

Description

In the case of driving a car on a highway, when a driver approaches a tunnel and the tunnel occupies a sufficiently wide area in the driver's range of vision, the driver scans the road surface area from the car to the entrance and judges whether any obstacle exists on the road's surface. Then the driver proceeds while concentrating his line of vision and attention on the dark tunnel. Starting at this point, the center of the driver's line of vision is filled with darkness from inside the tunnel and his visual acuity begins to rapidly decrease. The geographical point at which the driver starts to pay attention to the entrance of the tunnel is called "the beginning attention point". According to an experiment, when the driver does not need to carefully watch any other obstacles on the road such as other cars, he usually pays attention to the entrance of the tunnel during about 80% of the time interval from the afore-mentioned "beginning attention point".

Meanwhile the illumination in the tunnel is weakened gradually in accordance with an increase of distance between the entrance portion of the tunnel and the spot to be illuminated in an inner space thereof. That needs to be changed depending on the open-air brightness condition. Usually in an ordinary tunnel, illumination starts at a point 10 m from the tunnel entrance in connection with the amount of existing natural light and the brightness of the illumination is controlled in proportion to the open-air brightness. However, if the brightness of the illumination apparatus such as a sodium lamp or the like is controlled in a wider range, its average life span may be shortened causing maintenance problems and operating costs.

From the FR—A—2359365 document a method and an apparatus for illuminating a tunnel is known. According to the teaching of said document solar rays are used to illuminate the tunnel. However, there is no disclosure in same about illuminating the entrance portion in order to decrease the brightness of the illumination along the length of the entrance portion of said tunnel.

It is the task of the present invention to provide an illumination method and an apparatus in which no brightness control is necessary and by which maintenance costs can be eliminated.

This task is solved with a method and an apparatus as claimed in the claims 1 and 5.

Preferred embodiments are disclosed in the independent claims.

Fig. 1 is a graph showing an illumination curve at the entrance portion of the tunnel.

Fig. 2 is a perspective view for explaining the construction of an embodiment of the present invention.

Fig. 3 is a perspective view for explaining a preferred embodiment of the light radiator used in the device.

Fig. 4 is a perspective view of an embodiment of the solar ray collecting device 10 shown in Fig. 1 which previously proposed by the present inventor.

Description of the preferred embodiment

Fig. 1 shows an illumination curve at the entrance portion of the tunnel. As shown in Fig. 1, when the length of the entrance illumination is equal to 1 (m), the entrance illumination curve consists of three portions: a boundary portion l_1 , a movement portion l_2 , and a mitigating portion l_3 (l_4).

The road surface brightness L_1 at the boundary portion, the road surface brightness L_2 at the final spot of the movement portion, the road surface brightness L_3 at the final spot of the mitigating portion, the road surface brightness L_4 at the fundamental portion, etc. are determined in accordance with the length of the tunnel, for example, as shown in Table 1. However, L_3 and l_3 are applicable to a tunnel of predetermined length only. In such a case, the brightness of the road surface varies as shown in the dotted line portion of Fig. 1. The value in Table 1 shows the degree of brightness thereon. In the case of open-air brightness of 6000 candela/m² (nt), the respective values in Table 1 will be multiplied by 1.5, and in the case of open-air brightness of 3000 candela/m² (nt) these shall be multiplied by 0.75.

TABLE 1

Tunnel elongation (m)	Road surface (candela/m ²) brightness L _r (nt)				Length l (m)				
	L ₁	L ₂	L ₃	L ₄	l ₁	l ₂	l ₃	l ₄	l ₅
75 or less	116	—	—	—	40	0	0	0	40
100	111	106	—	—	55	10	0	0	65
125	105	91	—	—	55	35	0	0	90
150	103	77	—	—	55	50	0	0	110
175	99	67	—	—	55	80	0	0	135
200	95	58	—	—	55	105	0	0	160
250	95	47	—	—	55	150	0	0	205
300	95	47	27	—	55	150	45	0	250
350	95	47	15	—	55	150	90	0	295
400 or more	95	47	—	9.0	55	150	0	135	340

As mentioned heretofore, the illumination in the tunnel is weakened gradually in accordance with an increase of distance between the entrance portion of the tunnel and the spot to be illuminated in an inner space thereof. That needs to be changed depending on the open-air brightness condition. Usually in an ordinary tunnel, illumination starts at a location 10 m apart from the tunnel entrance in connection with the amount of natural light and the brightness of the illumination is therefore controlled in proportion to the open-air brightness. However, if the brightness of the illumination apparatus such as a sodium lamp or the like is controlled in a wider range, its average life span may be shortened causing increased maintenance problems and operating costs.

The present invention was performed in order to solve the problems mentioned. Specifically, a bundle of solar rays is focused by use of a lens and guided into an optical conductor cable which transmits the resultant light into the internal space of a tunnel. The light transmitted through the optical conductor cable can be utilized for illumination at the entrance portion of the tunnel. In such a manner, the problems mentioned above can be largely avoided.

Fig. 2 illustrates the construction of an embodiment in respect to a method for illuminating a spot in a tunnel according to the present invention. In Fig. 2, 10 is a solar ray collecting device for focusing a solar ray by the use of a lens and by guiding it into an optical conductor cable. The solar ray guided into the optical conductor cable by the solar ray collecting device is further projected into a tunnel 30 through the optical conductor cable 20. The light is emitted from a light radiator 40 at the entrance portion of the tunnel 30 to be used for illumination inside the tunnel.

Illumination at the entrance portion of the tunnel 30 is preferably performed so as to follow the illumination curve distribution as shown in Fig. 1. Various kinds of means for embodying such illumination can be thought up. For instance, a plurality of optical conductor cables can be installed on the inner wall-surface of a tunnel as shown in Fig. 2, at a predetermined distance apart and perpendicular to the car's line of motion A. More definitely, those cables are installed in accordance with the distribution (wiring) density which corresponds to the illumination curve shown in Fig. 1.

By use of an illumination device constructed in such a manner, the driver's eyesight may gradually adjust to the darkness in the tunnel when the driver enters it making it safer for driving. Moreover, since the amount of light guided into the optical conductor cable automatically corresponds to the brightness of the open-air at that time, the brightness at the entrance portion of the tunnel will automatically correspond to it. There will be no need to use a brightness controlling device as disclosed in the prior art. Consequently it is not necessary to invest much money in equipment for controlling the brightness inside the tunnel.

Further, in respect to the technology for emitting outside light transmitted through an optical conductor, the present applicant has already proposed various kinds of devices called "light radiators". When such devices are used as shown in Fig. 2, the light may be emitted in the manner shown in Fig. 3.

Fig. 3 illustrates a preferred embodiment of the light radiator 40 used in the device according to the present invention. In Fig. 3, 41 is an optical conductor through which a bundle of solar rays are guided as mentioned heretofore. The optical conductor cable 20 consists of many bundles of those optical conductors

41. A notch is formed on the surface of the respective optical conductors 41 as already proposed by the present applicant, or a transparent or semi-transparent material of large refractive index is attached thereto, and the light transmitted through the optical conductor is emitted through such portions outside of it.

5 However, the optical conductor is very fine, specifically about 0.1 mm to several millimeters in size. Because of that fact, the optical conductor is subject to being destroyed. In practice, the optical conductor inserted into the protection tube 42 is used as shown in Fig. 3. On that occasion, if nearly half the portion of the protection tube's inner peripheral surface is constructed as a reflection surface 43, the light radiates from the light radiator 40 only in one direction. Therefore, when the light radiator is installed on the
10 reflecting surface, as on the wall surface, it may be possible to illuminate the road utilizing the light emitted from the optical conductor. Furthermore, if the reflection surface is directed in the same direction as the moving vehicle, the light from the light radiator will not reach the driver's eyes directly so that he will not be hampered by it in any way.

An embodiment of the illumination device in which the light radiator is installed on the inner wall
15 surface of a tunnel facing a direction which is perpendicular to the car's direction of movement is explained heretofore. While the present invention has been shown and described in relation to an illumination device placed in a tunnel, such is only illustrative and the present invention can be applied to various other devices as well. Therefore, the present invention is not limited only to the above-mentioned embodiment. For example, the illumination device may be installed in parallel with the car's progressing motion. In such a
20 case, by changing the length of the optical conductor, the entire illumination distribution may be changed in order to satisfy the illumination curve shown in Fig. 1.

Another example is one in which a bundle of optical conductor cables is untied and the light is emitted from the outer peripheral surface of the respective optical conductors for the purpose of illuminating the tunnel as explained heretofore. It is not always necessary to untie the bundle of optical conductor cables.
25 For instance, the light may be emitted directly from the edge surfaces of the optical conductor cables for illuminating the tunnel. Even though the bundle of optical conductor cables is untied, it is not always necessary to emit the light from the outer peripheral surfaces. Furthermore, the illumination curve, as shown in Fig. 1, can also be obtained by distributing evenly the light-emitting edges of the respective optical conductors.

Another example in which a solar ray illuminates the road surface at the entrance portion of a tunnel is explained hereafter. In such a case, it may be possible to combine the afore-mentioned solar ray illumination with artificial light illumination. At least the fundamental lighting of the road's surface can be done by means of artificial light. When a solar ray cannot be utilized, for example at night, it may be possible to illuminate the road's surface by using an artificial light source.
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One of the possible problems not heretofore mentioned is that the light radiated from the optical conductor may directly enter the driver's eyes and cause brightness on the wall surfaces of a tunnel and/or on the road surface by the use of radiated light. In such a case, it is not necessary to form a reflecting surface in the afore-mentioned tube 42. If the light radiator constructed in such a manner is dispersingly installed on the wall surface and/or the road surface at the entrance portion of the tunnel the desired
40 light-distributing curve can be obtained.

Previous examples were given in which a notch is formed on the surface of an optical conductor or a transparent or semi-transparent material of larger refractive index than that of the optical conductor is attached thereto for the purpose of emitting the transmitted light outside of the optical conductor. However, it is not always necessary to perform such a procedure. The optical conductor itself leaks light to
45 some extent. Such leaking light can also be used for illuminating a tunnel.

As is apparent from the foregoing descriptions, a solar ray is collected to obtain a desired distribution of illumination according to the present invention. When the open-air brightness varies, the brightness for road illumination also varies by comparison. Therefore, there is no need to control the brightness inside a tunnel. Furthermore, since the light emitting portion is not likely to be damaged, its maintenance will be
50 easier and less costly. These are considered to be the chief merits of this illumination device according to the present invention.

Fig. 4 is a perspective view showing an embodiment of the solar ray collecting device 10 shown in Fig. 2. In the figure, is shown: 1. a cylindrical foundation; 2. a transparent dome-shaped head; and 3, capsule
55 constructed with those elements appropriate for use in the solar ray collecting device 10 is accommodated in the capsule 3 as is shown in Fig. 4. The solar ray collecting device 10 contains one or more lenses 11 (for example 7 or 19) for focusing the sun's rays; a solar ray direction sensor 12 for detecting the direction of the sun; a supporting frame 13 for unitarily supporting the lenses and the sensor; a first rotating shaft (not shown) for rotatably moving the support frame 13; a first motor 15 for rotating the first rotating shaft; a supporting arm 16 for supporting the lenses 11; the sensor 12, the frame 13, the first rotating shaft and the
60 motor 15; a second rotating shaft 17, arranged so as to cross perpendicularly to the first rotating shaft and a second motor (not shown) for rotating the second rotating shaft 17. The solar ray direction sensor 12 detects the direction of the sun and produces a detection signal which controls the afore-mentioned motors so as to always direct the lens (or lenses) 11 toward the direction of the sun. The solar rays focused by the lens 11 are guided into an optical conductor cable 20 (as shown in Fig. 1), the light-receiving edge of which
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is arranged at the focal position of the lens 11, and transmitted to the optional desired position through the optical conductor cable 20.

Claims

- 5 1. A method for illuminating a tunnel of a highway comprising the steps of collecting solar rays by focusing the solar rays utilizing a lens (10) guiding said collected solar rays along an optical conductor (20) leading to the interior of a tunnel and being provided with light radiator means (40) characterized therein that the entrance portion of the tunnel is illuminated by the collected solar rays, the intensity of the
10 illumination is gradually decreasing with increasing distance from the entrance portion of the tunnel such that a person's eyesight is allowed to gradually adjust to the darkness of the tunnel when driving into said tunnel, the brightness in said entrance portion being related to the brightness outside of the tunnel.
2. A method according to claim 1 characterized by installing said light radiator means (40) on the inner wall surface of said tunnel (30) and extending generally perpendicular to the longitudinal axis of said tunnel
15 (30).
3. A method according to claim 1 characterized therein that said solar rays transmitted through said optical conductor are used to produce a brightness of illumination on the wall surface and/or on the road surface and a light emitting portion of said optical conductor would disperse light.
4. A method according to claim 1 characterized by passing said optical conductor (41) through a
20 protection tube (42) and reflecting illumination from said optical conductor onto a reflecting surface (43) in said protection tube (42).
5. Apparatus for illuminating a highway tunnel comprising solar ray collecting means (10) for collecting solar rays, optical conductor means (20) extending into said tunnel for conducting said collected solar rays to light radiation means, said light radiation means (40) illuminating the entrance portion of said tunnel
25 (30), said light radiation means being variably spaced in said tunnel to provide a variable intensity of illumination that decreases from the entrance to the tunnel to thereby provide gradually decreasing illumination such that a person's eyesight is allowed to gradually adjust to the darkness of the tunnel upon driving into the tunnel, the brightness in said entrance portion of said tunnel being related to the brightness outside of the tunnel.
6. Apparatus according to claim 5, characterized therein that said solar ray collecting means (10) comprises a plurality of lenses (11), said lenses guiding the solar rays into said optical conductor means (40) and sensor means (12) on said solar ray collecting means (10) for detecting the direction of the sun to
30 direct the lenses towards the direction of incidence of the sunlight.
7. Apparatus according to claim 5, characterized by a protection tube (42) through which said optical conductor (41) passes said protection tube (42) having a reflecting surface (43) reflecting the light from the
35 optical conductor means into said tunnel.
8. Apparatus according to claim 5, characterized therein that said reflection surface (43) extends over a portion of the circumference of said protection tube (42).

40 Patentansprüche

1. Verfahren zur Beleuchtung eines Tunnels einer Straße, bei dem Sonnenstrahlung durch Fokussierung mit einer Linse (10) gesammelt und über einen optischen Leiter (20) in das Innere eines
45 Tunnels weitergeleitet werden, der mit Leuchtkörpern ausgestattet ist, dadurch gekennzeichnet, daß der Eingangsbereich des Tunnels durch die Sonnenstrahlung beleuchtet wird, wobei die Intensität der Beleuchtung mit zunehmender Entfernung von Tunneleingang abnimmt, so daß das Augenlicht einer Person sich schrittweise auf die Dunkelheit des Tunnels beim Einfahren in den Tunnel einstellen kann, wobei die Helligkeit im Eingangsbereich zu der Helligkeit außerhalb des Tunnels korreliert ist.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Leuchtkörper (40) auf der
50 Innenwandfläche des Tunnels (30) angeordnet werden und sich im wesentlichen senkrecht zur Längsachse des Tunnels (30) erstrecken.
3. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die durch den optischen Leiter hindurch übertragenen Sonnenstrahlen zur Erzeugung einer gewissen Helligkeit auf der Wandoberfläche und/oder auf der Straßenfläche im Tunnel eingesetzt werden und daß ein lichtemittierenden Teil des optischen
55 Leiters als Lichtverteiler eingesetzt ist.
4. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der optische Leiter (41) durch eine Schutzröhre (42) hindurchtritt, wobei das Licht von dem optischen Leiter auf eine reflektierende Fläche (43) in der Schutzröhre (42) fällt.
5. Vorrichtung zur Beleuchtung eines Straßentunnels, mit einer Sonnenkollektoreinrichtung (10) zum
60 Einfangen von Sonnenstrahlung, mit einer optischen Leiteinrichtung (20), die sich in dem Tunnel zu Leiten des eingesammelten Sonnenlichts zu Leuchtkörpern erstreckt, wobei die Leuchtkörper (40) den Eintrittsbereich des Tunnels (30) beleuchten und wobei die Leuchtkörper mit verschiedenen Abständen in dem Tunnel angeordnet sind, um eine unterschiedliche Beleuchtungsstärke zu erhalten, die vom Eingang des Tunnels zum Inneren hin abnimmt, so daß sich die Augen einer in den Tunnel einfahrenden Person
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is arranged at the focal position of the lens 11, and transmitted to the optional desired position through the optical conductor cable 20.

Claims

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1. A method for illuminating a tunnel of a highway comprising the steps of collecting solar rays by focusing the solar rays utilizing a lens (10) guiding said collected solar rays along an optical conductor (20) leading to the interior of a tunnel and being provided with light radiator means (40) characterized therein that the entrance portion of the tunnel is illuminated by the collected solar rays, the intensity of the illumination is gradually decreasing with increasing distance from the entrance portion of the tunnel such that a person's eyesight is allowed to gradually adjust to the darkness of the tunnel when driving into said tunnel, the brightness in said entrance portion being related to the brightness outside of the tunnel.

2. A method according to claim 1 characterized by installing said light radiator means (40) on the inner wall surface of said tunnel (30) and extending generally perpendicular to the longitudinal axis of said tunnel (30).

3. A method according to claim 1 characterized therein that said solar rays transmitted through said optical conductor are used to produce a brightness of illumination on the wall surface and/or on the road surface and a light emitting portion of said optical conductor would disperse light.

4. A method according to claim 1 characterized by passing said optical conductor (41) through a protection tube (42) and reflecting illumination from said optical conductor onto a reflecting surface (43) in said protection tube (42).

5. Apparatus for illuminating a highway tunnel comprising solar ray collecting means (10) for collecting solar rays, optical conductor means (20) extending into said tunnel for conducting said collected solar rays to light radiation means, said light radiation means (40) illuminating the entrance portion of said tunnel (30), said light radiation means being variably spaced in said tunnel to provide a variable intensity of illumination that decreases from the entrance to the tunnel to thereby provide gradually decreasing illumination such that a person's eyesight is allowed to gradually adjust to the darkness of the tunnel upon driving into the tunnel, the brightness in said entrance portion of said tunnel being related to the brightness outside of the tunnel.

6. Apparatus according to claim 5, characterized therein that said solar ray collecting means (10) comprises a plurality of lenses (11), said lenses guiding the solar rays into said optical conductor means (40) and sensor means (12) on said solar ray collecting means (10) for detecting the direction of the sun to direct the lenses towards the direction of incidence of the sunlight.

7. Apparatus according to claim 5, characterized by a protection tube (42) through which said optical conductor (41) passes said protection tube (42) having a reflecting surface (43) reflecting the light from the optical conductor means into said tunnel.

8. Apparatus according to claim 5, characterized therein that said reflection surface (43) extends over a portion of the circumference of said protection tube (42).

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Patentansprüche

1. Verfahren zur Beleuchtung eines Tunnels einer Straße, bei dem Sonnenstrahlung durch Fokussierung mit einer Linse (10) gesammelt und über einen optischen Leiter (20) in das Innere eines Tunnels weitergeleitet werden, der mit Leuchtkörpern ausgestattet ist, dadurch gekennzeichnet, daß der Eingangsbereich des Tunnels durch die Sonnenstrahlung beleuchtet wird, wobei die Intensität der Beleuchtung mit zunehmender Entfernung von Tunneleingang abnimmt, so daß das Augenlicht einer Person sich schrittweise auf die Dunkelheit des Tunnels beim Einfahren in den Tunnel einstellen kann, wobei die Helligkeit im Eingangsbereich zu der Helligkeit außerhalb des Tunnels korreliert ist.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Leuchtkörper (40) auf der Innenwandfläche des Tunnels (30) angeordnet werden und sich im wesentlichen senkrecht zur Längsachse des Tunnels (30) erstrecken.

3. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die durch den optischen Leiter hindurch übertragenen Sonnenstrahlen zur Erzeugung einer gewissen Helligkeit auf der Wandoberfläche und/oder auf der Straßenfläche im Tunnel eingesetzt werden und daß ein lichtemittierenden Teil des optischen Leiters als Lichtverteiler eingesetzt ist.

4. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der optische Leiter (41) durch eine Schutzröhre (42) hindurchtritt, wobei das Licht von dem optischen Leiter auf eine reflektierende Fläche (43) in der Schutzröhre (42) fällt.

5. Vorrichtung zur Beleuchtung eines Straßentunnels, mit einer Sonnenkollektoreinrichtung (10) zum Einfangen von Sonnenstrahlung, mit einer optischen Leitereinrichtung (20), die sich in dem Tunnel zu Leiten des eingesammelten Sonnenlichts zu Leuchtkörpern erstreckt, wobei die Leuchtkörper (40) den Eintrittsbereich des Tunnels (30) beleuchten und wobei die Leuchtkörper mit verschiedenen Abständen in dem Tunnel angeordnet sind, um eine unterschiedliche Beleuchtungsstärke zu erhalten, die vom Eingang des Tunnels zum Inneren hin abnimmt, so daß sich die Augen einer in den Tunnel einfahrenden Person



allmählich auf die Dunkelheit des Tunnels einstellen können, wobei die Beleuchtungshelligkeit im Eingangsbereich des Tunnels mit der Helligkeit außerhalb des Tunnels korreliert ist.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß die Sonnenkollektoreinrichtung (10) mehrere Linsen (11) aufweist, wobei die Linsen die Sonnenstrahlung in den optischen Leiter (40) einkoppeln und mit einer Sensoreinrichtung (12), die an der Sonnenkollektoreinrichtung (10) angeordnet ist und die Richtung der Sonne erfaßt, so daß die Linsen zur Sonne ausgerichtet werden.

7. Vorrichtung nach Anspruch 5, gekennzeichnet durch eine Schutzröhre (42), durch die der optische Leiter (41) hindurchtritt, wobei die Schutzröhre (42) eine reflektierende Fläche (43) hat, die Licht von dem optischen Leiter in den Tunnel reflektiert.

- 10 8. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß die reflektierende Fläche (43) sich über einen Umfangsbereich der Schutzröhre (42) erstreckt.

Revendications

- 15 1. Un procédé d'éclairage d'un tunnel d'une route à grande circulation, ou autoroute, comprenant les étapes consistant à collecter les rayons solaires par concentration des rayons solaires en utilisant une lentille (10), à guider lesdits rayons solaires collectés le long d'un conducteur optique (20) conduisant à l'intérieur d'un tunnel et pourvu d'un radiateur de lumière (40), caractérisé en ce que la partie d'entrée du tunnel est éclairée par les rayons solaires collectés, l'intensité d'éclairage diminue graduellement à mesure que la distance d'espacement par rapport à la partie d'entrée du tunnel augmente, de sorte que la vision d'une personne peut s'adapter graduellement à l'obscurité du tunnel lors d'une conduite d'un véhicule dans ledit tunnel, la luminosité dans ladite partie d'entrée étant en relation avec la luminosité à l'extérieur du tunnel.

- 25 2. Un procédé selon la revendication 1, caractérisé en ce qu'on installe ledit radiateur de lumière (40) sur la surface intérieure de paroi dudit tunnel (30), en l'orientant dans l'ensemble perpendiculairement à l'axe longitudinal dudit tunnel (30).

- 30 3. Un procédé selon la revendication 1, caractérisé en ce que lesdits rayons solaires transmis par l'intermédiaire dudit conducteur optique sont utilisés pour produire une luminosité d'éclairage sur la surface de paroi et/ou sur la surface de la route et une partie émettrice de lumière dudit conducteur optique produit une dispersion de la lumière.

4. Un procédé selon la revendication 1, caractérisé en ce qu'on fait passer ledit conducteur optique (41) dans un tube de protection (42) et la lumière d'éclairage provenant dudit conducteur optique est réfléchi sur une surface réfléchissante (43) prévue dans ledit tube de protection (42).

- 35 5. Installation pour éclairer un tunnel de route à grande circulation ou autoroute, comprenant un moyen collecteur de rayons solaires (10) pour collecter les rayons solaires, un moyen conducteur optique (20) s'étendant dans ledit tunnel pour conduire lesdits rayons solaires collectés jusqu'à un moyen de rayonnement de lumière, ledit moyen de rayonnement de lumière (40) éclairant la partie dudit tunnel proche de l'entrée (30), ledit moyen de rayonnement de lumière étant espacé de façon variable dans ledit tunnel de manière à créer une intensité d'éclairage variable qui diminue depuis l'entrée dans le tunnel en vue de produire ainsi une réduction graduelle d'éclairage, de telle sorte que la vision d'une personne puisse s'adapter graduellement à l'obscurité régnant dans le tunnel lors d'une conduite d'un véhicule dans le tunnel, la luminosité dans ladite partie d'entrée dudit tunnel étant en relation avec la luminosité à l'extérieur du tunnel.

- 45 6. Installation selon la revendication 5, caractérisée en ce que ledit moyen collecteur de rayons solaires (10) comprend une pluralité de lentilles (11), lesdites lentilles guidant les rayons solaires dans ledit moyen conducteur de lumière (40) et un moyen détecteur (12) étant placé sur ledit moyen collecteur de rayons solaires (10) pour détecter la direction du soleil afin de diriger les lentilles dans la direction d'incidence de la lumière solaire.

- 50 7. Installation selon la revendication 5, caractérisée par un tube de protection (42) au travers duquel passe ledit conducteur optique (41), ledit tube de protection (42) comportant une surface réfléchissante (43) réfléchissant la lumière du moyen conducteur optique jusque dans le tunnel.

8. Installation selon la revendication 5, caractérisée en ce que ladite surface réfléchissante (43) s'étend sur une partie de la circonférence dudit tube de protection (42).

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