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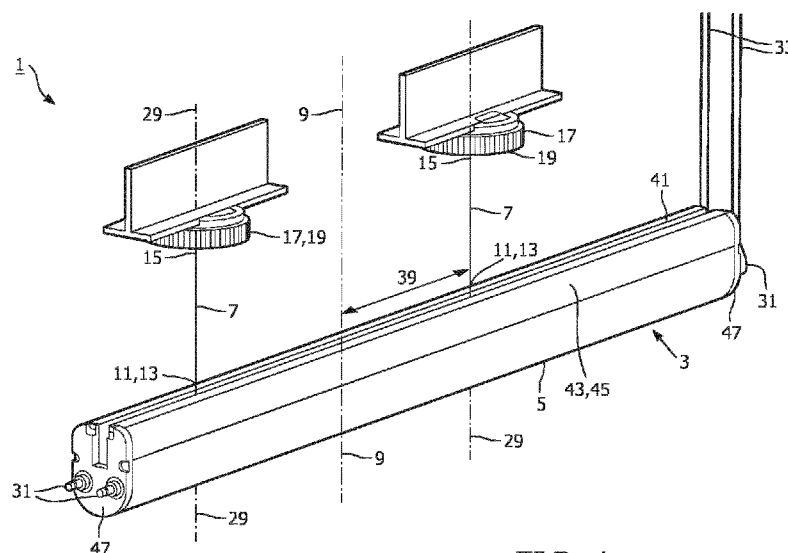


FIG. 1

(57) Abstract: A lighting device comprising a frame and at least one elongated suspension element. Said suspension element defining a suspension axis. The suspension element comprising at a second end a second connector via which it is connected to the frame, and at a first end a first connector for connection to a ceiling. The first connector comprises a casing with a circumferential inner wall around the suspension axis and enclosing a cavity. The first connector further comprising a resilient clamp accommodated in the cavity and comprising two mutually opposing clamping tabs on either side of the suspension axis and radially being spaced apart by a spacing S. The spacing S being adjustable by rotation of the casing over a rotation axis extending parallel to the suspension axis with respect to the clamp.



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LIGHTING DEVICE, SUSPENSION ELEMENT, LUMINAIRE AND LIGHTING SYSTEM

FIELD OF THE INVENTION

The invention relates to a lighting device comprising a frame and at least one suspension element connected to the frame. The invention further relates to a luminaire comprising said lighting device, a lighting system comprising at least two lighting devices or
5 luminaires, and the invention relates to a suspension element comprised in the lighting device, luminaire and/or lighting system.

BACKGROUND OF THE INVENTION

Such a lighting device is known from US3003735. In the known lighting
10 device the frame is a housing and the suspension element has a connector with a rotatable clamp having a pair of opposed clamping tabs for gripping around a T-bar of a false ceiling grid. For mounting of the lighting device onto the T-bar, the mutual position of the T-bar and the clamping tabs is such that T-bar can be brought in between the pair of opposed clamping tabs and subsequently the clamp is rotated such that the T-bar profile is engaged by the
15 clamping tabs thus fixing the lighting device to the T-bar. The known lighting device has the disadvantage that it has a relatively high risk of unintentionally being dismounted from the T-bar by unintentional or spontaneous back-rotation of the gripper. This disadvantage is identified in the known lighting device and thereto the clamping tabs are optionally provided with additional prongs/detents that frictionally engage with and bite into the T-bar. However,
20 this involves the further disadvantages of damage to the T-bar and that disengagement of the clamping tabs from the T-bar is cumbersome in that it requires the use of hammer and screw driver.

SUMMARY OF THE INVENTION

25 It is an object of the invention to provide a lighting device of the type as described in the opening paragraph in which at least one of the abovementioned disadvantages is counteracted. Thereto a lighting device according to the invention is provided which comprises

a frame, for example a rod, a cage or a housing, with at least one suspension element, said suspension element defining a suspension axis and comprising at a first end a first connector for connection to another element, said another element could be, for example a ceiling, a wall, a frame,

5 the first connector comprising a casing with an inner wall enclosing a cavity, a clamp at least partly accommodated in the cavity and comprising two mutually opposing clamping tabs on either side of the suspension axis and radially being spaced apart by a spacing S,

10 the spacing S being adjustable by rotation of the casing over a rotation axis extending parallel to the suspension axis with respect to the clamp,

wherein the cavity has a variable, radial diameter, such that upon a full rotation of the casing over the rotation axis, the mutually opposing clamping tabs at least twice change from an open position to a closed position.

The rotation axis can be a central rotation axis extending parallel or coinciding
15 with the suspension axis with respect to the gripper/clamp, for example in that against the resilient force of the gripper/clamp, the opposing clamping tabs are forced by the inner wall or at least one inwardly positioned or extending protrusion from the inner wall to move toward each other into a closed position. Thus a quick lock/unlock system is obtained requiring only a quarter of a full rotation, i.e. a rotation over a quarter of 360° is 90° , for
20 mounting/dismounting the assembly, which is particularly suited for T-bar grids and thus solving the problem of the prior art devices of a cumbersome (dis)engagement of the clamping tabs. It is applied by aligning the recess in between the clamping tabs with the T-bar and subsequently turning the casing 90 degrees clockwise (or counterclockwise) to snap the assembly together. To release the clamping tabs from the T-bar into an open position, the
25 casing is rotated back over 90 degrees counterclockwise (or clockwise). The clamping tabs are moving hence and forth, due to their resiliency, from an open into a closed position and vice versa. For example, the variation of said radial diameter can be as follows: the inner wall of the cavity has a height H_w , the cross section or diameter as measured in a respective direction perpendicular to the rotation axis, is essentially constant over essentially the full
30 height H_w of the inner wall, or in the case the inner wall comprises inwardly positioned protrusions with a height H_{iw} the diameter is essentially constant over said height H_{iw} . Alternatively, or additionally the cavity may have a mirror symmetrical shape with respect to at least one mirror plane, the rotation axis extending through and parallel to said at least one mirror plane.

Alternatively, the hence and forth movement of the clamping tabs can be forced by providing the cavity with additional protrusions that force the clamping tabs radially outwards towards the inner wall, the clamping tabs are thus located in radial direction in between the inner wall and a respective additional protrusion. The clamping tabs can be formed as an integral part of a ring seated in the cavity, or each clamping tab can be part of a respective separate (resilient) strip. The rotation movement for mounting/dismounting is essentially free from axial movement along the rotation axis. The clamp enables free movement of the lighting device along the length of the T-bar profile.

The first connector is particularly suitable for, for example, to grip around or clamp a T-bar of a false ceiling, but by having different executions of the sheet metal clamping tabs, also other ceiling fittings are possible, for example a plaster ceiling to which a locking plate with a T-bar profile is fixed, e.g. screwed, glued or nailed, but it can also be designed to fit band raster strips. Thus a single-sided quick lock suspension system not only for T-bar ceiling grids, but also for other ceiling comprising a recess-ridge structure is enabled and obtained. Typically and optionally the frame of the lighting device is a housing which accommodates an elongated light source, for example a fluorescent tube lamp or for example a plurality of LEDs, for example arranged in a row. Similar to the first connector, the second connector of the suspension element could be of the same configuration as the first connector to grip around a T-bar shaped profile of the housing of the lighting device. Alternatively the second connector could comprise a T-bar profile and the housing could comprise two mutually opposing clamping tabs with adjustable spacing S . Thus a double-sided quick lock suspension system is enabled and obtained.

The lighting device has the feature that the cavity has a variable, radial diameter, i.e. the diameter of the cavity is different in different radial directions, for example a ratio R_d between a maximum diameter D_{max} and a minimum diameter D_{min} is in the range $1.2 \leq R_d \leq 3$, for example $R_d=1.5$ or $R_d=2$. A ratio of at least 1.2 renders in general the first connector to have just enough difference in a minimal spacing S_{min} and a maximal spacing S_{max} between the clamping tabs for the T-bar to be insertable between the clamping tabs and subsequently upon rotation of the of the casing for the clamping tabs to engage the T-bar sufficiently for a reliable grip. A ratio of more than three renders the casing to become too voluminous thus forming an obtrusive, unattractive part of the suspension element. The different diameter in different directions can be formed by the inner wall itself or be formed by an at least one inwardly positioned protrusion of the inner wall, for example two oppositely provided and arranged inwardly positions protrusions of the inner wall.

The lighting device might have the feature that the clamping tabs have a respective straight clamping portion which in mounted position rest against flat/straight inner wall portions of the inner wall to render the connector to assume a stable close, mounted position, which is a kind of snapped position. Thus, safety of a mounted lighting device is enhanced as the risk on unintentional dismounting is reduced. The flat and/or straight inner wall portion can be formed by the inner wall itself or be formed by at least one of said inwardly positioned protrusions of the inner wall.

Alternatively, the invention provides a lighting device comprising a frame and at least one, often elongated, suspension element, said suspension element defining a suspension axis,

the suspension element comprising at a second end a second connector via which it is connected to the frame, for example slideably connected to the frame, and at a first end a first connector, for example for connection to a ceiling,

the first connector comprising:

a casing with an, often circumferential, inner wall around the suspension axis and enclosing a cavity,

a clamp, preferably resilient, accommodated in the cavity and comprising two mutually opposing clamping tabs on either side of the suspension axis and radially being spaced apart by a spacing S,

the spacing S being adjustable by rotation of the casing over a rotation axis extending parallel to the suspension axis with respect to the clamp, in particular in that the clamp thus changes between an open or unlocked and a closed or locked configuration.

The lighting device might have the feature that the cavity is elongated in radial direction, the cavity has an aspect ratio AR of length and width in the range of $1.2 \leq AR \leq 5$, for example $AR=1.5$, $AR=2$ or $AR=3$. The width of the casing preferably is the same or somewhat less than the width of the T-bar to render it relatively unobtrusive and provide much design freedom. In particular such a small width renders the lighting device to acceptably lower a possible distortion in illumination of the ceiling from which it suspends. Yet, the length of the casing is at least somewhat larger than the width of the T-bar, for example at least 1.2 times the width of the T-bar in the case of an $AR=1.2$, for example at least twice or three times the width of the T-bar. Typically the width of the T-bar for a standard suspended ceiling grid is in the range of 20 mm to 50 mm, but could even be up to 150 mm, for example 100 mm. The AR should be less than 5 because it becomes visually

unattractive and the risk of blocking the rotation of the casing becomes too large, also positioning of the lighting device relatively close to (façade) walls is blocked then.

The lighting device might have the feature that the casing and the clamp have a matching male/female configuration. This has the advantage that the resilient clamp can be maintained in a snapped position with respect to the casing and that an undesired release from the mutual position of casing and clamp can be counteracted, thus reducing the risk of unintentional dismounting (and possibly falling down) of the lighting device from the ceiling.

The lighting device might have the feature that, at least in a mounted position of the lighting device, the clamp rests with pressing force against an inner wall of the casing. The pressing force supports in keeping the casing and the clamp in the current mutual position.

The lighting device might have the feature that the clamping tabs each have a respective clamp opening, in a plane P transverse to the suspension axis a lowest part of said clamp opening being flush with an upper surface of the casing, i.e. the clamp opening just protrudes in axial direction from the surface of the casing. Each of said clamp openings typically can grip around a respective cross-bar of the T-bar profile. The clamp opening can be dimensioned to have a snugly fit, i.e. that the cross-bar of the T-bar profile has a thickness which just fit into the height/width of the clamp opening. This enhances a stable mounted position and reduces the risk on an unstable or wobbling mounting of the lighting device when suspended from the T-bar profile.

The lighting device might have the feature that an insert is accommodated in the cavity for acting on the clamp. Upon rotation of the casing, the insert is deformed and/or displaced such that it deforms and/or displaces the clamping tabs of the clamp and thus results in a change of the spacing between the clamping tabs. The casing, insert and clamp all may be arranged concentric around the suspension/rotation axis. The insert helps in extending the lifetime of the suspension element by reducing the friction between the casing and the clamp during rotation. Said friction might hamper simple rotation and cause damage to the casing and eventually might cause failure of the suspension element.

The lighting device might have the feature that electronic/electric means is accommodated in the cavity of the casing. This, for example, reduces separate, extensive cabling from driver to lighting device compared to the known device in which the driver is hidden behind the false ceiling tiles. Examples of electronic means/electric means that can be accommodated in said cavity are at least one of the group of converter, driver, ballast, controller, sensor, memory, contacting means to mains power supply. This offers the

advantage that said electronic means/electric means are relatively easily accessible for maintenance while still being hidden from direct view.

The lighting device might have the feature that the casing has a circumferential outer wall around the suspension axis, the shape of said outer wall being one of the group consisting of a circle, an ellipse, a regular polygon e.g. hexagon, square, triangle, a stretched hexagon, rectangle. These shapes are usually applied in lighting devices and are generally accepted and appreciated as aesthetically pleasant.

The lighting device might have the feature that a distance between the second connector and the first connector is adjustable, for example via a threaded bolt, an adjustable slide, or a slotted coupling. Thus height differences in mounting surface, for example false ceiling or plastered ceiling, can be compensated for, so that the lighting device can be suspended in an exactly horizontal manner and independent of the contour of the ceiling to a certain extent.

The invention further relates to a suspension element having all the characteristics of the suspension element of the lighting device as claimed in any one of the preceding claims. In particular a suspension element comprising at a second end a second connector via which it is connected to the frame, and at a first end a first connector for connection to a ceiling, the first connector comprising:

a casing with a circumferential inner wall around the suspension axis and enclosing a cavity,

a resilient clamp accommodated in the cavity and comprising two mutually opposing clamping tabs on either side of the suspension axis and radially being spaced apart by a spacing S,

the spacing S being adjustable by rotation of the casing over a rotation axis extending parallel to the suspension axis with respect to the clamp.

Such a suspension element essentially has all the advantages as mentioned in relation to the lighting device.

In broader perspective the invention further relates to a suspension element, said suspension element defining a suspension axis and comprising at a first end a first connector for connection to another element, said another element could be, for example a ceiling, a wall, a frame,

the first connector comprising a casing with an inner wall enclosing a cavity,

a clamp at least partly accommodated in the cavity and comprising two mutually opposing clamping tabs on either side of the suspension axis and radially being spaced apart by a spacing S,

the spacing S being adjustable by rotation of the casing over a rotation axis extending parallel to the suspension axis with respect to the clamp.

The invention further relates to a luminaire comprising the lighting device according to the invention. Such a luminaire could comprise a permanently built-in LED strip as the light source, additionally or alternatively it could comprise permanently built-in electronic means/electric means.

The invention further relates to a lighting system comprising at least two lighting devices according to the invention. Such a lighting system might have the feature that at least two lighting devices are mutually connected in a length direction via respective luminaire ends of the respective frame, said length direction being parallel to/along the ceiling/transverse to the suspension axis. Thus continuous light lines can be obtained which comprises multiple lighting devices mutually connected in the length direction in a row as a serial of lighting devices, for example 5, 10, 25 or 100 lighting devices.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further elucidated by means of the schematic and non-limiting drawings, in which:

Fig. 1 shows a perspective overview of an embodiment of a luminaire of the invention;

Fig. 2A-B shows a first embodiment of a suspension element of the invention;

Fig. 3A-D shows further details of the first connector of the suspension element shown in Fig. 2A-B;

Fig. 4A-D show details of a second embodiment of the first connector; and

Fig. 5A-B show further configurations of mounting possibilities of lighting devices suspended from a ceiling.

DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 shows a perspective overview of an embodiment of a luminaire 1 of the invention. The luminaire 1 comprises a lighting device 3 comprising a frame 5, in the figure a housing, and at least one elongated suspension element 7, said suspension element defining a suspension axis 9. The suspension element 7 comprising at a second end 11 a second

connector 13 via which it is connected to the frame 5, and at a first end 15 a first connector 17 for connection to a ceiling (not shown). The second connector 13 comprises a round cylindrical bolt and nut 37 (see Fig. 2A) which can be inserted in and moved in length direction 39 through an elongated slot 41 in the frame 5. The first connector comprises a casing 19 which is rotatable over a rotation axis 29 which extends parallel to the suspension axis 9. The luminaire further comprises contacting means 31, in the figure located at respective device ends 47 of the lighting device 3, for electrically contacting to electric cabling 33 of a mains power supply (not shown) and further comprises an elongated fluorescent tube as a light source 43 covered by an optical element 45 for uniform illumination of the ceiling. A lighting system according to the invention comprises at least two of the lighting devices or luminaires 1 connected to each other at their respective device ends 47.

Fig. 2A-B shows a first embodiment of a suspension element 7 of the invention respectively in an assembled form (Fig. 7A) as well as in an exploded view (Fig. 7B). Said suspension element 7 comprising a second connector 13 (comprising a bolt and nut 37) and a first connector 17 mutually connected via a suspension portion 49, in the figure a flexible metal wire but which alternatively could for example be a rigid, telescopic metal or plastic tube for adjustment of the suspension height. The first connector 17 comprising a casing 19 with a circumferential inner wall 21 around the suspension axis 9 and enclosing a cavity 23. An insert 35 and a resilient clamp 25 are accommodated in the cavity 23. The clamp 25 comprises two mutually opposing clamping tabs 27a, 27b on either side of the suspension axis 9 and radially being spaced apart by a spacing S, in the assembled position. The spacing S being adjustable by rotation of the casing 19 over a rotation axis 29 extending parallel to the suspension axis 9 with respect to the clamp 25. As shown in Fig. 2B the inner wall comprises two radially inwardly positioned protrusions 51 in the cavity 23 of the casing 19 to move the clamping tabs 27a, 27b toward each other upon rotation of the insert 35 and clamp 25 with respect to the casing 19. The two radially inwardly positioned protrusions 51 in the cavity 23 of the casing 19 render the cavity to have a radial diameter D which variable between D_{min} and D_{max} . The ratio R_d between D_{max} and D_{min} is about 1.4. At least one, but in the figure both, of said inwardly positioned protrusions 51 have a flat or straight portion 52 rendering the clamping tabs 27a, 27b, comprising a respective straight clamping portion 28a, 28b, to assume a stable position when in clamping position. Each flat portion has a respective width and height, as measured transverse to the axis 9 respectively along the axis 9, which have equal dimensions or about equal dimensions, i.e. have a dimension ratio P_r of

said portion with $0.2 \leq Pr \leq 5$, in the figure 2B said ratio Pr of width versus height is about 1.5.

Fig. 3A-D shows further details of the first connector 17 of the suspension element 7 shown in Fig. 2A-B. Fig. 3A-B show a perspective, semi-transparent view of the first connector 17 respectively in closed, mounted position and in open, unmounted position. In the closed, mounted position the clamping tabs 27a,27b are spaced apart by a spacing S equal to S_{min} , and in the open, unmounted position the clamping tabs 27a,27b are spaced apart by a spacing S equal to S_{max} . Switching from the open to the closed position of the clamping tabs 27a,27b is attained by rotation over the rotation axis 29 of the casing 19 (counter)clockwise with respect to the insert 35 and clamp 25. At least in the closed, mounted position the clamp 25 rests with resilient force against the inner wall 21, i.e. the inwardly positioned protrusions 51, around the cavity 23 of the casing 19. Fig 3C and Fig 3D respectively show perspective cross sections of the first connector 17 respectively in closed, mounted position, i.e. where the clamping tabs 27a,27b grip around the cross-bar 55 of the T-bar profile 53, and in open, unmounted position where the T-bar profile 53 is already seated on the insert 35 and in between the clamping tabs 27a,27b of the clamp but not yet gripped by them. Indicated in Fig. 3C is suspension portion 49 coinciding with the rotation axis 29, and indicated in Fig. 3D is the height H_w of the inner wall 19, and the height H_{iw} of the inwardly position protrusions 51 of the inner wall. As visible in the Fig. 3A-B, a full rotation of the casing 19 and insert 35 with respect to the clamping tabs 27a,27b, i.e. rotation over 360° , involves the clamping tabs to assume twice the open position wherein $S = S_{max}$, and twice the closed position wherein $S = S_{min}$.

Fig. 4A-D show details of a second embodiment of a first connector 17 according to the invention, respectively in closed, mounted position and in open, unmounted position. In the closed, mounted position the clamping tabs 27a,27b are spaced apart by a spacing S equal to S_{min} , and in the open, unmounted position the clamping tabs 27a,27b are spaced apart by a spacing S equal to S_{max} , with a ratio S_r of S_{max} to S_{min} of about 1.8. Switching from the open to the closed position of the clamping tabs 27a,27b is attained by rotation over the rotation axis 29 of the clamp 25 (counter)clockwise with respect to the casing 19. Both in the closed, mounted position and in the open, unmounted position the clamp 25 rests with resilient force against inwardly positioned protrusions 51 of the inner wall 21 around the cavity 23 of the casing 19 which helps in maintaining the clamp within the casing when in unmounted position, where in closed, mounted position the clamping tabs 27a,27b rest with respective straight clamping portion 28a,28b against flat/straight inner wall

portions 22a,22b to render the connector to assume a stable close, mounted position. As visible in the Fig. 4A-B, a full rotation of the casing 19 with respect to the clamping tabs 27a,27b involves the clamping tabs to assume twice the open position. Fig 4C and Fig 4D respectively show perspective cross sections of the first connector 17 respectively in closed, mounted position, i.e. where the clamping tabs 27a,27b grip around the cross-bar 55 of the T-bar profile 53, and in open, unmounted position where the T-bar profile 53 is already resting on the inner wall 21 of the casing and is positioned in between the clamping tabs 27a,27b of the clamp but not yet gripped by them. The casing 19 has an aspect ratio AR of length L and width Wc of about four. The width Wc of the casing 19 is somewhat less than the width Wb of the cross-bar 55 of the T-bar profile 53. The clamping tabs 27a,27b each have a respective clamp opening 57a,57b which snugly fits over a portion of the cross-bar 55 of the T-bar profile 53.

Fig. 5A-B show further configurations of mounting possibilities of lighting devices 3 or luminaires 1 suspended from a ceiling 59. In Fig. 5A the suspension element 7 comprises a first connector 17 which is particularly suitable for, for example, to grip around or clamp a T-bar 53 carrying ceiling tiles 63 of a false ceiling 59. Connected to the first connector 17 is a second connector 13 via suspension portion 49, in the figure a rod defining a suspension axis 9, said second connector 13 is similar in construction as the first connector 17, for example as the first connector 17 as shown in Figs. 3A-D and Figs 4A-. Thus a double-sided quick lock suspension system is enabled and obtained. The second connector 13 grips around an indented profile 61 of a housing/frame 5 of the luminaire 1, shown in cross section perpendicular to the length direction 39. Alternatively the second connector could comprise a T-bar profile and the housing could comprise two mutually opposing clamping tabs with adjustable spacing S. Typically and optionally the housing 5 of the luminaire 1/lighting device 3 accommodates an elongated light source 43, for example a fluorescent tube lamp but in the Figure a plurality of LEDs arranged in a row in the length direction 39. The luminaire comprising the, optionally permanently, built-in light source 43, during operation issues light rays 71 towards the ceiling via the optical element 45 for, preferably uniform, illumination of said ceiling. Fig. 5B shows a plaster ceiling 59,65 to which a locking plate 67 with a T-shaped profile 69 is fixed, in the figure screwed, but, alternatively it can also be designed to fit band raster strips. The first connector then is connected to said T-shaped profile 67.

CLAIMS:

1. A lighting device comprising a frame with at least one suspension element, said suspension element defining a suspension axis and comprising at a first end a first connector for connection to another element, preferably a ceiling,

the first connector comprising a casing with an inner wall enclosing a cavity,

5 a clamp at least partly accommodated in the cavity and comprising two mutually opposing clamping tabs on either side of the suspension axis and radially being spaced apart by a spacing S,

the spacing S being adjustable by rotation of the casing over a rotation axis extending parallel to the suspension axis with respect to the clamp, wherein the cavity has a
10 variable, radial diameter such that upon a full rotation of the casing over the rotation axis, the mutually opposing clamping tabs at least twice change from an open position to a closed position.

2. A lighting device as claimed in any one of the preceding claims, wherein the
15 clamping tabs have a respective flat clamping portion against which, in mounted position, rest against flat inner wall portions of the inner wall.

3. A lighting device as claimed in any one of the preceding claims, wherein the suspension element comprising at a second end a second connector via which it is connected
20 to the frame.

4. A lighting device as claimed in any one of the preceding claims, wherein the cavity is elongated in radial direction.

5. A lighting device as claimed in any one of the preceding claims, wherein the casing and the clamp have a matching male/female configuration.

6. A lighting device as claimed in any one of the preceding claims, wherein, at least in a mounted position of the lighting device, the clamp rests with pressing force against an inner wall of the casing.

7. A lighting device as claimed in any one of the preceding claims, wherein the clamping tabs each have a respective clamp opening, in a plane P transverse to the suspension axis a lowest part of said clamp opening being flush with an upper surface of the casing.

8. A lighting device as claimed in any one of the preceding claims, wherein the casing comprises an insert which is accommodated in the cavity for acting on the clamp.

9. A lighting device as claimed in any one of the preceding claims, wherein electronic and/or electric means is accommodated in the cavity of the casing.

10. A lighting device as claimed in claim 9, wherein the electronic and/or electric means is at least one of the group of converter, driver, ballast, controller, sensor, memory, contacting means to mains power supply.

11. A lighting device as claimed in any one of the preceding claims, wherein the casing has a circumferential outer wall around the suspension axis.

12. A lighting device as claimed in any one of the preceding claims, wherein a distance between the second connector and the first connector is adjustable.

13. A suspension element comprising at a first end a first connector for connection to another element, preferably a ceiling,

the first connector comprising a casing with an inner wall enclosing a cavity,

a clamp at least partly accommodated in the cavity and comprising two

mutually opposing clamping tabs on either side of the suspension axis and radially being spaced apart by a spacing S,

the spacing S being adjustable by rotation of the casing over a rotation axis extending parallel to the suspension axis with respect to the clamp, wherein the cavity has a variable, radial diameter such that upon a full rotation of the casing over the rotation axis, the

mutually opposing clamping tabs at least twice change from an open position to a closed position .

14. A luminaire comprising the lighting device as claimed in any one of the
5 preceding claims 1 to 12.
15. A lighting system comprising at least two lighting devices as claimed in any
one of the preceding claims 1 to 12.

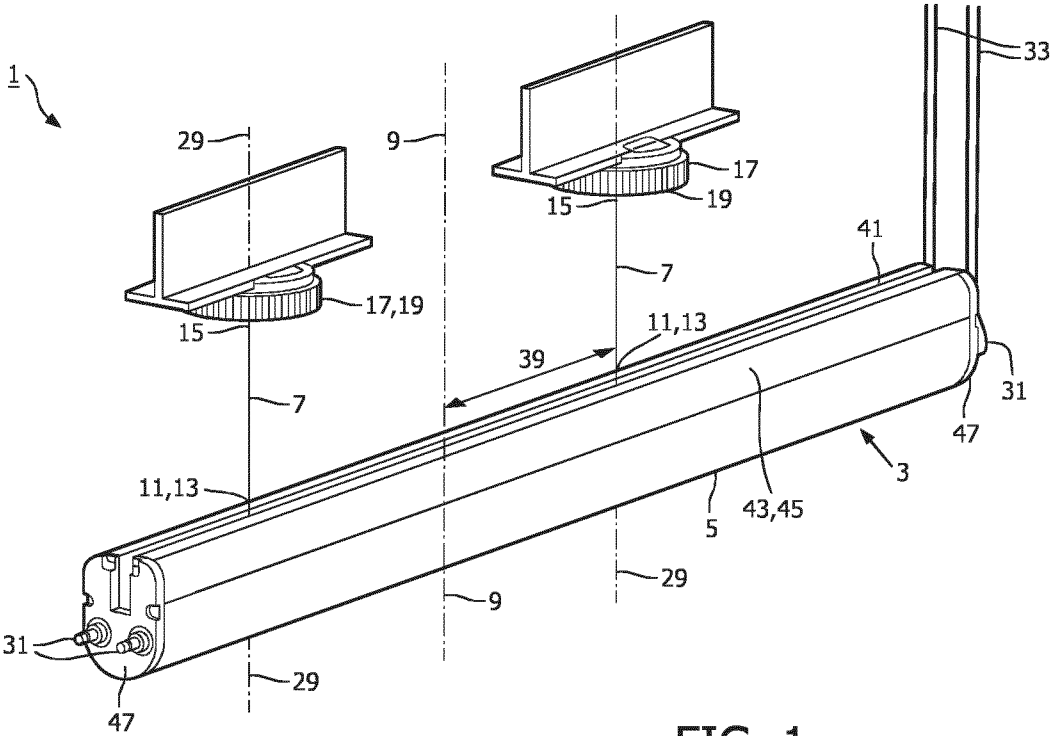
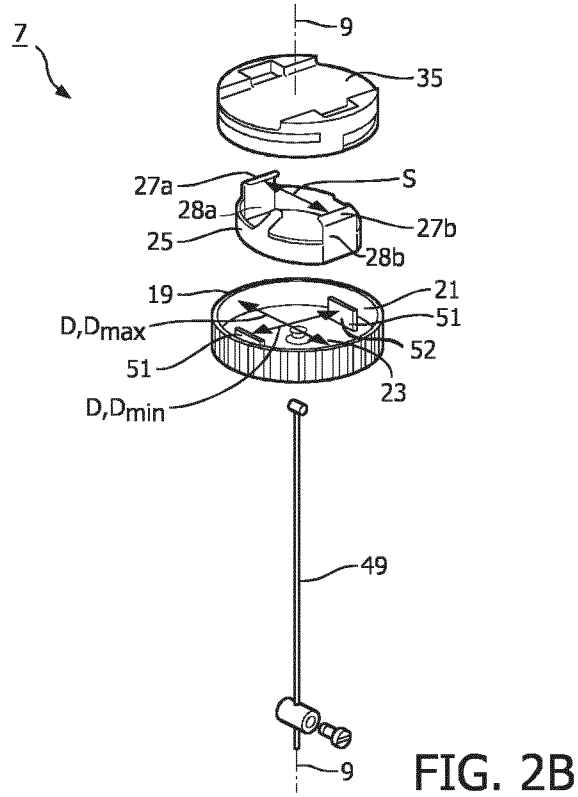
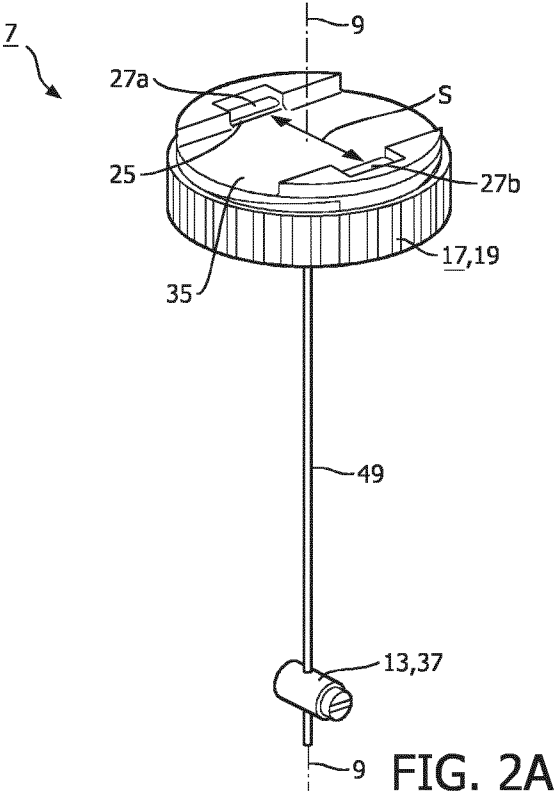


FIG. 1



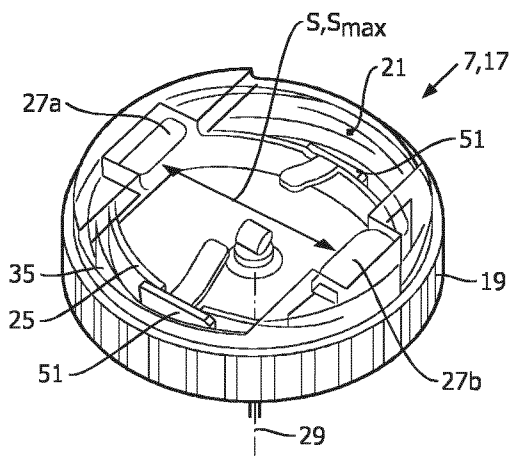


FIG. 3A

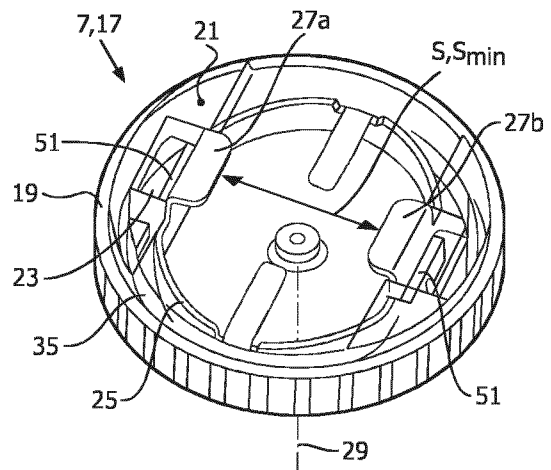


FIG. 3B

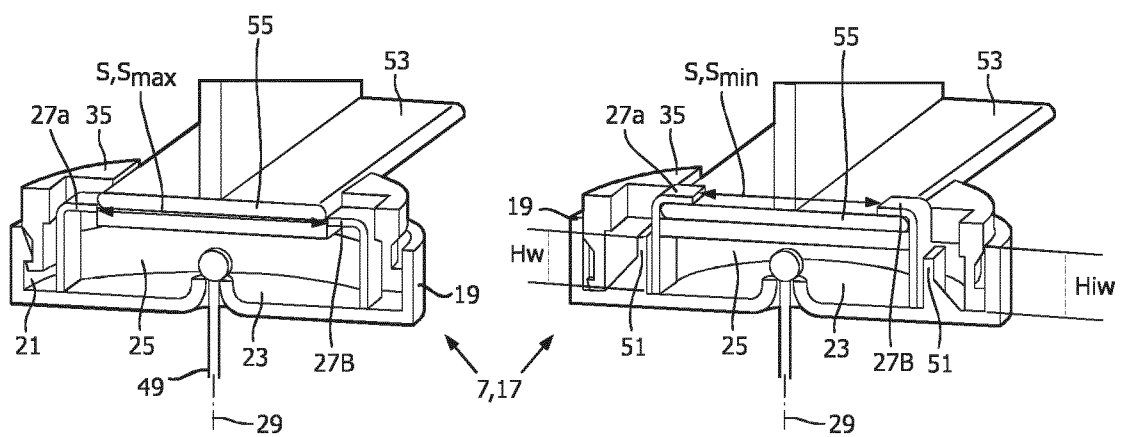


FIG. 3C

FIG. 3D

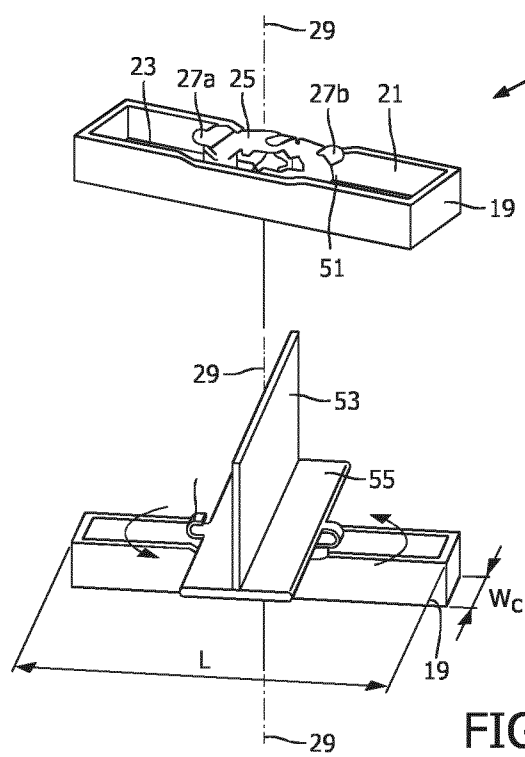


FIG. 4A

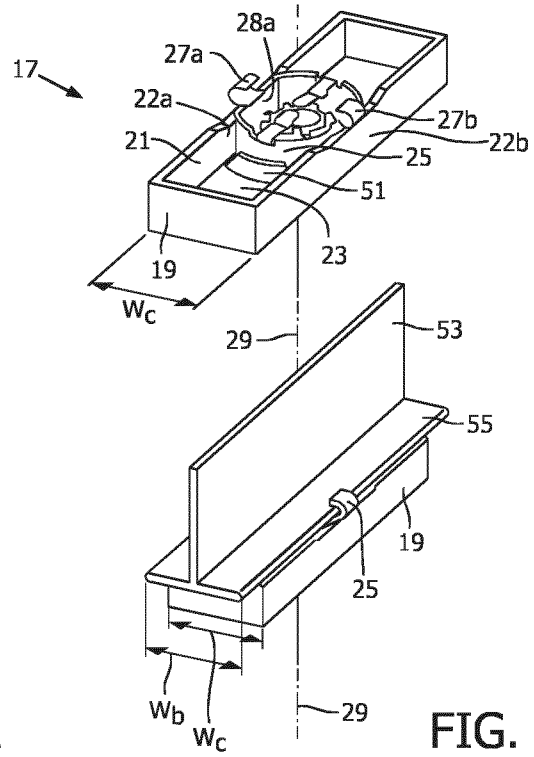


FIG. 4B

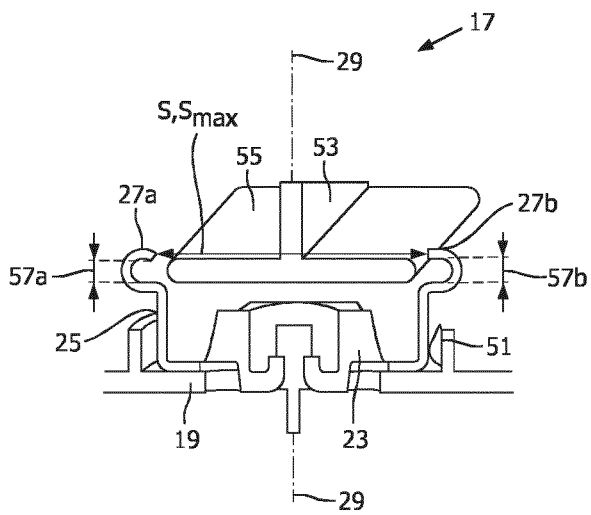


FIG. 4C

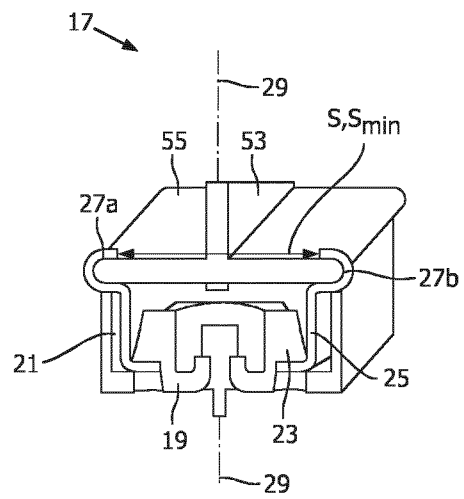


FIG. 4D

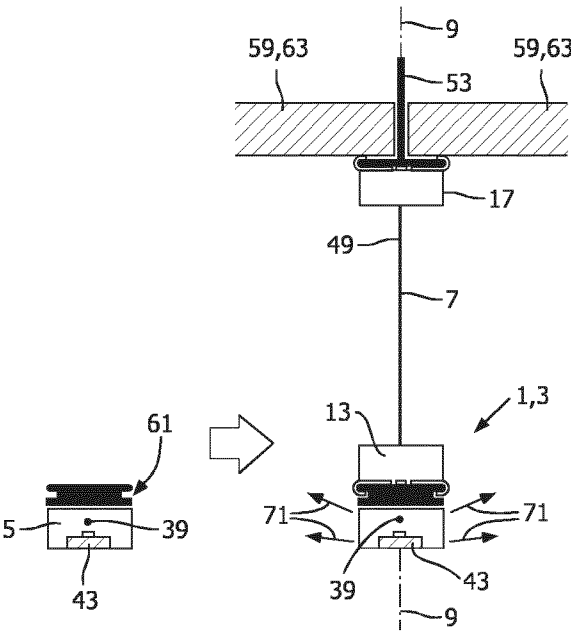


FIG. 5A

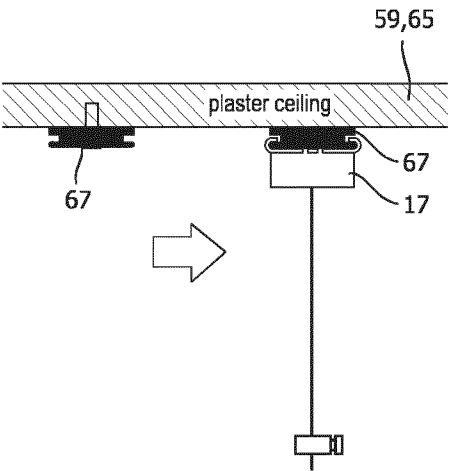


FIG. 5B

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/059924

A. CLASSIFICATION OF SUBJECT MATTER
INV. F21S8/06 F21V21/008 F21V21/088
ADD. F21V23/06 F21V21/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F21S F21V F16B E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 274 798 A (RUDOLPH KOSTAL) 3 March 1942 (1942-03-03) the whole document -----	1-15
A	US 5 341 276 A (SHEN WEI H [TW]) 23 August 1994 (1994-08-23) column 1 - column 2, line 28 figures 1-4 -----	1-15
A	US 2 589 520 A (HERMANNI WALLENIOUS TUOMO JAAKK) 18 March 1952 (1952-03-18) column 1 - column 3, line 20 figures 1-4 -----	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

17 May 2018

Date of mailing of the international search report

30/05/2018

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/059924

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			GB 2278964 A	14-12-1994
			US 5341276 A	23-08-1994

US 2589520	A	18-03-1952	NONE	
