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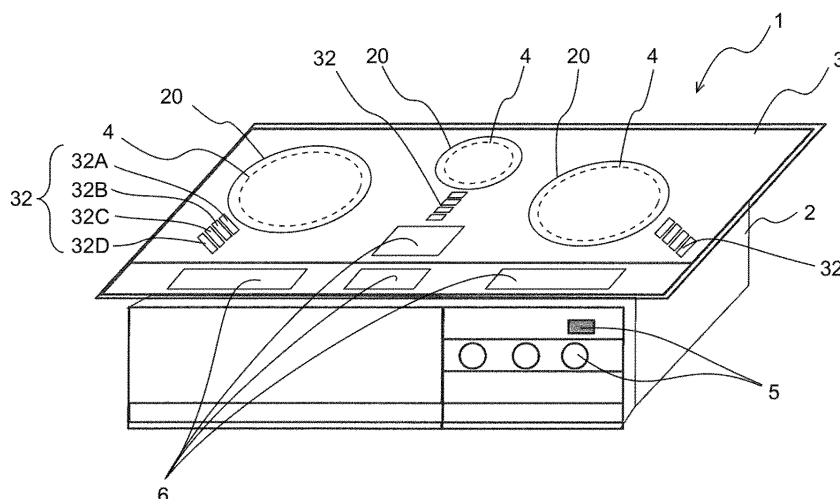
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(54) **HEAT-COOKING DEVICE**

(57) A cooking heater includes a top plate on which cookware is to be placed; a heating source provided under the top plate; a heat zone provided to the top plate to indicate a position at which the cookware is to be placed; a plurality of light sources provided under the top plate and controlled independently of each other; and a transmission part provided in the top plate, located outward of the heat zone, and configured to allow light emit-

ted from the plurality of light sources to be transmitted through the transmission part. A selected one or ones of the plurality of light sources successively emit light while the heating source is being operated, such that the successively emitted light is emitted from the transmission part and flows in a single direction parallel to a surface of the top plate.

FIG. 1



Description

Technical Field

[0001] The present disclosure relates to a cooking heater configured to indicate an operating state of a heating source by using light.

Background Art

[0002] A known cooking heater is configured to heat cookware placed on a top plate by using a heating coil or a resistance heater as a heating source. For example, in an induction cooking heater, magnetic flux generated by passing an electric current through a metal body, such as a heating coil, disposed in the cooking heater generates an eddy current in a cookware body placed above a heating coil with a top plate interposed between the cookware body and the heating coil. The cookware is heated by Joule heat generated by such an eddy current and resistance in the cookware body.

[0003] In recent years, cases in which cooking heaters having a heating coil or a resistance heater as a heating source are selected for elderly people have been increased. A reason why users prefer such cooking heaters is because the possibility of burns caused by flames, clothing catching fire, or fire spreading is reduced by users cooking without a flame.

[0004] Cooking is done with such cooking heaters without a flame unlike with cooking heaters configured to heat cookware with flames, and thus whether a heating source is being operated and the intensity of heating power of the heating source are not directly visible to a user. For this reason, various devices are proposed to facilitate a user's grasp of the operating state of a cooking heater.

[0005] An existing cooking heater includes a plurality of indicators provided radially outward of an outer ring line of a heat zone (for example, see Patent Literature 1). The luminous areas of the indicators of the cooking heater vary depending on the heating output of an induction heating coil.

[0006] Another cooking heater is proposed (for example, see Patent Literature 2). The cooking heater is configured to allow the light emitted from a light-emitting unit provided under a top plate to be transmitted through a plurality of slits that are formed in a film provided on the top plate by printing. Patent Literature 2 states that a flame pattern is imaged on a side surface of a pan by reflecting the light transmitted through the slits on the side surface of the pan.

Citation List

Patent Literature

[0007]

Patent Literature 1: Japanese Unexamined Patent

Application Publication No. 2005-123054

Patent Literature 2: Japanese Unexamined Patent

Application Publication No. 2003-257601

5 Summary of Invention

Technical Problem

[0008] In the technique in Patent Literature 1, light-emitting parts each emit light in a certain luminous area depending on the heat source output. This configuration enables a user to recognize variation in the heat source output because the luminous areas of the light-emitting parts vary at the moment the heat source output varies. However, when the heat source output does not vary, the luminous areas of the light-emitting parts do not vary either. In addition, there is no comparison target for the luminous areas of the light-emitting parts. Thus, when the heat source output does not vary, it is difficult for a user to recognize whether the heat source is outputting power and to recognize the output level.

[0009] An object of the technique in Patent Literature 2 is to present a user with an image in which a pan is placed in flames as the flame pattern is imaged on the side surface of the pan and to make a warm impression on the user. However, it may be difficult for a user to recognize the flame pattern, depending on the color of or stains on a surface of the pan. It is particularly difficult for a visually impaired person, such as an elderly person, to recognize the flame pattern.

[0010] The present disclosure is made in view of such a problem and provides a cooking heater configured to allow even a user having a problem with visual perception to easily recognize that a heating source is being operated.

Solution to Problem

[0011] A cooking heater according to an embodiment of the present disclosure includes a top plate on which cookware is to be placed; a heating source provided under the top plate; a heat zone provided to the top plate to indicate a position at which the cookware is to be placed; a plurality of light sources provided under the top plate and controlled independently of each other; and a transmission part provided in the top plate, located outward of the heat zone, and configured to allow light emitted from the plurality of light sources to be transmitted through the transmission part. A selected one or ones of the plurality of light sources successively emit light while the heating source is being operated, such that the successively emitted light is emitted from the transmission part and flows in a single direction parallel to a surface of the top plate.

55 Advantageous Effects of Invention

[0012] According to an embodiment of the present dis-

closure, while the heating source is being operated, light is emitted from the transmission part and flows in a single direction parallel to the surface of the top plate. A light flow is visible to a user, and thus the user easily recognizes that the heating source is being operated.

Brief Description of Drawings

[0013]

[Fig. 1] Fig. 1 is a schematic perspective view of a cooking heater 1 according to Embodiment 1.

[Fig. 2] Fig. 2 is a schematic block diagram of a part of the cooking heater 1 according to Embodiment 1.

[Fig. 3] Fig. 3 is a schematic plan view of a top plate 3 according to Embodiment 1.

[Fig. 4] Fig. 4 is a timing chart illustrating a lighting control example of light sources according to Embodiment 1.

[Fig. 5] Fig. 5 is a timing chart illustrating another lighting control example of the light sources according to Embodiment 1.

[Fig. 6] Fig. 6 is a timing chart illustrating still another lighting control example of the light sources according to Embodiment 1.

[Fig. 7] Fig. 7 is a timing chart illustrating yet another lighting control example of the light sources according to Embodiment 1.

[Fig. 8] Fig. 8 is a schematic plan view of a top plate 3 according to Modification 1 of Embodiment 1.

[Fig. 9] Fig. 9 is a schematic plan view of a top plate 3 according to Modification 2 of Embodiment 1.

[Fig. 10] Fig. 10 illustrates Modification 1 of the lighting control example 1 of the light sources according to Embodiment 1.

[Fig. 11] Fig. 11 illustrates Modification 2 of the lighting control example 1 of the light sources according to Embodiment 1.

[Fig. 12] Fig. 12 illustrates Modification 3 of the lighting control example 1 of the light sources according to Embodiment 1.

[Fig. 13] Fig. 13 illustrates Modification 4 of the lighting control example 1 of the light sources according to Embodiment 1.

[Fig. 14] Fig. 14 is a schematic plan view of a top plate 3 according to Embodiment 2.

[Fig. 15] Fig. 15 is a schematic plan view of a top plate 3 according to Embodiment 3.

[Fig. 16] Fig. 16 illustrates a transmission part and a plurality of light sources according to Embodiment 4.

[Fig. 17] Fig. 17 is a timing chart illustrating a lighting control example of light sources according to Embodiment 5.

[Fig. 18] Fig. 18 is a schematic plan view of a top plate 3 according to Embodiment 6.

Description of Embodiments

[0014] Embodiments in which a cooking heater according to the present disclosure is applied to a household induction heating (IH) cooking heater will be described below with reference to the drawings. The present disclosure is not limited to the embodiments below, and various modifications can be made without departing from the gist of the present disclosure. The present disclosure includes any feasible combination of configurations in the embodiments below. The cooking heaters in the drawings are examples of the device to which the cooking heater according to the present disclosure is applied and do not limit devices to which the present disclosure is applied. Terms that mean directions (for example, "up", "down", "right", "left", "forward", and "backward") are used as appropriate in the description below to make the description easy to understand. However, these terms are used for the description and do not limit the present disclosure. In the drawings, components having the same reference signs are the same or corresponding components, and this applies to the entire description. For example, the relative size relationships or the shapes of the components in the drawings may differ from those of actual ones.

Embodiment 1

(Configuration of Cooking Heater)

[0015] Fig. 1 is a schematic perspective view of a cooking heater 1 according to Embodiment 1. As illustrated in Fig. 1, the cooking heater 1 includes a body 2 and a top plate 3, which is disposed on the body 2. A front operating unit 5 is provided at the front of the body 2. The front operating unit 5 includes a power switch for turning on or off the power of the cooking heater 1, and a plurality of operating dials for adjusting heating power.

[0016] The top plate 3 is composed of, for example, a heat-resistant glass plate and a metal frame attached to the perimeter of the glass plate. Heat zones 20, which are heat regions, are provided to the top plate 3. In Embodiment 1, three heat zones 20 are provided to the top plate 3. Marks indicating regions in which cookware, such as a pan and a frying pan, is to be placed are provided at respective positions of the heat zones 20 on an upper surface or a lower surface of the top plate 3. Heating coils 4, which are heating sources, are provided inside the body 2 under the respective heat zones 20. The heat zones 20 are each formed into the same shape as the external shape of the corresponding heating coil 4, which is a heating source, or into a shape slightly larger than the external shape of the corresponding heating coil 4. In Embodiment 1, the marks of the heat zones 20 are each shaped into a circle in plan view.

[0017] Transmission parts 32, which each indicate the driving state of the heating source disposed under the corresponding heat zone 20, are provided outward of the

respective heat zones 20. The transmission parts 32 are each configured to allow the light emitted from a light-emitting unit 30 (see Fig. 2), which is disposed under the top plate 3, to be transmitted through the transmission part 32. The transmission parts 32 in Embodiment 1 are parts of the top plate 3 composed of a glass plate and are regions that are not coated or that are coated such that light is transmitted through the transmission parts 32. The transmission parts 32 can also be formed by hollowing out the opaque glass plate included in the top plate 3 and by inserting transparent glass plates at the hollow positions. In addition to such a configuration, materials and structures capable of transmitting light can be used as the transmission parts 32. The entire shape of the transmission part 32 provided for each heat zone 20 extends in a direction away from the perimeter of the heat zone 20.

[0018] The transmission parts 32 in Embodiment 1 each include a plurality of transmission parts. In Embodiment 1, the plurality of transmission parts forming the transmission part 32 are referred to as a first transmission part 32A, a second transmission part 32B, a third transmission part 32C, and a fourth transmission part 32D. In Fig. 1, to prevent the figure from being intricate, only the transmission part 32 provided for the heating coil 4 at the furthest left of the figure is assigned reference signs 32A, 32B, 32C, and 32D. When a description of a configuration applies to any of the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D, these are simply referred to as the transmission part 32 in the description.

[0019] The first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D are disposed in this order in a direction outward from the heat zone 20. That is, the first transmission part 32A is disposed closest to the heat zone 20, and the second transmission part 32B is disposed at a position farther from the heat zone 20 than is the first transmission part 32A.

[0020] The number and the shape of the heating coils 4 are not limited to those illustrated in Fig. 1. The number of the heating coils 4, that is, the number of heating sources, is only required to be at least one.

[0021] An operation display unit 6 is provided in a front portion of the top plate 3. The operation display unit 6 in Embodiment 1 includes an electrostatic capacitive touch sensor and display screens that include a plurality of light-emitting diodes (LEDs) or liquid crystal displays (LCDs). The touch sensor receives user input via the top plate 3. The operation display unit 6 includes an operating unit, a heating-power display unit configured to display the intensity of heating power set in the operating unit, and an information display unit configured to display information on the settings and the operating state of the cooking heater 1. The operating unit of the operation display unit 6 receives input on the settings such as the heating power, the temperature, and the cooking mode of the heating

coil 4 under each heat zone 20. In addition, the operating unit of the operation display unit 6 receives input on instructions such as starting heating and stopping heating. The information on the operating state of the cooking heater 1 can include a selected cooking mode, automatic cooking progress, and the temperature and the warning information of the cookware placed on the heat zone 20.

[0022] Fig. 2 is a schematic block diagram of a part of the cooking heater 1 according to Embodiment 1. Fig. 2 illustrates a schematic section and the functional configuration of the cooking heater 1 together with cookware 300 placed on the top plate 3. Although Fig. 2 illustrates only one heating coil 4, the other heating coils 4 also have similar structures. As illustrated in Fig. 2, the heating coil 4, a coil base 9, which supports the heating coil 4, a plurality of ferrite cores 10, which are disposed on a lower surface of the coil base 9, and an infrared sensor 11 are provided inside the body 2 of the cooking heater 1 and under the top plate 3. A contact temperature sensor 12 is attached to the lower surface of the top plate 3. In addition, a temperature detection unit 13, a control unit 14, an inverter 15, and the light-emitting unit 30 are provided under the top plate 3.

[0023] The heating coil 4 is disposed under the heat zone 20, which is provided to the top plate 3. The heating coil 4 is a coil formed by winding a conducting wire such as a copper wire and an aluminum wire. A high-frequency magnetic field is generated by supplying a high-frequency electric current to the heating coil 4. Although the heating coil 4 in Embodiment 1 has a double ring shape, the shape and the disposition of the heating coil 4 are not limited to those illustrated in Fig. 2. Instead of or in addition to the heating coil 4, an electric resistance heater, in which heat is generated by passing electricity through a heating element, may be provided as a heating source.

[0024] The coil base 9 is made from, for example, synthetic resin and houses and supports the heating coil 4.

[0025] The ferrite cores 10 are rod-shaped parts made of a non-conductive ferromagnetic material having high magnetic permeability. Flux leakage downward from the heating coil 4 is reduced by providing the ferrite cores 10, and thus it is possible to improve heating efficiency and to heat the cookware 300 uniformly. The shape and the configuration of each ferrite core 10 do not limit the present disclosure.

[0026] The contact temperature sensor 12 is disposed in contact with the lower surface of the top plate 3, that is, a surface facing the heating coil 4. A plurality of contact temperature sensors 12 may be provided for each heating coil 4. The contact temperature sensor 12 detects, via the top plate 3, the temperature of the cookware 300 placed on the top plate 3.

[0027] The infrared sensor 11 detects the infrared energy radiated from the bottom of the cookware 300 placed on the top plate 3 above the heating coil 4. The infrared sensor 11 is surrounded by a sensor case 110 not to come into direct contact with the cooling air flowing in the vicinity of the heating coil 4. The infrared sensor 11 is

held in the sensor case 110 with a distance maintained such that the ambient temperature of the infrared sensor 11 is uniform. For example, the sensor case 110 is screwed to the coil base 9 with tapping screws or is formed to be partly integral with the coil base 9. Such a holding structure of the sensor case 110 enables the distance between the top plate 3 and the infrared sensor 11 to be kept fixed.

[0028] A transmission window 16 is provided in the heat zone 20 of the top plate 3. The transmission window 16 is provided to enable the infrared sensor 11 to detect the infrared radiation from the cookware 300 transmitted through the top plate 3. The transmission window 16 is provided within the heat zone 20 to face a detection unit of the infrared sensor 11. To facilitate transmission of infrared radiation, it is preferable not to coat the transmission window 16. However, when the transmission window 16 is not coated, for example, the heating coil 4 and wires inside the body 2 may be visible from above the top plate 3, and this is not preferable in terms of design. For this reason, when the transmission window 16 is not coated, it is only required to provide, in a direction toward the top plate 3, a cylindrical part or plates on the coil base 9, which holds the heating coil 4, and the sensor case 110. The provision of such a cylindrical part or plates for screening the inside of the body 2 enables the heating coil 4, wires, or other parts to be difficult to see from the outside. In addition, instead of coating the entire transmission window 16, the transmission window 16 may be coated with a dot pattern or a stripe pattern to reduce the proportion of the uncoated portion of the opening. This enables aesthetic design and functionality to be guaranteed.

[0029] The temperature detection unit 13 receives output values from the infrared sensor 11 and the contact temperature sensor 12 and calculates the temperature of the cookware 300 on the basis of the received output values. The temperature detection unit 13 is composed of hardware such as a circuit device configured to implement the function, or of an arithmetic unit such as a microcomputer and software configured to run on the arithmetic unit.

[0030] The control unit 14 controls the operation of the cooking heater 1 on the basis of the settings input to the front operating unit 5 or the operation display unit 6. In addition, the control unit 14 controls the inverter 15 on the basis of the cooking temperature set by a user and the temperature of the cookware 300 calculated by the temperature detection unit 13 to control heating. In addition, the control unit 14 controls the operation of the light-emitting unit 30 on the basis of the input to the front operating unit 5 or the operation display unit 6.

[0031] The control unit 14 is composed of dedicated hardware or a microcomputer including memory and a CPU configured to execute the programs stored in the memory. The control unit 14 may be configured to have the function of the temperature detection unit 13.

[0032] When the control unit 14 is dedicated hardware,

the control unit 14 is, for example, a single circuit, multiple circuits, an application specific integrated circuit (ASIC), a field-programmable gate array (FPGA), or a combination of these circuits. Each of the functional parts implemented in the control unit 14 may be implemented in separate hardware, or the functional parts may be implemented in a single piece of hardware.

[0033] When the control unit 14 is a microcomputer, the functions implemented in the control unit 14 are implemented in software, firmware, or a combination of software and firmware. Software and firmware are written as programs and are stored in memory. A CPU reads and executes the programs stored in the memory to implement the functions of the control unit 14. The memory is, for example, a nonvolatile or volatile semiconductor memory such as a RAM, a ROM, a flash memory, an EPROM, and an EEPROM.

[0034] The inverter 15 is a driving circuit configured to convert an alternating current from a commercial power supply 200 into a high-frequency electric current and supply the high-frequency electric current to the heating coil 4. The cooking heater 1 may include components other than the components illustrated in Fig. 2. For example, the cooking heater 1 may include a communication unit configured to communicate with external devices.

[0035] The light-emitting unit 30 includes a control circuit configured to separately control a plurality of light sources and light-emitting operations of the light sources. The light-emitting unit 30 in Embodiment 1 includes a first light source 31A, a second light source 31B, a third light source 31C, and a fourth light source 31D. Although the light-emitting unit 30 in Embodiment 1 includes the four light sources, it is only required that the number of light sources be two or more. The first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D in Embodiment 1 include light-emitting diodes (LEDs) mounted on a substrate. The first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D, which are a plurality of light sources, may be mounted on a single substrate or may be separately mounted on respective substrates. The control circuit provided in the light-emitting unit 30 separately turns on or off the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D in accordance with the instruction from the control unit 14.

[0036] The light-emitting surfaces of the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D respectively face the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D. The light emitted from the first light source 31A, the light emitted from the second light source 31B, the light emitted from the third light source 31C, and the light emitted from the fourth light source 31D are respectively transmitted through the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmis-

sion part 32D, which the light-emitting surfaces of the first light source 31A, the second light source 31 B, the third light source 31C, and the fourth light source 31D respectively face, and then reach above the top plate 3. The light transmitted through the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D is visible to a user.

[0037] Although Embodiment 1 shows an example in which one light source is disposed to face one transmission part, a plurality of light sources controlled independently of each other may be disposed for one transmission part. Each of the light sources can include one or more light-emitting devices such as light-emitting diodes. In addition, a plurality of light-emitting devices configured to emit light having different colors may be provided in each light source. In this case, the color of light emitted from one light source can be changed by the control circuit of the light-emitting unit 30 separately turning on or off the light-emitting devices configured to emit light having different colors.

[0038] The first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D are configured to allow light to be transmitted through the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D, and thus the substrate of the light-emitting unit 30, wires, or other parts inside the body 2 may be visible from above the top plate 3. This is not preferable in terms of design. In addition, the light emitted from one light source may enter the transmission parts that the one light source does not face. For example, in addition to the light emitted from the first light source 31A, the light emitted from the second light source 31 B may enter the first transmission part 32A. If any of these cases applies, cylindrical parts or plates for preventing the light emitted from one light source from entering the transmission parts that the one light source does not face may be provided between the light-emitting surfaces of the light sources and the corresponding transmission parts.

(Disposition of Light Transmission Parts)

[0039] Fig. 3 is a schematic plan view of the top plate 3 according to Embodiment 1. The dispositions and the shapes of the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D are described. A set of the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D are disposed outward of each of the heat zones 20. The first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D are linearly disposed in this order in a direction away from the heat zone 20. The first transmission part 32A, the second transmission part 32B, the third transmission part

32C, and the fourth transmission part 32D in Embodiment 1 each have a rectangular shape in plan view and have the same area.

[0040] The first transmission part 32A is provided to face the perimeter of the heat zone 20 having a circular shape. The first transmission part 32A in Fig. 3 is a rectangle whose side facing the perimeter of the heat zone 20 having a circular shape is a long side of the first transmission part 32A. The second transmission part 32B is provided to face the first transmission part 32A and has long sides parallel to the long side of the first transmission part 32A. Similarly, the third transmission part 32C is provided to face the second transmission part 32B and has long sides parallel to the long sides of the second transmission part 32B. In addition, the fourth transmission part 32D is provided to face the third transmission part 32C and has long sides parallel to the long sides of the third transmission part 32C.

[0041] The number of the transmission parts (four in Embodiment 1) provided for one heat zone 20 may be one. In this case, a plurality of light sources can be provided to face one transmission part 32. The number of the transmission parts provided for one heat zone 20 may or may not be equal to the number of output levels of the heating coil 4, which is a heating source.

[0042] The number of light transmission windows of the transmission part 32 does not have to be equal to the number of heating power settings. The heating power settings may be assigned such that, when heating power 1 or 2 is set, the first light source 31A is turned on, and when heating power 3 or 4 is set, the first light source 31A and the second light source 31B are turned on.

(Lighting Control Example 1)

[0043] Fig. 4 is a timing chart illustrating a lighting control example of the light sources according to Embodiment 1. Fig. 4 illustrates timings of turning on and off the first light source 31A to the fourth light source 31D. The horizontal axis in Fig. 4 represents time. A period t1 is an example of a period during which the heating power 1 is set. A period t2 is an example of a period during which the heating power 3, which is higher than the heating power 1, is set. The lighting control of the first light source 31A to the fourth light source 31D is described by taking as an example a case in which the setting is changed from the heating power 1 to the heating power 3.

[0044] As illustrated in the period t1, when the heating power 1 is set in the front operating unit 5 or the operation display unit 6, and instructions for starting heating are input, the control unit 14 turns on the first light source 31A. After a period a has elapsed, the control unit 14 turns off the first light source 31A and turns on the second light source 31B. After the control unit 14 has turned on the second light source 31B and a period b has elapsed, the control unit 14 turns off the second light source 31B and turns on the first light source 31A. That is, the control unit 14 turns on the first light source 31A and the second

light source 31B alternately. The length of each period a, during which the first light source 31A is on, is a fixed value. The length of each period b, during which the second light source 31B is on, is also a fixed value. The control unit 14 exercises control, during the period t1, during which the heating power 1 is set, such that the first light source 31A and the second light source 31B are turned on and off without overlap between such lighting periods.

[0045] Next, a case is considered in which the setting is changed from the heating power 1 to the heating power 3. The relationship the heating power 3 > the heating power 1 is satisfied. In this case, the control unit 14 stops the lighting control in the heating power 1 and, as illustrated in the period t2, starts another lighting control in the heating power 3. As illustrated in the period t2 in Fig. 4, the control unit 14 turns on the first light source 31A. After the period a has elapsed, the control unit 14 turns off the first light source 31A and turns on the second light source 31 B. After the control unit 14 has turned on the second light source 31B and the period b has elapsed, the control unit 14 turns off the second light source 31B and turns on the third light source 31C. After the control unit 14 has turned on the third light source 31C and a period c has elapsed, the control unit 14 turns off the third light source 31C and turns on the fourth light source 31D. After the control unit 14 has turned on the fourth light source 31 D and a period d has elapsed, the control unit 14 turns off the fourth light source 31D and turns on the first light source 31A. That is, when a direction in the order of the first light source 31A, the second light source 31 B, the third light source 31C, and the fourth light source 31D is defined as a first direction, the control unit 14 turns on and off the light sources successively in the first direction. Each of the lengths of the periods a to d, during which the first light source 31A to the fourth light source 31 D are on respectively, is a fixed value. The control unit 14 exercises control, during the period t2, during which the heating power 3 is set, such that the first light source 31A to the fourth light source 31D are turned on and off without overlap between such lighting periods.

[0046] The control unit 14 continues the lighting control illustrated in the periods t1 and t2 until the heating power is changed or until a heating stop operation is performed.

[0047] When the heating power 2 (not illustrated in Fig. 4) is set, the control unit 14 turns on and off the first light source 31A, the second light source 31 B, and the third light source 31C successively in this order. The relationship the heating power 1 < the heating power 2 < the heating power 3 is satisfied. When heating power 0.5 is set, the control unit 14 turns on and off only the first light source 31A. The relationship the heating power 0.5 < the heating power 1 is satisfied.

[0048] As described above, while a heating operation is being performed by the heating source, the control unit 14 turns on and off, successively in a single direction, adjacent ones of the first light source 31A to the fourth light source 31 D, the number of the adjacent ones being

determined depending on the heating power. When the heating power is low, lighting control is exercised only on the first light source 31A and the second light source 31B, which are close to the heat zone 20. As the heating power becomes higher, the third light source 31C and the fourth light source 31D are added in this order as a light source to be subjected to lighting control. The light emitted by turning on and off adjacent light sources successively is visible to a user having a viewpoint above the top plate 3 such that the light flowing in a single direction parallel to a surface of the top plate 3 is emitted from the transmission part 32. When the lighting control illustrated in the period t2 in Fig. 4 is exercised, in the example illustrated in Fig. 3, the light emitted from the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D cyclically successively in this order in a single direction is visible to a user. That is, a beam of light flowing from the position closest to the heat zone 20 toward the outside of the heat zone 20 is visible to a user.

[0049] The following has been described in the example in Fig. 4. As the heating power becomes higher, the number of the light sources to be turned on is increased in the order from the first light source 31A, which is positioned closest to the heat zone 20, toward the fourth light source 31D, which is positioned farthest from the heat zone 20. However, the order in which the light sources are turned on may be the order reverse to that in Fig. 4. Specifically, when the heating power is lowest, the control unit 14 turns on and off only the fourth light source 31D, which is positioned farthest from the heat zone 20, and as the heating power becomes higher, the light sources to be turned on and off are added in the order of the third light source 31C, the second light source 31B, and the first light source 31A. The light emitted by turning on and off the light sources in such a manner is visible to a user having a viewpoint above the top plate 3 such that the light flowing in a direction toward the heat zone 20 is emitted from the transmission part 32.

[0050] In the example in Fig. 4, the periods a, b, c, and d have the same length. When the plurality of light sources are turned on and off successively at equal lengths in such a manner, three or more light sources are turned on and off in the order in which the light sources are arranged. The light emitted by turning on and off the light sources in such a manner is visible to a user such that the light emitted from the transmission part 32 flows in a single direction. In addition, light directivity can be further accentuated by repeating a loop process in which three or more light sources are turned on and off in the order in which the light sources are arranged and are then turned on and off again after the last light source is turned on and off in the order from the first light source. In the example in Fig. 4, the first light source 31A, the second light source 31 B, the third light source 31C, and the fourth light source 31D are turned on and off in this order and are then turned on and off again in the order from the first light source 31A, which is positioned first. When the

loop process in which three or more light sources are turned on and off in such a manner is repeated, light flowing in a single direction is successively visible to a user. When such light flowing in a single direction is visible to a user, the user easily recognizes that the heating coil 4, which is a heating source, is being operated.

[0051] In the example in Fig. 4, each of the lengths of the periods a, b, c, and d can be within one second. Each of the lengths of the periods a, b, c, and d may be one second or more, for example, about two seconds to three seconds. When such lengths are set, even a user such as an elderly person having impaired visual perception easily visually recognizes a light flow. In addition, in the example in Fig. 4 and the following examples, the lengths of the periods a to d may be capable of being changed by a user. In this case, for example, an input unit to which lengths of lighting periods are input is provided in the front operating unit 5, and the control unit 14 determines the lengths of the periods a to d on the basis of the lighting periods input to the input unit.

(Lighting Control Example 2)

[0052] Fig. 5 is a timing chart illustrating another lighting control example of the light sources according to Embodiment 1. As is clear from a comparison between Fig. 5 and Fig. 4, each of the periods a, b, c, and d, during which the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D are on respectively, is shorter than that illustrated in Fig. 4. That is, the cycle in which the plurality of light sources are turned on and off differs from that in the lighting control example 1.

[0053] The control unit 14 switches between the lighting control example 1 illustrated in Fig. 4 and a lighting control example 2 illustrated in Fig. 5 depending on the operating state of the heating source or the state of the cooking heater 1. This enables a user to recognize a change in the operating state of the heating source or a change in the state of the cooking heater 1 more easily.

[0054] For example, when the infrared sensor 11 or the contact temperature sensor 12 detects that the temperature of the cookware 300 approaches a target temperature, the control unit 14 switches from the lighting control example 1 to the lighting control example 2. The target temperature can be set in the front operating unit 5, the operation display unit 6, or an automatic cooking function. When the lighting control example is switched from the lighting control example 1 to the lighting control example 2, the cycle in which ones of the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D are turned on and off is changed with the number of the ones turned on and off maintained. When the lighting control example is switched to the lighting control example 2, a change in which the light flowing in a single direction becomes faster than before is visible to a user. This enables the light emitted from the transmission part 32 and flowing in a

single direction to be used as a warning indication that indicates that the temperature of the cookware 300 approaches a target temperature.

[0055] In addition, for example, the lighting control example 1 and the lighting control example 2, in which the speeds at which the light sources are turned on and off differ from each other, can be used to represent a difference in heating source output. Specifically, the control unit 14 performs the process of the lighting control example 1 in one of the case in which the output of the heating coil 4 is high and the case in which the output of the heating coil 4 is low, and performs the process of the lighting control example 2 in the other. This enables a user to easily recognize a difference in heating source output.

(Lighting Control Example 3)

[0056] Fig. 6 is a timing chart illustrating still another lighting control example of the light sources according to Embodiment 1. In a lighting control example 3 illustrated in Fig. 6, the control unit 14 turns on and off the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D at the same time. The lighting control example 3, in which all of the light sources are turned on and off such that the timings of the light sources are synchronized as described above, is used by combining with one or both of the lighting control example 1 in Fig. 4 and the lighting control example 2 in Fig. 5. The control unit 14 switches from the lighting control example 1 illustrated in Fig. 4 or the lighting control example 2 illustrated in Fig. 5 to the lighting control example 3 illustrated in Fig. 6 depending on the operating state of the heating source or the state of the cooking heater 1. This enables a user to recognize a change in the operating state of the heating source or a change in the state of the cooking heater 1 more easily.

[0057] For example, when the infrared sensor 11 or the contact temperature sensor 12 detects that the temperature of the cookware 300 reaches a target temperature, the control unit 14 switches from the lighting control example 1 or the lighting control example 2 to the lighting control example 3. When the lighting control example is switched to the lighting control example 3, light flowing in a single direction is visible to a user such that the light is stopped. This enables the blinking light that is emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D turned on and off at the same time and that is transmitted through the transmission part 32 to be used as a warning indication for a user. When the infrared sensor 11 or the contact temperature sensor 12 detects that the temperature of the cookware 300 reaches a target temperature, in addition to the process of the lighting control example 3, the control unit 14 may exercise control such that the heating source stops heating.

(Lighting Control Example 4)

[0058] Fig. 7 is a timing chart illustrating yet another lighting control example of the light sources according to Embodiment 1. The vertical axis in Fig. 7 represents, in a simplified manner, the luminance level of the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D.

[0059] A lighting control example 4 is similar to the lighting control example 1 and the lighting control example 2 described above in that the plurality of light sources are turned on and off successively. However, the lighting control example 4 differs from the lighting control example 1 and the lighting control example 2 in that the luminance of the light sources is reduced gradually or successively. The control unit 14 turns on the first light source 31A periodically and reduces its luminance gradually or successively during one lighting period. This causes fading blinking light to be visible to a user.

[0060] The lighting control example 4 is used by combining with one or more of the lighting control examples 1 to 3 described above. The control unit 14 switches from one of the lighting control examples 1, 2, and 3 to the lighting control example 4 illustrated in Fig. 7 depending on the operating state of the heating source or the state of the cooking heater 1. This enables a user to recognize a change in the operating state of the heating source or a change in the state of the cooking heater 1 more easily.

[0061] For example, when the infrared sensor 11 or the contact temperature sensor 12 detects that the temperature of the cookware 300 reaches a target temperature, the control unit 14 performs the process of the lighting control example 3. After performing the process of the lighting control example 3 for a while, the control unit 14 reduces the heating source output and switches from the lighting control example 3 to the lighting control example 4. When the lighting control example is switched to the lighting control example 4, fading blinking light is visible to a user. The light that is thus fading and blinking and transmitted through the transmission part 32 can be used as a warning indication that indicates, to a user, reduced heating source output.

(Lighting Control Example 5)

[0062] A lighting control example 5 is a lighting control example in which a randomly selected one or ones of the plurality of light sources are turned on and off successively. The control unit 14 randomly selects, by using, for example, random numbers, one of the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D, turns on the selected one, and turns off the others. The control unit 14 repeats this control process. The control unit 14 turns on a light source without overlap between lighting periods. The length of each lighting period may be a fixed value or a random value.

[0063] The lighting control example 5 is used by combining with one or more of the lighting control examples 1 to 4 described above. The control unit 14 switches from one of the lighting control examples 1, 2, and 3 to the lighting control example 5 illustrated in Fig. 6 depending on the operating state of the heating source or the state of the cooking heater 1. This enables a user to recognize a change in the operating state of the heating source or a change in the state of the cooking heater 1 more easily.

[0064] For example, when the infrared sensor 11 or the contact temperature sensor 12 detects that the temperature of the cookware 300 reaches a target temperature, the control unit 14 performs the process of the lighting control example 3. When, after performing the process of the lighting control example 3 for a while, the infrared sensor 11 or the contact temperature sensor 12 detects that the temperature of the cookware 300 becomes higher than a threshold value, which indicates that the temperature of the cookware 300 is excessively increased, the control unit 14 switches from the lighting control example 3 to the lighting control example 5. When the lighting control example is switched to the lighting control example 5, randomly blinking light is visible to a user. The light thus randomly emitted from the transmission part 32 can be used as a warning indication that indicates, to a user, an abnormal condition in which the cookware 300 is excessively heated.

[0065] As described above, the cooking heater 1 in Embodiment 1 includes the light-emitting unit 30 including the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D, which are provided under the top plate 3 and controlled independently of each other. In addition, the cooking heater 1 in Embodiment 1 includes the transmission part 32, which is provided in the top plate 3, located outward of the heat zone 20, and configured to allow the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D to be transmitted through the transmission part 32. A selected one or ones of the first light source 31A to the fourth light source 31D successively emit light while the heating coil 4 is heating the cookware 300. Specifically, as illustrated in Figs. 4, 5, and 7, the first light source 31A to the fourth light source 31D, which are linearly disposed, are turned on and off successively in this order, and the turning on and off of the first light source 31A to the fourth light source 31D is repeated cyclically. Such operations of the first light source 31A to the fourth light source 31D cause the light flowing in a single direction parallel to the surface of the top plate 3 to be emitted from the transmission part 32. As a result, a light flow is visible to a user. Thus, even when a user has color-vision impairment, the user easily recognizes that the cooking heater 1 is being operated. When a user easily recognizes that the cooking heater 1 is being operated, it is possible to inhibit the user from forgetting to turn off the power of the cooking heater 1 and from applying unnecessary electric power to the heating source.

[0066] In addition, In Embodiment 1, the number of ones of the first light source 31A to the fourth light source 31D that are to be turned on and off varies depending on the intensity of the output of the heating coil 4, which is a heating source. In the lighting control example 1 illustrated in Fig. 4, the number of the light sources that emit light is increased as the output of the heating coil 4 becomes higher. When the number of ones of the disposed first light source 31A to fourth light source 31D that are to be turned on and off varies, blinking light is visible to a user such that the position of the blinking light varies depending on the output of the heating coil 4. For this reason, the user easily visually recognizes a change in the output of the heating source. Thus, the user can adjust the output of the heating source easily and without anxiety. In addition, when a user can adjust the output of the heating source easily, the user can heat the cookware 300 by output suitable for cooking. As a result, it is possible to improve finished cooking quality and to reduce electric power consumption.

(Modifications of Transmission Part)

[0067] Modifications of the shape of the transmission part 32 will be described below with reference to the drawings.

[0068] Fig. 8 is a schematic plan view of a top plate 3 according to Modification 1 of Embodiment 1. In an example illustrated in Fig. 8, the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D, which form each transmission part 32, each have the same shape as a part of the shape similar to that of the corresponding heat zone 20. In the example in Fig. 8, the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D each have a circular arc shape. The lengths and the surface areas of the circular arc of the circular arc shape are larger in the direction away from the heat zone 20. In the example in Fig. 8, the order of increasing length of the circular arc is the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D, and the length of the circular arc of the fourth transmission part 32D, which is the outermost transmission part, is largest. This configuration enables a user to be impressed that the light transmitted through the transmission part 32 spreads from the heat zone 20.

[0069] It is preferable that the area of the transmission part 32 that emits light be increased toward the outside of the heat zone 20 as the output of the heating source becomes higher. Specifically, when the heating power 1 is set in the heating coil 4, light is emitted from the first transmission part 32A and the second transmission part 32B. When heating power higher than the heating power 1 is set in the heating coil 4, light is emitted from the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmis-

sion part 32D. When the area in which light is emitted is thus increased as heating power becomes higher, a user easily recognizes the intensity of heating power.

[0070] The shapes of the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D are not limited to a circular arc shape and may be, for example, a rectangular shape.

[0071] Fig. 9 is a schematic plan view of a top plate 3 according to Modification 2 of Embodiment 1. In an example illustrated in Fig. 9, in the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D, which form each transmission part 32, the lengths of their sides in a radial direction of the corresponding heat zone 20 are larger as the transmission part position is farther from the heat zone 20. In the example in Fig. 9, the order of increasing length of the sides in the radial direction of the heat zone 20 is the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D, and the length of the sides of the fourth transmission part 32D, which is the outermost transmission part, is largest. This configuration enables a user to be impressed that the light transmitted through the transmission part 32 spreads from the heat zone 20.

[0072] It is preferable that the area of the transmission part 32 that emits light be increased toward the outside of the heat zone 20 as the output of the heating source becomes higher. Specifically, when the heating power 1 is set in the heating coil 4, light is emitted from the first transmission part 32A and the second transmission part 32B. When heating power higher than the heating power 1 is set in the heating coil 4, light is emitted from the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D. When the area in which light is emitted is thus increased as heating power becomes higher, a user easily recognizes the intensity of heating power.

(Modification 1 of Lighting Control Example 1)

[0073] Fig. 10 illustrates Modification 1 of the lighting control example 1 of the light sources according to Embodiment 1. Modification 1 is similar to the lighting control example 1 in Fig. 4 in that two or more of the first light source 31A to the fourth light source 31D are turned on and off successively without overlap between lighting periods. Modification 1 differs from the lighting control example 1 in Fig. 4 in that Modification 1 has an off period during which none of the light sources is on from when one light source is turned on to when another light source is turned on. In Fig. 10, the off period is represented by the reference sign "e". When, in the configuration in which the plurality of light sources are turned on and off successively, a period during which none of the light sources is on is thus provided between the lighting periods of the light sources, the on state and the off state of the light

sources are clearly distinguished, and a user easily visually recognizes the on state and the off state. This enables a user to more clearly recognize information, such as heating power, transmitted via the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D.

(Modification 2 of Lighting Control Example 1)

[0074] Fig. 11 illustrates Modification 2 of the lighting control example 1 of the light sources according to Embodiment 1. Modification 2 is an example in which the plurality of light sources are turned on and off repeatedly in a specific cycle and the length of the period from when the first light source of the plurality of light sources is turned on to when the second light source is turned on differs from the length of the period from when the second light source is turned on to when the third light source is turned on. Modification 2 is similar to the lighting control example 1 in Fig. 4 in that two or more of the first light source 31A to the fourth light source 31D are turned on and off successively without overlap between lighting periods.

[0075] Modification 2 is an example in which the lengths of the periods during which the light sources are on vary from each other. In Embodiment 1, one lighting time period is longer as the light source position is farther from the heat zone 20. The order of increasing lighting time period is the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D. That is, the relationship the period $a < \text{the period } b < \text{the period } c < \text{the period } d$ is satisfied. The period a is, for example, about one second, and the period d is, for example, about three seconds. When the light sources are turned on and off with the length of one lighting time period varied, a user easily recognizes which light source is emitting light. This enables a user to more clearly recognize information, such as heating power, transmitted via the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D.

[0076] Similarly to Modification 1, Modification 2 may also have an off period during which none of the light sources is on from when one light source is turned on to when another light source is turned on. This enables Modification 2 to achieve an operational effect similar to that in Modification 1. In Modification 2, the light sources may be turned on and off successively without the off period.

(Modification 3 of Lighting Control Example 1)

[0077] Fig. 12 illustrates Modification 3 of the lighting control example 1 of the light sources according to Embodiment 1. Modification 3 is an example in which the plurality of light sources are turned on and off repeatedly in a specific cycle. In addition, Modification 3 is an example in which the length of the period from when the first

light source of the plurality of light sources is turned on to when the second light source is turned on differs from the length of the period from when the last light source is turned on to when the first light source is turned on again. Modification 3 is similar to the lighting control example 1 in Fig. 4 in that, when each of the first light source 31A to the fourth light source 31D is focused on, the first light source 31A to the fourth light source 31D are turned on and off repeatedly without overlap between lighting periods.

[0078] Modification 3 is an example in which one lighting period of the light source positioned farthest from the heat zone 20 of the light sources that are turned on and off in a loop process is longer than one lighting period of each of the other light sources. Fig. 12 illustrates an example in which three light sources, that is, the first light source 31A, the second light source 31B, and the third light source 31C are turned on and off successively. The period c , during which the third light source 31C positioned farthest from the heat zone 20 is on, is longer than each of the periods a and b . When heating power is lower than that illustrated in Fig. 12, the first light source 31A and the second light source 31B are turned on and off successively such that the relationship the period $a < \text{the period } b$ is satisfied. When heating power is higher than that illustrated in Fig. 12, the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D are turned on and off successively such that the relationship the period $a = \text{the period } b = \text{the period } c < \text{the period } d$ is satisfied. When the lighting period of the outermost one of the light sources that are turned on and off in a loop process is thus longer than the lighting period of each of the other light sources, a user easily recognizes the outer edge of the light emitted from the transmission part 32. This enables a user to more clearly recognize information, such as heating power, transmitted via the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D.

[0079] Similarly to Modification 1, Modification 3 may also have an off period during which none of the light sources is on from when one light source is turned on to when another light source is turned on. This enables Modification 3 to achieve an operational effect similar to that in Modification 1. In Modification 3, the light sources may be turned on and off successively without the off period.

(Modification 4 of Lighting Control Example 1)

[0080] Fig. 13 illustrates Modification 4 of the lighting control example 1 of the light sources according to Embodiment 1. Modification 4 is an example in which the plurality of light sources are turned on and off repeatedly in a specific cycle and the length of the period from when the first light source of the plurality of light sources is turned on to when the second light source is turned on differs from the length of the period from when the second

light source is turned on to when the third light source is turned on. Modification 4 is similar to the lighting control example 1 in Fig. 4 in that two or more of the first light source 31A to the fourth light source 31D are turned on and off.

[0081] In Modification 4, although the timings of starting to turn on the light sources to be turned on and off differ from each other, the lighting periods of the light sources overlap each other, and the timings of turning off the light sources are identical with each other. Specifically, the first light source 31A starts to be turned on, and the second light source 31B then starts to be turned on in the on state of the first light source 31A. Then, the third light source 31C starts to be turned on in the on states of the first light source 31A and the second light source 31B. Then, the fourth light source 31D starts to be turned on in the on states of the first light source 31A, the second light source 31B, and the third light source 31C. Then, the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D are turned off at the same time. Although Modification 4 is similar to the lighting control example 1 in that the light sources are turned on and off repeatedly when each of the light sources is focused on, the lighting periods of the light sources overlap each other. Thus, light flowing in a single direction is visible to a user such that the light is gradually increased, and the user easily recognizes the light flow. This enables a user to more clearly recognize information, such as heating power, transmitted via the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D.

[0082] Fig. 13 illustrates an example in which the timings of starting to turn on the light sources to be turned on and off differ from each other. Alternatively, all of the timings of starting to turn on the light sources to be turned on and off may be synchronized, and the timings of turning off the light sources may be caused to differ from each other successively. For example, the first light source 31A, the second light source 31B, and the third light source 31C are turned on at the same time and then turned off in this order each after some time. This also causes the light emitted by turning on the light sources at the same time to be visible to a user such that the light flows and fades in a single direction, and thus the user easily recognizes the light flow. In addition, both the timings of starting to turn on and the timings of turning off the light sources to be turned on and off may differ from each other. Specifically, the first light source 31A, the second light source 31B, and the third light source 31C are turned on successively each after some time, and then the three light sources are on at the same time during a period. Subsequently, the first light source 31A, the second light source 31B, and the third light source 31C are turned off in this order each after some time. This causes the light to be visible to a user such that the light flows and gradually increases in a single direction and then flows and fades in the same direction, and thus the

user easily recognizes the light flow.

Embodiment 2

[0083] In Embodiment 2, the shapes and the dispositions of the transmission parts 32 and the dispositions of the light sources are described. The configuration other than the shapes and the dispositions of the transmission parts 32 and the dispositions of the light sources is similar to that in Embodiment 1. Thus, the description of Embodiment 2 focuses on the differences between Embodiment 1 and Embodiment 2.

[0084] Fig. 14 is a schematic plan view of a top plate 3 according to Embodiment 2. The transmission parts 32 in Embodiment 2 are similar to those in Embodiment 1 in that the transmission parts 32 are provided outward of the respective heat zones 20. The entire shape of each of the transmission parts 32 in Embodiment 2 differs from that in Embodiment 1 in that the entire shape of each of the transmission parts 32 in Embodiment 2 extends in a direction from the corresponding heat zone 20 toward the operation display unit 6.

[0085] The first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D, which are included in each of the transmission parts 32 in Embodiment 2, are linearly disposed in this order in a direction away from the operation display unit 6. The entire shape of the transmission part 32 is an isosceles triangle, and its vertex angle is positioned closer to the operation display unit 6 than are its base angles. The triangle is formed by the first transmission part 32A, which is shaped into a triangle, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D, which are each shaped into a trapezoid. The left-right width of the fourth transmission part 32D, which is positioned farthest from the operation display unit 6, is largest. The left-right width of the first transmission part 32A, which is positioned closest to the operation display unit 6, is smallest.

[0086] In Fig. 14, the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D, which are disposed under the top plate 3, are represented by dashed lines. The first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D each have a basic configuration similar to that described in Embodiment 1. The first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D are provided such that the light emitted from the light sources is transmitted through the transmission part 32. It is preferable that the plurality of light sources be disposed to overlap the transmission part 32 in plan view. The first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D are linearly disposed in this order in the direction away from the operation display unit 6. Fig. 14 illustrates an example in which the plurality of light sources the number

(four in Embodiment 2) of which is equal to the number of the plurality of transmission parts forming the transmission part 32 are disposed to overlap the corresponding transmission parts in plan view. However, the plurality of light sources may be disposed for one transmission part.

[0087] As illustrated in the lighting control examples in Embodiment 1, lighting control is exercised on the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D. When the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D are turned on, the light emitted from the light sources is transmitted through the transmission part 32, and the transmitted light is visible to a user.

[0088] Embodiment 2 enables the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D to be easily visible to a user using the cooking heater 1 and positioned facing the operation display unit 6. This enables a user to more clearly recognize information, such as heating power, transmitted via the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D.

[0089] Embodiment 2 can achieve an effect similar to that in Embodiment 1. In addition, Embodiment 2 enables the first light source 31A to the fourth light source 31D to be easily disposed at positions away from a heating source that is to be hot. Thus, the deterioration of the first light source 31A to the fourth light source 31D due to heat is reduced, and it is possible to improve the durability of the first light source 31A to the fourth light source 31D. The improvement of the durability of the first light source 31A to the fourth light source 31D enables heat-resistant structures that are to be provided for the first light source 31A to the fourth light source 31D to be simplified and thus the material costs of the cooking heater 1 to be reduced.

Embodiment 3

[0090] In Embodiment 3, the shapes and the dispositions of the transmission parts 32 and the dispositions of the light sources are described. The configuration other than the shapes and the dispositions of the transmission parts 32 and the dispositions of the light sources is similar to that in Embodiment 1. Thus, the description of Embodiment 3 focuses on the differences between Embodiment 1 and Embodiment 3.

[0091] Fig. 15 is a schematic plan view of a top plate 3 according to Embodiment 3. The transmission parts 32 in Embodiment 3 are similar to those in Embodiment 1 in that the transmission parts 32 are provided outward of the respective heat zones 20. The entire shape of each of the transmission parts 32 in Embodiment 3 differs from that in Embodiment 1 in that the entire shape of each of the transmission parts 32 in Embodiment 3 extends along

the width of the top plate 3.

[0092] The first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D, which are included in each of the transmission parts 32 in Embodiment 3, are linearly disposed in this order from left to right along the width of the top plate 3. The first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D each have a rectangular shape in plan view and form the entire rectangular shape of the transmission part 32.

[0093] In Fig. 15, the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D, which are disposed under the top plate 3, are represented by dashed lines. The first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D each have a basic configuration similar to that described in Embodiment 1. The first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D are provided such that the light emitted from the light sources is transmitted through the transmission part 32. It is preferable that the plurality of light sources be disposed to overlap the transmission part 32 in plan view. The first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D are linearly disposed in this order from left to right along the width of the top plate 3. Fig. 15 illustrates an example in which the plurality of light sources the number (four in Embodiment 3) of which is equal to the number of the plurality of transmission parts forming the transmission part 32 are disposed to overlap the corresponding transmission parts in plan view. However, the plurality of light sources may be disposed for one transmission part.

[0094] As illustrated in the lighting control examples in Embodiment 1, lighting control is exercised on the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D. When the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D are turned on, the light emitted from the light sources is transmitted through the transmission part 32, and the transmitted light is visible to a user.

[0095] Embodiment 3 can achieve an effect similar to that in Embodiment 1. The first light source 31A to the fourth light source 31D and the first transmission part 32A to the fourth transmission part 32D illustrated in Fig. 15 may be disposed to be laterally reversed.

Embodiment 4

[0096] In Embodiment 4, examples of attributes of the light emitted from the transmission part 32 are described. The description of Embodiment 4 focuses on the differences between Embodiment 1 and Embodiment 4.

[0097] Fig. 16 illustrates a transmission part and a plurality of light sources according to Embodiment 4. In Fig. 16, the first light source 31A, the second light source 31B,

the third light source 31C, and the fourth light source 31D, which are disposed under the transmission part 32, are represented by dashed lines. The wavelengths of the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D in Embodiment 4 are longer in this order. The hue of the light emitted from the light sources is varied by varying the wavelength of the light, and thus the light having different hues transmitted through the transmission part 32 is visible to a user. For example, the first light source 31A emits yellow light, the second light source 31B emits orange light, the third light source 31C emits vermilion light, and the fourth light source 31D emits red light. In addition, light sources configured to emit two kinds of light having different wavelengths may be disposed alternately. When Embodiment 4 is combined with the lighting control example 1 in Fig. 4, the light having a relatively short wavelength is emitted from the first light source 31A in the case of low heating source output. As the heating source output becomes higher, the wavelengths of the light emitted from the second light source 31B, the third light source 31C, and the fourth light source 31D are longer in this order.

[0098] The first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D may each include a plurality of light-emitting devices each configured to emit light having a different wavelength. For example, the first light source 31A, which is one of the light sources, includes a plurality of light-emitting devices configured to emit light having different colors. One or more of the light-emitting devices provided in the first light source 31A emit light at the same time. In this manner, the color (RGB) of the light that is emitted from the transmission part 32 and that is visible to a user can be varied by combining light-emitting devices configured to emit light. For example, the first light source 31A emits blue light, the second light source 31B emits green light, the third light source 31C emits orange light, and the fourth light source 31D emits red light.

[0099] Instead of or in addition to varying the wavelength of the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D, the color of the first transmission part 32A to the fourth transmission part 32D may be varied. For example, the first transmission part 32A to the fourth transmission part 32D are colored transparent parts. When the first light source 31A to the fourth light source 31D emit single-color light, for example, white light, the emitted light is refracted by being transmitted through the first transmission part 32A to the fourth transmission part 32D and is recognized, by a user, as the light having colors corresponding to the colors of the first transmission part 32A to the fourth transmission part 32D.

[0100] Instead of or in addition to varying the wavelength of the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D, and varying the color of

the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D, the light transmittance of the first transmission part 32A to the fourth transmission part 32D may be varied. For example, the amounts of light transmitted through the first transmission part 32A, the second transmission part 32B, the third transmission part 32C, and the fourth transmission part 32D are larger in this order. Specifically, printing is performed on the surface or the inside of the transmission part 32 with a coating made of glass-based inorganic material, thermosetting resin, ultraviolet-curing resin, or other substances. The light transmittance can be changed by changing the density of the printed coating. The coating usable for printing is not limited to that described above. A wide range of materials are usable as long as the materials have relatively high rigidity and low brittleness and do not contain hazardous substances.

[0101] As described above, Embodiment 4 enables light having different hues to be visible to a user. This enables a user to more clearly recognize information, such as heating power, transmitted via the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D.

Embodiment 5

[0102] In Embodiment 5, an example in which a plurality of light sources each emit light having different luminance is described. The description of Embodiment 5 focuses on the differences between Embodiment 1 and Embodiment 5.

[0103] Fig. 17 is a timing chart illustrating a lighting control example of light sources according to Embodiment 5. The vertical axis in Fig. 17 represents, in a simplified manner, the luminance level of the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D.

[0104] As illustrated in Fig. 17, the luminance of the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D is higher in this order. Such a configuration enables even a user having color-vision impairment and thus having difficulty in discriminating different hues of light to easily recognize the distinction of the light emitted from each of the light sources. For example, even if blue light, green light, and orange light, which have different hues, are emitted, it is difficult for a user having a red-green color vision deficiency, which is a common congenital disease, to discriminate the different hues. However, as the plurality of light sources each emit light having different luminance, Embodiment 5 enables a user to more clearly recognize information, such as heating power, transmitted via the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D.

Embodiment 6

[0105] The configuration in Embodiment 6 differs from that in Embodiment 1 in that a user can select the color of the light to be emitted from the transmission part 32. The description of Embodiment 6 focuses on the differences between Embodiment 1 and Embodiment 6.

[0106] Fig. 18 is a schematic plan view of a top plate 3 according to Embodiment 6. The cooking heater 1 in Embodiment 6 includes a setting unit 33 in which the color of the light to be emitted from the transmission part 32 is set. The setting unit 33 is an interface, such as a touch screen and a push button, configured to receive input on color settings. Although Fig. 18 illustrates an example in which the setting unit 33 is provided in an upper surface of the cooking heater 1, the position of the setting unit 33 is not limited to that illustrated in Fig. 18.

[0107] When the top plate 3 is black and the color of the light emitted from the transmission part 32 is red, the emitted light looks only dark gray light to a user having a red-green color vision deficiency. Then, it is difficult for the user to recognize information, such as heating power, transmitted via the light emitted from the transmission part 32. In such a case, a user sets the color of the light to be emitted from the transmission part 32 via the setting unit 33. The control unit 14 changes the color of the light to be emitted from the plurality of light sources on the basis of the settings in the setting unit 33. When the color of the light emitted from the transmission part 32 is a color having a white component, in particular, white, a pastel color, which is a color having a strong white component, or yellow, a user having a red-green color vision deficiency easily recognizes the emitted light. For this reason, when the top plate 3 is black, it is preferable that a color having a white component be prepared as a color capable of being set in the setting unit 33. Each of the light sources includes one light-emitting device capable of changing the color of light emitted from the light source or includes a plurality of light-emitting devices configured to emit light having different colors. In this case, the color of the light emitted from one light source can be changed by the control circuit of the light-emitting unit 30 separately turning on or off the light-emitting devices configured to emit light having different colors.

[0108] When the top plate 3 is white or has a color close to white, and the color of the light emitted from the transmission part 32 is white, yellow, or a color having a strong white component, such as a pastel color, it is difficult for a user to visually recognize the light emitted from the transmission part 32. In such a case, a user sets the color of the light to be emitted from the transmission part 32 via the setting unit 33. The control unit 14 changes the color of the light to be emitted from the plurality of light sources on the basis of the settings in the setting unit 33. It is preferable that the three primary colors, which are red, blue, and green, or colors close to these colors be prepared as colors capable of being set in the setting unit 33.

[0109] Embodiment 6 enables a user who uses the cooking heater 1 to select the color of the light to be emitted from the transmission part 32. Thus, a user easily recognizes the light emitted from the transmission part 32 by setting colors suitable for the color vision of the user via the setting unit 33.

[0110] Two or more of the embodiments and the modifications described above can be used by being combined with each other. This enables a user to more clearly recognize information, such as heating power, transmitted via the light emitted from the first light source 31A, the second light source 31B, the third light source 31C, and the fourth light source 31D.

[0111] In addition to the embodiments described above, a plurality of light sources provided in the light-emitting unit 30 may be disposed to represent characters or signs. Ones of the light sources disposed in such a manner, the ones representing a character or a sign, are treated as one light source, and lighting control is exercised on the light sources as described in the embodiments. This enables a user to recognize that the light visually recognized as characters or signs flows in a single direction. For example, a plurality of light sources are disposed to have a ring shape, and a plurality of sets of the light sources disposed to have a ring shape are provided. When the light sources disposed to have a ring shape are treated as one light source, and lighting control is exercised on the light sources, a user can recognize that ring-shaped light flows in a single direction.

[0112] In addition, a plurality of light sources provided in the light-emitting unit 30 may be disposed in a matrix. Ones of the light sources disposed in a matrix, the ones representing a character or a sign, are treated as one light source, and lighting control is exercised on the light sources as described in the embodiments. This enables a user to recognize that the light visually recognized as characters or signs flows in a single direction.

Reference Signs List

[0113] 1 cooking heater 2 body 3 top plate 4 heating coil 5 front operating unit 6 operation display unit 9 coil base 10 ferrite core 11 infrared sensor 12 contact temperature sensor 13 temperature detection unit 14 control unit 15 inverter 16 transmission window 20 heat zone 30 light-emitting unit 31A first light source 31B second light source 31C third light source 31D fourth light source 32 transmission part 32A first transmission part 32B second transmission part 32C third transmission part 32D fourth transmission part 33 setting unit 110 sensor case 200 commercial power supply 300 cookware

Claims

1. A cooking heater comprising:

a top plate on which cookware is to be placed;

- a heating source provided under the top plate;
a heat zone provided to the top plate to indicate
a position at which the cookware is to be placed;
a plurality of light sources provided under the
top plate and controlled independently of each
other; and
a transmission part provided in the top plate, lo-
cated outward of the heat zone, and configured
to allow light emitted from the plurality of light
sources to be transmitted through the transmis-
sion part,
wherein a selected one or ones of the plurality
of light sources successively emit light while the
heating source is being operated, such that the
successively emitted light is emitted from the
transmission part and flows in a single direction
parallel to a surface of the top plate.
2. The cooking heater of claim 1, wherein the number
of ones of the plurality of light sources that emit light
is increased as output of the heating source be-
comes higher.
 3. The cooking heater of claim 1 or 2, wherein the plu-
rality of light sources are turned on and off in syn-
chronization with a change in output of the heating
source.
 4. The cooking heater of any one of claims 1 to 3,
wherein
while the heating source is being operated, one or
ones of the plurality of light sources are turned on
and off, and,
when output of the heating source is changed, a cy-
cle in which the one or ones of the plurality of light
sources are turned on and off is changed with the
number of the ones of the plurality of light sources
that are turned on and off maintained.
 5. The cooking heater of any one of claims 1 to 4,
wherein
the plurality of light sources include a first light
source, a second light source, and a third light source
that are disposed in order in a first direction, and
while the heating source is being operated, the first
light source, the second light source, and the third
light source are turned on and off successively in the
order in the first direction or in order in a direction
reverse to the first direction and are turned on and
off repeatedly and cyclically.
 6. The cooking heater of any one of claims 1 to 5,
wherein the plurality of light sources are linearly dis-
posed in a direction outward from a center of the
heat zone.
 7. The cooking heater of any one of claims 1 to 5, further
comprising
 - an operating unit that is provided in an upper surface
of the cooking heater and in which output of the heat-
ing source is set,
wherein the plurality of light sources are linearly dis-
posed in a direction away from the operating unit.
 8. The cooking heater of any one of claims 1 to 5,
wherein the plurality of light sources are linearly dis-
posed along a width of the top plate.
 9. The cooking heater of any one of claims 1 to 3,
wherein
the plurality of light sources include a first light source
and a second light source,
while the heating source is being operated, the first
light source and the second light source are each
turned on and off repeatedly in a specific cycle, and
a period from when the first light source is turned on
to when the second light source is turned on differs
from a period from when the second light source is
turned on to when the first light source is turned on
again.
 10. The cooking heater of any one of claims 1 to 9,
wherein
the transmission part includes a first transmission
part and a second transmission part, and
the second transmission part is disposed at a posi-
tion farther outward from the heat zone than is the
first transmission part.
 11. The cooking heater of any one of claims 1 to 9,
wherein
the transmission part includes a first transmission
part and a second transmission part,
the first transmission part and the second transmis-
sion part each have a circular arc shape in plan view,
the second transmission part is disposed at a posi-
tion farther outward from the heat zone than is the
first transmission part, and
a length of a circular arc of the second transmission
part is larger than a length of a circular arc of the first
transmission part.
 12. The cooking heater of any one of claims 1 to 9,
wherein
the transmission part includes a first transmission
part and a second transmission part,
the second transmission part is disposed at a posi-
tion farther outward from the heat zone than is the
first transmission part, and
a length of the second transmission part in a direction
outward from a center of the heat zone is larger than
a length of the first transmission part in the direction
outward from the center of the heat zone.
 13. The cooking heater of any one of claims 1 to 12,
wherein a cycle in which the plurality of light sources

are turned on and off varies depending on at least one of output of the heating source, a temperature of the cookware, and a temperature of the top plate.

14. The cooking heater of any one of claims 1 to 12, wherein luminance of the plurality of light sources varies depending on at least one of output of the heating source, a temperature of the cookware, and a temperature of the top plate. 5
10
15. The cooking heater of any one of claims 1 to 14, wherein the transmission part includes a plurality of transmission parts, and light transmitted through each of the plurality of transmission parts has at least one of a different hue, a different wavelength, and different luminance. 15
16. The cooking heater of any one of claims 1 to 15, wherein the transmission part includes a plurality of the transmission parts having different light transmittance. 20
17. The cooking heater of any one of claims 1 to 15, wherein a wavelength of light transmitted through the transmission part in a case in which output of the heating source is high is longer than a wavelength of light transmitted through the transmission part in a case in which the output of the heating source is low. 25
30
18. The cooking heater of any one of claims 1 to 16, wherein luminance of light transmitted through the transmission part in a case in which output of the heating source is high is higher than luminance of light transmitted through the transmission part in a case in which the output of the heating source is low. 35
19. The cooking heater of any one of claims 1 to 18, further comprising a setting unit in which a hue of light to be emitted from each of the plurality of light sources is set, wherein the hue of the light to be emitted from each of the plurality of light sources is changed depending on a setting in the setting unit. 40
45
20. The cooking heater of any one of claims 1 to 13, wherein, when the top plate is black, light transmitted through the transmission part has a white component, or, when the top plate has a color having a white component, the light transmitted through the transmission part has one of three primary colors, which are red, blue, and green. 50
55

FIG. 1

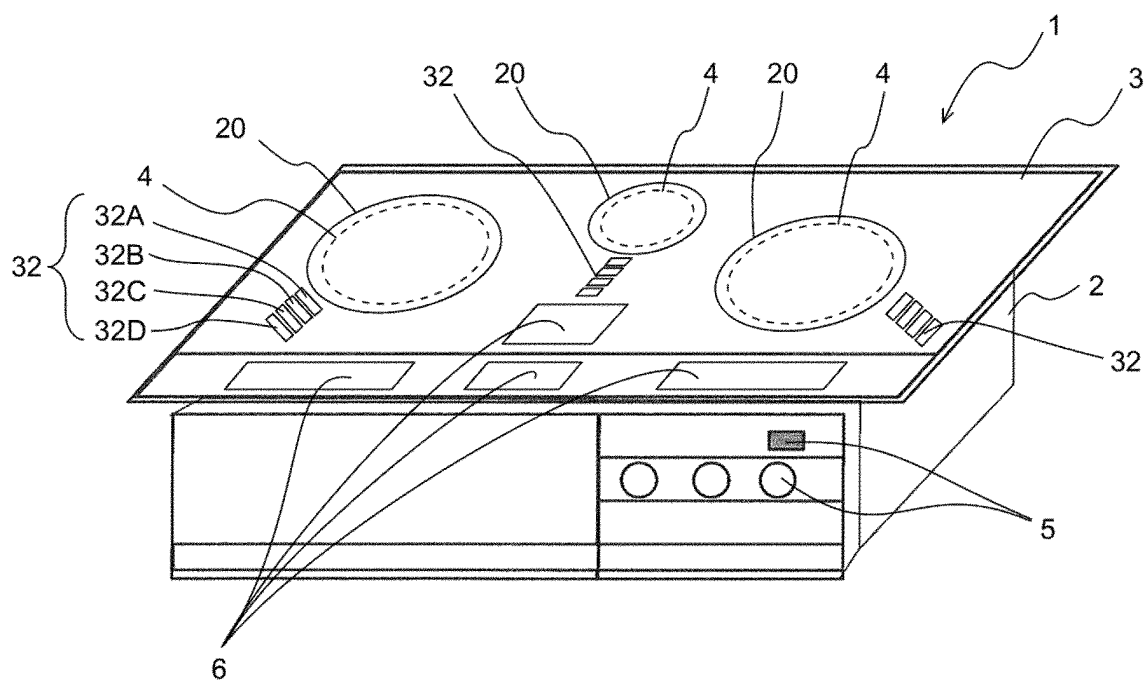


FIG. 2

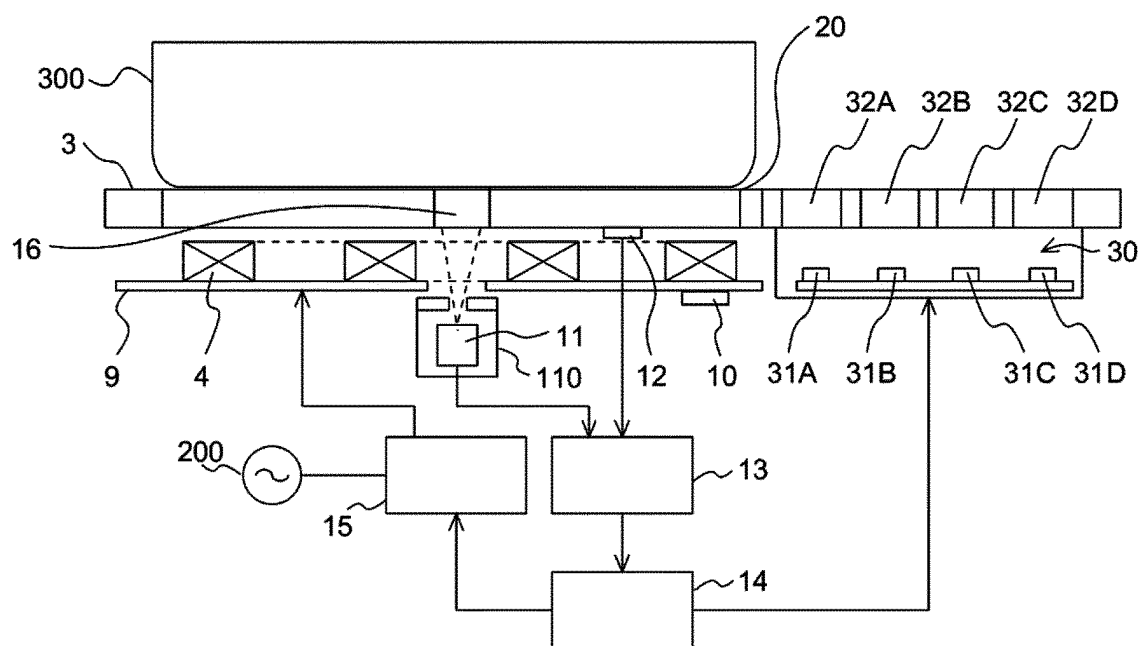


FIG. 3

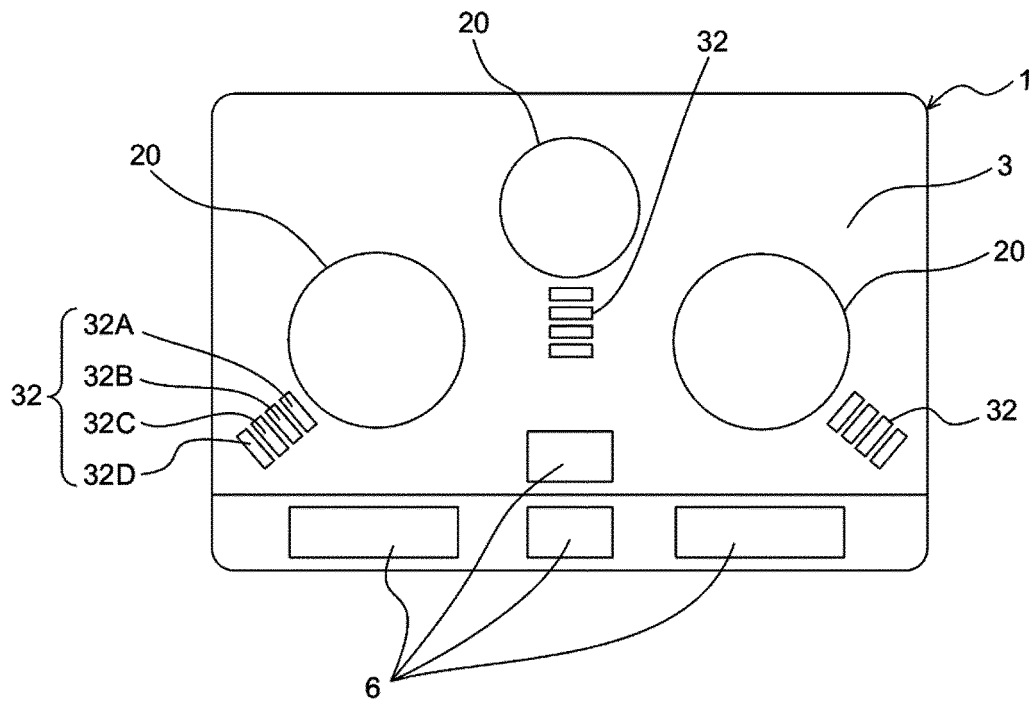


FIG. 4

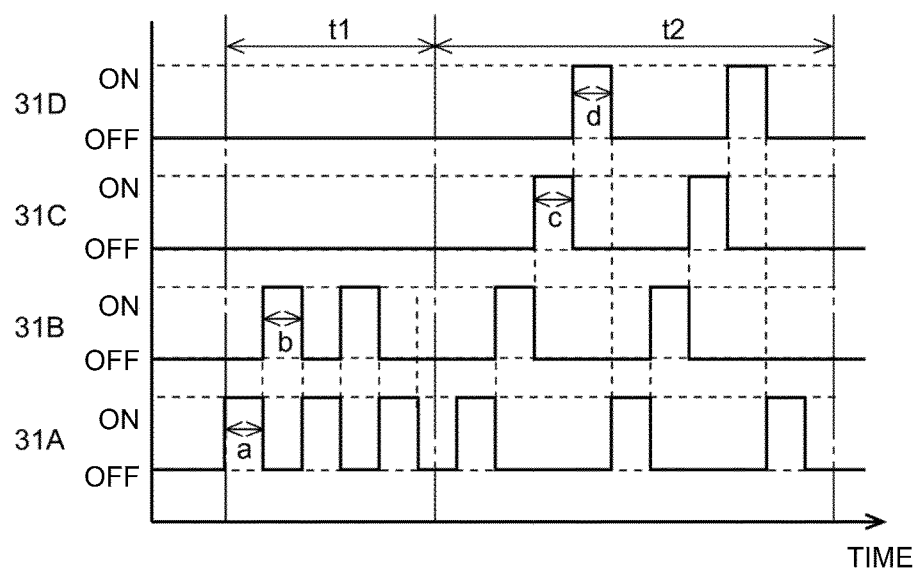


FIG. 5

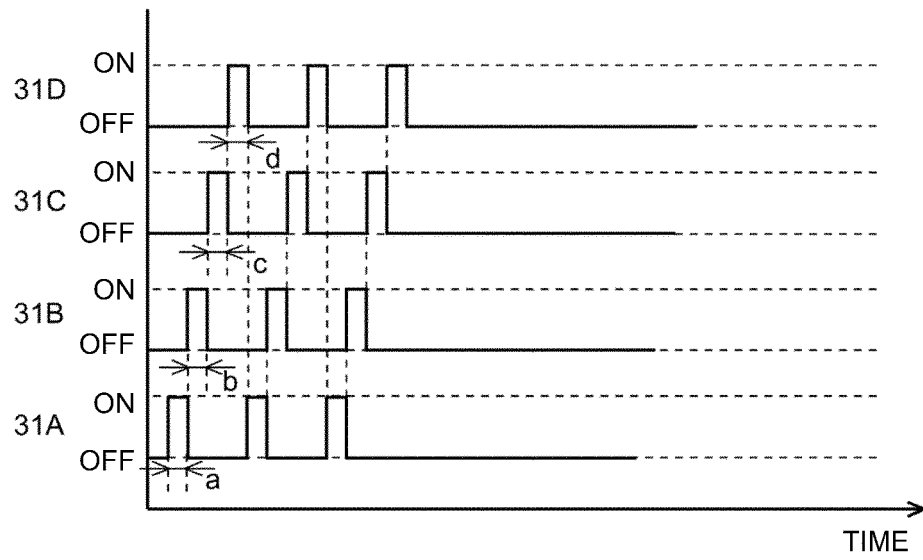


FIG. 6

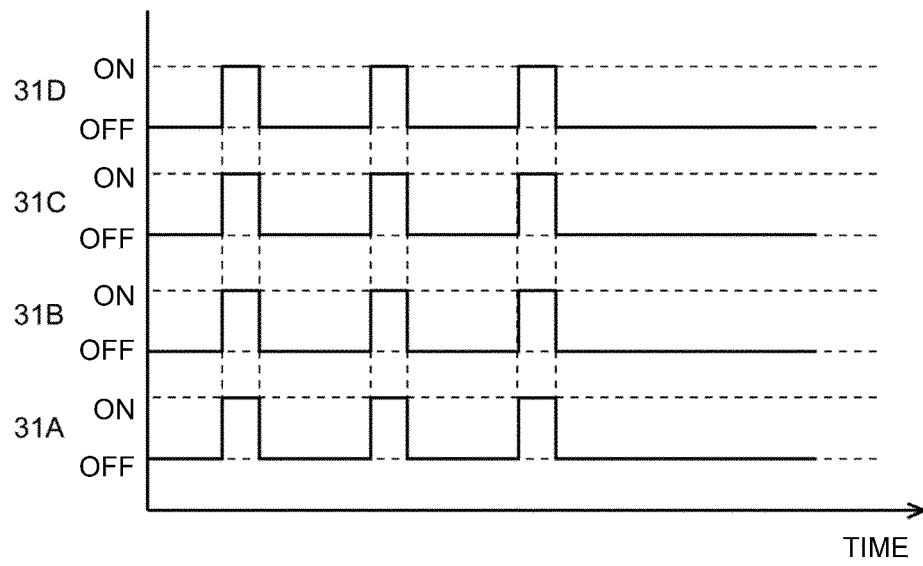


FIG. 7

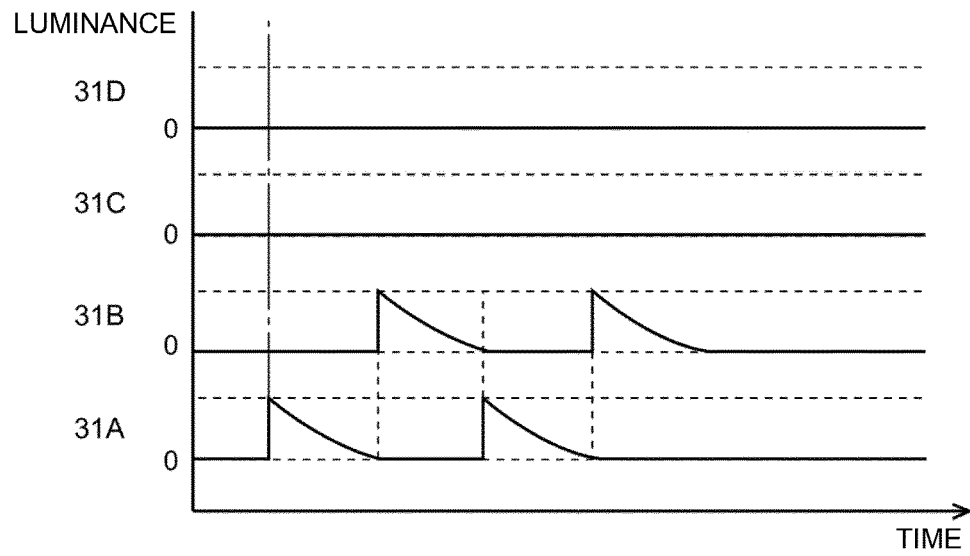


FIG. 8

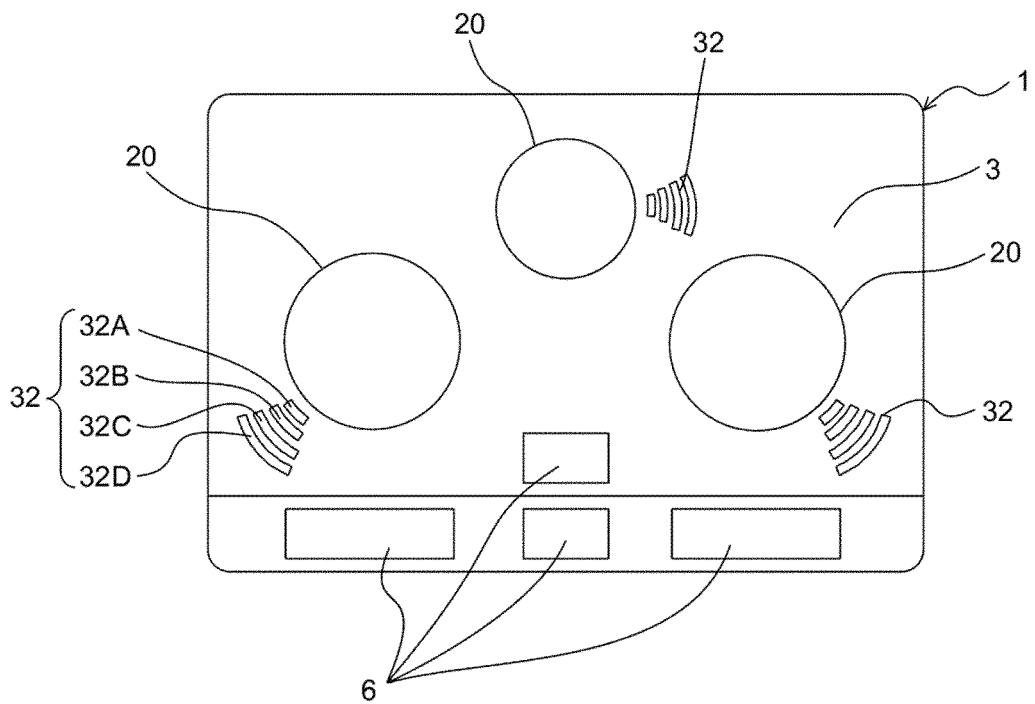


FIG. 9

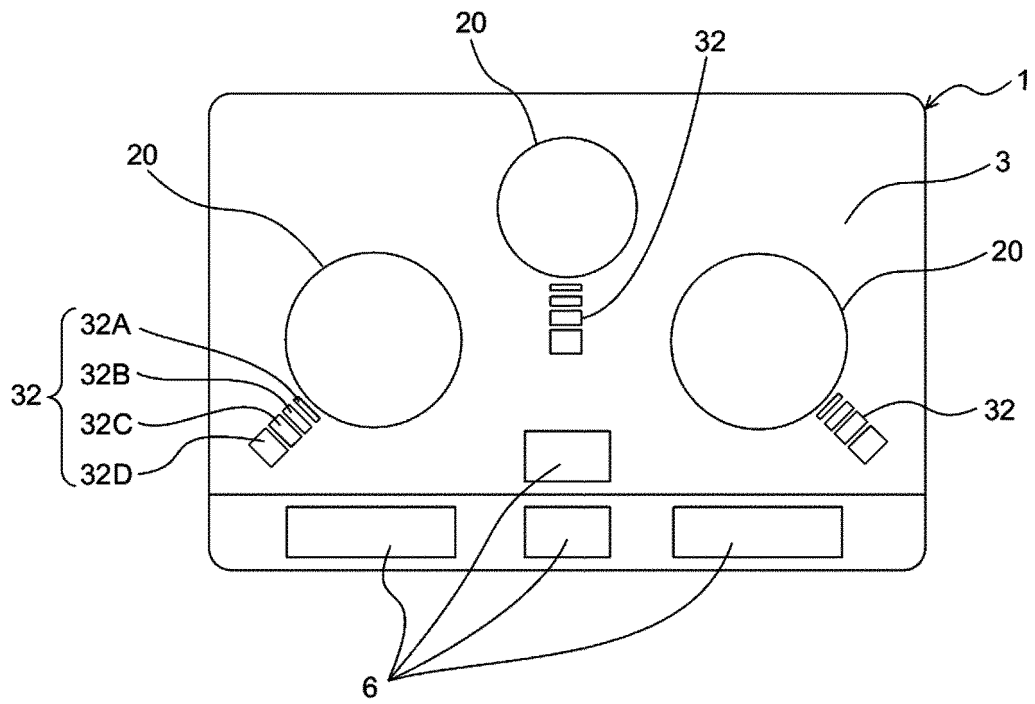


FIG. 10

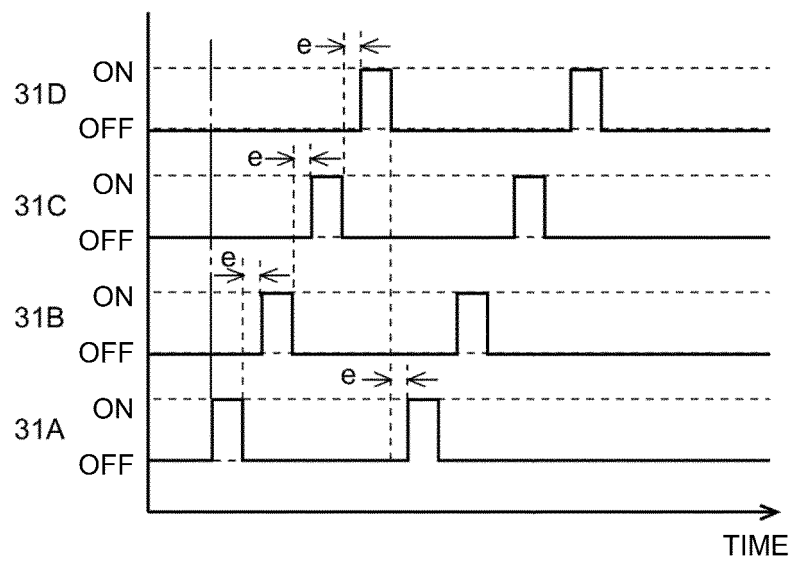


FIG. 11

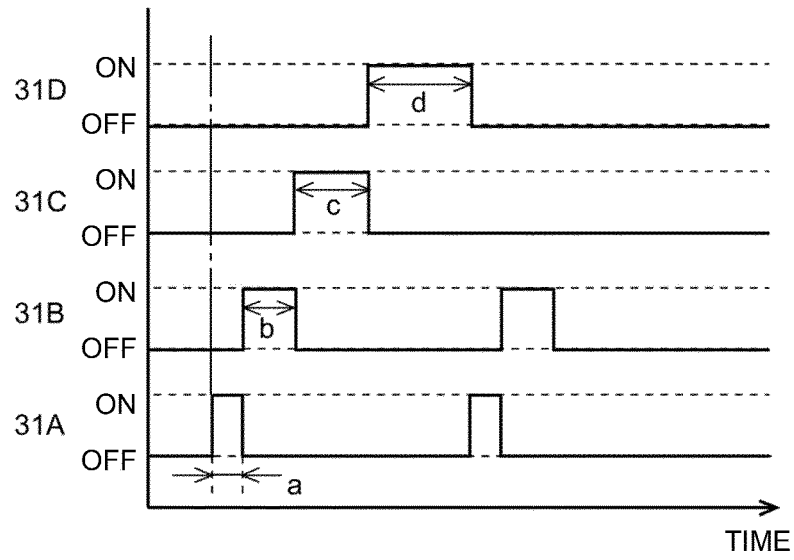


FIG. 12

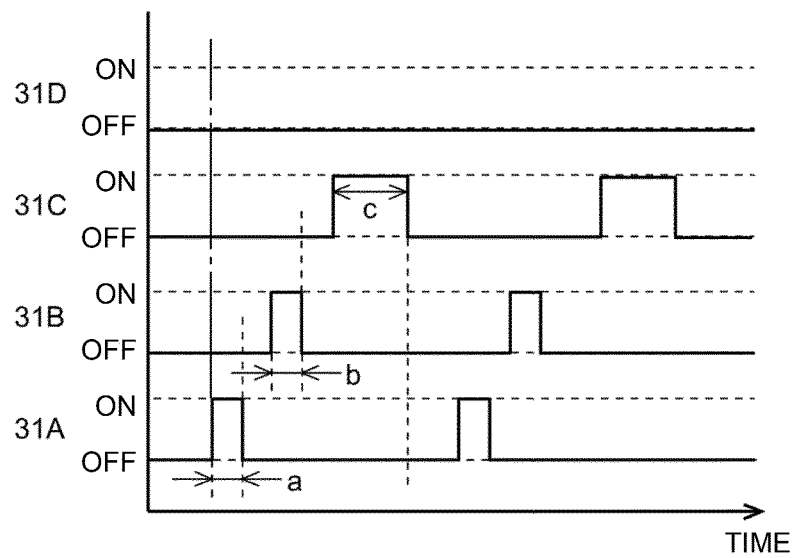


FIG. 13

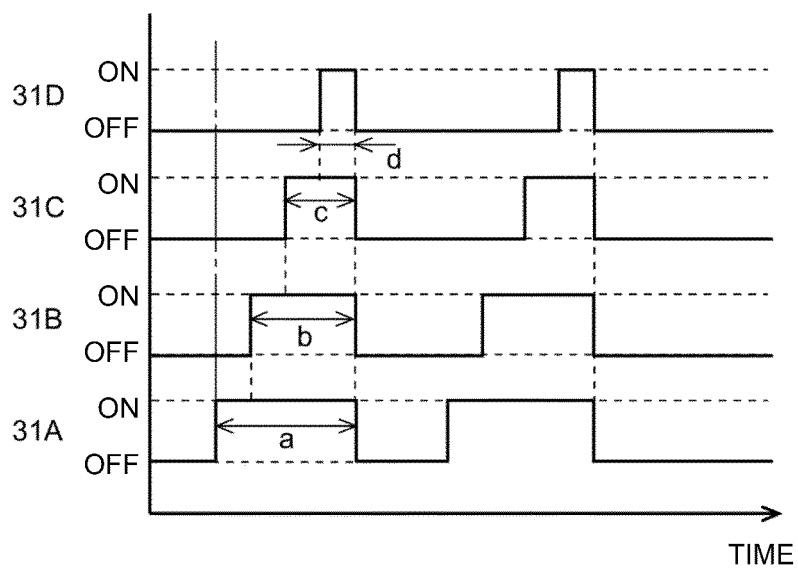


FIG. 14

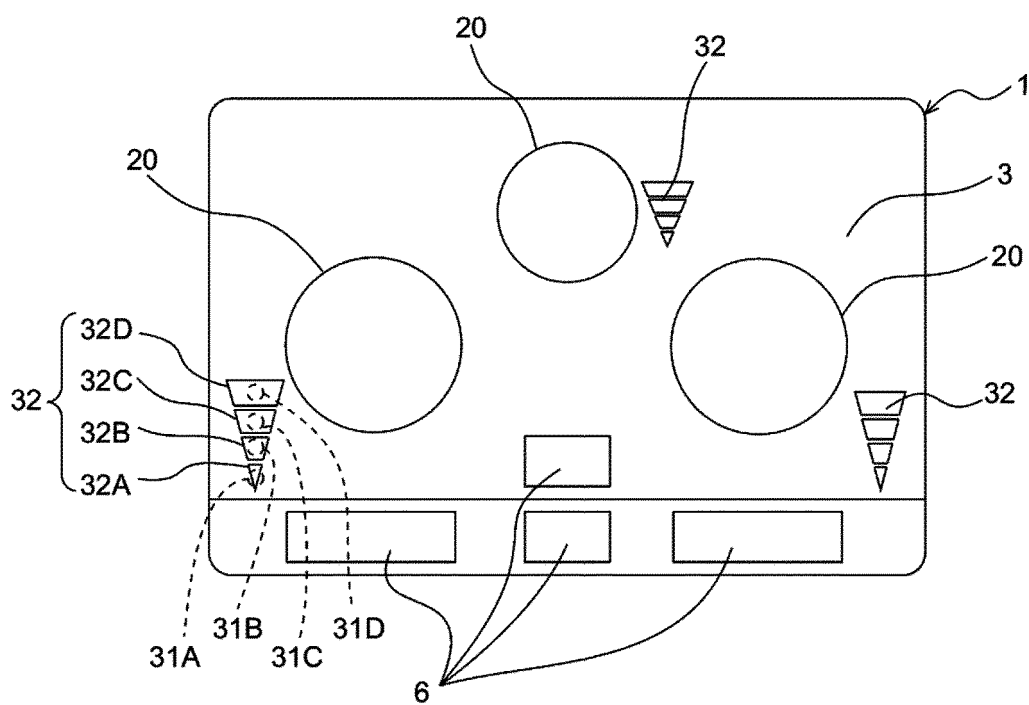


FIG. 15

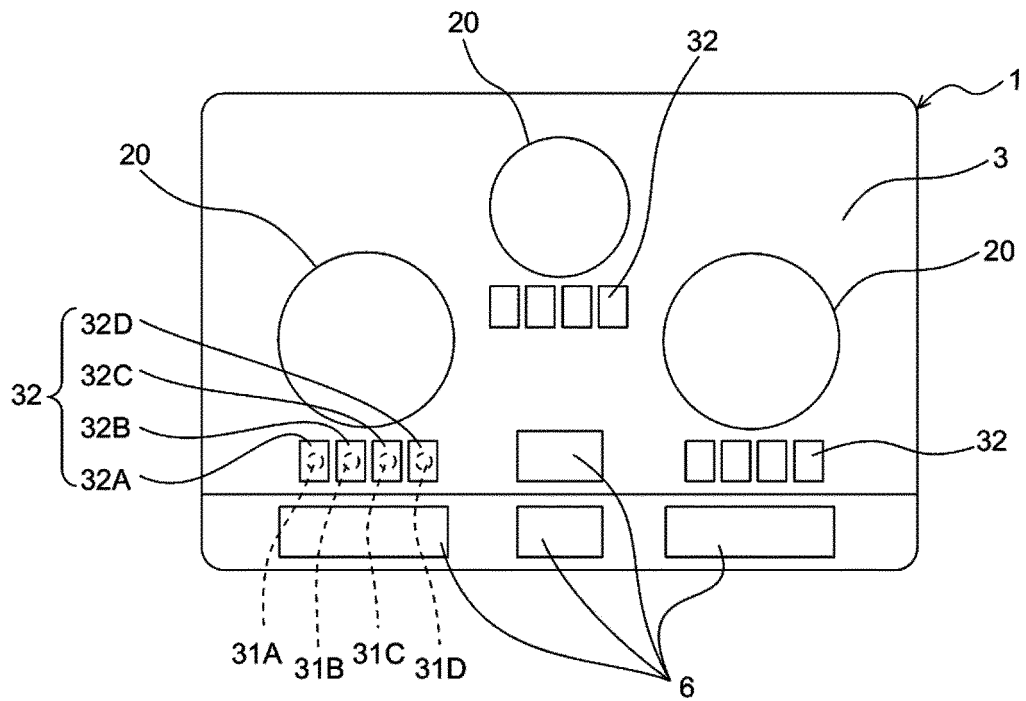


FIG. 16

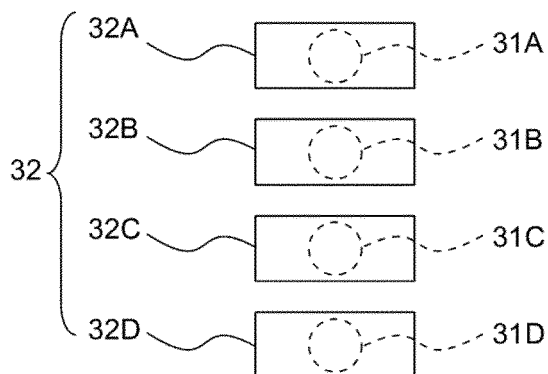


FIG. 17

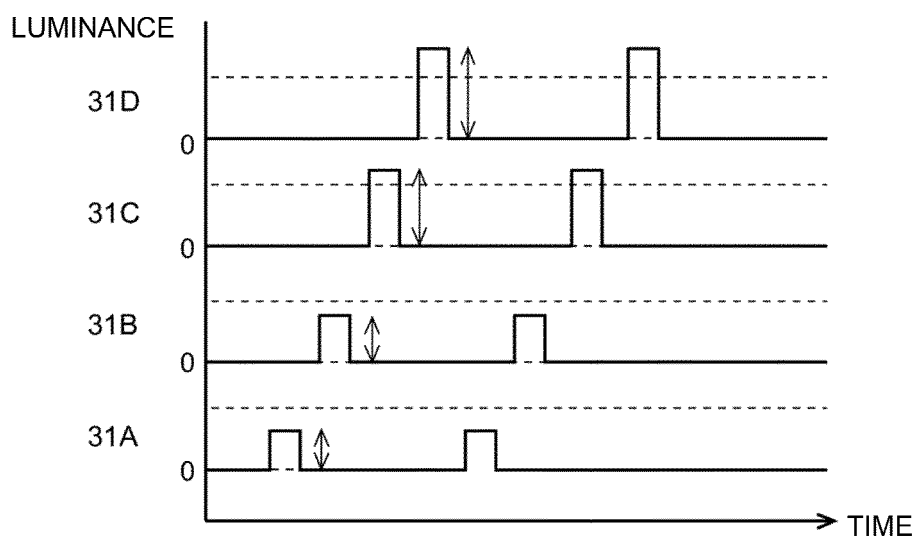
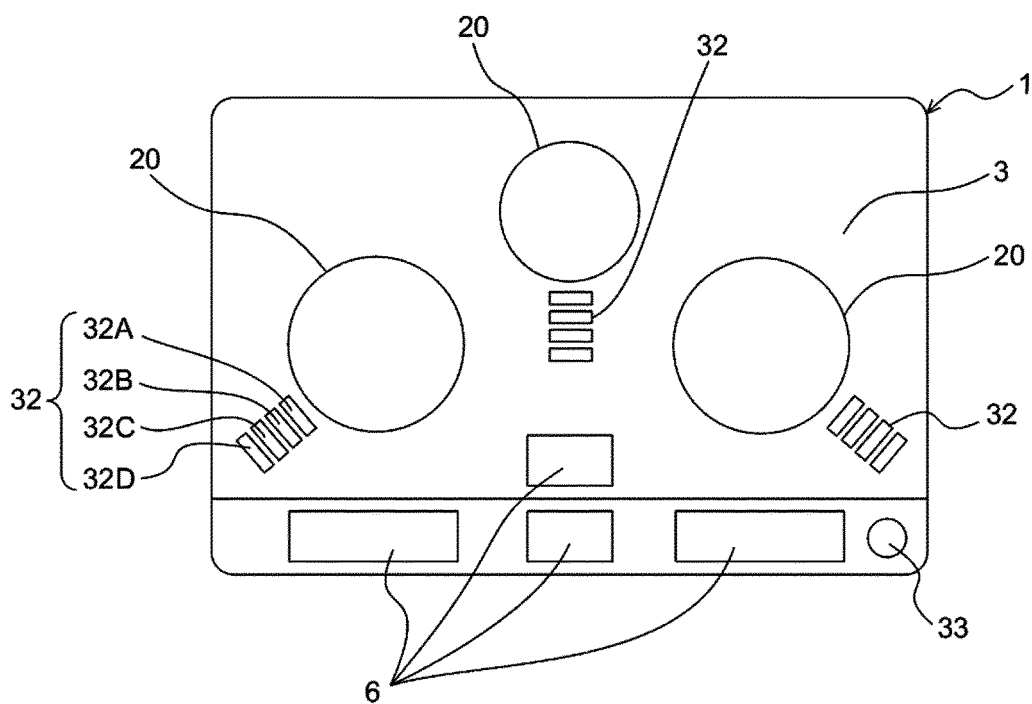


FIG. 18



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/026923

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. H05B6/12 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl. H05B6/12, F24C7/08, F24C15/00, F24C15/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2003-77627 A (SANYO ELECTRIC CO., LTD.) 14	1, 4-5, 9, 13
Y	March 2003, paragraphs [0021]-[0034], fig. 1, 5 (Family: none)	2-3, 6-8, 10-12, 14-20
Y	JP 2005-123054 A (HITACHI HOMETEC LTD.) 12 May 2005, paragraphs [0025]-[0058], fig. 1-3 (Family: none)	2-3, 6-8, 10-12, 14-20



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

05.10.2018

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/026923

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	JP 6-123428 A (RINNAI KK) 06 May 1994, fig. 2 (Family: none)	10-12, 14-20
Y	US 2018/0128493 A1 (ELECTROLUX HOME PRODUCTS, INC.) 10 May 2018, fig. 3 (Family: none)	10-12, 14-20
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Y	JP 2015-41495 A (MITSUBISHI ELECTRIC CORPORATION) 02 March 2015, paragraphs [0042]-[0051] (Family: none)	15-20

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REFERENCES CITED IN THE DESCRIPTION

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