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(54) **LIGHTING APPARATUS**

(57) Lighting apparatus (10), comprising at least one fixed lighting unit (11) provided with at least one light source (12) connected to at least one electric power supply cable (13), and at least one mobile diffuser unit (14) configured to diffuse the light emitted by the light source (12).

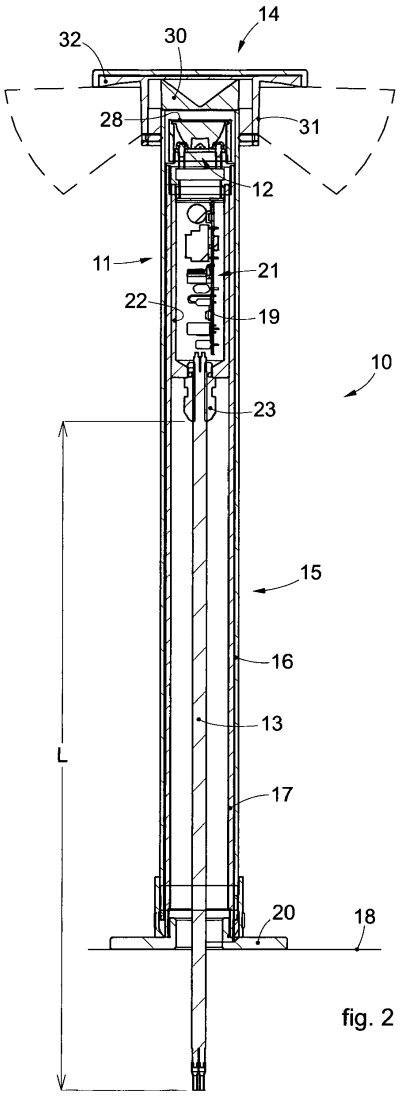

fig. 2

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a lighting apparatus, such as a light pole or suchlike, and in particular a lighting apparatus in which the position of the diffuser unit is adjustable, for example in height. The following description will refer in particular to a light pole, but it is clear that the present invention can also be applied for any other type of lighting apparatus in which it is desirable to vary the position, for example the height, of the light diffuser unit.

BACKGROUND OF THE INVENTION

[0002] It is known that lighting apparatuses generally comprise a lighting unit and a diffuser unit. The lighting unit comprises a light source, for example LEDs, bulbs or suchlike, which is electrically powered by means of a power supply cable.

[0003] The diffuser unit can comprise reflecting and diffusing elements of various shapes and types, in order to diffuse the light coming from the lighting unit in the desired manner, for example in the desired direction and with the desired intensity.

[0004] One type of lighting apparatus is represented by light poles, which usually have a height-adjustable diffuser unit and normally constrained to the lighting unit. The diffuser unit and the lighting unit can be located for example inside a fixed support, therefore when the position of the diffuser unit is changed with respect to the fixed support, the lighting unit inevitably also moves.

[0005] In these light poles, therefore, it is necessary to provide a power supply cable for the lighting unit of variable length, in order to adapt to the different positions taken by the assembly consisting of the diffuser unit and the lighting unit.

[0006] For example, the power supply cable will have a shorter length when the light pole is in the lowered position and a greater length when the light pole is in the raised position.

[0007] The power supply cable is positioned partly rolled up inside a suitable oversized housing, so its length is substantially varied by rolling or unrolling it.

[0008] The power supply cable may therefore be subject to risks of jamming and twisting during its movement to adapt to the position of the diffuser unit.

[0009] The unwanted jamming or twisting of the cable can for example cause the incorrect functioning of the light pole, for example, a jamming of the power supply cable in a retracted position could cause the failed or incorrect raising of the assembly consisting of the diffuser unit and the lighting unit.

[0010] Furthermore, in the production of the light pole, the provision of an oversized housing to accommodate the variable-length power supply cable must in any case be considered.

[0011] There is therefore a need to perfect a lighting apparatus that can overcome at least one of the disadvantages of the state of the art.

[0012] In particular, one purpose of the present invention is to provide a lighting apparatus having a diffuser unit the position of which can be adjusted independently of the position of the lighting unit and in which therefore the movement of the diffuser unit does not entail a lengthening/shortening of the power supply cable.

[0013] Another purpose of the present invention is to provide a lighting apparatus which functions correctly whatever the position taken by the diffuser unit, which is structurally simple and therefore does not require the construction of particular housings for the power supply cable, for example oversized housings or suchlike.

[0014] Another purpose of the present invention is to minimize the overall losses in efficiency of the light intensity due to the distancing of the diffuser unit from the lighting unit.

[0015] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0016] The present invention is set forth and characterized in the independent claim. The dependent claims describe other characteristics of the present invention or variants to the main inventive idea.

[0017] In accordance with the above purposes, a lighting apparatus according to the present invention comprises at least one lighting unit provided with at least one light source connected to at least one electric power supply cable, both in a fixed position, and at least one mobile and independent diffuser unit, configured to effectively diffuse the light emitted by the light source.

[0018] Advantageously, the position of the diffuser unit can be adjusted independently of the position of the lighting unit and consequently the length of the power supply cable remains constant regardless of the position assumed by the diffuser unit.

[0019] This allows to prevent the power supply cable from being subjected to unwanted bends, twists or blocks that could cause the apparatus to not function correctly.

[0020] Therefore, the present lighting apparatus functions correctly whatever the position assumed by the diffuser unit, it is structurally simple and does not require the construction of special housings for the power supply cable.

[0021] According to another aspect of the invention, this diffuser unit can be associated with a light channeling element having a variable extension so as to adjust the distance between the lighting unit and the diffuser unit.

[0022] According to another aspect of the invention, the channeling element can comprise, for example, at least one substantially tubular element with which the diffuser unit is associated and preferably telescopically

extractable with respect to a support with which the lighting unit is associated.

[0023] The diffuser unit can be housed on the top, or more generally at the end, of the channeling element.

[0024] The support can be, for example, a tubular element inside which the lighting unit is housed.

[0025] The lighting unit can be housed on the top, or also in this case more generally at the end, of the support.

[0026] The tubular element can be fitted on the support, therefore if the tubular element and the support have a cylindrical section, the tubular element has an internal diameter greater than the external diameter of the support.

[0027] The lighting unit and the diffuser unit can be substantially coaxial, so as for example to adjust the position in height of the diffuser unit with respect to the lighting unit.

[0028] The lighting unit can comprise at least one optical element for emitting a very narrow beam of light, that is, preferably having an amplitude comprised between about 3° and about 20°.

[0029] The lighting unit can comprise a system for clamping the cable into position. The diffuser unit can comprise at least one optical element, at least one diffusing element and at least one reflective element which are clearly distinct or made by means of a single component.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] These and other aspects, characteristics and advantages of the present invention will become apparent from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings that show the possible application in a light pole for external environments with installation in the ground, wherein:

- fig. 1 is a three-dimensional view of a lighting apparatus that incorporates the present invention in a retracted position;
- fig. 2 is a longitudinal section view of the lighting apparatus of fig. 1;
- fig. 3 is a three-dimensional view of the lighting apparatus in an extended position;
- fig. 4 is a longitudinal section view of the lighting apparatus of fig. 3;
- fig. 5 is a three-dimensional and exploded view of a lighting unit of the present lighting apparatus;
- fig. 6 is a three-dimensional view of a support of the lighting unit;
- fig. 7 is a three-dimensional and exploded view of a diffuser unit;
- fig. 8 is a three-dimensional view of a channeling element with which the diffuser unit is associated.

[0031] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one embodiment can conveniently be incorporated into other embodiments without further clarifications.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

[0032] We will now refer in detail to the possible embodiments of the invention, of which one or more non-limiting examples are shown in the attached drawings. The phraseology and terminology used here is also for the purposes of providing non-limiting examples.

[0033] With reference to the attached drawings, see in particular fig. 1 and fig. 2, a lighting apparatus 10 according to the present invention comprises at least one fixed lighting unit 11 provided with at least one light source 12 connected to at least one electric power supply cable 13, and at least one mobile diffuser unit 14, configured to diffuse the light emitted by the light source 12 and separated from the lighting unit 11.

[0034] The diffuser unit 14 can be associated with a light channeling element 15 having a variable extension so as to adjust the distance between the lighting unit 11 and the diffuser unit 14.

[0035] Basically, the channeling element 15 has the function of containing toward the outside the light radiation from the generation point represented by the lighting unit 11 to the external emission point represented by the diffuser unit 14.

[0036] The channeling element 15, see also fig. 3 and fig. 4, can comprise at least one tubular element 16 with which the diffuser unit 14 is associated. The tubular element 16 can be telescopically extractable with respect to a support 17 with which the lighting unit 11 is associated. Of course, there could be provided several extractable tubular elements associated with such support 17.

[0037] The support 17 can also be a tubular element inside which the lighting unit 11 is housed. The lighting unit 11 is preferably housed on the top of the support 17, so as to be at the minimum distance from the channeling element 15. In this case, the power supply cable 13 will therefore substantially pass through the entire extension of the support 17 and therefore will be connected on one side to the lighting unit 11 and on the other to a source of electrical energy, for example a normal mains power supply network.

[0038] Preferably, by way of a non-limiting example, the tubular element 16 is fitted onto the support 17, therefore if the tubular element 16 and the support 17 have a cylindrical section, the tubular element 16 will have an internal diameter greater than the external diameter of the support 17. In this way, the light passage section is not reduced passing from the lighting unit 11 to the channeling element 15.

[0039] The telescopic tubular system described above for producing the channeling element 15 is only one of the possible solutions for this channeling element 15, which could therefore also be made according to other

modalities that in any case provide the movement of the channeling element 15 so as to adjust the distance between the lighting unit 11 and the diffuser unit 14.

[0040] The support 17 can be attached on, or embedded in, an installation surface 18. If the lighting apparatus 10 is a light pole, the installation surface 18 is the ground and the support 17 can be anchored to the ground by means of a base 20. The base 20 can comprise an aperture for the cable 13 to exit toward the source of electrical energy.

[0041] The diffuser unit 14 can be housed on the top of the channeling element 15, in order to correctly diffuse the light emitted by the lighting unit 11 and in order to obtain the maximum possible extension for the lighting apparatus 10.

[0042] The lighting unit 11 and the diffuser unit 14 are therefore substantially coaxial and, if the lighting apparatus 10 is a light pole, the height of the diffuser unit 14 with respect to the fixed lighting unit 11 can be varied thanks to the mobile channeling element 15 with which the diffuser unit 14 is associated.

[0043] The lighting unit 11, see in particular fig. 5 and fig. 6, can comprise a command and drive assembly 21, provided for example with a compartment 22 which houses inside it an electronic circuit 19 for powering and piloting the light source 12, for example one or more LEDs. The compartment 22 can optionally be made hermetically sealed by means of suitable sealing means, such as for example an O-ring or suchlike, for example a cable gland.

[0044] Furthermore, in the lighting unit 11 there can be provided a system 23 for clamping the cable 13 into position, for example a strap or suchlike, useful for preventing any accidental twisting and/or detaching phenomena.

[0045] If the light source 12 is LED-based, it can comprise a printed circuit 25 on which an LED diode is positioned, for example an XHP35 or XPG2 LED. This printed circuit 25 can be positioned on a metal support 26 by means of attachment means 24, such as screws or suchlike.

[0046] The lighting unit 11 can also be provided with at least one optical element 28, for example a polycarbonate lens, with emission of a very narrow beam of light, that is, preferably having an amplitude comprised between about 3° and about 20°. This optical element 28 can be part of a light emission assembly 27 and possibly be housed on a clamping and/or centering support 29. In this way, the lighting unit 11 is able to generate a "very narrow" beam of light. The optical element 28 could be the light source 12 itself, a reflector instead of the lens, or other.

[0047] The fact that the beam generated by the lighting unit 11 is narrow means that a large part of the emitted light radiation directly reaches the diffuser unit 14, limiting the continuous light refractions generated by the outermost beams of light that impact the internal walls of the channeling element 15 and which could cause a loss of output of the lighting apparatus 10. Thanks to the narrow beam generated by the lighting unit 11, the light output is therefore influenced by the distance between the lighting unit 11 and the diffuser unit 14 in a substantially negligible manner.

[0048] The diffuser unit 14, see in particular fig. 7 and fig. 8, can comprise an optical element 30, preferably made of polycarbonate, suitably designed and manufactured to receive all the light coming from the lighting unit 11 and completely radiate it to a diffusing element 31.

[0049] The diffusing element 31 can consist of a shaped diffuser, preferably made of polycarbonate, able to homogenize the light coming from the optical element 30.

[0050] The diffuser unit 14 will also comprise a reflective element 32 comprising for example a body or preferably a disc made of plastic material with an ultra-reflective white finish which recovers a large part of the luminous flux that may have escaped from the diffusing element 31, in order to redirect it toward the latter and therefore toward the outside. The diffuser unit 14 can be completed by a cover 33, for example with a circular shape, as shown.

[0051] In some embodiments, the optical element 30, the diffusing element 31 and the reflective element 32 could be made clearly distinct or by means of a single component specifically designed to emit a particular desired beam of light toward the outside.

[0052] In figs. 1 and 2 the present lighting apparatus 10 is shown in a retracted position, that is, in the case of a light pole, with the diffuser unit 14 at the minimum height from the ground. In figs. 3 and 4 the present lighting apparatus 10 is shown in an extended position, that is, in the case of a light pole, with the diffuser unit at the maximum height above the ground.

[0053] As can be seen, in both situations, see in particular fig. 2 and fig. 4, the electric power supply cable 13 has a constant length L, since the lighting unit 11 remains fixed while the diffuser unit 14 is raised or lowered, thanks to the movement of the channeling element 15 with which it is associated.

[0054] The length L of the cable 13 is therefore substantially independent of the movements of the diffuser unit 14 away from or toward the lighting unit 11, therefore the need of known lighting apparatuses to shorten or lengthen the cable is overcome, and incidents of the cable getting stuck and twisted are thus prevented.

[0055] Therefore, in this lighting apparatus it is not necessary to provide power supply cables of increased length or particular housings that have to accommodate the cable, for example in a rolled-up configuration or in any case in a non-extended configuration.

[0056] It is clear that modifications and/or additions of parts may be made to the lighting apparatus as described heretofore, without departing from the field and scope of the present invention as defined by the claims, and that the proposed solution can be integrated in lighting apparatuses of a different shape of type of installation.

[0057] In the following claims, the sole purpose of the references in brackets is to facilitate reading: they must

not be considered as restrictive factors with regard to the field of protection claimed in the specific claims.

Claims

1. Lighting apparatus (10), comprising at least one lighting unit (11) provided with at least one light source (12) connected to at least one electric power supply cable (13), both in a fixed position, and at least one mobile and independent diffuser unit (14) configured to effectively diffuse the light emitted by said light source (12).

2. Lighting apparatus (10) as in claim 1, **characterized in that** said diffuser unit (14) is separated and unconstrained from said lighting unit (11) and is associated with a light channeling element (15) having a variable extension so as to adjust the distance between said lighting unit (11) and said diffuser unit (14).

3. Lighting apparatus (10) as in claim 2, **characterized in that** said channeling element (15) comprises at least one substantially tubular element (16) with which said diffuser unit (14) is associated and preferably telescopically extractable with respect to a support (17) with which said lighting unit (11) is associated.

4. Lighting apparatus (10) as in claim 2, **characterized in that** said diffuser unit (14) is housed on the top, or more generally at the end, of the channeling element (15).

5. Lighting apparatus (10) as in claim 3, **characterized in that** said support (17) is a substantially tubular element inside which said lighting unit (11) is housed.

6. Lighting apparatus (10) as in claim 3, **characterized in that** said lighting unit (11) is housed on the top, or more generally at the end, of said support (17).

7. Lighting apparatus (10) as in claim 3, **characterized in that** said tubular element (16) is fitted onto said support (17), therefore, if said tubular element (16) and said support (17) have a cylindrical section, said tubular element (16) has an internal diameter greater than the external diameter of said support (17).

8. Lighting apparatus (10) as in any claim hereinbefore, **characterized in that** said lighting unit (11) and said diffuser unit (14) are substantially coaxial.

9. Lighting apparatus (10) as in any claim hereinbefore, **characterized in that** said lighting unit (11) comprises at least one optical element (28) for emitting a very narrow beam of light, that is, preferably having an amplitude comprised between about 3° and about 20°.

10. Lighting apparatus (10) as in any claim hereinbefore, **characterized in that** said lighting unit (11) comprises a system (23) for clamping the cable (13) into position.

11. Lighting apparatus (10) as in any claim hereinbefore, **characterized in that** said diffuser unit (14) comprises at least one optical element (30), at least one diffusing element (31) and at least one reflective element (32) which are clearly distinct or made by means of a single component.

12. Lighting apparatus (10) as in any claim hereinbefore, **characterized in that** it is a light pole.

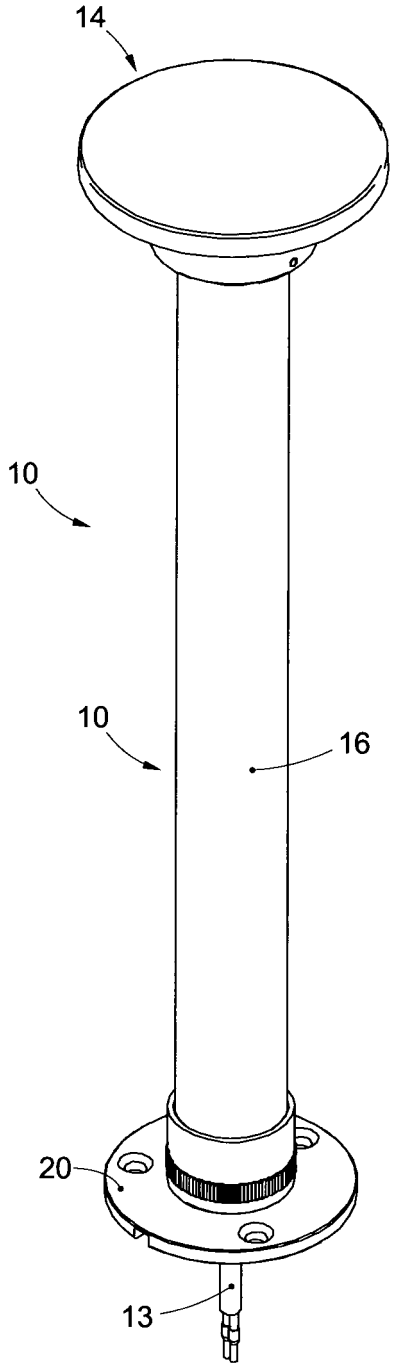

fig. 1

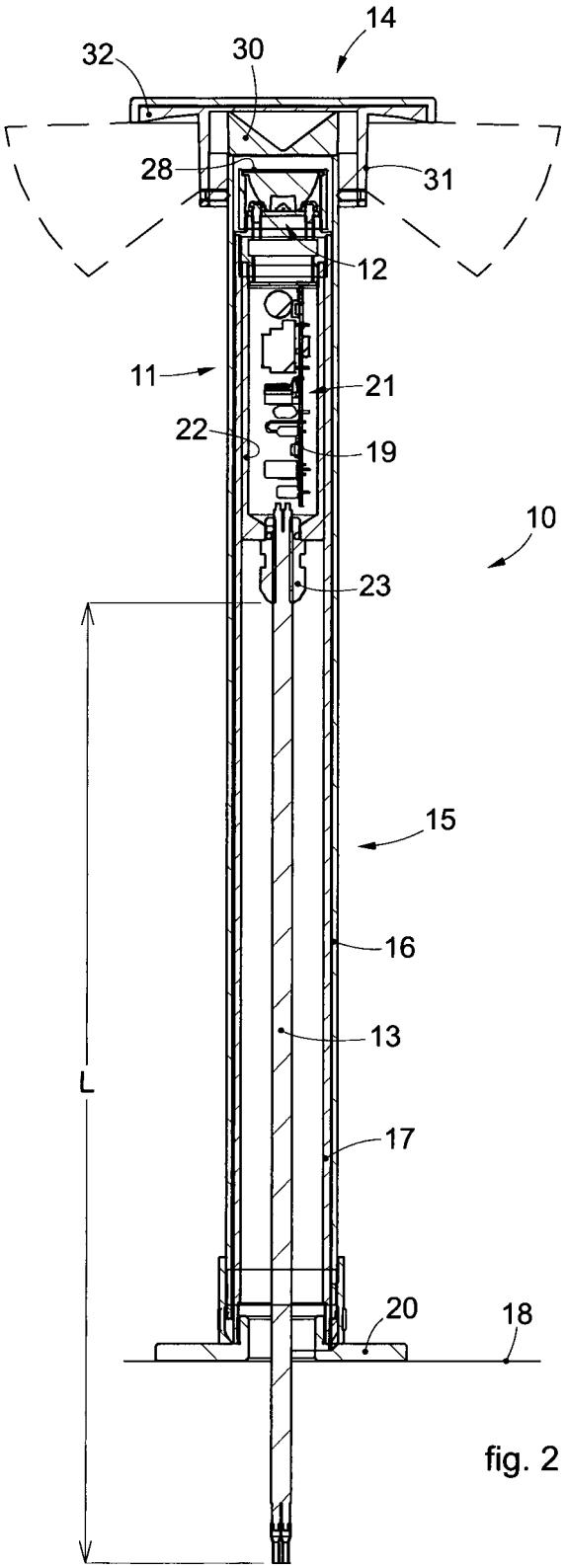

fig. 2

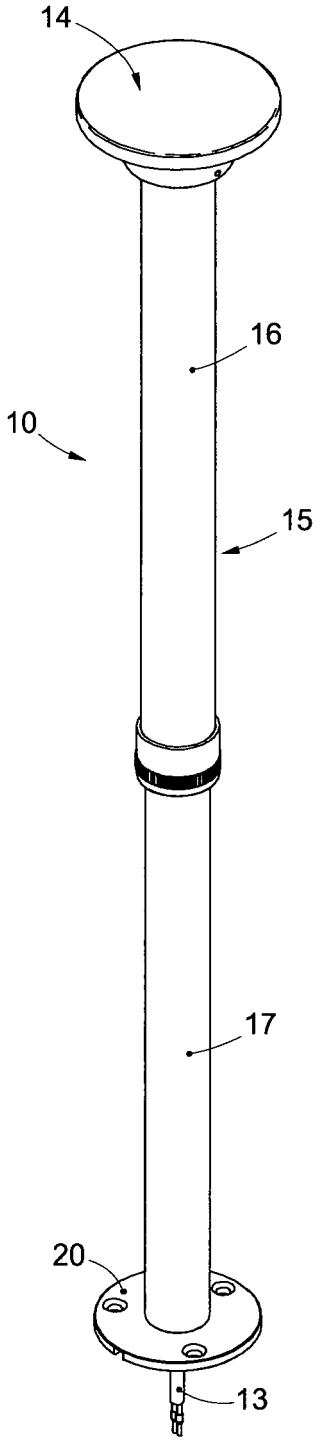

fig. 3

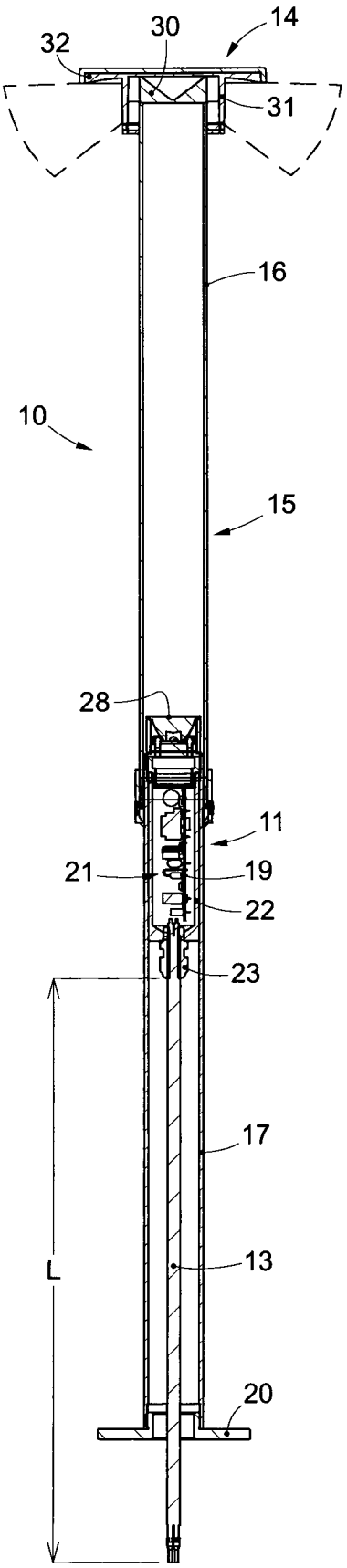

fig. 4

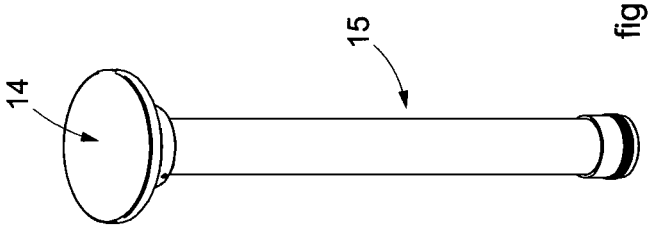

fig. 8

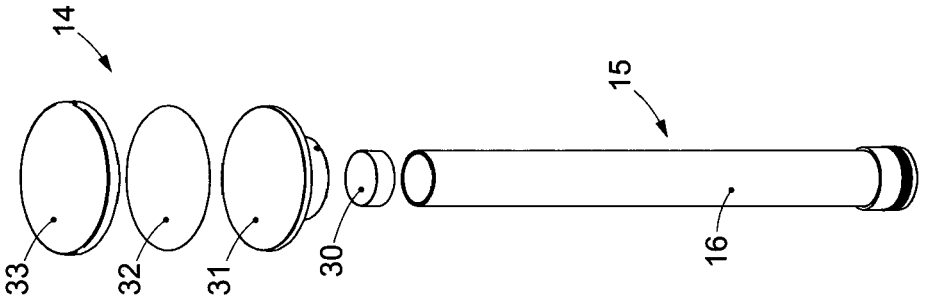

fig. 7

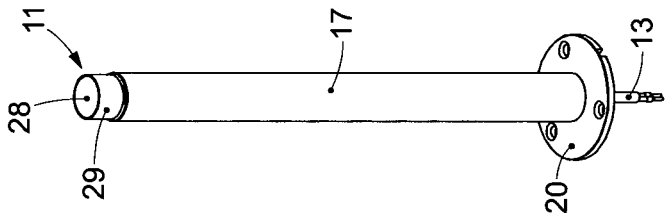

fig. 6

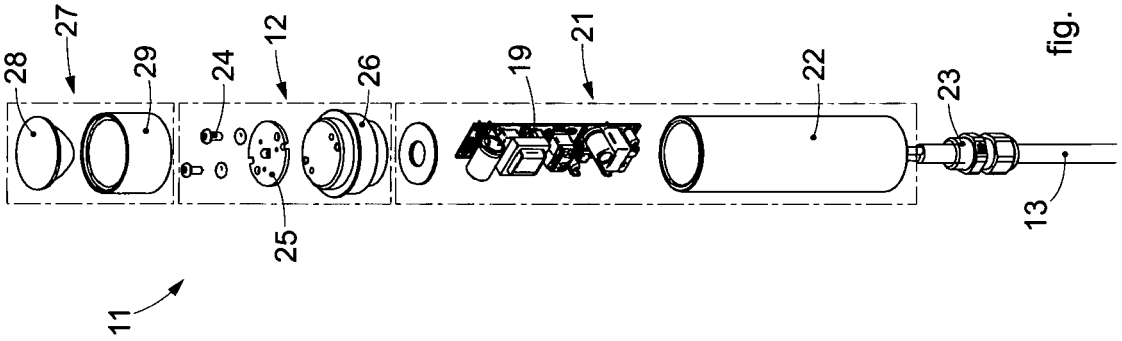

fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 21 42 5020

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 October 2021	Prévot, Eric

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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