

DISCRIMINATING LIGHT-EMITTING APPARATUSBACKGROUND OF THE INVENTION

5 The present invention relates to a discriminating light-emitting apparatus in which, when a coded signal or a signal having a specific wavelength is transmitted by a transmitting device, a light emitting section of a receiving device, receiving the signal, is turned on or off, to make
10 a specific article conspicuous, the receiving device being mounted on, or resting on the article whereby the article can be found simply and quickly.

By way of example, when a vehicle is parked in a region
15 of, for example, complete darkness, or is parked in a large parking are, a sports ground, or the like (where plenty of vehicles are parked), the location of one's own vehicle is retained in memory for a short time. However, after some time has elapsed, it takes far longer to find one's own
20 vehicle. The same problem is experienced after other

vehicles are moved so that parking circumstances change. The more number of vehicles increases, the more this is true. Alternatively, in a case where many people utilize a clog cabinet having no door, or take off their shoes at a location where there is no clog cabinet, it is extremely difficult to someone to find their own shoes among the other shoes.

SUMMARY OF THE INVENTION

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It is an object of the invention to provide a discriminating light-emitting apparatus which can simply, speedily and accurately show the location of a specific article within pitch darkness, or among many similar articles.

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According to the invention, there is provided a discriminating light-emitting apparatus comprising:

transmitting means for transmitting an optical signal which is coded or which has a specific wavelength; and
 20 receiving means having a light receiving element responsive only to said optical signal transmitted from said transmitting means and having a light-emitting section for displaying an indication of receipt ^{of} said ~~coded~~ optical signal, said receiving means including a plurality of light
 25 receiving elements which are so arranged as to cover an entire periphery of said receiving means; and

said transmitting means transmitting the optical signal upon turning-on a drive switch, said receiving means turning on when said light receiving element receives said optical
 30 signal, and said light-emitting section being turned on, for at least a predetermined time period, to display said indication of receipt of said signal.

A user of the discriminating light-emitting apparatus
 35 places the receiving means within pitch

darkness or within plenty of objects the same in type as each other, and mounts or attaches, or rests the receiving means on or to, or on a particularly conspicuous adequate location or portion of a specific article which the user desires to find out or locate. If the specific article is, for example, a vehicle or automobile, the receiving means is mounted on or is attached to, or is rested on a dashboard, a front board or a rear board within the vehicle, on a top of the vehicle, on an upper part of a wing-like antenna for automobile telephone, or the like, although, in case where the receiving means is arranged on the outside of the vehicle, there is a case where theft countermeasures must be considered. The location or portion on which the receiving means is mounted or rested may be locations where a signal from the transmitting means can reach the receiving means, and may be anywhere if the user can view the light from the light emitting section. A resting or mounting method may be one in which the receiving means is simply put, or one in which the receiving means is stuck or pasted through an adhesive seal or the like. Further, other mounting tools such as, for example, magnets, sky carriers or the like may be used.

If, subsequently, a signal is sent from the transmitting means to the receiving means, the receiving means radiates the light emitting section in response to the signal. Accordingly, even in dead

darkness, or even in a circumstance where there are plenty of articles the same in type with each other, it is possible for the user to easily find out an article desired to be found out by himself, for example, a
5 vehicle or automobile or the like.

Furthermore, as another example in case where the receiving means is mounted on the vehicle, if the arrangement is such that a high mount stop lamp consisting of a light emitting diode serves as a light
10 emitting section, and, when a signal is received by the receiving section, a drive signal is sent to a light emitting circuit of the lamp, the original or unique light emitting section is dispensed with, and the discriminating light-emitting apparatus comprises only
15 the receiving section, because a car battery is utilized. Accordingly, it is possible to further small-size and lighten the entire apparatus, and to realize the apparatus at low cost.

In connection with the above, it is needless
20 to say that, although description was made with a vehicle taken as an example, a using example of the invention is not limited to ordinary or general cars, buses, trucks, motor-bicycles and other vehicles, but can be applied also to other arrangements.

25 Furthermore, in case where a specific person is found out among a crowd, in case where own shoes are found out from plenty of shoes, in case where own article is found out among other plenty of baggage when

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one takes a trip, or the like, the discriminating light-emitting apparatus is convenient, and application thereof can be considered over a wide range.

The arrangement may be such that, as the
5 transmitting means for transmitting the coded signal or the signal having the specific wavelength, ~~radio-transmitting means of small electric power type or weak electric power type, or the light transmitting means~~
having ^{an} ~~the~~ infrared light-emitting diode, for example,
10 is used, ^{and} / as the receiving means for receiving the signal issued from the light transmitting means, the signal from the light transmitting means is received by the receiving means provided, for example, ~~with a homodyne receiver or a heterodyne receiver, or is~~
15 ~~received by the receiving means provided~~ with a light receiving element such as a pin photodiode, a phototransistor, a SIT phototransistor or the like, and, at that time, a receiving circuit issues or generates a drive signal to turn on a light emitting
20 element such as, for example, a visible light-emitting diode or the like of the light emitting section. In this case, the arrangement may be such that an IC, a transistor, a relay circuit or the like is built in the receiving circuit to turn on and off the light emitting
25 element.

If the SIT phototransistor is used as the light receiving element, it is preferable because the SIT phototransistor is remarkably superior in sensitive

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characteristic as compared with other transistors and pin photo-diodes or the like. If comparison is made with an image sensor that is the same optical sensor taken as an example, assuming that output signal current of 1 μA is obtained for one of MOS type, then an output more than 100 μA is obtained for one of SIT type. Furthermore, if comparison is made with respect to one of CCD type, the SIT phototransistor has a sensitive characteristic higher in further several figures. Also in this respect, the SIT phototransistor is an element capable of catching also a weak optical signal transmitted from a considerably far remote location as compared with other light receiving elements.

Moreover, in case where an infrared light-emitting diode is used as a light emitting element in order to enable use in the daytime, it is adequate to use a light receiving element which is most superior in sensitive characteristic with reference to infrared wavelength. In this case, it can be expected for an element using Ge (germanium) to increase the sensitive characteristic, though it is possible also for a phototransistor using Si (silicon).

In connection with the above, in case where the used wavelength is infrared, if the transmitting element of the transmitting device and the receiving element of the receiving device are covered with a glass material or a resin material formed of a material

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cutting the wavelength of the visible light, or the entire apparatus is covered with a resin such as a plastic material having a red to dark-red color, or the like, it is possible to use the apparatus without
5 erroneous operation due to affection or influence such as a sunlight or the like.

With the above arrangement of the invention, according to the discriminating light-emitting apparatus of the invention, if a user mounts or rests
10 the apparatus according to the invention on an adequate and particularly conspicuous location of a specific article which the user desires to find out or locate, within dead darkness, or among plenty of articles the same in type as each other, it is possible to rapidly
15 and easily find out the specific article. For example, the apparatus is useful for finding out own vehicle in, for example, a parking area or the like. Moreover, the apparatus is not limited to vehicles, but is convenient also in case where own bag or the like is found out
20 among many burdens during traveling, or the like. Application of the apparatus extends over a wide scope.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing ~~an~~
25 ~~embodiment of~~ a discriminating light-emitting apparatus ~~according to the invention;~~

Fig. 2 is a schematic longitudinal cross-sectional view showing a receiving device according to

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~~another~~ embodiment of the invention;

Fig. 3 is a cross-sectional view taken along a line III - III in Fig. 2;

Fig. 4 is a schematic perspective view showing a transmitting device of the aforesaid ~~another~~ embodiment;

Fig. 5 is a basic circuit view of the transmitting device and the receiving device of the aforementioned ~~another~~ embodiment;

Fig. 6 is a view showing an applied example or a modification of the receiving device;

Fig. 7 is a perspective view showing an example of how to mount the receiving device;

Fig. 8 is a schematic cross-sectional view showing a transmitting device according to still another embodiment; and

Fig. 9 is a schematic perspective view of the transmitting device illustrated in Fig. 8.

20 DESCRIPTION OF THE EMBODIMENTS

Referring first to Fig. 1, there is schematically shown ~~an embodiment of~~ a discriminating light-emitting apparatus ~~according to the invention~~. The reference numeral 1 denotes an external transmitting source such as a radio or wireless light-emitting unit of small-electric-power type, or the like; and 2, an antenna. The external transmitting source 1 and the antenna 2 cooperate with each other to

form a transmitting device. If a used frequency is within a VHF band ~ UHF band, a wave can reach within a range of the order of 10 m ~ 200 m, if an output is within 1 mW to 10 mW.

5 The reference numeral 3 denotes an antenna of a receiving section to be described subsequently; 4, a receiving section; and 5, a light-emitting section such as a visible light-emitting diode, or the like. The antenna 3, the receiving section 4 and the light-emitting section 5 cooperate with each other to form a receiving device. When the visible light-emitting diode 5 receives a signal from the external transmitting source 1, the diode 5 is turned on or off. The receiving section 4 should sufficiently be higher in sensitivity than the external transmitting source 1, and it is advisable that the receiving section 4 is of homodyne type or of heterodyne type.

 In order to further facilitate operation for specifying an article to be discriminated, ~~in this embodiment,~~ a modulator and a demodulator should be mounted respectively on the external transmitting source 1 and the receiving section 4, respectively. Specifically, optional characters or numerals are combined with each other so as to be coded and modulated on a modulating side, while only a coded signal is responded to turn on and off the visible light-emitting diode on the demodulating side. With such arrangement, the receiving section 4 responds only

to a signal of a specific code and, therefore, it is possible to prevent radio interference, and affection or influence of noises. As a result, the operation for specifying the article to be discriminated can be facilitated. Furthermore, similar advantages can be obtained if a frequency or a wavelength of the external transmitting source 1 and the receiving section 4 are optionally selected.

Fig. 2 is a schematic longitudinal cross-sectional view of a receiving device according to another embodiment of the invention; Fig. 3, a cross-sectional view taken along a line III - III in Fig. 2; and Fig. 4, a schematic perspective view of a transmitting device according to the aforesaid another embodiment.

In Fig. 2, the reference numeral 11 denotes a cylindrical casing. The cylindrical casing 11 has a side surface on the inside of which a plurality of light receiving elements 12 such as, for example, SIT phototransistors or the like are built in such that light from the exterior can reach the light receiving section through convex lenses 13. A plurality of visible light-emitting diodes 14 are built in on an upper portion of the casing 11. A closure of lid 15 having a generally hemispherical configuration having a lens effect covers the circumference of the visible light-emitting diodes 14. Moreover, a cell 16 for radiating the light-emitting diodes 14 is built in at a

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center of the casing 11.

As shown in Fig. 3, four (4) light receiving elements 12 are arranged concentrically with the casing 11 and facing outwardly. The convex lenses 13 and mirror-surface reflecting plates 17 for enhancing light-receiving sensitivity are arranged respectively in front of the light-receiving elements 12.

In connection with the above, the arranging method of the light receiving elements 12 should not be limited to the above-described one, but may be any one if the arranging method is such that an entire periphery of the casing 11 is covered, such as the light receiving elements 12 being closely arranged on a side surface of the casing 11, or the like, without the use of the reflecting plates 17. Further, a configuration of the casing 11 should not be limited to the cylindrical configuration. Furthermore, the arrangement may be such that a light receiving section and a light emitting section are formed separately from each other.

As shown in Fig. 4, the transmitting device is arranged such that an infrared light-emitting diode 19 that is a transmitting source, a convex lens 20 movable along an optical-axis direction for regulating a light emitting angle, a cell 21, and a drive switch 22 are received within a case 18. The lens 20 has an effect that, in case where there is a searching or seeking vehicle or the like at a relatively near

location, a light-projecting angle is enlarged or widened whereby an optical signal can be sent within a wide range or area even if a light projecting strength becomes relatively weak and, therefore, a receiving device is caught or seized for a short period of time, and an optical signal can be transmitted to the caught receiving device. Moreover, in case where an optical signal is sent over a far or remote distance, a light projecting angle is restricted whereby the light projecting strength can be raised. Thus, it is possible to improve receiving accuracy.

Fig. 5 is a view showing fundamental or basic circuits of the respectively transmitting device and receiving device of the present embodiment. The circuit of the transmitting device comprises a cell 21 for radiating the infrared light-emitting diode 19, a switch 22, a limiting resistance 23 and the like. Further, the circuit of the receiving device comprises a light receiving element 12 and the cell 16 for radiating the light emitting diode 14.

Fig. 6 is a view showing a modified example of the receiving circuit. This example builds therein an amplification stabilizing circuit 24 for supplying an always constant output without relying upon an input light quantity, to the light emitting diode 14 of the light emitting section, in order to prevent current flowing through the light emitting diode 14 from being reduced in case where an input optical signal is weak.

In connection with the above, a hold circuit of an output to the light emitting diode 14 is built in series with the stabilizing circuit, whereby it is possible to send out an output signal continuously if a signal is once inputted even if the input signal is for a moment. Furthermore, a timer circuit is built in whereby operation of the hold circuit can be limited to a predetermined period of time.

Fig. 7 is a view showing an example of a structure or arrangement for mounting the receiving device. The mounting arrangement is a case where an antenna for a radio of a vehicle, for example, is used as a mounting section. Naturally, utilization of the antenna enables the receiving device to be mounted at a location higher than a ceiling of the vehicle. As a method of mounting the receiving device, there is a method in which the receiving device is mounted through a leaf spring which is put in the antenna, a method in which the receiving device is mounted through a mounting metallic element 27 of type in which the mounting metallic element 27 is fitted about the antenna and is fixedly mounted thereto by screws, and the like. In this case, also, the arrangement may be such that only the receiving section is mounted on the antenna, and the light emitting section is mounted by utilization of a high-mount stop lamp, or the like.

Figs. 8 and 9 are a schematic cross-sectional view and a schematic perspective view showing an

embodiment in which a light receiving element is also mounted on the side of the transmitting device. As shown in Fig. 8, the arrangement is such that a light receiving element 28 is arranged adjacent to the light emitting element 19, and the light receiving element 28 is received within the case 18 in parallel relation to the infrared light emitting diode 19 through a convex lens 29.

Moreover, as shown in Fig. 9, in case where a radiated optical signal is reflected and is returned, a light receiving element 28 on the side of the transmitting device catches the signal so that a light emitting diode 30 in front of the switch 22 is turned on and off. A circuit according to the present embodiment is similar to the transmitting circuit and the receiving circuit illustrated in Fig. 5. If the circuit according to the present embodiment is used, even in case where vehicles high in height such as wagon vehicles, trucks and the like are parked in front of and in rear of, and on the left- and right-hand sides of an own vehicle, and light is obstructed or hindered by the vehicles so that the light does not reach the receiving device which is mounted on the objective vehicle, light reflected from the vehicles high in the ceiling is caught by the receiving element 29 on the side of the transmitting device, and turning-on and -off of the light emitting diode 30 inform that there is an obstacle. Accordingly, even if

a light emitting direction is oriented toward directions other than the direction toward the light emitting diode 20, if there is no radiation from the receiving device, it is possible to inform other vehicles that there is own vehicle, in a parking direction of the vehicle high in height. In this manner, if the light receiving element 29 is built in also on the side of the transmitting device, identification of the objective article is facilitated and is made rapidly.

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**CLAIMS:**

1. A discriminating light-emitting apparatus comprising:

5 transmitting means for transmitting an optical signal which is coded or which has a specific wavelength; and

receiving means having a light receiving element responsive only to said optical signal transmitted from said
10 transmitting means and having a light-emitting section for displaying an indication of receipt ^{of} ~~said coded~~ optical signal, said receiving means including a plurality of light receiving elements which are so arranged as to cover an entire periphery of said receiving means; and

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said transmitting means transmitting the optical signal upon turning-on a drive switch, said receiving means turning on when said light receiving element receives said optical signal, and said light-emitting section being turned on,
20 for at least a predetermined time period, to display said indication of receipt of said signal.

2. Apparatus according to claim 1, wherein said transmitting means is also provided with a light-emitting
25 section which is responsive to a signal issued from said transmitting means, to execute a display, when said optical signal is reflected and is returned from said receiving means.

30 3. Apparatus according to Claim 1, wherein a light-emitting section for an object on which said receiving means is arranged is also said light-emitting section of said receiving means, and an output signal from said light-receiving element of said receiving means is supplied to a
35 light-emitting circuit of said light-emitting section as a drive signal.



4. Apparatus according to Claim 1 wherein said transmitting means and said receiving means are covered respectively by materials which cuts out light having a wavelength other than said transmitted optical signal.

5. Apparatus according to Claim 1 wherein said transmitting means includes a light-emitting element, and said discriminating light-emitting apparatus further includes a lens movable along an optical axis direction which is arranged in front of said light-emitting element of said transmitting means, so that a light projecting direction of said light-emitting element is adjustable.

6. Apparatus according to Claim 1 wherein said transmitting means has a light-emitting element, and said light-emitting of said transmitting means is an infrared light-emitting diode.

7. Apparatus according to Claim 1 wherein said receiving means includes a plurality of light receiving means, and said light-receiving elements of said receiving means are SIT phototransistors.

8. Apparatus according to Claim 1 wherein said receiving means is a receiving unit provided with a light receiving element which is at least one of a pin photodiode, a phototransistor, and a SIT phototransistor.

9. Apparatus according to Claim 1 wherein said receiving means is a receiving unit provided with a light receiving element which responses an infrared wavelength of an infrared light-emitting diode, and wherein said light receiving element is an element comprising germanium.

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10. Apparatus according to Claim 1 wherein said wavelength is infrared, wherein said transmitting means has a transmitting element and said receiving means has a



receiving element, and wherein said transmitting element and said receiving element are covered with at least one of a glass material and a resin material, which is formed of a material which cuts out wavelengths of visible light.

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11. Apparatus according to Claim 1 wherein said transmitting means includes a case, and an infrared light-emitting diode that is a transmitting source, a convex lens movable along an optical axis, for regulating a light-emitting angle, a
10 cell, and a drive switch, which are built into said case.

12. Apparatus according to Claim 1 wherein said receiving means comprises:

15 a cylindrical casing having a power source for a visible light-emitting diode built in a central portion thereof;

a plurality of light receiving elements arranged inside said casing such that said light receiving elements are in
20 a concentric relation to said casing and facing outwardly;

a conical mirror-surface reflecting plate for guiding light from outside to said light receiving elements and a convex lens, for enhancing light receiving sensitivity,
25 arranged respectively in front of said light receiving elements; and

a generally hemispherical lid having a lens effect covering a circumference of a plurality of visible light-emitting diodes arranged on an upper portion of said casing:
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said transmitting means comprising:

a case within which are received a power source for an
35 infrared light-emitting diode and a drive circuit;

a manual operating drive switch disposed on an upper surface of said case;



a convex lens projecting from a side surface of said case and movable along an optical axis direction for regulating a light-emitting angle; and

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an infrared light-emitting diode for issuing an optical signal through said convex lens; and

wherein said optical signal is transmitted by turning on
10 said drive switch of said transmitting means, said light receiving element reacts and turns on in response to said optical signal thereby supplying electric current to said visible light-emitting diodes.

15 13. Apparatus according to Claim 12 including an amplification stabilizing circuit for supplying a substantially constant output, without relying upon an input light quantity, to said visible light-emitting diode.

20 14. Apparatus according to Claim 12 wherein said receiving means is mounted on an antenna of a radio for a vehicle.

15. Apparatus according to Claim 12 wherein:

25 said transmitting means comprises a resistor, an infrared light-emitting diode, a power source and a switch connected in series in an electrical circuit; and

said receiving means comprises a light receiving
30 element, a visible light-emitting diode and a power source connected in series in another electric circuit.

16. Apparatus according to any of Claims 12-15 wherein a light receiving element is disposed adjacent to said light-
35 emitting element of said transmitting means and said light receiving element is arranged therein in parallel relation to said infrared light-emitting diode through convex lenses, respectively, the optical signal from said transmitting



means being thereafter returned and received by said light receiving element of said transmitting means, to turn on and off a light-emitting diode.