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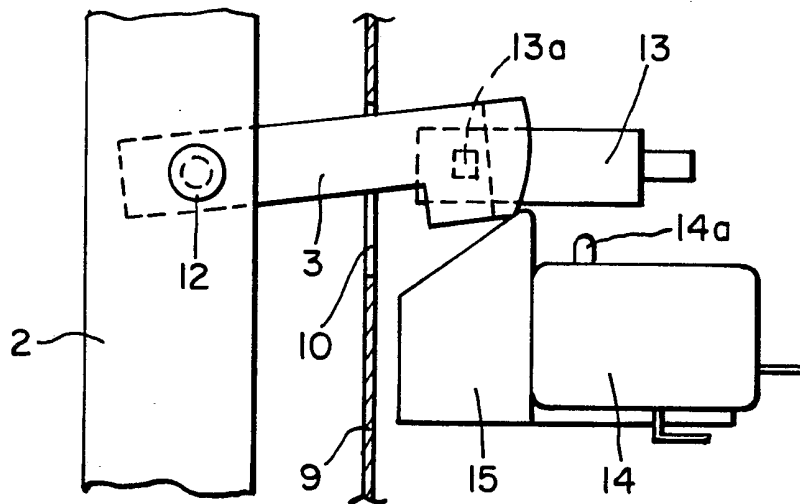
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(71) Applicant Sharp Kabushiki Kaisha (Japan), 22022 Nagaike-cho, Abeno-ku, Osaka, Japan	(58) Field of search H5H Selected US specifications from IPC sub-class H05B
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(54) **Switching arrangement for oven door**

(57) A heating appliance including an oven housing, an oven door attached to the oven housing which can be operated between a closed and an opened positions to provide access to the interior of the oven housing, a door latching assembly for securing the oven door for opening and closing the oven housing, the door latching assembly including a latch head 3 disposed on the oven door 2 and a latch hook provided in the oven housing for engaging with and disengaging from the latch head, a first switch 13 disposed in the oven housing, the first switch being directly switched by the latch head, and a second switch 14 disposed in the oven housing, the second switch being directly switched by the latch head after the switching of the first switch.

FIG. 5.



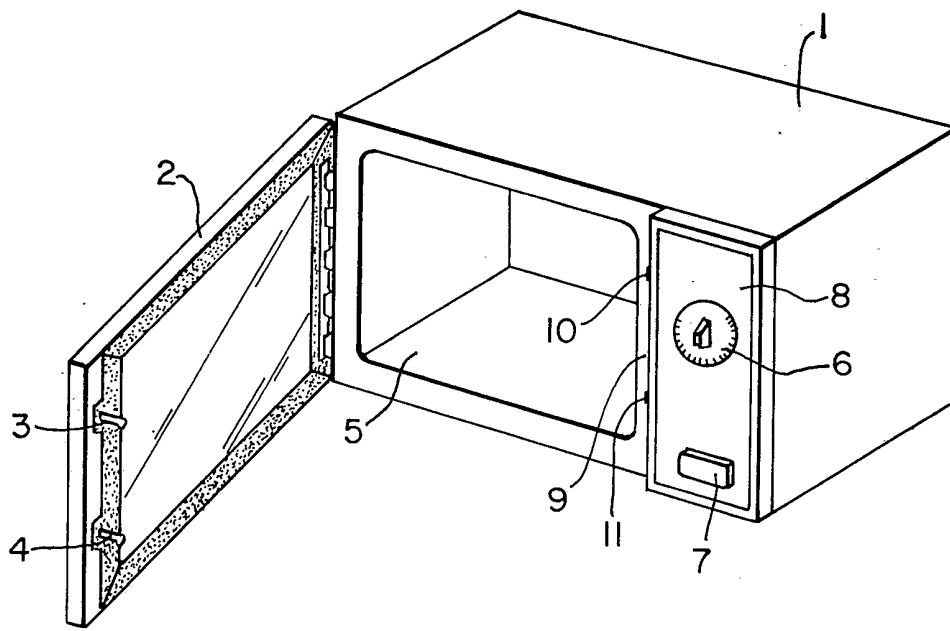


FIG. 1.

FIG. 2.

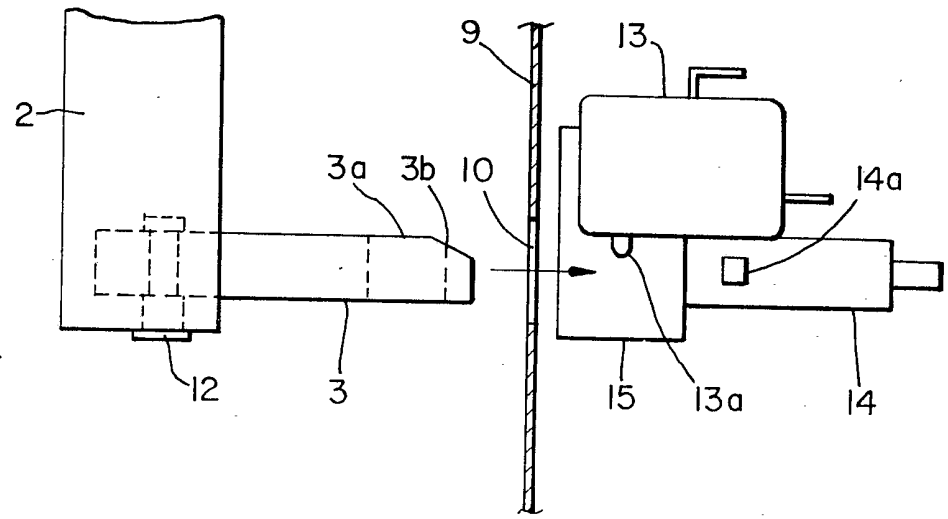


FIG. 3.

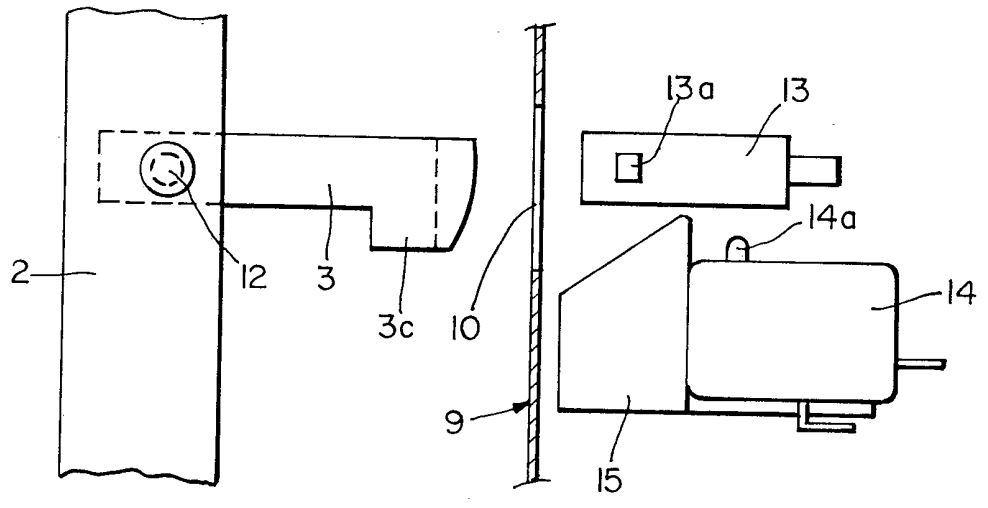


FIG. 4.

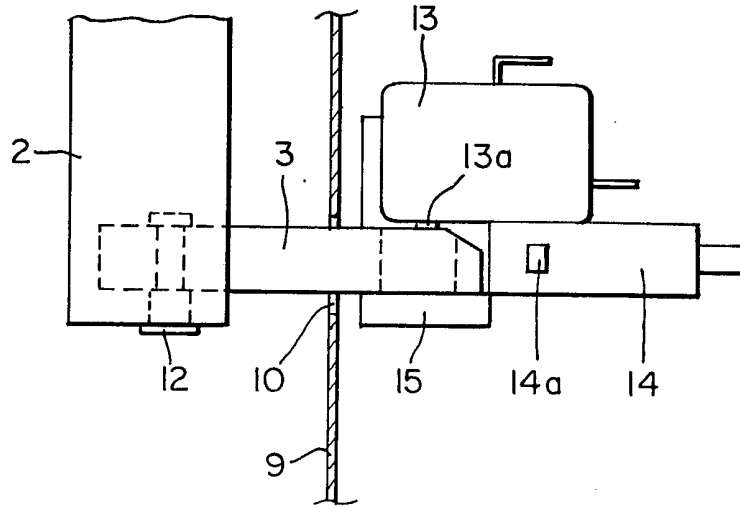
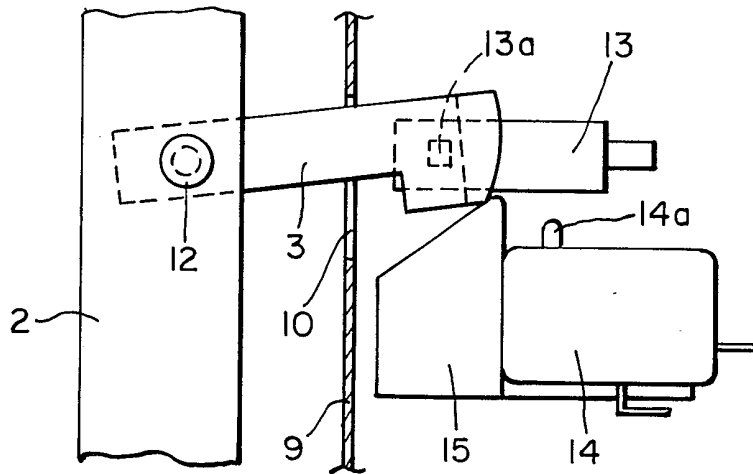


FIG. 5.



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FIG. 6.

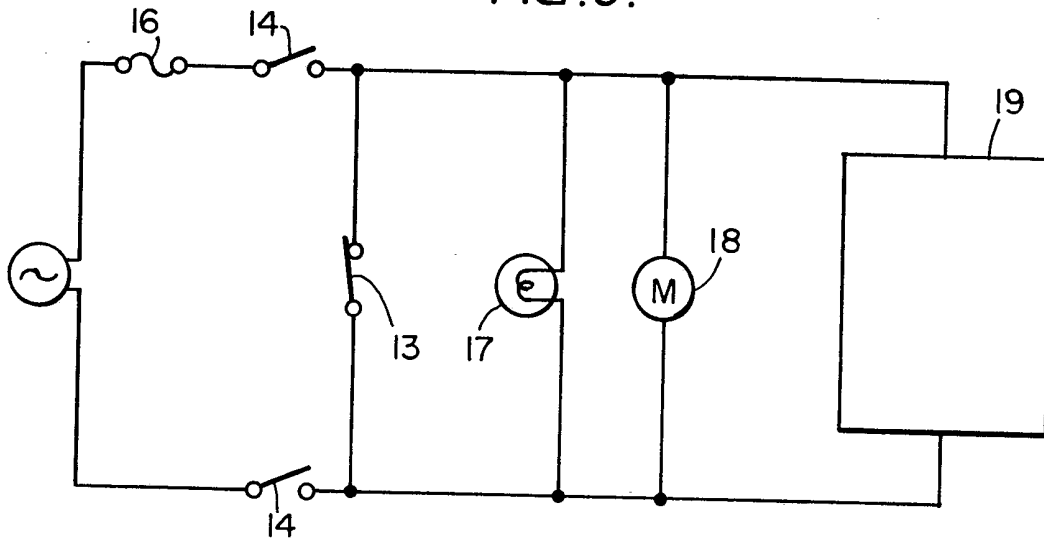


FIG. 7.

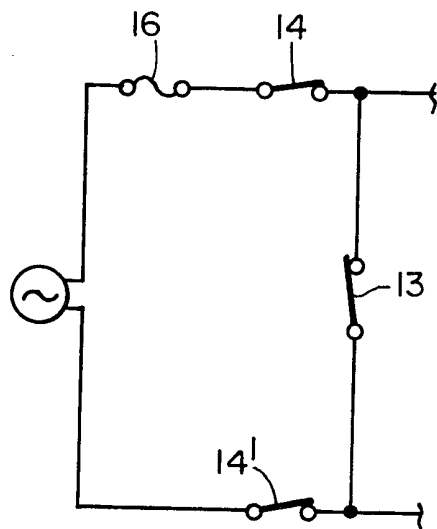


FIG. 8.

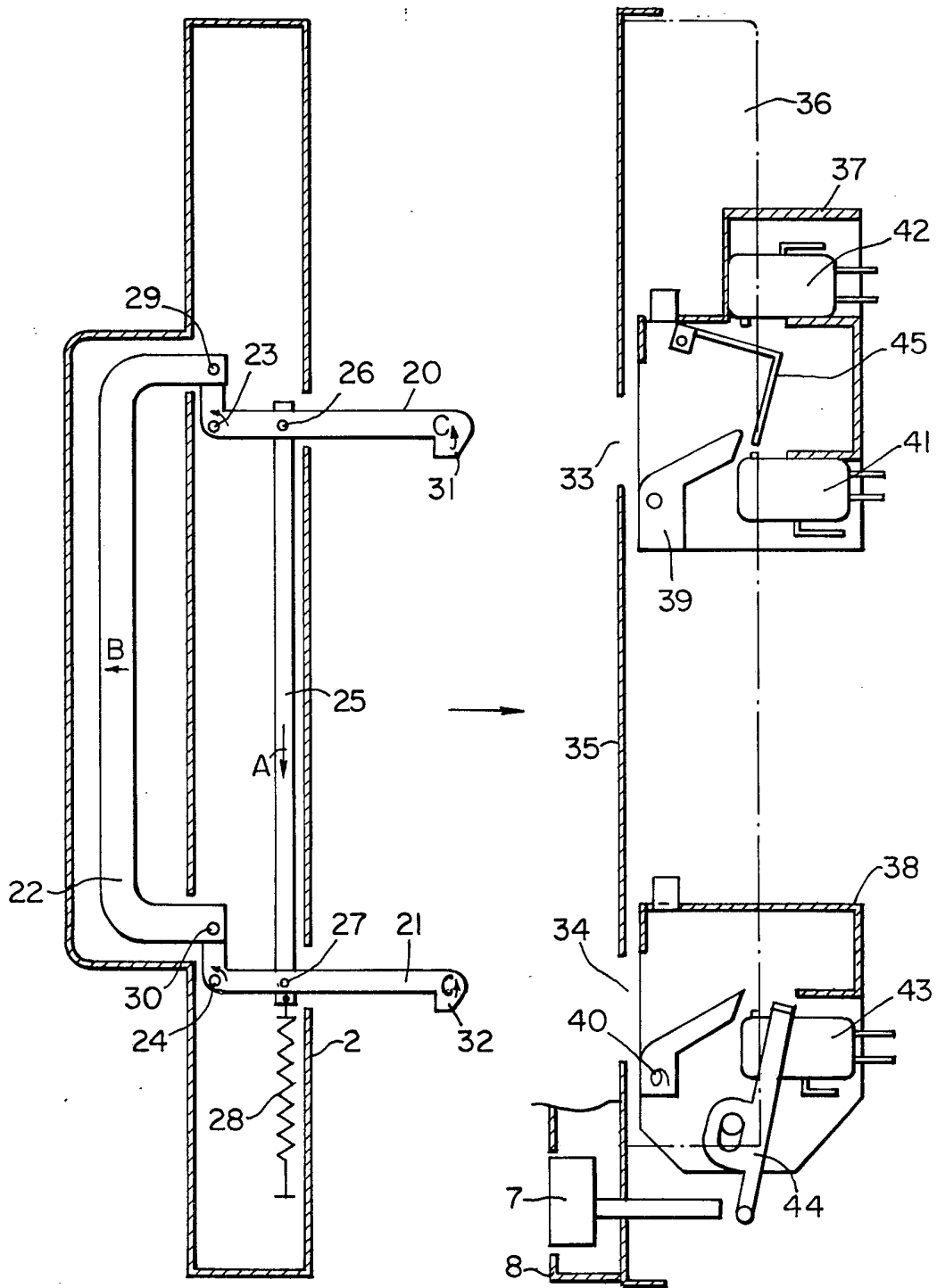


FIG. 9.

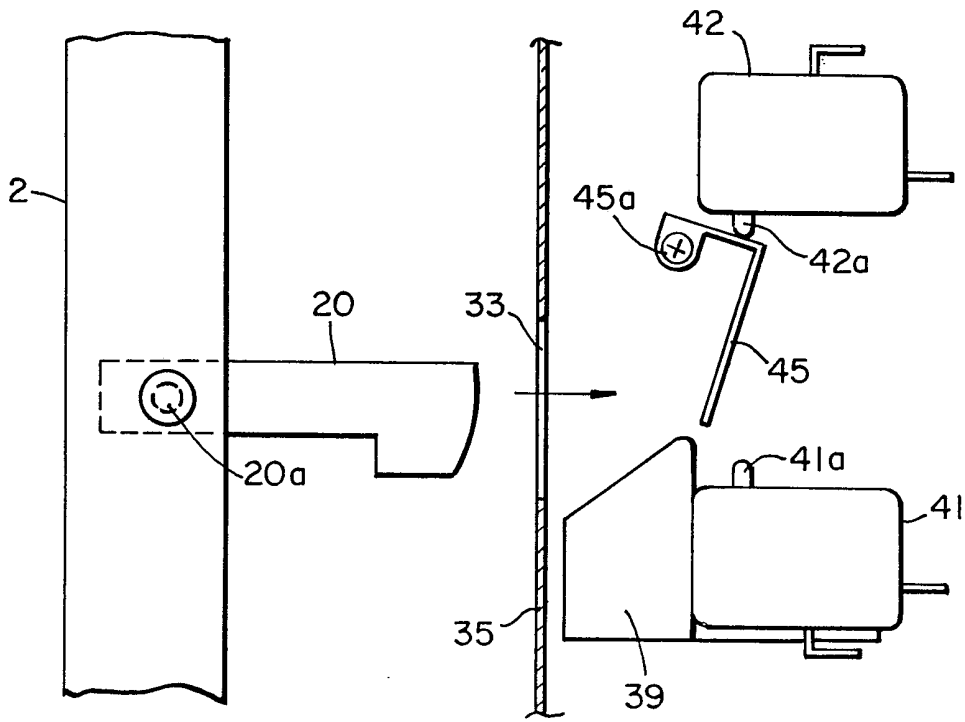
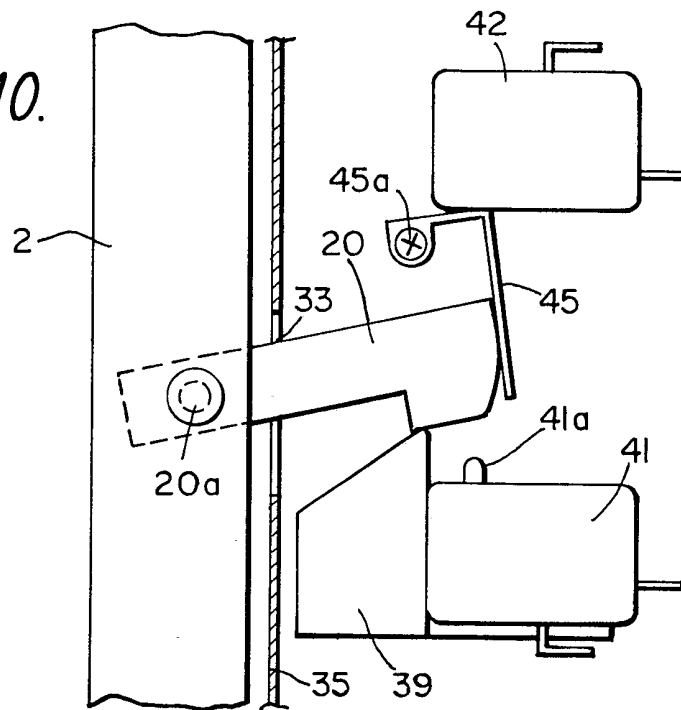


FIG. 10.



## SPECIFICATION

## Heating appliance with switching assembly

## 5 BACKGROUND OF THE INVENTION

The present invention relates to a heat appliance and, more particularly, to a switching assembly for a heating appliance which operates in response to the door opening and closing operations of a heating appliance such as a microwave oven.

A conventional switching assembly for a heating appliance is as shown in Fig. 8, and is disclosed in US Patent No. 4,542,269, entitled "COOKING APPLIANCE WITH SWITCHING ASSEMBLY" by Yasuhiro Sakoda.

Movable latch heads 20 and 21 are, respectively, held by pins 23 and 24 to allow free movement. The latch heads 20 and 21 are connected to a connector lever 25 by pins 26 and 27, respectively. The connector lever 25 is constantly biased by a spring 28 in the direction of arrow A, and is movable vertically. A door handle 22 is coupled to the latch heads 20 and 21 with pins 29 and 30. When the door handle 22 is pulled in the direction of arrow B, the latch heads 20 and 21 turn counterclockwise around pivot pins 23 and 24. As a result, fingers 31 and 32 at the tips of the latch heads 20 and 21, respectively, move in the direction of arrow C. Openings 33 and 34 which are provided on the front panel 35, allow the latch heads 20 and 21 to freely enter or leave the space behind the front panel 35. First and second switch base plates 37 and 38 are respectively secured to the upper and lower parts of the bent side wall 36 of the front panel 35. Latch hooks 39 and 40, engageable with the latch heads 20 and 21, are integrally secured to the first and second switch base plates 37 and 38. When the oven door 2 is closed, the latch heads 39 and 40, respectively, engage the fingers 31 and 32 of the latch heads 20 and 21, thus securely locking the oven door 2 of the microwave oven. The first switch base plate 37 is provided with a first safety switch 41 of the normally open type and a monitor switch 42 of the normally closed type. The second switch base plate 38 is provided with a second safety switch 43 of the normally open type. The second safety switch 43 is a control switch and also functions as a heating switch in cooperation with a heating lever or operating lever 44. These switches 41, 42, and 43 are respectively built into the door locking mechanism so that they can be activated in conjunction with the latch heads 20 and 21, respectively. Thus, the monitor switch 42 is under the control of the L-shaped switch lever 45 which is movable by the depressing movement of the point of the latch head 20. A conventional door mechanism is, also, disclosed in US Patent No. 4,341,409, entitled "DOOR LATCHING ASSEMBLY", by Yasuhiro

Sakoda.

In the conventional switching assembly, the L-shaped switching lever is additionally required for switching the first safety switch 41 and the monitor switch 42, thus requiring much labor during assembly, and making it difficult to reduce the cost and make the compact switching assembly.

## 75 SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved switching assembly for a heating appliance comprising a simplified mechanism.

80 It is another object of the present invention to provide an improved switching assembly for a heating appliance which allows a smoothly switching operation.

It is a further object of the present invention to provide an improved switching assembly for a heating appliance which operates a pair of switches in response to the movement of a latch head of a latch mechanism.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. It should be understood, however, that the detailed description of and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

To achieve the above objects, according to the present invention, a heating appliance comprises an oven housing, an oven door attached to said oven housing which can be operated between a closed and an opened positions to provide access to the interior of said oven housing, a door latching assembly for securing said oven door for opening and closing said oven housing, said door latching assembly comprising a latch head disposed on said oven door and a latch hook provided in said oven housing for engaging with and disengaging from said latch head, first switch means disposed in said oven housing, said first switch means being directly switched by said latch head, and second switch means disposed in said oven housing, said second switch means being directly switched by said latch head after the switching of said first switch means. A contact actuator of said first switch means is directly touched by said latch head.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be better understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention and wherein:

130 *Figure 1* shows a perspective view of a mi-



crowave oven including a switching assembly according to an embodiment of the present invention;

5 *Figure 2* shows an upper plan view of a switching assembly according to an embodiment of the present invention when an oven door is closed;

*Figure 3* shows a sectional view of the switching assembly of Fig. 2;

10 *Figure 4* shows an upper plan view of the switching assembly according to an embodiment of the present invention before the oven door is securely closed;

15 *Figure 5* shows a sectional view of the switching assembly of Fig. 4;

*Figure 6* shows an electrical circuit of a microwave oven;

20 *Figure 7* shows an electrical circuit of the microwave oven when safety switches are closed;

*Figure 8* shows a sectional view of the conventional switching assembly;

25 *Figure 9* shows a sectional view of the switching assembly of Fig. 8 when the oven door closed; and

*Figure 10* shows a sectional view of the switching assembly of Fig. 9 before the oven door is securely closed.

### 30 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 shows a perspective view of a microwave oven including a switching assembly of a preferred embodiment of the present invention. The present invention may be applied to various apparatus other than the microwave oven.

An oven door 2 is secured to a microwave oven 1 via a pivot. Movable latch heads 3 and 4 are provided at the right edge of the inner door periphery, each protruding from the inner door edge surface and having a finger in a tip portion thereof. A control panel 8 that accommodates a timer 6 and a heating button 7 is installed at the right-hand front panel of the microwave oven 1. With food (not shown) being placed in the oven cavity 5, after the closure of the oven door 2, and subsequent manual depression of the heating button 7, cooking (or heating) is performed for a predetermined period by the timer 6.

Fig. 6 shows an electrical circuit of the microwave oven. A safety switch 14 which functions as a door switch is closed when the oven door 2 is closed. The safety switch 14 is of the normally close type, for example, an interlock switch. A monitor switch 13 is opened when the oven door 2 is closed. The monitor switch is of the normally close type. A fuse is designated by numeral 16. When a rated voltage is applied to the circuit of Fig. 6, the oven door 2 is closed, and a cook switch is closed by the heating button 7, an oven lamp 17 is turned on, and a fan motor 18 is driven so that a cooling fan is rotated to

introduce cooling air at each component. At the same time, the voltage is applied to the microwave generator 19 such as a magnetron to generate the microwaves into the oven cavity 5. The heating thereby starts.

70 After the heating completion, in case where when the oven door 2 is opened, the contact actuator 14a of the safety switch 14 accidentally fails to open the circuit of the microwave oven is short-circuited by the monitor switch 13 so that the fuse 16 is forcibly melt. Accordingly, unnecessary microwaves are not generated for safety measure.

80 However, the circuit of the microwave oven may be short-circuited at a moment when the safety switch 14 and the monitor switch 13 are operated at the same timings. Therefore, the fuse 51 may be melt.

85 To resolve the disadvantage, in the conventional switching assembly as shown in Figs. 9 and 10, the L-shaped lever 45 is provided between the monitor switch 42 and the safety switch 41. The latch head 20 presses the L-shaped lever 45 according to the substantially forward movement of the latch head 20 which is pivotally around the pin 20a by a constant angle, and then the contact actuator 42a of the monitor switch 42 is, first, opened, and after the contact actuator 41a of the safety switch 41 is closed by the depression of the finger 31 of the latch head 20.

95 In the conventional switching assembly, the additional components such as the L-shaped lever 45 and the pin 45a are required. It is difficult to reduce the costs and make the compact switching assembly.

100 The preferred embodiment of the present invention will be described below with reference to Figs. 2 through 5. A latch head 3 is rotatably connected with an oven door 2, and is pivotally rotated around a pin 12 by a predetermined angle. A latch hook 15 is provided in the oven housing covering the oven cavity 5 and secured adjacent of the front panel 12 of the oven. The finger 3c of the latch head 3 is engaged with or disengaged from the latch hook 15 according to the opening and closing operations of the oven door 2. A contact actuator 13a of a monitor switch 13 is pressed by the side face 3c of the latch head 3 according to the door closing operation. A contact actuator 14a of a safety switch 14 is pressed by the finger 3c of the latch head 3 according to the door closing operation. The position of the contact actuator 13a as the contact of the monitor switch 13 is closer to the oven door than the position of a contact actuator 14a as the contact of the safety switch 14. The latch head 3 is pivotally provided about the pin 12 by the predetermined constant angle, and is biased by a spring (not shown) in the lower direction. The portion 3b of the latch head 3 is inclined so that the contact actuator 13a of the monitor switch 13 can be moved along the side wall

3b of the latch head 3. Opening 10 provided at the front panel 9 of the oven housing allow the latch head 3 to freely enter into or leave the space behind the front panel 9 of the oven. The latch hook 15 is provided behind the front panel 9 and adjacent to the opening 10.

The safety switch 14 is provided adjacent to the latch hook 15 and includes the contact actuator 14a projected into the path of the latch head 3. The monitor switch 13 is provided over the latch hook 15 and the safety switch 14. The contact actuator 13a of the monitor switch 13 is projected into the path of the latch head 3. The contact actuators 13a and 14a are provided on the path of the latch head 3. The latch head 3 is moved in the substantially horizontal direction, and is rotated via the pin 12 when the latch head 3 is moved along the latch hook 13. In this case, the monitor switch 13 and the safety switch 14 are perpendicular each other so that a direction of the actuating the contact actuator 13a is perpendicular to a direction of actuating the contact actuator 14a. The contact actuator 13a is provided nearer to the front panel 9 than the contact actuator 14a so that the actuating timings of the contact actuators 13a and 14a are different each other. The contact actuators 13a and 14a are touched or depressed by the latch head 3 in response to the opening and closing operations of the door.

The monitor switch 13 and the safety switch 14 may be provided on the switch base plate as shown in Fig. 8. A pair of safety switches 14 and 14' may be provided at the upper portion and the lower portion of the oven housing as shown in Fig. 8, and may be cooperated with a pair of latch heads 3 and 4 provided on the oven door as shown in Fig. 1.

In the above construction, when the oven door 2 is closed, the latch head 3 is inserted between the monitor switch 13 and the safety switch 14 through the space 10 and is engaged with the latch hook 15. First, the tip of the latch head 3 presses the contact actuator 13a of the monitor switch 13 disposed near the oven door 2 so that the contact of the monitor switch 13 is opened so as to open the safety circuit. Second, the finger 3c at the tip of the latch head 3 depresses the contact actuator 14a of the safety switch 14 so that the contact of the safety switch 14 is closed so as to close the main circuit of the microwave oven. Thereafter, when the cook switch is switched on by the cook button 7, the oven lamp 17 is turned on, and the fan motor 18 and the microwave generator 19 such as a magnetron are driven so as to start the cooking. When the oven door 2 is opened after the cook completion, the latch head 3 is lifted up or pivoted in the counterclockwise direction along the latch hook 15 by a con-

necting lever (for example, the connecting lever 25 as shown in Fig. 8). The depression of the finger 3c of the latch head 3 to the contact actuator 14a of the safety switch 14 is released so that the contact of the safety switch 14 is opened so as to open the main circuit of the microwave oven. The depression of the latch head 3 to the contact actuator 13a of the monitor switch 13 is released so that the contact of the monitor switch 13 is closed so as to close the safety circuit.

The release operations of the latch head 3 to the monitor switch 13 and the safety switch 14 are not carried out at the same time because the contact actuator 13a of the monitor switch 13 and the contact actuator 14a of the safety switch 14 are separated each other on the path of the latch head 3. Accordingly, the opening and closing operations of the contacts of the monitor switch 13 and the safety switch 14 are smoothly and separately performed. The opening and closing operations of the contact actuators 13a and 14a of the monitor switch 13 and safety switch 14 is under the control of the latch head 3 which is movable with the oven door 2 between the door closing position and the door opening position, and is rotatable via the pin 12.

As described above, the switching assembly for the heating appliance comprises a latch head provided on the oven door, a latch hook provided on the oven housing including the oven cavity for engaging with or disengaging from the latch head, the monitor switch in which the contact actuator of the monitor switch is depressed by the latch head when the door is closed, the safety switch in which the contact actuator of the safety switch is depressed when the door is closed, wherein the contact actuator of the monitor switch is provided adjacent or nearer the oven door and the contact actuator of the safety switch is further from the oven door. Accordingly, the opening and closing operations of the contact actuators of the monitor switch and the safety switch are smoothly performed and are directly carried out by the latch head without the additional components such as the L-shaped lever. As the contact actuator of the monitor switch is provided on the movement path of the latch head adjacent or near the oven door, and the contact of the safety switch is far from the oven door, the opening and the closing timings of the safety switch are different from the closing and opening timings of the monitor switch, respectively. The contact actuators 13a and 14a are directly touched or depressed by the latch head 3. The tip of the latch head 3 is positioned between the contact actuator 13a and the contact actuator 14a.

The switches should not be limited to the safety switch and the monitor switch. Various switches other than the safety switch and the

monitor switch may be used.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications are intended to be included within the scope of the following claims.

#### 10 CLAIMS

1. A heating appliance comprising:  
an oven housing;

an oven door attached to said oven housing which can be operated between a closed and an opened positions to provide access to the interior of said oven housing;

a door latching assembly for securing said oven door for opening and closing said oven housing said door latching assembly comprising a latch head disposed on said oven door and a latch hook provided in said oven housing for engaging with and disengaging from said latch head;

first switch means disposed in said oven housing, said first switch means being directly switched by said latch head; and

second switch means disposed in said oven housing, said second switch means being directly switched by said latch head after the switching of said first switch means.

2. The heating appliance of claim 1, wherein said first switch means is directly touched by said latch head.

3. A heating appliance comprising:  
an oven housing;

an oven door attached to said oven housing which can be operated between a closed and an opened positions to provide access to the interior of said oven housing;

a door latching assembly for securing said oven door in the closed position, said door latching assembly comprising a latch head movably disposed on said oven door and a latch hook disposed in said oven housing for engaging with said latch head when said oven door is placed in the closed position;

said latch head being moved in the substantially horizontal direction according to the opening and the closing operations of said oven door;

first switch means disposed in said oven housing, and having a first contact actuator being disposed on the movement path of said latch head so that said first contact actuator is directly depressed by said latch head according to the closing operation of said oven door; and

second switch means disposed in said oven housing, and having a second contact actuator being disposed on the movement path of said latch head so that said second contact actuator is directly depressed by said latch head according to the closing operation of said oven door after the depression of said first contact actuator of said first switch means.

4. The heating appliance of claim 3, wherein said first contact actuator of said first switch means is directly touched by said latch head.

5. An electrical appliance in which a door is movable relative to a housing between open and closed positions, and in which a door latching mechanism is provided for releasably holding the door in its closed position,

wherein electrical switch means responsive to the opening and closing of the door comprises first and second switches which are arranged to be switched one after the other directly by a common latch member of said latching mechanism, said latch member and said switch means being relatively movable during such opening and closing of the door.

6. An electrical appliance according to claim 5 wherein said first and second switches have respective movable actuators for switch operation, and are arranged so that said actuators are contacted by different surface portions of said latch member and are moved in respective different directions relative to the direction of relative movement of the latch member and the switch means.

7. An electrical appliance substantially as hereinbefore described with reference to Figs. 2 to 5 of the accompanying drawings.

8. A heating appliance substantially as hereinbefore described with reference to Figs. 2 to 5 of the accompanying drawings.

9. A microwave oven substantially as hereinbefore described with reference to Figs. 2 to 7 of the accompanying drawings.

10. A microwave oven substantially as hereinbefore described with reference to Figs. 1 to 7 of the accompanying drawings.

#### 105 CLAIMS

Amendments to the claims have been filed, and have the following effect:—

Claims 1–5 above have been deleted or textually amended.

110 New or textually amended claims have been filed as follows:—

Claims 6, and 7–10 above have been re-numbered as 2 and 8–11 and their appendancies corrected.

115

1. An electrical appliance in which a door is movable relative to a housing between open and closed position, and in which a door latching mechanism is provided for releasably holding the door in its closed position, wherein electrical switch means responsive to the opening and closing of the door comprises first and second switches which are arranged to be switched by direct contact with a common latch member of said latching mechanism, said latch member and said switch means being relatively movable during such opening and closing of the door to cause sequential operation of said first and second switches.

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3. An electrical appliance according to claim 1 or claim 2 wherein said common latch member is mounted on the door, and said electrical switch means is mounted in said housing, the latching mechanism including a further latch member, mounted in the housing, for engaging said common latch member to hold the door in its closed position.
4. An electrical appliance according to claim 3, the arrangement being such that on closure of the door, the second switch is actuated as the common latch member and the further latch member come into mutual latching engagement, after the actuation of the first switch.
5. An electrical appliance according to any preceding claim including an electrical load and a safety circuit which includes said switch means, permitting the load to be energised only when the door is closed, the first switch being connected across the load and being arranged to be opened on closing of the door, prior to the closing of the second switch, which is connected in series with the load.
6. An electrical appliance according to any preceding claim wherein the housing defines a heating chamber, said door providing access to said heating chamber in said open position.
7. An electrical appliance according to any preceding claim wherein the common latch member and the switch means are relatively horizontally moveable on opening and closing of the door.