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(54) **LIGHTING DEVICE AND CORRESPONDING METHOD**

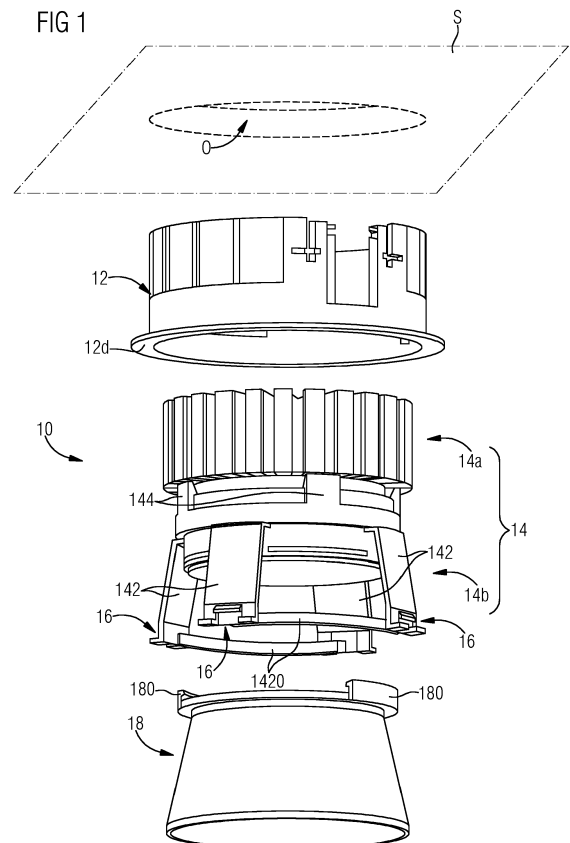
(57) A lighting device includes:

- an annular support body (12),
- a source carrier body (14) for carrying a light radiation source, for example of the LED type, and
- a mechanism for coupling the source carrier body (14) to the annular support body (12).

The coupling mechanism includes a plurality of flexible arms (142) extending radially outwardly of the source carrier body (14), said flexible arms (142) having distal engagement formations (16) for engaging complementary engagement formations (12b) on the support body (12).

The flexible arms (142) are arranged in pairs of flexible arms (142) coupled bridge-like by flexible traction members (1420) to be drawn inwardly of the source carrier body (14) to flex the flexible arms (142) and permit engagement of the aforementioned distal engagement formations (16) with the complementary engagement formations (12b).

FIG 1



**Description**Technical field

**[0001]** The present description relates to lighting devices.

**[0002]** One or more embodiments can relate to lighting devices which can be used for assembling electrically powered light radiation sources, such as for example solid-state light radiation sources such as LED sources.

Technical background

**[0003]** The assembly and the removal of lighting devices intended to be assembled, for example, in a manner recessed in false ceilings or other supporting surfaces (this may be the case, for example, for lighting devices usually referred to as "spotlights") may be difficult and hard to understand.

**[0004]** Even though it may be possible upon first installation to refer to assembly instructions, whoever wishes to perform subsequent removal (which may be a final user with no particular expertise) may find themselves in a situation in which they have to work by trial and error, this also leading to possible errors.

**[0005]** In addition, it may be necessary to resort to special tools both during assembly and during disassembly.

**[0006]** All of this results in a method which may be lengthy, time-consuming, laborious and difficult to understand.

**[0007]** Documents such as DE 10 2005 032 265 A1, EP 2 372 231 A1 and US 5 868 493 A are representatives of the prior art.

Object and summary

**[0008]** It is an object of one or more embodiments to overcome the disadvantages outlined above.

**[0009]** According to one or more embodiments, this object can be achieved by a lighting device having the features specified in the claims which follow.

**[0010]** One or more embodiments can also relate to a corresponding method.

**[0011]** The claims form an integral part of the technical teaching provided here in relation to one or more embodiments.

**[0012]** One or more embodiments make it possible to accomplish one or more of the following advantages:

- reduction in the number of parts of the device,
- reduction in assembly (and disassembly) time,
- possibility to do without special tools,
- assembly and disassembly operations made less laborious,
- assembly and disassembly made easy,
- possibility to realize a lighting device which is not very cumbersome, for example in terms of "imprint" on the assembly surface, and

- possibility to rotate the lighting device (luminaire) through 360°.

Brief description of the figures

**[0013]** One or more embodiments will now be described purely by way of non-limiting example with reference to the accompanying figures, in which:

- figure 1 shows a lighting device according to one or more embodiments, represented in an exploded view,
- figure 2 is a view on an enlarged scale of one of the components shown in figure 1,
- figure 3 is a view on a further enlarged scale, corresponding approximately to the portion denoted by the arrow III in figure 2, aimed at showing possible ways of coupling components shown in figure 1,
- figures 4 to 7 show possible successive steps in a sequence for assembling a device according to one or more embodiments, with figure 7 substantially being able to be assimilated with a diametrical section in a final assembly state.

**[0014]** It will be understood that, for the clarity of the drawing, the various figures may not be shown on the same scale.

Detailed description

**[0015]** The following description illustrates various specific details with a view to providing a thorough understanding of various exemplary embodiments. The embodiments may be obtained without one or more of the specific details, or through other processes, components, materials, etc. In other cases, known structures, materials or operations are not illustrated or described in detail to avoid obscuring the various aspects of the embodiments.

**[0016]** In the context of the present description, a reference to an "embodiment" is intended to indicate that a particular configuration, structure or feature described in relation to the embodiment is included in at least one embodiment. Thus, expressions such as "in an embodiment" which may be present at various points in the present description will not necessarily refer exactly to the same embodiment. Furthermore, particular configurations, structures or features may be combined in any suitable way in one or more embodiments.

**[0017]** The references used here are merely provided for convenience and therefore do not define the scope of protection or the extent of the embodiments.

**[0018]** In the figures, reference numeral 10 denotes a lighting device (luminaire) in its entirety.

**[0019]** One or more embodiments may involve a light-

ing device 10 intended for a recessed installation, for example with the device 10 inserted into an opening O made in a false ceiling S or another assembly surface (as shown by way of example by a dashed line in the top part of figure 1).

**[0020]** In one or more embodiments, the lighting device 10 may include:

- an annular support body 12, which can be inserted, for example, in the opening O and is provided, for this purpose, with a flange 12a that can be positioned so as to bear against the periphery of the opening O and can also define a front light radiation emission end starting from the lighting device 10; and
- a body 14 that can be inserted in the support body 12 and can carry a light radiation source L (visible only in figure 7).

**[0021]** In one or more embodiments, the light radiation source L can be an electrically powered light radiation source, such as a solid-state light radiation source, for example an LED source.

**[0022]** In one or more embodiments, as shown here by way of example, the source carrier body 14 may include two parts or portions.

**[0023]** In one or more embodiments, the first part or portion, denoted by 14a, may be intended for assembly of the light radiation source L (which per se may not be part of one or more embodiments). To this end, in one or more embodiments, the part 14a may be in the form of a heat sink: this applies as regards the constituent material (for example a molded plastic material or a metal material with good heat dissipation characteristics) and/or as regards the more or less extensively finned shape, for example.

**[0024]** The second part or portion, denoted by 14b and shown on its own in figure 2, may include a structure which can substantially be assimilated with a cage, possibly with the presence of an annular base body 140 (see in this respect figure 2), from which a plurality of flexible arms or branches 142 depart, extending for example in a radial direction and in a distal direction (alternatively, in the assembled device 10, towards the front end at which the flange 12a of the body 12 is provided).

**[0025]** In one or more embodiments, the arms or branches 142 can be used to connect the cage-like portion 14b (and the source carrier body 14 in its entirety) to the support body 12 in the ways illustrated more clearly hereinbelow.

**[0026]** In one or more embodiments, a plurality of teeth 144 may also depart from the annular base body 140, said teeth extending in a generally axial direction and in a proximal direction (alternatively away from the front region where the flange 12a is located) and making it possible to clasp between them the parts 14a and 14b of the source carrier body 14.

**[0027]** It will be understood that, in one or more embodiments, both the support body 12 and the source body

14 may have a shape which is different to the generally circular (cylindrical) shape shown by way of example here.

**[0028]** By way of example, in one or more embodiments, the support body 12 and/or the source carrier body 14 may have an annular shape, which, instead of being like a closed ring as shown by way of example here, may be in the form of an open ring, this being expedient, for example, for the cage-like part 14b shown in figure 2.

**[0029]** In one or more embodiments, at least the cage-like part 14b of the source carrier body 14 can be made of a material (for example a molded plastic material or a lightweight metal material) such that the arms 142 are flexible (for example elastically deformable) so that they can be folded radially towards the inside of the body 14, as is shown by way of example by the double arrows in figure 4, in respect of which further details will be discussed hereinbelow.

**[0030]** In one or more embodiments, the distal ends (alternatively the opposing ends with respect to the base body 140) of at least some of the arms 142 may be provided with engagement formations, which can be constituted, for example, by clamp formations 16 that can grasp or clamp (see, for example, figure 3, corresponding to a view on an enlarged scale of the portion, denoted by the arrow III in figure 2, of the cage 14b when coupled to the support body 12) respective sections of a rib formation 12b protruding radially from the inner surface of the support body 12.

**[0031]** It will be understood moreover that, in one or more embodiments, the coupling configuration between the distal ends of the arms 142 and the support body 12 may be entirely or partially complementary with respect to that illustrated here, for example with the provision, on the inner surface of the support body 12, of a gully or groove including respective portions which can clamp internally protruding formations (for example tooth-shaped formations) carried by the distal ends of the arms 142.

**[0032]** Whichever specific ways are adopted for implementing the coupling between the engagement formations (for example the clamps 16) carried by the distal ends of the arm 142 and the complementary engagement formations (for example sections of the rib formation 12b on the inner surface of the annular body 12), this condition of coupling or mutual engagement is suitable for being accomplished by utilizing the general flexibility of the arms 142.

**[0033]** In one or more embodiments, the bending of the arms 142 which can realize the aforementioned coupling condition may be simplified by organizing the arms 142 in pairs, for example with these pairs being distributed regularly, for example evenly angularly, around the perimeter of the source carrier body 14 (for example of the base body 140 of the cage-like portion 14b),

**[0034]** In one or more embodiments as shown here by way of example, two pairs of arms 142 may be present,

arranged in diametrically opposed positions with respect to the angular progression of the source carrier body 14.

[0035] In one or more embodiments, the arms 142 of each pair can be connected to one another, for example at the distal ends thereof, by wire-like or band-like flexible members 1420, which extend bridge-like between the two arms 142 of the respective pair so as to form, for example, a type of connection bridle for the two arms.

[0036] By acting on these traction members (for example by a manual action performed using the thumb and the index finger of a hand to work on the two opposed members 1420 visible in figure 4), it is possible to draw the arms 142 radially inwardly of the source carrier body 14 (see, indeed, the two opposed arrows which are visible in figure 4), realizing elastic bending of the arms 142, which can permit coupling between the engagement formations (for example the clamps 16) provided at the distal ends of said arms 142 and the complementary coupling formations (for example the sections of rib formation 12b) carried by the support body 12.

[0037] In one or more embodiments, the traction members 1420 can be made of a material such as an elastomer material or a plastic material or a metal material (for example spring steel), which can provide said members with flexibility, if need be elastic, properties.

[0038] By way of example, in one or more embodiments, the members 1420 can be produced with monostable or bistable equilibrium properties, or else in such a way that they have properties of elastic return towards a rest position (shown by way of example in figures 1 to 3 and again in figures 6 and 7) wherein the aforementioned members 1420 are radially mutually spread apart, i.e. along the periphery of the support body 12 into which the source carrier body 14 can be inserted by carrying out the assembly sequence shown schematically by way of example in figures 4 to 7.

[0039] This sequence provides for the realization of a (relative) movement of insertion of the source carrier body 14 into the support body 12 performed with the arms 142 held radially contracted with a radial force applied to the traction members 1420 (see once again the arrows reproduced in figure 4).

[0040] The relative insertion movement can be continued until the engagement formations (for example the clamps 16) located at the distal ends of the arms 142 come into alignment with the complementary engagement formations (for example the sections 12b of the inner rib formation) of the body 12.

[0041] At this point, as shown schematically in figure 5, the aforementioned traction force applied to the members 1420 to bring about the radial contraction of the arms 142 can be released in that the arms 142 are spread elastically, making the clamps 16 grip the respective sections of the rib formation 12b, thereby accomplishing a condition of engagement between the engagement formations carried by the arms 142 and the complementary formations of the support body 12 so as to realize the coupling between the body 12 and the body 14.

[0042] At this point, the members 1420 can assume (or directly due to their elasticity, that is on account of the fact that they are brought back into these conditions with a spreading action exerted, for example, with the same fingers which previously gripped the members 1420 between them) the spread-apart condition visible, for example, in figure 6 (and also in figures 1 and 2), in which the members 1420 do not protrude towards the inside of the body 12.

[0043] In these conditions, as shown schematically in the sequence of figures 6 and 7, it is possible to insert into the support body 12 a reflector 18, such as for example a frustoconical reflector or a parabolic reflector, for example made of molded plastic or metal material, which if appropriate is made or coated in such a way as to be internally light-reflective.

[0044] In one or more embodiments, the reflector 18 is able to carry clasp formations which permit coupling with the device 10, for example by means of a bayonet-like coupling (axial translation and subsequent rotation) with the proximal or root regions of the arms 142.

[0045] In one or more embodiments, the source carrier body 14, and possibly the reflector 18 coupled thereto, can be made to rotate (including through an angle of 360°) with respect to the support body 12 utilizing the possibility of relative rotation of the complementary engagement formations (clamps 16 and sections of rib formation 12b) of the arms 142 of the source carrier body 14 and of the support body 12.

[0046] In one or more embodiments, the reflector 18 can be coupled to the body 12. In one or more embodiments, the coupling of the reflector 18 to the rest of the device 10 can be achieved by a coupling which differs from a bayonet-like coupling, for example by means of a screw-type coupling or interference coupling.

[0047] Obviously, without affecting the background principles, the details of construction and the embodiments may vary, also significantly, with respect to that illustrated here purely by way of a non-limiting example, without thereby departing from the scope of protection.

[0048] This scope of protection is defined by the accompanying claims.

## Claims

### 1. A lighting device, including:

- an annular support body (12),
- a source carrier body (14) for carrying a light radiation source (L), and
- a mechanism for coupling the source carrier body (14) to the annular support body (12), the coupling mechanism including a plurality of flexible arms (142) extending radially outwardly of the source carrier body (14), said flexible arms (142) having distal engagement formations (16) for engaging complementary engagement for-

mations (12b) on said support body (12),

wherein said flexible arms (142) include pairs of flexible arms (142) coupled bridge-like by flexible traction members (1420) to be drawn inwardly of the source carrier body (14) to flex said flexible arms (142) and permit engagement of said distal engagement formations (16) and said complementary engagement formations (12b).

2. The lighting device of claim 1, including a front light emission end (12a) wherein said source carrier body (14) includes an annular base member (140) with said flexible arms (142) extending from said annular base member (140) towards said front light emission end (12a). 5
3. The lighting device of claim 1 or claim 2, wherein said pairs of flexible arms (142) are evenly angularly distributed around said source carrier body (14). 10
4. The lighting device of claim 3, including two pairs of said flexible arms (142) diametrically opposed across said source carrier body (14). 15
5. The lighting device of any of the previous claims, wherein said traction members (1420) are elastically biased towards a rest condition wherein said traction members (1420) are mutually spread apart. 20
6. The lighting device of any of the previous claims, wherein said traction members (1420): 25
  - are wire-like or blade-like, and/or
  - include a material selected out of elastomeric material, plastic material or metal material. 30
7. The lighting device of any of the previous claims, wherein said distal engagement formations and said complementary engagement formations include clamp members (16) and complementary sections of a rib formation (12b) clampable by said clamp members (16), said clamp members (16) and said sections of rib formation (12b) being preferably carried by said flexible arms (142) and by the support body (12). 35
8. The lighting device of any of the previous claims, wherein said source carrier body (14) includes a heat sink portion (14a) and a cage-like portion (14b) coupled (144) with said heat sink portion (14a), wherein said cage-like portion (14b) includes said flexible arms (142). 40
9. The lighting device of any of the previous claims, including a reflector (18) coupleable, preferably bayonet-like (180), to said source carrier body (14). 45

10. A method of assembling a lighting device of any of claims 1 to 9, including:

- advancing said source carrier body (14) relative to said support body (12) with said flexible arms (142) radially contracted by a radial force exerted on said traction members (1420) until said distal engagement formations (16) and said complementary engagement formations (12b) are arranged facing each other, and
- releasing said radial force thereby permitting radial expansion of the flexible arms (142) and coupling of said distal engagement formations (16) and said complementary engagement formations (12b). 50

FIG 1

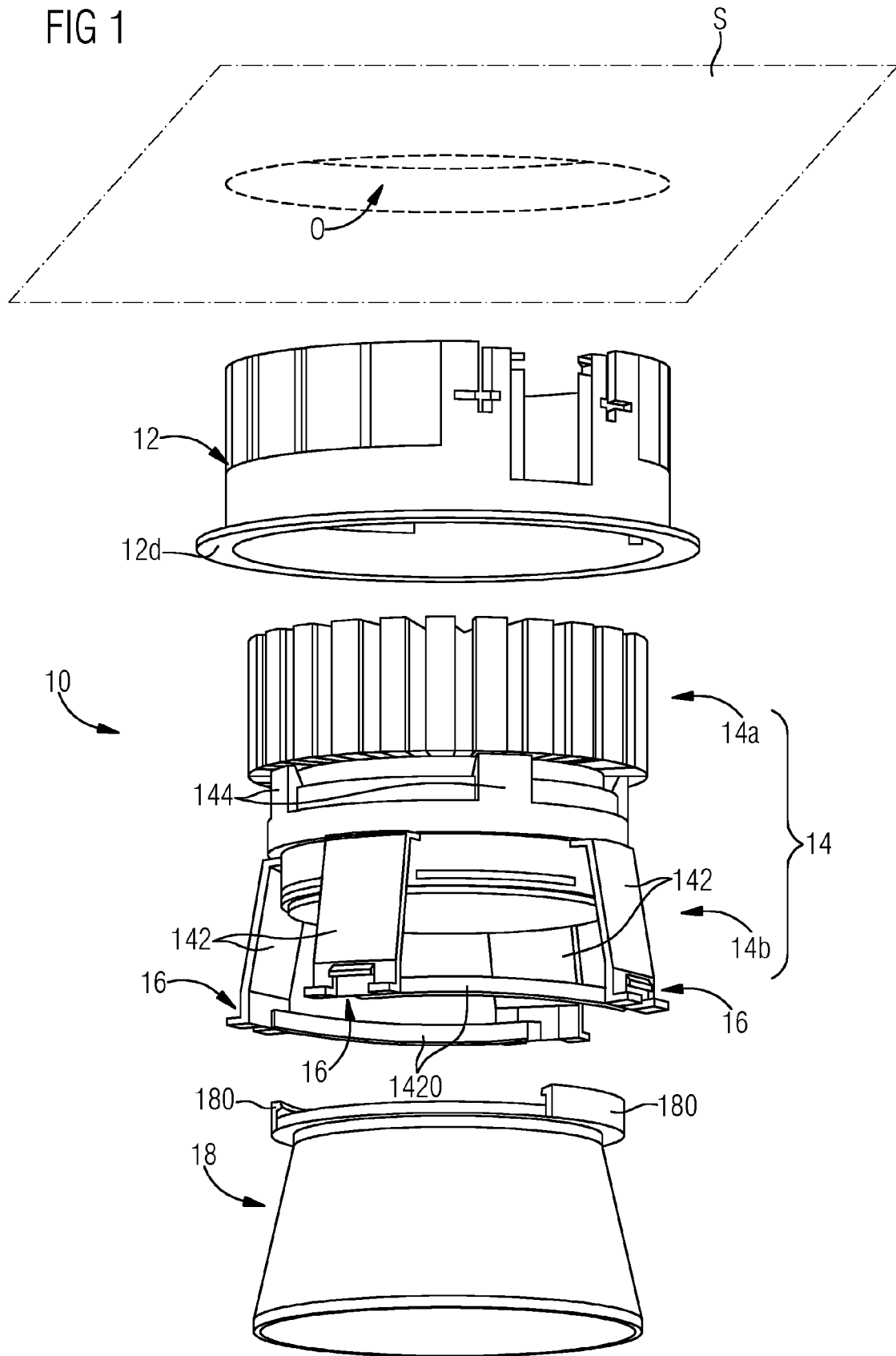


FIG 2

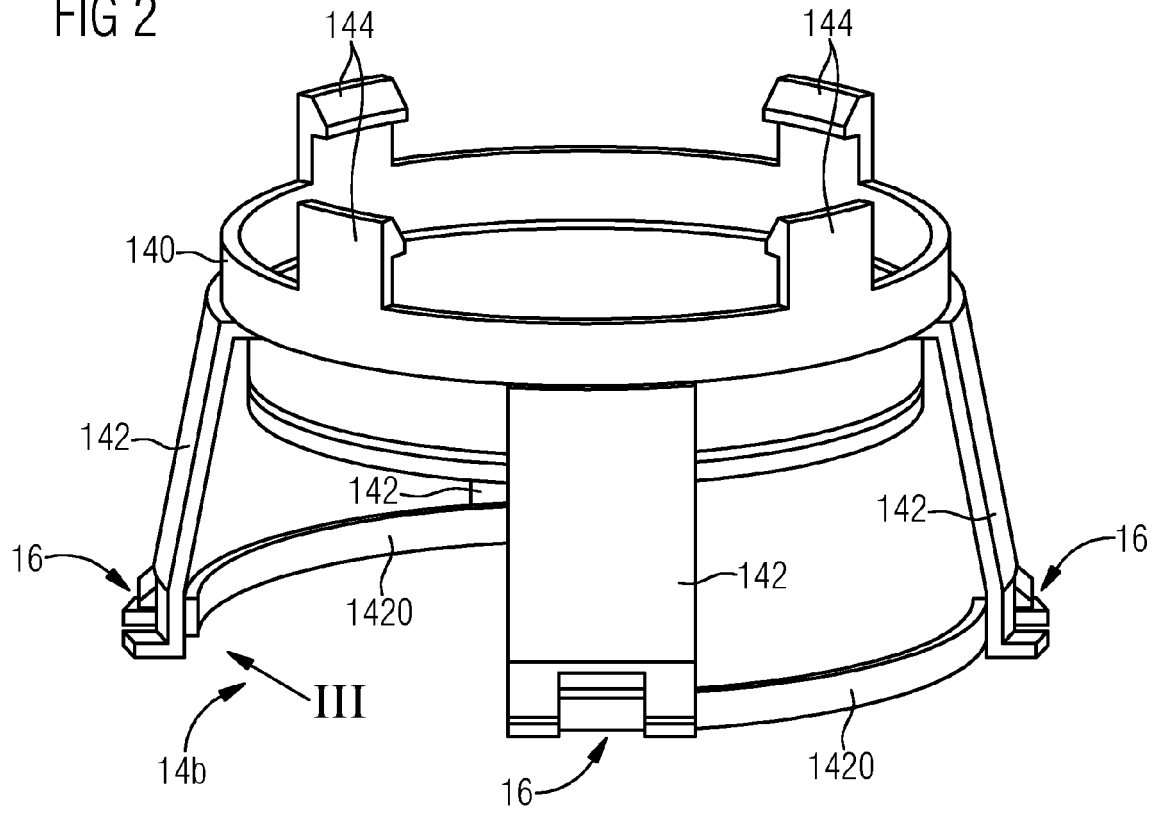


FIG 3

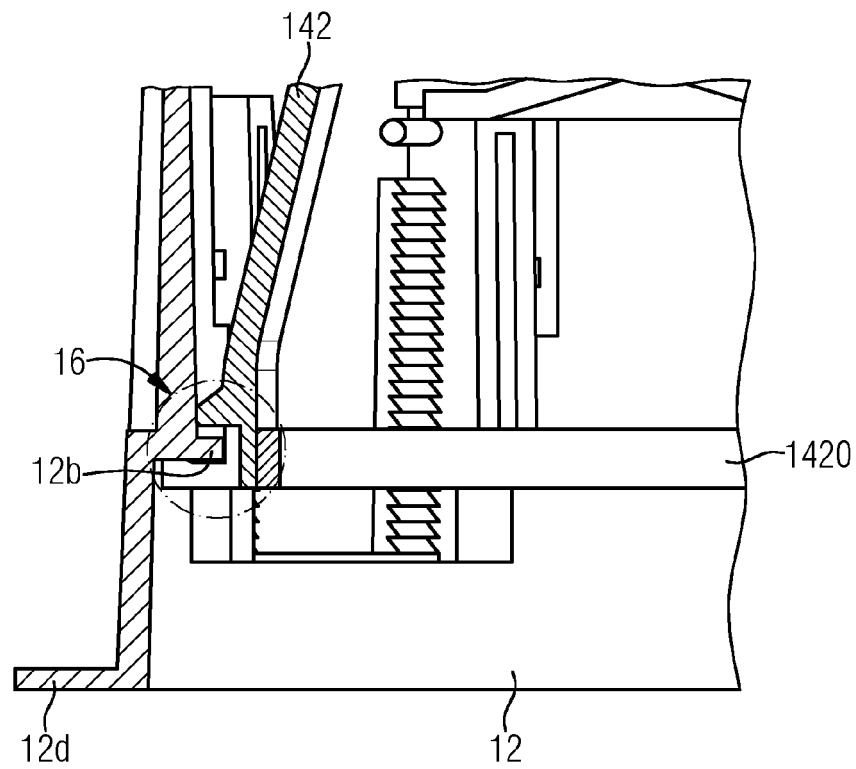


FIG 4

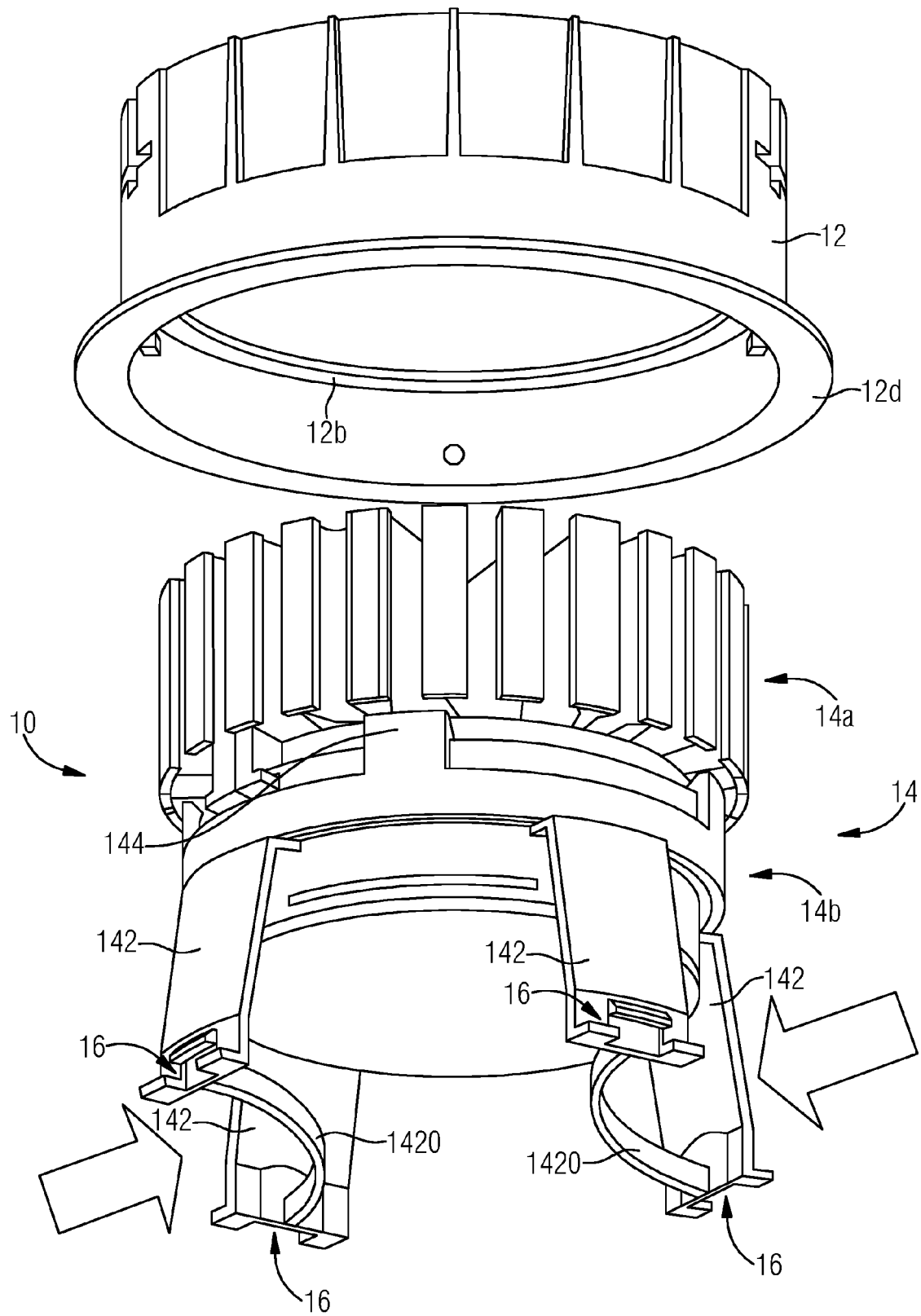




FIG 5

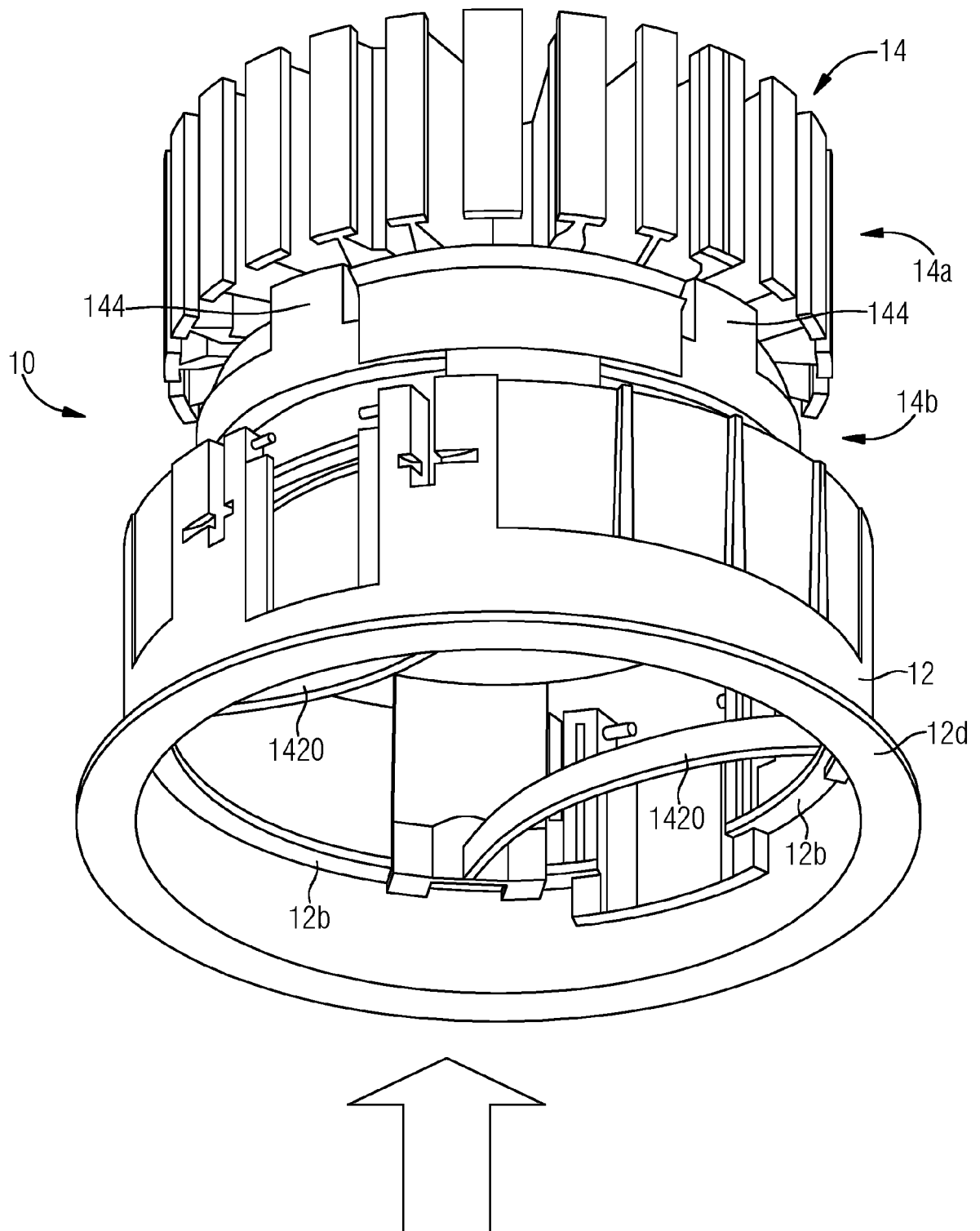


FIG 6

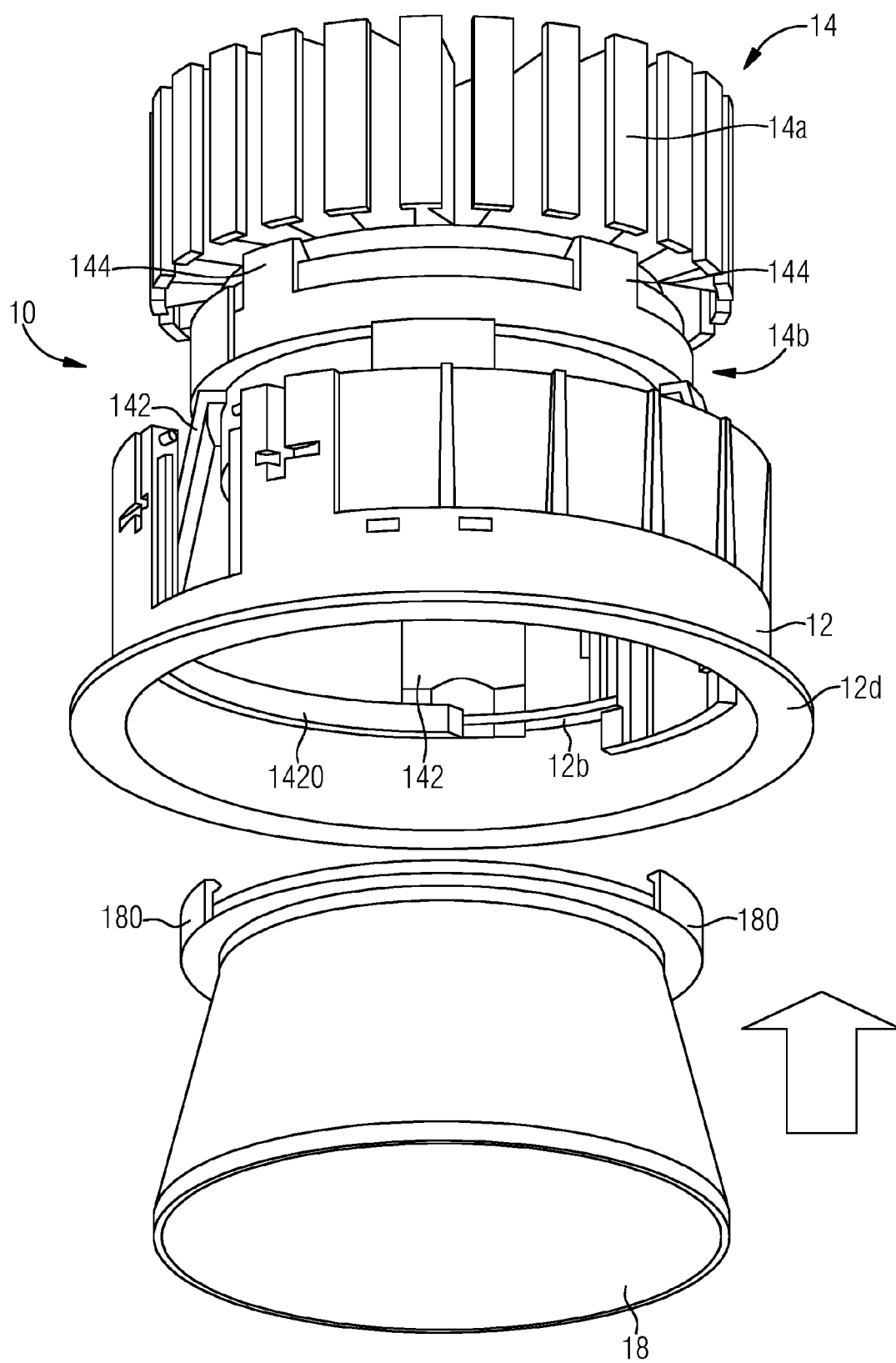
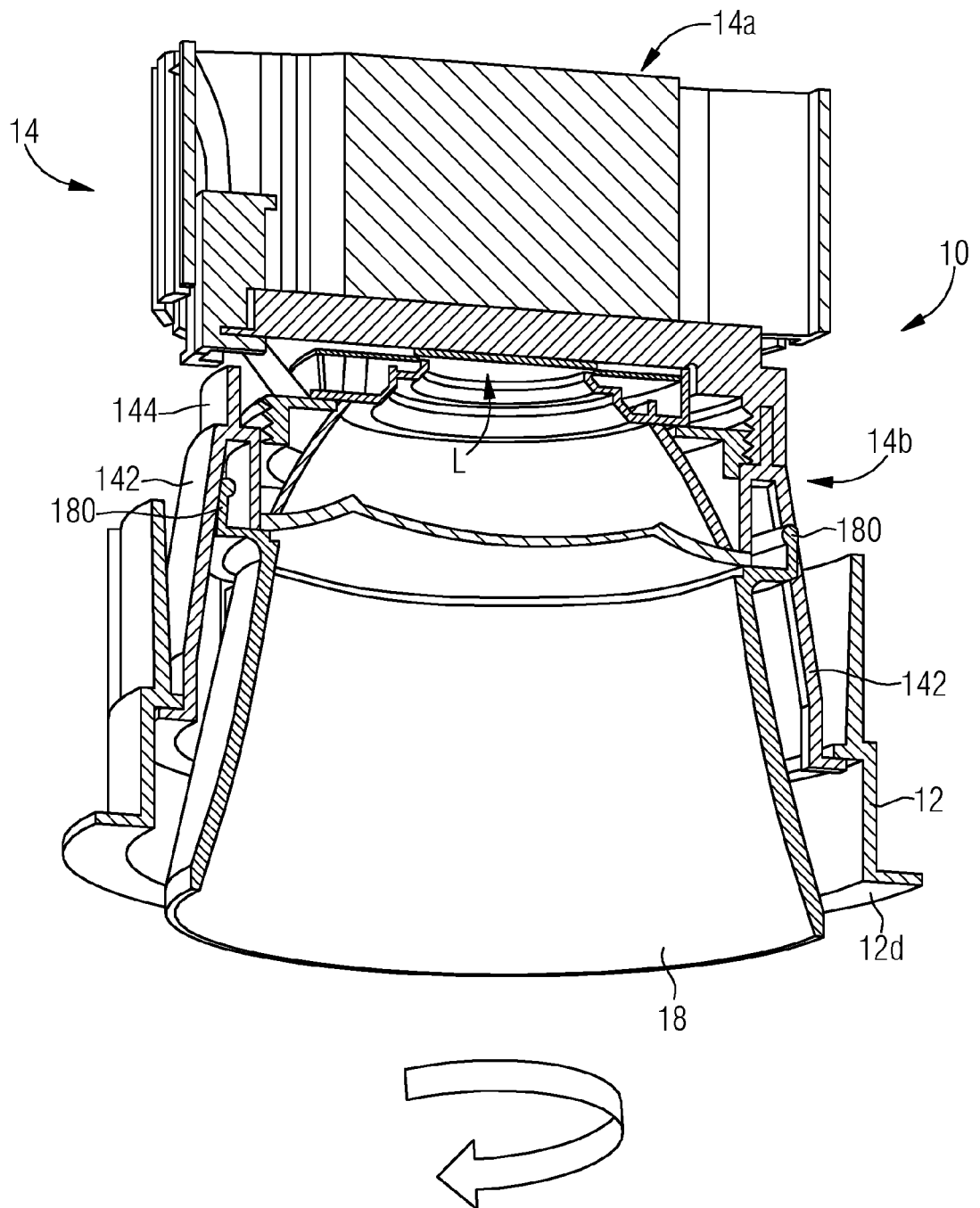


FIG 7





## EUROPEAN SEARCH REPORT

Application Number  
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Place of search <b>Munich</b>		Date of completion of the search <b>24 January 2017</b>	Examiner <b>Schulz, Andreas</b>
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