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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **A device permitting of economizing electric lighting energy.**

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GB-A-1 477 438
US-A-3 085 179
US-A-3 450 939
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Description

A problem which nowadays affects the individual citizen is the saving of energy. Everyone should make his contribution using energy more rationally and making the most of alternatives where possible.

A place which is over illuminated on a street or a garden illuminated when natural light is already sufficient does not help to save energy.

In the majority of cases a chandelier is constituted by several lamps not with the object of meeting actual demand for illumination but for a function which is purely aesthetic and attractive.

In the majority of cases, in public places, restaurants and hotels due to forgetfulness or negligence these chandeliers are always alight even when natural light would be sufficient and the energy which is wasted is enormous.

Devices which connect or disconnect apparatus for illumination by means of photo-cells when the sunlight diminishes and increases respectively beyond a predetermined value are already known (see, for example, U.S. Patents 4 023 035; GB—A—1 455 875; US 3 573 543; US 3 450 939; US 3 896 334; US 3 543 088; US 3 517 259; German OS 1 945 267; German OS 1 764 469).

Said devices comprise electronic members and at least one photo-cell, permitting of subduing the light of a lamp or group of lamps so as to emit light with a luminous intensity almost inversely proportional to the luminous intensity of the surrounding environment; the minimum luminous intensity of the lamp or of the group of lamps being capable of being predetermined and preregulated at any point of the characteristic of attenuation of the lamp.

The devices according to said prior art are provided with a photo-cell positioned in the housing of the lamp and receiving the light through a window of said housing.

The device according to the present invention is characterized in that it comprises at least one bundle of optical fibres, the external end of which is placed remote from the device, in order to receive only the light of the environment and to transmit it to the photo-cell.

The attached drawings show some preferred embodiment of the device in question.

Fig. 1 shows the device applied to a chandelier;

Fig. 2 shows the enlarged section made in the plane passing through II—II of Fig. 1:

Figs. 3, 4 and 5 show in exploded view the components of the device of Figs. 1 and 2;

Fig. 6 shows in front view partly in section a second embodiment applied to the lamp holder of a conventional single lamp;

Fig. 7 shows the device in question applied to a tubular fluorescent lamp;

Fig. 8 shows the diagram of the power (W) absorbed by the lamp or by the group of lamps according to the luminous intensity "Ia" of the surroundings;

Fig. 9 shows the preferred electronic circuit diagram for realizing the device in question.

In Fig. 1 is illustrated a chandelier 3 in the rose 4 of which (see the section of Fig. 2) is inserted the device 1 according to the present invention from which device the bundle of optical fibres 2 projects which take and convey to the said device the light with the luminous intensity peculiar to the surroundings.

Figs. 3, 4 and 5 show the assembly of the device in question comprising a pointed circuit 8 with the electronic components or the photo-electric cell 7, the bundle of optical fibres 2 with terminal 2', the holder 5, the cover 6 mounted. The pointed circuit 8 is mounted in the holder 5 and the photo-electric cell 7 is illuminated by means of the bundle of optical fibres 2. On the free end of the bundle of optical fibres is mounted a device (not shown) for regulating manually the light which the terminal receives, or a connector for optical fibres 2' so that the said bundle may be extended for the manual or automatic regulation at a distance of the desired luminous intensity.

Fig. 6 shows one embodiment of the device for screwing into the existing lamp holder 9. The device is similar to an additional lamp holder which is screwed into the lamp holder 9 and receives in its turn by screwing, the bulb. On the inside is mounted the circuit with the relative components illustrated in Fig. 9.

The optical rod 2 (Fig. 6) takes the light to the outside to avoid the photo-cell 7 receiving the light from the bulb reflected by the shield 14. Without the rod towards the outside the bulb 10 would be extinguished immediately by its reflected light.

Fig. 7 shows the application of the device to fluorescent or neon lamps and for all types of street lamps etc. Electrically it is equal to the realization according to Figs. 3, 4, 5 whilst the holder may vary from lamp to lamp and is adapted to the mechanical construction of said lamp. It is a closed box 1 from which emerges the bundle of optical fibres 2 which receives light from outside.

Fig. 8 shows the diagram according to two different preferred procedures 12 and 13 of the power W absorbed from the lamp (ordinate) according to the luminous intensity of the surroundings Ia (abscissa). If the light of the surroundings increases the power W of the lamp decreases.

As can be seen from line 12 of the diagram besides a specific luminous intensity of the surroundings, the lamp (or the group of lamps) is extinguished completely and the power absorbed passes immediately from the point P to zero Watt.

In the following a few practical examples are given:

1. A place is illuminated by two 100W bulbs to each of which is applied the device in question. Lighting one of the lamps consumes 100W. Lighting also the second, if it is very close to the first there is not a double consumption 100W + 100W, but somewhat less because each bulb takes into account that the other is alight and therefore reduces by means of the device in question its own luminous energy.

If an external source of light enters the place the

electronic device of each lamp takes into account this new contribution and reduces therefore the electrical energy consumed. If the place is sufficiently illuminated from outside the lamps become almost extinguished.

2. A condominium of six floors has the illumination plant of the staircase connected to that of the cellar. If a person during the day goes down to the cellar to light the cellar lamp he has to light all the lamps of the staircase. With the device according to the invention applied to all the lamps only the cellar lamp is to be illuminated because it is in a dark place whilst those on the staircase do not light because the light entering from the outside is sufficient.

3. A garden at the entrance of a house is illuminated by one or more lamps. When dawn breaks the lamp having more external light reduces gradually its own luminosity and therefore the consumption of energy, whilst that most concealed from the light maintains it.

4. Many children are afraid to sleep in the dark; with the device according to the present invention it is possible to adapt a degree of night luminosity for the bulb of the room thus consuming less energy.

5. A chandelier normally has many lamps. When all are alight the energy consumed is enormous. It is possible to unscrew some superfluous bulbs in order to consume less energy but aesthetically that is less attractive and creates a sense of hardship in front of visitors. With the device according to the invention all the bulbs remain alight but each one reduces its own energy so that the total energy does not become excessive.

6. For street lighting or in public places the applications are very varied.

The operation of the electronic circuit (Fig. 9) is as follows:

The condenser C1 with the coils L1 and L2 forms a filter for the disturbances caused by the triac during its lighting. The condenser C3 is charged through the resistance R1, R2 and R5. When the voltage at its ends reaches a value of about 30V, the diac T1 connects the triac T2 and the lamp 10 lights up. By varying the charging current of the condenser C3 the voltage of 30V at its ends advances or retards and consequently the lighting of the triac. The lighting of the triac can vary within 180 degrees of the half-period of the alternating current. Displacing the point of lighting of the triac varies the power supplied to the lamp and consequently its degree of luminosity.

Lighting the triac at the beginning of 180 degrees the lamp receives the maximum power.

The electrical resistance of the photo-cell F1 when it is blacked out is very high above 10 Mohm; since the resistance R4 also has a high value the current which passes through R1 is almost equal to the current which passes through R2 and C3 is charged for a very short time. The luminosity of the lamp has under these conditions its maximum value. If the photo-cell is illuminated the value of its electrical resistance decreases and consequently more current circulates in it. The current which passes through the photo-cell is to be subtracted from the charging current of the condenser C3 and the voltage at its ends increases more slowly and consequently the lighting of the triac is retarded. The bulb 10 reduces its degree of luminosity proportionally to the electrical resistance of the photo-cell.

The fully illuminated photo-cell has an electrical resistance of about 500 ohm, the lamp 10 in these circumstances is almost extinguished.

Placing a zener diode in series with the photo-cell F1 the point M of Figure 8 is obtained. By varying the value of the zener diode selected the point M is displaced upwards or downwards. By varying the values of R3 and R4 the characteristic 13 of Fig. 8 is obtained.

Here in the following are given some values of the components, the electronic circuit:

L1 = 100 micro henry; L2 — 100 micro henry; C1 and C2 — 0.1 micro farad; C3 — 0.01 micro farad; C4 — 1 micro farad; R1 — 33 Kohm; R2 — 3.3 Kohm; R3 = 4.7 Kohm; R4 = 8.2 mega ohm; R5 = 22 Kohm; G1 — rectifier; T1 = diac; T2 = triac; F1 = photo-cell.

It is provided for the device in question to be capable of being incorporated directly in a chandelier or in any holder or lamp holder at the time of their manufacture or mounted at any point of the circuit feeding the bulb always located in the space illuminated by the said bulb all this without departing from the scope of protection of the invention.

Claims

1. A device for economizing electric lighting energy comprising electronic members associated with at least one photo-cell which permit subduing the light of a lamp or group of lamps so as to emit light with a luminous intensity inversely proportional or almost inversely proportional to the luminous intensity of the surrounding environment; the minimum luminous intensity (Figure 8) of the lamp or of the group of lamps being capable of being predetermined and preregulated at any point of the characteristic of attenuation of the lamp, characterized in that the photo-cell is exclusively illuminated by the internal end of at least one bundle of optical fibres (2), the external end of which is placed remote from the device, in order to receive only the light of the environment and to transmit it to the photo-cell.

2. A device according to claim 1, characterized in that said group of lamps is joined into a single assembly and is constituted by a chandelier (3, Fig. 1) and that the device is fitted in the electric circuit of the chandelier according to the framework for attachment of the chandelier to the ceiling under the rose (4, Fig. 1) of the said chandelier.

3. A device according to claim 1, characterized in that it is adapted so as to be capable of being screwed between the lamp holder (9, Fig. 6) and the lamp (10).

4. A device according to claims 1 or 2, characterized in that on the free end of the bundle of optical fibres there is mounted a device for regulating manually the light which the bundle receives from the space surrounding the lamp or assembly of lamps or a connector for optical fibres (2', Fig. 5) so that this bundle may be lengthened for the manual or automatic regulation at a distance of the desired luminous intensity.

Patentansprüche

1. Elektrische Lichtenergiesparvorrichtung mit elektronischen Bauelementen, die wenigstens einer eine Dämpfung des Lichts einer Lampe oder einer Gruppe von Lampen ermöglichenden Photozelle zugeordnet sind, um Licht mit einer Lichtstärke abzugeben, die umgekehrt proportional oder nahezu umgekehrt proportional zur Lichtstärke der Umgebung ist, wobei die minimale Lichtstärke (Figur 8) der Lampe oder der Gruppe von Lampen an irgendeinem Punkt der Dämpfungskennlinie der Lampe vorbestimmbar und voreinstellber ist, dadurch gekennzeichnet, daß die Photozelle ausschließlich durch das innere Ende wenigstens eines Bündels aus optischen Fasern (2), dessen äußeres Ende entfernt von der Vorrichtung angeordnet ist, um lediglich das Licht der Umgebung aufzunehmen und zur Photozelle zu übertragen, beleuchtet wird.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Gruppe von Lampen zu einer einzigen Baueinheit zusammengefaßt ist sowie einen Kronleuchter (3, Fig. 1) bildet und daß die Vorrichtung in den elektrischen Schaltkreis des Kronleuchters in Übereinstimmung mit dem Tragsystem zur Befestigung des Kronleuchters an der Decke unter den Baldachin (4, Fig. 1) des Kronleuchters eingebaut ist.

3. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß sie zum Einschrauben zwischen die Lampenfassung (9, Fig. 6) und die Glühlampe (10) ausgestaltet ist.

4. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß am freien Ende des Bündels aus optischen Fasern eine Einrichtung zur manuellen Einregelung des Lichts, das das Bündel von dem die Lampe oder die Gruppe von Lampen oder ein Verbindungsstück (2', Fig. 5) für optische Fasern, durch das das Bündel für die manuelle oder selbsttätige Regelung in einem Abstand zur gewünschten Lichtstärke verlängerbar ist, umgebenden Raum empfängt, angebracht ist.

Revendications

1. Dispositif pour économiser l'énergie lumineuse électrique comprenant des éléments électroniques associés au moins à une cellule photoélectrique qui permettent d'abaisser la lumière d'une lampe ou d'un groupe de lampes de façon à émettre une lumière à une intensité lumineuse inversement proportionnelle ou à peu près inversement proportionnelle à l'intensité lumineuse de l'environnement, l'intensité lumineuse minimale (figure 8) de la lampe ou du groupe de lampes pouvant être prédéterminée et préréglée en tout point de la caractéristique d'atténuation de la lampe, caractérisé en ce que la cellule photoélectrique est éclairée exclusivement par l'extrémité intérieure d'au moins un faisceau de fibres optiques (2) dont l'extrémité extérieure est placée à l'écart du dispositif afin de recevoir seulement la lumière de l'environnement et de la transmettre à la cellule photo-électrique.

2. Dispositif selon la revendication 1, caractérisé en ce que ledit groupe de lampes est joint dans un seul ensenble et est constitué par un chandelier (3, fig. 1) et que le dispositif est monté dans le circuit électrique du chandelier selon la structure pour la fixation du chandelier au plafond sous la rosace (4, fig. 1) dudit chandelier.

3. Dispositif selon la revendication 1, caractérisé en ce qu'il est adapté pour être capable d'être vissé entre le porte-lampe (9, fig. 6) et la lampe (10).

4. Dispositif selon la revendication 1 ou la revendication 2, caractérisé en ce que sur l'extrémité libre du faisceau de fibres optiques est monté un dispositif pour régler manuellement la lumière que le faisceau reçoit de l'espace environnant la lampe ou l'ensemble de lampes ou un connecteur pour fibres optiques (2', fig. 5) de façon que ce faisceau puisse être allongé pour le réglage manuel ou automatique à distance de l'intensité lumineuse désirée.

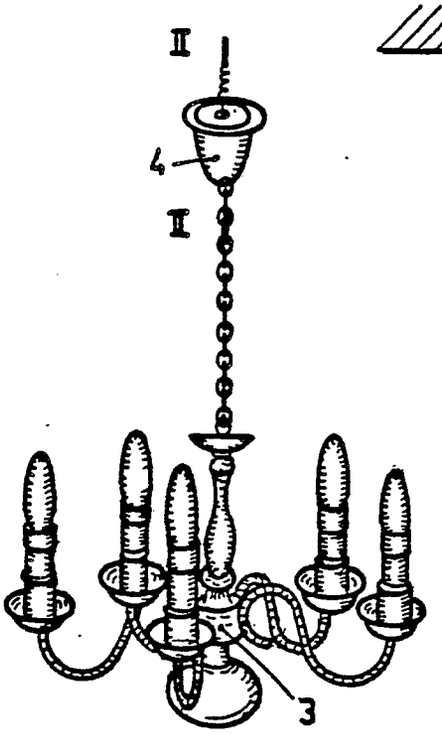

Fig.1

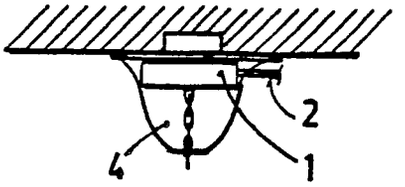

Fig.2

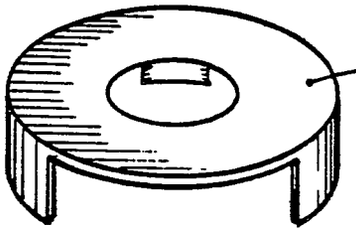

Fig.3

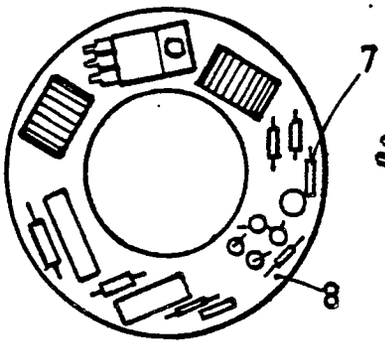

Fig.4

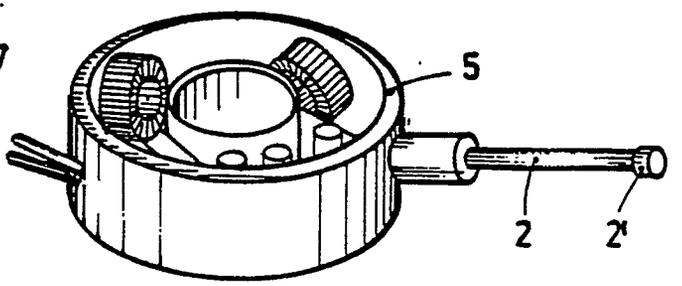

Fig.5

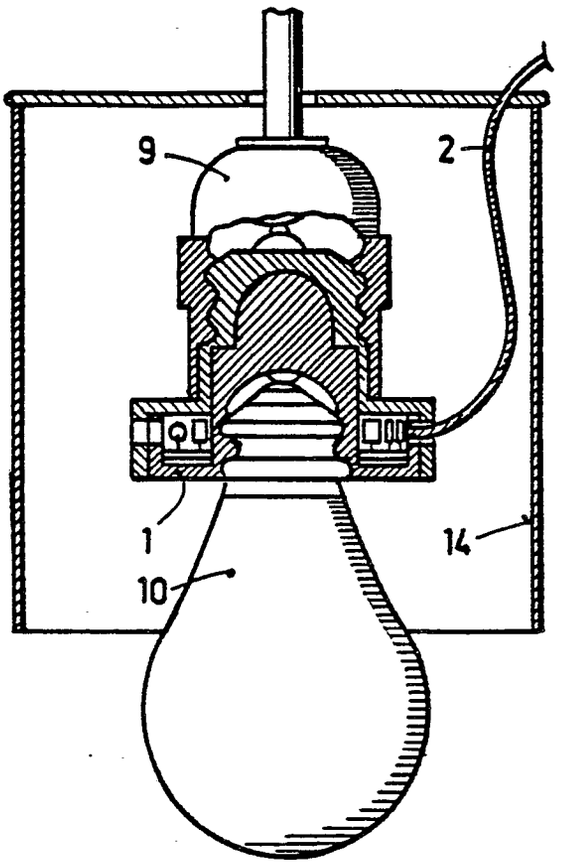

Fig.6

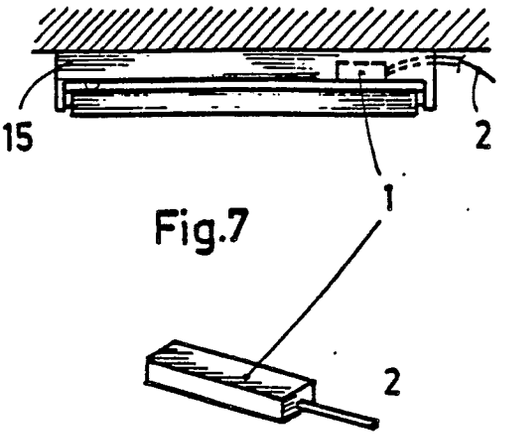

Fig.7

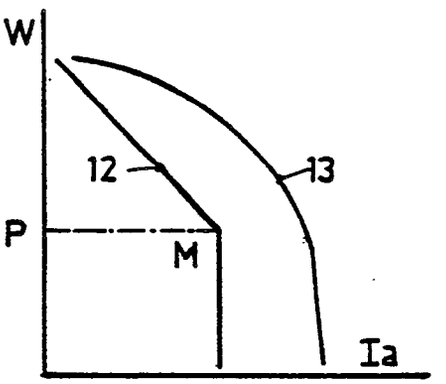

Fig.8

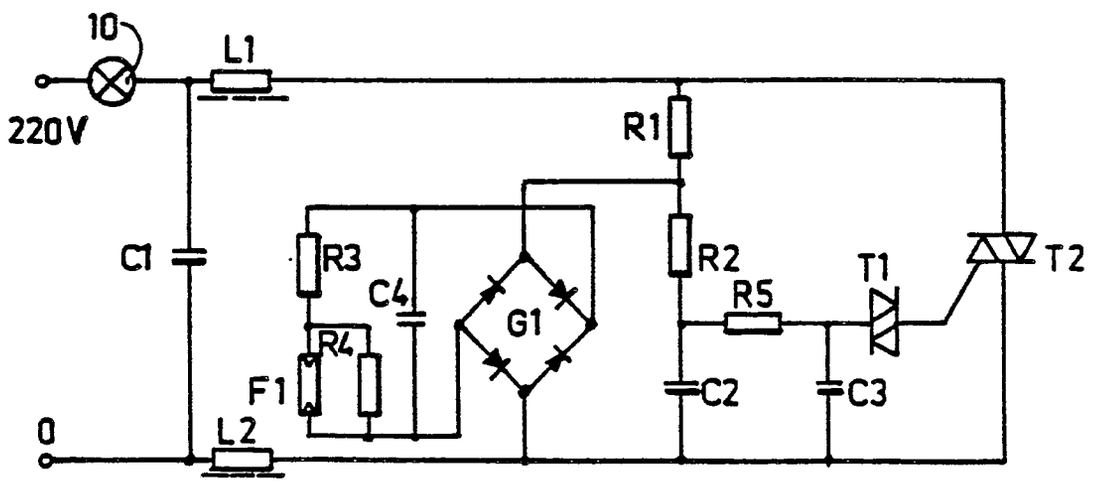

Fig.9