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(54) **LED-TYPE LUMINOUS SIGNALING DEVICE AND RELATIVE CONTROL METHOD**

LED-LEUCHTSIGNALVORRICHTUNG UND ZUGEHÖRIGES STEUERVERFAHREN

DISPOSITIF LUMINEUX DE SIGNALISATION DU TYPE À DELS ET MÉTHODE DE COMMANDE ASSOCIÉE

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(56) References cited:
**EP-A1- 0 974 947 EP-A2- 1 215 641
WO-A1-02/19776 US-A1- 2006 001 547**

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a LED-type luminous signaling device used, for example but not only, in traffic-light apparatuses.

[0002] In particular, the luminous signaling device according to the present invention is preferentially used in traffic-light apparatuses to regulate rail or road traffic, whether driven manually or automatically.

[0003] Here and hereafter in the description, as a non-restrictive example, we will refer specifically to traffic-light apparatuses used in railroad applications, but it cannot be excluded that the luminous signaling device according to the present invention can also be applied to other types of signaling apparatuses, such as signaling buoys, signaling devices for electric pylons or cables, or public lighting devices.

[0004] More generally, and without constituting a limitation, the device according to the invention is applied in cases where it is desired to guarantee a great safety in the correct functioning of luminous signaling systems, in order to prevent accidents or dangerous situations for persons or things.

[0005] The invention also concerns the connected control method.

[0006] EP-A-1.215.641 discloses the features of the preamble of the main claims 1 and 8.

BACKGROUND OF THE INVENTION

[0007] On the railways, in order to guarantee a correct functioning of traffic-light apparatuses, that is, to ensure adequate diagnostics that will signal possible anomalies in functioning, it is known to associate with the electric lines that feed the lamps a device to detect the current that is actually absorbed.

[0008] This allows to detect, in the event of a partial or total breakage of the lamp, that the expected value of electronic current has not been absorbed, and therefore to signal said malfunction to the operators responsible for supervising the rail traffic. In this way it is possible to act quickly, for example by modifying the current state of rail traffic, warning the personnel driving the trains and the operators responsible for maintenance of the rail network in order to carry out the appropriate operations.

[0009] Moreover, in numerous fields of application, it is more and more frequent to use LED-type luminous elements both because the light emitted is more direct and coherent, and also because they last longer and have lower electric consumption, given the same light emitted, compared with traditional lamps. Another advantage of LED-type luminous elements is that given by their nature as multi-point emitter, so that they can continue to carry out their function even when there is a breakage and/or malfunction in some of the elements.

[0010] Since this is an innovative technology, it is only

recently that such LED-type luminous elements have been applied in traffic-light apparatuses on the railways or suchlike.

[0011] Since it is more complex than the filament of a bulb, LED technology has a lot of cases of breakdowns, for example an open LED, a short-circuited LED, low light emission, or others.

[0012] This entails a real difficulty in guaranteeing high reliability of the functioning diagnostics, which is, however, indispensable in such types of luminous signaling applications.

[0013] Indeed it is practically impossible to identify with certainty all the possible conditions of breakage or malfunctioning of LED-type elements based on the analysis or detection of electric quantities, such as current, tension, electric power absorbed.

[0014] Given their nature, it is extremely difficult to distinguish between a condition in which total or partial current is absorbed in order to understand if there are sufficient LED elements functioning to guarantee the correct functioning of the signaling device. It is also possible for a LED element that is not emitting luminous radiation to absorb current in any case, thus rendering it impossible to detect that it is broken, except by carrying out a visual inspection.

[0015] Furthermore, unlike the traditional incandescent bulb, LED technology, since it is multi-source, allows to keep the device in an operating state even in the event of one or more elementary LED sources not functioning. Indeed there are different techniques to guarantee full functioning even in poor conditions, such as for example the use of current shunt to the heads of broken LEDs, increasing the pilot current on LEDs that are still whole, or others. However, in this case too, as we said before, it is difficult to detect reliable diagnostic data based on the detection of the functioning electric quantities of the LEDs.

[0016] Purpose of the present invention is to achieve a LED-type luminous signaling device used preferably, but not only, in traffic-light apparatuses, which makes the functioning diagnostics reliable, detecting and signaling possible malfunctions, even partial, such as breakages or considerable reductions in the luminous radiation emitted.

[0017] 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

[0018] The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0019] In accordance with the above purpose, a LED-type luminous signaling device according to the present invention comprises one or more LED-type luminous

emission sources and at least a light-directing lens suitable to diffuse the luminous radiation emitted by a corresponding LED-type luminous emission source in at least one signaling direction.

[0020] According to a characteristic feature of the present invention, the light-directing lens is conformed so as to define at least an interception portion suitable to divert a predefined fraction of total luminous radiation emitted by each LED-type luminous emission source in one or more control directions different from the signaling direction. The signaling device comprises optical detection means disposed coherent with a corresponding control direction so as to detect said predefined fraction of luminous radiation diverted by the interception portion.

[0021] In this way it is possible to obtain, substantially continuously, an optical feedback that allows to detect the actual and real functioning of the LED-type luminous emission sources, that is, of the signaling device, thus achieving a safe and reliable diagnostic function. Indeed, since the fraction of luminous radiation diverted with respect to the total emitted is known, a reduction in said fraction, as detected by the optical detection means, allows to identify and thus to signal possible functioning anomalies.

[0022] According to a variant of the present invention, the LED-type luminous emission source or sources emit luminous radiation on the same wavelength.

[0023] According to a variant of the present invention the LED-type luminous emission sources are divided into two or more groups, uniformly distributed on a single support, each group being able to be alternately activated and suitable to emit luminous radiation at a determinate wavelength. In this way, by selectively controlling the activation of each group of LED-type luminous emission sources it is possible to emit a luminous radiation of the desired color, for example red, amber or green, or to provide that all the LED-type luminous emission sources are the same color, thus being able to activate the groups alternately, allowing to increase the operating duration of the device.

[0024] According to a variant of the present invention, the signaling device comprises control and processing means, connected to the optical detection means, to acquire the detection data and to calculate the quantity of luminous radiation emitted over all.

[0025] According to another variant, the device comprises an electric load, or fictitious load, able to be selectively activated according to the detection of the quantity of light emitted over all and detected by the optical detection means. In this way, by switching said electric load on or off, according to the real functioning state of the device, it is possible to signal a functioning anomaly that can be detected remotely as if the signaling device were actually provided with a traditional lamp.

[0026] According to another variant of the present invention, the one or more light-directing lenses comprise darkening portions, suitable to absorb incident light from outside the signaling device. In this way it is possible to

prevent detection errors by the detectors, produced for example by a high level of incident ambient light on the light-directing lens or lenses.

5 BRIEF DESCRIPTION OF THE DRAWINGS

[0027] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a view from above of a LED-type luminous signaling device according to the present invention;
- fig. 2 is a perspective schematic view of a detail of the device in fig. 1;
- fig. 3 is an enlarged lateral schematic view of a detail of fig. 2;
- fig. 3A is an enlarged view of a detail in fig. 3;
- fig. 3B is a view from above of fig. 3A;
- fig. 4 is a functional block diagram of the device in fig.1.

[0028] To facilitate comprehension, the same reference numbers have been used, where possible, to identify common elements that are identical in the drawings. It is understood that elements and characteristics of one form of embodiment can conveniently be incorporated in other forms of embodiment without any further clarifications.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF

35 EMBODIMENT

[0029] With reference to the attached drawings, a LED-type luminous signaling device 10 according to the present invention is advantageously used in a traffic-light apparatus, not shown in the drawings, used for example to regulate rail traffic.

[0030] The device 10 comprises a support 12, provided with a plurality of light-directing lenses 14 made in a single piece with the support 12. The support 12 is made by molding in plastic or polymer material, for example polycarbonate. The support 12 is stably coupled with an electronic card 13, or PCB (Printed Circuit Board), on which a plurality of LED-type luminous sources 16 are mounted, each associated with a corresponding light-directing lens 14, and a plurality of photo-detectors 17.

[0031] The support 12 and the electronic card 13 are similar in shape, in this case substantially circular, able to allow them to be stably inserted in a containing structure of the traffic-light apparatus. The LED-type luminous sources 16 are mounted on the electronic card 13, in a predetermined disposition consistent with the disposition of the light-directing lenses 14 on the support 12, so as to define an effective area of light emission, substantially

concentrated in correspondence with the light-directing lenses 14.

[0032] In particular, the light-directing lenses 14 comprise a collimation portion 22 (fig. 3), disposed below the lens 14 and suitable to collimate in a single direction, or signaling direction, the luminous radiations emitted by an associated LED-type luminous source 16 in different directions. In this case the signaling direction is perpendicular to the plane identified both by the electronic card 13 and also by the upper surface of the support 12.

[0033] The light-directing lens 14 also comprises an exit portion 24, substantially flat, circular in shape, made on an upper face of the support 12. From the exit portion 24 the luminous radiations of the LED-type luminous sources 16 are emitted toward the outside in the signaling direction.

[0034] The light-directing lenses 14 are grouped together in modules 15 of three (fig. 2), in a regular disposition, in which the center of each light-directing lens 14 of the same module 15 is positioned in correspondence with the tops of an equilateral triangle and the corresponding exit portions 24 are reciprocally tangent in pairs. This modular disposition is repeated continuously and regularly over the whole support 12.

[0035] Each light-directing lens 14 of the same module 15 is associated with an underlying LED-type luminous source 16 of a different color. In this way, for each module 15, the corresponding triad of LED-type luminous sources 16 is able to be activated alternately, so as to switch them on one at a time, and thus to emit from the device 10 a luminous radiation of the desired color.

[0036] It is understood that the LED-type sources 16 can be the same type, that is, they can emit luminous radiation on the same wavelength, corresponding to a single color, in this case achieving a signaling device having a single signaling function, and in which all the LED-type sources 16 are activated simultaneously, or alternatively one LED-type source 16 at a time, so as to prolong the duration of operative functioning of the device 10.

[0037] At least some of the light-directing lenses 14, in correspondence with their exit portion 24, have an interception portion 18, able to divert a predefined fraction of light, that is, a known percentage of the total light emitted by each LED-type source 16. In particular, as shown in figs. 1 and 2, the interception portion 18 has a circular shape, common to the three light-directing lens 14 of the same module 15.

[0038] The interception portion 18 comprises an interception prism 19 (figs. 2 and 3) of the total reflection type, having an inclination of about 45 degrees with respect to the flat upper surfaces of the exit portion 24 and the interception portion 18, and a circular surface development. The interception prism 19 is suitable to intercept the predefined fraction of light emitted by the LED-type sources 16 associated with the module 15 and to reflect it in a direction substantially parallel to the flat surfaces of the interception portion 18 and the exit portion 24, that

is, perpendicular to the signaling direction.

[0039] The length of the interception prism 19, and hence the thickness of the interception portion 18 with respect to the exit portion 24, is made both as a function of the wavelength of the luminous radiations emitted, and also as a function of the predefined fraction of luminous radiation to be intercepted.

[0040] According to a preferential embodiment, the predefined fraction of luminous radiation to be intercepted is around one per cent.

[0041] The interception portion 18 also comprises a reflection prism 20, again of the total reflection type, disposed in a central position with respect to the interception portion 18. The reflection prism 20 is suitable to reflect the fraction of luminous radiation intercepted by the interception portion 19 toward an area of the electronic card 13, central with respect to the three light-directing lenses 14, in correspondence with which area the associated photo-detector 17 is mounted. The reflection prism 20 is substantially shaped conical, with the lateral surface inclined by about 45 degrees with respect to the upper flat surface of the interception portion 18.

[0042] According to a variant, shown schematically in the block diagram in fig. 4, where only one photo-detector 17 and only one LED-type source 16 are shown, the signaling device 10 also comprises a processing and control unit 30, directly connected both to the photo-detectors 17 and also to the LED-type sources 16. The processing and control unit 30 is suitable to switch on the LED-type sources 16, based on a command received for example from remote, and also to acquire the data relating to the fraction of luminous radiation detected by the photo-detectors 17 and then to calculate the total luminous radiation emitted by the device 10.

[0043] The processing and control unit 30 can be a microprocessor of a known type, typically used in electronic devices.

[0044] Furthermore, in this solution, the device 10 comprises a fictitious electric load 32, connected to the control unit 30, able to be selectively driven by it according to the detection of total luminous radiation emitted by the device 10 and calculated by means of the detection of the corresponding fraction intercepted by the photo-detectors 17. The load 32 is switched on or off according to the real functioning state of the device 10, which allows to signal any functioning anomaly, for example detected remotely, as if the signaling device were actually provided with a traditional type lamp.

[0045] Advantageously some of the modules 15 of the device 10 are not provided with the interception portion 18, inasmuch as the light they emit is not sent in the signaling direction but is intercepted outside the device 10 by a front shield of the traffic-light apparatus, not shown. This light is diverted toward the bottom of the traffic-light apparatus so as to allow the operators responsible for maintenance to inspect the actual functioning state visually.

[0046] Advantageously, at least part of the support 12

comprises darkening portions 26, in which the plastic material is made opaque in correspondence with the spaces between the modules 15. This is to absorb the external light incident on the signaling device 10 and therefore to prevent external ambient luminous radiation being detected by the photo-detectors 17, which is not wanted.

[0047] The LED-type signaling device 10 as described heretofore functions as follows.

[0048] When the signaling device 10 is switched on, that is, when a first group of LED-type luminous sources 16 corresponding to the desired color is activated, a plurality of rays R' emitted by each LED-type source 16 in different directions is collimated by the collimation portion 22 into corresponding rays R" in the signaling direction. The rays R" are sent, inside the light-directing lens 14, toward the exit portion 24, striking it perpendicularly and coming out as rays emitted Re in the signaling direction.

[0049] A predetermined fraction of rays R', which after collimation inside the lens 14 is transformed into control rays Rc', incident on a part of the interception prism 19, is totally reflected by it and transformed into rays Rc" in a direction perpendicular to the signaling direction (figs. 3, 3A and 3B). The rays Rc" are propagated along the surface of the interception portion, substantially radially toward the center of the module 15 as far as the interception prism 20, in correspondence with which they are further reflected, totally, into corresponding control rays Rc'" toward the corresponding photo-detector 17 disposed on the electronic card 13.

[0050] The processing and control unit 30 acquires in a known manner the luminous radiation detected by each photo-detector 17, calculating the luminous radiation emitted overall by the device 10, according to the known and predefined percentage of the interception fractions of the interception prisms 19.

[0051] The detection of the luminous radiation captured by the photo-detectors 17 does not refer to an absolute emission value, but to a relative value corresponding to a stream of light specifically defined for each optical group. In fact, when the device 10 is inserted in a containing structure of the traffic-light apparatus, the calibration of the threshold level below which the malfunction is signaled allows to keep in consideration all the constructional variables of the signaling device 10, both mechanical and electrical, which can influence the stream of light actually emitted.

[0052] If from said calculation it emerges that the total light emitted by the device 10 is less than a predetermined functioning threshold, the device 10 activates an anomaly or breakdown signal, such as for example switching off the fictitious load 32, therefore allowing the remote detection of the functioning anomaly by a traffic control center.

[0053] It is understood that the signal can be done in a different way, for example by sending a message through a suitable communication network, by a wave conveyed on the electric feed line of the traffic-light apparatus.

[0054] It is clear that modifications and/or additions of parts and/or steps may be made to the LED-type luminous signaling device 10 and the relative control method as described heretofore, without departing from the field and scope of the present invention.

[0055] For example, it comes within the field of the present invention to provide that each module 15 is associated with a pair of photo-detectors 17, independent of each other, so as to guarantee a greater functioning reliability and detection efficiency.

[0056] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of LED-type luminous signaling device and the relative control method, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. LED-type luminous signaling device comprising one or more LED-type luminous emission sources (16) and at least a light-directing lens (14) able to diffuse the luminous radiation emitted by a corresponding LED-type luminous emission source (16) in at least one signaling direction, **characterized in that** the at least one light-directing lens (14) is conformed so as to define at least an interception portion (18) suitable to divert a predefined fraction of total luminous radiation emitted by each LED-type luminous emission source (16) in one or more control directions, different from the signaling direction, wherein the signaling device comprises optical detection means (17) disposed coherently with the control direction so as to detect said predefined fraction of luminous radiation diverted by the interception portion (18).
2. Device as in claim 1, **characterized in that** the LED-type emission source or sources (16) emit luminous radiation on the same wave length.
3. Device as in claim 1 or 2, **characterized in that** the LED-type luminous emission sources (16) are divided into two or more groups, uniformly distributed on a single support (12), each group being able to be alternately activated and suitable to emit luminous radiation on a predetermined wave length.
4. Device as in any claim hereinbefore, **characterized in that** it comprises darkening portions (26) able to absorb incident luminous radiation from outside the device.
5. Device as in any claim hereinbefore, **characterized in that** it comprises control and processing means (30), connected to the optical detection means (17),

and able to acquire the data from the optical detection means (17), in order to calculate the overall luminous radiation emitted.

6. Device as in any claim hereinbefore, **characterized in that** it comprises an electric load (32) able to be selectively activated according to the detection of the overall luminous radiation emitted and detected by the optical detection means (17).
7. Traffic-light apparatus used on the railways or roads comprising a LED-type signaling device (10) as in any claim from 1 to 6.
8. Method to control the emission of luminous radiation from a luminous signaling apparatus, such as a traffic-light apparatus, comprising a step of emitting luminous radiation generated by one or more LED-type luminous emission sources (16) in a signaling direction by means of at least a light-directing lens (14), **characterized in that** it comprises an interception step in which a predefined fraction of the total luminous radiation emitted by one or more LED-type luminous emission sources (16) is diverted by means of an interception portion (18) of said light-directing lens (14) in one or more control directions, different from the signaling direction, and in which, by means of optical detection means (17), said predefined fraction of diverted luminous radiation is detected.
9. Method as in claim 8, **characterized in that** by means of control and processing means (30), connected to the optical detection means (17), the overall luminous radiation emitted by the luminous signaling apparatus is calculated.

Patentansprüche

1. LED-Leuchtsignalvorrichtung umfassend eine oder mehrere LED-Lichtemissionsquellen (16) und mindestens eine lichtleitende Linse (14), die geeignet ist, die von einer entsprechenden LED-Lichtemissionsquelle (16) emittierte Lichtstrahlung in mindestens eine Signalrichtung zu streuen, **dadurch gekennzeichnet, dass** die mindestens eine lichtleitende Linse (14) angepasst ist, mindestens einen Abfangabschnitt (18) zu definieren, welcher geeignet ist, einen vorbestimmten Anteil der gesamten von jeder LED-Lichtemissionsquelle (16) emittierten Lichtstrahlung in eine oder mehrere von der Signalrichtung abweichende Steuerrichtungen umzuleiten, wobei die Signalvorrichtung optische Erfassungsmittel (17) umfasst, die kohärent zu der Steuerrichtung angeordnet sind, um den vorbestimmten Anteil emittierter Lichtstrahlung, die von dem Abfangteil (18) umgelenkt wird, zu erfassen.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die LED-Emissionsquelle oder -quellen (16) Lichtstrahlung auf derselben Wellenlänge emittieren.
3. Vorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die LED-Lichtemissionsquellen (16) in zwei oder mehr Gruppen unterteilt sind, gleichmäßig auf einem einzigen Träger (12) verteilt, wobei jede Gruppe geeignet ist, abwechselnd aktiviert zu werden, und sich zum Emittieren von Lichtstrahlung auf einer vorbestimmten Wellenlänge eignet.
4. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie Dunkelungsabschnitte (26) umfasst, die geeignet sind, von außerhalb der Vorrichtung einfallende Lichtstrahlung zu absorbieren.
5. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie Steuer- und Verarbeitungsmittel (30) umfasst, welche mit den optischen Erfassungsmitteln (17) verbunden sind, und welche geeignet sind, die Daten von den optischen Erfassungsmitteln (17) zu erfassen, um die gesamte emittierte Lichtstrahlung zu berechnen.
6. Vorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine elektrische Last (32) umfasst, welche geeignet ist, selektiv gemäß der Erfassung der gesamten emittierten und von den optischen Erfassungsmitteln (17) erfassten Lichtstrahlung aktiviert zu werden.
7. Ampelapparatur, verwendet bei der Eisenbahn oder auf den Straßen, umfassend eine LED-Leuchtsignalvorrichtung (10) nach einem der Ansprüche 1 bis 6.
8. Verfahren zum Steuern der Emission von Lichtstrahlung von einer Leuchtsignalapparatur, wie z.B. einer Ampelapparatur, umfassend einen Schritt eines Emittierens von durch eine oder mehrere LED-Lichtemissionsquellen (16) in einer Signalrichtung erzeugter Lichtstrahlung mittels mindestens einer lichtleitenden Linse (14), **dadurch gekennzeichnet, dass** es einen Abfangschritt umfasst, in welchem ein vorbestimmter Anteil einer gesamten von einer oder mehreren LED-Lichtemissionsquellen (16) emittierten Lichtstrahlung mittels eines Abfangteils (18) in eine oder mehrere von der Signalrichtung abweichende Steuerrichtungen umgelenkt wird, und in welchem der vorbestimmte Anteil umgelenkter Lichtstrahlung durch optische Erfassungsmittel (17) erfasst wird.
9. Verfahren nach Anspruch 8, **dadurch gekennzeichnet,**

zeichnet, dass durch Steuer- und Verarbeitungsmittel (30), welche mit den optischen Erfassungsmitteln (17) verbunden sind, die gesamte von der Leuchtsignalapparatur emittierte Lichtstrahlung berechnet wird.

5

Revendications

1. Dispositif de signalisation lumineuse de type DEL comprenant une ou plusieurs sources d'émission lumineuse de type DEL (16) et au moins une lentille dirigeant la lumière (14) capable de diffuser le rayonnement lumineux émis par une source d'émission lumineuse de type DEL (16) correspondante dans au moins une direction de signalisation, **caractérisé en ce que** ladite au moins une lentille dirigeant la lumière (14) est conformée de façon à définir au moins une portion d'interception (18) adaptée pour dévier une fraction prédéfinie du rayonnement lumineux total émis par chaque source d'émission lumineuse de type DEL (16) dans une ou plusieurs directions de commande, différentes de la direction de signalisation, dans lequel le dispositif de signalisation comprend un moyen de détection optique (17) disposé de façon cohérente avec la direction de commande de façon à détecter ladite fraction prédéfinie de rayonnement lumineux déviée par la portion d'interception (18). 10
2. Dispositif selon la revendication 1, **caractérisé en ce que** la ou les source(s) d'émission de type DEL (16) émettent un rayonnement lumineux sur la même longueur d'onde. 15
3. Dispositif selon la revendication 1 ou 2, **caractérisé en ce que** les sources d'émission lumineuse de type DEL (16) sont divisées en deux groupes ou plus, répartis uniformément sur un seul support (12), chaque groupe pouvant être activé alternativement et étant adapté pour émettre un rayonnement lumineux sur une longueur d'onde prédéterminée. 20
4. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** comprend des portions d'assombrissement (26) capables d'absorber le rayonnement lumineux incident provenant de l'extérieur du dispositif. 25
5. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** comprend un moyen de commande et de traitement (30), raccordé au moyen de détection optique (17), et capable d'acquérir les données en provenance du moyen de détection optique (17), afin de calculer le rayonnement lumineux global émis. 30
6. Dispositif selon l'une quelconque des revendications 35

précédentes, **caractérisé en ce qu'il** comprend une charge électrique (32) pouvant être sélectivement activée en fonction de la détection du rayonnement lumineux global émis et détecté par le moyen de détection optique (17). 40

7. Appareil de feux de signalisation utilisé sur les voies ferrées ou les routes, comprenant un dispositif de signalisation de type DEL (10) tel que dans l'une quelconque des revendications de 1 à 6. 45
8. Procédé de régulation de l'émission d'un rayonnement lumineux en provenance d'un appareil de signalisation lumineuse, tel qu'un appareil de feux de signalisation, comprenant une étape d'émission de rayonnement lumineux généré par une ou plusieurs sources d'émission lumineuse de type DEL (16) dans une direction de signalisation au moyen d'au moins une lentille dirigeant la lumière (14), **caractérisé en ce qu'il** comprend une étape d'interception dans laquelle une fraction prédéfinie du rayonnement lumineux total émis par une ou plusieurs sources d'émission lumineuse de type DEL (16) est déviée au moyen d'une portion d'interception (18) de ladite lentille dirigeant la lumière (14) dans une ou plusieurs directions de commande, différentes de la direction de signalisation, et dans laquelle, au moyen du moyen de détection optique (17), ladite fraction prédéfinie de rayonnement lumineux dévié est détectée. 50
9. Procédé selon la revendication 8, **caractérisé en ce qu'au** moyen du moyen de commande et de traitement (30), raccordé au moyen de détection optique (17), le rayonnement lumineux global émis par l'appareil de signalisation lumineuse est calculé. 55

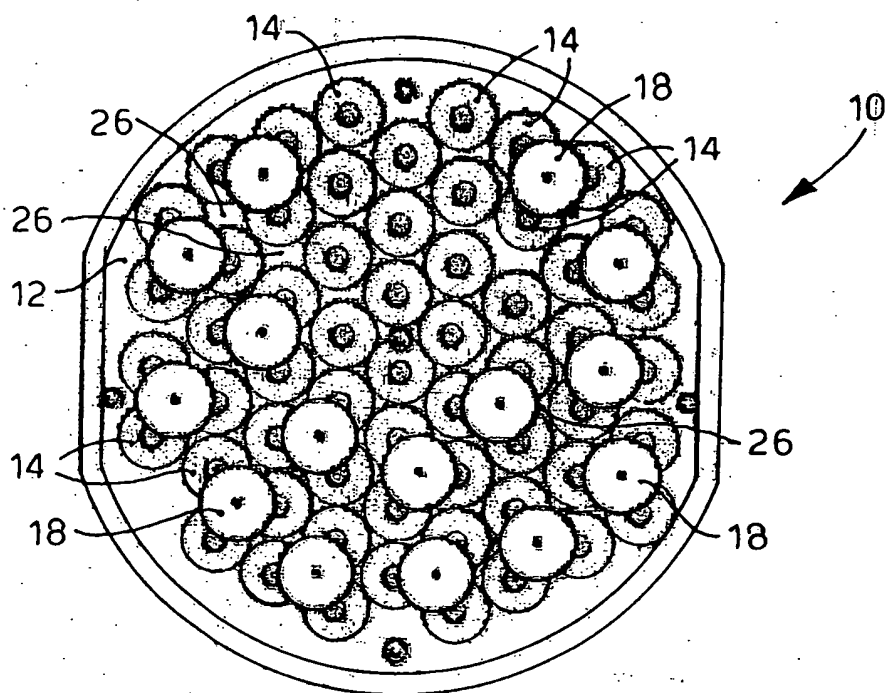


fig. 1

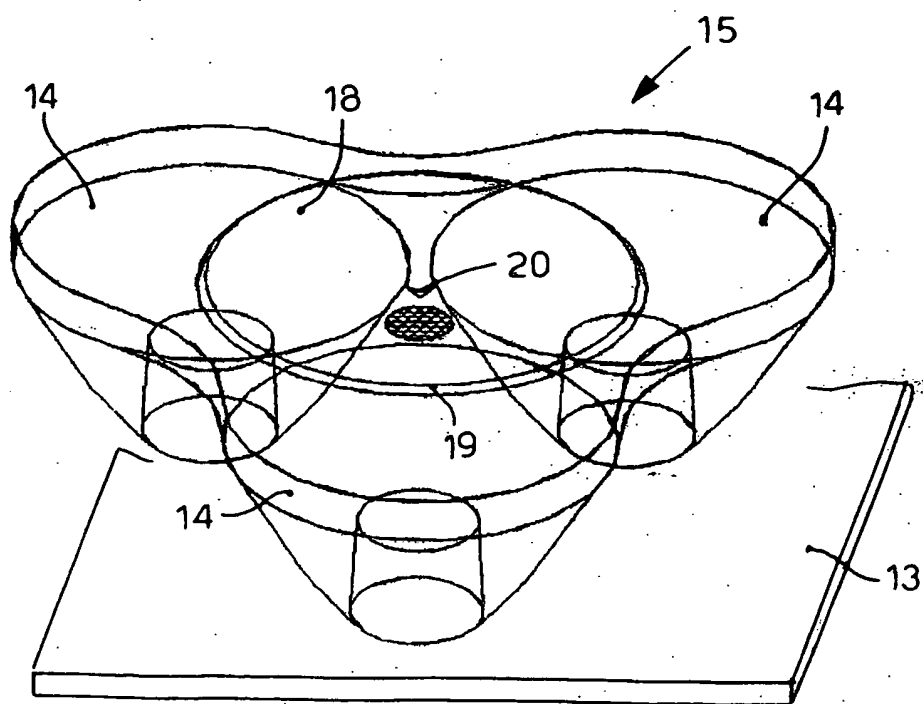


fig. 2

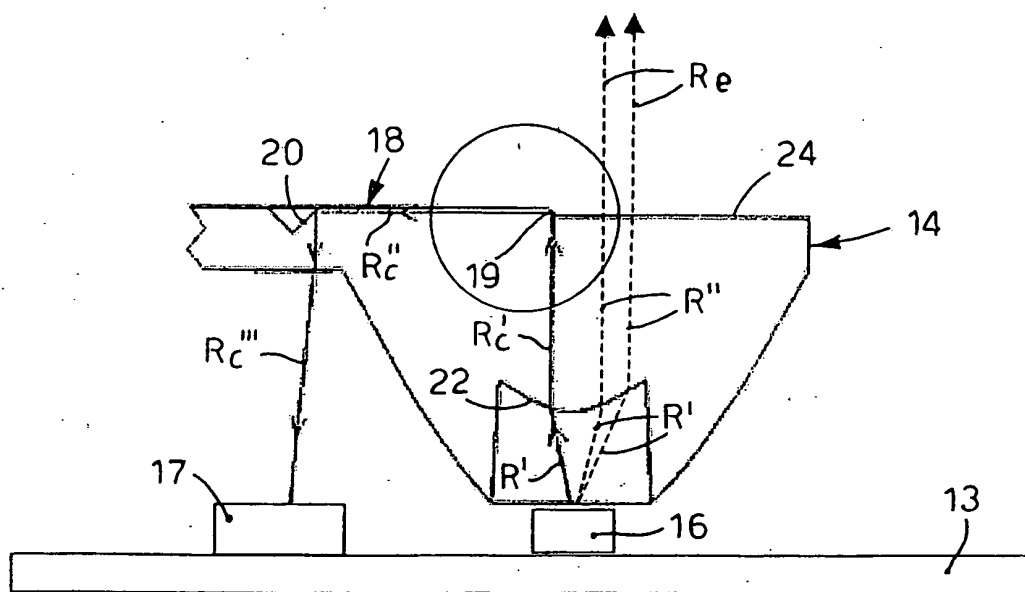


fig. 3

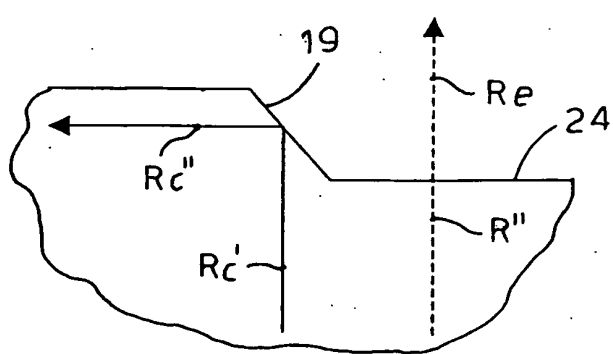


fig. 3A

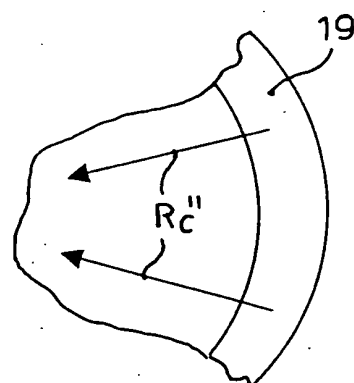


fig. 3B

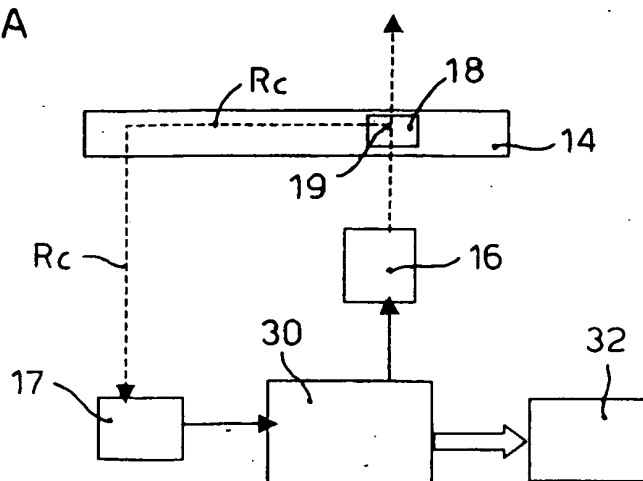


fig. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1215641 A [0006]