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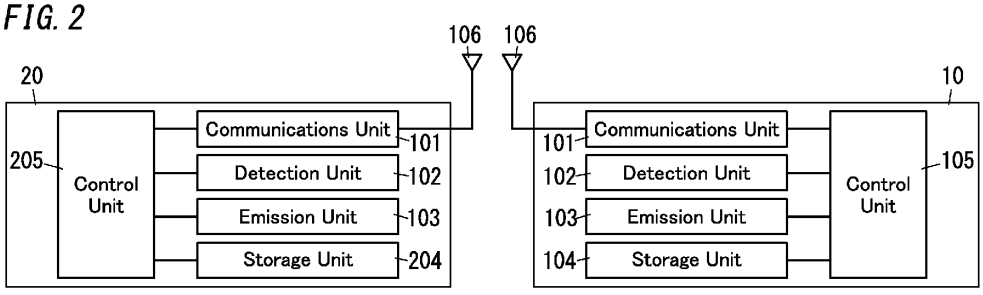
# (54) ALARM SYSTEM AND ALARM DEVICE

(57) The problem to be overcome by the present disclosure is to reduce the consumption current of slave devices without wasting the consumption current of a master device more than necessary. An alarm system (1) includes a master device (10) and a plurality of slave devices (20) to communicate with the master device (10). The master device (10) includes a storage unit (104). The storage unit (104) stores a plurality of slave device identification codes to identify the plurality of slave devices (20) from each other. Each of the plurality of slave devices (20) includes a communications unit (101) and a control unit (205). The communications unit (101) receives a first communication signal including a first slave device identification code, which is one of the slave device identification codes. The control unit (205) controls the communications unit (101). The control unit (205) of each of the plurality of slave devices (20) compares, on detecting reception of the first communication signal, the first slave device identification code with a second slave device identification code, which is an identification code of its own slave device (20), and instructs the communications unit (101) of its own slave device (20) to stop performing reception processing when a result of comparison indicates that first and second slave device identification codes disagree with each other.

FIG. 2

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## Description

### Technical Field

**[0001]** The present disclosure relates to an alarm system and an alarm device.

### Background Art

**[0002]** An alarm system designed to activate a plurality of devices in synch with each other has been provided in the art. As disclosed in JP 2006-343983 A, for example, in such an alarm system, when any one of the plurality of devices detects any abnormality, the device not only gives the alarm but also transmits information about the abnormality detected to the other devices by communicating with the other devices. This allows not only the device installed at the fire origin but also the other devices to give the alarm simultaneously in synch with each other.

### Summary of Invention

**[0003]** An alarm system includes a master device and a plurality of slave devices. The master device is configured to transmit a signal to the respective slave devices. In this case, to let the signal reach the destinations both quickly and with reliability, the signal may be transmitted as a multicast signal from the master device to the slave devices. In the case of multicasting, however, when a request is sent to only a specified slave device, the other slave devices are also activated in response to the signal transmitted, thus causing an increase in the consumption current of those slave devices.

**[0004]** Such a problem may be overcome by adopting unicasting by which the signal is transmitted sequentially to all of those slave devices. Unicasting, however, requires the master device to transmit the signal to each of the plurality of slave devices sequentially, which causes an increase in the consumption current of the master device.

**[0005]** In view of the foregoing background, an object of the present disclosure is to reduce the consumption current of the slave devices without wasting the consumption current of the master device more than necessary.

**[0006]** An alarm system according to an aspect of the present disclosure is an alarm system including a master device and a plurality of slave devices to communicate with the master device. The master device includes a storage unit to store a plurality of slave device identification codes to identify the plurality of slave devices from each other. Each of the plurality of slave devices includes: a communications unit to receive a first communication signal including a first slave device identification code, which is one of the plurality of slave device identification codes; and a control unit to control the communications unit. The control unit of each of the plurality of slave devices compares, on detecting reception of the first communication signal, the first slave device identification code with a second slave device identification code, which is an identification code of its own slave device, and instructs the communications unit of its own slave device to stop performing reception processing when a result of comparison indicates that first and second slave device identification codes disagree with each other.

**[0007]** An alarm device according to another aspect of the present disclosure functions as a slave device which communicates with a master device. The alarm device includes: a communications unit to receive a first communication signal including a first slave device identification code; and a control unit to control the communications unit. The control unit compares, on detecting reception of the first communication signal, the first slave device identification code with a second slave device identification code, which is an identification code of the alarm device itself, and instructs the communications unit to stop performing reception processing when a result of comparison indicates that first and second slave device identification codes disagree with each other.

**[0008]** An alarm system according to still another aspect of the present disclosure includes a master device and a plurality of slave devices to communicate with the master device. The master device includes a storage unit to store a plurality of slave device identification codes to identify the plurality of slave devices from each other. Each of the plurality of slave devices includes: a communications unit to receive a first communication signal including a particular number of slave device identification codes, the particular number being equal to or greater than one but fewer than the number of the slave device identification codes; and a control unit to control the communications unit. The control unit of each of the plurality of slave devices compares, on detecting reception of the first communication signal, each of the particular number of slave device identification codes included in the first communication signal with a slave device identification code of its own slave device, and instructs the communications unit of its own slave device to stop performing reception processing when a result of comparison indicates that none of the particular number of slave device identification codes included in the first communication signal agrees with the slave device identification code of its own slave device.

### Brief Description of Drawings

**[0009]**

FIG. 1 is a schematic representation illustrating an alarm system according to an exemplary embodiment;

FIG. 2 is a block diagram illustrating a master device and a slave device according to the exemplary embodiment;

FIG. 3 is a timing diagram illustrating how an alarm system according to the exemplary embodiment

may operate;

FIG. 4 is a timing diagram illustrating how the alarm system according to the exemplary embodiment may also operate;

FIG. 5 is a flowchart illustrating how the alarm system according to the exemplary embodiment may operate; and

FIG. 6 is a timing diagram illustrating how an alarm system according to a variation of the exemplary embodiment may operate.

**Description of Embodiments**

**[0010]** An exemplary embodiment of the present disclosure will now be described in detail with reference to the accompanying drawings. Note that the exemplary embodiment to be described below provides a comprehensive or specific example of the present disclosure. The numerical values, constituent elements, relative positions between the constituent elements, their connection, the order in which respective processing steps are performed, and other specifics to be presented in the following description are all examples and should not be construed as limiting the scope of the present disclosure. In addition, constituent elements described in the following description of embodiments which are not recited in an independent claim indicating the broadest scope of the present disclosure should be regarded as optional constituent elements.

**[0011]** Furthermore, the drawings attached herewith are all schematic representations, which are not necessarily exactly to scale. Also, any constituent element illustrated on multiple drawings and having substantially the same configuration is designated by the same reference sign, and their description will be either omitted or simplified, once described, to avoid redundancies.

(Embodiment)

(Overview)

**[0012]** An alarm system 1 according to an exemplary embodiment will now be described with reference to FIGS. 1-5. FIG. 1 is a schematic representation illustrating the alarm system 1. FIG. 2 is a block diagram illustrating a master device 10 and a slave device 20 thereof. FIG. 3 is a timing diagram illustrating how the alarm system 1 may operate. FIG. 4 is a timing diagram illustrating how the alarm system 1 may also operate. FIG. 5 is a flowchart illustrating how the alarm system 1 may operate.

**[0013]** The alarm system 1 according to the exemplary embodiment is a system which is installed in a facility such as a multi-family dwelling house or a single-family dwelling house to detect the presence of fire and alert person(s) in the facility to the presence of the fire. The device performing the functions of the alarm system 1 is herein supposed to be selected arbitrarily. In the following description of embodiments, a situation where the alarm system 1 is implemented as residential fire alarm devices will be described as an example. As shown in FIG. 1 the alarm system 1 includes a master device 10 and a plurality of (e.g., three in the example illustrated in FIG. 1) slave devices 20 (slave devices 20A-20C). The master device 10 communicate wirelessly with the slave devices 20. As for the slave devices 20, the plurality of slave devices 20 will be hereinafter collectively referred to as "slave devices 20" when their common feature is described. On the other hand, when the slave devices 20 need to be distinguished from each other, the slave devices 20 will be hereinafter referred to as a "slave device 20A," a "slave device 20B," and a "slave device 20C," respectively. Note that the number of the slave devices 20 provided does not have to be three.

**[0014]** In the alarm system 1 according to this embodiment, each slave device 20 includes a control unit 205 as shown in FIG. 2. The control unit 205 compares a slave device identification code included in a first communication signal that the control unit 205 has received from the master device 10 with a slave device identification code of its own slave device 20 and instructs a communications unit 101 thereof to stop performing reception processing when these slave device identification codes disagree with each other.

**[0015]** This configuration allows the master device 10 to send an instruction to only a specified slave device 20. At this time, all of the other slave devices 20, but the slave device 20 that has received the instruction, stop performing the reception processing. This may eventually reduce the consumption currents of the slave devices 20. Meanwhile, the master device 10 has the function of transmitting a communication signal to all of the plurality of slave devices 20, as needed, by multicasting. This allows the master device 10 to transmit the communication signal to all of the slave devices 20A-20C at a time without sequentially transmitting the communication signal to one of the slave devices 20A-20C after another by unicasting. This enables reducing the consumption current of the master device 10. That is to say, each slave device 20 performs the reception processing when instructed to do that in accordance with the communication signal from the master device 10 and stops performing the reception processing when not instructed to do that. Consequently, this may reduce the consumption currents of the slave devices 20 without wasting the consumption current of the master device 10 more than necessary.

(Configuration for master device)

**[0016]** As shown in FIG. 2, the master device 10 includes a communications unit 101, a detection unit 102, an emission unit 103, a storage unit 104, and a control unit 105.

**[0017]** The communications unit 101 establishes wireless communication with the slave devices 20 via an antenna 106 in compliance with a low power radio standard

requiring no radio station license. That is to say, the communications unit 101 transmits and receives a communication signal to/from the slave devices 20. As this type of low power radio standard, Specified Low Power Radio standard that uses radio waves falling within either the 920 MHz band or the 426 MHz band is defined in the country of Japan, for example.

**[0018]** In this case, the communication signal includes a first communication signal and a second communication signal. The first communication signal is a signal including a slave device identification code of a particular slave device 20 and used to control the operation of the particular slave device 20. On the other hand, the second communication signal is a signal including a multicast address and used to control the operation of the plurality of slave devices 20 collectively.

**[0019]** The detection unit 102 detects the presence of fire by sensing smoke and heat involved with the fire, for example.

**[0020]** When the detection unit 102 detects the presence of fire, the emission unit 103 emits at least one of light or sound. As used herein, the "sound" may be an alarm sound alerting the person(s) to the presence of fire or an alert voice message, whichever is appropriate. Meanwhile, the light as used herein may be flashing light or continuous light emitted from an indicator lamp or illuminating light that irradiates the floor when fire is present, whichever is appropriate.

**[0021]** The storage unit 104 includes, as its major constituent elements, a microcomputer and a programmable nonvolatile memory such as an electrically erasable programable read-only memory (EEPROM). The control unit 105 performs various types of functions by making the microcomputer execute a program stored in the memory.

**[0022]** In addition, the storage unit 104 also stores the slave device identification codes. Either during their manufacturing process or registration work to be performed in advance, unique identification codes are assigned to the master device 10 and slave devices 20. During the registration work to be performed in advance on the master device 10 and the slave devices 20, the master device 10 stores the respective slave device identification codes of the slave devices 20A-20C. These slave device identification codes allow the master device 10 to specify a target slave device 20 to which the communication signal is transmitted. In this case, the slave device identification code of a slave device 20 may be, for example, the IP address, MAC address, or name of the slave device 20.

**[0023]** As described above, a unique slave device identification code is assigned to each slave device 20 either during the manufacturing process or during the registration work. Nevertheless, specifying the slave device identification code as a part of the destination address of the communication signal makes the bit length relatively long, thus causing an increase in the transmission time of the wireless signal and thereby accelerating the consumption of the battery. Thus, as the slave device identification code of each slave device 20A-20C, the device number may be assigned to each slave device 20A-20C. As used herein, the "device number" is arbitrary number such as "1," "2," and so on registered with the alarm system 1. In this example, device numbers "1," "2," and "3" are assigned to the slave devices 20A-20C, respectively. In addition, as the destination address of the communication signal, the device number may be specified instead of the slave device identification code. This makes the bit length relatively short, thus shortening the transmission time of the communication signal and reducing the power consumption of the master device 10. In addition, if the master device 10 is driven by battery, this may also reduce the consumption of the battery of the master device 10.

**[0024]** The control unit 105 performs various types of functions. For example, if the detection unit 102 detects the presence of fire, then the control unit 105 controls the emission unit 103 to emit at least one of sound or light from the emission unit 103. In addition, to make the other devices sound the fire alarm, the control unit 105 controls the communications unit 101 to transmit a communication signal including a fire detection signal to the slave devices 20. Furthermore, when the communications unit 101 receives a communication signal including a fire detection signal from the slave device 20 at the fire origin, the control unit 105 controls the emission unit 103 to emit at least one of sound or light and also controls the communications unit 101 to transmit a communication signal including a fire detection signal to another slave device 20 different from the slave device 20 at the fire origin.

(Configuration for slave device)

**[0025]** As shown in FIG. 2, each slave device 20 includes a communications unit 101, a detection unit 102, an emission unit 103, a storage unit 204, and a control unit 205. The detection unit 102 and the emission unit 103 each have the same configuration as their counterpart of the master device 10 and description thereof will be omitted herein.

**[0026]** The storage unit 204 includes, as its major constituent elements, a microcomputer and a programmable nonvolatile memory such as an EEPROM. The control unit 205 (to be described later) performs various types of functions by making the microcomputer execute a program stored in the memory.

**[0027]** In addition, the storage unit 204 also stores the slave device identification code. Either during their manufacturing process or registration work to be performed in advance, unique identification codes are assigned to the master device 10 and slave devices 20. In this case, the slave device identification code of a slave device 20 may be, for example, the IP address, MAC address, or name of the slave device 20. This slave device identification codes are used by the master device 10 to specify the destination of the communication signal. This allows the slave device 20 to determine whether or not to per-

form the reception processing by comparing the slave device identification code included in the first communication signal that the slave device 20 has received from the master device 10 with the slave device identification code stored in the storage unit 104. In addition, as described above, the storage unit 204 may also store the device number assigned to the slave device identification code. In the following description, the slave device identification code stored in the storage unit 204 will be hereinafter referred to as an "individual identification code."

**[0028]** The control unit 205 performs various types of functions. For example, if the detection unit 102 detects the presence of fire, then the control unit 205 controls the emission unit 103 to emit at least one of sound or light from the emission unit 103. In addition, the control unit 205 controls the communications unit 101 to transmit a communication signal including a fire detection signal to the master device 10. Furthermore, when the communications unit 101 receives a communication signal including a fire detection signal from the master device 10, the control unit 205 controls the emission unit 103 to emit at least one of sound or light from the emission unit 103.

**[0029]** In addition, the control unit 205 also determines whether the communication signal received from the master device 10 is the first communication signal or the second communication signal. For example, when finding that the communication signal includes a multicast address, the control unit 205 determines the communication signal received to be the second communication signal. On the other hand, when finding that the communication signal includes no multicast address, the control unit 205 determines the communication signal received to be the first communication signal. Alternatively, when finding that the communication signal includes the slave device identification code of a particular slave device 20, the control unit 205 may determine the communication signal received to be the first communication signal.

**[0030]** On detecting that the first communication signal has been received, the control unit 205 compares the slave device identification code included in the first communication signal that the slave device 20 has received from the master device 10 with its own slave device identification code (individual identification code) stored in the storage unit 204. If the result of comparison indicates that these slave device identification codes disagree with each other, then the control unit 205 instructs the communications unit 101 of the slave device 20 to stop performing the reception processing. A specific operation will be described later.

(Communication operation of alarm system 1)

**[0031]** Next, it will be described with reference to FIGS. 3 and 4 how the alarm system 1 according to this embodiment performs a communication operation. In the following description, the communication operation to be performed between the master device 10 and the three slave devices 20A-20C will be described. The communication signal including the first communication signal and the second communication signal is supposed to be, for example, a fire detection signal alerting the person(s) to the presence of fire.

**[0032]** In the alarm system 1, the master device 10 serves as a main controller for performing overall control on the respective slave devices 20A-20C, thereby making the slave devices 20A-20C perform their respective operations. Specifically, the master device 10 transmits the communication signal to the respective slave devices 20A-20C, while the respective slave devices 20A-20C receive the communication signal from the master device 10 to execute the control command in accordance with the communication signal.

**[0033]** First, an exemplary communication operation by multicasting will be described with reference to FIG. 3. The master device 10 receives a synch signal A1 in every predetermined period T1. In this case, the status of communication between the master device 10 and the respective slave devices 20A-20C is normal, and therefore, the respective slave devices 20A-20C receive the synch signal A1. The master device 10 and the respective slave devices 20A-20C are synchronized with each other with the synch signal A1.

**[0034]** In this situation, when the detection unit 102 of the slave device 20B detects the presence of fire, the emission unit 103 of the slave device 20B sounds the fire alarm. In addition, at a predetermined transmission timing, which is defined by reference to the timing of reception of the synch signal A1, the slave device 20B transmits a fire detection signal B1 to the master device 10. On receiving the fire detection signal B1 from the slave device 20B, the master device 10 makes the emission unit 103 sound the fire alarm. In addition, to acknowledge the reception of the fire detection signal B1, the master device 10 transmits a response signal B2 to the slave device 20B.

**[0035]** Then, the master device 10 establishes communication by multicasting to notify the respective slave devices 20A-20C of the presence of fire at a time. The master device 10 transmits a fire detection signal B3 as the second communication signal to the respective slave devices 20A-20C. On detecting that the fire detection signal B3 thus received is the second communication signal, the control unit 205 of the respective slave devices 20A-20C allows their communications unit 101 to perform reception processing. At this time, the control unit 205 recognizes the multicast address included in the fire detection signal B3 to detect that the fire detection signal B3 is the second communication signal. When the reception processing is performed, the control unit 205 executes the control command included in the fire detection signal B3. Specifically, the control unit 205 makes the emission unit 103 sound the fire alarm. In addition, to acknowledge the reception of the fire detection signal B3, each of the slave devices 20A-20C transmits a response signal B4 to the master device 10. When finishing performing this series of operations, the slave devices 20A-20C each

resume the standby state in which the slave devices 20A-20C receive the synch signal A1 in every predetermined period T1.

**[0036]** This configuration enables, at the outbreak of fire, transmitting the fire detection signal to all slave devices 20, thus allowing all the devices to sound the fire alarm in synch with each other. This enables alerting the person(s) to the presence of fire quickly.

**[0037]** Next, an exemplary communication operation by unicasting will be described with reference to FIG. 4. As described above, the master device 10 and the respective slave devices 20A-20C are synchronized with each other with the synch signal A1.

**[0038]** When the detection unit 102 of the slave device 20B detects the presence of fire, the slave device 20B transmits a fire detection signal B1 to the master device 10 at a predetermined transmission timing, which is defined by reference to the timing of reception of the synch signal A1. In response, to acknowledge the reception of the fire detection signal B1, the master device 10 transmits a response signal B2 to the slave device 20B.

**[0039]** Then, to allow only the slave device 20A sound the fire alarm out of the plurality of slave devices 20, the master device 10 establishes communication by unicasting using the first communication signal including the slave device identification code of the slave device 20A. Specifically, first, the master device 10 transmits a fire detection signal B5, which is the first communication signal including the identification code of the slave device 20A, to the respective slave devices 20A-20C. On detecting that the fire detection signal B5 received is the first communication signal, the control unit 205 of each of the slave devices 20A-20C compares the slave device identification code included in the first communication signal with its own slave device identification code. If the result of comparison indicates that these slave device identification codes agree with each other, the control unit 205 allows the communications unit 101 to perform the reception processing. On the other hand, if the result of comparison indicates that these slave device identification codes disagree with each other, the control unit 205 makes the communications unit 101 to stop performing the reception processing. That is to say, in this embodiment, the fire detection signal B5 includes the slave device identification code of the slave device 20A, and therefore, the control unit 205 of the slave device 20A makes the communications unit 101 perform the reception processing. On the other hand, the control unit 205 of the slave devices 20B, 20C makes their communications unit 101 stop performing the reception processing.

**[0040]** When the reception processing is performed, the slave device 20A executes the control command included in the fire detection signal B5. Specifically, the slave device 20A makes the emission unit 103 sound the fire alarm. In addition, to acknowledge the reception of the fire detection signal B5, the slave device 20A transmits a response signal B6 to the master device 10. When finishing performing this series of operations, the slave device 20A resumes the standby state in which the slave device 20A receives the synch signal A1 in every predetermined period T1. Meanwhile, the other slave devices 20B, 20C that have stopped performing the reception processing resume the standby state at the timing when the slave devices 20B, 20C stopped performing the reception processing.

**[0041]** This configuration enables making, at the outbreak of fire, the slave device 20 (such as the slave device 20B) that has detected the fire and a particular slave device 20 (such as the slave device 20A) sound the fire alarm and making the other slave device 20 (such as the slave device 20C) sound no fire alarm. In other words, this enables controlling, when the fire is present, the particular slave device 20 to perform a specified operation. This improves the versatility of the alarm system 1, thus making the alarm system 1 adjustable to various types of facilities and/or various specifications required by the user.

**[0042]** In the foregoing description, the communication signal is supposed to be a fire detection signal. However, this is only an example and should not be construed as limiting. Rather, the communication signal has only to be a signal participating in the control of the emission unit 103. Examples of such signals participating in the control of the emission unit 103 include a fire detection signal, a fire stop signal, and a request signal. As used herein, the fire detection signal is a signal for use to notify, when one device detects the presence of fire, another device of the presence of the fire that has been detected. The fire stop signal is a signal for use to stop calling an alert to the presence of the fire. The request signal is a signal requesting emitting a particular sound and/or emitting light in a particular emission pattern when fire is present.

**[0043]** If the communication signal is the fire stop signal, then the signal enables, while all slave devices 20 are sounding the fire alarm at the outbreak of fire, making only a particular slave device (such as the slave device 20A) stop sounding the fire alarm, for example. On the other hand, if the communication signal is the request signal, then the signal enables, at the outbreak of fire, making only a particular slave device 20 (such as the slave device 20A) emit a different sound as the fire alarm and/or emit light in a different emission pattern as the fire alarm.

**[0044]** Alternatively, the control unit 205 of the slave device 20 may compare the device number included in the first communication signal with the device number of its own slave device 20, instead of comparing the slave device identification codes. In that case, if the result of comparison indicates that these device numbers agree with each other, then the control unit 205 allows the communications unit 101 to perform the reception processing. On the other hand, if the result of comparison indicates that these device numbers disagree with each other, then the control unit 205 makes the communications unit 101 stop performing the reception processing.

**[0045]** The data about whether the signal to be trans-

mitted by the master device 10 to the slave device 20 is the first communication signal or the second communication signal and to which slave device 20 the master device 10 should transmit the first communication signal may be stored in advance in the storage unit 104 of the master device 10. This may have been determined during the manufacturing process of the master device 10 or may be set by the user after the master device 10 has been installed.

**[0046]** Optionally, a management device (not shown) may be further provided as a high-order system for the master device 10 and may control the master device 10 to determine what communication signal the master device 10 should transmit to the slave device 20. In this case, the management device may be, for example, a home energy management system (HEMS) controller to be installed in a facility. The management device may communicate with a plurality of devices provided in the facility, e.g., may be installed to be ready to communicate with the master device 10. The management device may not only control the operation of the master device 10 but also receive a fire detection signal from the master device 10. When receiving the fire detection signal, the management device may not only manage the fire alarm but also post, on a display screen, an alert message indicating that the fire is present.

(Operation of slave device 20)

**[0047]** Next, the series of operation to be performed by each slave device 20 will be described in detail with reference to the flowchart shown in FIG. 5. First, a multicast communication will be described. After having been activated, the slave device 20 is in standby state to be ready to receive the communication signal (in Step S1). If the presence of fire is detected in such a state to command the slave device 20 to communicate with the master device 10, the slave device 20 receives the communication signal from the master device 10 (in Step S2). The control unit 205 determines whether or not the communication signal received includes a multicast address (i.e., whether or not the communication signal received is the second communication signal) (in Step S3). When deciding that the communication signal received should include the multicast address (i.e., that the second communication signal should have been received from the master device 10) (if the answer is YES in Step S3), then the control unit 205 performs the reception processing (in Step S6). Then, the control unit 205 executes the control command included in the communication signal received (in Step S7) and transmits a response signal to the master device 10 (in Step S8). When finishing performing this series of processing steps, the slave device 20 resumes the standby state.

**[0048]** Next, a unicast communication will be described. After having been activated, the slave device 20 is in standby state to be ready to receive the communication signal (in Step S1). If the presence of fire is detected in such a state to command the slave device 20 to communicate with the master device 10, the slave device 20 receives the communication signal from the master device 10 (in Step S2). The control unit 205 determines whether or not the communication signal received includes a multicast address (i.e., whether or not the communication signal received is the second communication signal) (in Step S3). When finding that the communication signal received includes no multicast address, the control unit 205 decides that the second communication signal should have not been received as the communication signal (i.e., that the first communication signal should have been received as the communication signal) (i.e., the answer is NO in Step S3). In that case, the control unit 205 compares the slave device identification code included in the first communication signal received with the individual identification code of its own slave device 20 (in Step S4). The control unit 205 determines whether or not the slave device identification code and the individual identification code agree with each other (in Step S5). Specifically, the control unit 205 determines whether or not the slave device identification code included in the first communication signal agrees with the individual identification code of its own slave device 20.

**[0049]** If the result of comparison indicates that these identification codes agree with each other (i.e., when deciding that the slave device identification code included in the first communication signal should agree with the individual identification code of its own slave device 20) (if the answer is YES in Step S5), then the control unit 205 performs the reception processing (in Step S6). Then, the control unit 205 executes the control command included in the communication signal (i.e., the first communication signal) received (in Step S7) and transmits a response signal to the master device 10 (in Step S8). When finishing performing this series of processing steps, the slave device 20 resumes the standby state. On the other hand, if the result of comparison indicates that these identification codes disagree with each other (i.e., when deciding that the slave device identification code included in the first communication signal should disagree with the individual identification code of its own slave device 20) (if the answer is NO in Step S5), then the control unit 205 stops performing the reception processing and resumes the standby state.

(Advantage)

**[0050]** According to this configuration, the control unit 205 of the slave device 20 determines whether the communication signal that the slave device 20 has received from the master device 10 is the first communication signal that adopts unicasting or the second communication signal that adopts multicasting and controls the reception processing of the communications unit 101 based on the decision. In addition, if the communication signal received is the first communication signal, the control unit 205 compares the slave device identification code includ-

ed in the first communication signal with the slave device identification code of its own slave device 20. If the result of comparison indicates that these slave device identification code disagree with each other, the control unit 205 makes the communications unit 101 stop performing the reception processing. That is to say, the slave device 20 performs the reception processing when required to deal with the communication signal received from the master device 10 but stops performing the reception processing when not required to deal with the communication signal received from the master device 10. This enables reducing the consumption current of the slave device without wasting the consumption current of the master device more than necessary.

(Variations)

**[0051]** Note that the embodiment described above is only an exemplary one of various embodiments of the present disclosure and should not be construed as limiting. Rather, the exemplary embodiment may be readily modified in various manners depending on a design choice or any other factor without departing from the scope of the present disclosure. The functions of the alarm system 1 according to the exemplary embodiment described above may also be implemented as a method for controlling the alarm system 1, a computer program, or a non-transitory storage medium that stores the computer program thereon. Next, variations of the exemplary embodiment will be enumerated one after another. Note that the variations to be described below may be adopted as appropriate in combination.

**[0052]** In the exemplary embodiment described above, the alarm system 1 is supposed to be used in a facility such as a multi-family dwelling house or a single-family dwelling house. However, the facility does not have to be a dwelling house but may also be a store or a non-dwelling multitenant facility such as an office building.

**[0053]** Also, in the exemplary embodiment described above, the detection unit 102 is supposed to detect the presence of fire. However, this is only an example and should not be construed as limiting. Alternatively, the detection unit 102 may also be a sensor for detecting the outbreak of flood or an earthquake, gas leakage, or the presence of carbon monoxide, for example.

**[0054]** Furthermore, in the exemplary embodiment described above, the master device 10 and the slave devices 20 communicate with each other wirelessly. However, the means of their communication is not limited to any particular one but may be wired or wireless communication or optical communication.

**[0055]** Furthermore, in the exemplary embodiment described above, each of the master device 10 and the slave devices 20 is supposed to be an alarm device including the detection unit 102 and the emission unit 103 and having the capability of detecting fire and the capability of giving the alarm. However, this is only an example and should not be construed as limiting. Alternatively, the master device 10 may have only the capability of sounding the alarm and the slave devices 20 may have only the capability of detecting fire, for example. That is to say, the present disclosure is also applicable to an automatic fire alarm system including a receiver, a relay, and a sensor. In that case, the receiver may serve as the master device 10 and the relay may serve as the slave device 20. Alternatively, the relay may serve as the master device 10 and the sensor may serve as the slave device 20. Still alternatively, the receiver may serve as the master device 10 and the sensor may serve as the slave device 20. Optionally, the automatic fire alarm system may further include the management device described above and the management device and the receiver may be connected together to communicate with each other.

**[0056]** In the exemplary embodiment described above, the first communication signal includes a single slave device identification code. However, this configuration is only an example and should not be construed as limiting. Alternatively, the first communication signal may include a particular number of slave device identification codes, where the particular number is equal to or greater than one but fewer than the number of the slave device identification codes. In that case, the control unit 205 of each slave device 20 compares, on detecting reception of the first communication signal, each of the particular number of slave device identification codes included in the first communication signal with the individual identification code of its own slave device 20. When deciding that none of the particular number of slave device identification codes included in the first communication signal should agree with the individual identification code of its own slave device 20, the control unit 205 of each slave device 20 instructs the communications unit 101 to stop performing reception processing. On the other hand, when deciding that any of the particular number of slave device identification codes included in the first communication signal should agree with the individual identification code of its own slave device 20, the control unit 205 of each slave device 20 instructs the communications unit 101 to perform the reception processing. Then, the control unit 205 executes the control command included in the communication signal received (first communication signal) and transmits a response signal to the master device 10.

**[0057]** Next, it will be described with reference to FIG. 6 how the alarm system 1 according to this variation performs a communication operation. In the following description, the communication operation to be performed between the master device 10 and the three slave devices 20A-20C will be described. The communication signal including the first communication signal and the second communication signal is supposed to be a fire detection signal alerting the person(s) to the presence of fire. As described above, the master device 10 and the respective slave devices 20A-20C are synchronized with each other with a synch signal A1.

**[0058]** In this situation, when the detection unit 102 of the slave device 20B detects the presence of fire, the slave device 20B transmits a fire detection signal B1 to the master device 10 at a predetermined transmission timing, which is defined by reference to the timing of reception of the synch signal A1. To acknowledge the reception of the fire detection signal B1, the master device 10 transmits a response signal B2 to the slave device 20B.

**[0059]** Then, to allow only the slave device 20A sound the fire alarm out of the plurality of slave devices 20, the master device 10 establishes communication by using the first communication signal including the slave device identification code of the slave device 20A. Specifically, first, the master device 10 transmits a fire detection signal B5, which is the first communication signal including the identification code of the slave device 20A and the identification code of the slave device 20C, to the respective slave devices 20A-20C. On detecting that the fire detection signal B5 received is the first communication signal, the control unit 205 of each of the slave devices 20A-20C compares the slave device identification codes included in the first communication signal with its own slave device identification code. If the result of comparison indicates that these slave device identification codes agree with each other, the control unit 205 allows the communications unit 101 to perform the reception processing. On the other hand, if the result of comparison indicates that these slave device identification codes disagree with each other, the control unit 205 makes the communications unit 101 to stop performing the reception processing. That is to say, in this embodiment, the fire detection signal B5 includes the respective slave device identification codes of the slave devices 20A, 20C, and therefore, the control unit 205 of the slave devices 20A, 20C makes their communications unit 101 perform the reception processing. On the other hand, the control unit 205 of the slave device 20B makes its communications unit 101 stop performing the reception processing.

**[0060]** When the reception processing is performed, each of the slave devices 20A, 20C executes the control command included in the fire detection signal B5. Specifically, the slave devices 20A, 20C each make the emission unit 103 sound the fire alarm. In addition, to acknowledge the reception of the fire detection signal B5, the slave devices 20A, 20C each transmit a response signal B6 to the master device 10. When finishing performing this series of operations, the slave devices 20A, 20C resume the standby state in which the slave devices 20A, 20C receive the synch signal A1 in every predetermined period T1. Meanwhile, the slave device 20B that has stopped performing the reception processing resumes the standby state at the timing when the slave device 20B stopped performing the reception processing.

**[0061]** This configuration enables making, at the outbreak of fire, a particular slave device 20 perform a specified operation. This improves the versatility of the alarm system 1, thus making the alarm system 1 adjustable to various types of facilities and/or various specifications required by the user.

(Recapitulation)

**[0062]** As can be seen from the foregoing description, an alarm system 1 according to a first aspect includes a master device 10 and a plurality of slave devices 20 to communicate with the master device 10. The master device 10 includes a storage unit 104 to store a plurality of slave device identification codes to identify the plurality of slave devices 20 from each other. Each of the plurality of slave devices 20 includes: a communications unit 101 to receive a first communication signal including a first slave device identification code, which is one of the slave device identification codes; and a control unit 205 to control the communications unit 101. The control unit 205 of each of the plurality of slave devices 20 compares, on detecting reception of the first communication signal, the first slave device identification code with a second slave device identification code, which is an identification code of its own slave device. The control unit 205 instructs the communications unit 101 of its own slave device to stop performing reception processing when a result of comparison indicates that first and second slave device identification codes disagree with each other. The first aspect enables reducing the consumption current of the slave devices without wasting the consumption current of the master device more than necessary.

**[0063]** In an alarm system 1 according to a second aspect, which may be implemented in conjunction with the first aspect, the control unit 205 preferably instructs the communications unit 101 to perform the reception processing when the result of comparison indicates that the first and second slave device identification codes agree with each other. The second aspect enables reducing the consumption current of the slave devices without wasting the consumption current of the master device more than necessary.

**[0064]** In an alarm system 1 according to a third aspect, which may be implemented in conjunction with the first or second aspect, the control unit 205 preferably instructs, on detecting reception of a second communication signal including a multicast address, the communications unit 101 to perform the reception processing. According to the third aspect, the master device 10 has the function of transmitting a communication signal to all of the plurality of slave devices 20, as needed, by multicasting. This allows the master device 10 to transmit the communication signal to all of the slave devices 20 at a time without sequentially transmitting the communication signal to one of the slave devices 20A-20C after another by unicasting. This enables reducing the consumption current of the master device 10.

**[0065]** In an alarm system 1 according to a fourth aspect, which may be implemented in conjunction with the third aspect, the slave device 20 further includes: a detection unit 102 to detect abnormality; and an emission

unit 103 to emit at least one of light or sound in response to detection of the abnormality by the detection unit 102. At least one of the first communication signal or the second communication signal preferably includes a signal for controlling the emission unit 103. The fourth aspect enables controlling, when a fire is present, a particular slave device 20 to perform a specified operation. This improves the versatility of the alarm system 1, thus making the alarm system 1 adjustable to various types of facilities and/or various specifications required by the user.

**[0066]** In an alarm system 1 according to a fifth aspect, which may be implemented in conjunction with any one of the first to fourth aspects, the storage unit 104 of the master device 10 stores a plurality of unique device numbers as the plurality of slave device identification codes. The control unit 205 of each of the plurality of slave devices 20 is preferably able to compare a first device number and a second device number with each other. The first device number is one of the device numbers. The second device number is a device number of its own slave device 20. The fifth aspect makes the bit length relatively short, thus shortening the time it takes to transmit the communication signal and thereby cutting down the power consumption of the master device 10. In addition, if the master device 10 is driven by a battery, this may also reduce the consumption of the battery of the master device 10.

**[0067]** An alarm device according to a sixth aspect functions as a slave device 20 which communicates with a master device 10. The alarm device includes: a communications unit 101 to receive a first communication signal including a first slave device identification code; and a control unit 205 to control the communications unit 101. The control unit 205 compares, on detecting reception of the first communication signal, the first slave device identification code with a second slave device identification code, which is a slave device identification code of the alarm device itself. The control unit 205 instructs the communications unit 101 to stop performing reception processing when a result of comparison indicates that first and second slave device identification codes disagree with each other. The sixth aspect enables reducing the consumption current of the slave device without wasting the consumption current of the master device more than necessary.

**[0068]** An alarm system 1 according to a seventh aspect includes a master device 10 and a plurality of slave devices 20 to communicate with the master device 10. The master device 10 includes a storage unit 104 to store a plurality of slave device identification codes to identify the plurality of slave devices 20 from each other. Each of the plurality of slave devices 20 includes: a communications unit 101 to receive a first communication signal including a particular number of slave device identification codes, the particular number being equal to or greater than one but fewer than the number of the slave device identification codes; and a control unit 205 to control the communications unit 101. The control unit 205 of each of the plurality of slave devices 20 compares, on detecting reception of the first communication signal, each of the particular number of slave device identification codes included in the first communication signal with a slave device identification code of its own slave device 20, and instructs the communications unit 101 of its own slave device 20 to stop performing reception processing when a result of comparison indicates that none of the particular number of slave device identification codes included in the first communication signal agrees with the slave device identification code of its own slave device 20. The seventh aspect enables reducing the consumption current of the slave devices without wasting the consumption current of the master device more than necessary.

**Reference Signs List**

**[0069]**

| | |
|---|---|
| 1 | Alarm System |
| 10 | Master Device |
| 20 | Slave Device |
| 101 | Communications Unit |
| 102 | Detection Unit |
| 103 | Emission Unit |
| 104,204 | Storage Unit |
| 105, 205 | Control Unit |
| 106 | Antenna |
| A1 | Synch Signal |
| B1, B3, B5 | Fire Detection Signal |
| B2, B4, B6 | Response Signal |
| T1 | Predetermined Period |

**Claims**

**1.** An alarm system (1) comprising a master device (10) and a plurality of slave devices (20) configured to communicate with the master device (10),

the master device (10) including a storage unit (104) configured to store a plurality of slave device identification codes to identify the plurality of slave devices (20) from each other,
each of the plurality of slave devices (20) including: a communications unit (101) configured to receive a first communication signal including a first slave device identification code, the first slave device identification code being one of the plurality of slave device identification codes; and a control unit (205) configured to control the communications unit (101),
the control unit (205) of each of the plurality of slave device (20) being configured to, on detecting reception of the first communication signal, compare the first slave device identification code with a second slave device identification

code, the second slave device identification code being an identification code of its own slave device (20), and instruct the communications unit (101) of its own slave device (20) to stop performing reception processing when a result of comparison indicates that first and second slave device identification codes disagree with each other.

**2.** The alarm system (1) of claim 1, wherein
the control unit (205) is configured to instruct the communications unit (101) to perform the reception processing when the result of comparison indicates that the first and second slave device identification codes agree with each other.

**3.** The alarm system (1) of claim 1 or 2, wherein
the control unit (205) is configured to, on detecting reception of a second communication signal including a multicast address, instruct the communications unit (101) to perform the reception processing.

**4.** The alarm system (1) of claim 3, wherein

the slave device (20) further includes: a detection unit (102) configured to detect abnormality; and an emission unit (103) configured to emit at least one of light or sound in response to detection of the abnormality by the detection unit (102), and
at least one of the first communication signal or the second communication signal includes a signal for controlling the emission unit (103).

**5.** The alarm system (1) of any one of claims 1 to 4, wherein

the storage unit (104) of the master device (10) is configured to store a plurality of unique device numbers as the plurality of slave device identification codes, and
the control unit (205) of each of the plurality of slave devices (20) is configured to compare a first device number and a second device number with each other, the first device number being one of the plurality of device numbers, the second device number being a device number of its own slave device (20).

**6.** An alarm device configured to function as a slave device (20), the slave device (20) being configured to communicate with a master device (10),

the alarm device including: a communications unit (101) configured to receive a first communication signal including a first slave device identification code; and a control unit (205) configured to control the communications unit (101),
the control unit (205) being configured to, on detecting reception of the first communication signal, compare the first slave device identification code with a second slave device identification code, the second slave device identification code being an identification code of the alarm device itself, and instruct the communications unit (101) to stop performing reception processing when a result of comparison indicates that first and second slave device identification codes disagree with each other.

**7.** An alarm system (1) comprising a master device (10) and a plurality of slave devices (20) configured to communicate with the master device (10),

the master device (10) including a storage unit (104) configured to store a plurality of slave device identification codes to identify the plurality of slave devices (20) from each other,
each of the plurality of slave devices (20) including: a communications unit (101) configured to receive a first communication signal including a particular number of slave device identification codes, the particular number being equal to or greater than one but fewer than the number of the plurality of slave device identification codes; and a control unit (205) configured to control the communications unit (101),
the control unit (205) of each of the plurality of slave device (20) being configured to, on detecting reception of the first communication signal, compare each of the particular number of slave device identification codes included in the first communication signal with a slave device identification code of its own slave device (20), and instruct the communications unit (101) of its own slave device (20) to stop performing reception processing when a result of comparison indicates that none of the particular number of slave device identification codes included in the first communication signal agrees with the slave device identification code of its own slave device (20).

FIG. 1

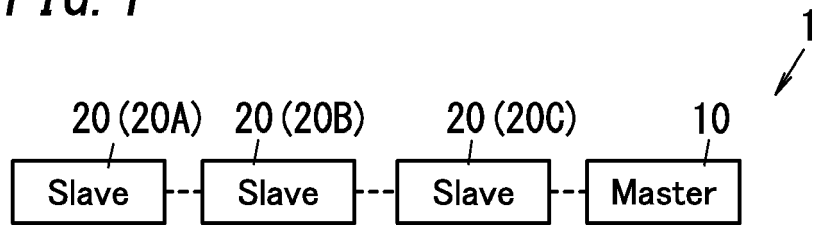


FIG. 2

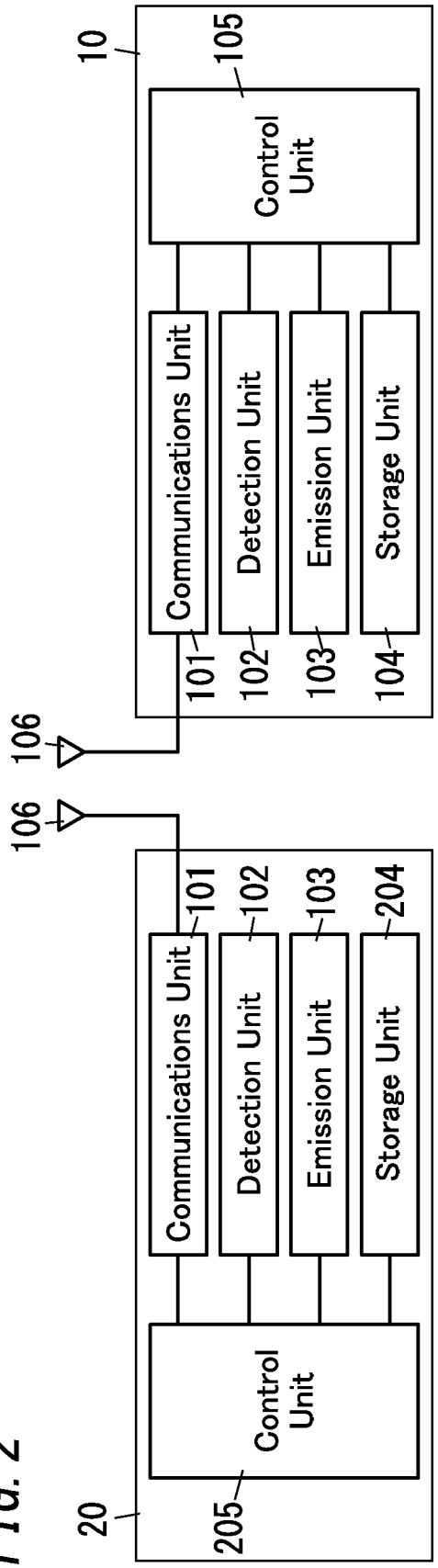

10
105
Control Unit
Communications Unit
Detection Unit
Emission Unit
Storage Unit
101
102
103
104
106
106
101
102
103
204
Communications Unit
Detection Unit
Emission Unit
Storage Unit
Control Unit
205
20

FIG. 3

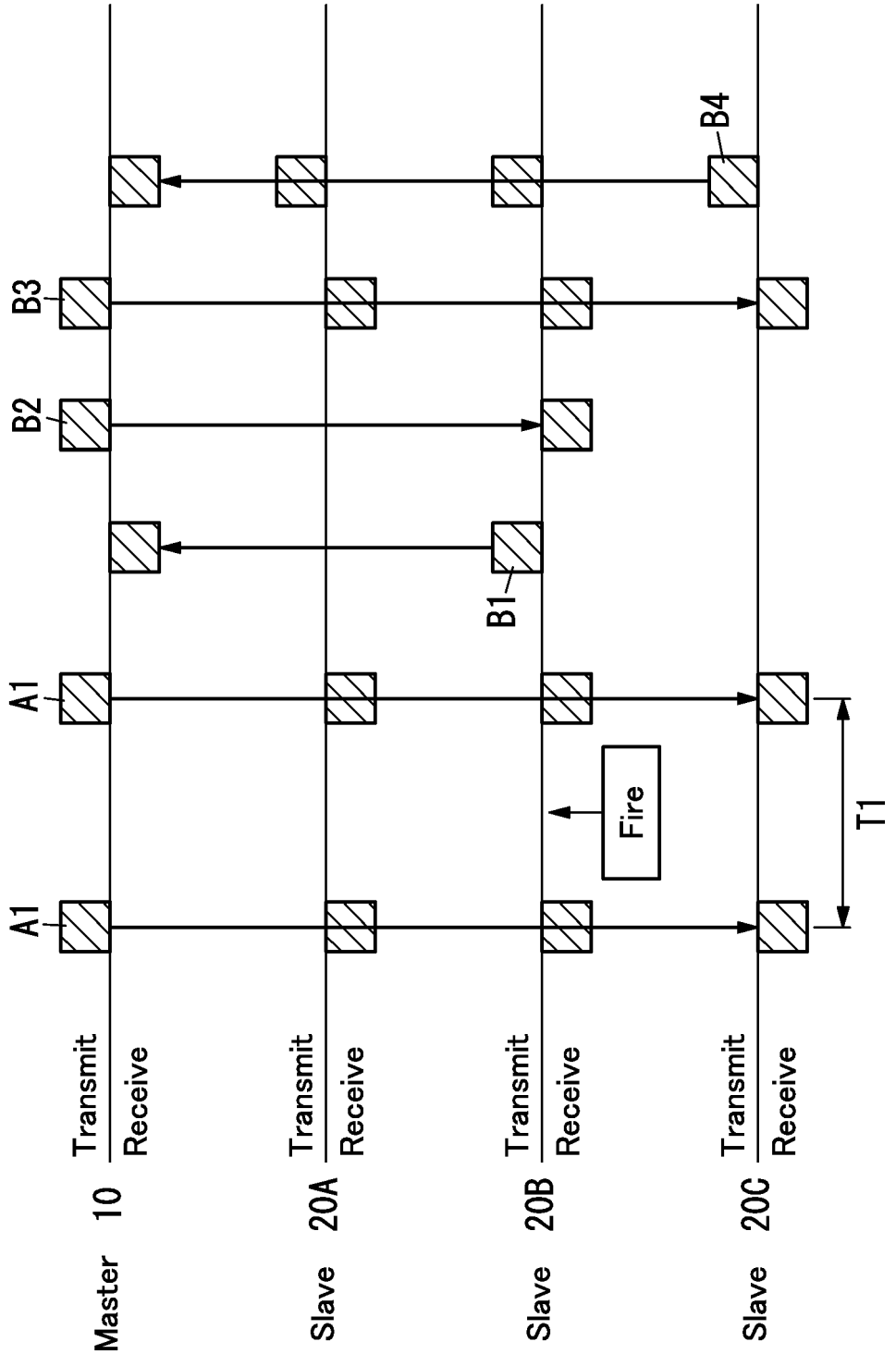

Master 10
Slave 20A
Slave 20B
Slave 20C
Transmit
Receive
A1
A1
B1
B2
B3
B4
Fire
T1

FIG. 4

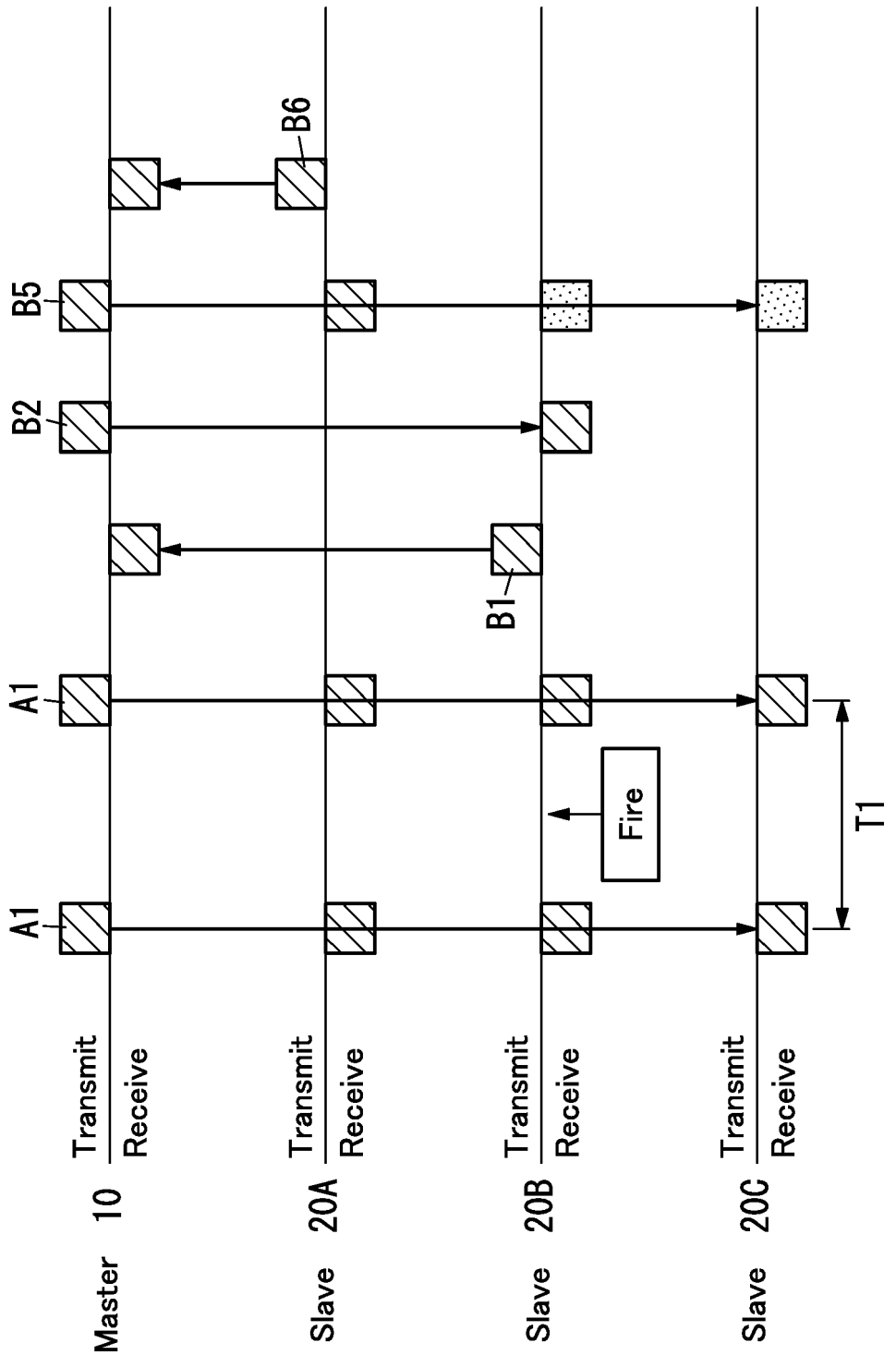

Master 10
Slave 20A
Slave 20B
Slave 20C
Transmit
Receive
A1
A1
B1
B2
B5
B6
Fire
T1

FIG. 5

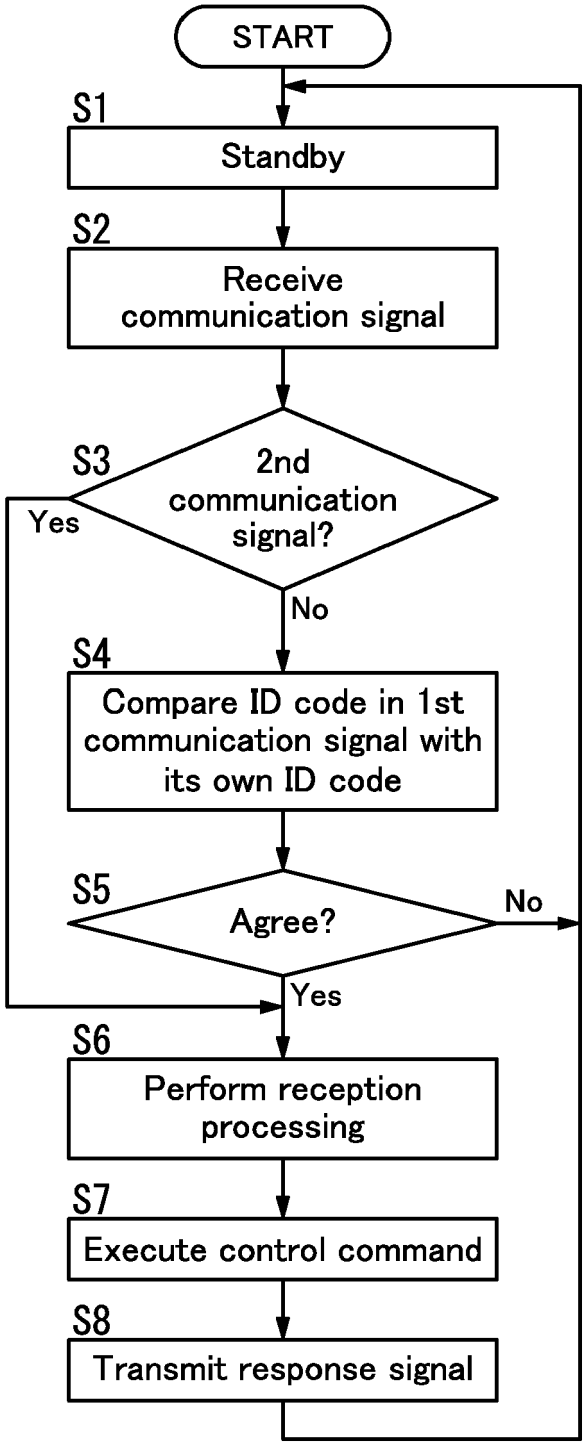
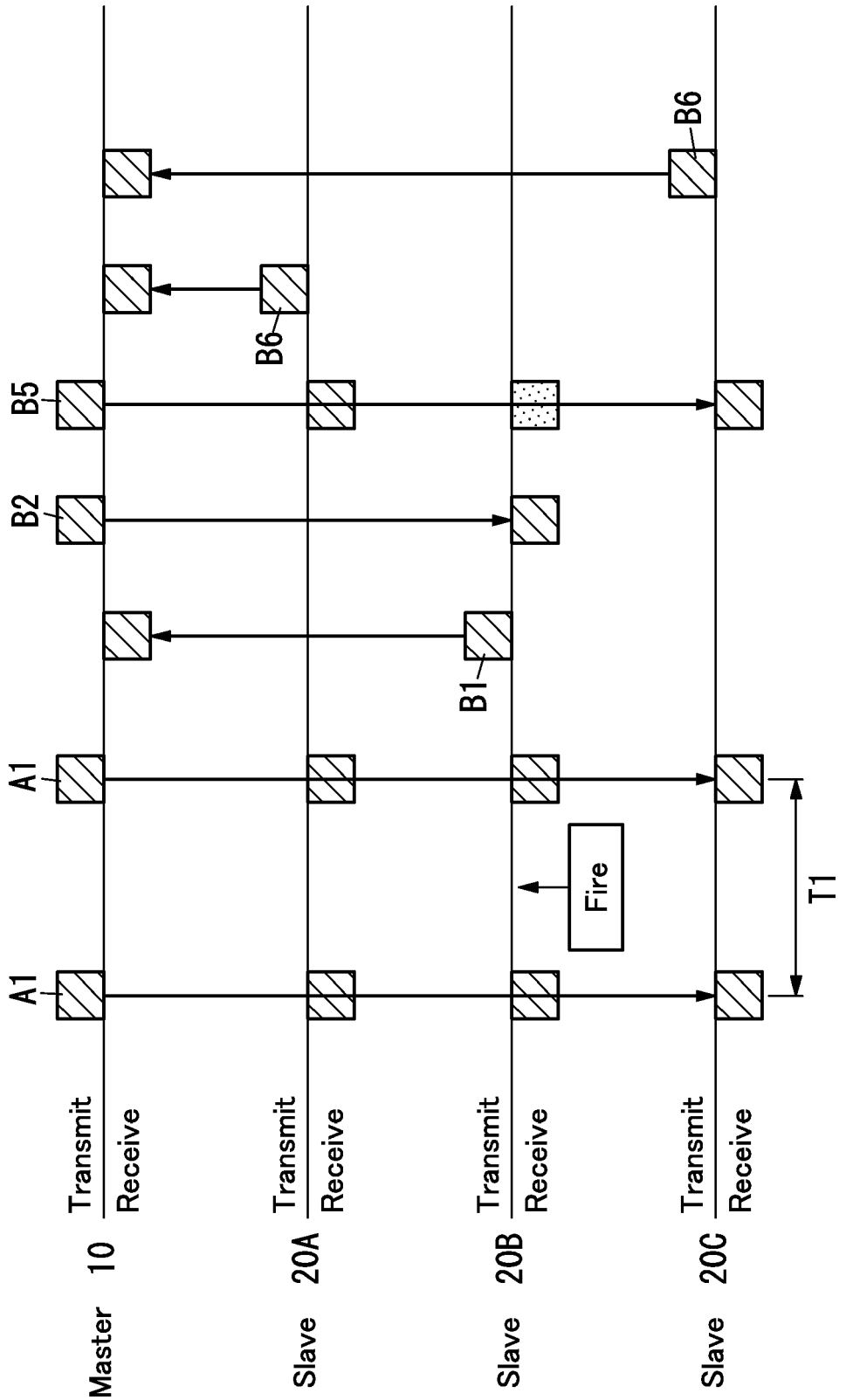

START
S1
Standby
S2
Receive communication signal
S3
2nd communication signal?
Yes
No
S4
Compare ID code in 1st communication signal with its own ID code
S5
Agree?
No
Yes
S6
Perform reception processing
S7
Execute control command
S8
Transmit response signal

FIG. 6


Master 10
Slave 20A
Slave 20B
Slave 20C
Transmit
Receive
A1
B1
B2
B5
B6
Fire
T1

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# EUROPEAN SEARCH REPORT

Application Number
EP 22 17 5154

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G08B

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 21 October 2022 | Wagner, Ulrich |

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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