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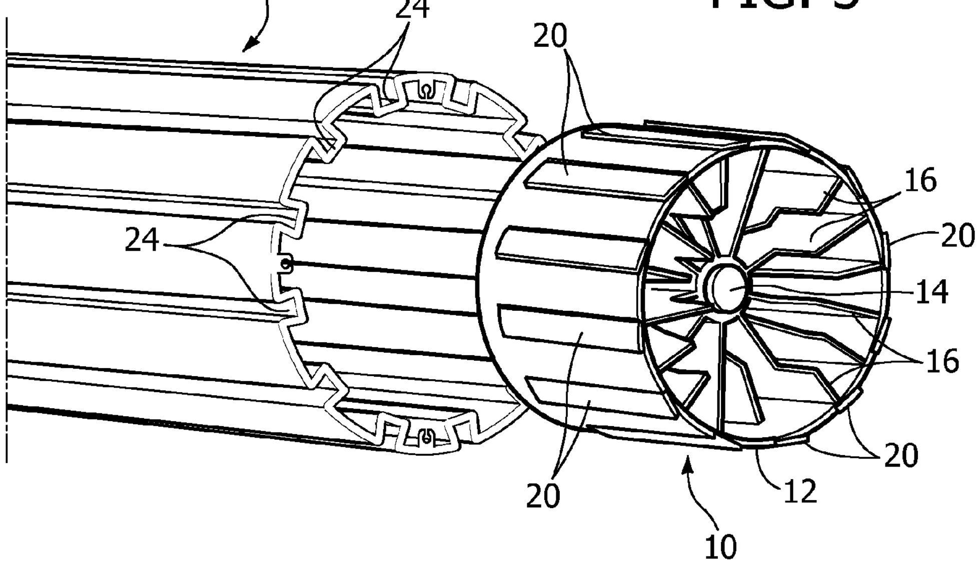
(54) Heat-sink body and relative heat-sink assembly

(57) A heat-sink body (10) made of thermally conductive material for a light radiation source includes:
- a tubular skirt wall (12),
- a core (14) located axially within the aforementioned tubular skirt wall (12),
- an array of fins (16) which extend like spokes from the core (14) to join said core (14) to the tubular skirt wall (12), and
- a support surface (18) for a light radiation source at one end of the core (14).

FIG. 3



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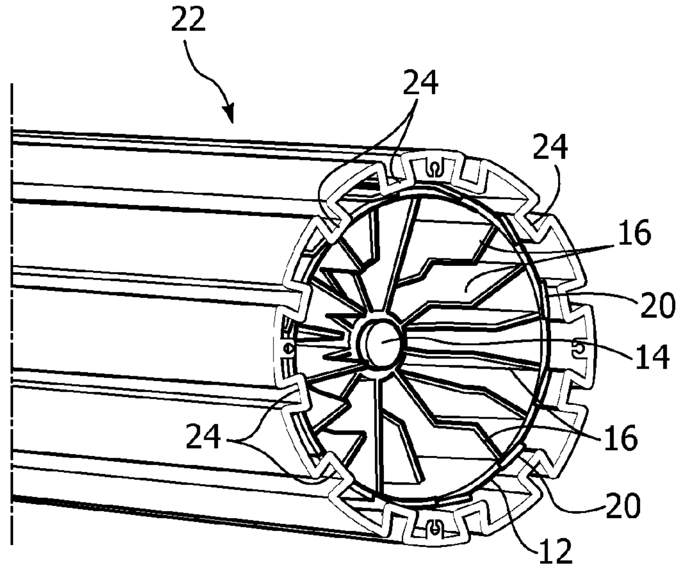


FIG. 4

Description

Technical field

[0001] The description relates to heat sinks.

[0002] Various embodiments may relate to heat sinks which can be used together with lighting devices.

Technical background

[0003] In the field of lighting devices, such as for example the devices used as LED light radiation sources, there is provision for a heat dissipation action (active and/or passive) delegated primarily to the shell of the lighting device.

[0004] This solution is shown to be unsatisfactory in at least two aspects:

- it is difficult to achieve optimum management of the heat dissipation depending on the application and/or the power level, and
- the production costs can be negatively influenced by the need to implement heat sinks in reduced batches, related to the number of lighting devices of a certain type with which the latter are intended to be associated.

[0005] In this respect, it would be desirable to have heat-sink elements which can be used in different lighting devices, if needed with the possibility to adapt the heat sink as a whole to the features of the lighting device.

Object and summary

[0006] It is an object of various embodiments to provide an answer to the requirements mentioned above.

[0007] According to the invention, this object is achieved by a heat-sink body having the features specifically mentioned in the claims which follow. The invention also relates to a corresponding heat-sink assembly.

[0008] The claims form an integral part of the technical teaching provided here in relation to the invention.

[0009] Various embodiments can provide for a heat-sink body with a cylindrical overall shape which is provided internally with heat-sink fins and can be coupled externally to an auxiliary heat sink.

[0010] Various embodiments may include a primary core which can be coupled to a plurality of different auxiliary heat sinks (with a specific internal coupling geometry), in order to make it possible to boost the overall heat dissipation effect and/or to permit adaptation to different types of bodies of lighting devices.

Brief description of the figures

[0011] The invention will be described, purely by way of non-limiting example, with reference to the accompanying figures, in which:

- figures 1 and 2 are two perspective views, in two opposite respects, of one embodiment,
- figures 3 and 4 show the ways in which heat-sink elements are coupled in embodiments, and
- figure 5, including five parts indicated progressively from a) to e), shows operating criteria which can be used in the embodiments shown in figures 3 and 4.

Detailed description

[0012] In the following description, various specific details aimed at providing a fuller understanding of the embodiments are explained. The embodiments may be implemented without one or more of the specific details or using other methods, components, materials, etc. In other cases, known structures, materials or operations are not shown or described in detail so that various aspects of the embodiments may be understood more clearly.

[0013] The reference to "an embodiment" in the context of this description indicates that a particular configuration, structure or feature described in relation to the embodiment is included in at least one embodiment. Therefore, phrases such as "in one embodiment", which may occur at various points in this description, do not necessarily refer to the same embodiment. Moreover, particular forms, structures or features may be combined in any suitable manner in one or more embodiments.

[0014] The reference signs used here are provided solely for the sake of convenience and therefore do not define the scope of protection or ambit of the embodiments.

[0015] In the figures, the reference numeral 10 denotes, as a whole, a heat-sink body which is constituted, for example, by a thermally conductive material such as, for example, metals in general (e.g. aluminum), plastic, thermally conductive plastic, thermally conductive ceramic.

[0016] In various embodiments, the body 10 may be constituted by a single piece of molded material.

[0017] In various embodiments, the body 10 may include:

- a skirt wall 12 with a tubular overall shape,
- a core 14 located axially within the tubular skirt wall 12, and
- an array of fins 16 which extend like spokes from the core 14 to join said core 14 to the skirt wall 12.

[0018] In various embodiments, one end of the core 14 (that visible more clearly in figure 1, in the example under consideration) may be provided with a planar surface 18, for example with a circular shape, which can act as a support/mounting surface for a lighting device ("light engine" - not explicitly visible in the drawings).

[0019] In various embodiments, such a device may include, for example, one or more LED light radiation sources with possibly associated electrical driving circuits.

[0020] The task of the heat-sink body 10 is to dissipate the heat generated by the aforementioned lighting device, which is assumed to rest precisely on the surface 18, or at least transmits heat to said surface 18.

[0021] In various embodiments, the tubular skirt wall 12 has a cylindrical shape with the core element 14 extending in a central position with respect to the skirt wall 12.

[0022] As can be seen more clearly in the view in figure 2, at least some of the fins 16 can have a length (detected axially with respect to the skirt wall 12) which is longer in the vicinity of said skirt surface 12 compared to the corresponding length in the vicinity of the core 14. In this way, as can also be seen in the view in figure 2, the end of the heat-sink body 10 opposite the end where the surface 18 is provided may be provided with a cavity that can act as a receiving seat for further components, with the possibility to benefit from the heat dissipation action implemented by the fins 16.

[0023] In various embodiments, the skirt wall 12 may be provided externally with a lining made of a thermal interface material such as, for example, graphite, silicone-based pastes with thermally conductive ceramic powders, thermally conductive materials in general.

[0024] In various embodiments, the aforementioned material may be provided in the form of strips which extend axially with respect to the skirt wall 12, i.e., in the exemplary embodiment under consideration here, in the direction of the generatrices of the cylindrical surface over which the skirt wall 12 extends.

[0025] In various embodiments, the strips 20 can be distributed around the body 10 in a uniform angular distribution.

[0026] Figures 3 and 4 show the way in which a heat-sink body 10 of the type described above can be coupled to an auxiliary heat sink 22 constituted, for example, by a heat-sink material which is the same as or different to that which constitutes the body 10, for example metals in general (for example aluminum), plastics, thermally conductive plastics, thermally conductive ceramics.

[0027] In various embodiments, the auxiliary heat sink 22 is in the form of a profiled tube which can be fitted on the body 10.

[0028] For this purpose, in various embodiments the auxiliary heat sink 22 may be in the form of a section provided internally with axial ribs 24 which can make contact with the skirt wall 12 of the body 10, especially with the strips 20 thereof.

[0029] In various embodiments, as schematized by the sequence of figures 3 and 4, the body 10 and the auxiliary heat sink 22 can be coupled to one another, with the body 10 being introduced into the axial cavity of the tubular auxiliary heat sink 22 such as to give rise to a composite heat-sink assembly having heat dissipation properties which are improved compared to those which can be shown by the body 10 taken on its own.

[0030] In various embodiments, the coupling schematized in figure 4 may take the form of a tight fit which is achieved such that the strips 20 arranged on the skirt wall 12 of the body 10 are wedged between the aforementioned skirt wall and the radially internal ends of the ribs 24.

[0031] In various embodiments, this outcome can be achieved such that, as can be seen more clearly from figure 5, the strips 20 are mounted on the skirt wall 12 in a general gearwheel-like arrangement (more precisely a ratchet-like arrangement), i.e. such that - in the strips 20 - one side of each strip is closer to the hub 14 than the opposite side of said strip.

[0032] Adopting this solution, as schematically shown in part a) of figure 5, the body 10 can initially be inserted axially into the auxiliary heat sink 22, with it being made to slide axially within the auxiliary heat sink 22, with the strips 20 being kept aligned with the spaces between the ribs 24 (it is assumed that these are distributed in an angularly uniform manner over the internal surface of the auxiliary heat sink 22).

[0033] In this first angular position (part a) of figure 5), with the strips 20 made of thermal interface material located in the spaces between adjacent axial ribs 24 of the auxiliary heat sink 22, the heat-sink body 10 and the auxiliary heat sink 22 are capable of axial movement with respect to one another.

[0034] Subsequently, as shown by the sequence of parts b), c), d) and e), the body 10 and the auxiliary heat sink 22 can be made to rotate in relation to one another (in the exemplary embodiment shown here, it is assumed that the aforementioned relative movement takes place such that the body 10 rotates clockwise within the auxiliary heat sink 22), and the strips 20 move to the distal ends of the ribs 24, thereby implementing the desired wedged condition specifically because they are arranged "like a ratchet".

[0035] In this second angular position (part e) of figure 5), the strips 20 made of thermal interface material are urged like wedges against the axial ribs 24 of the auxiliary heat sink 22, whereby the heat-sink body 10 and the auxiliary heat sink 22 are locked against axial movement with respect to one another.

[0036] The coupling methods considered here make it possible, for example, to control and/or modify the condition of axial mounting of the body 10 within the auxiliary heat sink 22, for example such as to vary the position in which the surface 18 is found within the auxiliary heat sink 22, for example depending on the dimensions of the lighting device mounted on said surface 18.

[0037] In addition, whereas the sequence of figures 3 and 4 refers to a solution in which the end of the body 10 which bears the surface 18 is oriented toward the inside of the auxiliary heat sink 22, the arrangement of the body 10 inserted within the heat sink 22 may be the opposite, i.e. such as to keep the surface 18 facing toward the outside of the heat sink 22.

[0038] Obviously, without affecting the principle of the invention, the construction details and embodiments may vary, also significantly, with respect to that illustrated here purely by way of non-limiting example, without thereby departing from the scope of protection of the invention; this scope of protection is defined by the accompanying claims.

Claims

1. A heat-sink body (10) made of thermally conductive material for light radiation sources, the body including:

    - a tubular skirt wall (12),
    - a core (14) located axially within said tubular skirt wall (12),
    - an array of fins (16) which extend like spokes from said core (14) to join said core (14) to said tubular skirt wall (12), and
    - a support surface (18) for a light radiation source at one end of said core (14).

2. The body as claimed in claim 1, wherein said tubular skirt wall (12) is a cylindrical wall having said core (14) extending centrally with respect thereto.

3. The body as claimed in claim 1 or claim 2, wherein at least some of said fins (16) have a length axially with respect to said skirt wall (12) which is longer at said skirt wall (12) than at said core (14).

4. The body as claimed in any of the preceding claims, wherein said skirt wall (12) is provided externally with a lining (20) made of a thermal interface material.

5. The body as claimed in claim 4, wherein said lining includes strips (20) made of a thermal interface material which extend axially with respect to said skirt wall (12).

6. A heat-sink assembly, including:

    - the heat-sink body (10) as claimed in any of claims 1 to 5, and
    - an auxiliary heat sink (22) made of a thermally conductive material in the form of a tubular body which can be fitted onto said skirt wall (12) of said heat-sink body (10).

7. The heat-sink assembly as claimed in claim 6, wherein said auxiliary heat sink (22) includes axial ribs (24) extending toward the inside of the auxiliary heat sink (22) with the capability of contacting said skirt wall (12) of said heat-sink body (10).

8. The heat-sink assembly as claimed in claim 7, including strips (20) made of a thermal interface material which are arranged on said skirt wall (12) of said heat-sink body (10) and can be interposed like wedges between said axial ribs (24) and said skirt wall (12).

9. The heat-sink assembly as claimed in claim 8, wherein said strips (20) made of thermal interface material are arranged on said skirt wall (12) in a ratchet-like arrangement, whereby said heat-sink body (10) and said auxiliary heat sink (22) are mutually positionable in:

    - a first angular position, wherein said strips (20) made of thermal interface material are located in spaces between adjacent axial ribs (24) of said auxiliary heat sink (22) and said heat-sink body (10) and said auxiliary heat sink (22) are capable of axial movement with respect to one another, and
    - a second angular position, wherein said strips (20) made of thermal interface material are urged like wedges against said axial ribs (24) of said auxiliary heat sink (22), whereby said heat-sink body (10) and said auxiliary heat sink (22) are locked against axial movement with respect to one another.

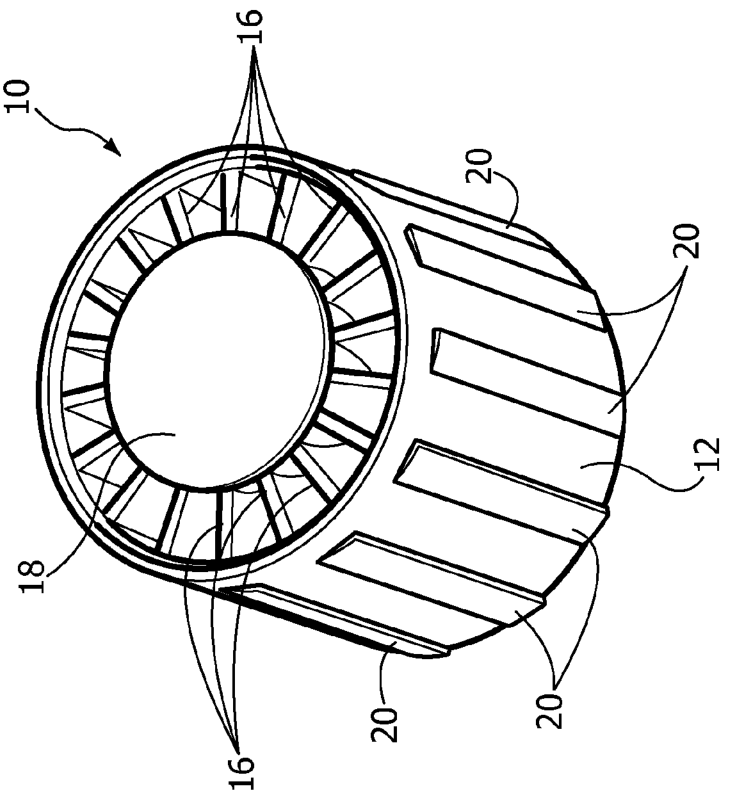


FIG. 1

FIG. 2

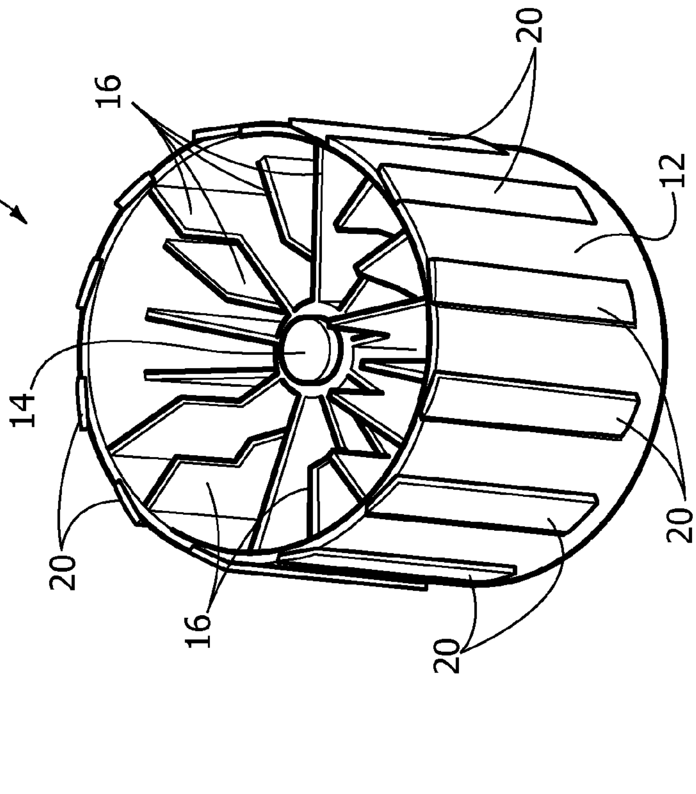


FIG. 3

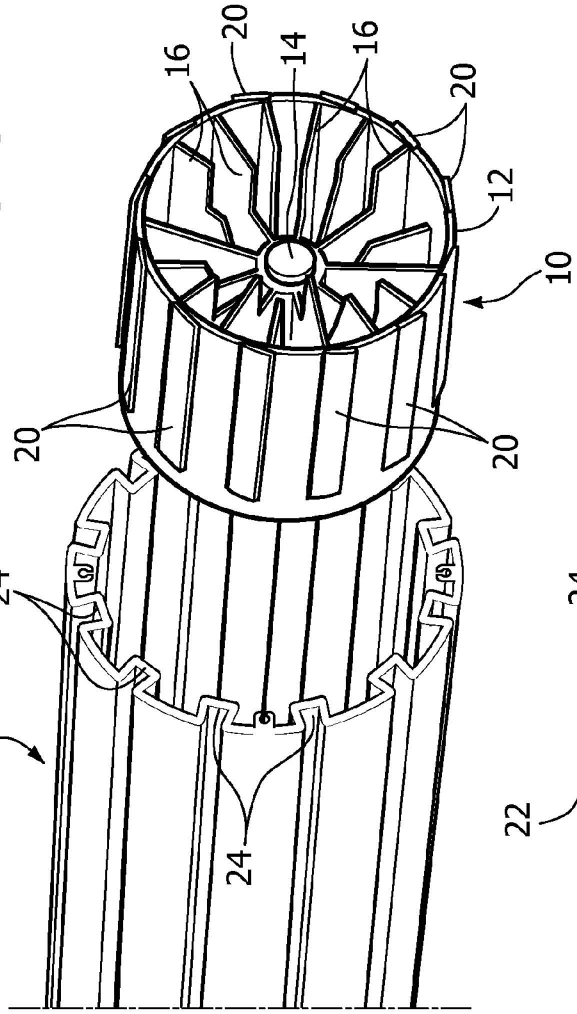


FIG. 4

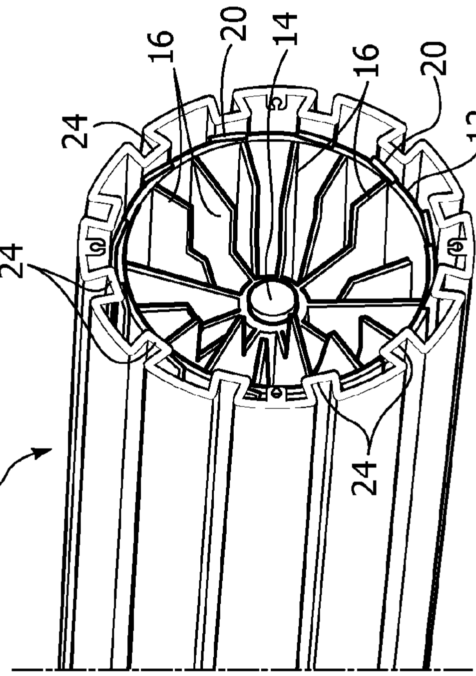


FIG. 5c

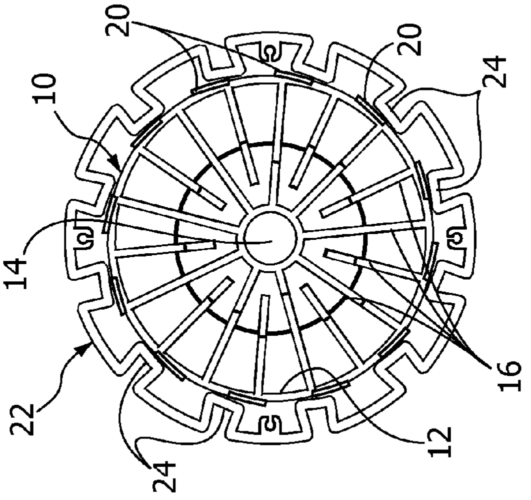


FIG. 5b

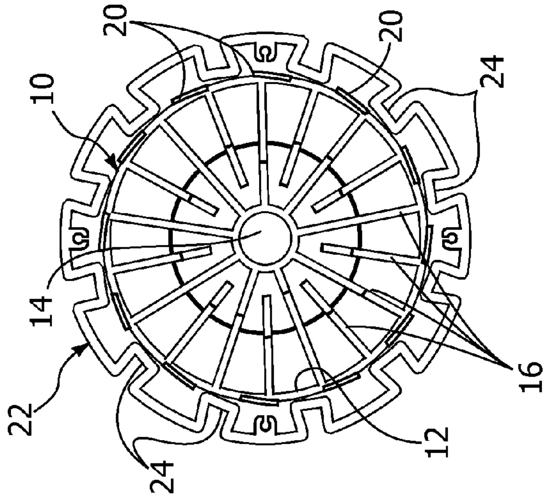


FIG. 5e

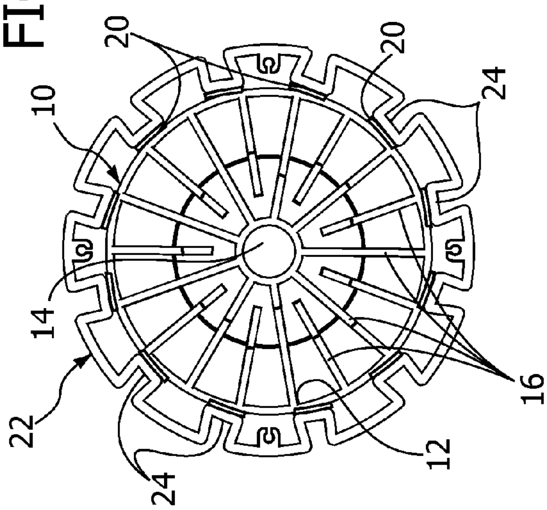


FIG. 5a

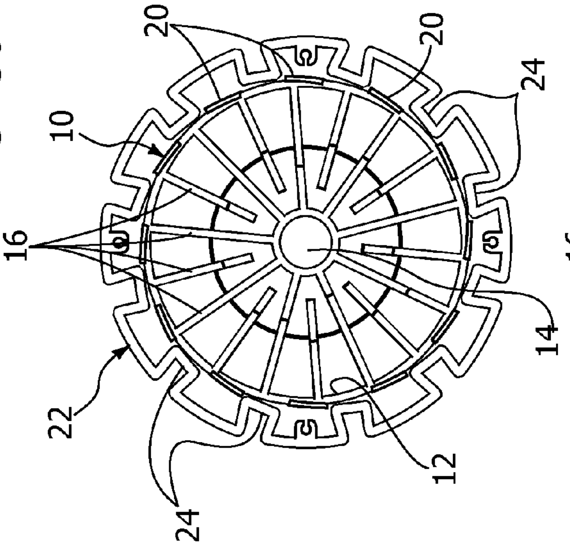
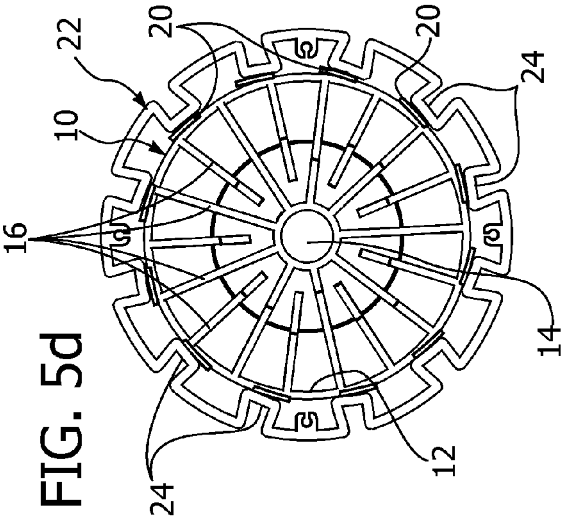


FIG. 5d



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EUROPEAN SEARCH REPORT

Application Number
EP 12 18 3462

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

F21V

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	24 September 2012	Chaloupy, Marc

CATEGORY OF CITED DOCUMENTS

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