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(71) Applicants:
• **OSRAM GmbH**
80807 München (DE)
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• **OSRAM S.P.A. - SOCIETA' RIUNITE OSRAM
EDISON CLERICI**
20126 Milano (IT)
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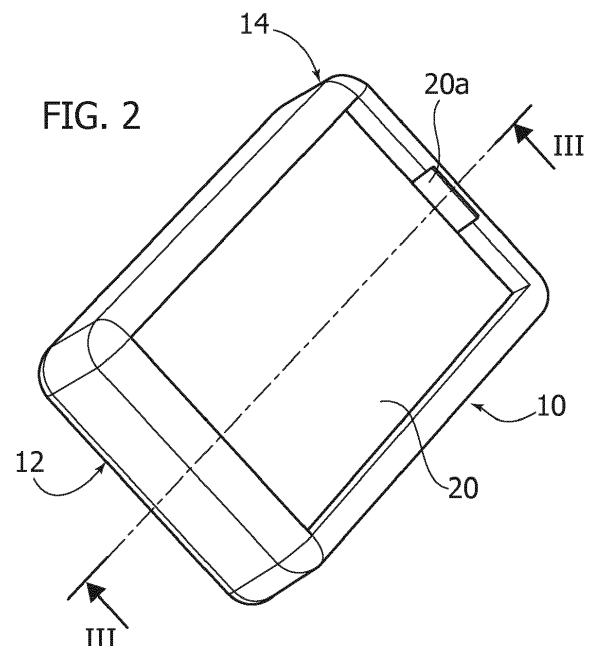
(72) Inventors:
• **ZANOTTO, Mr. Alberto**
I-35127 Padova (IT)
• **GRIFFONI, Alessio**
I-30030 Fossò (Venezia) (IT)
• **BALDO, Mr. Lorenzo**
I-31040 Giavera del Montello (Treviso) (IT)
• **PEZZATO, Mr. Luigi**
I-31000 Treviso (IT)

(74) Representative: **Bosotti, Luciano et al**
Buzzi, Notaro & Antonielli d'Oulx
Corso Vittorio Emanuele II, 6
10123 Torino (IT)

(54) **AN END CAP FOR LIGHTING DEVICES, CORRESPONDING METHOD AND DEVICE**

(57) An end cap (10) for elongate lighting modules (M) having an exposed end (E) includes:

- a body wall (12) applicable against said end (E), and
- at least one peripheral wall (14) adapted to wrap around said end (E), the peripheral wall (14) extending sidewise of body wall (12) so as to form at least one cup-like portion of the cap (10), wherein:
- said cup-like portion contains a filling of adhesive material (18) for sealingly coupling said cap with said end (E), and/or
- with the peripheral wall (14) there is coupled a shrinkable sheath (22) adapted to be vested onto said end (E) and to be sealingly shrunk onto it.



Description

Technical Field

[0001] The description relates to lighting devices.

[0002] One or more embodiments may find application in lighting devices employing electrically-powered light radiation sources, e.g. solid-state light radiation sources such as LED sources.

[0003] One or more embodiments may find employment in lighting devices having a protection against the penetration of foreign agents.

Technological Background

[0004] The current market of lighting technology, especially as regards Solid-State Lighting (SSL) sources, expresses a constantly growing demand for e.g. LED modules having an elongate shape, being linear and flexible and including a plurality of electrical units, e.g. connected in parallel.

[0005] In the final application, it is desirable that the length of such modules may be chosen according to the application and usage needs (i.e. that it may be "customized"), the possibility being given to cut a generally elongate module to length.

[0006] As a matter of fact, there is an ever-increasing demand of e.g. LED modules which may be used in a wide range of applications (e.g. outdoor applications, in swimming pools, garages, gas stations, in the automotive sector, etc.), so that the protection against the penetration of foreign agents (e.g. an IP grade protection) must be guaranteed also in product marking.

[0007] This protection need may be met with the implementation of e.g. LED modules which are linear, flexible and encapsulated (i.e. protected, e.g. with an IP grade protection) and which have fixed predetermined lengths.

[0008] Such a solution, however, may be a disadvantage as regards customization: indeed, it does not enable to cut the module to length at any desired position: such a cutting operation may actually eliminate the protection grade.

[0009] Another solution may envisage providing the final customer with end caps (e.g. of a plastic material) which may be applied (e.g. via an adhesive such as glue) onto the ends of the linear, flexible and encapsulated module; this is possible even if the module has been cut, e.g., at a certain electrical unit of the module, by adhesively applying the end cap in the position where the module has been cut.

[0010] By resorting to this solution, however, there is a difficulty in controlling the amount of the applied glue (which may be provided to the final customer in a tube); this may jeopardize the achievement of the desired protection grade.

Object and Summary

[0011] One or more embodiments aim at overcoming the previously outlined drawbacks.

[0012] According to one or more embodiments, said object may be achieved thanks to an end cap having the features set forth in the claims that follow.

[0013] One or more embodiments may also concern a corresponding method, as well as a corresponding lighting device.

[0014] The claims are an integral part of the technical teaching provided herein with reference to the embodiments.

[0015] One or more embodiments may lead to the achievement of an IP grade protection while allowing the user to cut the module to a desired length.

[0016] One or more embodiments may lead to one or more of the following advantages:

- the achievement of a desired IP protection grade,
- the final user has the possibility to reliably control the IP protection grade,
- the achievement of a high customization, thanks to the possibility offered to the user of cutting the module practically at any desired length.

Brief Description of the Figures

[0017] One or more embodiments will now be described, by way of non-limiting example only, with reference to the annexed Figures, wherein:

- Figure 1 exemplifies possible implementations of embodiments,
- Figure 2 is a perspective view of an end cap according to embodiments, shown in an enlarged scale with respect to Figure 1,
- Figure 3 shows the end cap of Figure 2 in a cross section along line III-III of Figure 2,
- Figures 4 and 5 exemplify possible implementations of embodiments from a viewpoint approximately corresponding to arrow IV of Figure 1,
- Figures 6 and 7 are perspective views of an end cap according to embodiments, observed from different viewpoints;
- Figure 8 exemplifies possible usages of embodiments as exemplified in Figures 6 and 7, and
- Figure 9 is a view approximately corresponding to arrow IX of Figure 8.

[0018] It will be appreciated that, for clarity and simplicity of illustration, the various Figures may not be drawn to the same scale.

Detailed Description

[0019] In the following description, various specific details are given to provide a thorough understanding of

various exemplary embodiments of the present specification. One or more embodiments may be practiced without one or several specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials or operations are not shown or described in detail to avoid obscuring various aspects of the embodiments. Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the possible appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

[0020] The headings provided herein are for convenience only, and therefore do not interpret the extent of protection or scope of the embodiments.

[0021] In the Figures, reference M denotes a lighting device (module) of elongate shape (optionally ribbon-like and/or flexible) adapted to employ electrically-powered light radiation sources, such as e.g. solid-state light radiation sources, for example LED sources.

[0022] Such modules may include e.g. a channel-shaped casing, wherein there is arranged a support substantially similar to a Printed Circuit Board (PCB) which hosts distributed light radiation sources, e.g. LED sources. A cover, including e.g. a sealing or potting material, is adapted to provide module M as considered herein with the features of protection against the penetration of external agents (e.g. with IP protection grade).

[0023] A module such as module M (adapted to exhibit any shape or size, e.g. having a rectangular cross section, as in the presently described examples, or a square, polygonal, circular or other cross section) may have a surface, e.g. a front surface, wherefrom light radiation is emitted.

[0024] Lighting devices (modules) of this kind are known in the art, which makes it unnecessary to provide a more detailed description herein.

[0025] A module M as shown herein may be considered as having an indefinite length, adapted to be cut to length according to the application and usage needs.

[0026] The cutting operation may originate end surfaces E (which normally extend in a transverse plane with respect to the lengthwise extension of the module) which may be exposed: in other words, cutting to length may remove the module protection features against the penetration of external agents (water, condensate, various particles) exactly at such end surface(s).

[0027] One or more embodiments may enable providing module M with a desired protection degree (e.g. IP grade protection) also at the end surfaces which are exposed due to the cutting operation.

[0028] To this end, one or more embodiments may envisage an end cap 10 adapted to be coupled to the end

of a module such as module M.

[0029] In one or more embodiments, a cap such as cap 10 may include a body adapted to be defined as a cup-like or vat-like body, which in the present case is exemplified as having a rectangular section, but which may have a section of any shape, e.g. of a shape complementary to the cross section of module M.

[0030] In one or more embodiments, a cap 10 as exemplified in the Figures may therefore include:

- a body wall (bottom wall) 12, applicable against the end surface resulting from the cutting of module M, and
- a peripheral wall 14 surrounding (e.g. continuously, without interruptions) body wall 12, so as to form a cup-like structure.

[0031] In one or more embodiments, body wall 12 of cap 10 may be applied against the end surface of module M, while peripheral wall 14 wraps around the end of module M.

[0032] In one or more embodiments, cap 14 may include (e.g. moulded) plastic material.

[0033] In one or more embodiments, as exemplified in Figures 2 to 5, the cup-like structure defined by the peripheral wall 14 wrapping around body wall 12 may contain a filling of adhesive material 18, adapted to be covered with a protection layer 20.

[0034] Layer 20 may optionally be provided with a pull-tab 20a, which enables the removal thereof in order to expose the adhesive material 18 (e.g. a glue or similar sealing material) located within the cup-like structure of cap 10.

[0035] In one or more embodiments, once the protection layer 20 has been removed, cap 10 may be applied onto the end of module M (as exemplified in Figure 1 and, in a magnified scale, in Figures 4 and 5).

[0036] In this way, the adhesive material 18 may adhere to the (exposed) end of the module, while also penetrating, thanks to a certain flowability of the adhesive material, into the gap between the end of module M and the peripheral wall 14 of cap 10 (see e.g. Figures 4 and 5), so as to create a coating which "encapsulates" end E of module M with a sealing (and therefore protective) action against external agents.

[0037] In one or more embodiments, as exemplified in Figures 6 and 7, in addition or as an alternative to the provision of adhesive material 18, to cap 10 (e.g. peripheral wall 14) there may be coupled (optionally at the inner surface or face of peripheral wall 14) a (heat-)shrinkable sheath 22.

[0038] For example, sheath 22 may be coupled to the peripheral wall 14 of cap 10 via an adhesive (glue) or other fixing means (e.g. heat sealing).

[0039] In one or more embodiments, shrinkable sheath 22 may optionally be formed integrally with cap 10, or at least with the peripheral wall 14 thereof.

[0040] In one or more embodiments, as schematically

shown in Figures 8 and 9, cap 10 may be vested onto an end E of module M (see for example Figures 8 and 9) with sheath 22 in a (thermally) unshrunk condition wrapping around the end portion of module M and extending for a certain length on the peripheral surface of module M itself.

[0041] In one or more embodiments, once the condition exemplified in Figures 8 and 9 has been established, sheath 22 may be shrunk (e.g. by applying heat), determining the contraction thereof and a consequent tight fit, therefore gripping and sealing (and thus protecting) end E of module M whereon cap 10 is applied.

[0042] One or more embodiments as exemplified herein may be applied to a cap 10 having a so to say twofold or two-faced structure, with a peripheral wall comprising portions extending in opposite directions sidewise of body wall 12, so as to enable arranging cap 10 sandwiched between two lighting modules M having mutually facing ends E.

[0043] One or more embodiments may therefore envisage an end cap (e.g. 10) for elongate lighting modules, for instance LED modules (e.g. M) having an exposed end (e.g. E), wherein the end cap comprises:

- a body wall (e.g. 12) applicable against said end, and
- at least one peripheral wall (e.g. 14) adapted to wrap around said end, said at least one peripheral wall extending (e.g. continuously, having no interruptions) sidewise of said body wall, so as to form at least one cup-like portion of the cap, wherein:
- said cup-like portion contains a filling of adhesive material (e.g. 18) for sealingly coupling said cap with said end, and/or (i.e., in combination or as an alternative)
- with said at least one peripheral wall there is coupled a shrinkable sheath (e.g. 22) adapted to be vested onto said end and to be sealingly shrunk onto said end.

[0044] One or more embodiments may include a removable layer (e.g. 20) to protect said filling of adhesive material.

[0045] In one or more embodiments, said removable layer may be provided with a pull-tab (e.g. 20a).

[0046] In one or more embodiments, said at least one peripheral wall may be dimensioned to form, around said end, a penetration gap for said adhesive material.

[0047] In one or more embodiments, said shrinkable sheath may include a heat-shrinkable sheath.

[0048] In one or more embodiments, a method of providing an end seal in at least one lighting module having an exposed end may include:

- providing an end cap according to one or more embodiments,
- coupling said end cap with said exposed end, by applying said body wall against said exposed end and with said at least one peripheral wall extending

around said end.

[0049] One or more embodiments may include causing said adhesive material to penetrate into a gap between said peripheral wall and said module.

[0050] One or more embodiments may include shrinking, optionally heat-shrinking, said sheath vested onto said end.

[0051] In one or more embodiments, a lighting device may include:

- at least one lighting module having an exposed end, and
- an end cap according to one or more embodiments, vested onto said end, with said at least one peripheral wall wrapping around said end.

[0052] Without prejudice to the basic principles, the details and the embodiments may vary, even appreciably, with respect to what has been described herein by way of non-limiting example only, without departing from the extent of protection.

[0053] The extent of protection is defined by the annexed claims.

Claims

1. An end cap (10) for elongate lighting modules (M) having an exposed end (E), wherein the end cap (10) includes:
 - a body wall (12) applicable against said end (E), and
 - at least one peripheral wall (14) for wrapping said end (E), said at least one peripheral wall (14) extending sidewise of said body wall (12) to form at least one cup-like portion of the cap (10), wherein:
 - a filling of adhesive material (18) is provided in said cup-like portion of the cap (10) for sealingly coupling said cap with said end (E), and/or
 - with said at least one peripheral wall (14) there is coupled a shrinkable sheath (22) for wrapping said end (E) and sealingly shrinking onto said end (E).
2. The end cap (10) of claim 1, including a removable protection layer (20) of said filling of adhesive material (18).
3. The end cap (10) of claim 2, wherein said removable layer (20) is provided with a pull-tab (20a).
4. The end cap (10) of any of the preceding claims, wherein said at least one peripheral wall (14) is dimensioned to form, around said end (E), a penetration gap for said adhesive material (18).

5. The end cap (10) of any of the preceding claims, wherein said shrinkable sheath (22) includes a heat-shrinkable sheath.
6. A method of providing an end seal in at least one lighting module (M) having an exposed end (E), the method including:
 - providing an end cap (10) according to any of claims 1 to 5,
 - coupling said end cap (10) with said end (E), by applying said body wall (12) against said end (E) and with said at least one peripheral wall (14) extending around said end (E).
7. The method of claim 6, including causing said adhesive material (18) to penetrate into a gap between said peripheral wall (14) and said module (M).
8. The method of claim 6 or claim 7, including shrinking said sheath (22) vested onto said end (E).
9. The method of claim 8, including heat-shrinking said sheath (22) vested onto said end (E).
10. A lighting device, including:
 - at least one lighting module (M) having an exposed end (E), and
 - an end cap (10) according to any of claims 1 to 5 vested onto said end (E) with said at least one peripheral wall (14) wrapping said end (E).

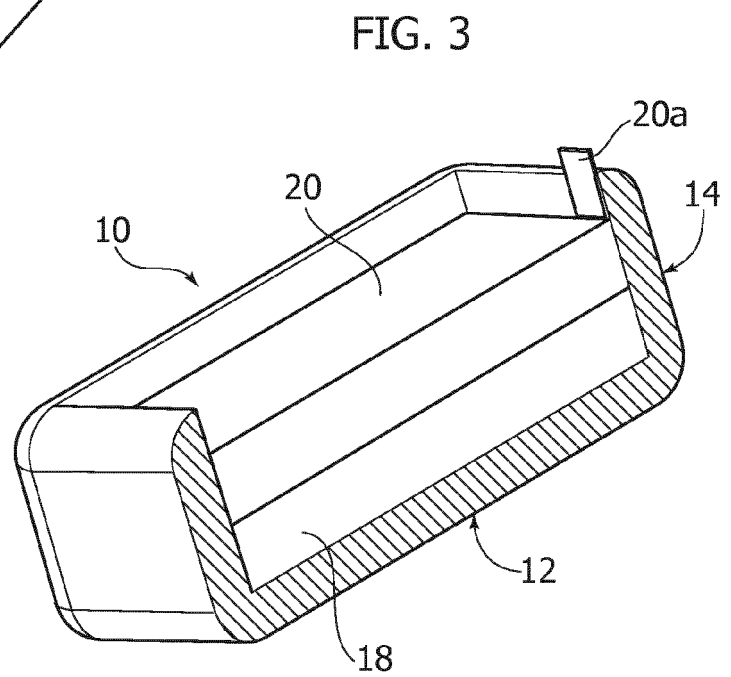
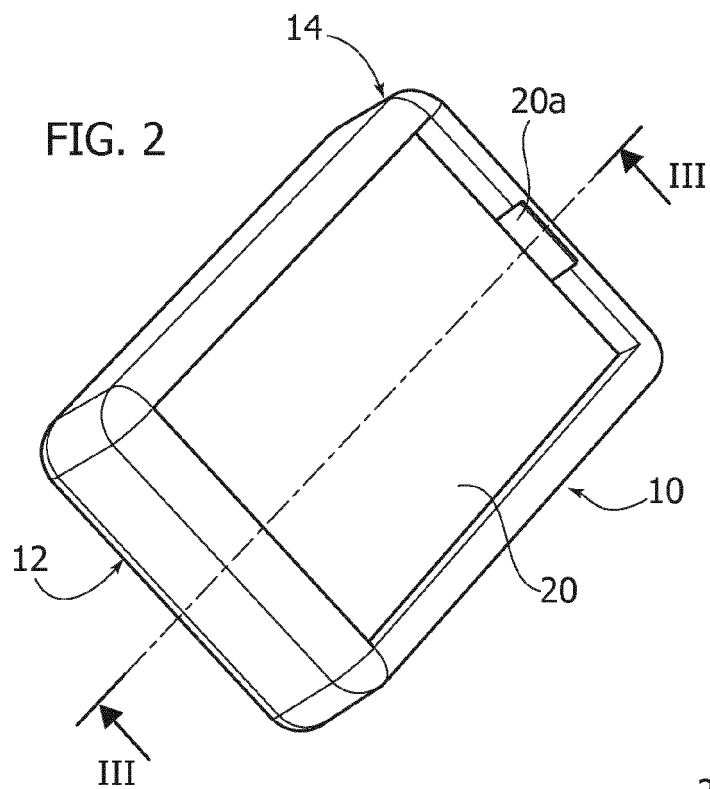
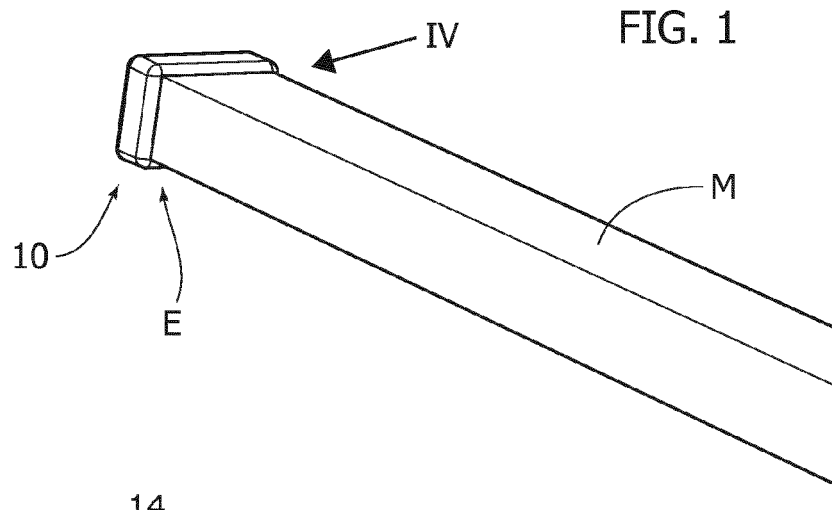


FIG. 4

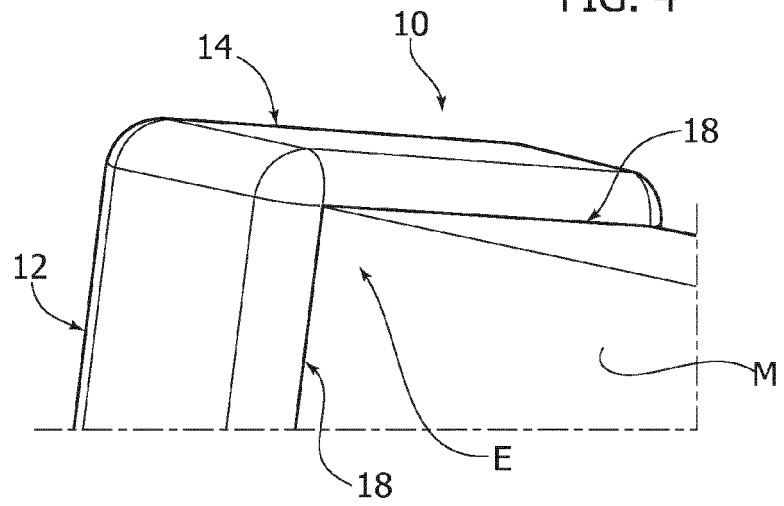


FIG. 5

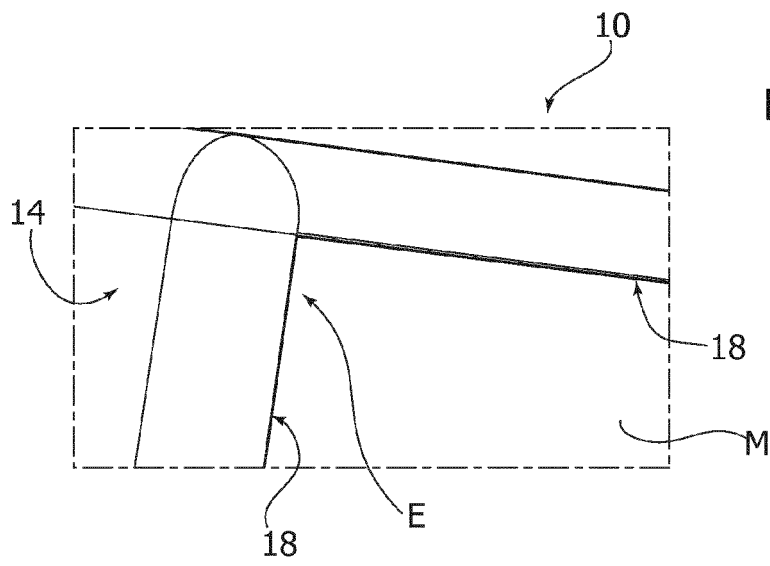


FIG. 6

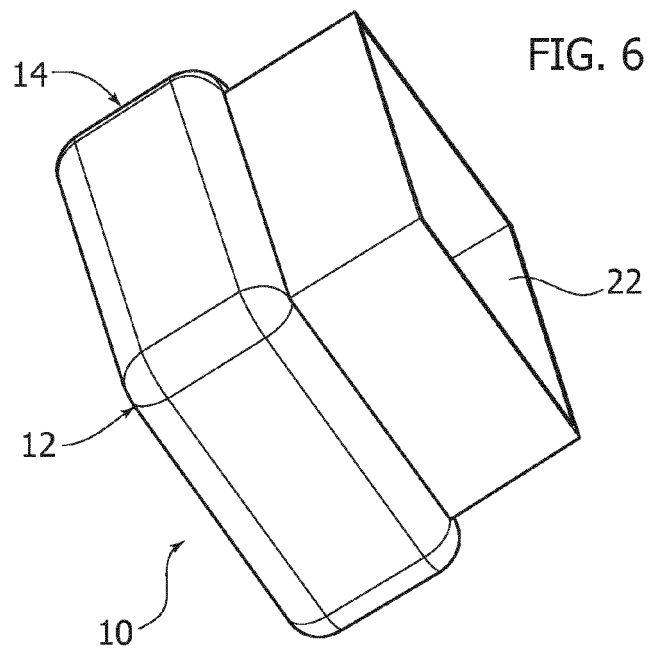


FIG. 7

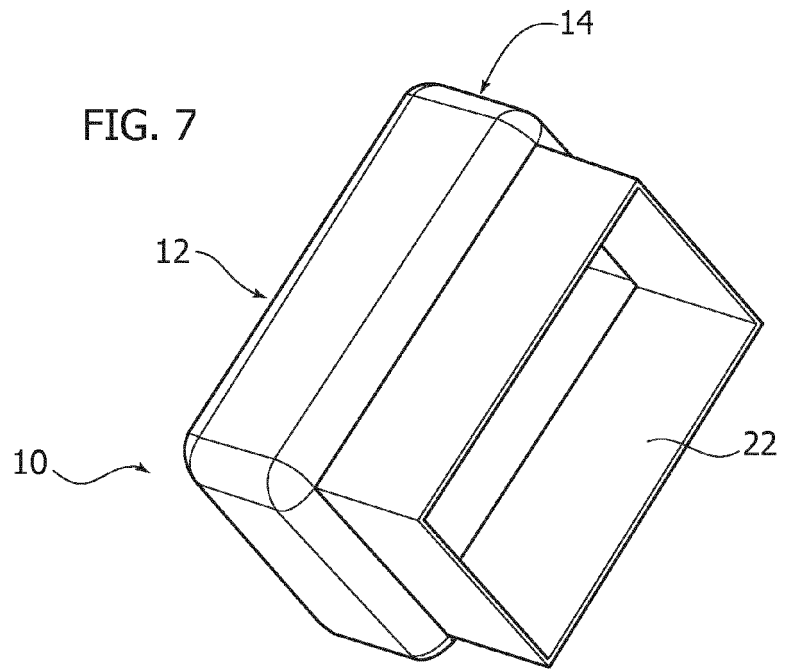


FIG. 8

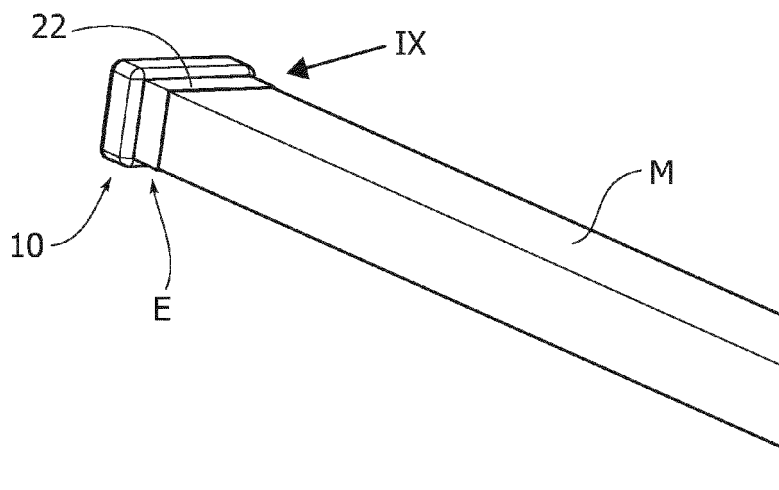
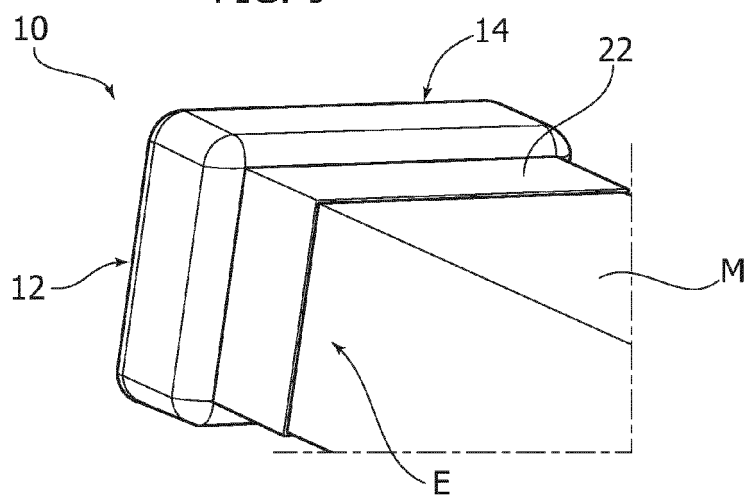


FIG. 9





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