The flat luminaire (1) according to any one of claims 9 to 11, further comprising a luminaire cover (9) being attached to the luminaire body (2) or its lighting section (3) to cover at least part of the lamp space (LS), wherein the luminaire cover (9) comprises:

- a light transmission section (90) delimiting, preferably together with the lighting section (3), a lighting space (92) within the lamp space (LS) for receiving the light source (6) so that light of the light source (6) can be emitted through the light transmission section (90), and/or
- a receiving section (91) delimiting, preferably together with the lighting section (3), a receiving space (93) within the lamp space (LS) for receiving at least part of the lighting elements (5), preferably the lighting electronic (7) if present.

13. The flat luminaire (1) according to any one of claims 9 to 12, wherein the luminaire cover (9) comprises at least one cover section (12, 13) for selectively closing, preferably sealing closing, at least part of the lamp space (LS), preferably the lighting space (92) and/or the receiving space (93) if present, respectively,
 wherein preferably the luminaire cover (9) comprises:

- a lighting cover section (12) for selectively closing, preferably sealing closing, the lighting space (92), and/or
- a storage cover section (13) for selectively closing, preferably sealing closing, the receiving space (93).

14. Method of manufacturing a flat, three-dimensional luminaire body (2) according to any one of claims 1 to 8, comprising:

a) providing a single metal sheet (2'), and
 b) forming, preferably bending and/or deep-drawing, the single metal sheet (2') to obtain the lighting section (3) and the mounting section (4), and optionally also to obtain, if present, the bulged section (42).

15. The Method according to claim 14, further compris-

ing:

c) connecting the end sections (40') to each other, preferably at the overlapping region (40) and/or preferably by material bonding, to manufacture the luminaire body (2) according to claim 3.

Amended claims in accordance with Rule 137(2) EPC.

1. A flat, three-dimensional luminaire body (2) for a flat luminaire (1), like an outdoor luminaire, the luminaire body (2) being made from a single metal sheet (2') by forming and comprises:

- a lighting section (3) which defines a flat three-dimensional lamp space (LS) for receiving lighting elements (5) at least comprising a light source (6) for emitting light, the lighting section (3) extending substantially along an extension plane (P), and
- a mounting section (4) which extends integrally from the lighting section (3) along an extension axis (X),

characterized in that

the mounting section (4) has a circumferentially closed cross-section (C) when viewed along the extension axis (X), to delimit an attachment space (AS) for receiving a support structure to attach the luminaire body (2).

2. The luminaire body (2) according to claim 1, wherein the mounting section (4) is made from two wing sections (4') of the single metal sheet (2') extending away from each other and being formed around the extension axis (X) into a tube shape having the circumferentially closed cross-section (C), wherein preferably opposite end sections (40') of the respective wing sections (4'), when being formed into the tube shape, overlap with each other when viewed in a radial direction with respect to the extension axis (X) to form an overlapping region (40).
3. The luminaire body (2) according to claim 2, wherein the end sections (40') are connected to each other, preferably at the overlapping region (40), wherein preferably the end sections (40') are connected to each other by material bonding.
4. The luminaire body (2) according to any one of the preceding claims, wherein the mounting section (4) comprises a fixing section (41) adapted to receive and/or support a fixing element (8) for fixing the luminaire body (2) to the support structure received in the attachment space (AS).
5. The luminaire body (2) according to claim 4, wherein

the mounting section (4) comprises a bulged section (42) formed into the metal sheet (2') to be bulged away from the extension axis (X) so as to define a fixing space (FS) between the attachment space (AS) and the fixing section (41) for receiving at least part of the fixing element (8), wherein preferably the bulged section (42) and the overlapping region (40) are arranged opposite to each other with respect to the attachment space (AS).

6. The luminaire body (2) according to any one of the preceding claims,

wherein the extension axis (X) extends parallel to the extension plane (P), or wherein the extension axis (X) is inclined relative to the extension plane (P) by a defined angle α , wherein the angle preferably is in a range of $0^\circ < \alpha \leq 110^\circ$ or $0^\circ < \alpha \leq 90^\circ$.

7. The luminaire body (2) according to any one of the preceding claims, wherein the lighting section (3) comprises

- a base section (31) substantially extending parallel to the extension plane (P), and
- at least one side wall section (32, 33) extending from the base section (31) so that the base section (31) and the side wall section (32, 33) together define the lamp space (LS), wherein the at least one side wall section (32, 33) preferably extends from the base section (31) obliquely or perpendicularly to the extension plane (P) and/or parallel to the extension axis (X), and/or wherein the lighting section (3) has a substantially U-shaped cross-section.

8. The luminaire body (2) according to any one of the preceding claims,

wherein the luminaire body (2) is made of aluminium or an aluminium alloy, preferably 1050 aluminium alloy, and/or wherein the luminaire body (2) is made from the single metal sheet (2') by bending and/or by deep-drawing, and preferably further processed by punching and/or cutting the metal sheet (2').

9. Flat luminaire (1), like a flat outdoor luminaire, comprising:

the luminaire body (2) according to any one of the preceding claims, and lighting elements (5) at least comprising a light source (6) for emitting light, wherein the lighting elements (5) are at least partially or completely received in the lamp space (LS).

10. The flat luminaire (1) according claim 9,

wherein the light source (6) comprises an LED (61) or an LED-module (60), and/or wherein the light source (6) is in flat contact with the luminaire body (2), preferably in flat contact with the base section (31) if present.

11. The flat luminaire (1) according to claim 9 or 10, wherein the lighting elements (5) further comprise a lighting electronic (7) being operably connected to the light source (6) for operating the light source (6), wherein preferably the lighting electronic (7) is at least partially or completely received in the lamp space (LS).

12. The flat luminaire (1) according to any one of claims 9 to 11, further comprising a luminaire cover (9) being attached to the luminaire body (2) or its lighting section (3) to cover at least part of the lamp space (LS), wherein the luminaire cover (9) comprises:

- a light transmission section (90) delimiting, preferably together with the lighting section (3), a lighting space (92) within the lamp space (LS) for receiving the light source (6) so that light of the light source (6) can be emitted through the light transmission section (90), and/or
- a receiving section (91) delimiting, preferably together with the lighting section (3), a receiving space (93) within the lamp space (LS) for receiving at least part of the lighting elements (5), preferably the lighting electronic (7) if present.

13. The flat luminaire (1) according to any one of claims 9 to 12, wherein the luminaire cover (9) comprises at least one cover section (12, 13) for selectively closing, preferably sealing closing, at least part of the lamp space (LS), preferably the lighting space (92) and/or the receiving space (93) if present, respectively, wherein preferably the luminaire cover (9) comprises:

- a lighting cover section (12) for selectively closing, preferably sealing closing, the lighting space (92), and/or
- a storage cover section (13) for selectively closing, preferably sealing closing, the receiving space (93).

14. Method of manufacturing a flat, three-dimensional luminaire body (2) according to any one of claims 1 to 8, comprising:

- a) providing a single metal sheet (2'), and
- b) forming, preferably bending and/or deep-drawing, the single metal sheet (2') to obtain the

lighting section (3) and the mounting section (4), and optionally also to obtain, if present, the bulged section (42).

15. The Method according to claim 14, further comprising:
c) connecting the end sections (40') to each other, preferably at the overlapping region (40) and/or preferably by material bonding, to manufacture the luminaire body (2) according to claim 3.

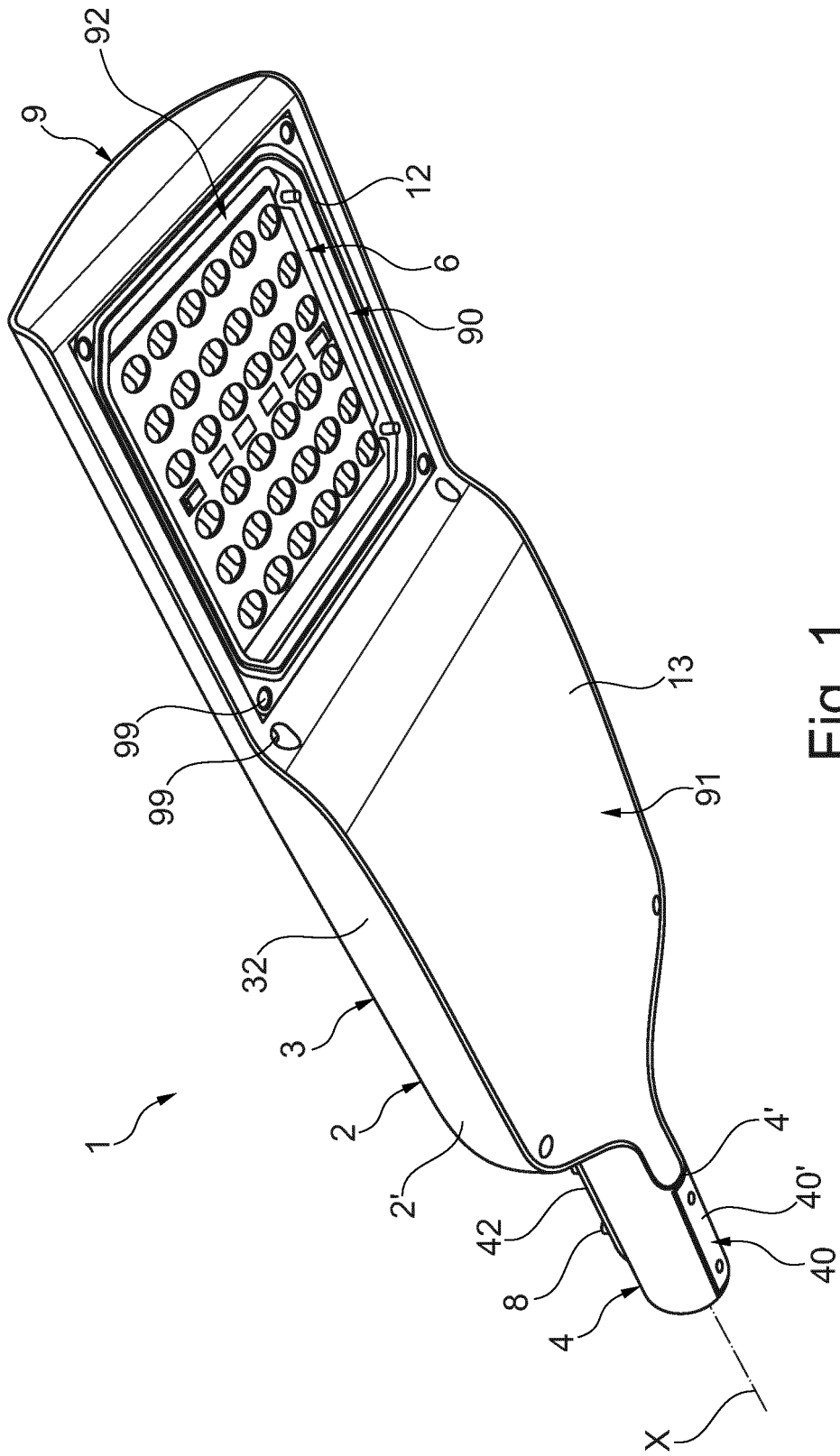


Fig. 1

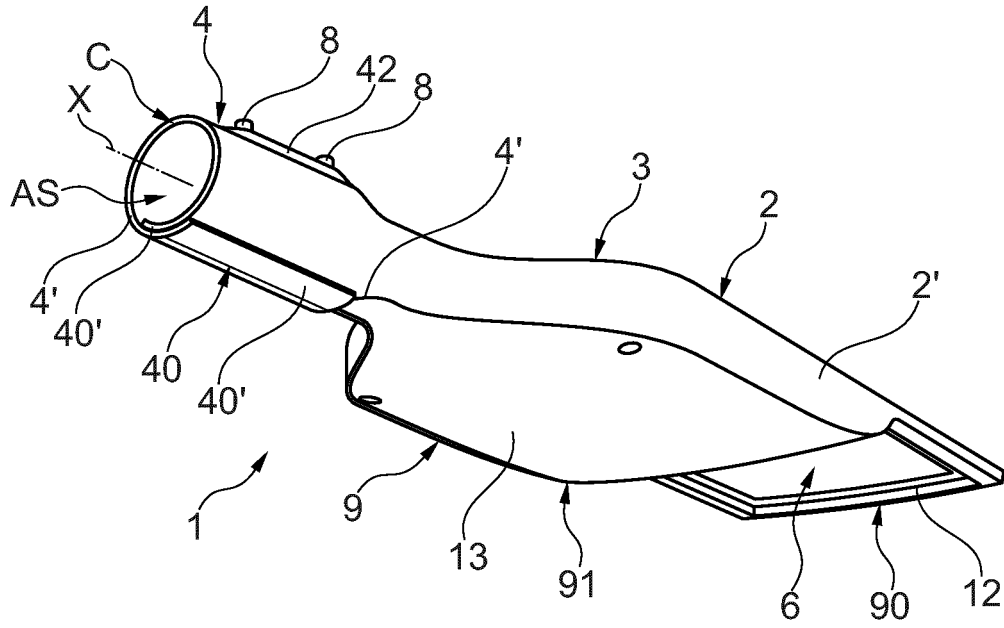


Fig. 2

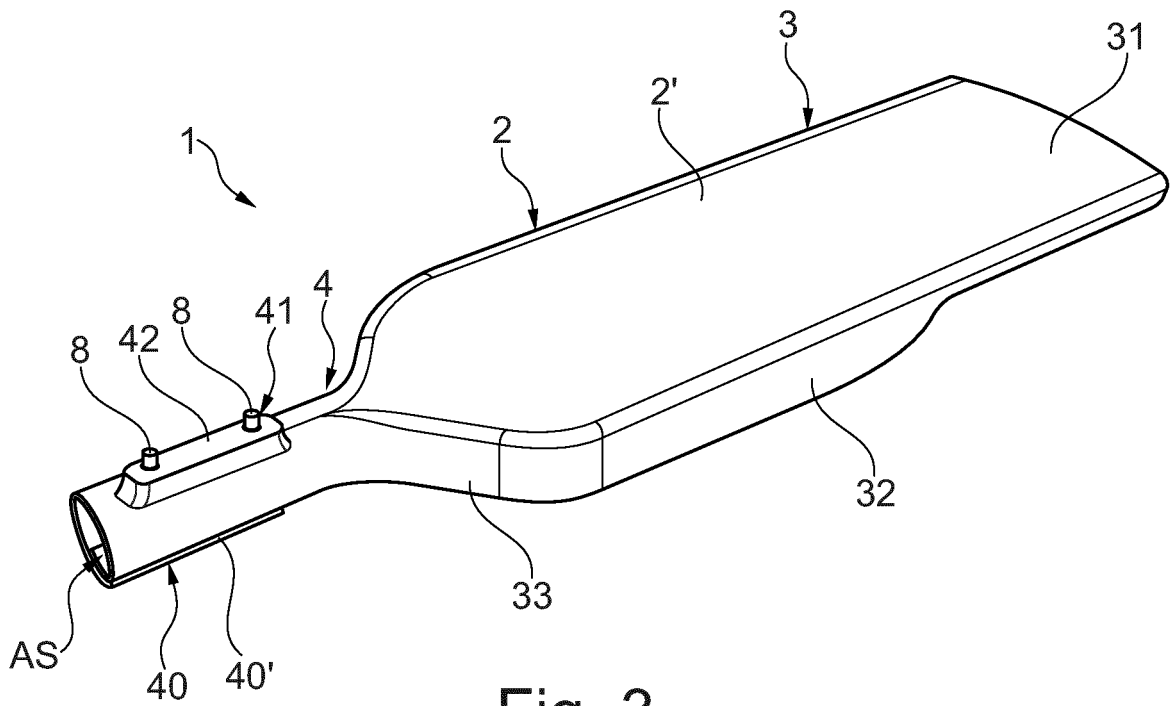


Fig. 3

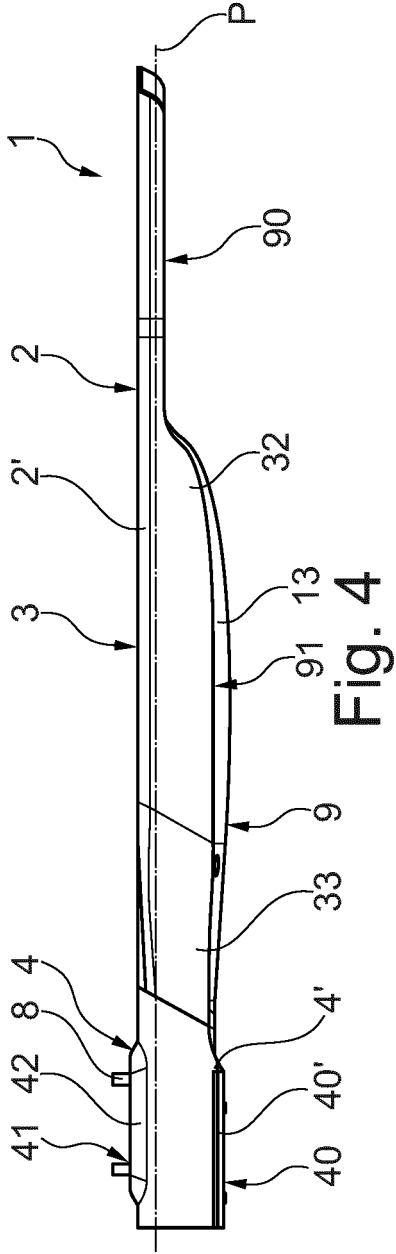


Fig. 4

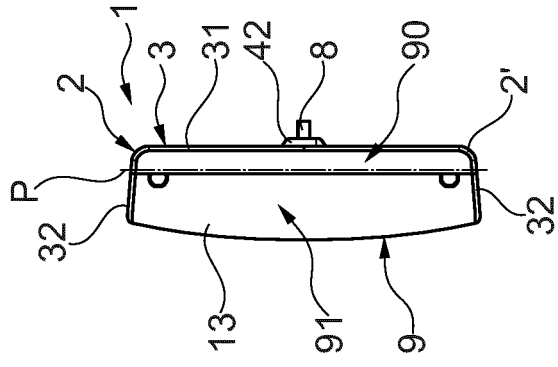


Fig. 6

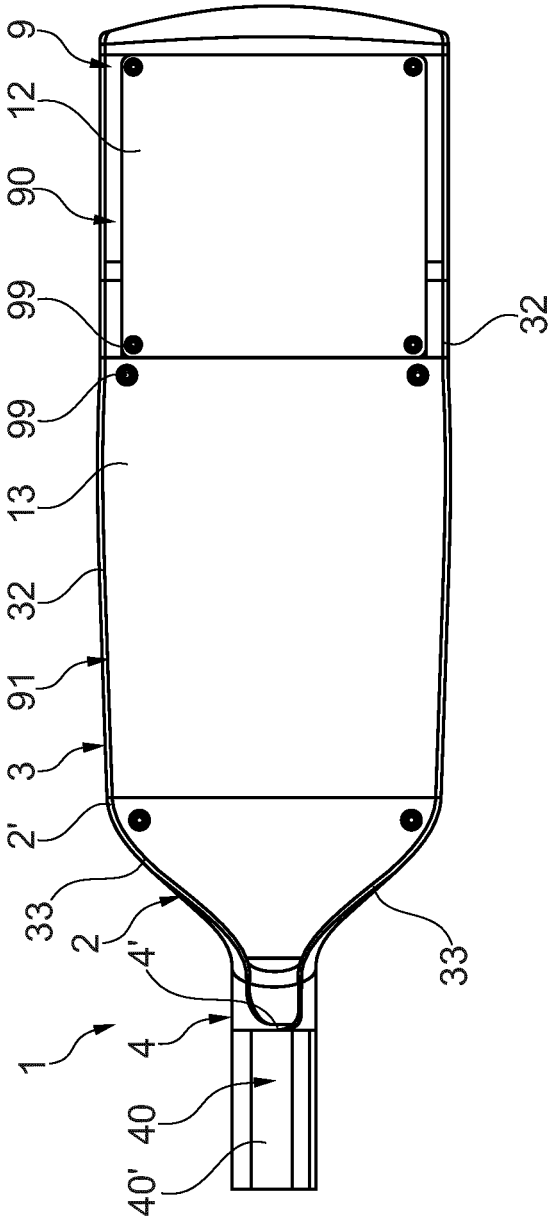


Fig. 5

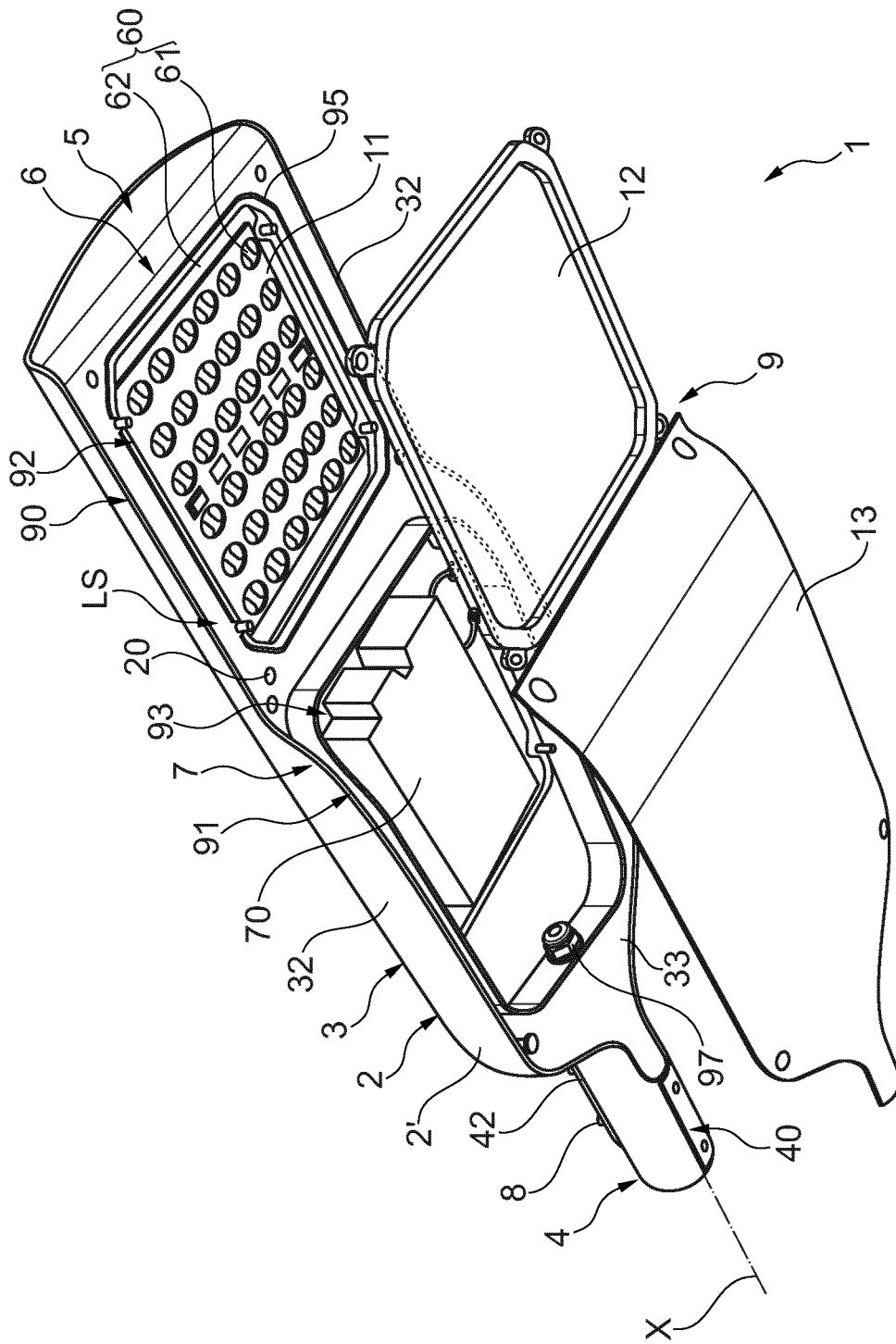


Fig. 7

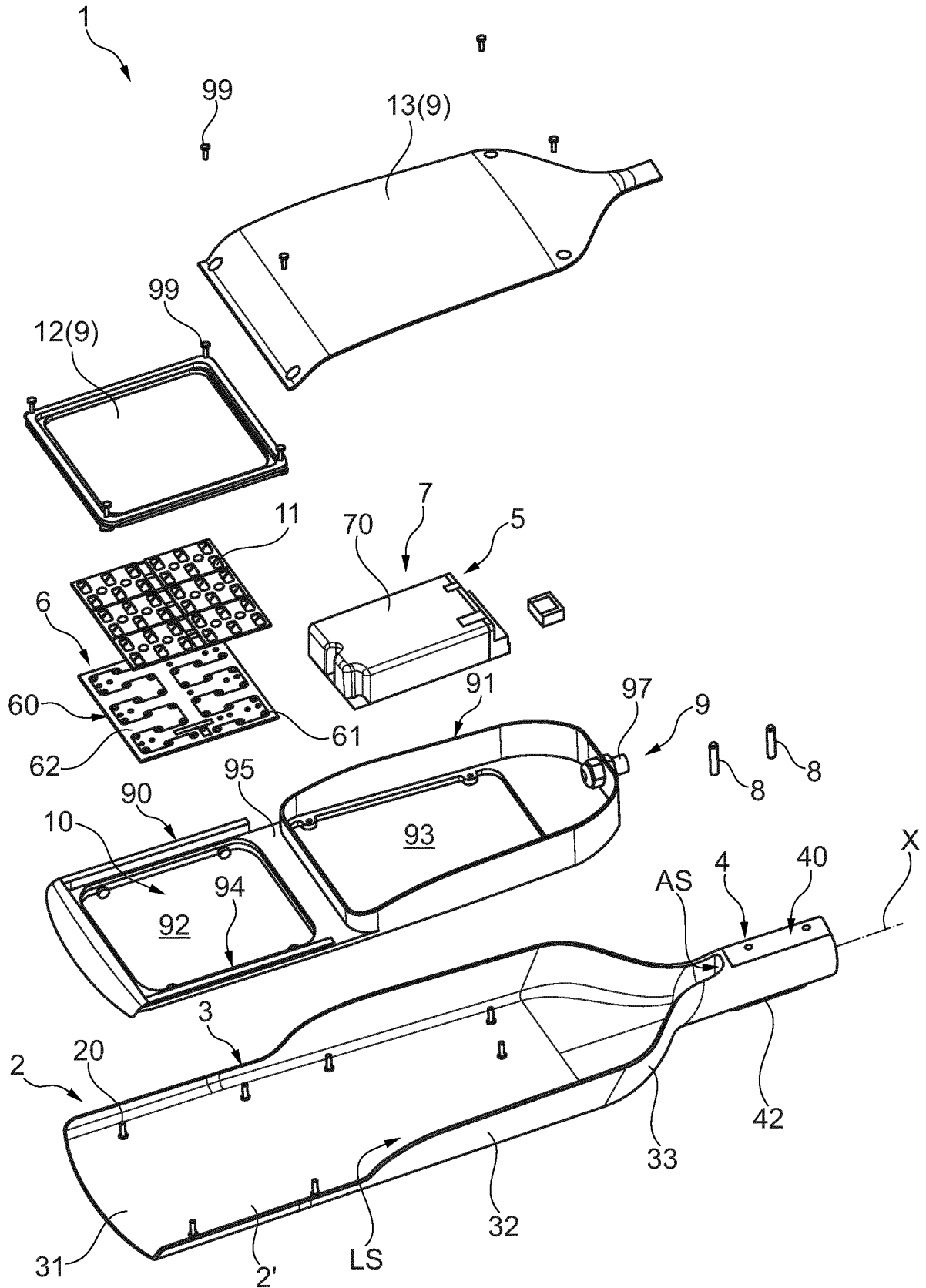


Fig. 8

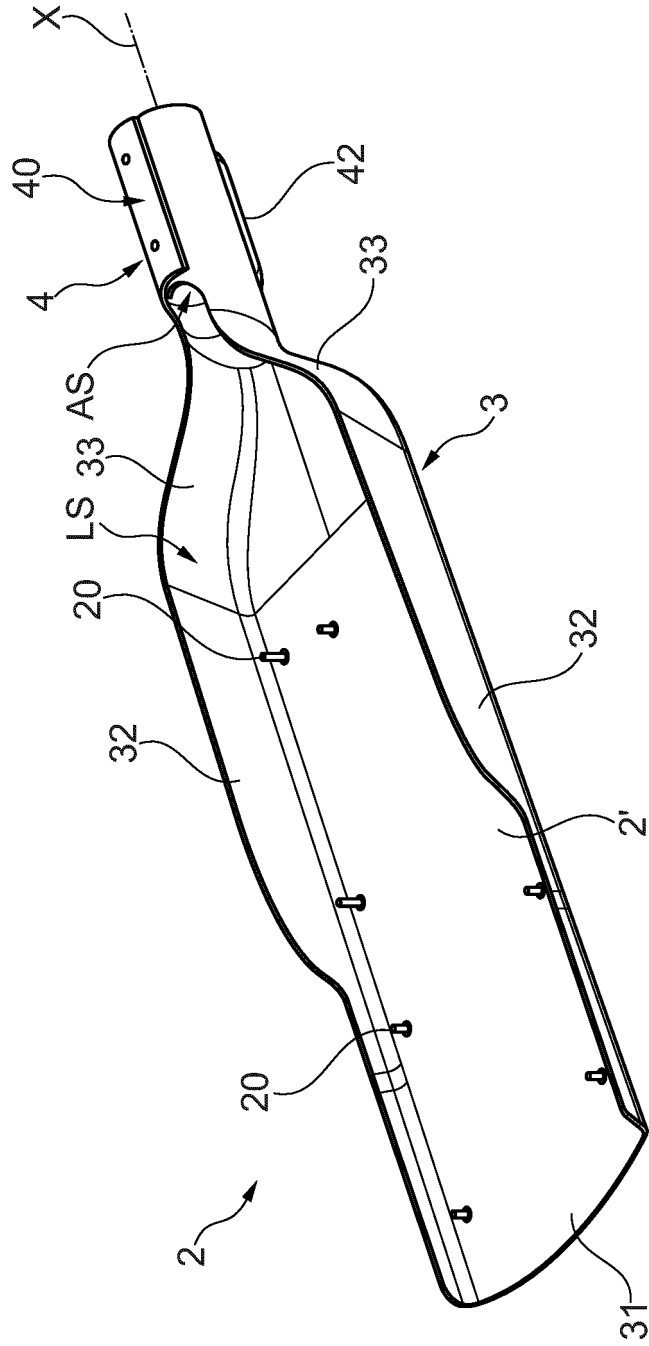


Fig. 9

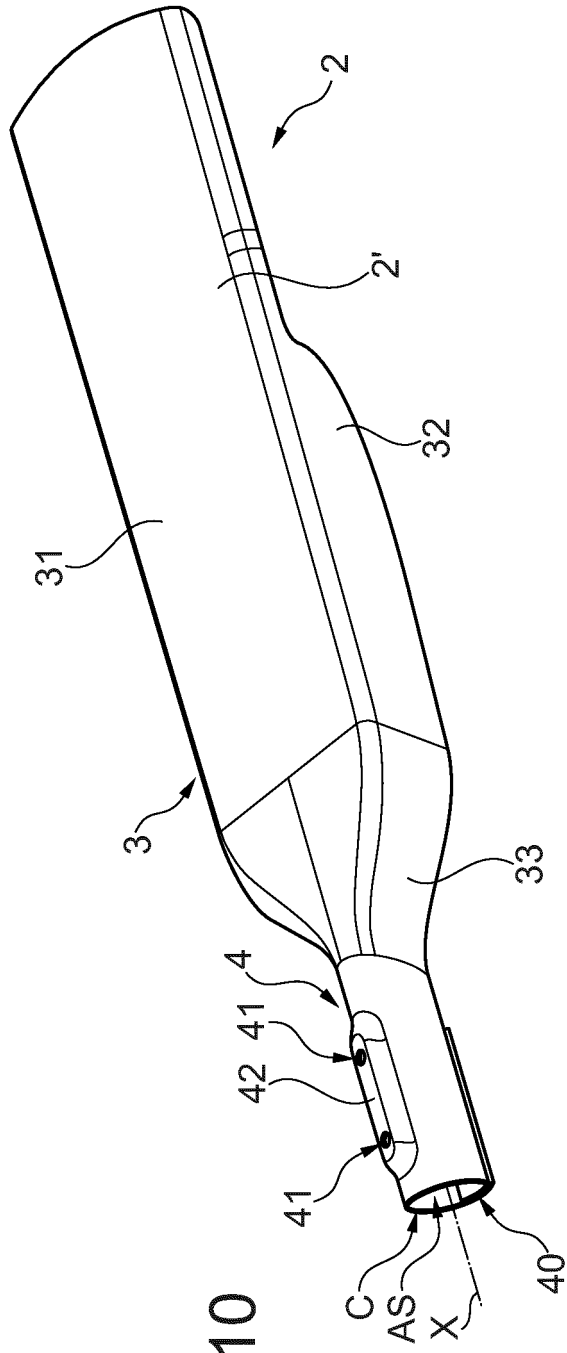


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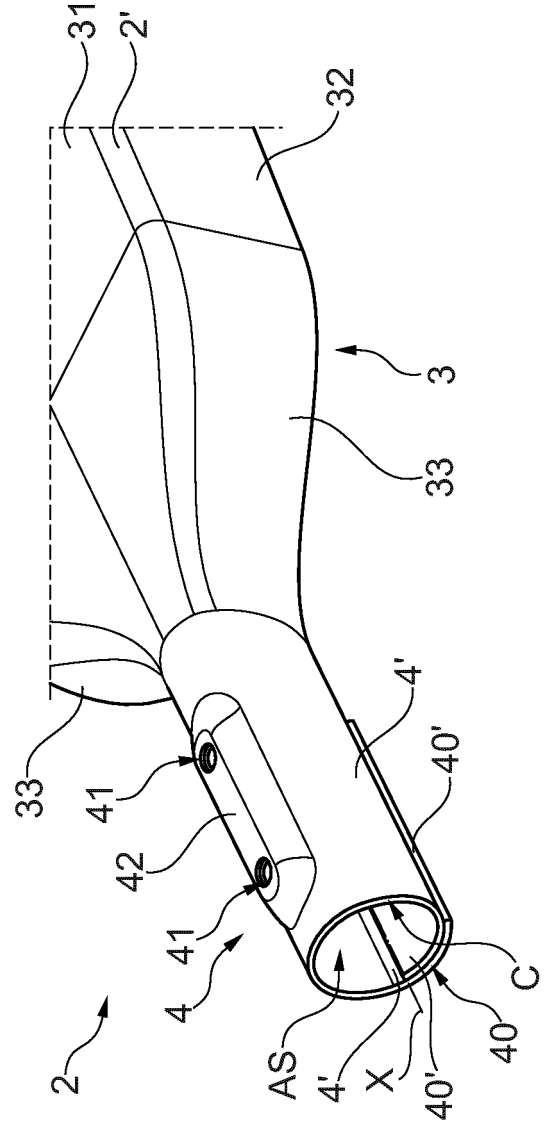


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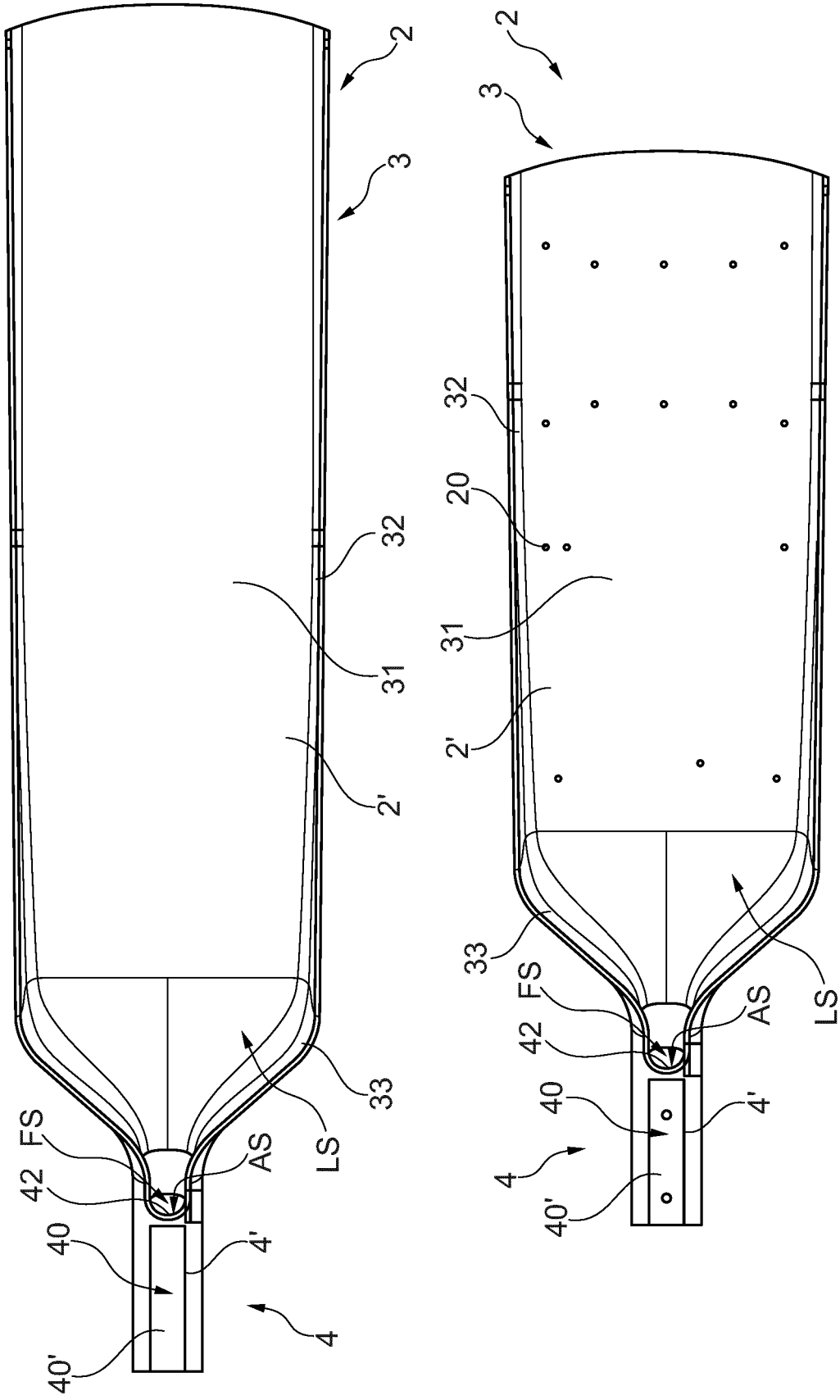


Fig. 12

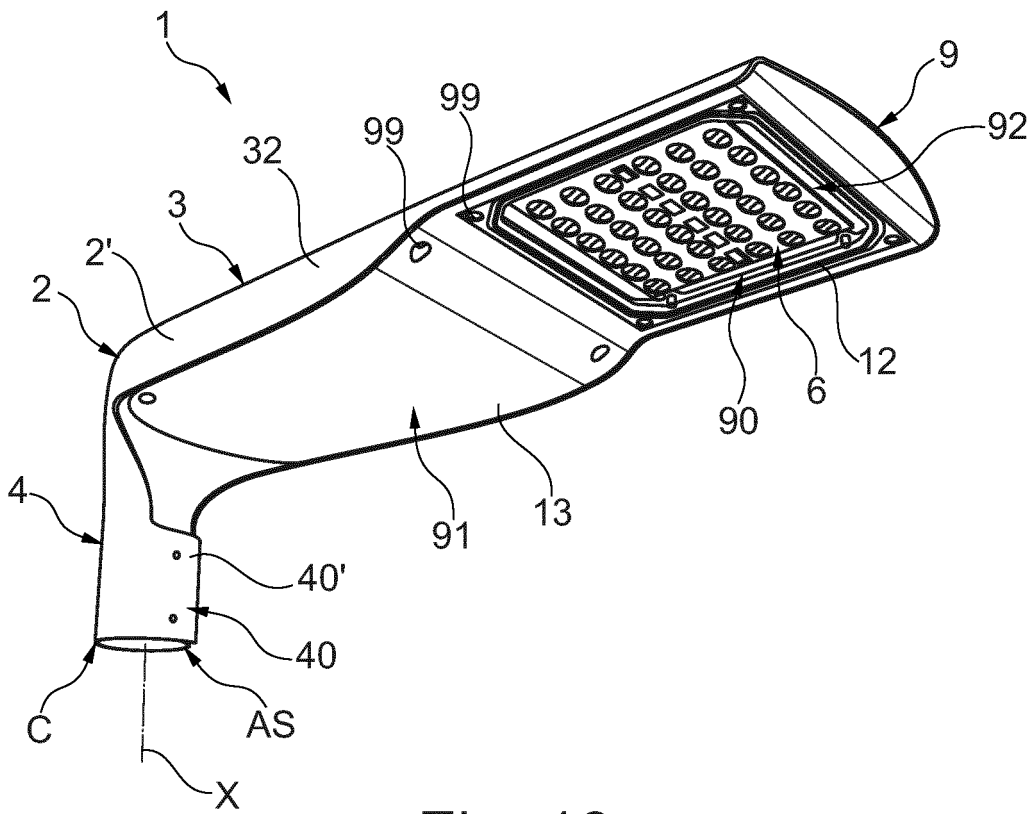


Fig. 13

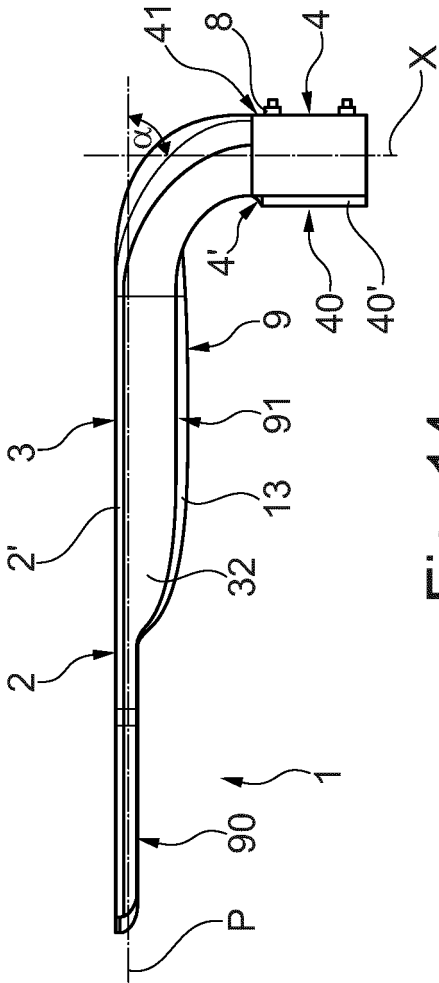


Fig. 14

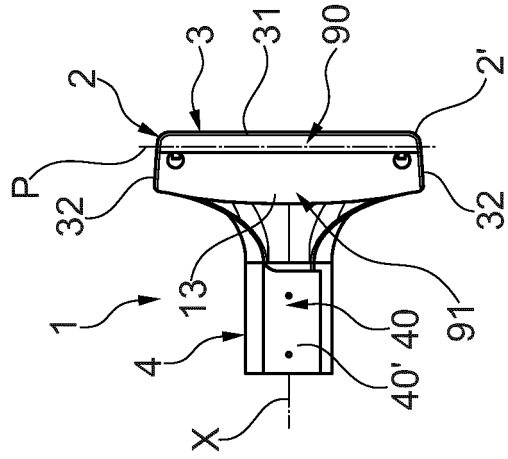


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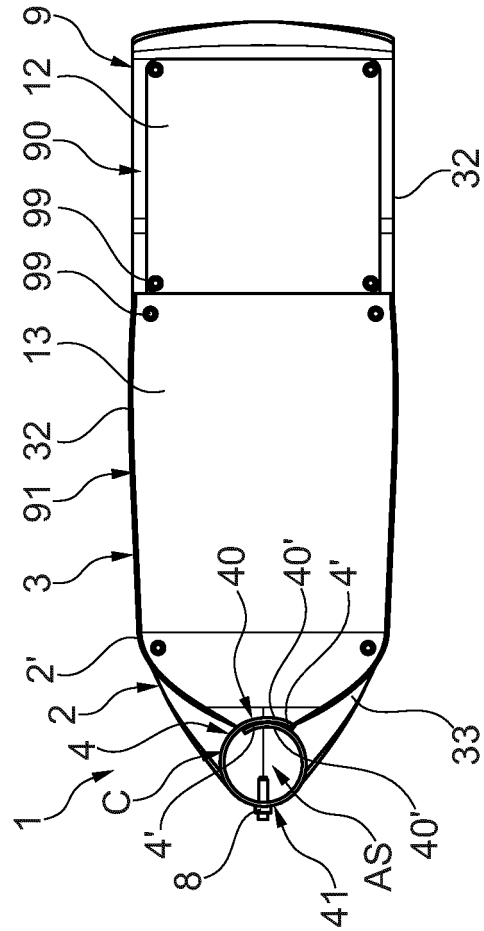


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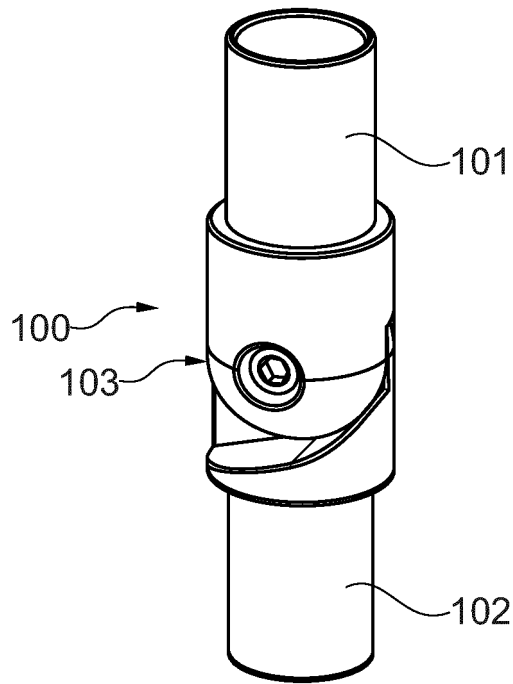


Fig. 17

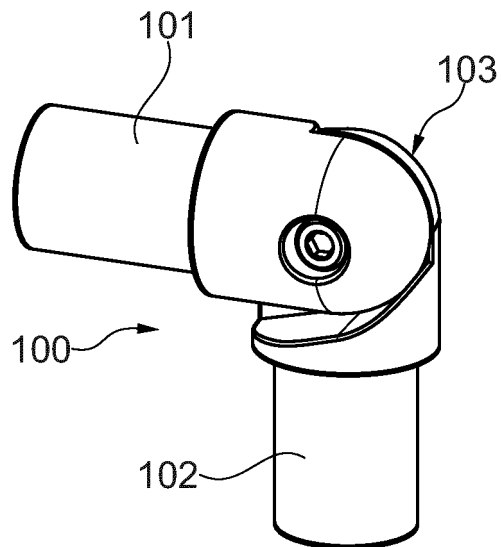
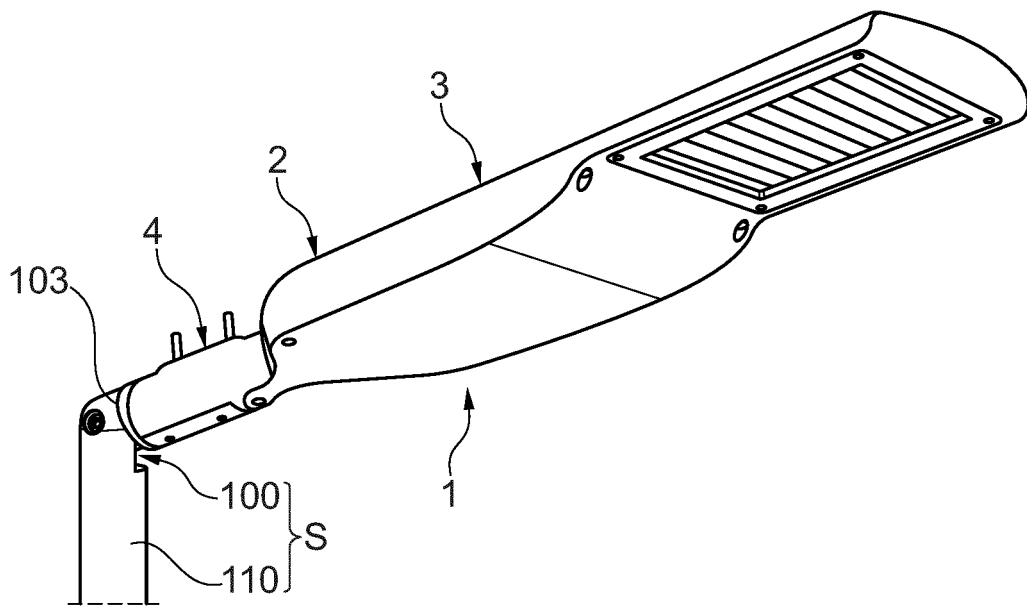
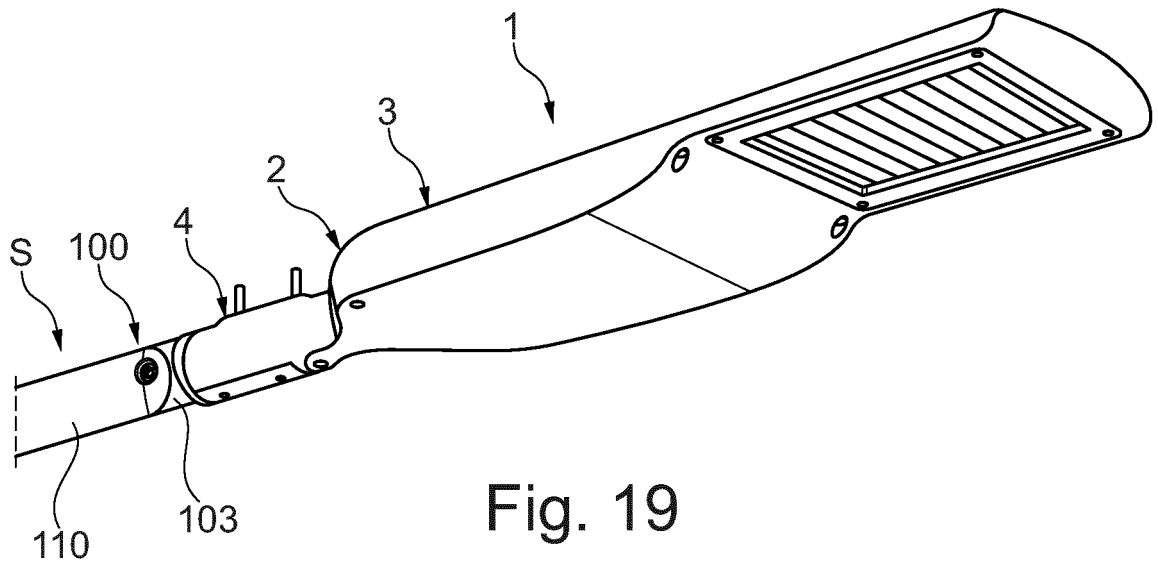


Fig. 18



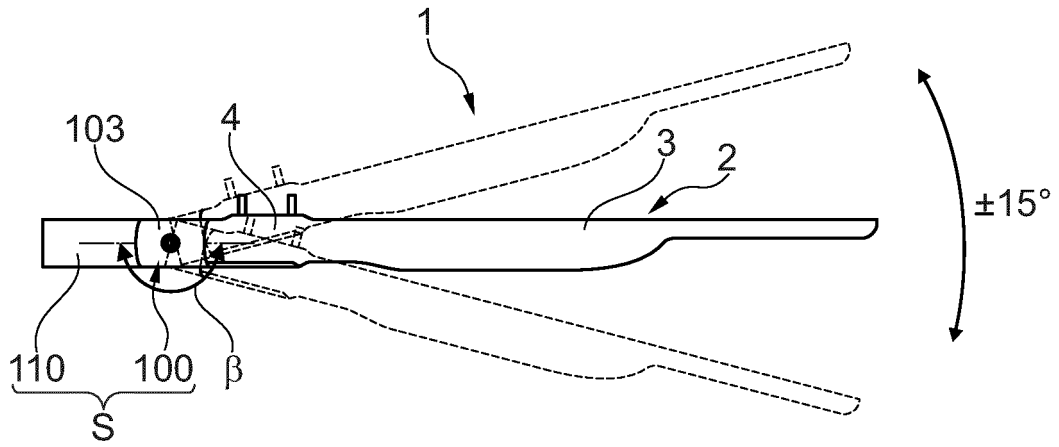


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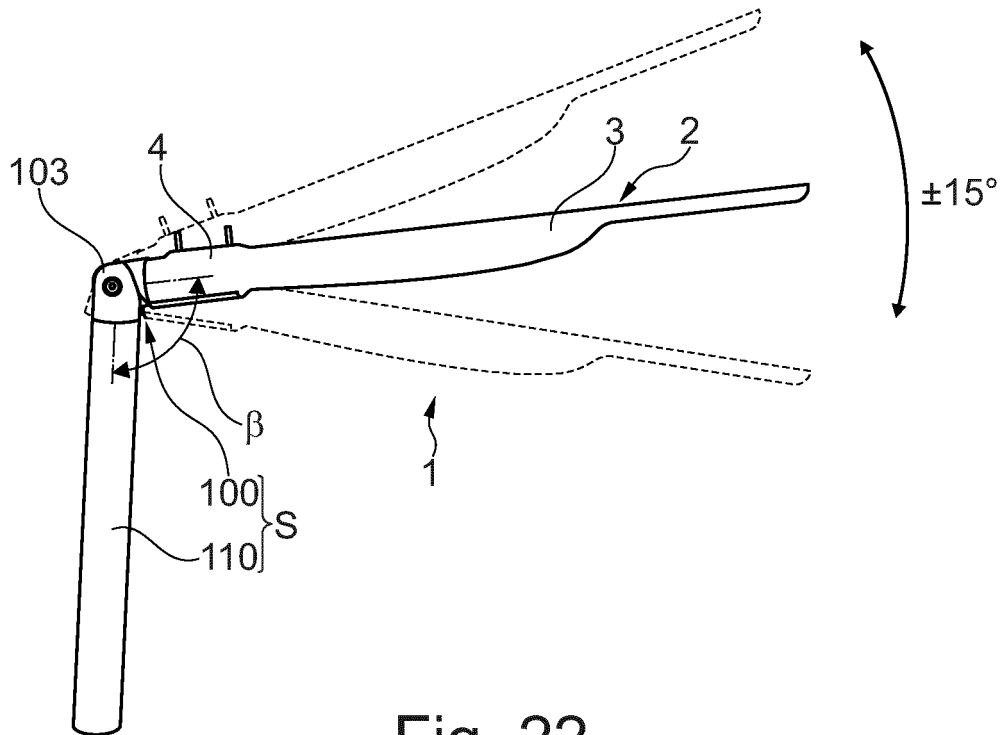


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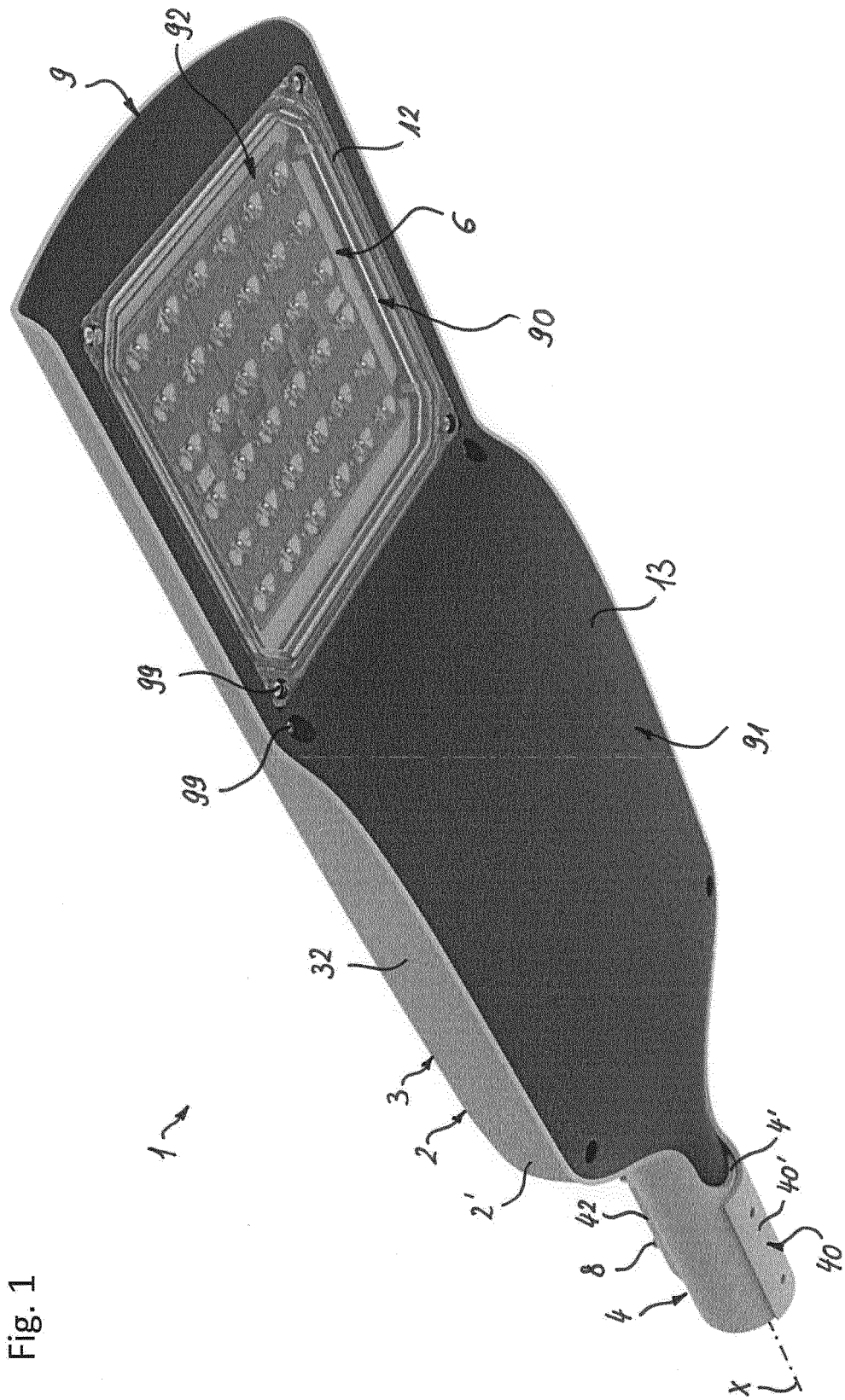


Fig. 1

Fig. 2

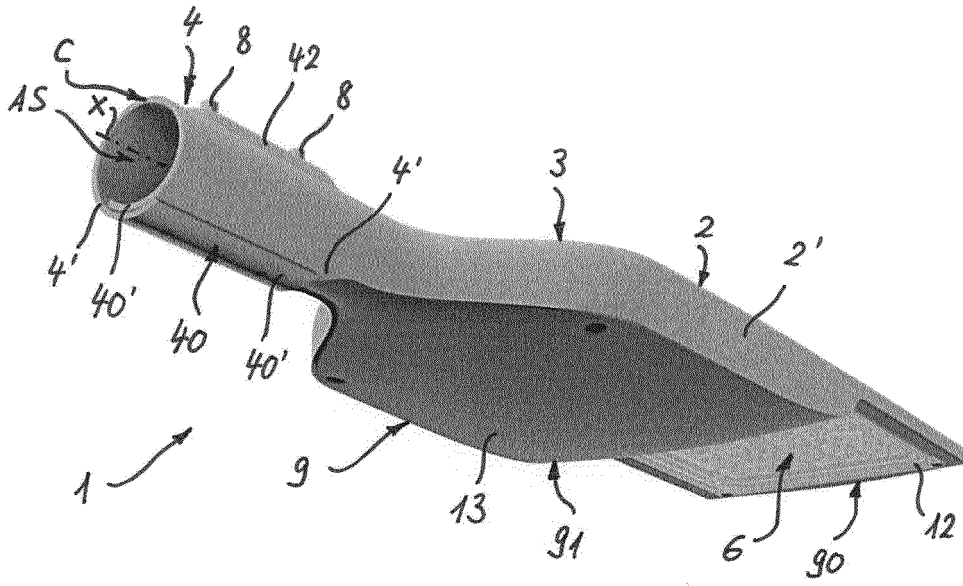
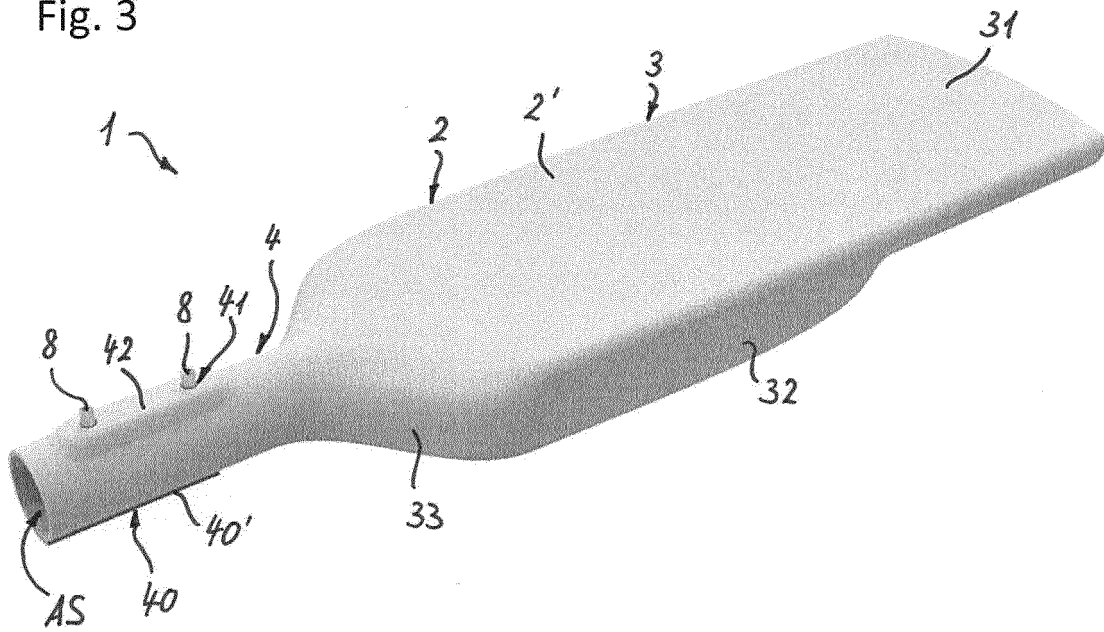


Fig. 3



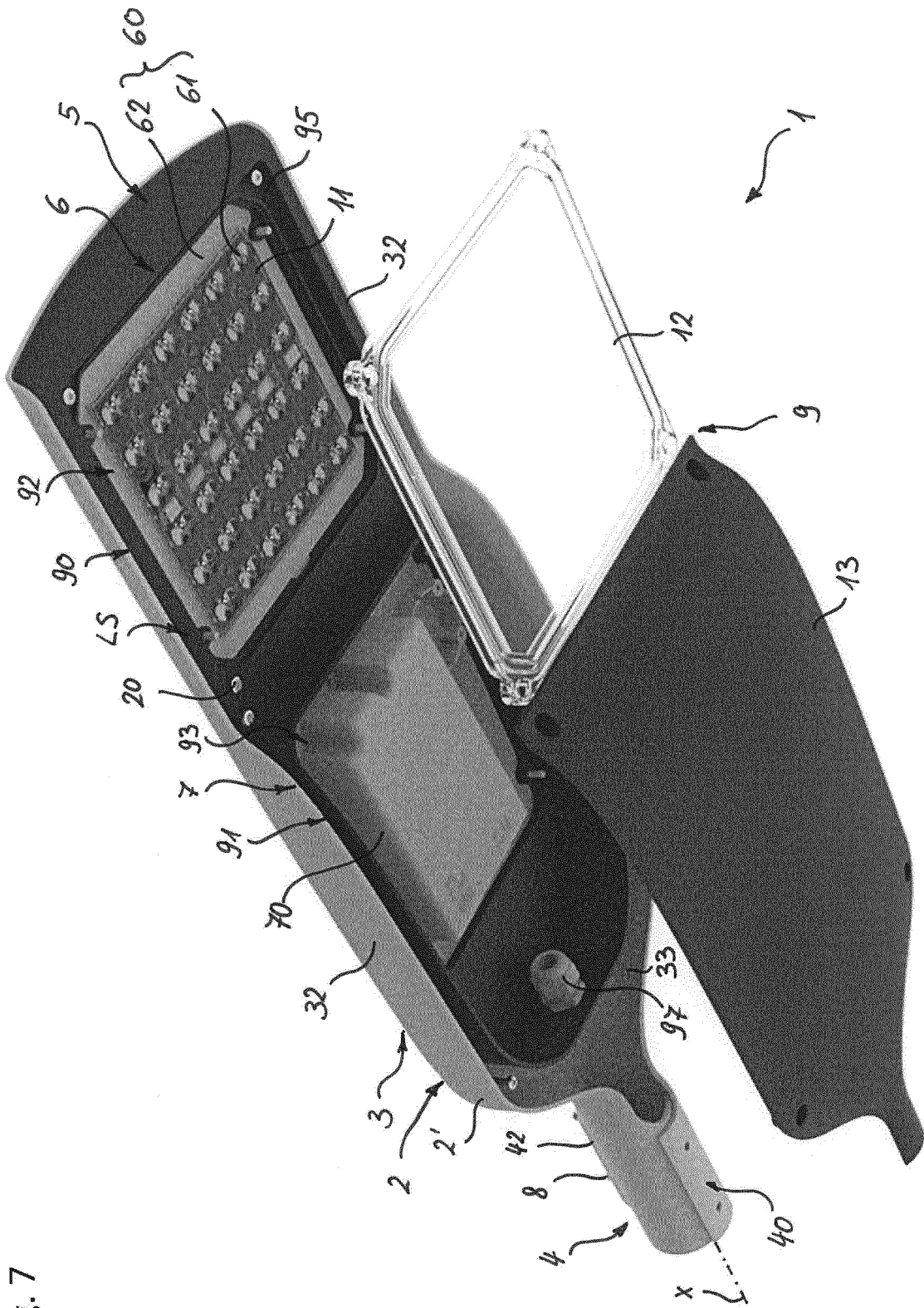
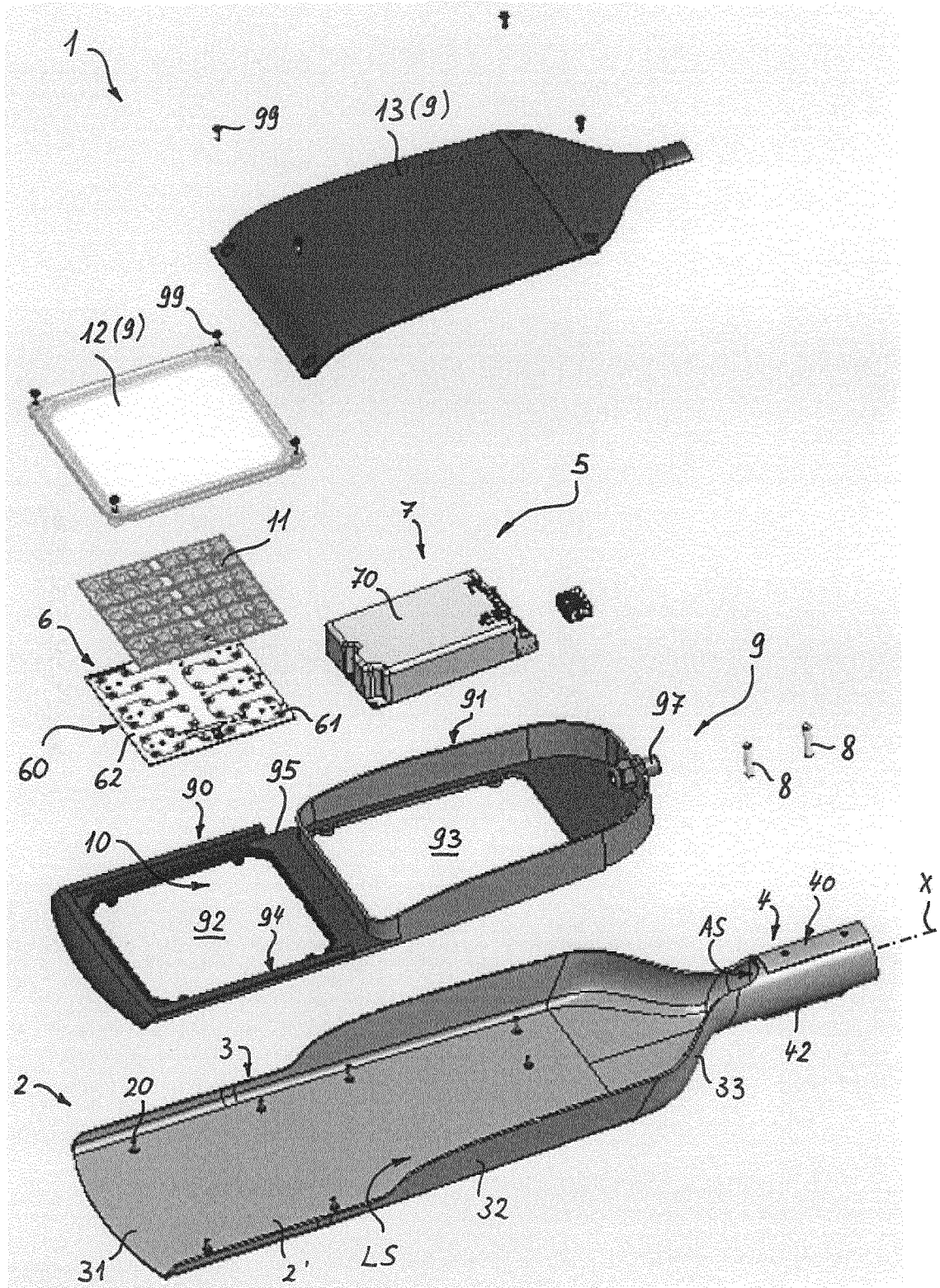


Fig. 7

Fig. 8



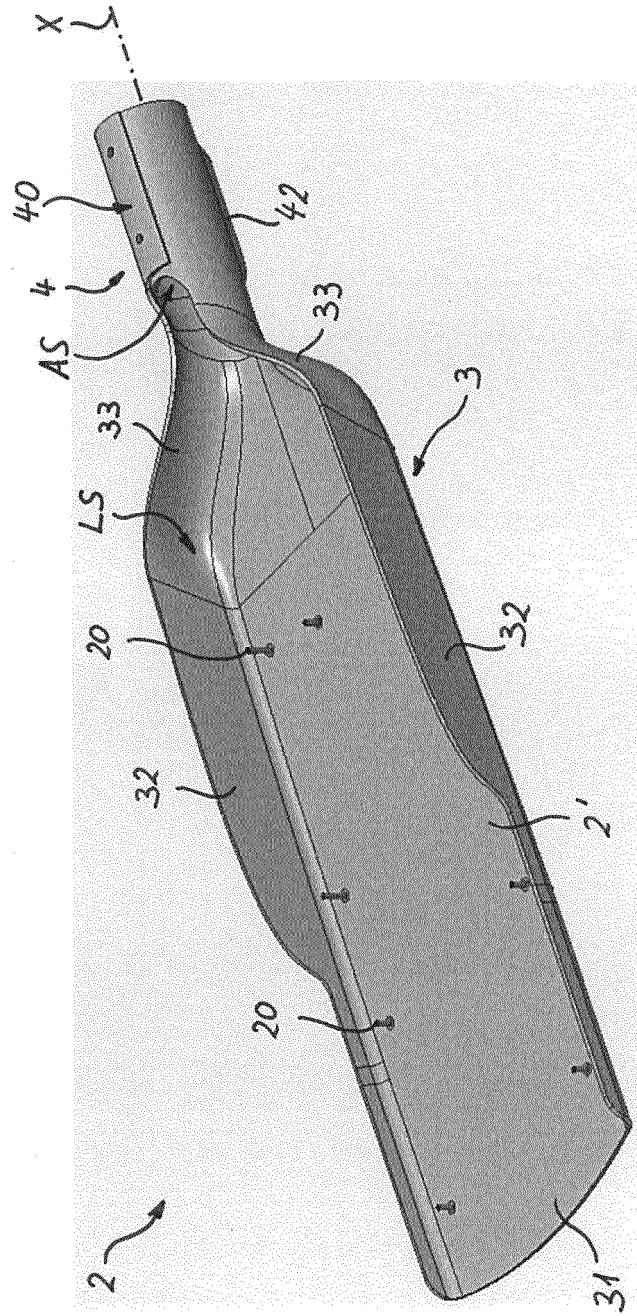


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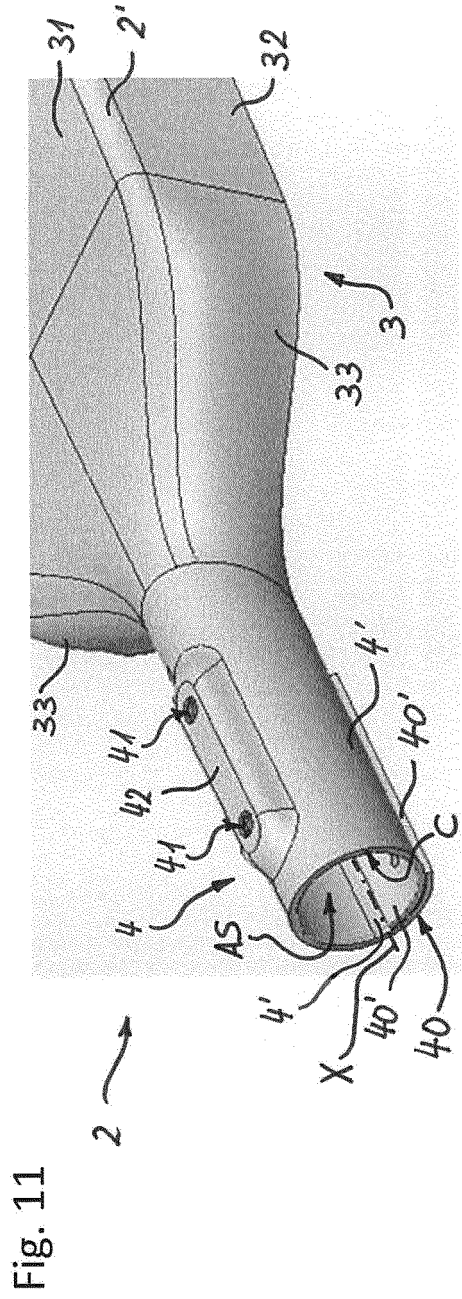
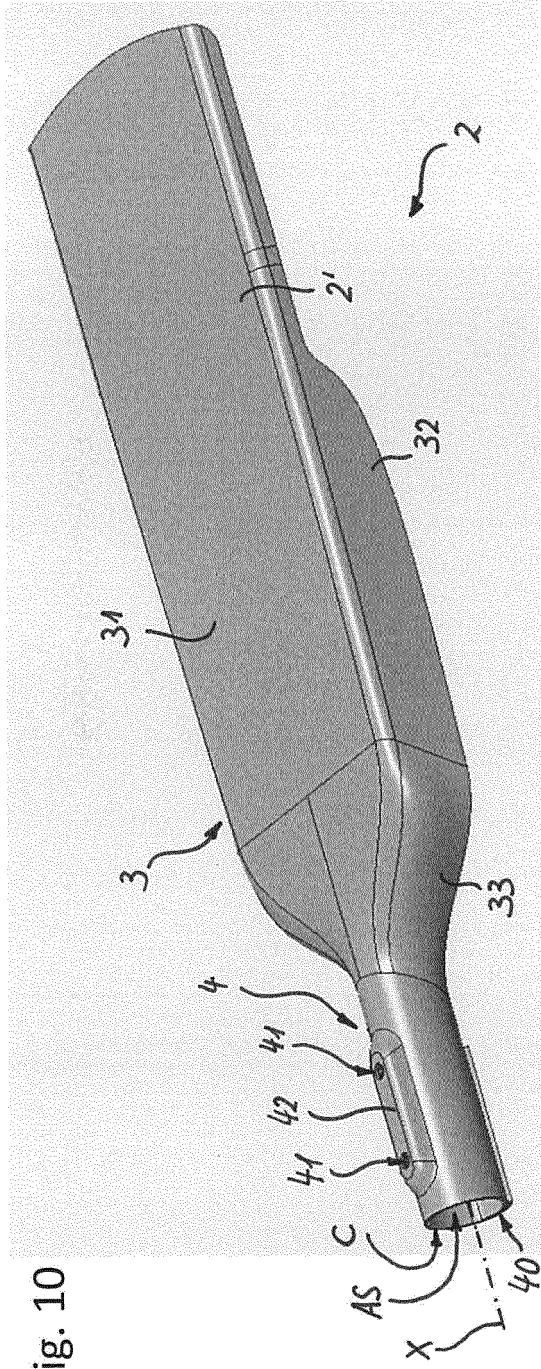
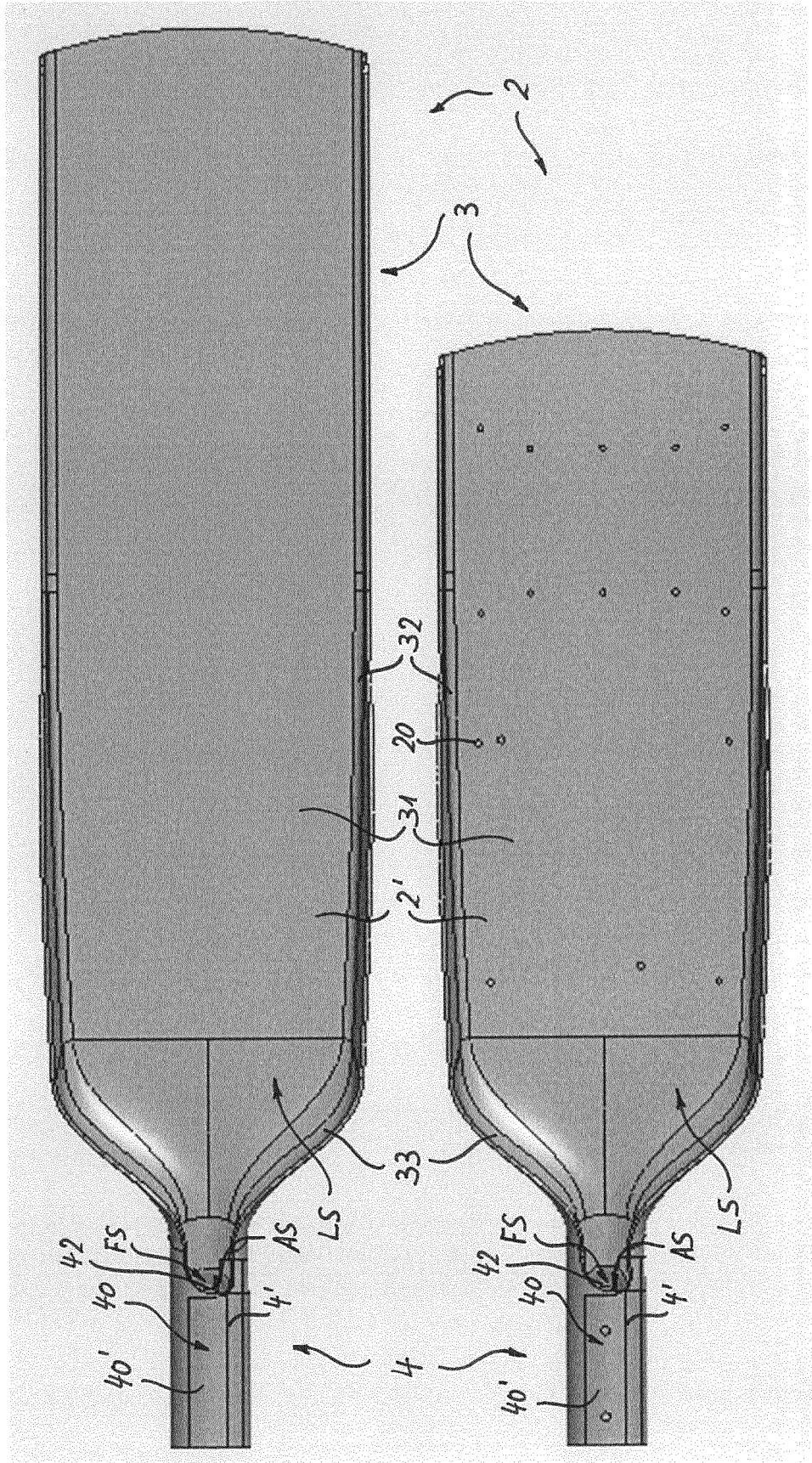


Fig. 12



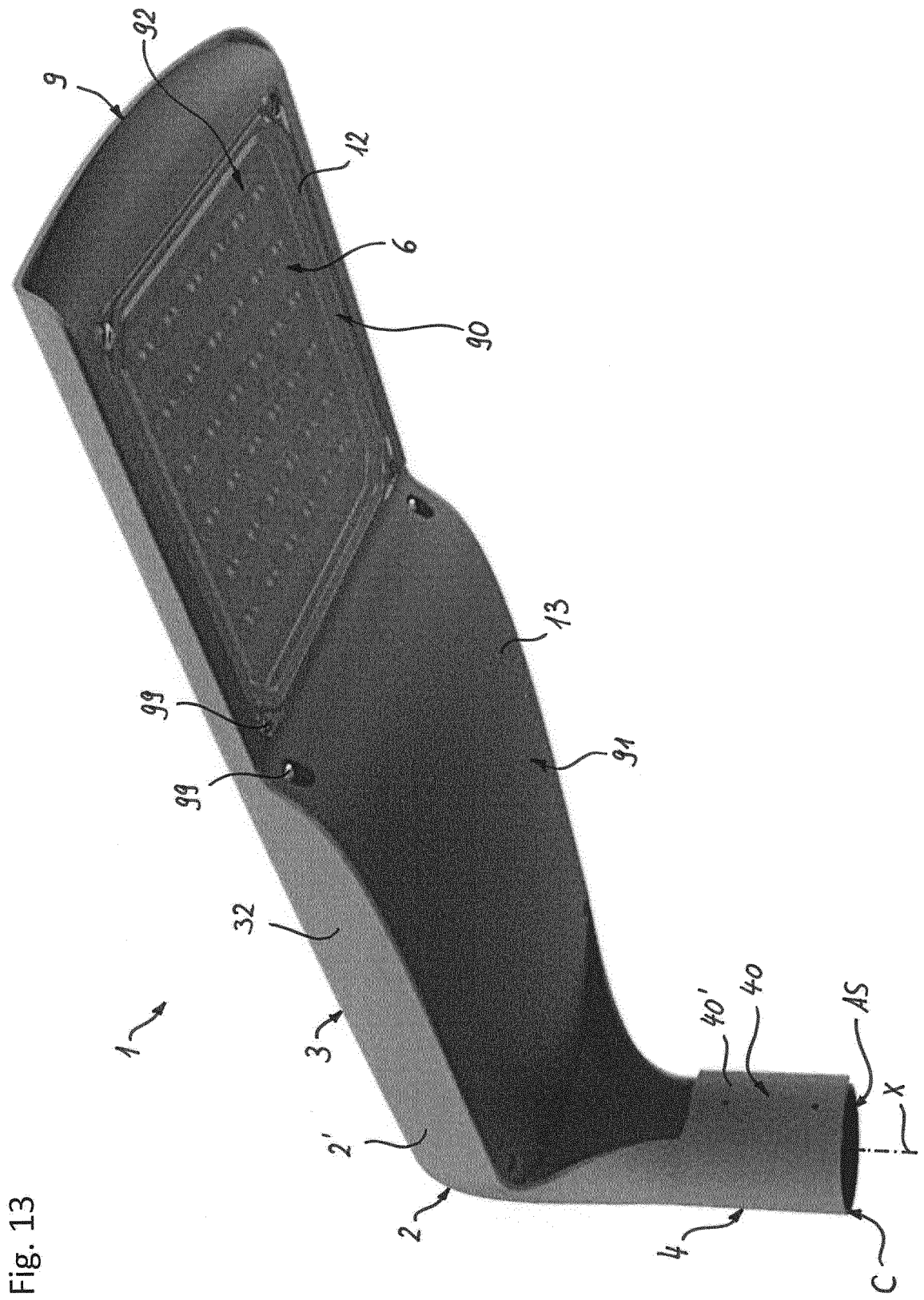


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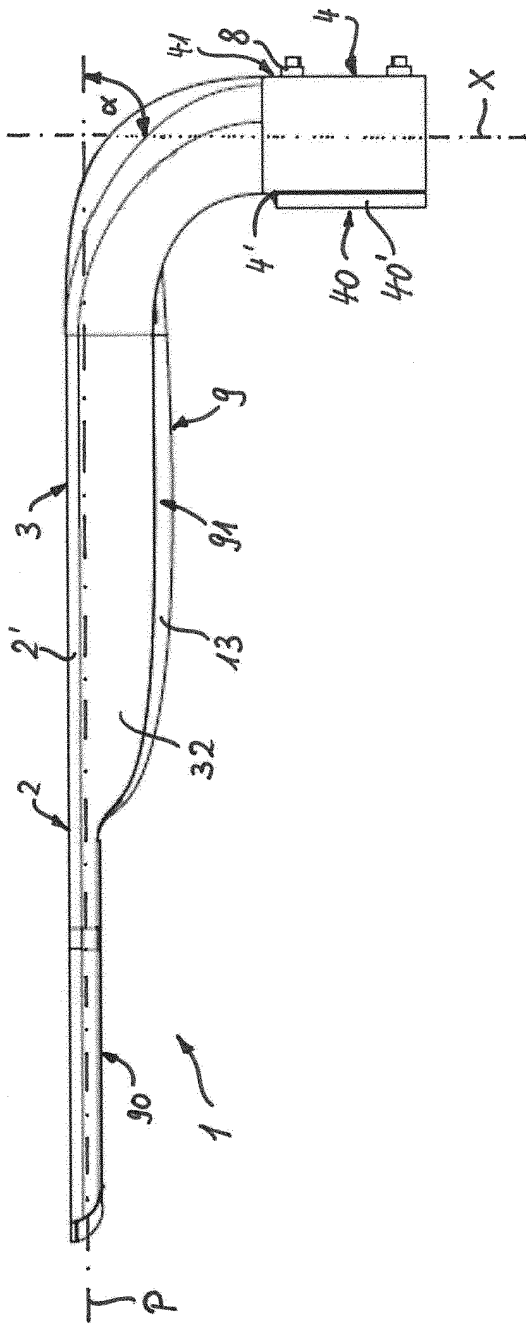


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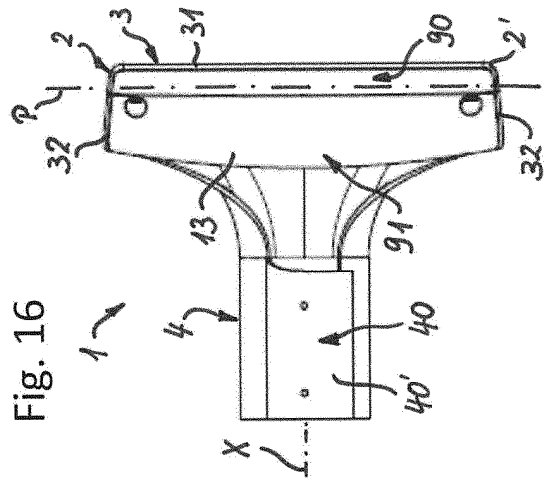


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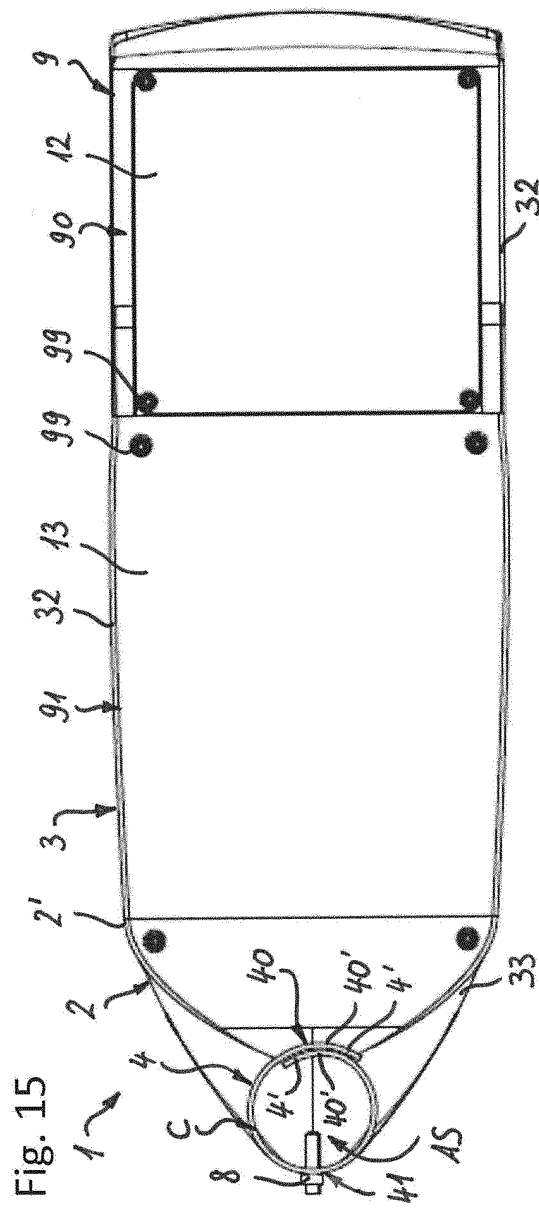


Fig. 15

Fig. 17

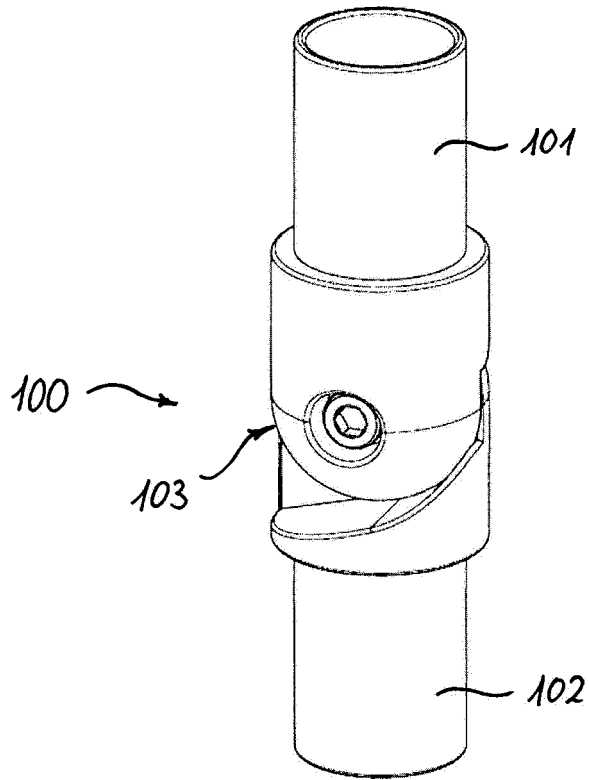


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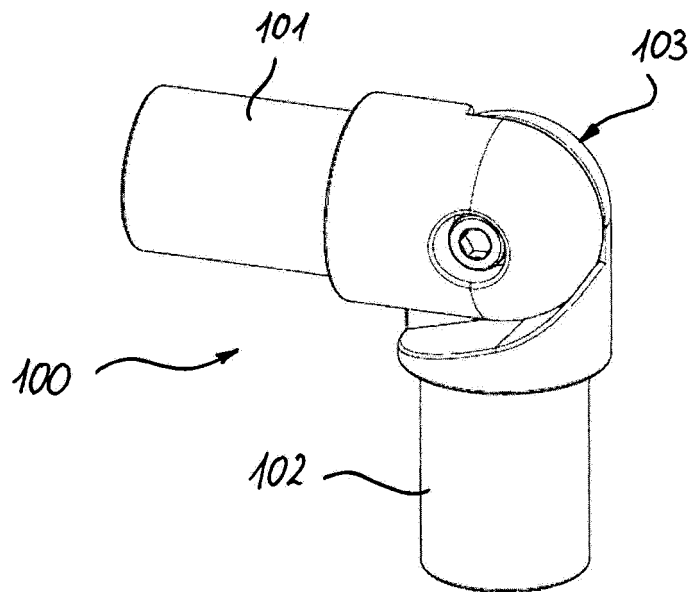


Fig. 19

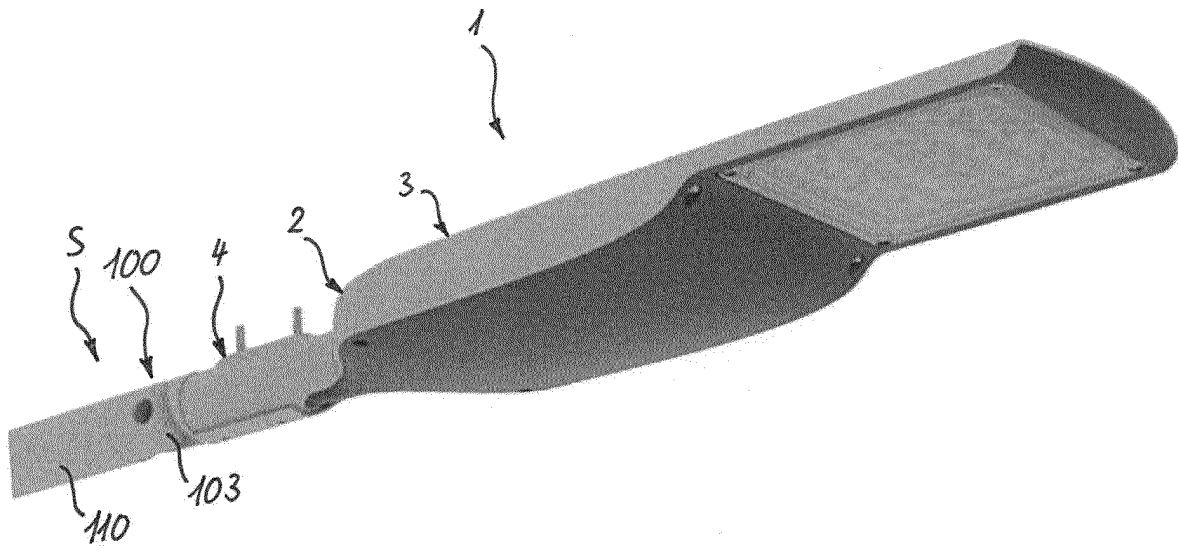


Fig. 20

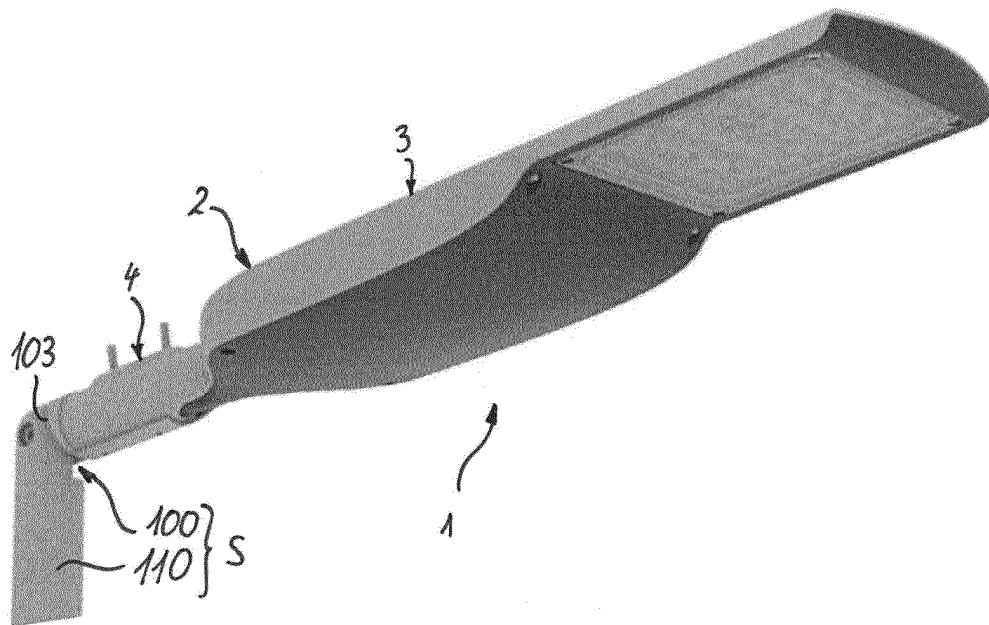


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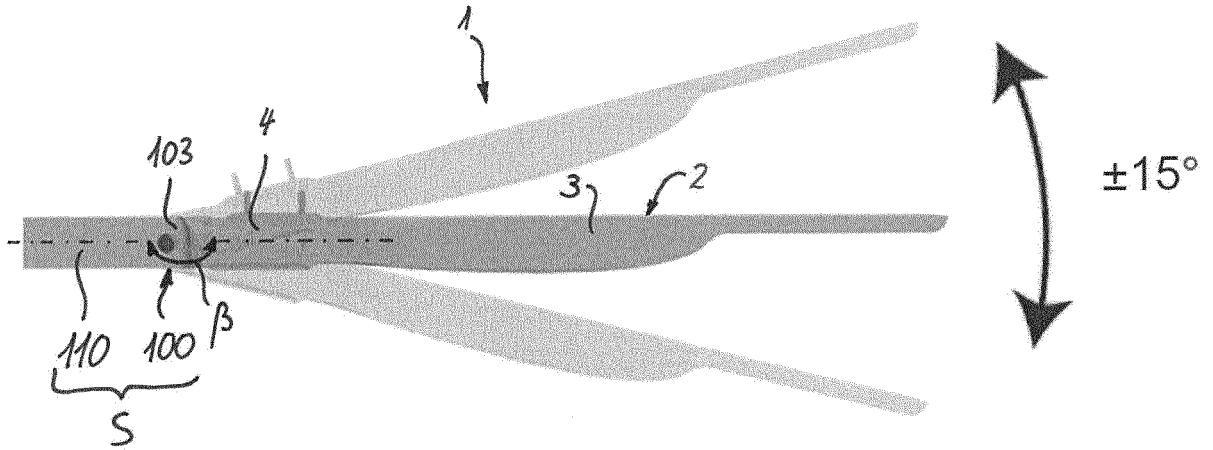
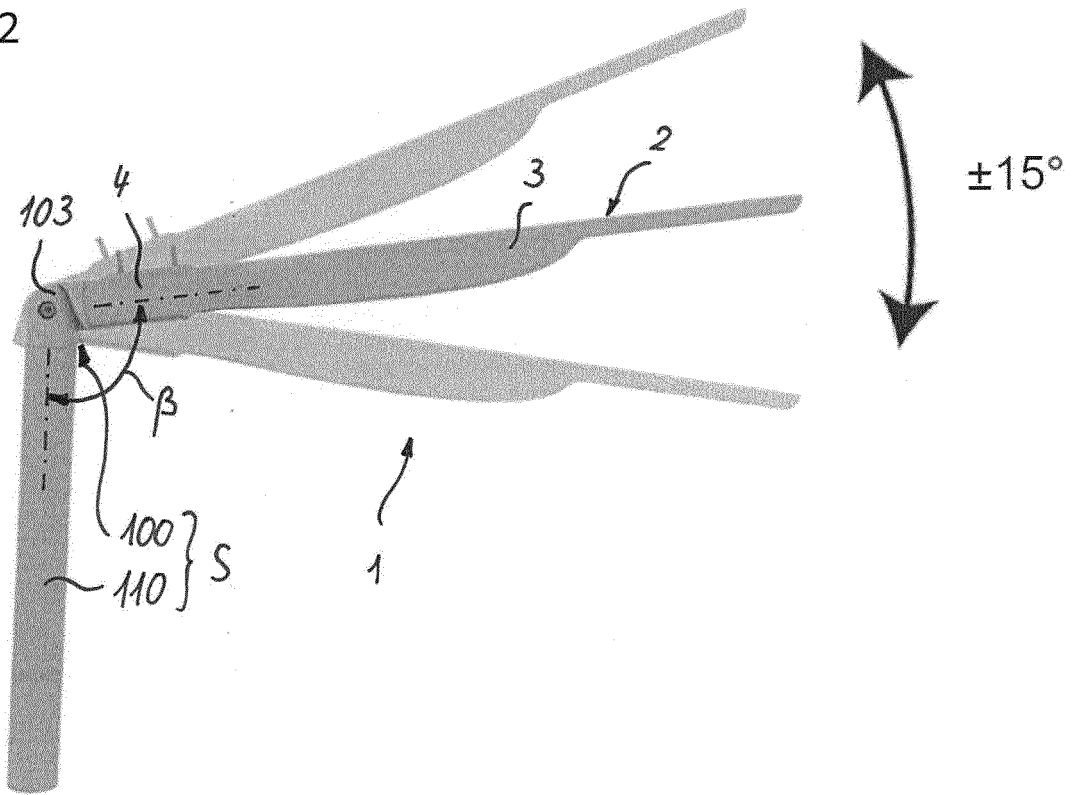


Fig. 22





EUROPEAN SEARCH REPORT

Application Number

EP 23 17 0229

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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	TW M 592 938 U (LITE ON ELECTRONICS GUANGZHOU [CN]; LITE ON TECHNOLOGY CORP [TW]) 1 April 2020 (2020-04-01) * figures 2, 3, 5, 6A, 6B * -----	1, 4-14	INV. F21S8/08 F21V15/01 F21V21/116
A	EP 3 855 066 A1 (THORN LIGHTING LTD [GB]) 28 July 2021 (2021-07-28) * paragraphs [0036] - [0050] * * figures 1, 6-11 * -----	1-15	
A	CN 111 561 687 A (SHANGHAI YAMING LIGHTING CO) 21 August 2020 (2020-08-21) * figures 1, 4 * -----	1-3	
			TECHNICAL FIELDS SEARCHED (IPC)
			F21S F21V
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 September 2023	Examiner Allen, Katie
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	

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

EP 23 17 0229

5 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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21-09-2023

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