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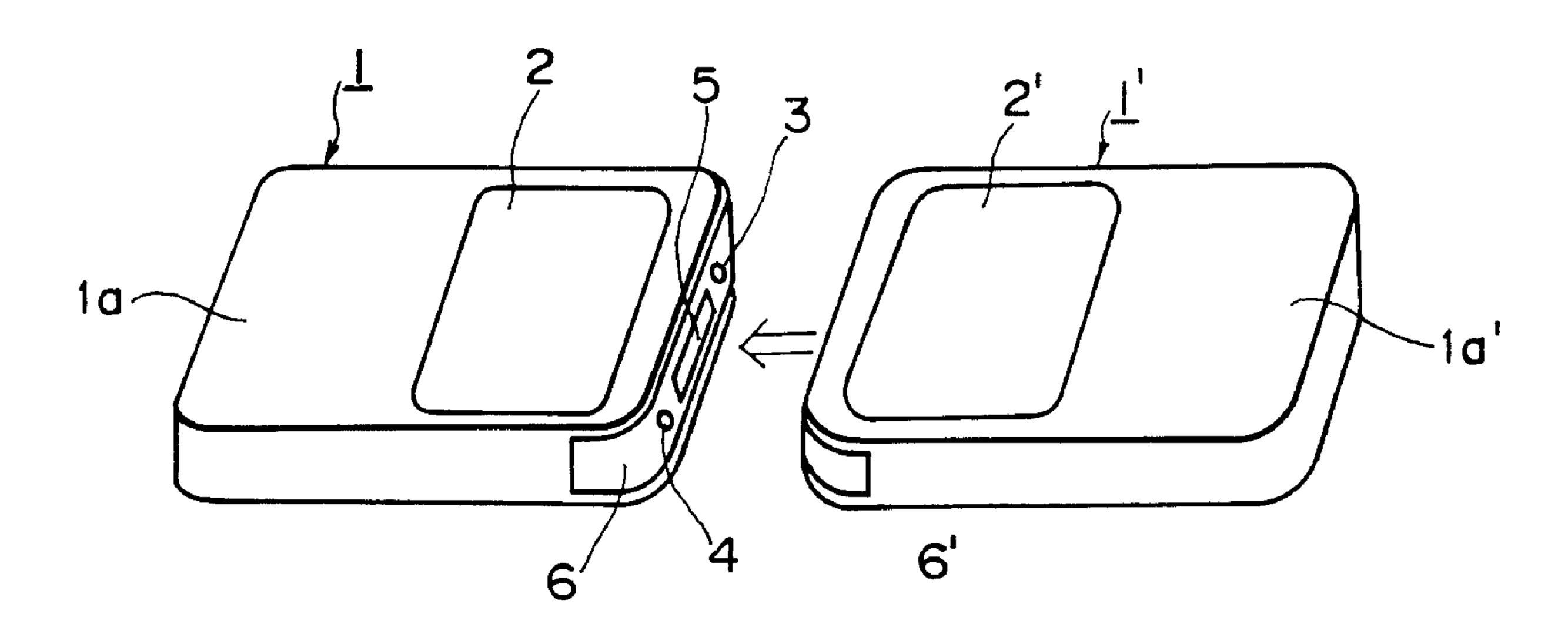
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(57) Abrégé/Abstract:

A portable electronic apparatus including a casing having a connecting surface adapted to be connected to a connecting surface of an external apparatus; a control unit accommodated in the casing; a transmitting terminal provided on the connecting surface of the casing for transmitting data as an optical signal generated by the control unit; and a receiving terminal provided on the connecting surface of the casing for receiving data as an optical signal generated by the external apparatus. The transmitting terminal and the receiving terminal are positioned in symmetrical relationship to each other with respect to a center of the connecting surface of the casing. Accordingly, in carrying out data transfer by optical space communication between two portable electronic apparatuses of the same kind, the transmitting terminal of one of the portable electronic apparatuses can be easily aligned to the receiving terminal of the other portable electronic apparatus.





ABSTRACT OF THE DISCLOSURE

A portable electronic apparatus including a casing having a connecting surface adapted to be connected to a connecting surface of an external apparatus; a control unit accommodated in the casing; a transmitting terminal provided on the connecting surface of the casing for transmitting data as an optical signal generated by the control unit; and a receiving terminal provided on the connecting surface of the casing for receiving data as an optical signal generated by the external apparatus. The transmitting terminal and the receiving terminal are positioned in symmetrical relationship to each other with respect to a center of the connecting surface of the casing. Accordingly, in carrying out data transfer by optical space communication between two portable electronic apparatuses of the same kind, the transmitting terminal of one of the portable electronic apparatuses can be easily aligned to the receiving terminal of the other portable electronic apparatus.

PORTABLE ELECTRONIC APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a portable electronic apparatus such as a portable computer or a handy terminal adapted to carry out data transfer with an optical signal.

Conventionally, optical communication between two portable electronic apparatuses is carried out by using optical fibers and optical connectors for connecting the two portable electronic apparatuses to each other through the optical fibers. This system is suitable to cope with undue radiation. However, it has a disadvantage such that the optical connectors cannot be quickly connected together to require much time. As a technique for solving this problem, it is known to adopt optical space communication without using any optical fibers and optical connectors. In the optical space communication, it is only necessary to decide a direction of radiation of an optical signal, so that data transfer can be easily carried out.

In the optical space communication, however, it is necessary to transmit an optical signal to another apparatus located remote from a transmitting position to some extent. Therefore, an output of the optical signal must be enlarged, resulting in an increase in current consumption. Accordingly, this technique is not applicable to a portable electronic

apparatus.

SUMMARY OF THE INVENTION

It is accordingly an object of the present invention to provide a portable electronic apparatus which can carry out data transfer quickly and suppress current consumption.

According to the present invention, there is provided a portable electronic apparatus comprising a casing having a connecting surface adapted to be connected to a connecting surface of an external apparatus; a control unit accommodated in said casing; a transmitting terminal provided on said connecting surface of said casing for transmitting data as an optical signal generated by said control unit; and a receiving terminal provided on said connecting surface of said casing for receiving data as an optical signal generated by said external apparatus; wherein said transmitting terminal and said receiving terminal are positioned in symmetrical relationship to each other with respect to a center of said connecting surface of said casing.

In the portable electronic apparatus having the abovementioned construction, the transmitting terminal and the
receiving terminal are positioned in symmetrical relationship
to each other with respect to the center of the connecting
surface of the portable electronic apparatus. Accordingly, in
carrying out data transfer by optical space communication
between two portable electronic apparatuses of the same kind

having the above construction, for example, the transmitting terminal of one of the portable electronic apparatus can be easily aligned to the receiving terminal of the other portable electronic apparatus only by attaching the connecting surface of the one portable electronic apparatus to the connecting surface of the other portable electronic apparatus in alignment. That is, an optical path between both the portable electronic apparatuses can be easily formed.

As described above, the portable electronic apparatus of the present invention has the transmitting terminal and the receiving terminal positioned in symmetrical relationship to each other with respect to the center of the connecting surface as a reference point. It is therefore advantageous that optical space communication between the portable electronic apparatus of the present invention and an external apparatus, especially, another same type portable electronic apparatus can be carried out easily and securely.

Other objects and features of the invention will be more fully understood from the following detailed description and appended claims when taken with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a portable computer as a portable electronic apparatus according to a first preferred embodiment of the present invention;

Fig. 2 is a horizontal sectional view of an essential part

of a portable computer according to a second preferred embodiment of the present invention;

Fig. 3 is a perspective view of a peripheral apparatus to which the portable electronic apparatus of the present invention is to be connected, according to a third preferred embodiment of the present invention; and

Fig. 4 is a block diagram of an electrical construction of the portable electronic apparatus of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1 which shows a first preferred embodiment of the present invention, reference numeral l generally designates a portable computer as the portable electronic apparatus of the present invention, and reference numeral l' generally designates another portable computer having the same construction as that of the portable computer 1. The portable computer 1' constitutes the external apparatus according to the present invention. Reference numeral la designates a casing of the portable computer 1, and reference numeral la' designates a casing of the portable computer l'. The casings la and la' are formed in a substantially rectangular shape. An upper surface of the casing la is provided with an operating portion 2 for displaying a command or the like and instructing execution of operation. Similarly, an upper surface of the casing la' is provided with an operating portion 2' identical with the operating portion 2.

One of side surfaces of the casing la is provided with an optical signal transmitting terminal 3 and an optical signal receiving terminal 4. The transmitting terminal 3 and the receiving terminal 4 are necessarily spaced apart from each other as far as possible, so as to prevent mutual interference. To this end, an IC card inserting slot 5 is formed between the transmitting terminal 3 and the receiving terminal 4 on the one side surface of the casing la. Accordingly, a space between the transmitting terminal 3 and the receiving terminal 4 can be ensured by a width of the slot 5, thereby preventing the mutual interference. In other words, while it is necessary to space the transmitting terminal 3 and the receiving terminal 4 from each other to some degree, so as to prevent the mutual interference, the space therebetween can be effectively utilized by forming the slot 5 in the space. Further, the slot 5 is arranged at a middle portion of the one side surface of the casing la, and the transmitting terminal 3 and the receiving terminal 4 are arranged on opposite sides of the slot 5. Accordingly, a positional relation among the transmitting terminal 3, the receiving terminal 4 and the slot 5 can be clearly recognized.

Although not shown in Fig. 1, one of side surfaces of the casing la' of the portable computer 1' is also provided with a transmitting terminal, a receiving terminal and a slot which are identical with the transmitting terminal 3, the receiving

terminal 4 and the slot 5 of the portable computer 1, respectively, so that the transmitting terminal of the portable computer 1' is adapted to face the receiving terminal 3 of the portable computer 1, and the receiving terminal of the portable computer 1' is adapted to face the transmitting terminal of the portable computer 1' is adapted to face the transmitting terminal of the portable computer 1.

As to the specific arrangement of the transmitting terminal 3 and the receiving terminal 4, it should be noted that the transmitting terminal 3 and the receiving terminal 4 are arranged in symmetrical relationship to each other with respect to a longitudinal central point on the one side surface of the casing la. That is, assuming that a central point on a center line in respect of a longitudinal direction of the one side surface of the casing la is defined as a reference point, the transmitting terminal 3 and the receiving terminal 4 are arranged in equally spaced relationship from this reference point, i.e., in symmetrical relationship to this reference point. Further, a transparent cover 6 formed of resin or the like is provided on the one side surface of the casing la so as to cover the transmitting terminal 3 and the receiving terminal 4. The slot 5 is formed through the cover 6.

As mentioned above, the transmitting terminal 3, the receiving terminal 4 and the cover 6 constitute an essential part of the present invention, and this essential part is applied to a portable computer in the preferred embodiment

shown in Fig. 1. According to the portable computer including this essential part, data is received as an optical signal from the receiving terminal 3, and data collected in the portable computer is transmitted as an optical signal to the outside.

In the preferred embodiment shown in Fig. 1, data transfer is carried out between the portable computers I and I' of the same kind. In operation, the one side surface of the casing la of the portable computer 1 on which surface the transmitting terminal 3 and the receiving terminal 4 are provided is attached to the one side surface of the casing la' of the portable computer l'. At this time, by aligning four sides of the one side surface of the casing la to four sides of the one side surface of the casing la', the reference point on the one side surface of the casing la becomes coincident with the reference point on the one side surface of the casing la'. Since the transmitting terminal 3 and the receiving terminal 4 on the one side surface of the casing la are arranged in symmetrical relationship to each other with respect to the reference point, the transmitting terminal 3 of the portable computer I faces the receiving terminal of the portable computer l', and the receiving terminal 4 of the portable computer I faces the transmitting terminal of the portable computer l'. In this manner, only by attaching the one side surface of the casing la of the portable computer 1 to the one side surface of the casing la' of the portable computer l',

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alignment of optical paths for the data transfer between both the portable computers 1 and 1' can be finished. Thus, the alignment of the optical paths can be easily effected without paying any other special attention.

Fig. 2 shows a second preferred embodiment of the present invention, in which the same reference numerals as those shown in Fig. 1 designates like or corresponding parts. In Fig. 2, the transmitting terminal, the receiving terminal and the slot of the portable computer l' are designated by reference numerals 3', 4' and 5', respectively. The second preferred embodiment differs from the first preferred embodiment in the point that the covers 6 and 6' are specially designed. is, the cover 6 of the portable computer 1 is provided with a projection 6a at a portion corresponding to the transmitting terminal 3, and is also provided with a recess 6b at a portion corresponding to the receiving terminal 4. Similarly, the cover 6' of the portable computer l' is provided with a projection 6a' at a portion corresponding to the transmitting terminal 3', and is also provided with a recess 6b' at a portion corresponding to the receiving terminal 4'. When both the covers 6 and 6' are attached to each other in operation, the projection 6a of the cover 6 comes into engagement with the recess 6b' of the cover 6', and the recess 6b of the cover 6 comes into engagement with the projection 6a' of the cover 6'. Therefore, the alignment of the optical paths can be effected

more easily as compared with the first preferred embodiment shown in Fig. 1. Thus, the covers 6 and 6' also serve as guides. When the projections 6a and 6a' come into engagement with the recesses 6b and 6b', respectively, reference points A and A' on the covers 6 and 6' are aligned to each other so as to lie on a one-dot chain line (a longitudinal center line of each portable computer). Accordingly, light emitted from the transmitting terminal 3 of the portable computer 1 is transmitted through the projection 6a of the cover 6 and the recess 6b' of the cover 6' to the receiving terminal 4' of the portable computer 1'.

In engaging the projections 6a and 6a' with the recesses 6b and 6b', respectively, there is a possibility of flaw due to rubbing between the projections 6a and 6a' and the recesses 6b and 6b', causing easy occurrence of light scattering. To cope with this, the projection 6a is formed at its top with a recess 6c in the range of light transmission. Similarly, the projection 6a' is formed at its top with a recess 6c' in the range of light transmission. With this structure, the rubbing between the projections 6a' and 6a' and the recesses 6b and 6b' can be suppressed to reduce the flaw.

According to the first and second preferred embodiments as described above, only by attaching the one side surface of the casing la of the portable computer 1 to the one side surface of the casing la' of the portable computer 1', the transmitting

terminal 3 and the receiving terminal 4 of the portable computer 1 can be closely aligned to the receiving terminal 4' and the transmitting terminal 3' of the portable computer 1', respectively, so that electrically non-contact optical space communication between both the portable computers 1 and 1' is effected. Accordingly, it is unnecessary to provide a connecting cable or a connector for data transfer. Further, when both the portable computers 1 and 1' are attached to each other in operation, the transmitting terminal 3 and the receiving terminal 4 of the portable computer 1 are disposed close to the receiving terminal 4' and the transmitting terminal 3' of the portable computer 1', respectively. Accordingly, an output of the transmitting terminals 3 and 3' can be made smaller than that in the conventional optical space communication.

As a result, current consumption can be greatly suppressed to thereby reduce battery consumption, so that the optical space communication in the preferred embodiments is greatly effective as a method for data transfer between two portable electronic apparatuses of the same kind.

Furthermore, as the transmitting terminal 3 and the receiving terminal 4 of the portable computer 1 are disposed close to the receiving terminal 4' and the transmitting terminal 3' of the portable computer 1' in operation, an external noise is hardly mixed in. In addition, a sufficient

receiving level can be ensured even though an output of an optical signal is low. Accordingly, in carrying out the data transfer by the optical space communication, no complex error correction is needed, and malfunction due to the external noise is hard to occur.

Fig. 3 shows a third preferred embodiment of the present invention, in which data collected in the portable computer l is transferred to a peripheral apparatus 10 such as a printer. The peripheral apparatus 10 is provided with a connecting portion Il for connecting the portable computer 1 and a mounting portion 12 for mounting the portable computer 1. The connecting portion ll is provided with a transmitting terminal and a receiving terminal having the same function as that of the transmitting terminal 3 and the receiving terminal 4 of the portable computer 1. The connecting portion 11 is further provided with a recess adapted to engage the projection 6a of the portable computer 1 and a projection adapted to engage the recess 6b of the portable computer 1. With this structure, the portable computer I and the peripheral apparatus 10 can be easily connected together, and the data in the portable computer 1 can be securely transferred to the peripheral apparatus 10.

Fig. 4 shows an electrical construction of the portable computer 1 in a schematic block diagram form. As shown in Fig. 4, the portable computer 1 includes a control unit comprising a

CPU 50 for generally controlling the operation, a ROM 51 previously storing a predetermined program, a RAM 52 for temporarily storing data, a clock generator 53 for generating an operation timing signal, and a gate array 55 for controlling the operating portion 2, the transmitting terminal 3 and the receiving terminal 4. The gate array 55 also controls a speaker 54 to output a predetermined sound signal thereto. Reference numeral 56 denotes an IC card to be inserted from the slot 5.

In the above construction, the program stored in the ROM 51 is executed by the CPU 50 with a period of clock generated by the clock generator 53. Data received from the receiving terminal 4 is temporarily stored into the RAM 52, and if required, the data is stored into the IC card 56. A predetermined command is input by operating the operating portion 2, as required, and it is displayed on the operating portion. Further, a sound is generated from the speaker 54, if required. A transmitting timing of an optical signal from the transmitting terminal 3 and a receiving timing of an optical signal from the receiving terminal 4 are decided by the gate array 55.

While the invention has been described with reference to specific embodiments, the description is illustrative and is not to be construed as limiting the scope of the invention.

Various modifications and changes may occur to those skilled in

the art without departing from the spirit and scope of the invention as defined by the appended claims.

THE EMBODIMENT OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A portable electronic apparatus (1) for transferring optical data signals to an external apparatus (1') comprising:

a casing (1a) having a connecting surface adapted to be connected to a connecting surface of said external apparatus (1');

a transmitting terminal (3) provided on said connecting surface of said casing (1a) for transmitting data as an optical signal generated by a control unit to said external apparatus; and

a receiving terminal (4) provided on said connecting surface of said casing (1a) for receiving data as an optical signal generated by said external apparatus (1');

wherein said transmitting terminal (3) and said receiving terminal (4) are positioned in symmetrical relationship to each other with respect to a centre of said connecting surface of said casing (1a);

characterized in that

said transmitting and receiving terminals (3, 4) are covered by a transparent cover (6), having the shape of a round-cornered rectangle,

an upper surface of said casing (1a) is provided with an operating portion (2) for displaying and instructing the execution of an operation, and that said apparatus (1) further comprises:

a gate array (55) for controlling said operating portion (2) so as to display a predetermined command being input by operating said operating portion (2),

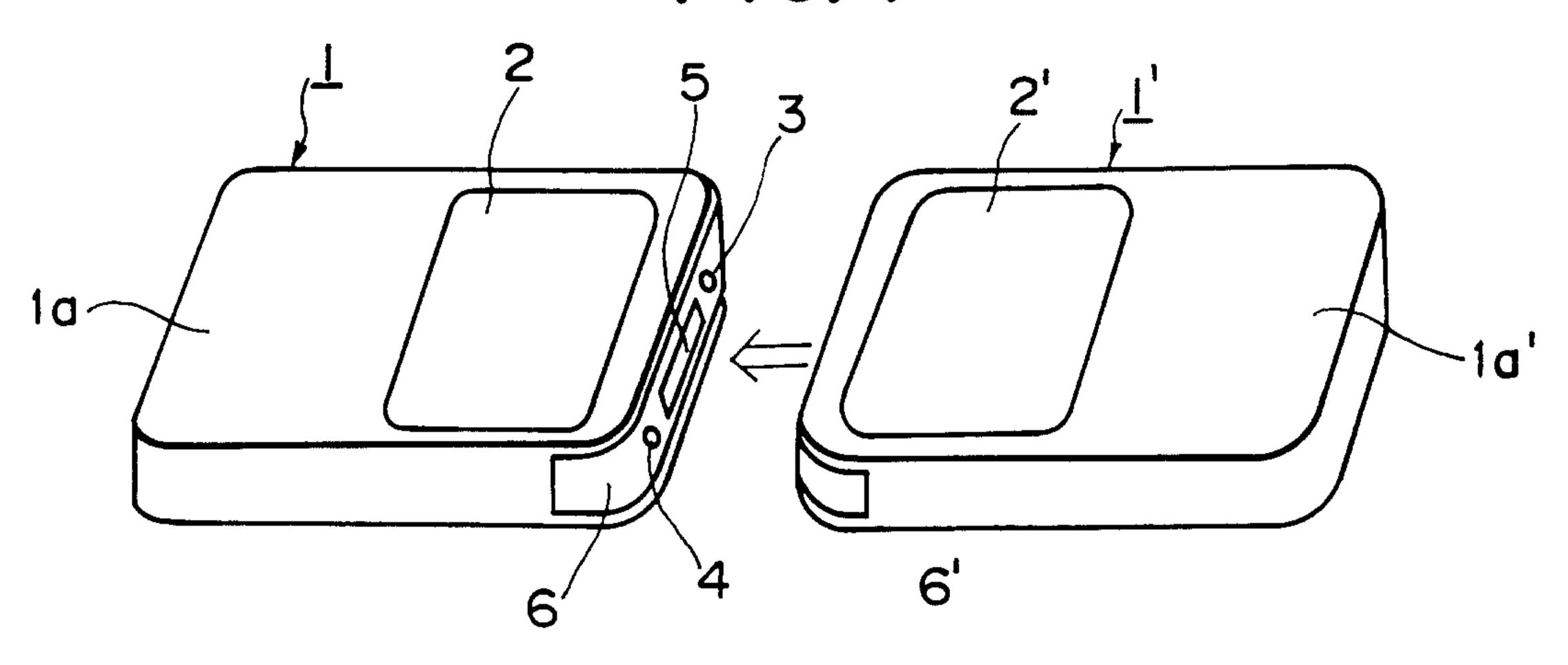
wherein the transmitting timing of an optical signal from said transmitting terminal (3) and the receiving timing of an optical signal from said receiving terminal (4) are decided by said gate array (55) being operated by said operating portion (2).

2. A portable electronic apparatus according to any one of the preceding claims, wherein said casing (1a) is formed in a substantially rectangular shape, and said connecting surface of said casing is formed as one of outer side surfaces of said casing (1a).

- 3. A portable electronic apparatus according to any one of the preceding claims, wherein said optical signal is emitted from said transmitting terminal (3) directly through said transmitting terminal (3) directly through said connecting surface of said casing.
- 4. A portable electronic apparatus according to any one of the preceding claims, wherein said connecting surface of said casing (1a) has a memory card inserting slot (5) extending between said terminating terminal and said receiving terminal.
- 5. A portable electronic apparatus according to any one of the preceding claims, wherein said external apparatus (1') has the same construction as that of said electronic apparatus, whereby in transmitting the data from said electronic apparatus to said external apparatus (1'), said connecting surface of said electronic apparatus (1) is attached to said connecting surface of said external apparatus (1') so that said transmitting terminal (3) of said electronic apparatus (1) faces a receiving terminal (4') of said external apparatus (1'), and said receiving terminal (4) of said electronic apparatus (1) faces a transmitting terminal (3') of said external apparatus (1').
- 6. A portable electronic apparatus according to any one of the preceding claims, wherein said external apparatus (1') is a peripheral apparatus.
- 7. A portable electronic apparatus according to claim 5 or 6, wherein said connecting surfaces have engaging portions adapted to engage with each other for closely positioning said transmitting terminal (3) and said receiving terminal (4) facing each other.

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FIG. 1



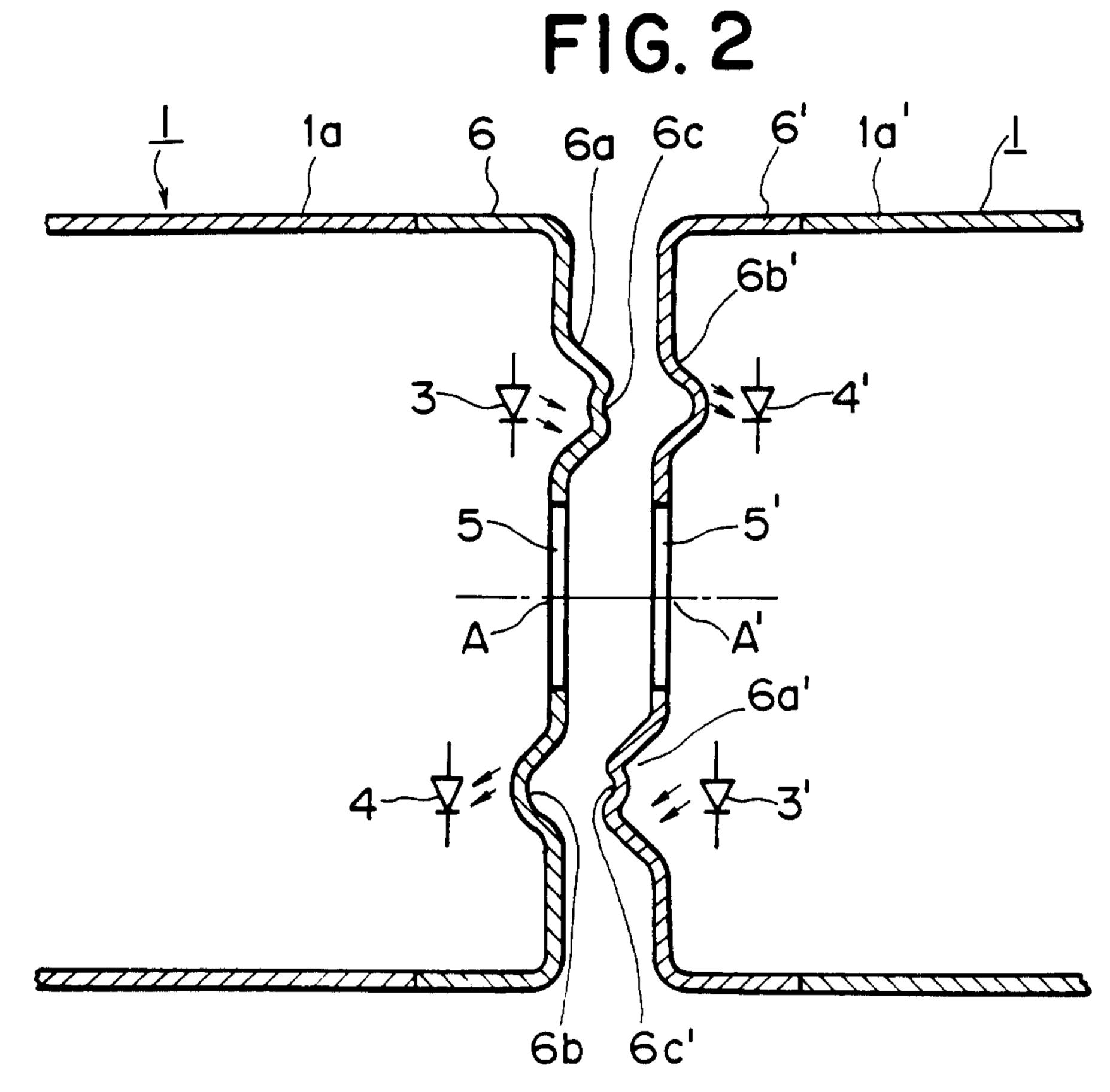


FIG. 3

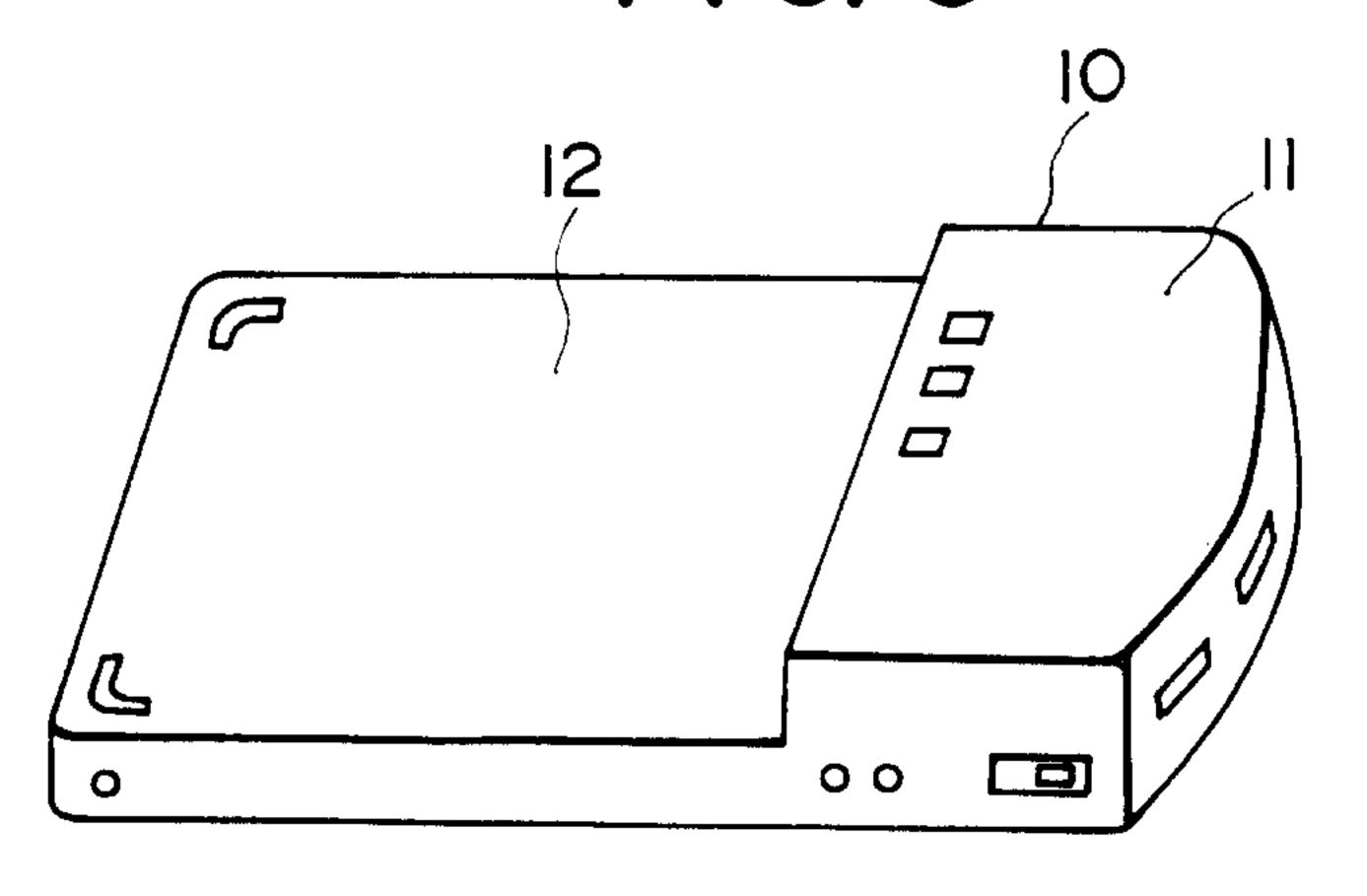


FIG. 4

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