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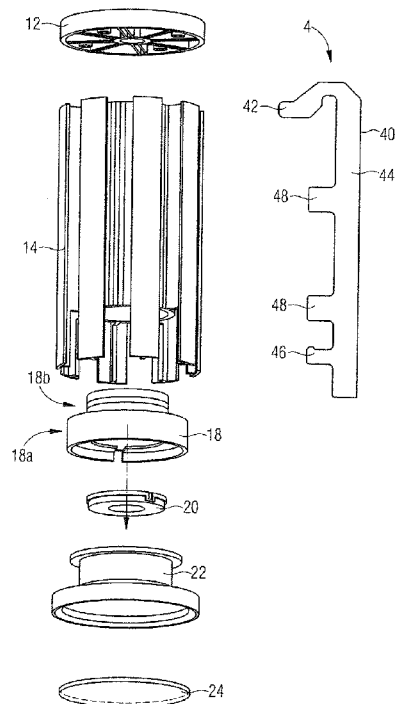
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(54) **Title:** LIGHTING SYSTEM

FIG 1A



(57) **Abstract:** A lighting system comprising a support body (12, 14, 18) for a lighting module (20) comprising at least one light source, wherein the support body (12, 14, 18) has an external surface with a plurality of channels (140, 150). The lighting source also comprises at least one profiled element (4) which can be coupled to the support body (12, 14, 18) and protrudes from the support body (12, 14, 18) when coupled to the support body (12, 14, 18). In particular, the profiled element (4) has engaging formations (48) which can be inserted inside the channels (140, 150) of the external surface of the support body (12, 14, 18).

Description

Lighting system

5 Technical field

The present description relates to lighting systems.

Technical background

10 Lighting systems which comprise at least one light source, such as one or more LEDs (Light Emitting Diodes) are known. These modules may require a cooling system in order to ensure the stability of the LEDs over time.

For example, the document WO 2009/039907 describes a lighting system in which a cylindrical body made of metallic material which comprises a plurality of longitudinal air flow channels is used as a heat dissipator. In particular, this document refers to the fact that such a cylindrical body may have an attractive aesthetic appearance such as not to require an external casing which surrounds the entire lighting system.

Object and summary

25 The inventors have noticed that this lack of an external casing results in the lighting system being not very flexible both from an aesthetic point of view and from a functional point of view.

The object of the invention is to overcome the abovementioned drawbacks.

30 According to the invention this object is achieved by means of a lighting system having the characteristic features mentioned in the claims below. The claims form an integral part of the technical teaching provided here in relation to the invention.

35 In various embodiments, the lighting system may comprise a lighting module, such as an LED module, and a support body.

In various embodiments, the support body may comprise a plurality of air flow channels or ducts. For example, the support body may comprise a cooling body which is closed on

one side by means of a cover and on the other side by means of a support on which the lighting module is mounted.

In various embodiments, additional elements may be fixed to the lighting system, for example by means of an engaging fit, so that at least one portion of the additional elements projects from the support body.

For this purpose, the cover may comprise on its external surface a plurality of seats arranged along an internal circumference line and the support may comprise a flange on its external surface. In this case, the additional elements may comprise at least one first portion configured so as to cooperate with one of the seats in the cover and a second portion comprising at least one projection for cooperating with the flange of the support.

In various embodiments, in order to improve the mechanical stability, each additional element may comprise at least one formation which cooperates with one of the channels in the cooling body.

Brief description of the drawings

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

- Figures 1a to 1c are schematic perspective views of a lighting system according to the present invention;
- Figures 2 to 7 show possible applications of the lighting system according to Figures 1a to 1c.

Detailed description

In the following description various specific details aimed at providing a fuller understanding of the embodiments are explained. The embodiments may be implemented using 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.

The reference to "an embodiment" in the context of this

description indicates that a particular configuration, structure or characteristic 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 characteristic features may be combined in any suitable manner in one or more embodiments.

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

— Figures 1a to 1c show different perspective views of a possible embodiment of a modular lighting system 1 according to the present invention.

In the embodiment considered, the lighting system 1 comprises lighting means 20, such as an LED module comprising at least one LED, and a casing.

As mentioned above, the casing of the lighting system 1 may be formed by a cooling body 14 comprising in the longitudinal direction a plurality of air flow channels or ducts 140.

For example, in the embodiment considered, the cooling body 14 comprises an internal body 142 with a tubular shape, i.e. the internal body has a closed cross-section and comprises axially a first opening and a second opening. For example, in the embodiment considered, the internal body 142 has a substantially cylindrical form. This internal body 142 may be used to support a drive circuit for the LED module 20.

In the embodiment considered, the cooling body 14 comprises a plurality of walls 146 which extend radially from the external surface of the tubular body 142 and which define together with the surface of the tubular body 142 the longitudinal air flow channels 140. Preferably, these channels 140 are arranged in an equidistant manner.

In one embodiment, in order to increase the surface area of the cooling body, the cooling body 14 also comprises an external body 144. In the embodiment considered, in order to

allow the air to flow inside the ducts 140, the external body 144 comprises at least one opening for each duct. For example, in the embodiment considered, the external body 144 also has a substantially cylindrical form and comprises radially a plurality of longitudinal incisions.

In the embodiment considered, the external body 144 is connected to the internal body 142 by means of the walls 146.

In one embodiment, the cooling body 14 is formed as one piece, for example by means of an extrusion process.

In one embodiment, the lighting system 1 comprises a cover 12 which is intended to close the cooling body 14 axially on a first side, i.e. on the top side shown in Figures 1a to 1c.

For example, in the embodiment considered, the cover 12 has a disk-like form. For example, this cover 12 may be fixed to the cooling body 14 via suitable fixing means, such as screws. For example, in the embodiment considered, the cooling body 14, for example the walls 146, comprises a plurality of blind holes 148 with an internal thread and the cover 12 comprises through-holes 122 in the corresponding positions.

In one embodiment, a support 18 is provided for fixing the LED module 20 to the cooling body 14. For example, in the embodiment considered, this support 18 has a first cylindrical portion 18a comprising a cavity inside which the LED module 20 may be fixed. For this purpose, the LED module 20 is mounted preferably on a printed circuit with a circular cross-section.

In the embodiment considered, the support 18 also comprises a second cylindrical portion 18b. This second cylindrical portion 18b has an external diameter which is substantially identical to the internal diameter of the internal body 142 of the cooling body 14 so that the portion 18b of the support 18 may be inserted in the internal body 142 in the manner of a "stopper". However, the support 18 could also be fixed to the cooling body 14 in any other suitable manner, for example via fixing means, such as screws.

Preferably, in order to be able to improve the thermal connection between the LED module 20 and the cooling body 14,

the support 18 is made of a material with a high heat dissipation coefficient.

In one embodiment, the lighting system 1 comprises a reflector 22 for focusing the light generated by the LED module 20.

In one embodiment, the lighting system 1 comprises a transparent cover 24. For example, this cover 24 may be fixed, for example by means of engagement, inside a suitable hollow portion 22a of the reflector 20.

In the embodiment considered, the casing of the reflector 22, the portion 22a of the reflector 22 and the transparent cover 24 also have circular cross-sections.

In one embodiment, the external body 144 of the cooling body 14 has a length which is greater than the length of the internal body 142 so that a part of the external body 144 covers at least the support 18 and preferably also the reflector 22. For example, in the embodiment considered, the external body 144 extends as far as the portion 22a of the casing of the reflector 22.

The solution described here allows additional decorative and/or functional elements 4 to be fixed to the lighting system 1.

In one embodiment, the additional elements 4 are fixed to the lighting system 1 by means of an engaging fit. For this purpose, the cover 12 comprises on its top side a plurality of seats 124, such as cavities or openings, which are arranged along an internal circumference line. For example, in the embodiment considered, the cover 12 comprises a plurality of incisions 124 which extend radially. Moreover, the portion 18a of the support 18 comprises a flange on the bottom side, i.e. on the side onto which the LED module 20 is fixed.

The additional elements 4 instead comprise at least one fastening element or profiled portion 40 for an engaging fit of the additional element 4 on the lighting system 1. For example, in the embodiment considered, the profile 40 has a clip-like form similar to a "square bracket", i.e. the profile comprises a cross-piece or bar 44 comprising, respec-

tively, on its end parts, a first portion 42 and a second portion 46 extending laterally.

In the embodiment considered, the portion 42 is configured to cooperate with the seats 124 in the cover 12, while
5 the portion 46 is configured to cooperate with the flange of the support 18. For example, in the embodiment considered, the portion 42 has a form complementing the cavity or openings 124 in the cover 12, while the portion 46 comprises a projection for joining together with the flange of the sup-
10 port 18.

In the embodiment considered, the additional element 4 is therefore fixed to the flange of the support 18 and not to the reflector 22 or to the transparent cover 24. In fact, in the embodiment considered, the reflector 22 comprises a top
15 portion with a cross-section which has a width smaller than the width of the cross-section of the portion 18a of the support 18 so that the flange on the support 18 is accessible from the outside. Consequently, in order to mount an additional element 4 on the lighting system 1, the portion 42 is
20 first inserted in one of the incisions 124 and the projection of the portion 46 is then pushed over the flange of the support 18.

In one embodiment, the additional elements 4 are fixed along the longitudinal channels, i.e. the seats 124 in the
25 cover 12 are arranged opposite the channels 140 in the cooling body 14.

In this case, the profile 40 may comprise at least one projection 48 which extends laterally and which cooperates with one of the channels 140 in the cooling body 14 when the
30 additional element 4 is fixed to the lighting system.

In the case where the channels 140 are too wide, smaller channels 150 may also be provided inside the channels 140.

Consequently, the channels 140 and, if present, the channels 150 are used not only to improve the cooling, but
35 also to improve the stability of assembly of the additional elements 4. Moreover, in the case where additional elements 4 are not fixed to the lighting system 1, external fixing elements are not visible.

Figure 2 shows a first possible embodiment of the additional element 4.

In the embodiment considered, the additional element 4 forms a support for resting the lighting system 1 on a table T. For this purpose the additional element 4 comprises the connection profile 40 described above, a base 420 with a flat surface intended to rest on the table T or on another flat surface, and a column 422 which connects the interconnecting profile 40 to the base 420.

Figure 3 shows a second possible embodiment of the additional element 4.

In the embodiment considered, the additional element 4 supports an optical element 430, such as a diffuser, a reflector or an optical lens, which is arranged along the path of the radiation emitted by the lighting system 1. In this case, also, a column 422 which connects the connecting profile 40 to the optical element 430 is provided.

Figure 4 shows a third possible embodiment of the additional element 4.

In the embodiment considered, the additional element 4 forms a support for fixing the lighting system 1 to a wall W. For this purpose the additional element 4 comprises the connecting profile 40 described above, a base 440 with a flat surface intended to rest on the wall W or on another flat surface, and a column 422 which connects the interconnecting profile 40 to the base 440.

In the embodiment considered, fixing means for fixing the base 440 to the wall W may also be provided.

Figure 5 shows a fourth possible embodiment of the additional element 4.

In the embodiment considered, the additional element 1 can be used to fix mechanically together several lighting systems 1 by means of a universal fastening system, thus making it possible to form a lighting apparatus with configurations which can be personalized.

For example, in the embodiment considered, the additional element 4 forms a connection piece for connecting together two corresponding lighting systems 1. For this pur-

pose, the additional element 4 comprises at least two connecting profiles 40a and 40b as described above.

The person skilled in the art will appreciate that the appearance and form of the additional elements 4 described above may be adapted to the technical needs of the application and/or the specific requirements of the end user. Moreover, the lighting system itself could also have different forms. For example, the cooling body 14 and optionally also the cover 12 and the support 18 may have circular or polygonal cross-sections, such as rectangular or square cross-sections.

For example, Figures 6a and 6b show a lighting system 1a with a rectangular cross-section which is connected to a lighting system 1b with a circular cross-section.

Instead, Figure 7 shows how a plurality of lighting systems 1 may also be connected together so as to form more complex structures.

Figure 7 also shows how such a lighting system may be used in combination with conventional electric rails where the lighting system is fixed to an electric rail by means of a hanging wire F. For example, in the embodiment considered, these hanging wires F are fixed via suitable fixing means directly to the additional elements 4.

In general, the fastening system described here provides the apparatus with spatial characteristics of structural stability both in the same plane or by expanding the structure in different planes which may also not be parallel to each other.

Moreover, the solution described here has several advantages, such as:

- versatile geometric composition by interconnecting several LED sources;
- simple interconnection (no screws, springs, etc.); and
- the possibility of providing other functions (in addition to those of structural mechanics), such as mechanical supporting, heat dissipation, fastening to other mechanical/optical structures and/or variation of the aesthetic appearance in terms of forms or colors.

Consequently, it is possible to provide LED lighting appliances which can be personalized (with potentially infinite configurations) using two basic components (LED source and interconnecting element). The fixing points may be rigid
5 and/or hung from surfaces (e.g. walls, ceilings) and/or other structures (e.g. secondary optical systems).

Moreover, assembly may also be performed only at the final destination, which simplifies the transportation logistics, considering the packaging - individual and/or in kit
10 form - both of the single light sources and of the interconnecting elements.

Moreover, owing to the modular nature of the lighting system, the basic lighting system may be reused, thus allowing the costs of the apparatus to be minimized, by taking advantage of the low costs for production of predefined components.
15

Obviously, without affecting the principle of the invention, the constructional details and embodiments may vary, also significantly, with respect to that illustrated here purely
20 by way of a non-limiting example, without thereby departing from the scope of the invention as defined in the accompanying claims.

Patent claims

1. A lighting system comprising:

- a support body (12, 14, 18) for a lighting module (20) comprising at least one light source, said support body (12, 14, 18) having an external surface with a plurality of channels (140, 150), and
- at least one profiled element (4) which can be coupled to said support body (12, 14, 18) and protrudes from said support body (12, 14, 18) when coupled to said support body (12, 14, 18), said profiled element (4) having engaging formations (48) insertable in the channels (140, 150) of the external surface of said support body (12, 14, 18).

2. The lighting system as claimed in claim 1, wherein said at least one profiled element (4) is chosen from among:

- a support (420, 422; 440, 422) for the lighting system;
- a support (422) for an optical element (430) arranged along the path of the radiation emitted by said at least one light source;
- an element (4, 40a, 40b) for interconnection with a corresponding lighting system.

3. The lighting system as claimed in claim 2, wherein said interconnecting element (4, 40a, 40b) has a first set (40a) and a second (40b) set of engaging formations (48) insertable in the channels (140, 150) of the external surfaces of the support bodies (12, 14, 18) of corresponding lighting systems.

4. The lighting system as claimed in one of the preceding claims, wherein said support body comprises:

- a tubular cooling body (14) comprising axially a first and a second opening, wherein said cooling body (14) has on its external surface said plurality of channels (140, 150),
- a cover (12) having an internal surface and an external surface, wherein said cover (12) closes with its internal

surface said first opening in said cooling body (14), and

- a support (18) having an internal surface and an external surface, wherein said support (18) closes with its internal surface said second opening in said cooling body (14),
5 and wherein said lighting module is fixed onto the external surface of said support (18).

5. The lighting system as claimed in claim 4, wherein said
10 profiled element (4) is fixed to said cover (12) and said support (18) of said support body by means of an engaging fit.

6. The lighting system as claimed in claim 5, wherein said
15 profiled element (4) comprises a first formation (42) and a second (46) formation configured to cooperate with corresponding formations in said cover (12) and said support (18) of said support body.

7. The lighting system as claimed in claim 6, wherein said
20 cover (12) comprises a plurality of seats (124) arranged along an internal circumferential line and wherein said support (18) of said support body comprises a flange on its external surface.

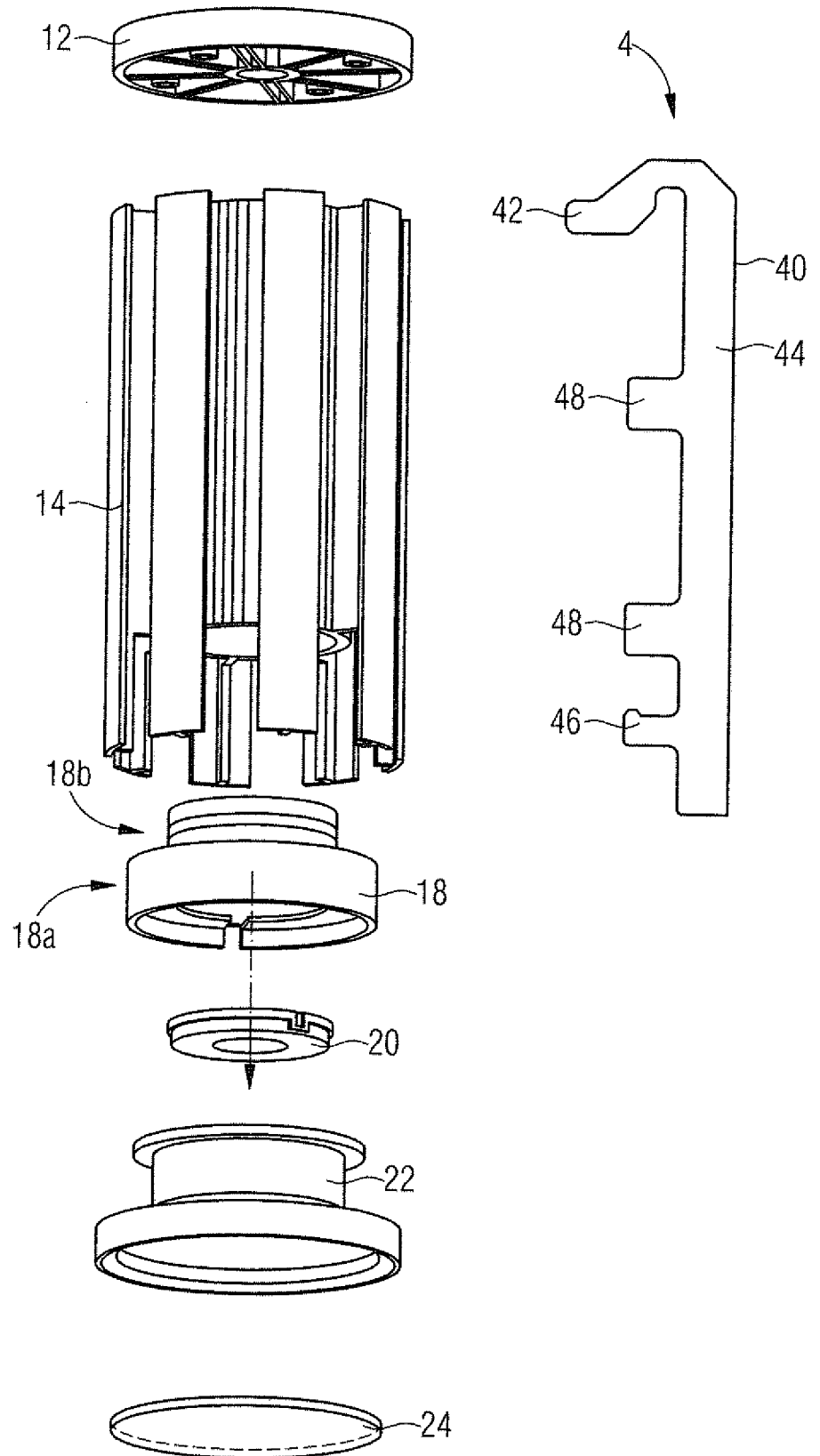
25 8. The lighting system as claimed in claim 7, wherein said channels (140, 150) are longitudinal channels and wherein said seats (124) in said cover (12) are arranged opposite said channels (140, 150).

30 9. The lighting system as claimed in one of the preceding claims, wherein said support body (12, 14, 18) has an external cross-section which is circular or polygonal.

10. The lighting system as claimed in one of the preceding
35 claims 4 to 9, comprising a drive circuit for said lighting module (20), wherein said drive circuit is arranged inside said cooling body (14).

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FIG 1A



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FIG 1B

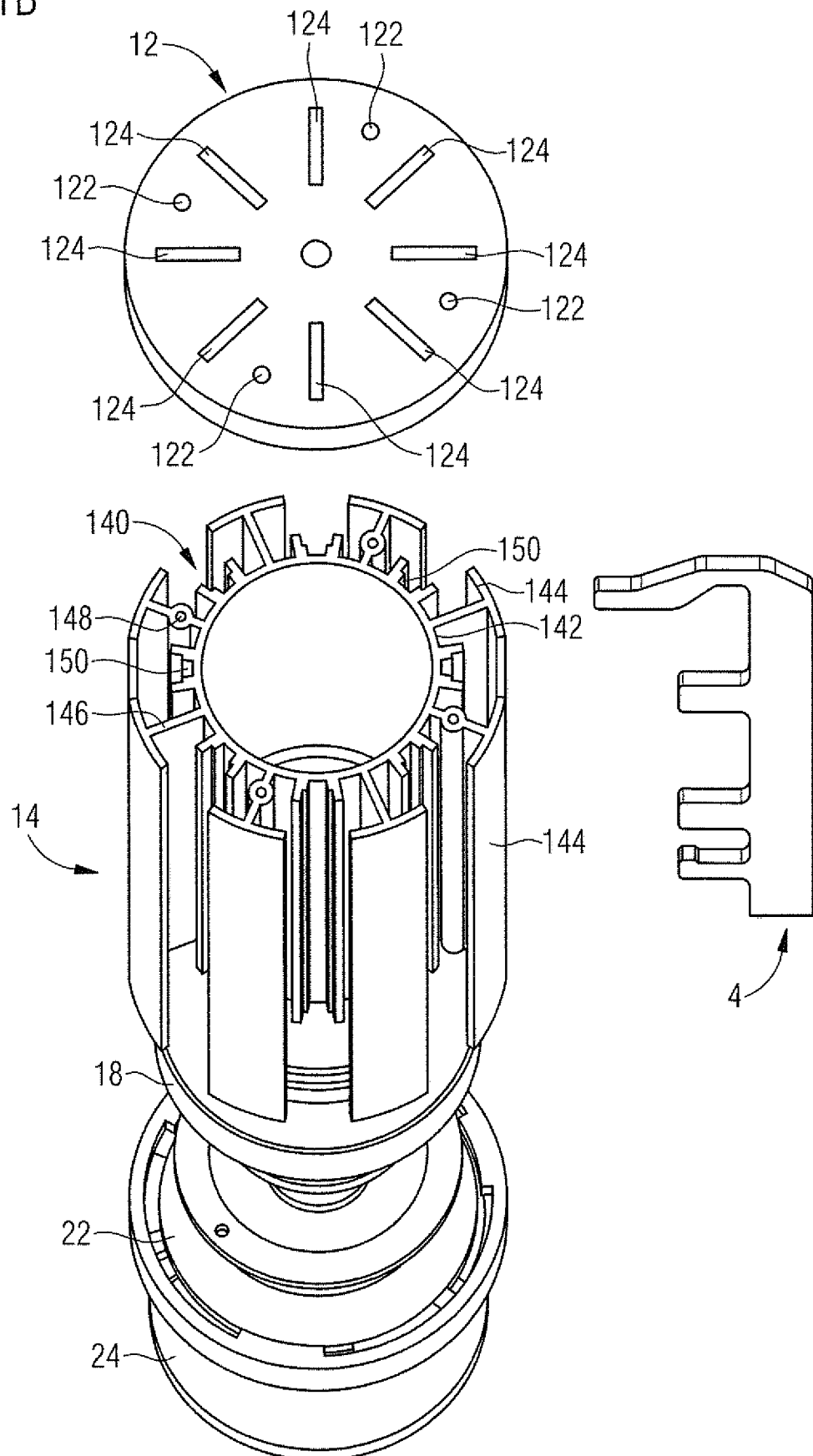
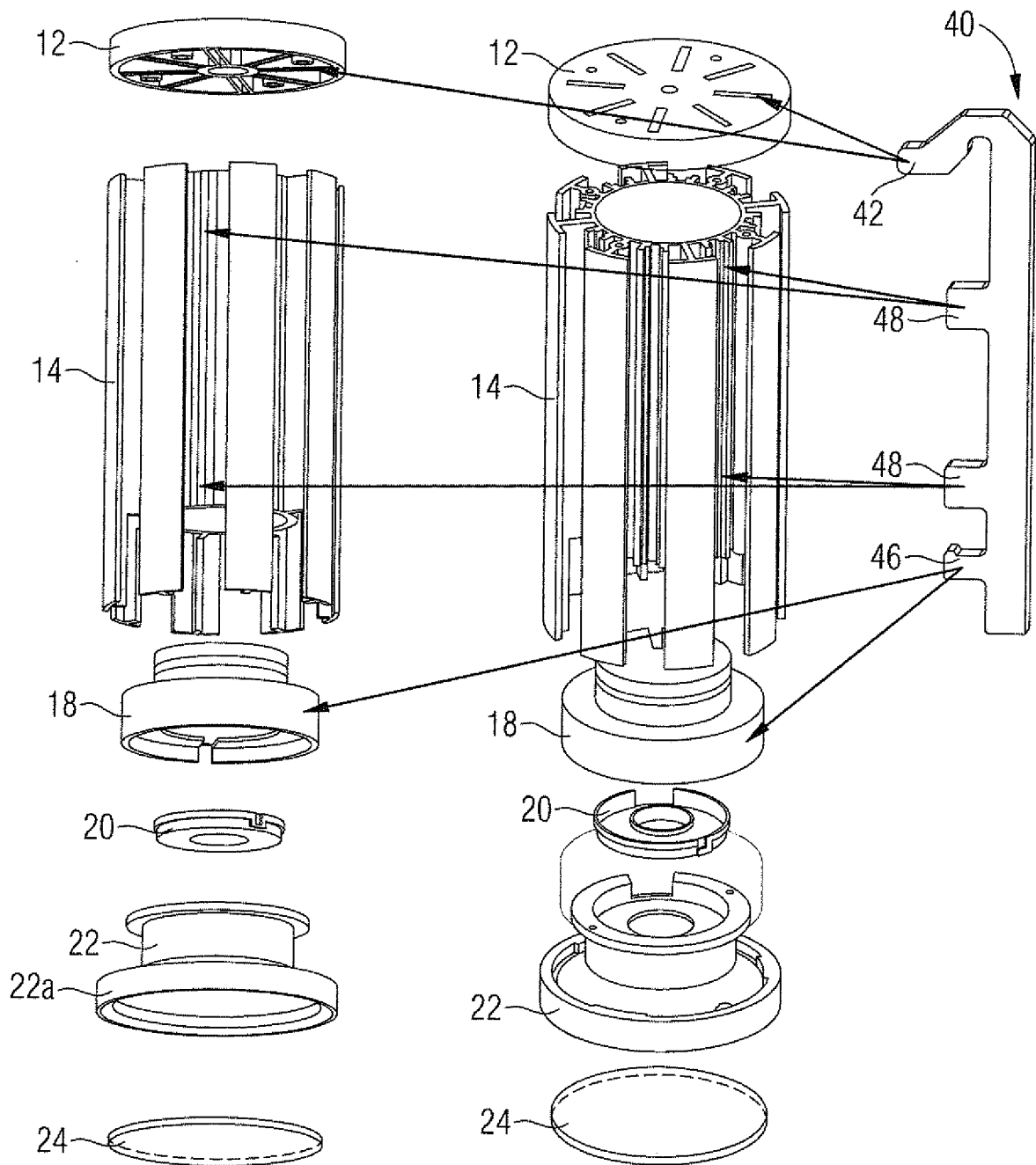


FIG 1C



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FIG 2

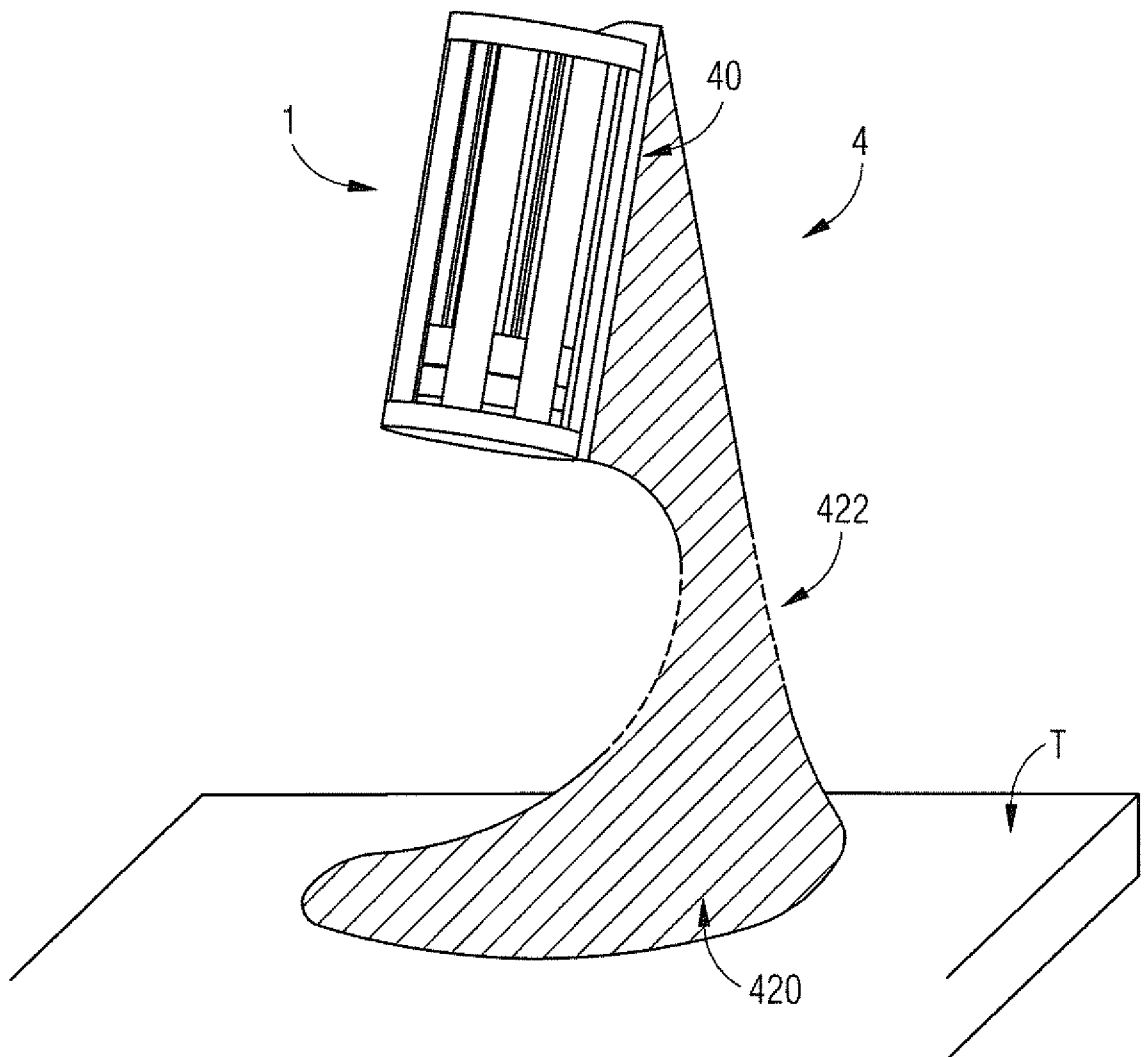
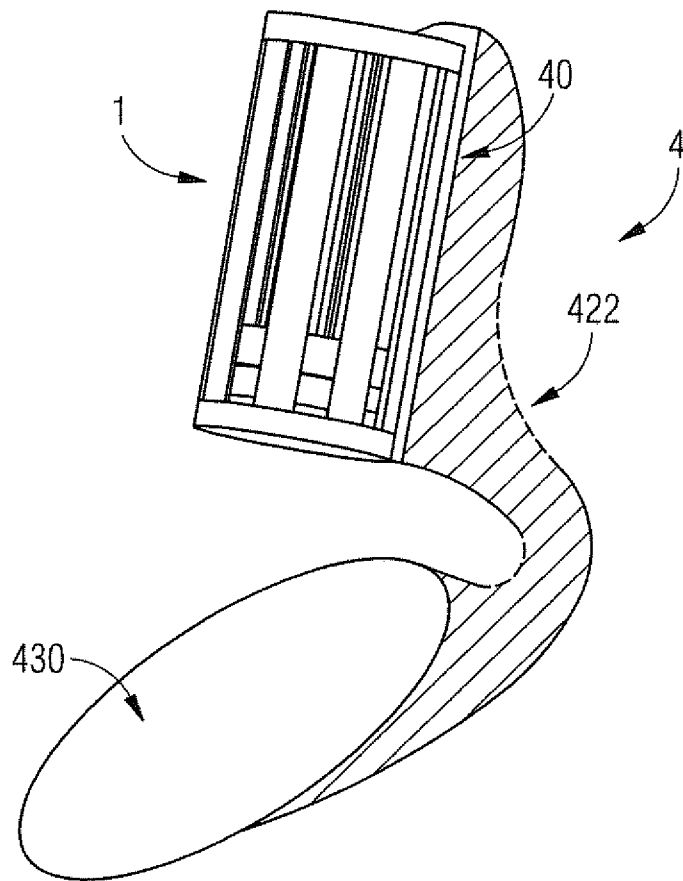
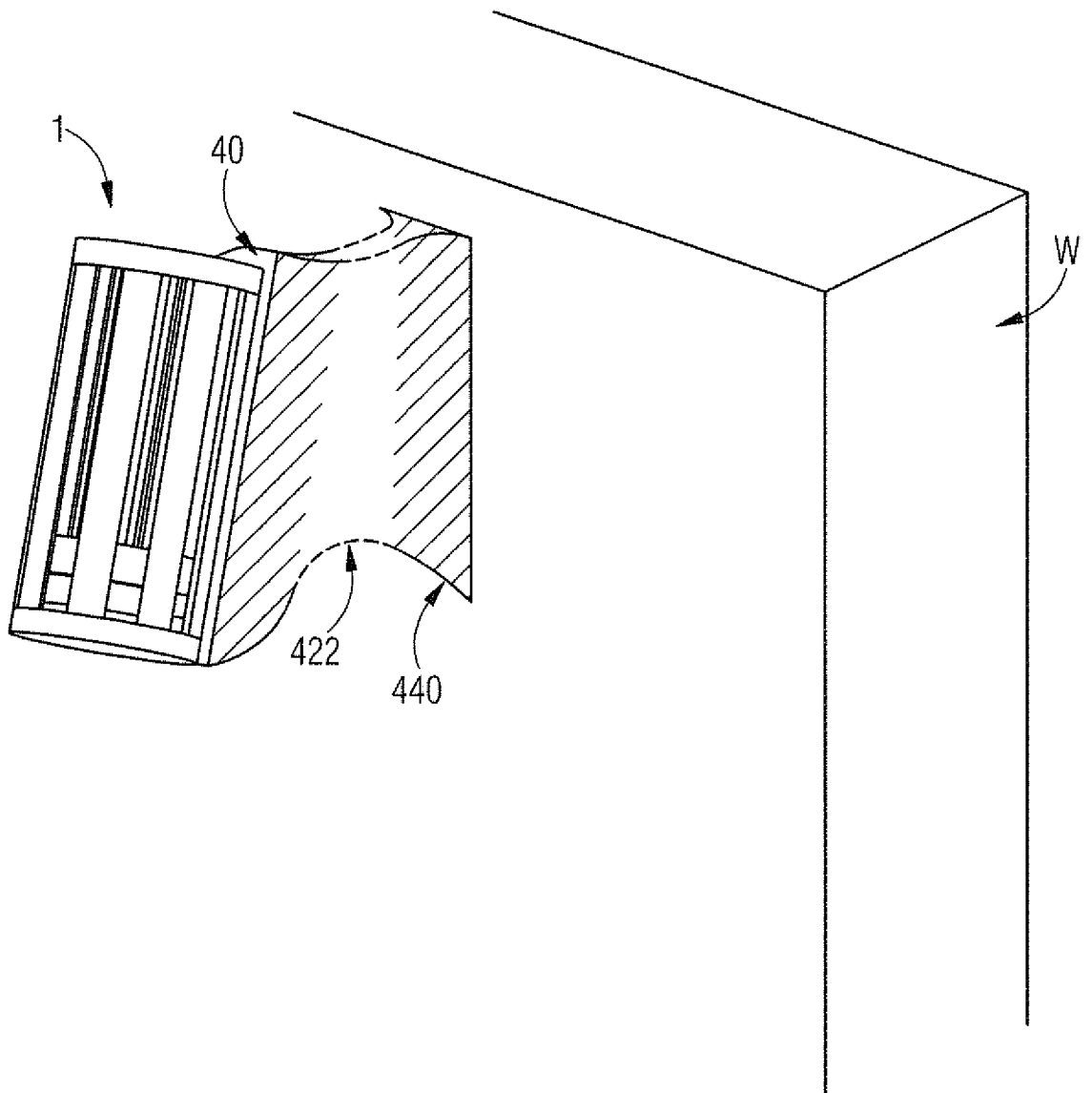


FIG 3



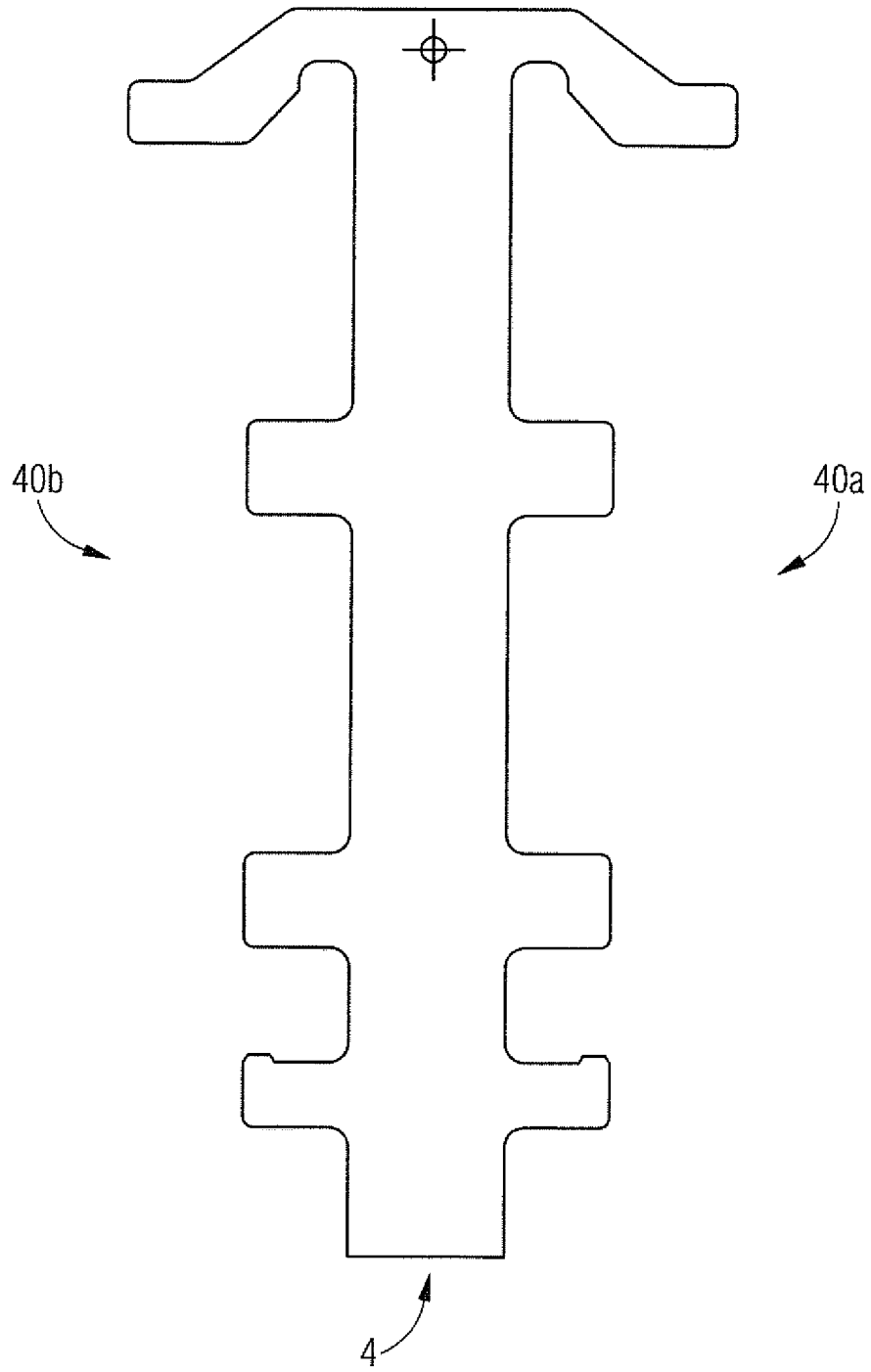
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FIG 4



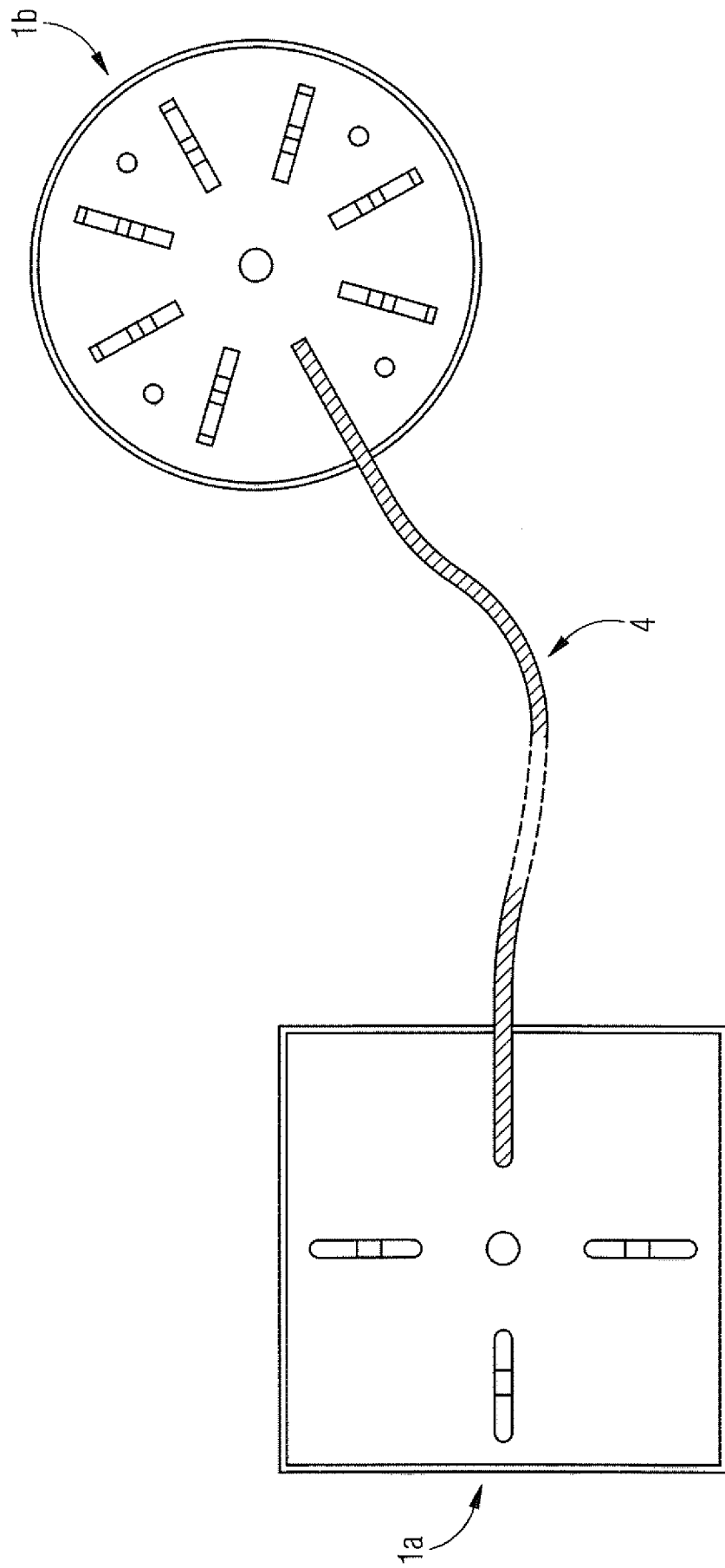
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FIG 5



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FIG 6A



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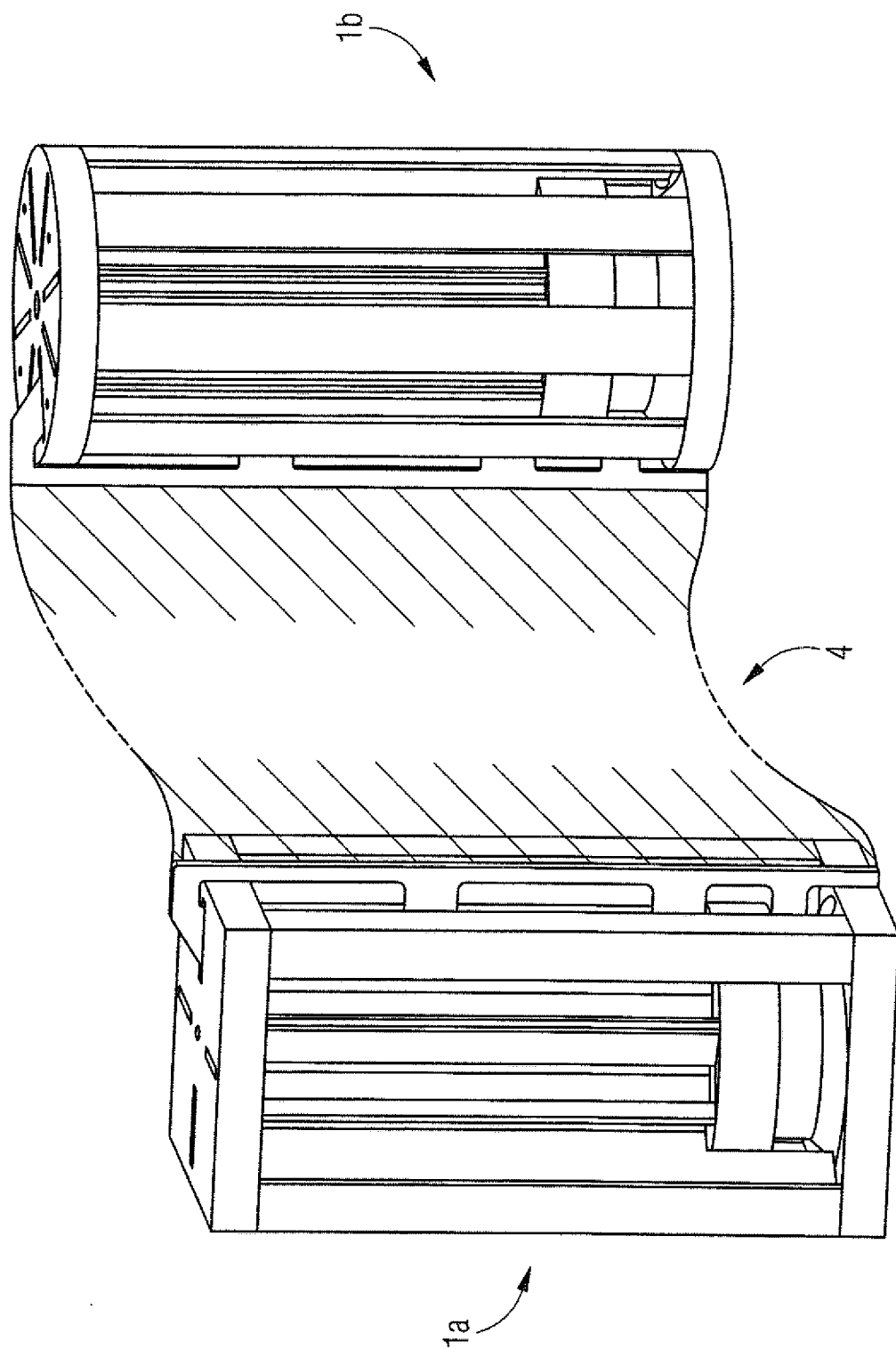


FIG 6B

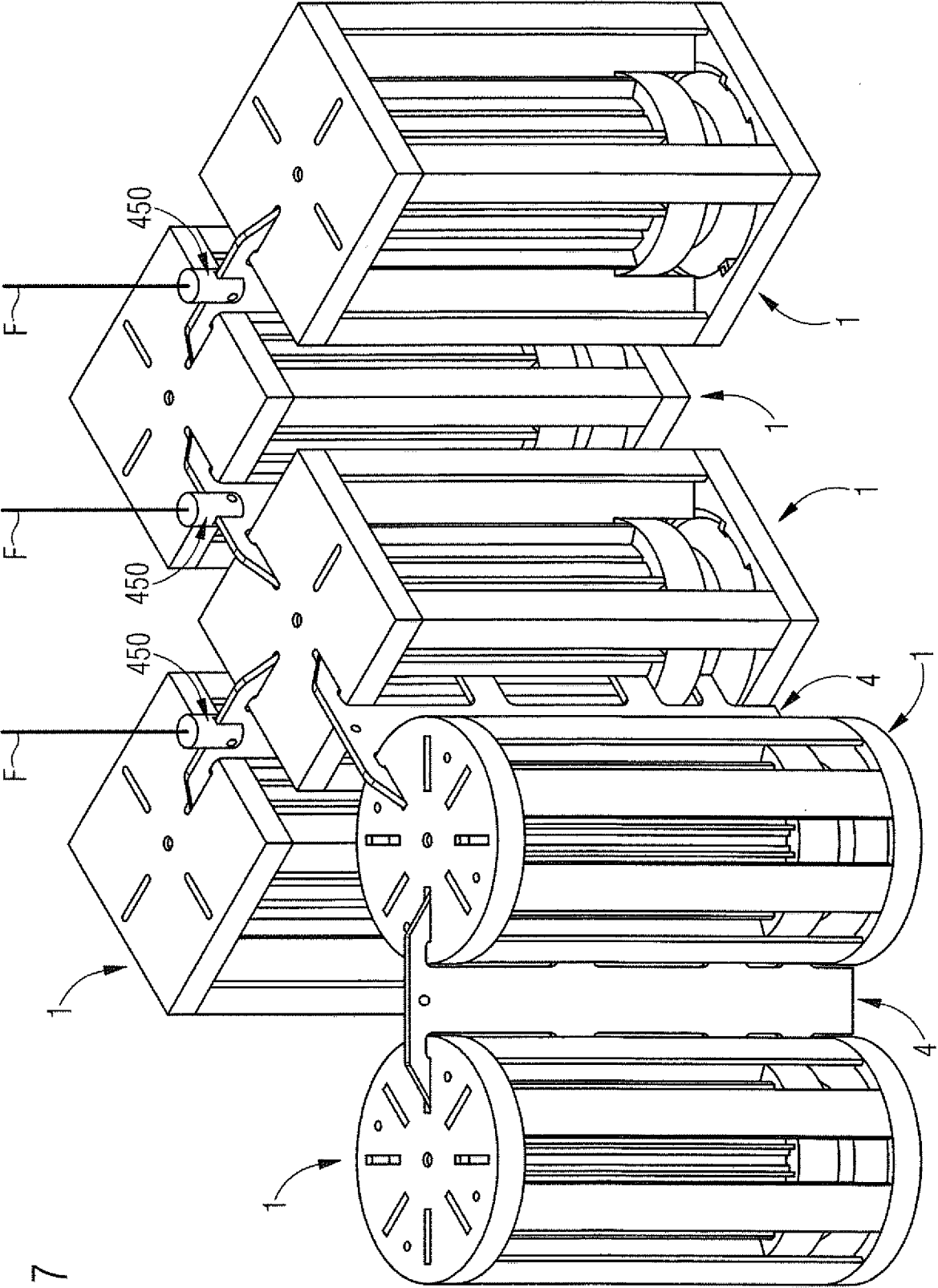


FIG 7