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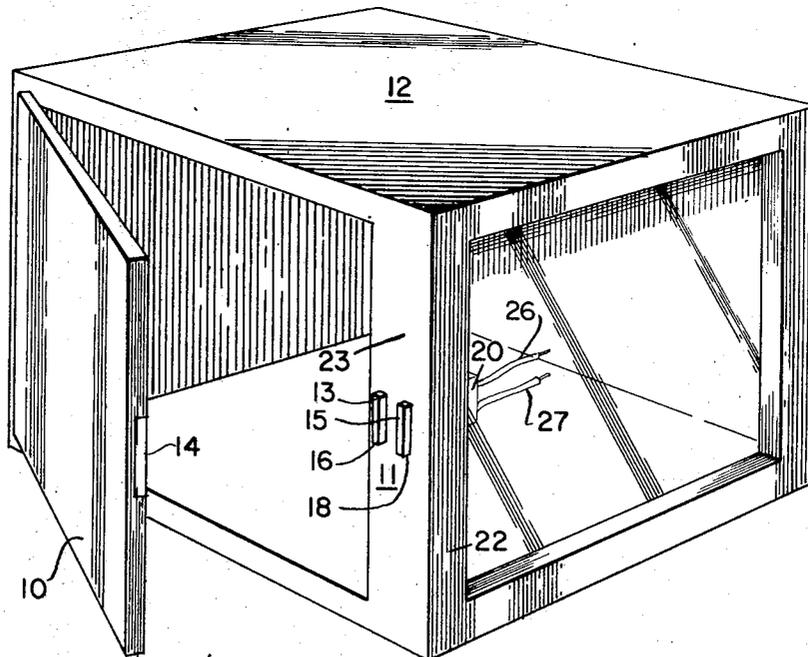
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[54] **MAGNETIC LATCHING AND SWITCHING**  
**10 Claims, 4 Drawing Figs.**

[52] U.S. Cl. .... **200/61.62,**  
 335/205, 335/230, 219/10.55  
 [51] Int. Cl. .... **H01h 3/16**  
 [50] Field of Search ..... 200/61.62,  
 205, 206, 207; 335/205, 206, 207; 219/10.55

**ABSTRACT:** A door latch and magnetically actuatable switch includes an H-shaped permanent magnet and pole assembly for both latching and switching having a first pair of pole ends that are shunted by a striker plate of low-reluctance ferromagnetic material located in the door when the door is closed. Opening the door removes the shunt to actuate a magnetic switch located near a second pair of pole ends of the permanent magnet.



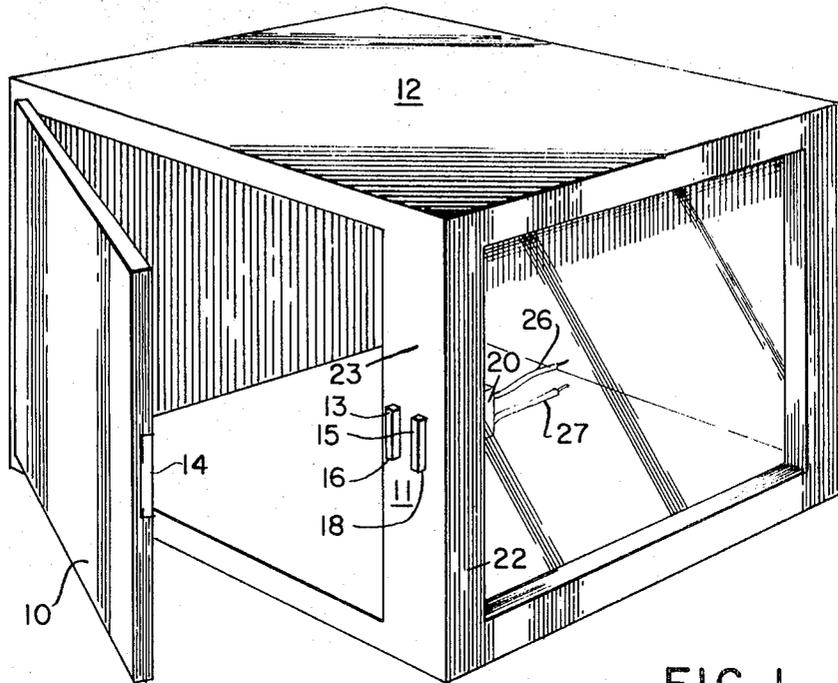


FIG. 1

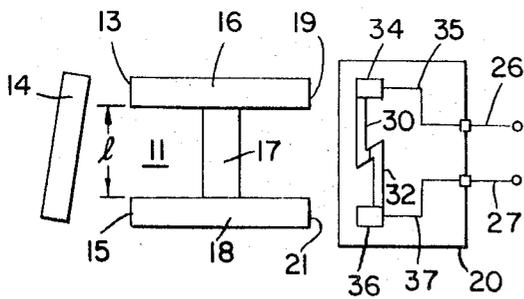


FIG. 2A

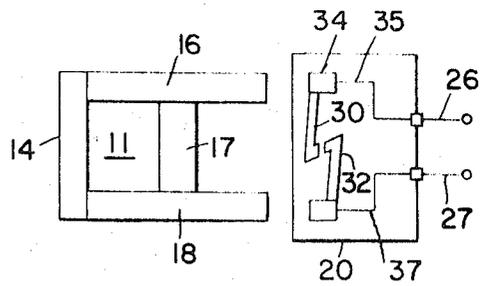


FIG. 2B

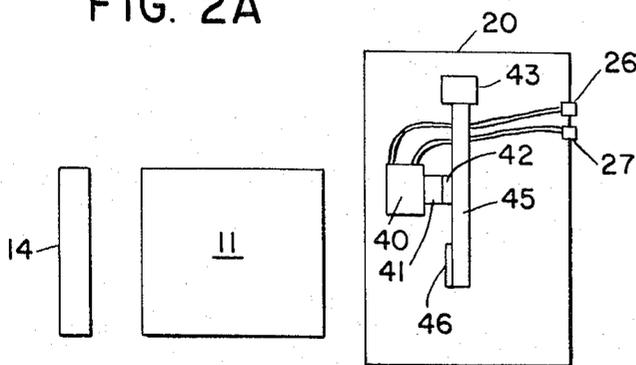


FIG. 3

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## MAGNETIC LATCHING AND SWITCHING

## BACKGROUND OF THE INVENTION

The present invention relates in general to magnetically latching and switching and more particularly concerns a novel system especially useful for a microwave oven in which a magnet both latches a door and actuates a switch.

In typical prior art microwave ovens a mechanically actuated switch deenergizes the microwave source when the door is opened to prevent the escape of potentially harmful radiation. Apart from cost considerations separate latch and switch mechanisms improperly adjusted may allow the microwave source to be energized while the radiation seal around the door has been broken.

It is an object of the invention to provide an improved door latch and switch arrangement.

It is a further object of the invention to magnetically latch and switch substantially simultaneously.

Still another object of the invention is to satisfy the above object reliably, inexpensively and relatively free from complexity.

## SUMMARY OF THE INVENTION

According to the invention, the latch and switch arrangement includes a magnet preferably used for both latching and switching. In one embodiment of the invention a permanent magnet with two pole ends contacts the door to latch it closed. The door includes a shunting member of low-reluctance ferromagnetic material that bypasses flux from a magnetic flux responsive switch adjacent to the magnet when the door is closed to deactivate the switch. Opening the door removes the bypassing effect to actuate the switch as it receives additional flux from the magnet.

Numerous other features, objects and advantages of the invention will now become apparent from the following specification when read in conjunction with the accompanying drawings in which:

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the microwave oven showing the door latch and switch according to the invention;

FIGS. 2A and 2B are top views of the magnetic latch and switch with the door open and closed, respectively; and

FIG. 3 is a side view of an alternate embodiment for the magnetic switch.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIG. 1 there is shown a perspective view of a microwave oven 12 having a magnetic latch and switch actuator according to the invention. Door 10 includes a recessed magnetic striker plate 14. A doorjamb 22 has a surface 23 facing striker plate 14 when the door is closed. Magnet assembly 11, which is shown in more detail in FIGS. 2A and 2B, respectively, includes low-reluctance pole ends 16 and 18 with respective pole faces 13 and 15 protruding slightly from surface 23 as shown in FIG. 1. Doorjamb 22 is fabricated of a nonmagnetic, high-reluctance, material to prevent flux loss through the oven itself. Switch 20 includes leads 26 and 27 which may connect to external circuitry (not shown).

When door 10 is open as shown, switch 20 receives flux coupled from magnet assembly 11. When the door is closed, striker plate 14 shunts pole faces 13 and 15 of magnet assembly 11 to deactivate switch 20 by reducing the flux it receives.

FIGS. 2A and 2B show top views of one embodiment of a latch and reed switch arrangement with the door in open and closed positions, respectively. Referring in particular to FIG. 2A, there is shown an H-shaped magnet assembly 11 including low-reluctance pole ends 16 and 18, magnet 17 and pole faces 13, 15, 19 and 21. Striker plate 14 is then away from pole faces 13 and 15. Switch 20, which is located near pole faces 19

and 21 of magnet assembly 11, is shown in FIG. 2A in a closed position when the door is open. The magnetic flux between pole faces 19 and 21 flowing through switch contacts 30 and 32 and support elements 34 and 36 is large enough to keep contacts 30 and 32 closed when plate 14 is not shunting pole faces 13 and 15. Contact arms 30 and 32 typically comprise ferromagnetic material. Wires 35 and 37 connect contact arms 30 and 32 to respective external leads 26 and 27.

In FIG. 2B striker plate 14 is shown shunting pole faces 13 and 15 when the door is closed to open switch 20 because the flux through contact arms 30 and 32 is then reduced to a level insufficient to keep them closed.

It has been found that the shape of the pole pieces 16 and 18 shown in FIGS. 2A and 2B provides the following functions: (1) a magnetic field in the vicinity of the switch that provides for efficient switch closure when the door is only slightly opened. (2) isolation between the magnet and switch so that stray magnetic leakage will not hold the switch closed after the door is shut; and (3) a convenient surface for the striker plate to short the magnetic field. The invention thus assumes substantially simultaneous switch actuation and door-opening reliability with relatively few components.

In FIG. 3 there is shown another embodiment of switch 20. This variation includes an arm 45 supported at one end by support member 43, and having a ferromagnetic contact 46 affixed to the other end. Arm 45 also includes an actuator shoulder 42 for pressing button 41 of switch 40 when the door is open as shown in FIG. 3. As with the embodiment of FIG. 2, when the door is open, ferromagnetic contact 46 moves toward magnet assembly 11, thereby pulling arm 45 to the left and pressing button 41. When the door is closed and striker plate 14 shunts magnet assembly 11, contact 46 moves away from magnet assembly 11, thereby releasing button 41.

Other variations may be practiced. For example, the magnet 17 may be an electromagnet. Switches with different poles and throws may be used. Also, a U-shaped magnet assembly could be used. Among the uses of the invention, it may be used as a proximity switch in other types of devices where accurate spatial control is desired.

It is evident that those skilled in the art may now make numerous uses and modifications of the specific embodiments described herein without departing from the inventive concepts. Consequently, the invention is to be construed as embracing each and every novel feature and novel combination of features present in or possessed by the apparatus and techniques herein disclosed and limited solely by the spirit and scope of the appended claims.

What is claimed is:

1. Magnetic switching and latching apparatus comprising;

first and second members,

said first member being movable toward and away from said second member,

magnetically actuatable switching means and a magnetic assembly both carried by one of said first and second members,

a magnetic flux shunting means carried by the other of said members and having an exposed surface,

said magnetic assembly including a permanent magnet and a pair of low-reluctance pole pieces secured to opposite ends of said permanent magnet and extending toward both said magnetically actuatable switching means and said magnetic flux shunting means when said first and second members are in close proximity,

said pole pieces having exposed faces positioned to contact the exposed surface of said shunting means when said members are moved together,

thereby completing a magnetic circuit through said permanent magnet that results in a force sufficient to hold said members together, and to actuate said switching means,

whereby the flux coupling to said switching means is reduced when said members are together to thereby cause said actuation.

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2. Magnetic, switching and latching apparatus in accordance with claim 1 wherein said first member includes a door for carrying said magnetic flux shunting means and said second member includes a container defining an opening to be covered by said door when closed, said magnetically actuatable switching means and said magnetic assembly being carried by said container.

3. Magnetic switching and latching apparatus in accordance with claim 1 wherein said switching means is positioned in fixed close relationship to said magnetic assembly.

4. Magnetic switching and latching apparatus in accordance with claim 3 wherein said switching means is positioned adjacent the end of said pole pieces opposite to the ends having the exposed faces.

5. Magnetic switching and latching apparatus in accordance with claim 2 wherein said magnetic flux shunting means comprises a striker plate of low-reluctance material seated in a recess in said door.

6. Magnetic switching and latching apparatus in accordance with claim 2 wherein said switching means comprises a magnetic reed switch.

7. Magnetic switching and latching apparatus in accordance with claim 2 wherein said door and container comprise a microwave oven.

8. Magnetic switching and latching apparatus in accordance with claim 2 wherein said switching means comprises a cantilevered arm having ferromagnetic material near the free end thereof for being attracted toward said magnetic assembly when said door is open,

10 and a mechanically actuated switch operated when said door is closed and said arm is released by said magnetic assembly.

9. Magnetic switching and latching apparatus in accordance with claim 1 wherein said magnetic assembly includes an H-shaped member with said pole pieces forming the legs of the member and the permanent magnet forming the crossing part of the member.

10. Magnetic switching and latching apparatus in accordance with claim 9 wherein said pole pieces extending relatively horizontally and parallel to each other.

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