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(72) Inventeurs/Inventors:
ITOH, KATSUTOSHI, JP;
YASUDA, MITSUYOSHI, JP;
NATORI, MAKOTO, JP;
YOSHIMURA, OSAMU, JP;
YOKOSHI, MINORU, JP;
ITAGAKI, TAKESHI, JP

(73) Propriétaire/Owner:
SONY ERICSSON MOBILE COMMUNICATIONS JAPAN, INC., JP

(74) Agent: GOWLING LAFLEUR HENDERSON LLP

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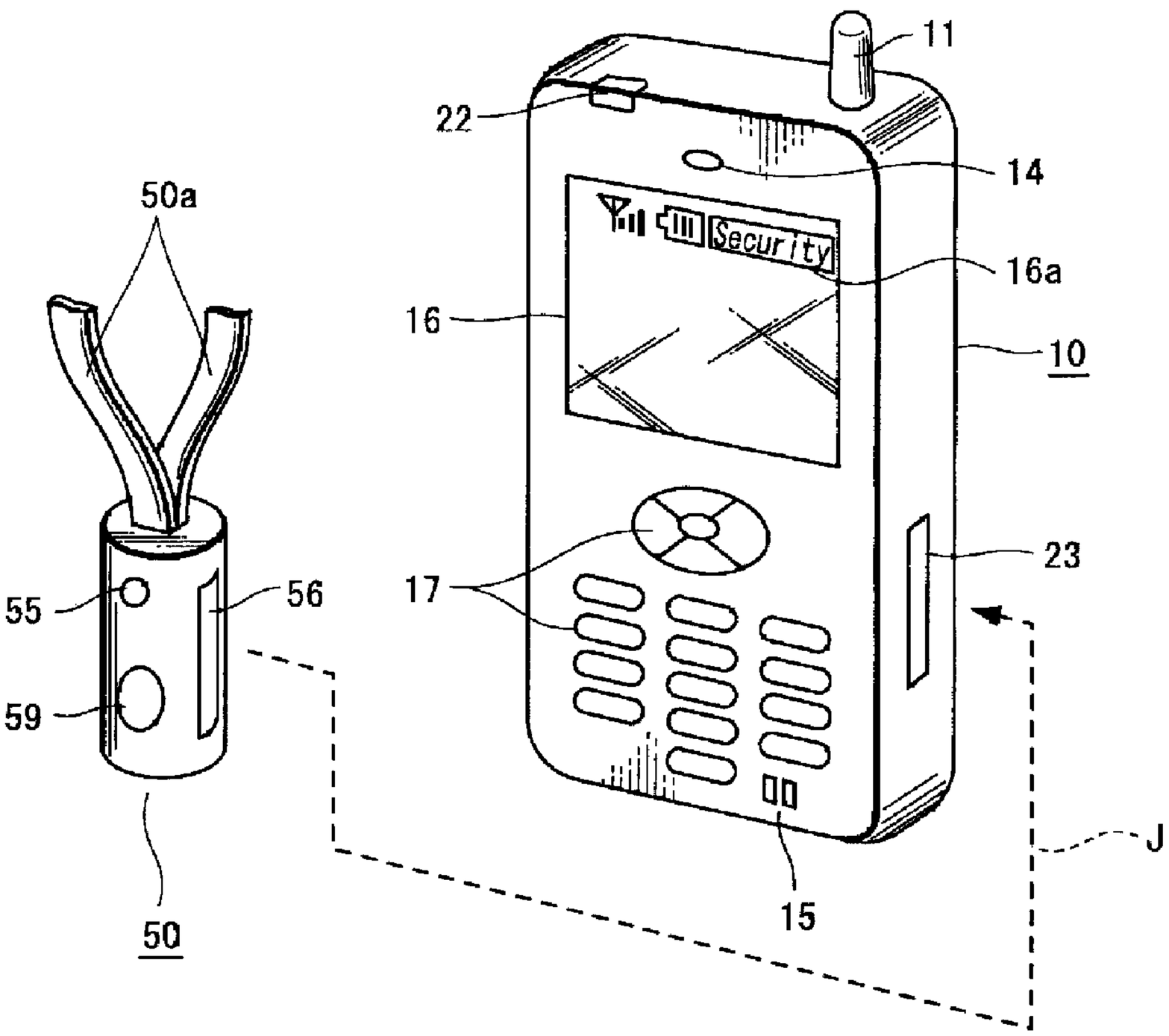

(57) Abrégé/Abstract:
In a case when a wireless communication is carried out between a communication terminal apparatus and a wireless key apparatus in which one of the two apparatuses which carry out the communication becomes a master and the other one becomes

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(57) Abrégé(suite)/Abstract(continued):
a slave, the slave detects a signal from the master and the wireless communication is carried out by a wireless communication system executing the wireless connection between the two apparatuses, it is constituted such that each of the communication terminal apparatus and the wireless key apparatus includes communication means for carrying out the wireless communication, and control means; and in a case when the wireless communication state between the communication terminal apparatus and the wireless key apparatus is a non-connection state, the side which becomes the master is to transmit a signal asking for a "response from the slave" intermittently by changing the period into a plurality of steps in response to the non-connection time period and the side which becomes the slave is to carry out a reception for searching a signal from the master intermittently by changing the period into a plurality of steps in response to the non-connection time period. It may be expected by this constitution that a communication terminal apparatus such as a mobile telephone terminal can be connected wirelessly with another terminal apparatus rapidly by low power consumption.

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ABSTRACT OF THE DISCLOSURE

In a case when a wireless communication is carried out between a communication terminal apparatus and a wireless key apparatus in which one of the two apparatuses which carry out the communication becomes a master and the other one becomes a slave, the slave detects a signal from the master and the wireless communication is carried out by a wireless communication system executing the wireless connection between the two apparatuses, it is constituted such that each of the communication terminal apparatus and the wireless key apparatus includes communication means for carrying out the wireless communication, and control means; and in a case when the wireless communication state between the communication terminal apparatus and the wireless key apparatus is a non-connection state, the side which becomes the master is to transmit a signal asking for a "response from the slave" intermittently by changing the period into a plurality of steps in response to the non-connection time period and the side which becomes the slave is to carry out a reception for searching a signal from the master intermittently by changing the period into a plurality of steps in response to the non-connection time period. It may be expected by this constitution that a communication terminal apparatus such as a mobile telephone terminal can be connected wirelessly with another terminal apparatus rapidly by low power consumption.

COMMUNICATION SYSTEM AND COMMUNICATION TERMINAL APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates, for example, to a communication system suitable for being applied to an apparatus constituted by a communication terminal apparatus such as a mobile telephone terminal and a wireless key apparatus restricting the operation of the terminal apparatus and to a communication terminal apparatus constituting the communication system.

Description of the Related Art:

In recent years, a mobile telephone terminal which is one of communication terminal apparatuses a user always taking along in possession has a trend such that various functions other than wireless telephone functions of primary functions are built-in so as to contain multi functions.

For example, there exists such a terminal in which a camera function carrying out a filming of a still picture and a moving picture, a recording and reproducing function of music data, a

viewing and listening function of television broadcast or the like is built-in.

In addition, there has been developed a mobile telephone terminal in which a function as a non-contacting IC card which has been prevailing rapidly in recent years is built-in. This non-contacting IC card is utilized as a boarding ticket of transport facilities, a membership card, an employee ID card, a card for price settlement means at a shop or the like where an authentication process is carried out by performing wireless communication between adjacent reader and writer, so that it is easy-to-use as compared with a magnetic card or the like. It should be noted in a case when an IC card function unit is mounted in a mobile terminal that the IC card function unit is not always necessarily to have a card type shape.

And now, it is preferable for the mobile telephone terminal having multi functions in this manner to be carried out with a process in order to secure some kind or another security for preventing various functions provided in the terminal from being abused when the terminal is lost. In particular, in case of a terminal installed with an IC card function unit, there is a possibility that personal information stored as the IC card function is read out unjustly or unjust settlement or the like utilizing the IC card function is carried out, so that the necessity for a function for preventing the unjust use thereof is high. There are descriptions, for example, in patent documents 1

and 2 that a wireless card which forms a pair with respect to the mobile telephone terminal is prepared and authentication request is wireless-transmitted periodically from that wireless card such that the functions of mobile telephone terminal is made to be restricted in a case when collation with respect to the authentication request cannot be taken.

[Patent Document 1] Jap. laid-open patent publication No. 2001—352579

[patent document 2] Jap. laid-open patent publication No. 2001—358827

However, if it is attempted to provide in a mobile telephone terminal with a communication circuit for carrying out an exclusive authentication process or authentication processing means for carrying out function limitation of that terminal such as shown in the descriptions in the patent documents 1 and 2, there is a problem that the constitution of the terminal becomes complicated. In case of carrying out such a wireless communication for the function limitation, if various wireless communication systems existing in the related art can be applied as they are, it is to contribute to lowering the cost of a mobile terminal.

However, in a case when it is considered to use various wireless communication systems existing in the related art as they are for the purpose of security assuring, a case is supposed

in which the function limitation does not always function effectively. More specifically, it is fundamental for a commonly used wireless communication system existing in the related art to carry out a wireless communication with a terminal of a partner as favorably as possible within the specification given by the wireless system. Consequently, for example, a wireless card for carrying out function limitation of a mobile telephone terminal and its terminal is prepared and even if a system is composed assuming that the function of the mobile telephone terminal is made to be limited in a case when the distance between the both sides becomes apart equal or more than around several meters, it is practically difficult to define one-sidedly a distance which makes the wireless communication possible between the mobile telephone terminal and the wireless card such that it is supposed that there were various problems for making it practicable wherein in case of a favorable communication environment, the function limitation is made effective after a quite far distance and in case of an inferior communication environment on the contrary, the wireless communication cannot be carried out even if the mobile telephone terminal and the wireless card are adjacent and the function limitation is made effective.

Also, it is preferable for an apparatus such as a wireless card or the like which is used as a pair with a mobile telephone terminal not to take a lot of trouble as much as possible for everyday use, but practically, relatively a large power

consumption occurs when it always exchanges data for authentication or the like with a mobile telephone terminal, so that it is frequently necessary to exchange or charge a battery and there was a problem that it took a lot of trouble for functioning it as an authentication apparatus.

Particularly, in a state in which apparatuses such as a mobile telephone terminal and the wireless card are wireless-connected, considerable degree of low power consumption is to be carried out/performed if the transmission and reception is carried out intermittently on both sides in synchronism with each other, but in case of a state in which a communication partner apparatus cannot be found (more specifically, a wireless communication cannot be executed), tremendous amounts of communication processes are necessary for finding out the communication partner and there was a problem that the power consumption becomes big. More specifically, if it is always wireless-connected with the communication partner, it can be wireless-connected by a relatively low power consumption, but in a case when the wireless connection is cut off for the reason that the wireless communication state between the two apparatuses are deteriorated caused by some kind or another factor, tremendous amounts of power consumption is spent for the reconnection and there was a problem that the battery duration period of the apparatus is to be shortened.

SUMMARY OF THE INVENTION

The present invention was invented in view of aforesaid matters and has recognized that a communication terminal apparatus such as a mobile telephone terminal can be wireless-connected with other terminal apparatus rapidly with a low power consumption.

The present invention is constituted such that in a case when a wireless communication is carried out between a communication terminal apparatus and a wireless key apparatus by carrying out a wireless communication based on a wireless communication system in which a wireless connection of two apparatuses is carried out in a condition that one of the two apparatuses which carry out a communication becomes a master, the other one thereof becomes a slave and the slave detects a signal from the master, each of the communication terminal apparatus and the wireless key apparatus is provided with communication means carrying out a wireless communication by a predetermined wireless communication system and control means for controlling communication state in the communication means; and in a case when the wireless communication state between the communication terminal apparatus and the wireless key apparatus is in non-connection, the communication means on the side to be the master changes the period in a plurality of steps in response to the non-connection period and transmits "signal asking for a response from the slave" intermittently and the communication means on the side to be the slave changes the period in a plurality of steps

in response to the non-connection period and carries out a reception for searching "signal from the master" intermittently.

By constituting in this manner, even in a case of a state when the wireless connection between the communication terminal apparatus and the wireless key apparatus is cut off, the process for finding out the partner apparatus is carried out by an intermittent transmission or reception and further by changing the intermittent transmission or reception period in a plurality of steps, it is possible to reduce power consumption in a state in which the wireless connection is cut off.

According to the present invention, even in a case of a state when the wireless connection between the communication terminal apparatus and the wireless key apparatus is cut off, the process for finding out the partner apparatus is carried out by an intermittent transmission or reception and further by changing the intermittent transmission or reception period in a plurality of steps, it is possible to reduce power consumption in a state in which the wireless connection is cut off and it is contributed to forming a structure of low power consumption of the communication terminal apparatus and the wireless key apparatus.

In a case when, communication means which becomes the side of a master transmits "signal asking for response from slave" and in a case when there is on response in a predetermined period, transmission of "signal asking for response" is stop, it carries out reception for searching "signal from slave" intermittent, so

that a process for searching the partner is carried out in a state where a transmission for which relatively large power is necessary is not carried out and it contributes to forming a structure of low power consumption.

Further, in a case when operation means is provided and the operation of this operation means is detected, "signal asking for response" is transmitted from the communication means, so that in a case when it is in a state that the partner carries out an intermittent reception, the possibility that the signal is received becomes high and it is possible to carry out a wireless connection rapidly between two apparatuses which are in a state that the wireless connection is cut off.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing a system constitutional example according to one exemplified embodiment of the present invention;

FIG. 2 is a block diagram showing a constitutional example of a communication terminal apparatus according to one exemplified embodiment of the present invention;

FIG. 3 is a block diagram showing a constitutional example of a wireless key apparatus according to one exemplified embodiment of the present invention;

FIG. 4 is an explanatory diagram showing a usage example according to one exemplified embodiment of the present invention;

FIG. 5 is a block diagram showing a modified example of a wireless key apparatus (example integrated with head set) according to one exemplified embodiment of the present invention;

FIG. 6 is an explanatory diagram showing a usage example of the example in FIG. 5;

FIG. 7 is an explanatory diagram showing a setting example of a security mode according to one exemplified embodiment of the present invention;

FIG. 8 is an explanatory diagram showing a transition example of a security mode by a communication mode according to one exemplified embodiment of the present invention;

FIG. 9 is a flowchart showing a mode selection process example according to one exemplified embodiment of the present invention;

FIG. 10 is a flowchart showing a scanning process example according to one exemplified embodiment of the present invention;

FIG. 11 is a flowchart showing a page transmission process example according to one exemplified embodiment of the present invention;

FIG. 12 is a timing diagram showing an example of a process state of a page transmission and a scanning according to one exemplified embodiment of the present invention;

FIG. 13 is a sequence diagram showing an example of a connection state according to one exemplified embodiment of the present invention;

FIG. 14 is a flowchart showing a shifting process example for low power consumption according to one exemplified embodiment of the present invention;

FIG. 15 is a sequence diagram showing a transmission example of a communication state message according to one exemplified embodiment of the present invention;

FIG. 16 is a flowchart showing a communication process example in a mobile terminal according to one exemplified embodiment of the present invention;

FIG. 17 is a flowchart showing a communication process example in a wireless key apparatus according to one exemplified embodiment of the present invention;

FIG. 18 is a sequence diagram showing a transmission example in a sniff state according to one exemplified embodiment of the present invention;

FIG. 19 is a flowchart showing a process example in a standby state according to one exemplified embodiment of the present invention;

FIG. 20 is a timing diagram showing a connection process example in a slave according to one exemplified embodiment of the present invention;

FIG. 21 is a timing diagram showing a connection process example in a master according to one exemplified embodiment of the present invention;

FIG. 22 is a sequence diagram showing a process example in a connection mode according to one exemplified embodiment of the present invention;

FIG. 23 is a sequence diagram showing a connection return process example by an operation in a wireless key apparatus in a connection mode according to one exemplified embodiment of the present invention;

FIG. 24 is a sequence diagram showing a connection return process example by an operation in a mobile terminal apparatus in a connection mode according to one exemplified embodiment of the present invention;

FIG. 25 is an explanatory diagram showing a state transition example of a wireless key apparatus in a connection mode according to one exemplified embodiment of the present invention;

FIG. 26 is an explanatory diagram showing a state transition example of a mobile terminal apparatus in a connection mode according to one exemplified embodiment of the present invention; and

FIG. 27 is an explanatory diagram showing a state transition example of a wireless key apparatus in a connection mode according to one exemplified embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

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Hereinafter, one exemplified embodiment of the present invention will be explained with reference to attached drawings.

In the present invention, a wireless key apparatus carrying out a wireless communication with a mobile telephone terminal apparatus is prepared and it is constituted such that security lock of the mobile telephone terminal apparatus is to be carried out according to a wireless communication state of the both sides.

FIG. 1 is a diagram showing an example of an apparatus of the present invention. A wireless key apparatus 50 is prepared as a separate body with a mobile telephone terminal apparatus 10. According to this example, the wireless key apparatus 50 is constituted in a smaller size as compared with the mobile telephone terminal apparatus 10 and, for example, it is constituted such that it is hung around the neck of a user by a neck strap 50a or the like and is made to be a small sized shape which a user can always wear. The wireless key apparatus 50 is arranged with a light emitting unit 55 and an operation unit 59 (constituted in FIG. 1 such that they are push button shaped), and it is also constituted such that a terminal unit 56 for connecting with the mobile telephone terminal apparatus 10 is prepared.

As a mobile telephone terminal apparatus 10, there is shown here an example of a general mobile telephone terminal. In the mobile telephone terminal apparatus 10, there are arranged an antenna 11 for a wireless telephone communication, a speaker 14,

a microphone 15, a display unit 16, an operation unit (operation key) 17, a light emitting unit 22 and the like. Also, a terminal unit 23 for connecting with the wireless key apparatus 50 is prepared. This terminal unit 23 may be used as an existing terminal which is prepared for the mobile telephone terminal apparatus 10 to be connected with a charger or various external apparatuses. Also, it may be constituted in the display unit 16 such, for example, that a security display 16a showing that it is in an operation under a state that security is assured as explained hereinafter and a display (not shown) showing a fact that a so-called security lock in which the operation is limited according to its security function is executed may be carried out.

Next, a constitutional example of the mobile telephone terminal apparatus 10 of the present invention will be explained with reference to FIG. 2. The mobile telephone terminal apparatus 10 of the present invention is provided with an antenna 11 for a wireless telephone communication for carrying out a wireless communication with a base station for a wireless telephone. The antenna 11 is connected to a communication circuit 12 for a wireless telephone communication so as to carry out a wireless communication with the base station under a control of a control unit 19. When a communication for a telephone call is carried out in the communication circuit 12, received sound data are supplied to a sound data processing unit 13 so as to perform a receiving process of the sound data and thereafter, they are supplied to a

speaker 14 to be outputted and also, sound data for transmission which are picked up by a microphone 15 and processed in the sound data processing unit 13 are supplied to the communication circuit 12 to be transmitted.

The mobile telephone terminal apparatus 10 is provided with a display unit 16 constituted by a liquid crystal display or the like and an operation unit 17 constituted by operation keys or the like. It is possible to display a mail sentence, a picture screen accessed to the web or the like on the display unit 16 an input operation of a telephone number, a mail sentence or the like and various mode settings or the like can be carried out by an operation unit 17. Here, it is constituted such that a communication process is carried out in a communication circuit 32 for short distance which will be described later on and in a case when its communication state is in a connection mode in which a connection process with a communication partner is carried out and when the control unit 19 detects that any one of the keys constituting the operation unit 17 or the like was operated, a process for transmitting a signal (page signal) compulsorily asking for a response with respect to the partner. This concrete process example will be described later on.

These respective blocks in the terminal apparatus 10 are connected with the control unit 19 or the like by way of a control line 25. Also, each block is constituted such that data transfer can be carried out by way of a data line 26 so as to

store necessary data in a memory 18. In the memory 18, not only data necessary as a mobile telephone terminal are stored but also it is possible to store data necessary in an IC card function unit 40 which will be described later on. Also, a necessary data saving for executing a program and/or for realizing the security function thereof can be carried out in the memory 18.

Also, the mobile terminal apparatus 10 is provided with a vibration unit 21 constituted by a vibration motor or the like which vibrates the terminal itself for carrying out notification of receiving signal by way of the telephone line to this terminal apparatus 10 and various warnings and a light emitting unit 22 constituted by a light emitting diode or the like. Then, the vibration and the light emission are carried out under a control of the control unit 19. These vibration unit 21 and light emitting unit 22 are used as notification means for notifying receiving signal or the like for the mobile telephone terminal and they are used also for necessary warning means as a security function. It should be noted that it is possible to output warning sound from the speaker 14 or the like in a case when sound is to ring as necessary warning means in the security function.

Then, the mobile telephone terminal 10 of the present invention is provided with a communication circuit 32 for short distance wireless communication in addition to the communication circuit 12 for telephone communication Then, it is carried out by

using this communication circuit 32 a wireless communication with a partner within a relatively narrow region of, for example, around from several meters to hundred meters at the maximum by way of a connected antenna 31 (however, it is constituted such that a process for narrowing the communication possible region is to be executed when carrying out a communication during a normal period with the wireless key apparatus as will be described later on). Here, for example, a wireless communication system for short distance referred to as Bluetooth® is applied. In this short distance wireless communication, various kinds of use applications are supposed such, for example, that a communication is carried out with a head set for a hands-free telephone call or a communication with a personal computer apparatus is carried out through the mobile telephone terminal apparatus 10. As to the frequency band used for the wireless communication, for example, 2GHz band is used, it is constituted such that a frequency band or modulation system which does not intervene in the wireless telephone communication in the communication circuit 12 is employed. According to this constitution, it is possible to carry out the wireless telephone communication in the communication circuit 12 and the communication in the communication circuit 32 for short distance wireless communication at the same time.

In case of this example, a wireless communication is carried out with a wireless key apparatus 50 by using this communication circuit 32 for short distance communication.

However, a wireless communication is possible also with an apparatus (head set, personal computer apparatus or the like) other than the wireless key apparatus 50 if it is a communication apparatus of the same communication system. Also, in a case when a security function is executed, the wireless key apparatus 50 carrying out a wireless communication by the communication circuit 32 is to be limited to a specific one apparatus. For that purpose, for example, identification ID or the like of the apparatus is to be registered in the memory 18 or the like beforehand. With respect to registered information relating to this wireless key apparatus 50, it may be constituted such that a user cannot revise it.

A transmission amplifier 33 which amplifies the transmission signal in the communication circuit 32 is constituted such that transmission power is to be set in a plurality of steps by the control of the control unit 19 or the like. Also, in a state in which it is wireless-connected with the wireless key apparatus 50, it is constituted such that low transmission power among the plurality of steps is to be set. Further, in a state in which it is connected with an apparatus other than the wireless key apparatus 50, transmission power of a relatively high step is to be set. It should be noted in a case when it is wireless-connected with an apparatus installed a function for a wireless key apparatus such as a head set which will be described later on that the transmission power is to be

set depending on the operation state of the partner apparatus at that time (more specifically, depending on whether or not it is operated only as a wireless key apparatus or whether or not combined another function is operated). It will be described later on with respect to a concrete process example for setting the transmission power.

The mobile telephone terminal 30 of the present invention is provided with a non-contacting IC card function unit 40. The non-contacting IC card function unit 40 includes a billing data control unit 41 connection with an antenna 42 and an adjacent wireless communication in a very adjacent distance of around several centimeters is carried out with reader and writer. In this adjacent wireless communication, it is possible to operate the billing data control unit 41 by means of the power obtained by receiving a radio wave from the reader and writer side, but according to this example, it is constituted such that the billing data control unit 41 is to be operated by the power supply supplied from a power supply circuit 24in the mobile telephone terminal 10.

When the IC card function is executed, the billing data control unit 41 reads out data necessary for billing or authentication from the memory 18 (or a memory in the billing data control unit 41 (not shown)) and an exchange of the read out data is carried out with the reader and writer by an adjacent wireless communication. For example, in a case when it is

functioned as a boarding ticket of transport facilities, it is constituted such that the billing data control unit 41 transmits data charged amount of money or the like which is possible to be paid by direct debit for an effective zone and an effective period as a boarding ticket (commutation ticket) or as a boarding ticket or personal information or the like relating to a person possessing this terminal (IC card) to the reader and writer so as to carry out a billing process or an authentication process. In case of using an employee ID card, a membership card, a card for price settlement, a credit card or the like, necessary information for its authentication is also exchanged.

Further, it is constituted such that the mobile telephone terminal apparatus 10 of the present invention is provided with a terminal unit 23 and various peripheral apparatuses, data process apparatuses which are not shown or the like can be connected directly thereto by way of this terminal 23. In this case, it is constituted such that power supply can be applied to external apparatuses connected by means of the terminal unit 23 from the power supply circuit 24 installed with a secondary battery or the like which applies power supply to respective portions in the mobile telephone terminal apparatus 10. For example, as shown by an arrow J of a dotted line in FIG. 1, it is constituted in a case when the terminal unit 56 of the wireless key apparatus 50 and the terminal unit 23 of this mobile telephone terminal apparatus 10 are connected directly such that it is possible to

supply power to a secondary battery in the wireless key apparatus 50 from the power supply circuit 24 in the mobile telephone terminal apparatus 10 so as to charge it. Also, it is constituted in a case when the wireless key apparatus 50 is connected directly to the terminal unit 23 of the mobile telephone terminal apparatus 10 such that the control unit 19 of the mobile telephone terminal apparatus 10 detects that fact and a security process when directly connected (for example, security process executed without short distance wireless communication which will be described later on) is to be carried out.

Next, it will be explained with respect to the constitution of the wireless key apparatus 50 which carries out a wireless communication with the mobile telephone terminal apparatus 10 according to the present invention with reference to FIG. 3. The wireless key apparatus 50 of the present invention is provided with a communication circuit 52 for short distance wireless communication. Then, by using this communication circuit 52, a wireless communication is carried out with a partner in a relatively narrow region of, for example, around several meters and at the maximum hundred meters by way of a connected antenna 51 (however, it is constituted when communication is carried out normally with the mobile telephone terminal apparatus 10 such that a process for narrowing the communication possible region is executed). Here, it is constituted such that Bluetooth system which is a short distance wireless communication system provided

on the mobile telephone terminal apparatus 10 side is also applied to the wireless key apparatus 50. The partner carrying out a wireless communication by the communication circuit 52 is limited to a specific one of the mobile telephone terminal apparatus 10. For that purpose, for example, the identification ID or the like of its apparatus was registered beforehand. With respect to the registered information as to the mobile telephone terminal apparatus 10, it may be constituted such that a user cannot revise it.

With respect to the wireless communication in the communication circuit 52, it is executed under a control of a control unit 53. In this case, it is constituted such that transmission power is to be set in a plurality of steps in a transmission amplifier 52a which amplifies a transmission signal in the communication circuit 52 under a control of the control unit 53 or the like. Also, in a state where it is wireless-connected with the mobile telephone terminal apparatus 10, a low transmission power is to be set in the plurality of steps. However, it is constituted in a case when the control unit 53 detects that an operation unit 59 (button shaped operation unit or the like as shown in FIG. 1) arranged in the wireless key apparatus 50 is operated such that the transmission power is to be heightened temporarily in the transmission amplifier 52a and a transmission process of a signal (page signal or the like) for making the partner recognize it compulsorily is to be carried out.

The wireless key apparatus 50 of this example is provided with a warning sound creation unit 54 connected with a speaker 54 a for outputting warning sound and a light emitting unit 55 constituted by a light emitting diode or the like. Then, output of the warning sound, vibration and light emission are carried out under the control of the control unit 53. These warning sound creation unit 54 and light emitting unit 55 are used as warning means necessary for security function. Also, it is constituted such that the light emitting unit 55 functions also as display means which displays the security mode at present in a state where a wireless communication is carried out with the mobile telephone terminal apparatus 10 and the security function is operated. Specifically, for example, the light emitting unit 55 functions also as display means for displaying a security mode by changing the display such that when the light emitting unit 55 is blinking in green, it indicates that it is in a normal mode and when it is blinking in red, it indicates that it is in a warning mode, when there is no display at all, it indicates that it is in a function limitation mode, or the like. The display means for displaying the security mode may be constituted such that a liquid crystal display or the like is used and a display where modes can be recognized directly by characters and figures or the like is carried out. Also, it may be constituted as warning means for warning by vibration.

It is constituted such that the control unit 53 and each unit is connected by means of a control line 58 and a wireless communication in the communication circuit 52, operations in the warning sound creation unit 54 and the light emitting unit 55 and the like are executed under a control of the control unit 53.

Also, it is constituted such that the wireless key apparatus 50 of the present invention is provided with a terminal unit 56 and the mobile telephone terminal apparatus 10 can be connected directly by using this terminal 56. When connected thereof, the control unit 53 in the wireless key apparatus 50 carries out a data transfer directly with the control unit 19 in the mobile telephone terminal apparatus 10 and carries out a security process when directly connected without carrying out a short distance wireless communication. Also, in a case when remaining charge amount of the secondary battery installed in a power supply circuit 57 in the wireless key apparatus 50 is small, it is possible to charge the secondary battery in the power supply circuit 57 by a power supplied from the side of the mobile telephone terminal apparatus 10.

When the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 constituted in this manner are used, a user always carries the wireless key apparatus 50 as shown, for example, in FIG. 4. Then, it is constituted such that when the user uses the mobile telephone terminal apparatus 10, the function is not to be limited (normal mode which will be

described later on). Then, in a case when a user goes away from the mobile telephone terminal apparatus 10 by a distance of a certain degree after putting the mobile telephone terminal apparatus 10 somewhere in a state where the wireless key apparatus 50 is always maintained to be carried, a warning operation is executed from the wireless key apparatus 50 (warning mode which will be described later on). If he stays away from the mobile telephone terminal apparatus 10 in a state where the warning operation is executed, it becomes a state where the function of the mobile telephone terminal apparatus 10 is limited (function limitation mode which will be described later on). It should be noted with respect to the warning operation in a warning mode that it may be constituted such that it is to be carried out only on the side of the mobile telephone terminal apparatus 10. Alternatively, it may be constituted such that the warning operation in the warning mode is to be carried out in both of the wireless key apparatus 50 and the mobile telephone terminal apparatus 10.

With respect to a function of the mobile telephone terminal apparatus 10 which is limited in a function limitation mode, it is a choice, for example, to direct to all of the functions of the mobile telephone terminal apparatus 10 (however, communication function related to security function is not to be limited) and it is another choice to direct to a partial function within the function which the terminal apparatus 10 is provided

with. Specifically, it may be constituted, for example, such that only the process using the non-contacting IC card function unit 40 is to be limited. Also, it may be constituted such that address book inspection of the mobile telephone terminal apparatus 10, display of personal information of mail inspection or the like is to be limited. Also, it may be constituted such that only the reception of a signal can be allowed while the transmission as a wireless telephone is to be limited. Also, it may be constituted such that only the reception of a signal can be allowed while the transmission as a wireless telephone is to be limited. In this case, it may be constituted such that only the telephone number for emergency announcement to a police station or the like can be transmitted. Also, it may be constituted such that a process using the non-contacting IC card function unit 40 is not to be limited while only the function as a wireless telephone apparatus is to be limited.

The wireless key apparatus 50 explained so far was constituted as an apparatus for exclusive use which carries out only the security function, but it should be noted that it may be constituted such that it is to be mounted on an apparatus having other function. For example, it may be constituted such that a wireless key apparatus is to be mounted on a head set for carrying out a wireless communication of Bluetooth system with the mobile telephone terminal apparatus 10 and carrying out a so-called hands-free telephone call.

FIG. 5 is a diagram showing a constitutional example of a head set with this wireless key. A head set with a wireless key 60 according to the present invention is provided with a communication circuit 62 for short distance wireless communication. This communication circuit 62 carries out a wireless communication with a partner in a relatively narrow region of, for example, around several meters and at the maximum hundred meters by way of a connection antenna 61. Here, Bluetooth system which is the same system as the short distance wireless communication system provided on the side of the mobile telephone terminal apparatus 10 is applied also to the communication circuit 62 of the head set with the wireless key. The partner carrying out a wireless communication by the communication circuit 62 is limited to the specific one of the mobile telephone terminal apparatus 10 which was registered. For that purpose, for example, identification ID of the apparatus or the like is registered beforehand. However, it may be constituted when using only the head set such that there is no limitation for the partner whom the communication circuit 62 carries out a wireless communication.

With respect to the wireless communication in the communication circuit 62, it is executed under a control of the control unit 63. In this case, it is constituted such that transmission power for the transmission amplifier 62a which

amplifies the transmission signal in the communication circuit 62 is to be set under a control of the control unit 63 or the like.

When a communication for the head set (more specifically, sound data communication for a telephone call) is carried out in the communication circuit 62, received sound data are supplied to a sound data processing unit 66 and a receiving process of the sound data is performed. Thereafter, they are supplied to a speaker 67 and outputted. Also, sound data picked up by a microphone 68 are processed in the sound data processing unit 66 so as to become sound data for transmission. Then, the sound data for transmission are supplied to the communication circuit 62 and transmitted.

In addition, the head set with the wireless key 60 of the present invention is provided with an operation unit 64 constituted by operation keys or the like,
a memory 65 and a light emitting unit 70. The light emitting unit 70 is used as warning means relating to the security function and at the same time used also as display means of operation state on the occasion when it is functioned as a head set. These respective units in the head set 60 can carry out exchange of control data by way of a control line 73. Further, the respective units can carry out exchange of sound data or the like by way of a data line 74.

Also, the head set with the wireless key 60 of the present invention is provided with a terminal unit 71 and it is

constituted such that the mobile telephone terminal apparatus 10 can be connected directly by means of this terminal 71. When connected with the mobile telephone terminal apparatus 10 directly, it is constituted such that the control unit 63 in the head set with the wireless key 60 carries out a data transfer directly with the control unit 19 in the mobile telephone terminal apparatus 10 and a direct sound data transfer or a security process is to be carried out without a short distance wireless communication. Also, in a case when remaining charge amount of a secondary battery installed in a power supply circuit 72 in the head set with the wireless key 60 is small, it is possible to charge the secondary battery in the power supply circuit 72 by an power supplied from the side of the mobile telephone terminal apparatus 10.

In a case when such a head set with a wireless key 60 is prepared, as shown, for example, in FIG. 6, a user putting on the head set with the wireless key 60 can carry out a so-called hands-free telephone call depending on a fact that the mobile telephone terminal apparatus 10 which remains inside a bag or the like and the head set with the wireless key 60 carries out a wireless communication. Further, with respect to a function as a wireless key apparatus, a warning and a function limitation of the mobile telephone terminal apparatus 10 are executed according to position relationship (distance) between the head set with the wireless key 60 and the mobile telephone terminal apparatus 10.

More specifically, in a case when the mobile telephone terminal apparatus 10 goes away from the head set with the wireless key 60 to a certain degree of distance, the head set with the wireless key 60 or the mobile telephone terminal apparatus 10 (alternatively, both sides) carries out a warning operation (warning mode which will be described later on). Then, if the user stays away from the mobile telephone terminal apparatus 10 in the state in which this warning operation was carried out, it becomes a state in which the function of the mobile telephone terminal apparatus 10 is limited (function limitation mode will be described later on).

Next, a fundamental process example in a case when the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 having such a constitution are prepared and a security process is carried out will be explained with reference to FIGS. 7 to 19. It should be noted in the following explanation that it will be explained on the assumption that the wireless key apparatus 50 is to be used but a security process in a case when the head set 60 with the wireless key is used is also similar fundamentally.

First, it will be explained with reference to FIG. 7 with respect to a security process mode (hereinafter designates as security process mode). It is constituted in case of this example such that there are prepared a normal mode M1 which does not limit the function of the mobile telephone terminal apparatus 10,

a warning mode M2 for warning that it gets out of the normal mode caused by a fact that the distance between the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 goes away or the like and a function limitation mode M3 for limiting the function of the mobile telephone terminal apparatus 10 in a case when it does not return to from the warning mode to the normal mode (more specifically, in a case when the distance between the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 remains in a far state).

With respect to the transition of these modes, there are, as shown by arrows in FIG. 7, a change from the normal mode M1 to the warning mode M2 and a change from the warning mode M2 to the function limitation mode M3 and further, it returns to the normal mode M1 if the wireless key apparatus 50 approaches the mobile telephone terminal apparatus 10 in a state in which it became the function limitation mode M3. Further, it returns to the normal mode M1 if the wireless key apparatus 50 approaches the mobile telephone terminal apparatus 10 in a state in which it became the warning mode M2 and the warning operation is carried out.

In case of the present invention, these security modes are made to have relation with the communication modes prepared in the Bluetooth system which is a wireless communication system between the mobile telephone terminal apparatus 10 and the wireless key apparatus 50. More specifically, as communication modes in the wireless communication system (Bluetooth system) of

this example are shown in FIG. 8, there is a connection mode M11 for authenticating and wireless-connecting the partner apparatus in both of the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 and when authentication is completed mutually and connection is carried out in the connection mode M11, it becomes a data transfer mode M12 in which payload data transfer is carried out practically. When the data transfer is completed in the data transfer mode M12, it is shifted to a low power consumption communication mode M13. In this low power consumption communication mode M13, the wireless communications of both sides are carried out intermittently by a cycle longer than a communication cycle in the data transfer mode M12 and it becomes a state in which the wireless connection between the both sides is maintained. Owing to the fact that the cycle carrying out the intermittent communication is long in this manner, it becomes possible to make the power consumption required for the communication smaller than a case in which it is operated in the data transfer mode M12 and low power consumption is realized. It should be noted that the low power consumption here indicates a phenomenon that the low power consumption is realized by thinning out communication cycles and is not related directly to the process for lowering the transmission power which will be described later on (however, it is constituted as described later on such that a process for lowering transmission power is carried out during a low power consumption mode).

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In a case when the data transfer between the both sides is to be restarted in a state of this low power consumption communication mode M13, it returns to the connection mode M11, a process for restarting the communication is carried out in the connection mode M11 and thereafter it becomes the data transfer mode M12 in which the data transfer is carried out practically. In a state in which the wireless connection is maintained in the low power consumption communication mode M13, the connection process in the connection mode M11 is carried out relatively simply and it is possible to carry out the restart of the data transfer rapidly as compared with a case in which the wireless connection is recommenced.

Also, in a case when a connection process with anyone of communication partners is not carried out in the connection mode M11 (or in a case when a connection is not possible), each apparatus is shifted to the standby mode M14. The apparatus which becomes this standby mode M14 carries out an intermittent reception or transmission with a very long cycle and carries out a process for searching whether or not a communication apparatus to become a partner exists. Here, it may be constituted such that the apparatus becoming the standby mode M14 does not return to the connection mode M11 if there is no process which may become some kind or another opportunity caused by a user operation or the like. Also, during a period when a communication is carried out between two apparatuses, the two apparatuses are to be set in

the same mode basically. More specifically, at least the connection mode M11, the data transfer mode M12 and the low power consumption mode M13 are the modes which shift in synchronism with each other between the two apparatuses.

Here, in case of the present invention, as shown in FIG. 8, the normal mode M1 is set as a security mode when it is a state in which it communicated between the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 in the low power consumption communication mode M13 and a warning mode is started by an opportunity that the communication mode shifts from the low power consumption communication mode M13 to the connection mode M11. The process with respect to the detail in which it is shifted from a warning mode to a function limitation mode will be described later on, but when the security mode becomes the function limitation mode M3, the function limitation mode M3 remains during a period when it is the connection mode M11, the data transfer mode M12 and the standby mode M14. It is constituted only in a case when it is shifted from the data transfer mode M12 to the low power consumption communication mode M13 such that the security mode is to return from the function limitation mode M3 to the normal mode M1.

Next, it will be explained a process in which the security mode is selected in each of the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 with reference to FIG. 9. This security mode selection process is, for example,

executed under the control of the control units 19 and 53 of the respective apparatuses.

First, it is judged whether or not the communication mode at present is in a low power consumption communication mode (step S1). Here, in a case when it is in a low power consumption communication mode, a state timer prepared in the control unit is reset (step S2). Then, the security mode is set to a normal mode (step S3) and a process as a normal mode (more specifically, a mode without limiting the function) is executed (step S4). It should be noted that the state timer is a timer counted up by passage of time.

Also, in a case when it is judged in step S1 that it is not in a low power consumption communication mode, it is judged whether or not the security mode just before (at present) is a normal mode (step S5). Here, in case of a normal mode, a state timer prepared in the control unit is made to start (step S6). Then, a start of a warning mode is set (step S7) and a warning operation as a warning mode is executed (step S8). It should be noted that in a case when it is constituted such that only one of the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 carries out the warning operation, any process is not carried out particularly in the other apparatus during the warning mode.

Then , in a case when it is judged in step S5 that the security mode just before (at present) is not a normal mode, it

is judged whether or not the counted value of the state timer activated in step S6 exceeds a value TH determined beforehand (step S9). It remains in the warning mode of step S8 until the counted value exceeds the predetermined value TH1 and in a case when the counted value exceeds the predetermined value TH1, it is made to change the security mode to a warning mode (step S10). It is designed such that the period when the counted value of the state timer exceeds the predetermined value TH1 after the count is started is a period, for example, of around several seconds to several ten seconds.

Next, it will be explained with reference to the drawings of FIG. 10 and subsequent thereto about a specific example of a communication state in each communication mode in each of the mobile telephone terminal apparatus 10 and the wireless key apparatus 50. First, it will be explained an example in which the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 carry out the authentication process of a partner in the connection mode M11.

In case of carrying out a wireless communication by Bluetooth system, one of the communication apparatus of the two apparatuses carrying out the communication becomes a master apparatus and the other communication apparatus becomes a slave apparatus. For the Bluetooth system, either one of the apparatuses may become a master or a slave, but in case of the present invention, it is to

be set such that the wireless key apparatus 50 becomes a master and the mobile telephone terminal apparatus 10 becomes a slave.

The apparatus which became a slave (mobile telephone terminal apparatus 10 here) carries out a scan process for searching the master in a connection mode. FIG. 10 is a flowchart showing an operation example in this scan process. In the scan process, continuous reception is carried out for a constant period and a process for searching a signal from the master is carried out (step S11). It is judged in its scan process whether or not a signal (page signal) added with an ID number of the wireless key apparatus 50 which is a partner carrying out the security process was received (step S12). Here, in a case when signal added with the ID number of the wireless key apparatus 50 is not received, it is shifted to an idle process so as to wait for a constant period (step S13) and thereafter it returned to step S11 such that the scan process is repeated.

Then , in a case when it is judged in step S12 that the page signal added with the ID number of the wireless key apparatus 50 was received, a response signal with respect to that page signal is transmitted (step S14) and it is shifted to a communication state by carrying out a connection process with the master (more specifically, shifted to a data transfer mode M12) (step S16).

Next, FIG. 11 will be explained. The apparatus which became a master (here, wireless key apparatus 50) starts a standby timer

when the connection mode starts (step S21). A page signal is transmitted by a determined channel for a predetermined period (step S22). At that time, for example, an ID number which was set for the own apparatus is added to the page signal and at the same time, the ID number of the communication partner is also added. Then, it is judged whether or not there is a response from the slave after the transmission of the page signal (step S23). In case of no response, it is judged whether or not the counted value of the standby timer exceeds a determined time period TH2 (step S24). In a case when the counted value of the standby timer does not exceed the determined time period TH2, it is shifted to an idle process and it waits for a constant period (step S25) and thereafter, it returns to step S22 and the transmission process of the page signal is repeated.

Then, in a case when it is judged in step S23 that there is a response from the slave, a connection process with the slave is performed and it is shifted to a communication state (more specifically, shifted to a data transfer mode) (step S27). Also, in a case when the counted value of the standby timer exceeds the determined time period TH2 in step S24, it becomes a standby state (step S28) and a process for attempting a connection with the slave here is discontinued.

FIGS. 12A and 12B are diagrams showing an example of a communication state between the apparatus which became the master (wireless key apparatus 50) in which the process of the flowchart

in FIG. 11 is carried out and the apparatus which became the master slave (mobile telephone terminal apparatus 10) in which the process of the flowchart in FIG. 10 is carried out. FIG. 12A shows a transmission timing of the page signal and an idle period of the master (wireless key apparatus 50). FIG. 12B shows a receiving (scan) timing and an idle period of the slave (mobile telephone terminal apparatus 10). As shown in FIGS. 12A and 12B, the idle period of the transmission side and the idle period of the receiving side are different from each other and it is constituted such that the page signal transmitted at any one of timings can be received on the receiving side.

FIG. 13 is a diagram showing the process of FIGS. 12 by a sequence diagram. As shown in FIG. 13, the transmission of the page signal is carried out from the wireless key apparatus 50 intermittently (at timing T11, T12, T13). Here, if there is a response with respect to the page signal (at timing T14), mutual exchange of the response between the two apparatuses are further carried out (at timing T15, T16), thereafter mutual exchange of the connection signal performing the wireless connection is carried out (at timing T17, T18) and it is shifted to a data transfer mode.

Next, a process example in a case when the respective apparatuses of the present invention are shifted to the data transfer mode M12 will be explained with reference to a flowchart

of FIG. 14. When it is shifted to a data transfer mode, an authentication process in a channel in which the data transfer is carried out is performed (step S31). Then, it is judged whether or not the authentication was completed correctly (step S32). In a case when the authentication process is not completed here, it returns to the connection mode M11.

Then, in a case when the connection process in step S32 is completed, a data transfer is carried out ordinarily, but in the security process of the present invention, the data transfer is not carried out and a process for shifting to a low power consumption mode M13 is carried out directly (step S33). Then, it is judged whether or not it can be shifted to a low power consumption mode (step S34). In case of a state in which it can be shifted to a low power consumption mode M13, it is set to a sniff_state of a low power consumption mode M13.In a case when it cannot be shifted to a low power consumption mode, it returns to the connection mode M11.

FIG. 15 is a sequence diagram showing an example of the communication state shown in the flowchart of FIG. 14. More specifically, packet transmission is carried out mutually in the data transfer mode M12 for performing authentication or the like (at timing T21, T22, T23, T24). Then, after the authentication is completed, data (sniff mode request) for shifting to a low power consumption mode is transmitted (at timing T25) from the master (wireless key apparatus 50) and its consent is received (at

timing T26) such that both apparatuses are shifted to a low power consumption mode (sniff mode).

FIG. 16 is a flowchart showing a process example in a low power consumption mode M13 (sniff mode) relating to the slave (mobile telephone terminal apparatus 10). The process will be explained. When it becomes a sniff mode, first, a timer is started (step S41) and a scan process for receiving a signal from the master is carried out (step S42). It is judged subsequently to the scan process whether or not a signal (page signal) added with the ID number of the wireless key apparatus 50 which is a partner carrying out a security process was received (step S43). Here, in a case when a signal added with the ID number of the wireless key apparatus 50 is received, a response signal with respect to the page signal is transmitted (step S44). Then, the timer started in step S41 is reset (step S45) and it is shifted to an idle period (step S46). When an idle period of a constant period elapses, it returns to the scan process in step S42. Here, in case of the present invention, it is constituted such that the idle period in step S46 (period when communication is not carried out) is set as a relatively longer period and at the same time, it is constituted such that it is synchronized with the idle period on the master side.

On the other hand, in a case when it is judged in step S43 that a signal added with the ID number of the wireless key apparatus 50 is not received, it is judged whether or not the

timer started in step S41 exceeded a predetermined value T_SV (step S47). Then, in a case when it does not exceed the predetermined value T_SV, the flow is shifted to the idle process of step S46. Then, in a case when step S47 it is judged it exceeds the predetermined value T_SV, the communication mode is changed to a connection mode M11 (step S48). The transmission power of the transmission amplifier may be changed to be higher when the communication mode is changed to a connection mode.

FIG. 17 is a flowchart showing a process example in the master (wireless key apparatus 50) with respect to the low power consumption mode (sniff mode). Its process will be explained. A first timer is started when it becomes a sniff mode (step S51). Then, a process for transmitting a page signal for a predetermined period is carried out (step S52). After the transmission of this page signal, it is judged whether or not a response from a partner (mobile telephone terminal apparatus 10) which carries out a security process was received (step S53). Here, in a case when the response signal is receive, the timer started in step S51 is to be reset (step S54). Then, the flow is shifted to the idle period (step S55). When an idle period of a constant period elapses, the flow returns to the page transmission process of step S52. Here, in case of the present invention, it is constituted such the idle period (period in which the communication is not carried out) in step S55 is to be

set as a relatively long period and at the same time is to be synchronized with the idle period on the slave side.

On the other hand, in a case when it is judged in step S53 that a response from the mobile telephone terminal apparatus 10 is not received, it is judged whether or not the timer started in step S51 exceeded a predetermined value T_SV (step S56). In a case when it does not exceed the predetermined value T_SV, it is shifted to the idle process of step S55. Then, in a case when it is judged in step S56 that the predetermined value T_SV is exceeded, the communication mode is changed to a connection mode M11 (step S57). When the communication mode is changed to a connection mode M11, the transmission power of the transmission amplifier may be changed to be high.

FIG. 18 a sequence diagram showing communication timings of the both apparatuses in a low power consumption mode (sniff mode). As shown in FIG. 18, the timing at which the sniff process of the master is carried out (portion designated as "ON") and the timing at which the sniff process of the slave is carried out coincide with each other approximately. More specifically, the timings at which polling packets are transmitted form the master (T31, T33, T35, T37) and the periods in which the reception thereof is carried out in the slave coincide, and respective polling packets are received by the slave and with respect to the responses thereof (at timing T32, T34, T36, T38), they are received on the master side. Owing to the fact that an intermittent

bidirectional communication is carried out in this manner, a low power consumption mode is maintained and a wireless connection state between the master and the slave is maintained.

FIG. 18 is a sequence diagram showing communication timings in the both apparatuses in connection with a low power consumption mode (sniff mode) M13. As shown in FIG. 18, the timing at which the sniff process (portion describes as ON) is carried out in the master and the timing at which the sniff process is carried out in the slave approximately coincide with each other. More specifically, the timings (T31, T33, T35, T37)at which polling packets are transmitted from the master and the periods when the reception thereof are carried out in the slave approximately coincide with each other. Also, respective polling packets are received by the slave and with respect to the responses thereof (at timing T32 , T34 , T36 , T38), they are received on the master side. Owing to the fact that an intermittent bidirectional communication is carried out in this manner, a low power consumption mode M13 is maintained and a wireless connection state between the master and the slave is maintained.

Owing to a fact that the processes explained so far are executed, in a case when the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 can wireless-communicate favorably in an adjacent state, the mobile telephone terminal

apparatus 10 and the wireless key apparatus 50 are maintained in a wireless-connected state using a low power consumption mode. In this wireless-connected state using the low power consumption mode, a data transfer which becomes a so-called payload is not carried out and a signal for maintaining the wireless connection is only transmitted and received intermittent. In this case, by selecting the idle period properly, it is possible to carry out a communication with very low power consumption. Therefore, it is possible to lower the power consumption caused by carrying out the security process of the present invention and it is possible to make the battery duration periods of both the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 be a longer period. In particular, there is a big effect on a wireless key apparatus which is desired to be constituted in a small size as much as possible.

Also, with respect to the mobile telephone terminal apparatus 10, a security process was carried out by applying a short distance wireless communication system of the Bluetooth system which has a great number of examples already mounted on mobile telephone terminals, so that the security process of the present invention can be realized only by slightly changing a control constitution or the like of a mobile telephone terminal provided with a short distance wireless communication circuit of an existing Bluetooth system and a favorable security function is realized easily.

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The process explained so far is a fundamental process for carrying out a security process of the present invention and here, in the present invention, it is constituted in a case when a connection is attempted in a state in which a wireless connection between the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 is cut off such that a following process it to be carried out. More specifically, the communication mode shown in FIG. 8 becomes a connection mode in a state in which the wireless connection is cut off and the connection process shown in FIGS. 10 and 11 is carried out with respect to a fundamental communication process, but according to the present invention, a process explained hereinafter will be carried out as a concrete communication process. With respect to the process in this connection mode, a reception for searching a signal from the master is carried out in the slave (mobile telephone terminal apparatus 10) and in the master (wireless key apparatus 50), a process for transmitting a signal (page signal) asking for a response from the slave is carried out. It should be noted in the following explanation that it is explained by an example in which the mobile telephone terminal apparatus 10 is made to be a slave and the wireless key apparatus 50 is made to be a master, but it may be constituted such that the mobile telephone terminal apparatus 10 is to be a master and the wireless key apparatus 50 is to be a slave.

FIG. 20 is a diagram showing a communication process example of the present invention which is carried out when the slave (mobile telephone terminal apparatus 10) is in a connection mode. Here, when it becomes a connection mode, a reception carried out continuously at the beginning for predetermined period (R1) and a reception of a page signal from the master is attempted. Here, it is assumed that this continuous reception is to be an interval 1. Then, in a case when a page signal cannot be received by the continuous reception in the interval 1, it is shifted to a process of an interval 2 and intermittent reception (R2, R3, R4) is carried out by a predetermined duty ratio. Then, in a case when a page signal cannot be received by the intermittent receive in the interval 2 either, it is shifted to a process of an interval 3 and intermittent reception (R5, R6) is carried out by making the duty ratio smaller than that of the interval 2 (making smaller here means a state in which receiving period is shortened). Further, in a case when a page signal cannot be received by the intermittent receive in the interval 3 either, it is shifted to a process of an interval 4 and intermittent reception (R7, R8) is carried out by making the duty ratio smaller than that of the interval 3. Thereafter, the process of the interval 4 is carried out as long as the connection mode continues.

FIG. 21 is a diagram showing a communication process example of the present invention which is carried out when the

master (wireless key apparatus 50) is in a connection mode. Here, when it becomes a connection mode, transmission of a page signal is carried out at the beginning for a predetermined period continuously (Ta). However, the continuously transmission here means a process for transmitting a packet of a page signal periodically and just after the page signal transmission, there exists a period in which a reception of a response with respect to the page signal is attempted. It is assumed that the continuous transmission is an interval 1. Then, in a case when a response signal with respect to the page signal transmission cannot be received by the continuous transmission in the interval 1, it is shifted to a process of an interval 2 and an intermittent transmission (Tb) is carried out by a predetermined duty ratio. Then, in a case when the response signal with respect to the page signal transmission cannot be received by the intermittent transmission for the interval 2 either, it is shifted to a process of an interval 3 and an intermittent transmission (Tc) is carried out by making the duty ratio smaller than that of the interval 2 (making smaller here means a state in which transmission period is shortened).

Further, in a case when there is no response and a connection cannot be realized in the interval 3 either, it is shifted to a process of an interval 4. In the process of this interval 4, signal detection mode is changed over from transmission to reception. More specifically, the transmission is

stopped and an intermittent reception (Ra, Rb) is carried out by a predetermined duty ratio. Thereafter, the receiving process in the interval 4 is carried out as long as the connection mode continues.

FIG. 22 a sequence diagram showing a state in which a communication between the mobile telephone terminal apparatus 10 and the wireless key apparatus 50 is carried out in a connection mode in this manner. The sequence diagram is a diagram in which there are shown a state controlling from the control unit 19 (host) on the side of the mobile telephone terminal apparatus 10 to the communication unit 32, a process in the communication unit 32 according to that control, a state controlling from the control unit 53 (host) on the side of the wireless key apparatus 50 to the communication unit 52 and a process in the communication unit 52 according to that control.

It will be explained according to FIG. 22, wherein an instruction for transmitting continuously is transmitted from the control unit on the side of the wireless key apparatus 50 which is the master (at timing T51) and a continuous transmission is carried out from the communication unit (at timing T52). An instruction for receiving continuously is transmitted from the control unit of the mobile telephone terminal apparatus 10 which is the slave (at timing T61) and a continuous reception is carried out in the communication unit.

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Thereafter, an instruction DTX1 for transmitting intermittently is transmitted from the control unit on the side of the wireless key apparatus 50 which is the master (at timing T53) and an intermittent transmission is carried out from the communication unit (at timing T54). Further, an instruction DTX2 for transmitting intermittently with the duty ratio being made small is transmitted (at timing T55) and an intermittent transmission with the duty ratio being made small is carried out from the communication unit (at timing T56).

Also, an instruction DRX for receiving intermittently is transmitted from the control unit of the mobile telephone terminal apparatus 10 which is the slave (at timing T62) and an intermittent reception is carried out in the communication unit.

Also, an instruction DRX for receiving intermittently is transmitted from the control unit of the mobile telephone terminal apparatus 10 which is the slave (at timing T62) and an intermittent reception is carried out in the communication unit.

In a state in which intermittent receiving processes are carried out in both of the master and the slave in this manner, it becomes a very low power consumption, because only an intermittent reception is carried out in at least each of the communication units 32 and 52. More specifically, the power consumption is small in the reception operation as compared with that in the transmission operation and even if the state remains

and is continued, it is possible to be in a low power consumption state of both the apparatuses 10 and 50.

Then, if there is any kind of operation in the operation unit of any one of the apparatuses when it becomes a state in which the intermittent receiving processes are carried out in both of the master and the slave in that manner, it is constituted according to the present invention such that a wireless connection can be executed rapidly by making the apparatus in which there was that operation to be changed from the intermittent reception state to a signal continuous-transmission state for asking for a response from the partner.

FIG. 23 is a sequence diagram showing a process example in a case when the operation unit 59 on the side of the wireless key apparatus 50 is operated in a state in which the intermittent receiving processes are carried out in both of the master and the slave. As shown in FIG. 23, an instruction DRX for receiving intermittently is transmitted from the control unit on the side of the wireless key apparatus 50 (at timing T71), an intermittent reception is carried out in the communication unit, an instruction DRX for receiving intermittently is transmitted from the control unit of the mobile telephone terminal apparatus 10 (at timing T81) and an intermittent reception is carried out in the communication unit. In this state, if the control unit 53 detects that a button constituting a part of the operation unit 59 or the like was operated (at timing T70), an instruction for

transmitting continuously is transmitted from the control unit 53 (at timing T72) and a continuous transmission of a signal asking for a response from the terminal 10 is carried out from the communication unit (at timing T73). With respect to the period in which this continuous transmission is carried out, it is preferable for the partner side apparatus, for example, to transmit continuously in a period of one time or more periods in which the intermittent reception is executed. Also, it may be constituted on an occasion of this continuously transmission such that the transmission power is to be set highly.

On the occasion of the intermittent reception in the mobile telephone terminal apparatus 10 if there is this continuously transmission, there is a high possibility that the transmitted signal is received and if received, a response signal is transmitted in a process in the communication unit 32 (at timing T82). If the response signal is received by the wireless key apparatus 50, that fact is transmitted to the control unit 19 (at timing T74), and at the same time, a confirmation signal (ACK signal) with respect to the response signal is sent back (at timing T75) and the reception of the ACK signal is conveyed to the control unit 19 of the mobile telephone terminal apparatus 10 (at timing T83).

If there are a reception of the response signal on the side of the wireless key apparatus 50 and a reception of the ACK signal on the side of the mobile telephone terminal apparatus 10

in this manner, a process for authenticating between the wireless key apparatus 50 and the mobile telephone terminal apparatus 10 mutually is carried out, a wireless connection process is carried out, a process in the connection mode is completed and it is shifted to a data transfer mode.

FIG. 24 is a sequence diagram showing a process example in a case when anyone of keys constituting the operation unit 17 on the side of the mobile telephone terminal apparatus 10 or the like is operated in a state in which the intermittent receiving processes are carried out in both of the master and the slave. As shown in FIG. 24, an instruction DRX for receiving intermittently is transmitted from the control unit on the side of the wireless key apparatus 50 (at timing T91), an intermittent reception is carried out in the communication unit, an instruction DRX for receiving intermittently is transmitted from the control unit of the mobile telephone terminal apparatus 10 (at timing T101) and the intermittent reception is carried out in the communication unit. In this state, if the control unit 19 detects that a key constituting a part of the operation unit 17 or the like was operated (at timing T102), an instruction for transmitting continuously is transmitted from the control unit 19 (at timing T103) and a continuously transmission a signal asking for a response from the wireless key apparatus 50 is carried out from the communication unit (at timing T104). With respect to the period in which this continuous transmission is carried out, it

is preferable for the partner side apparatus, for example, to transmit continuously in a period of one time or more periods in which the intermittent reception is executed. Also, it may be constituted on an occasion of this continuously transmission such that the transmission power is to be set highly.

On the occasion of the intermittent reception in the wireless key apparatus 50 if there is this continuously transmission, there is a high possibility that the transmitted signal is received and if received, a response signal is transmitted in a process in the communication unit 52 (at timing T92). If the response signal is received by mobile telephone terminal apparatus 10, that fact is transmitted to the control unit 19 (at timing T104), and at the same time, a confirmation signal (ACK signal) with respect to the response signal is sent back (at timing T105) and the reception of the ACK signal is conveyed to the control unit 53 of the wireless key apparatus 50 (at timing T93).

If there are a reception of the response signal on the side of the mobile telephone terminal apparatus 10 and a reception of the ACK signal on the side of the wireless key apparatus 50 in this manner, a process for authenticating between the wireless key apparatus 50 and the mobile telephone terminal apparatus 10 mutually is carried out, a wireless connection process is carried out, a process in the connection mode is completed and it is shifted to a data transfer mode.

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FIG. 25 is a diagram showing a state transition in a connection mode in the wireless key apparatus 50 in a case when such a process is carried out. In a state in which a page signal is transmitted continuously (step S111), when a period of a timer A1 which counts a predetermined period from that state elapses, it is shifted to an intermittent transmission of an interval 2 (step S112) and further, when a period of a timer A2 which counts a predetermined period from that state elapses, it is shifted to an intermittent transmission of an interval 3 (step S113). Then, further, when a period of a timer A3 which counts a predetermined period from that state elapses, it is shifted to an intermittent transmission of an interval 4 (step S114). Then, in either one of the states, if there is an operation of the operation unit, it is returned to the continuous transmission (step S111).

FIG. 26 is a diagram showing a state transition example in a connection mode in the mobile telephone terminal apparatus 10. In a state in which the page signal is received continuously (step S121), when a period of a timer B1 which counts a predetermined period from that state elapses, it is shifted to an intermittent reception of an interval 2 (step S122).

Then, if there is an operation of anyone of keys constituting the operation unit or the like on an occasion of the continuous reception in step S121, the period for carrying out the continuous reception in step S121 is prolonged. In this state, it is supposed that it is just after being shifted to a

connection mode and there is a high possibility that a page signal is transmitted continuously or transmitted by a relatively short period from the partner side, so that there is a high possibility that a connection can be realized only by continuing the reception.

Also, if there is an operation of any one of the keys constituting the operation unit or the like in the intermittent reception state in step S122, it is shifted to a process for repeating the transmission of a signal which asks for a response and an intermittent reception (step S123). In a case when a connection is not completed even if it becomes this state, it returns to an intermittent reception of an interval 2 when the period of the timer B1 which counts a predetermined period elapses (step S122).

Here, it may be constituted with respect to the state transition in the wireless key apparatus 50 such that it is to be set, for example, as shown in FIG. 27. More specifically, in a state in which the page signal is transmitted continuously (step S131), when a period of a timer C1 which counts a predetermined period from that state elapses, it is shifted to an intermittent transmission of an interval 2 (step S132) and further, when a period of a timer C2 which counts a predetermined period from that state elapses, it is shifted to an intermittent transmission of an interval 3 (step S133). Then, further, when a period of a timer C3 which counts a predetermined period from that state

elapses, it is shifted to an intermittent reception of an interval 4 (step S134). Then, in either one of the states, if there is an operation of the operation unit, it is to be returned to the continuous transmission in step S131.

It is all the same as the process in FIG. 25 so far, but when it is shifted to an intermittent reception in step S134 and when a period of a timer C4 which counts a predetermined period from that state elapses, it is shifted to an intermittent transmission of a page signal (step S135). Further, when the period of the timer C4 which counts a predetermined period from the intermittent transmission of the page signal in step S135 elapses, it is shifted to an intermittent reception in step S134. In this manner, if it is constituted such that an intermittent reception and an intermittent transmission are carried out repeatedly, a wireless connection can be executed automatically when it becomes a state in which the wireless key apparatus 50 and the mobile telephone terminal apparatus 10 can communicate wirelessly even if it is a sate in which there is no key operation at all or the like.

It should be noted in the exemplified embodiment mentioned above that short distance wireless communication means of such as Bluetooth system or the like was installed in the mobile telephone terminal 10 and the short distance wireless communication means was used for actuating the security mode, but it may be constituted, for example, such that the short distance

wireless communication is not installed in the mobile telephone terminal 10 the short distance wireless communication means is to be connected to the mobile telephone terminal 10 externally. More specifically, for example, two of an apparatus which corresponds to the wireless key apparatus are prepared and one of the two wireless key apparatuses is connected to the mobile telephone terminal 10 such that the security mode is to be set according to the communication mode of the two of wireless key apparatuses.

Also, in the exemplified embodiment explained so far, a communication circuit of a Bluetooth system was installed in a mobile telephone terminal such that a wireless communication is to be carried out with the wireless key apparatus by that communication circuit, but it may be constituted such that a wireless communication is to be carried out with the wireless key apparatus by means of another wireless communication system. More specifically, if it is a system which at least includes a first communication mode which enables a data transfer as a wireless communication system between both apparatuses which communicate each other and a second communication mode which carries out a wireless communication between both the apparatuses in a period shorter than that of the communication in the first communication mode in a wireless-connected state maintained, similar processes as those of the exemplified embodiment mentioned above are possible and applicable.

Also, in case of the Bluetooth system, one of the apparatus which carry out a communication becomes a master and the other one becomes slave and to make the above mentioned wireless key apparatus side be a master and to make the mobile terminal side be a slave is only one example and it is allowed to reverse the relation there-between. Also, it may be constituted such that the master and the slave are counterchanged on the communication halfway.

Also, in the exemplified embodiment mentioned above, it was applied to the security assuring process of the mobile telephone terminal apparatus, but it may be constituted such that it is applied to a process for assuring the security of other mobile type.

Further, also with respect to the wireless key apparatus, an example which was constituted as a key apparatus for exclusive use was employed in the exemplified embodiment mentioned above, but it may be constituted such that a program which makes if function as a key apparatus of the present invention is installed to a terminal apparatus capable of communicating by the Bluetooth system or the like (for example, PDA apparatus or the like) so as to function as a key apparatus.

It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other

factors insofar as they are within the scope of the appended claims or the equivalents thereof.

What is claimed is:

1. A communication system which is constituted by a communication terminal apparatus and a wireless key apparatus capable of a wireless communication with the communication terminal apparatus by a predetermined wireless communication system and limits a function of said communication terminal apparatus in response to a communication state between said communication terminal apparatus and said wireless key apparatus, wherein

said predetermined wireless communication system is a system in which one of two apparatuses carrying out a communication each other becomes a master and the other one becomes a slave such that a signal from the master is detected by the slave so as to carry out a wireless connection between the two apparatuses;

each of said communication terminal apparatus and said wireless key apparatus comprises communication means for carrying out a wireless communication by said predetermined wireless communication system and control means for controlling the communication state in said communication means;

in a case when the communication state between said communication terminal apparatus and said wireless key apparatus is a non-connection state, the communication means on the side which becomes said master intermittently transmits a signal asking for a response from said slave with a transmission period

while changing the transmission period in a plurality of steps in response to the duration of the non-connection state;

the communication means on the side which becomes said slave intermittently searches a reception of the signal from said master with a reception period while changing the reception period in a plurality of steps in response to the duration of the non-connection state; and

the communication means on the side of said master stops the transmission of said signal asking for a response, and intermittently searches a reception of a signal from said slave in a case when the signal asking for a response from said slave was transmitted and there is no response for a predetermined period.

2. A communication system according to claim 1, wherein said communication terminal apparatus and/or said wireless, key apparatus includes operation means, and the control means which detected an operation of the operation means transmits a signal asking for said response from the communication means.

3. A communication terminal apparatus that uses a wireless communication system in which one of partner communication apparatuses becomes a master and the other one becomes a slave, and a wireless connection is established between the master and the slaver when the slave detects a signal from the master, wherein the communication terminal apparatus comprises:

communication means for carrying out a wireless communication by said wireless communication system, and

control means for controlling a communication state in said communication means; wherein

when operating as said master in a case when the wireless communication state, said communication means intermittently transmits a signal asking for a response from said slave with a transmission period while changing the transmission period in a plurality of steps in response to the duration of a non-connection state, and when operating as said slave, said communication means intermittently searches a reception of a signal from said master with a reception period while changing the reception period in a plurality of steps in response to the duration of the non-connection state; and

said communication means ,when operating as said master, stops transmitting the signal asking for said response and intermittently searches a reception of a signal from said slave in a case when there is no response for a predetermined period.

4. A communication terminal apparatus according to claim 3, wherein operation means is included and when the control means detects an operation of the operation means, the signal asking for said response is transmitted from said communication means.

FIG. 1

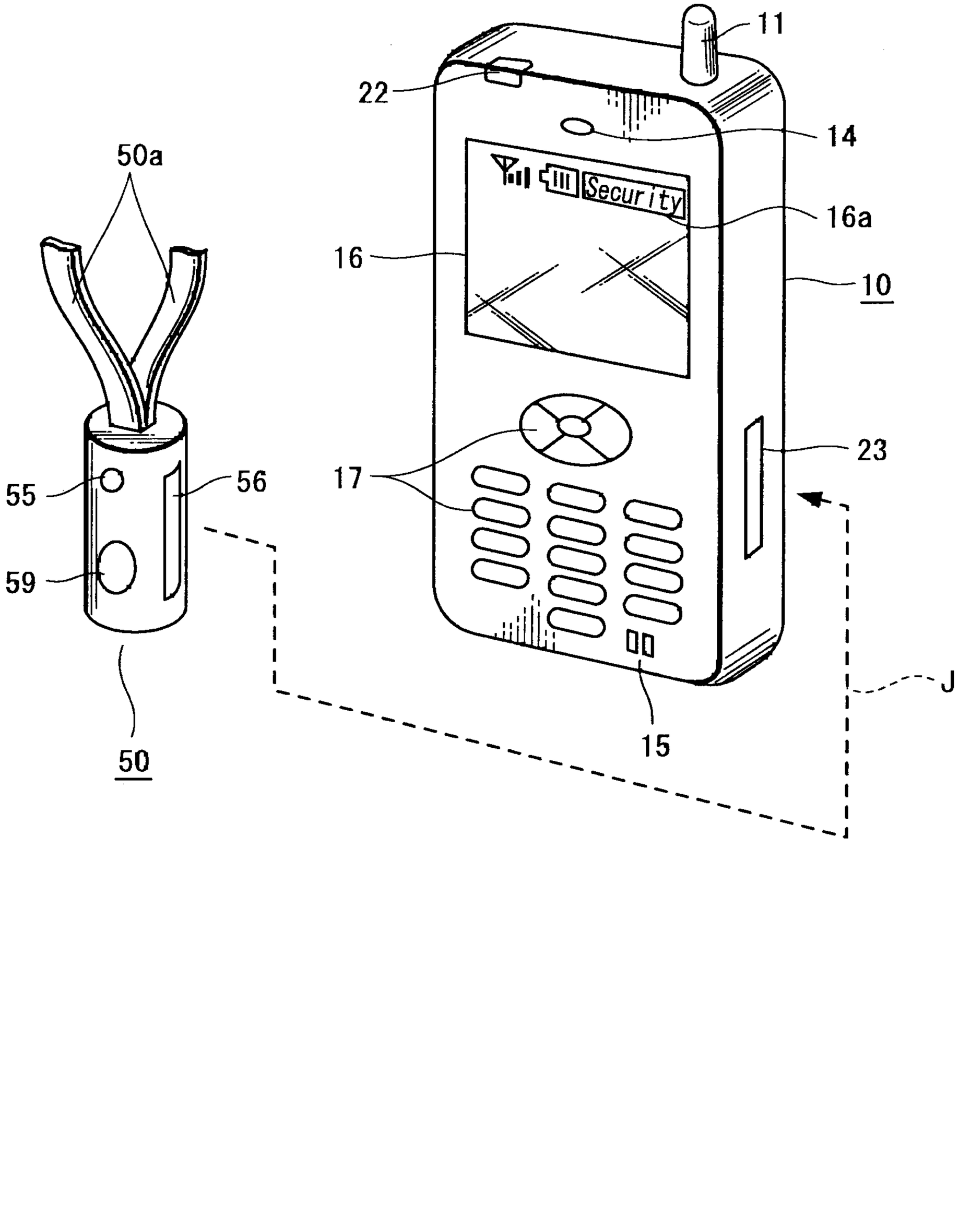

FIG. 2

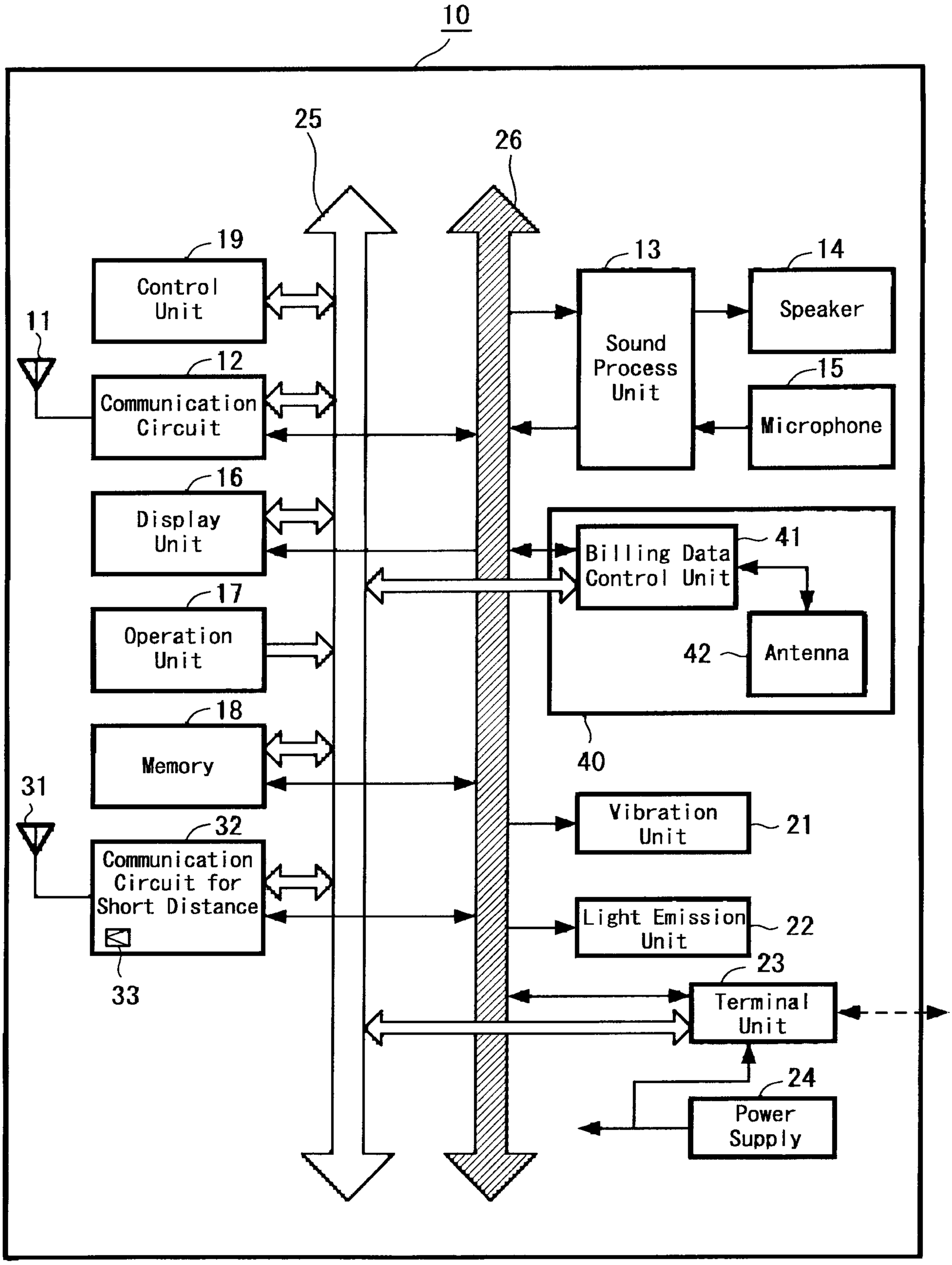

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FIG. 3

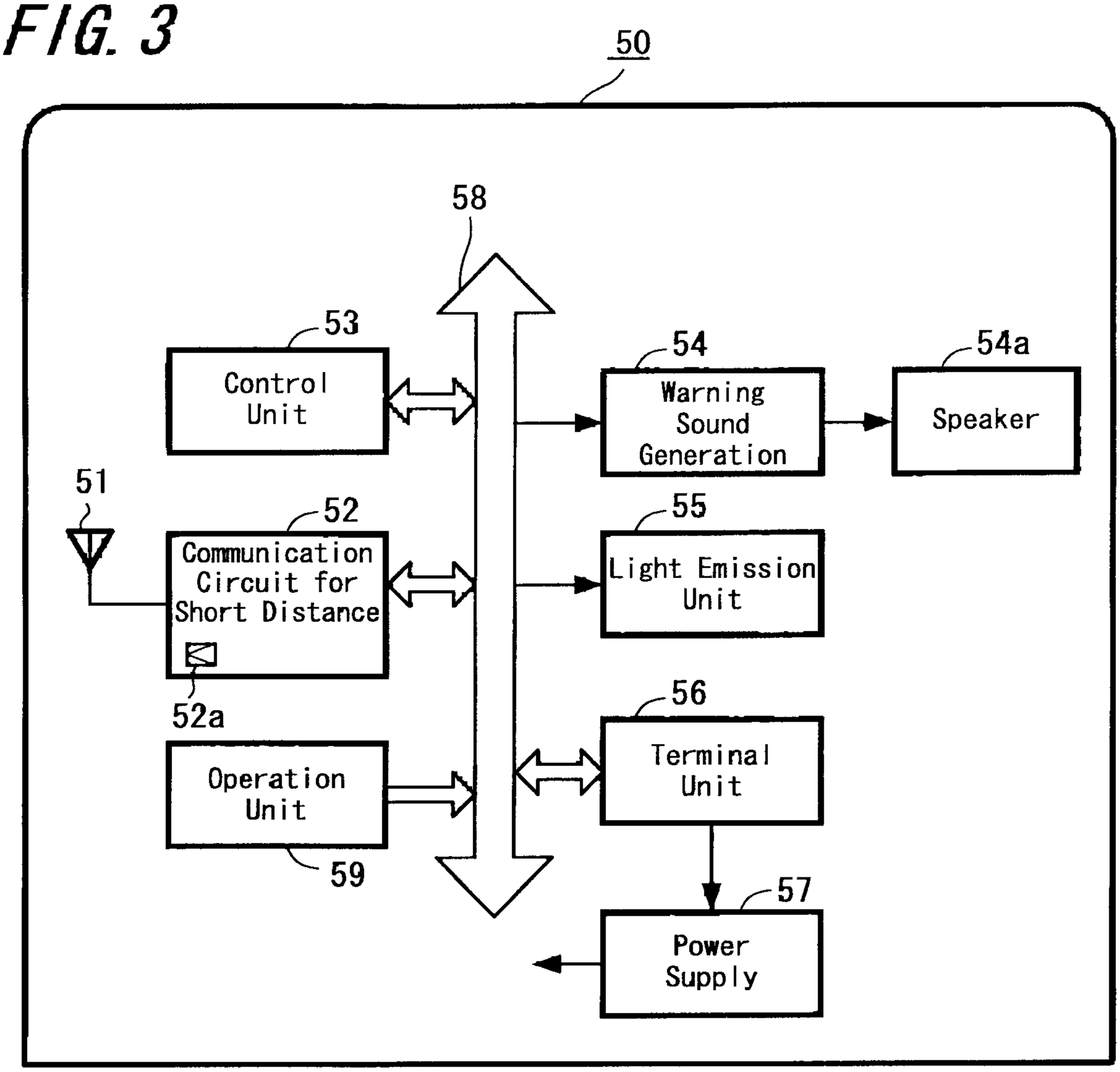
50
58
53
Control Unit
54
Warning Sound Generation
54a
Speaker
51
52
Communication Circuit for Short Distance
55
Light Emission Unit
52a
56
Operation Unit
Terminal Unit
59
57
Power Supply

FIG. 4

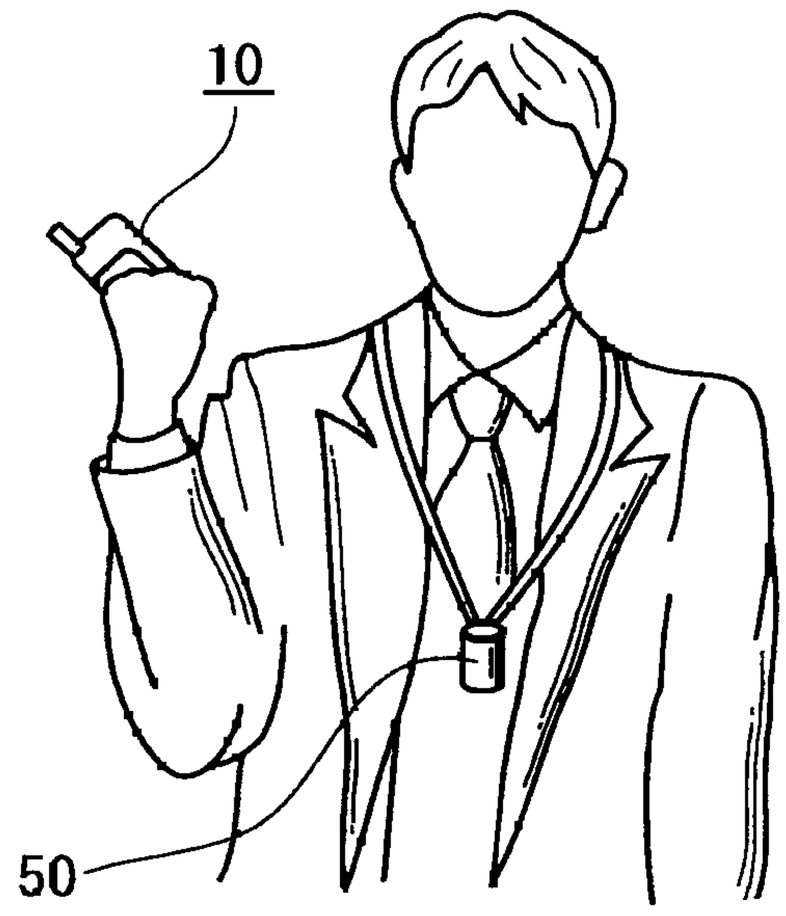
10
50

FIG. 5

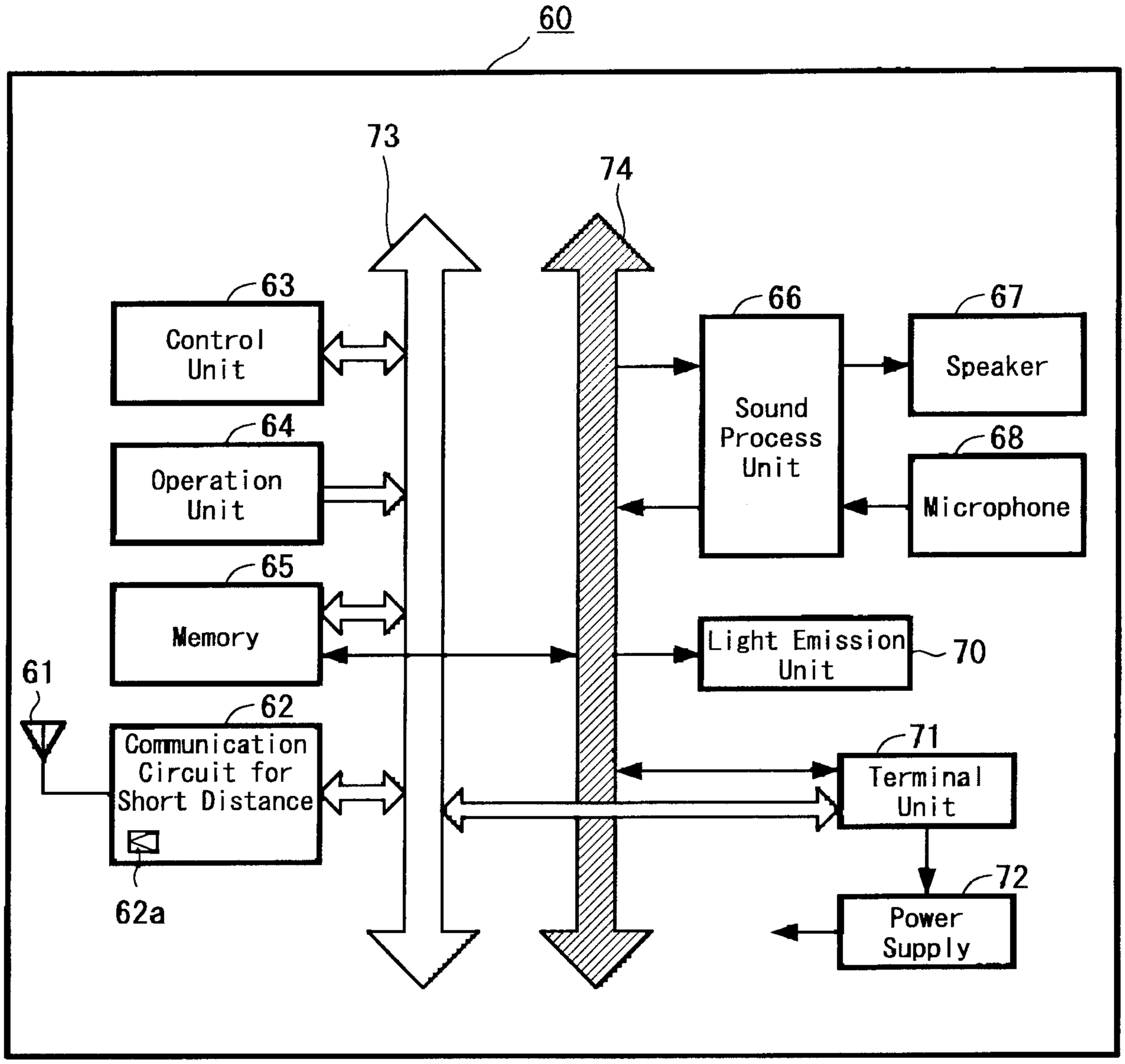

FIG. 6

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FIG. 7

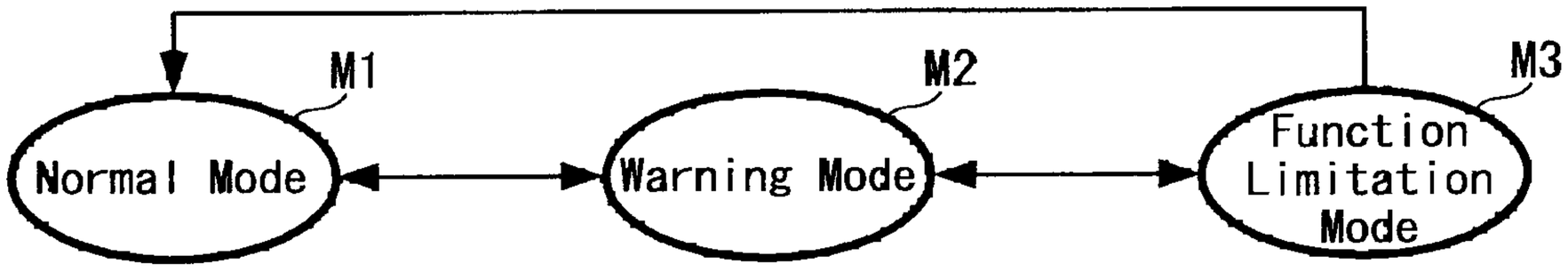
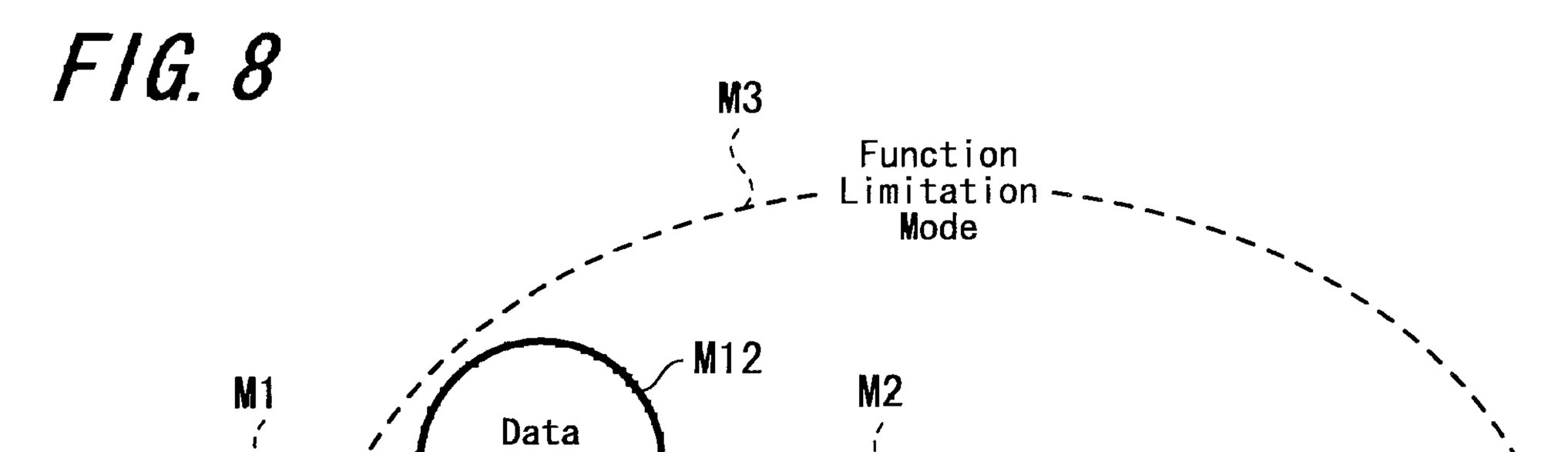


FIG. 8



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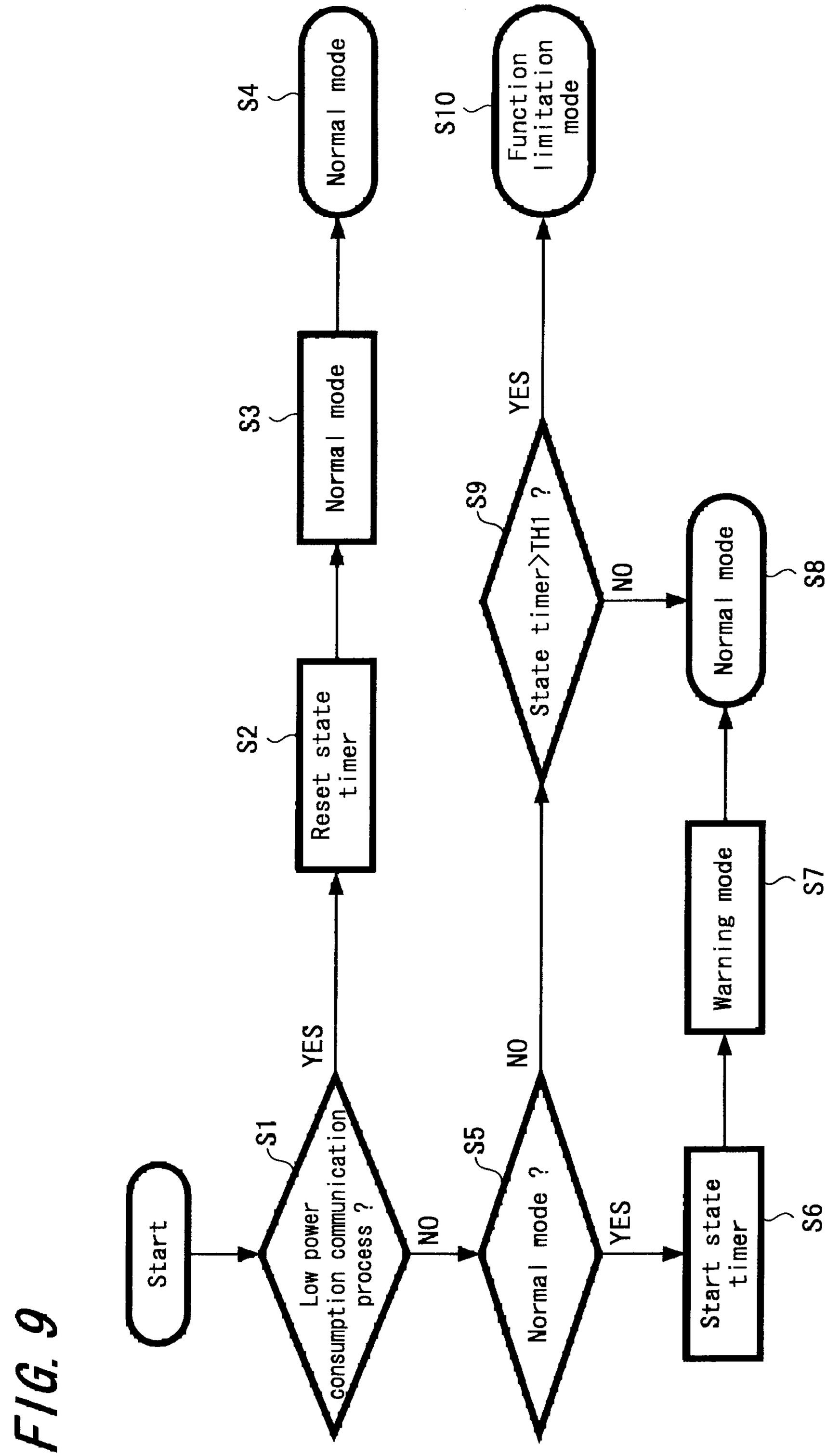

FIG. 9

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FIG. 10

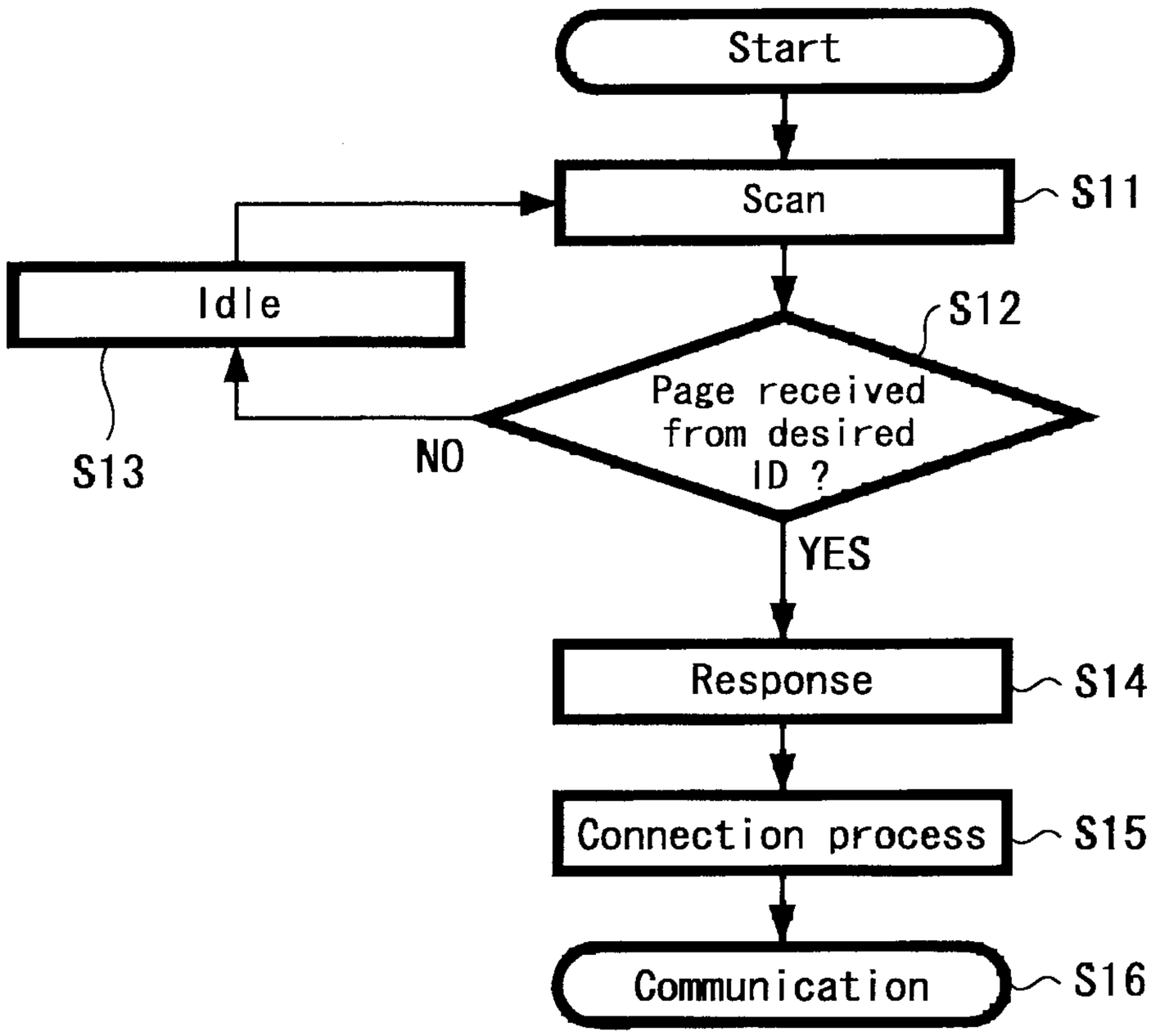
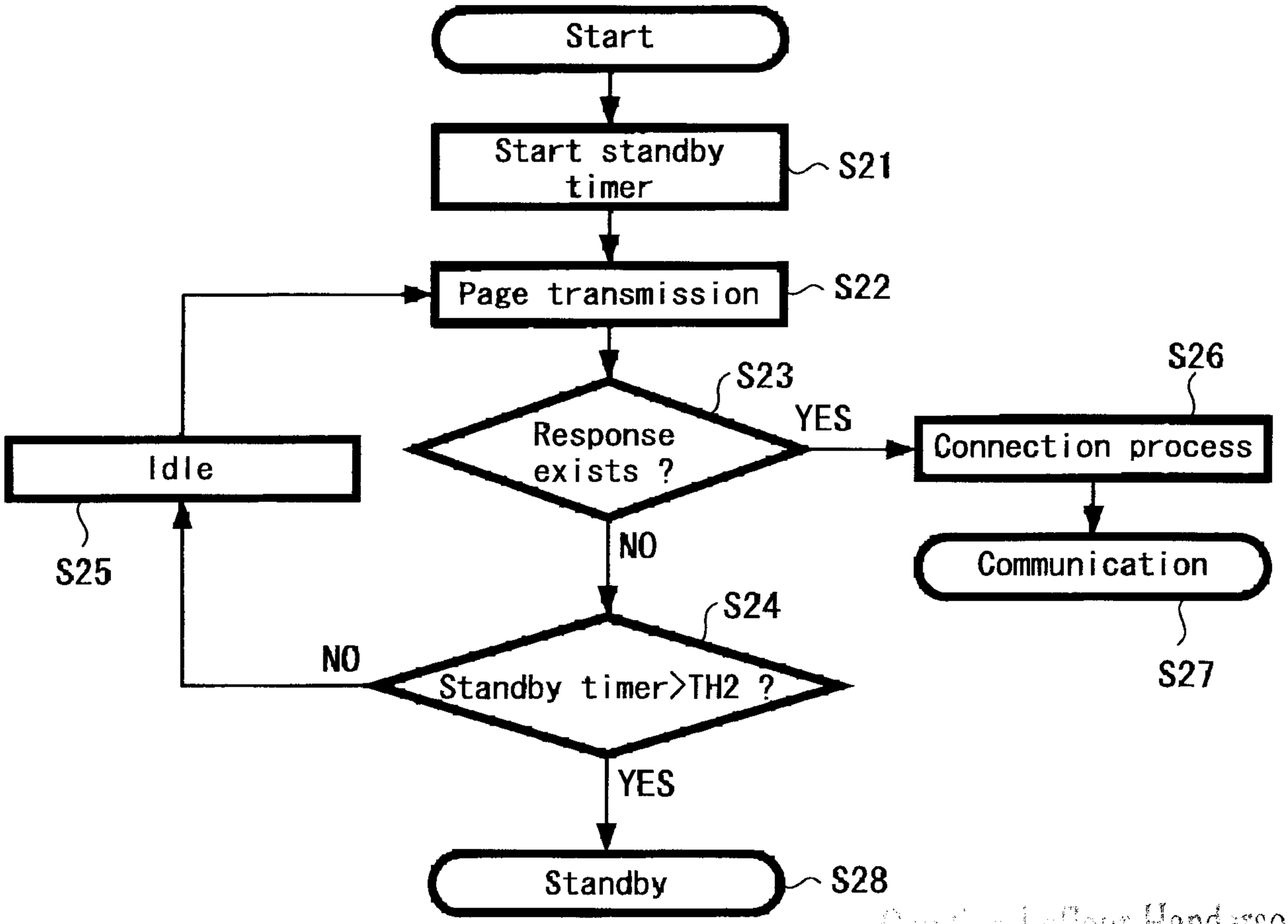


FIG. 11



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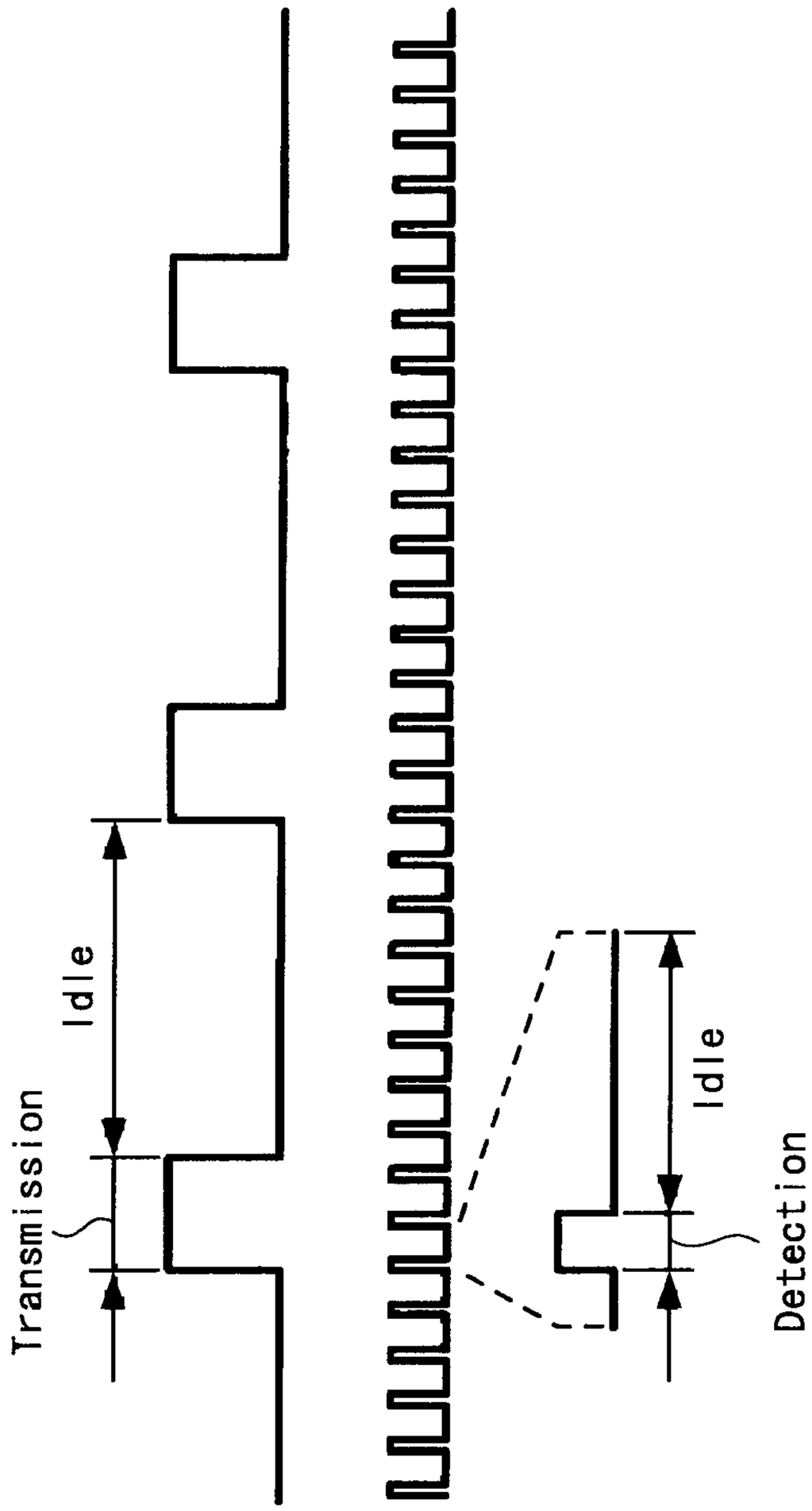

FIG. 12A

FIG. 12B

FIG. 13

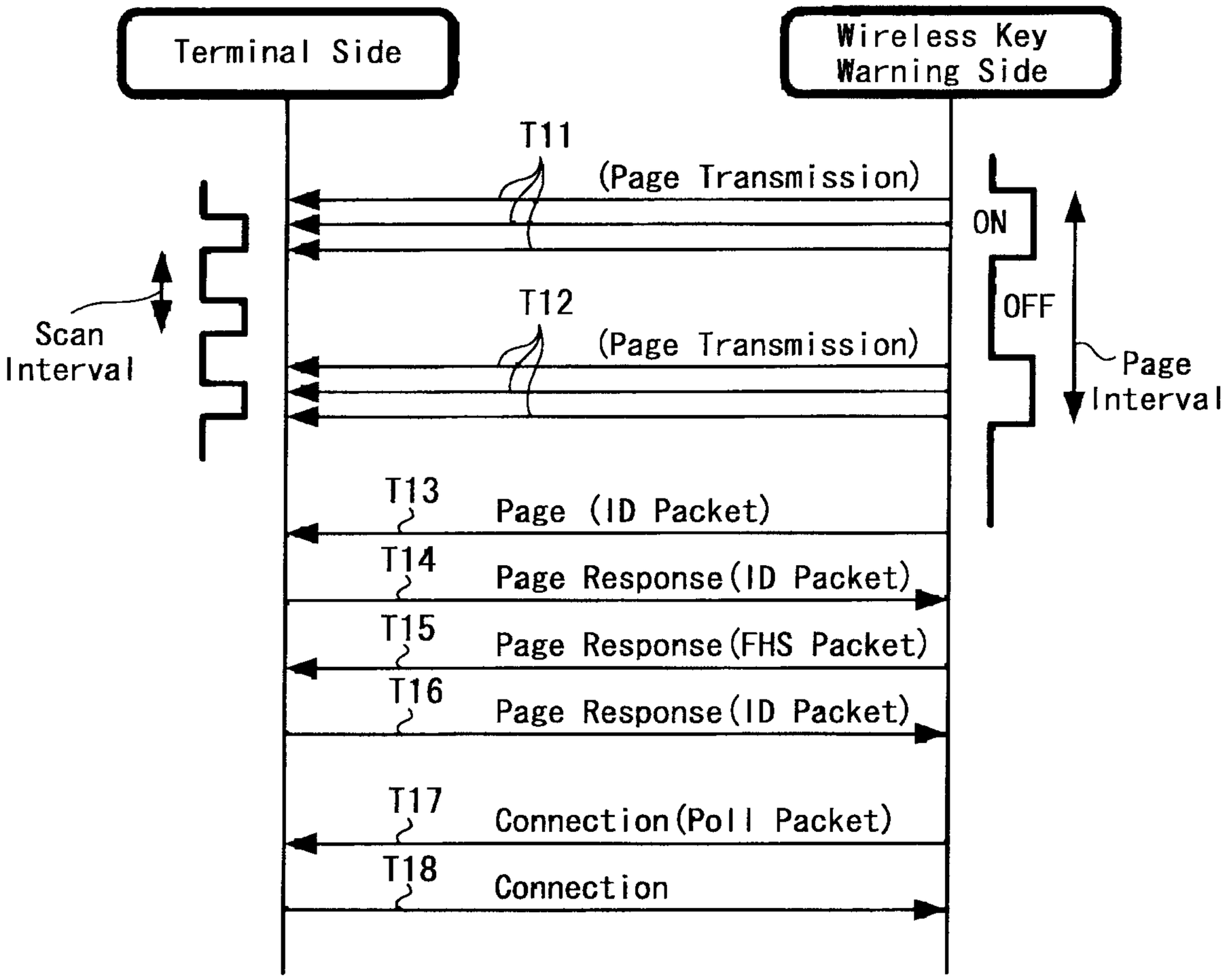

FIG. 14

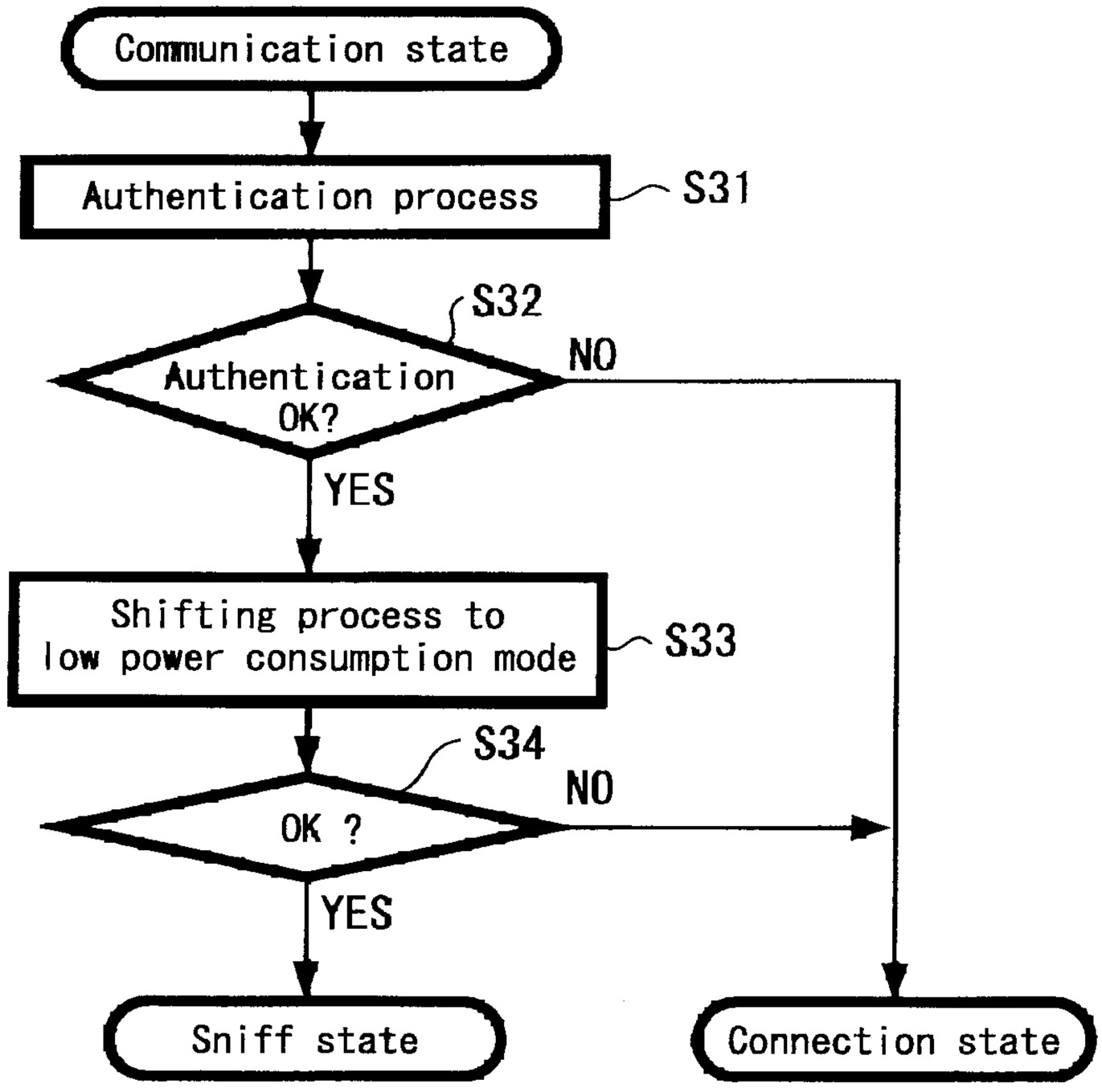

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FIG. 15

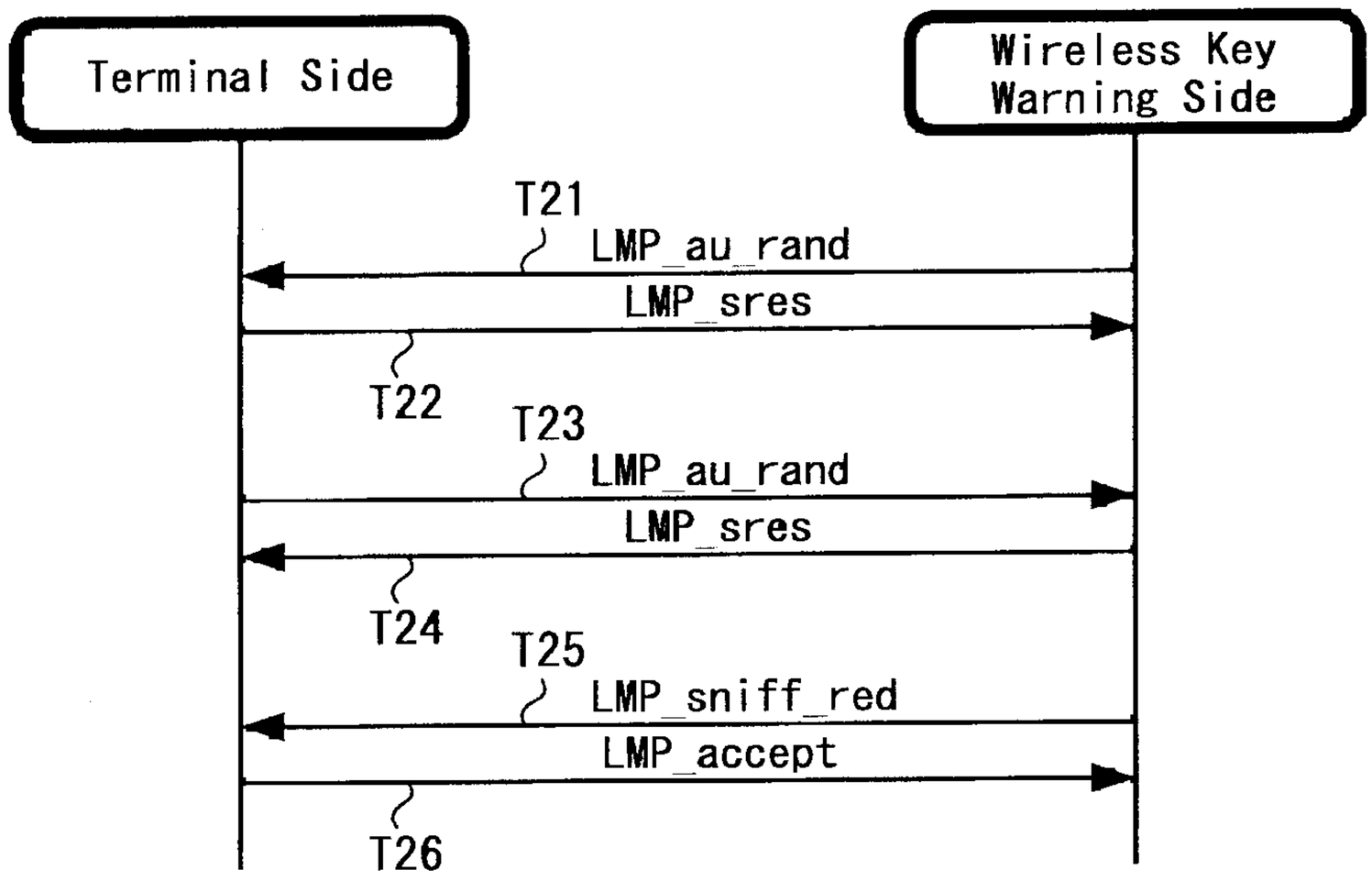

FIG. 16

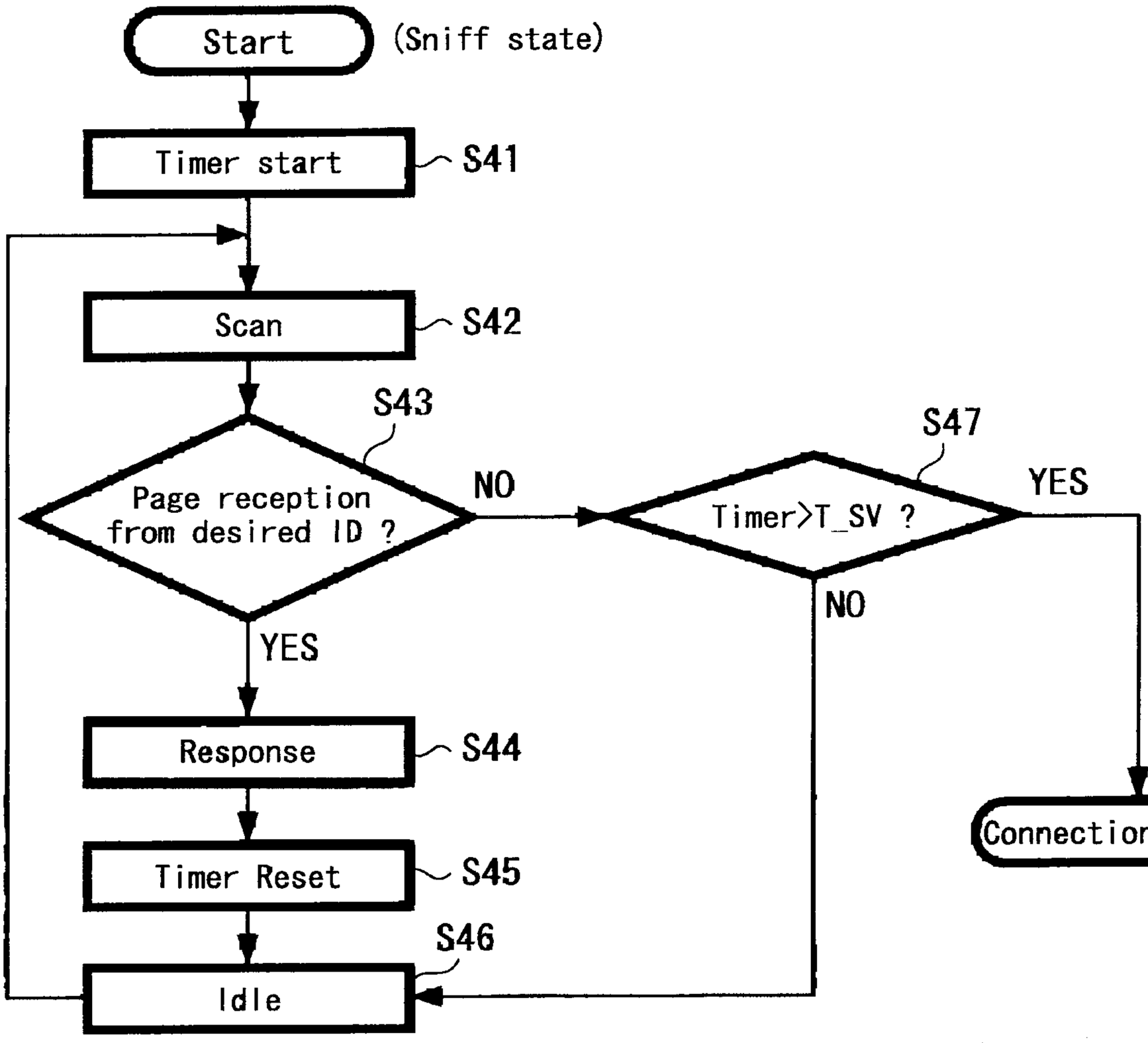

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FIG. 17

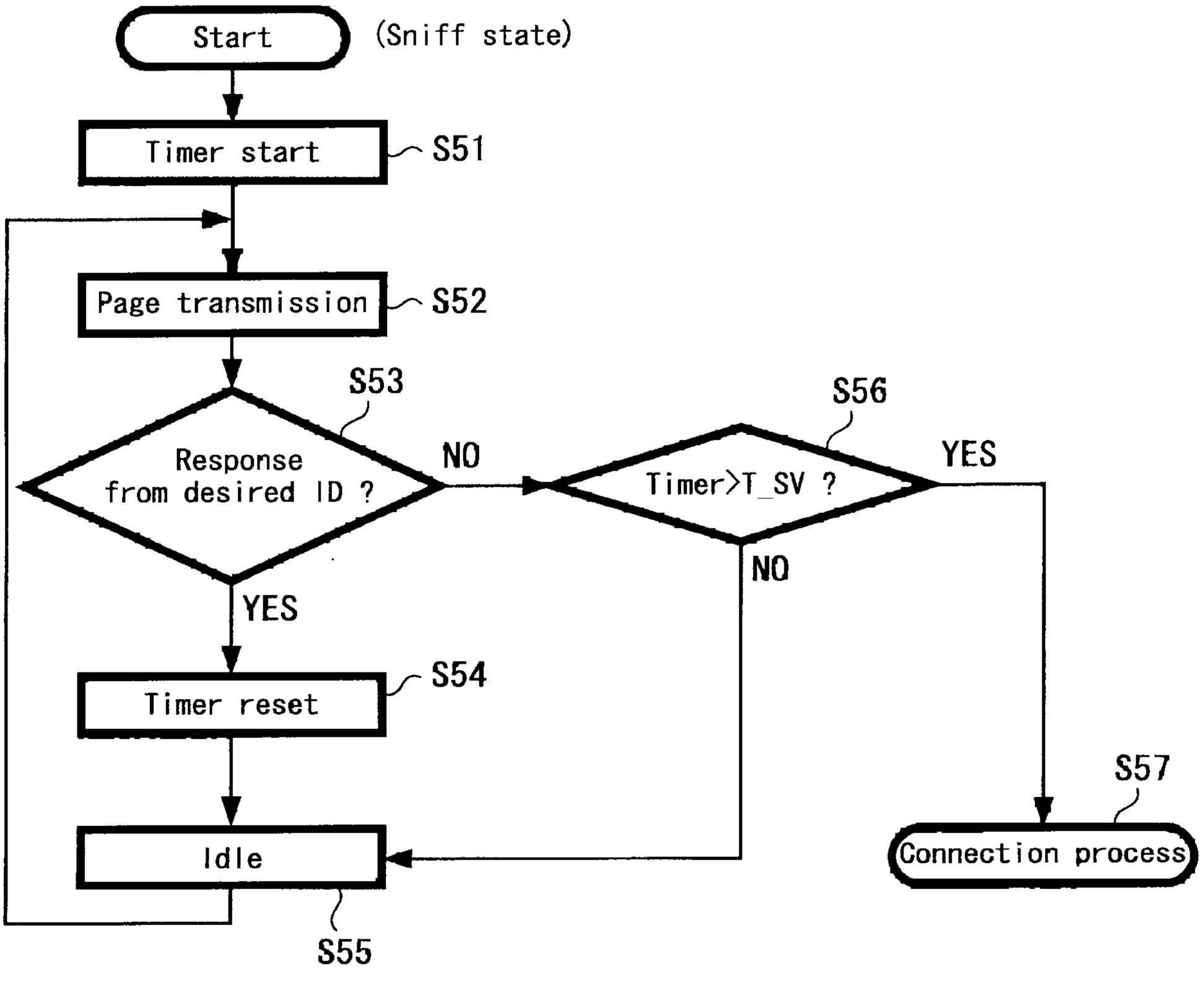

Start
(Sniff state)
Timer start
S51
Page transmission
S52
S53
Response from desired ID ?
NO
YES
S56
Timer>T_SV ?
YES
NO
Timer reset
S54
Idle
S55
S57
Connection process

FIG. 18

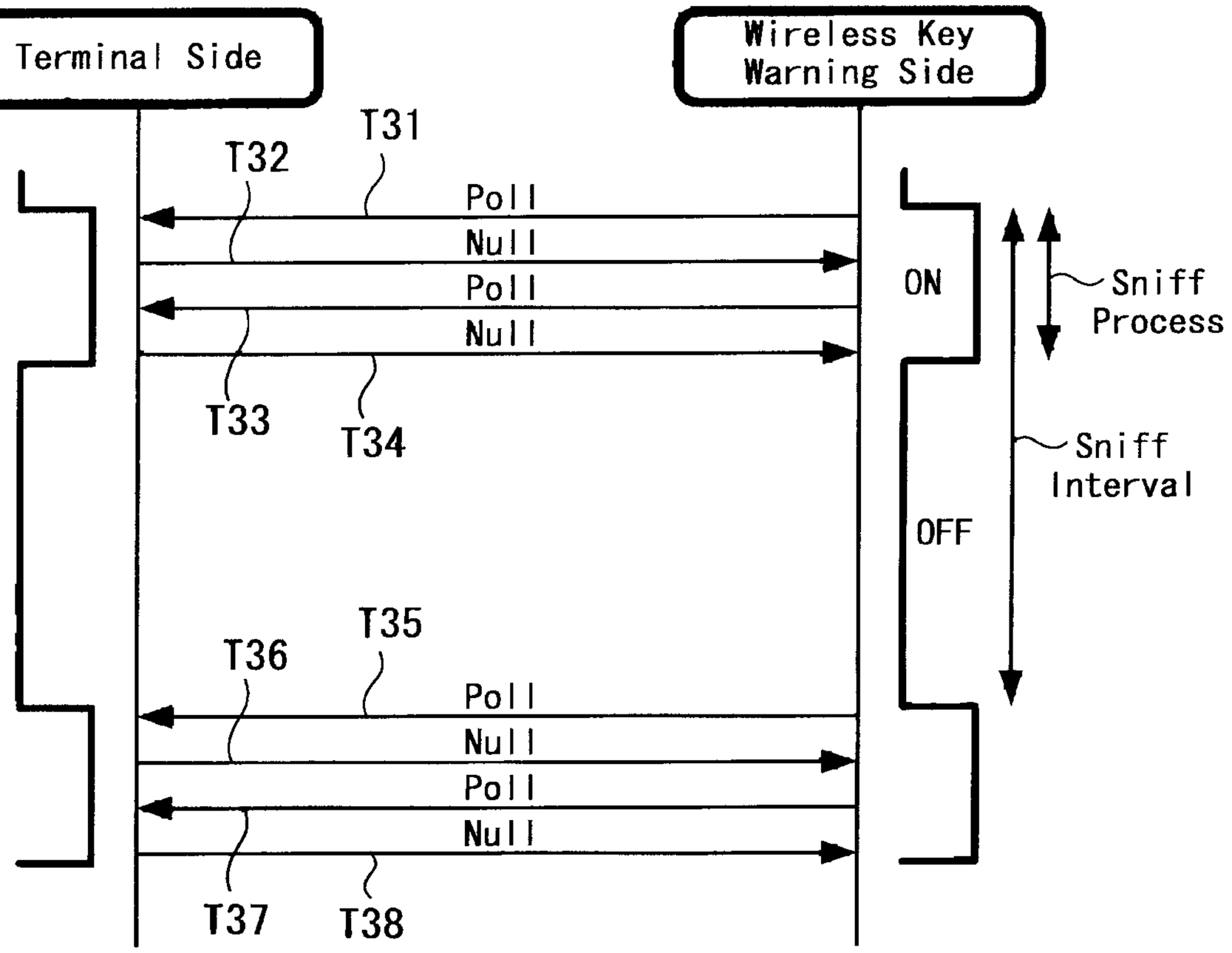
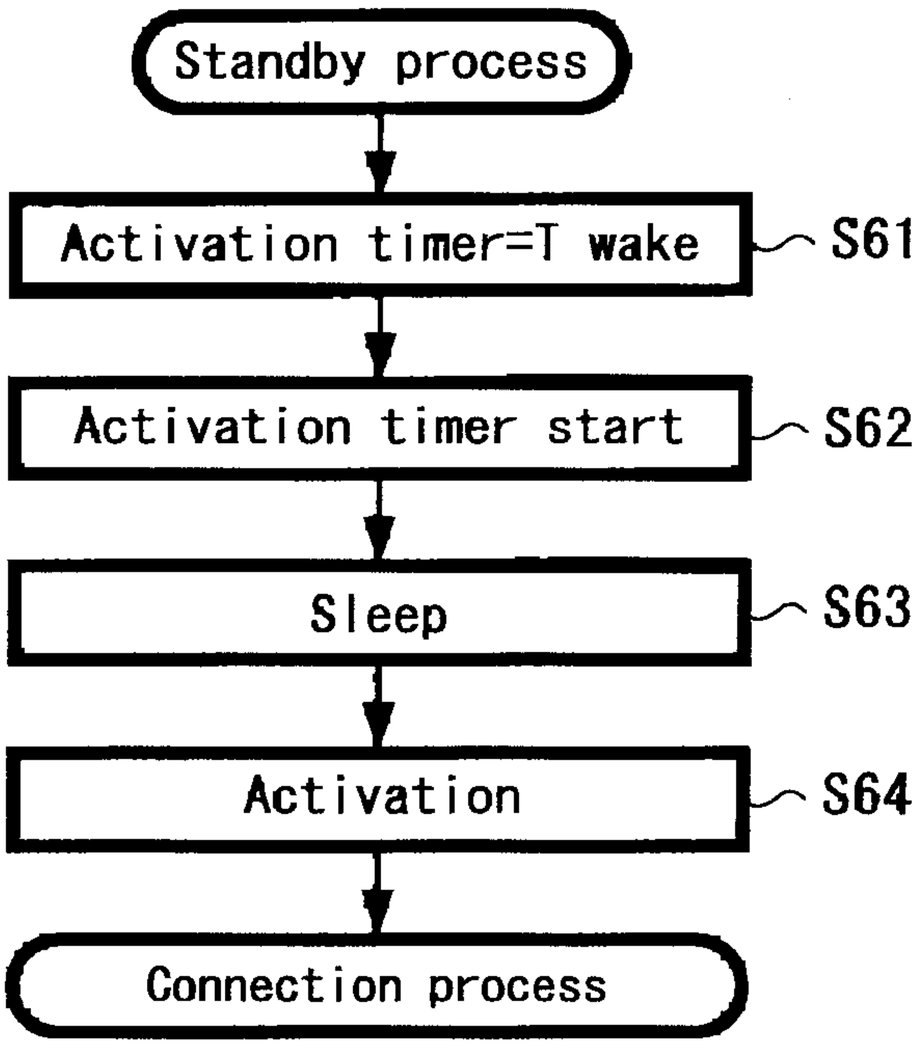


FIG. 19



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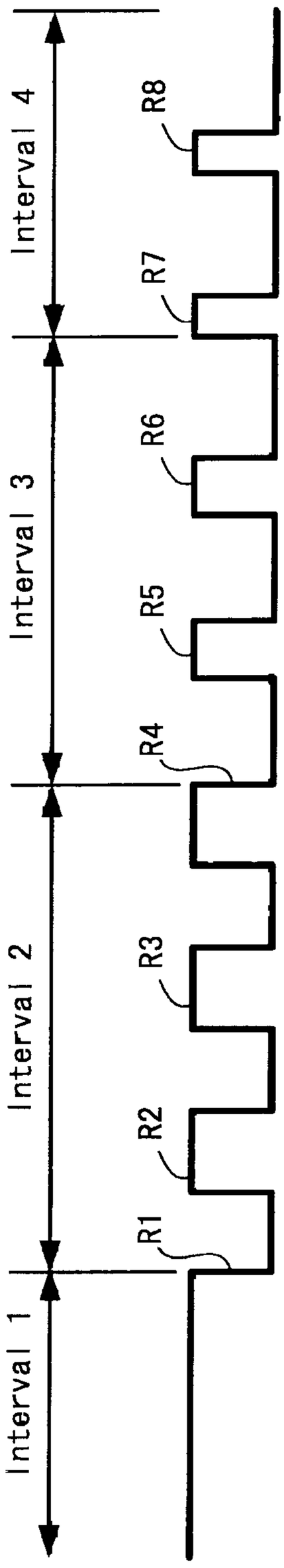

FIG. 20

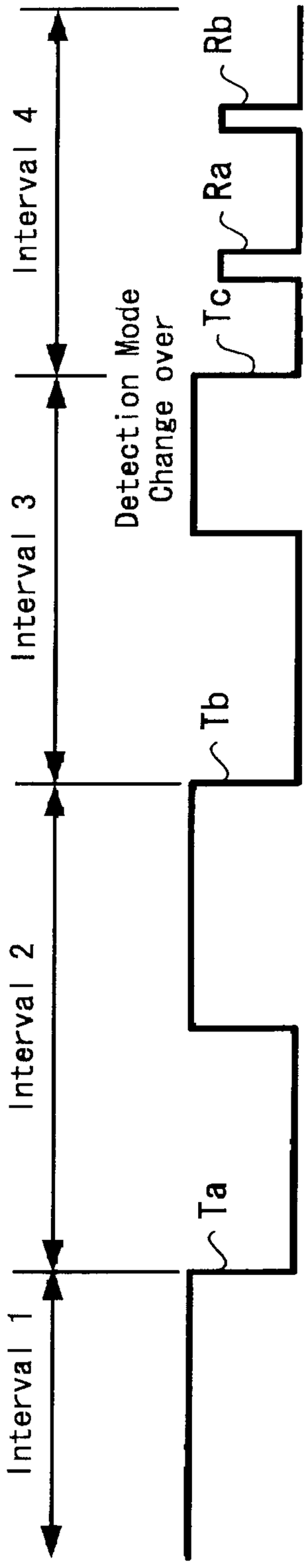

FIG. 21

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FIG. 22

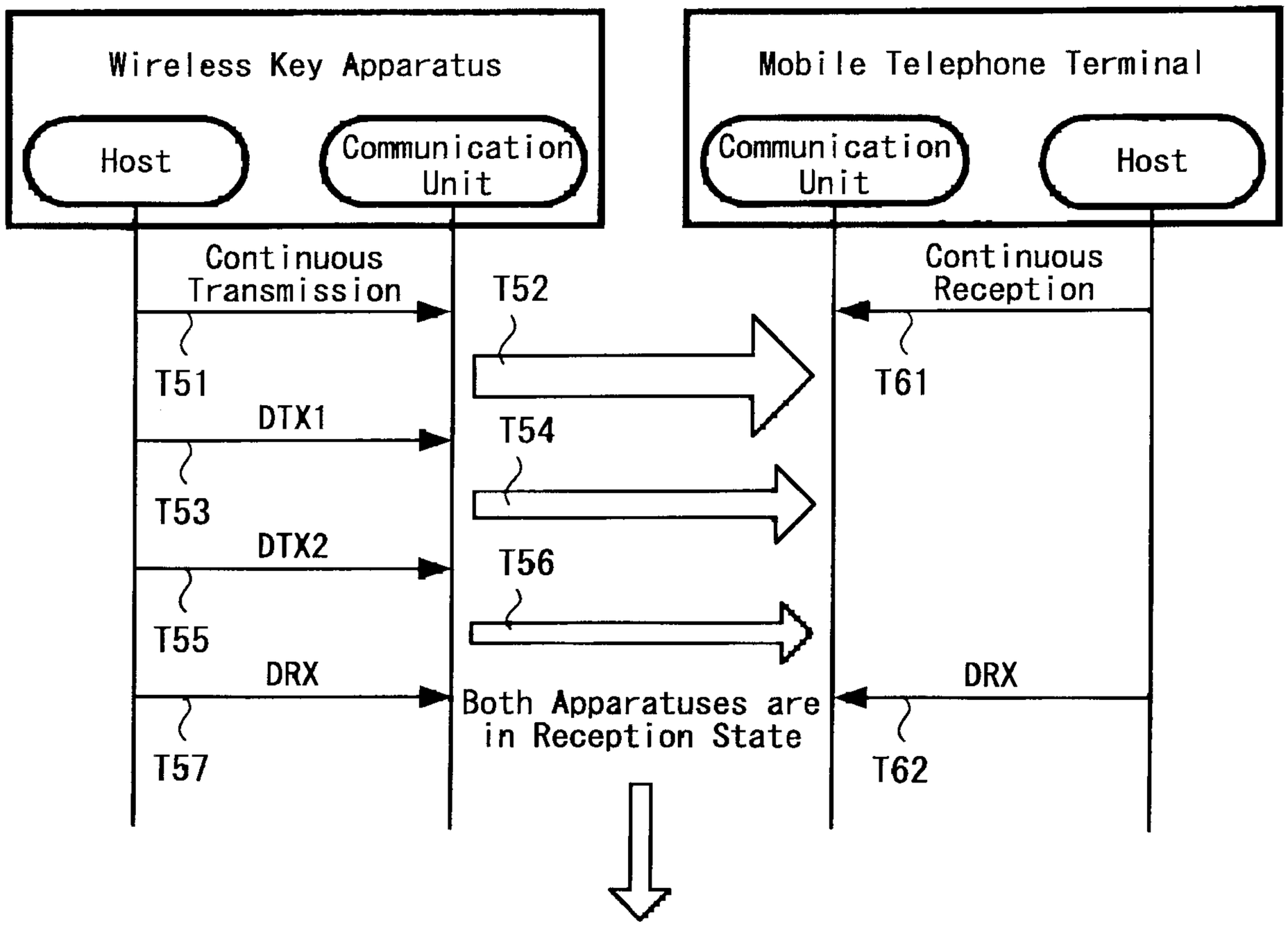

FIG. 23

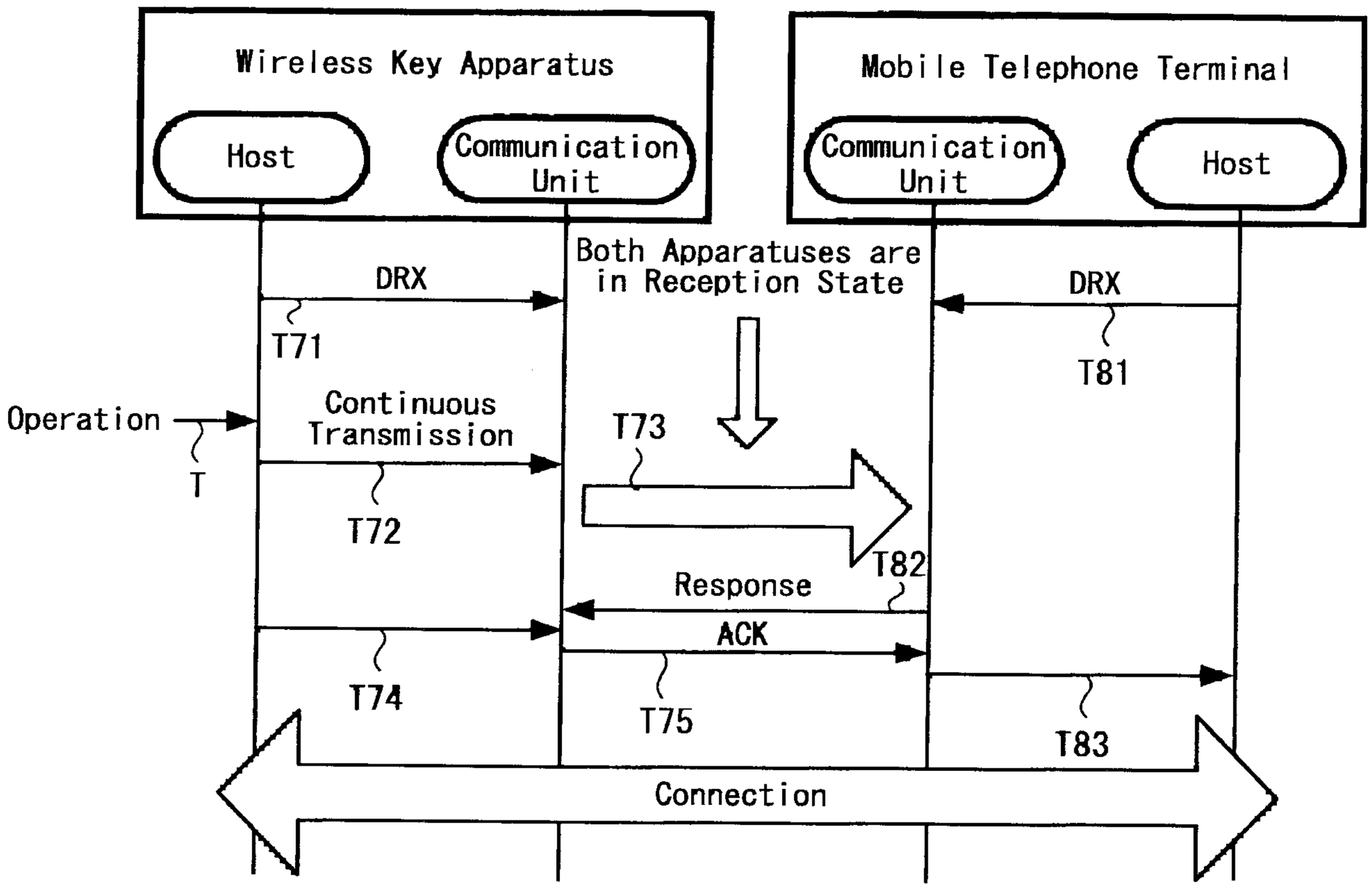

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FIG. 24

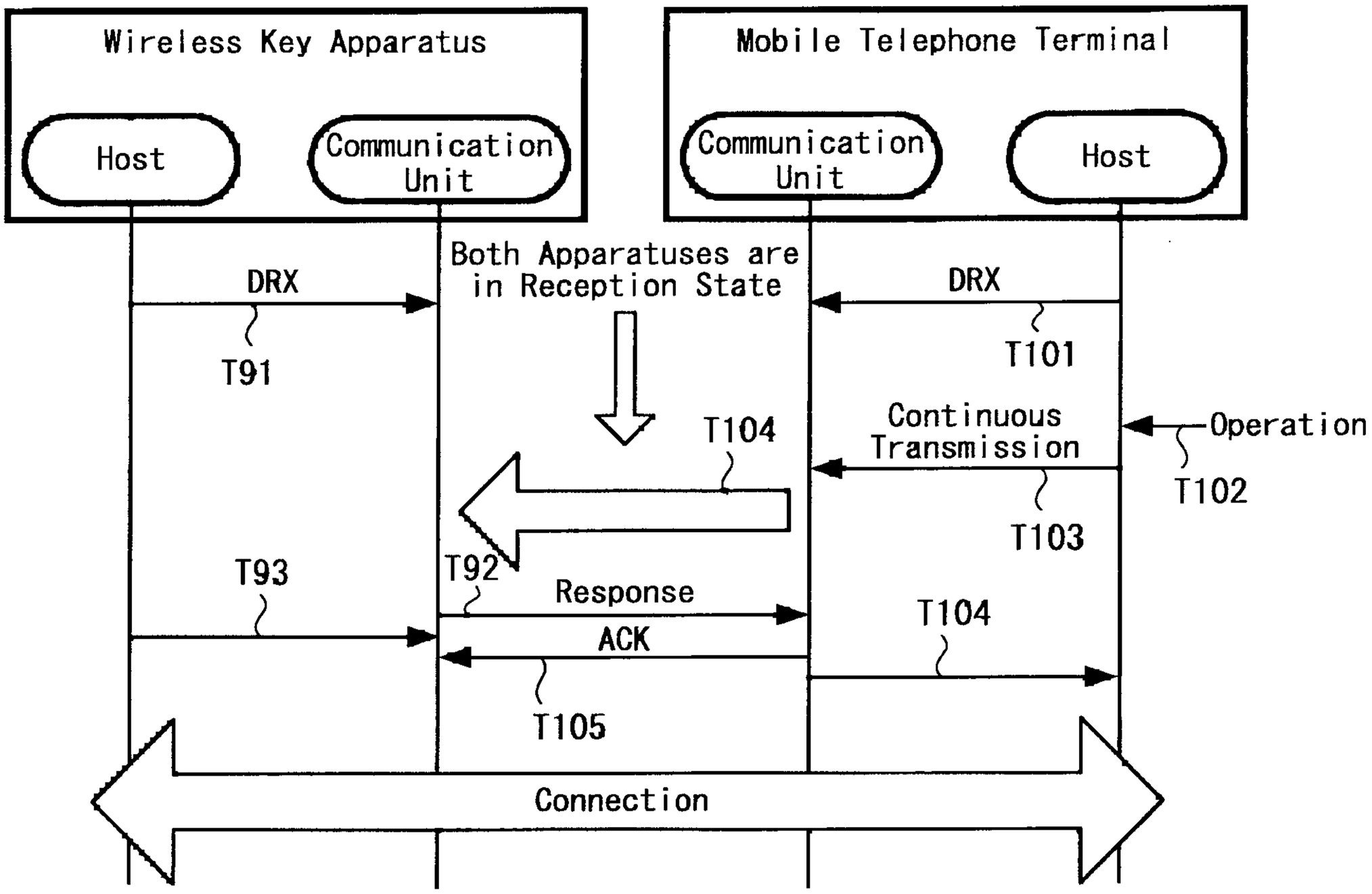

FIG. 25

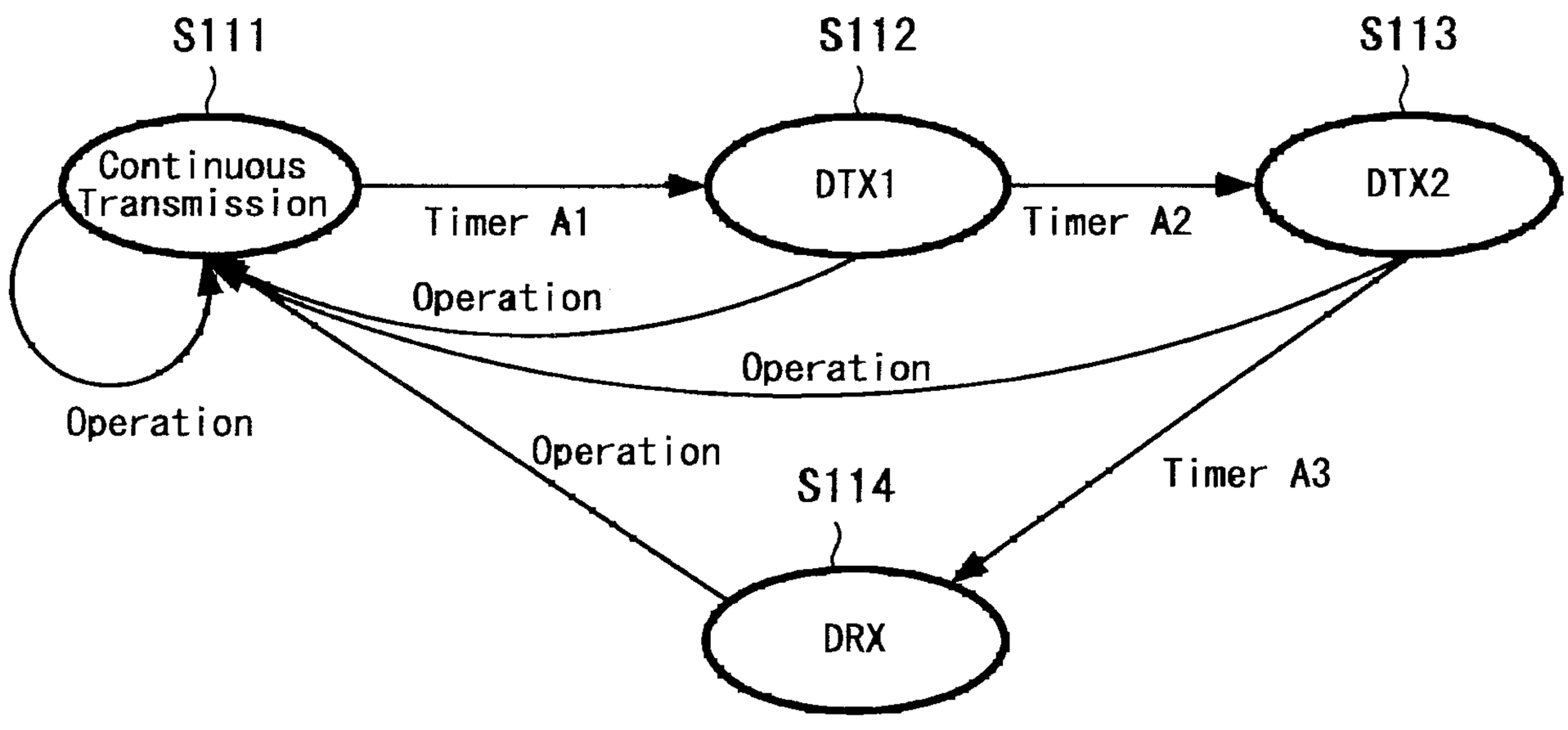

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FIG. 26

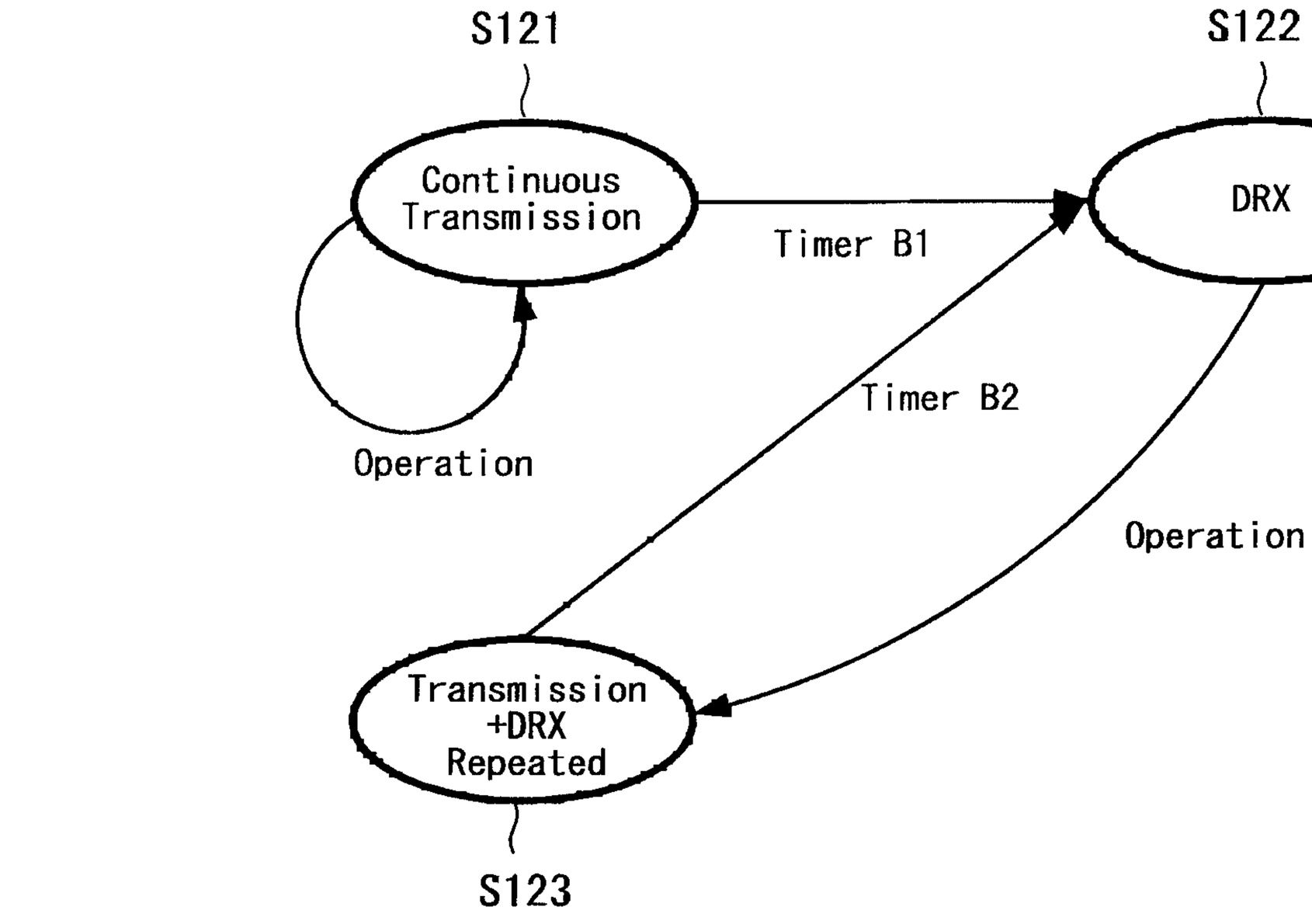
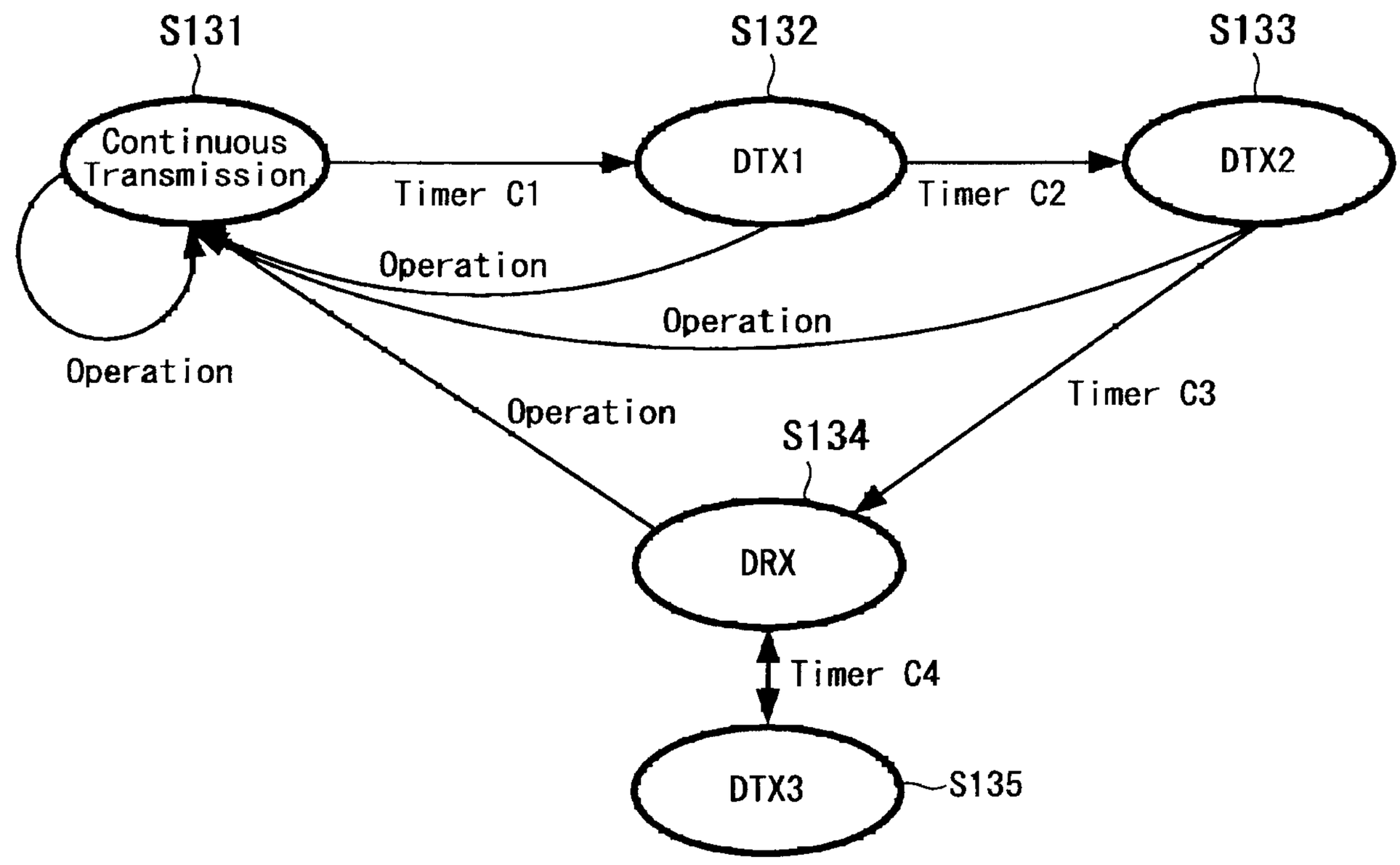


FIG. 27



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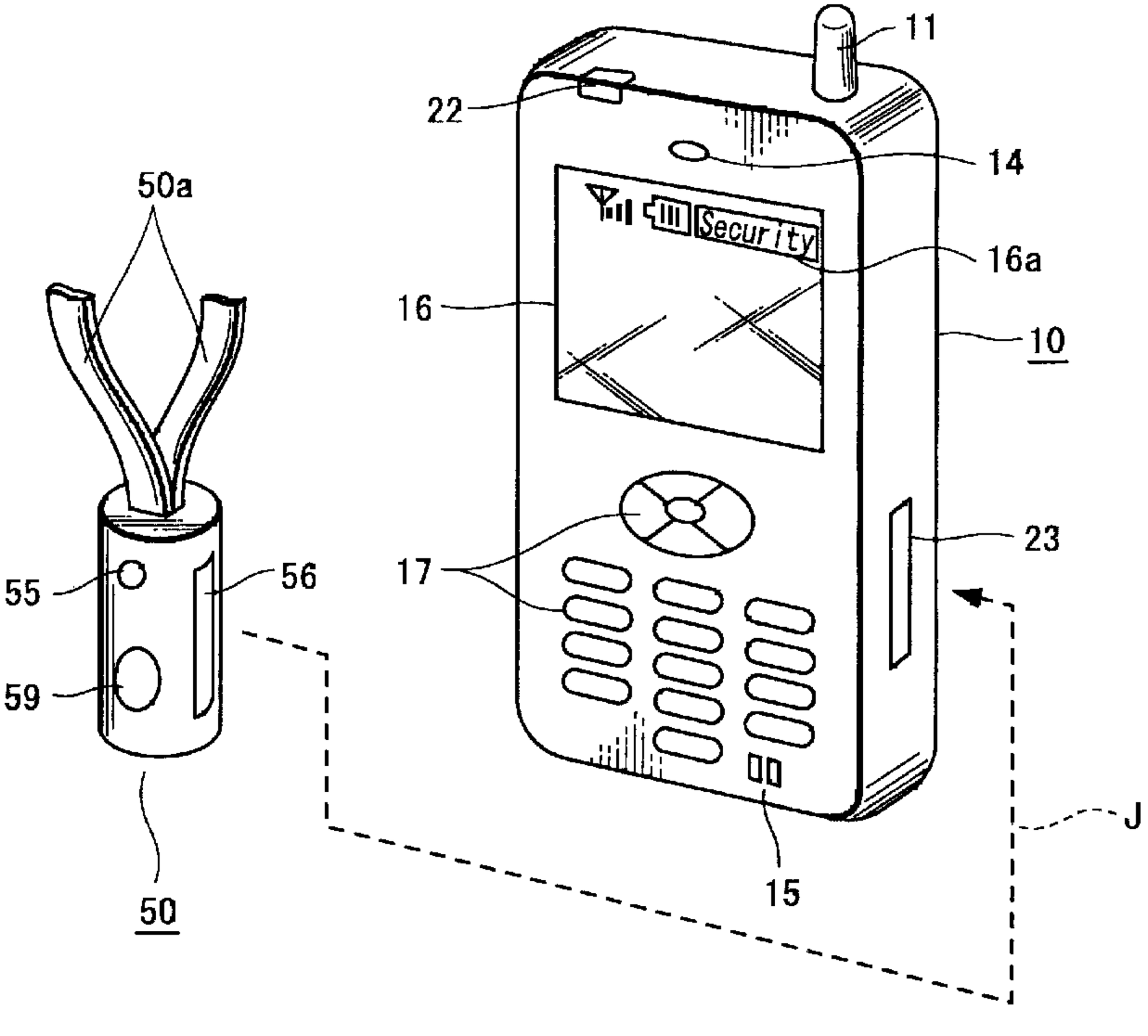
50a
55
56
59
50
11
22
14
16
16a
10
Security
17
23
J
15