March 29, 1966 R. J. SUTTON 3,243,565

PIVOTAL SWITCH-OPERATING ASSEMBLY

Filed July 22, 1964

FIG. 1

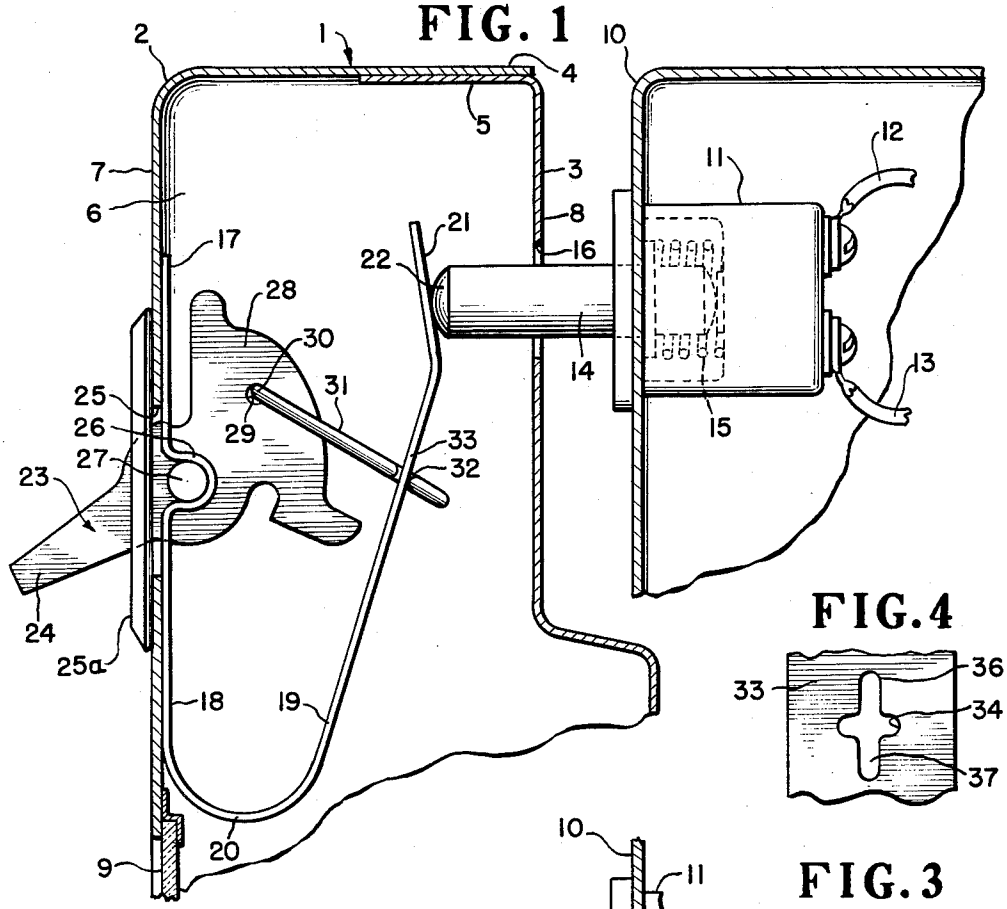


FIG. 4

FIG. 2

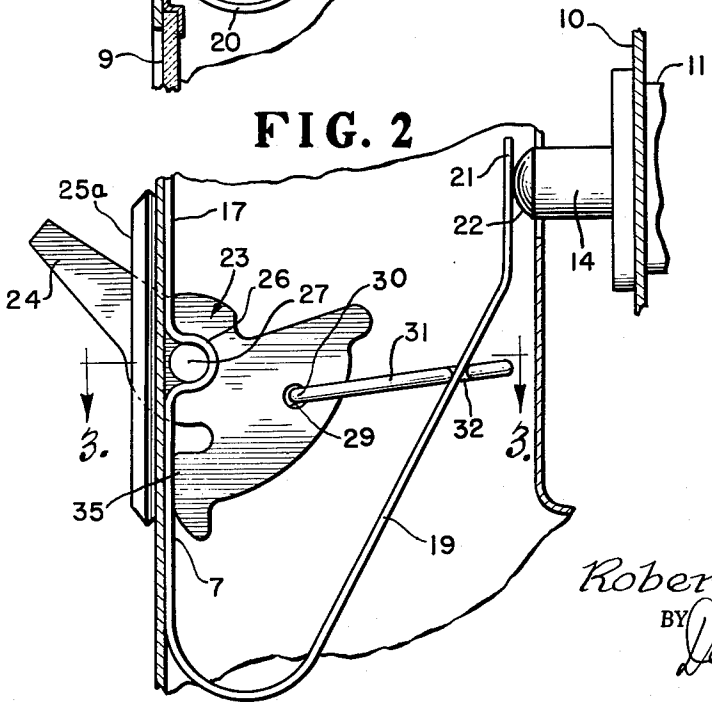
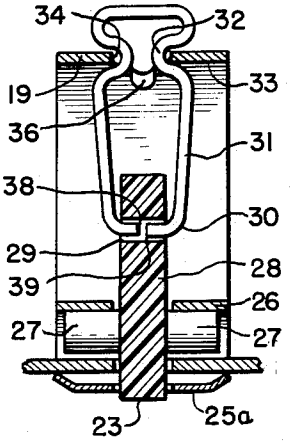


FIG. 3



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3,243,565

PIVOTAL SWITCH-OPERATING ASSEMBLY

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This invention relates to switch-operating assemblies, and more particularly to such assemblies wherein the structure is of the type which may be separated from the switch, such as, for instance, assemblies intended to be included in closure members and to operate a switch when in closed position.

It is a common expedient, in many structures having closure members, or doors, to provide a switch which operates when the door is opened so as either to complete a circuit or open a circuit. Such switches are of the utmost importance in, for instance, appliances such as dishwashers and clothes dryers in order to make sure that the appliance is not operating when the door is opened. Also, in appliances such as dryers and ovens it is highly desirable that, when the door is opened, a lighting circuit be completed for the benefit of the operator of the appliance.

In recent years, the use of glass in the closure member of appliances such as ovens has substantially increased; with this increase, there has come about the need to be able to turn on a light in the oven without opening the oven door so that the operator may view what is happening. As a result, many oven doors incorporate a "peek" switch. This structure, as normally provided, causes the closing of the oven door to close the door switch in the normal manner (usually to turn off an oven light), but further permits the door switch to be manually released to turn on the oven light just as though the door were open.

Such arrangements have proven difficult to design for long life without excessive expense, and it is an object of my invention to provide such a switch-operating arrangement which is economical to manufacture and highly effective in operation.

A further, more specific, object of my invention is to provide such a structure by the use of a rigid link member in cooperation with a pivoted arm in order to effect the desired movement of the door switch by manual operation.

In one aspect of my invention I provide my structure for use in a hollow door which is intended to close against a door frame having a switch-operating member biased to extend therefrom. On its inner side the hollow door has an opening through which the member extends when the door is closed.

On the outer side of the door, a manually operable member is pivotally mounted for movement between first and second positions. Within the door there is an arm, pivotally mounted and positioned with its free end bearing against the switch-operating member when the door is closed. A rigid link member is pivotally mounted at its one end to the manually operable member within the door, and at its other end to the arm between the ends thereof. In its first position, the manually operable member, through the link, causes the arm to push the switch-operating member toward the door frame to its operative position. In its second position, the manually operable member causes the arm to pivot away from the door frame, and thus permits the switch-operating member to return to its biased position.

This arrangement, including the link member, permits use of a switch which is very economical, and at the same time operates very easily and reliably.

The subject matter which I regard as my invention is

particularly pointed out and distinctly claimed in the concluding portion of this specification. My invention, however, both as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawing.

In the drawing,

FIGURE 1 is a fragmentary side elevational view, partly in cross-section, of a door and door frame incorporating the improved switch-operating assembly of my invention;

FIGURE 2 is a fragmentary view similar to FIGURE 1, showing the mechanism in a different position;

FIGURE 3 is a view along line 3—3 of FIGURE 2; and

FIGURE 4 is a fragmentary plan view of one of the elements shown in FIGURE 3.

Referring now to FIGURE 1, there is shown a door member, generally indicated at **1**, which is made of a pair of sheet metal members **2** and **3** having flanges **4** and **5** respectively. The flanges are joined together so that a hollow space **6** is provided between the surfaces, or panels, **7** and **8** which form the actual door. While no appliance is shown, it may be assumed that door **1** is intended to be used as the closure member for an appliance such as an oven. A window section **9** is formed in the door to allow the user of the appliance to see through the door what is happening inside. The door closes against a door frame generally indicated at **10**. While the entire frame is not shown, it will be understood that the frame conventionally forms a substantially rectangular opening, and that door **1** is movable between a position in which it covers the opening and a position in which it uncovers the opening.

An electric switch, schematically indicated by the numeral **11**, is rigidly mounted on the frame **10**. Suitable electric leads **12** and **13** may be provided extending to the switch so as to permit completion of a circuit depending upon the position of a switch-actuating member **14** which extends outwardly from the door frame **10**. As shown in dotted outline, a spring **15** may be provided as a part of the switch **11** so as to bias member **14** to the position shown in FIGURE 1. When door **1** is closed, member **14** extends through an opening **16** formed in inner door panel **8**.

A leaf spring member **17** has a flat arm **18** thereof rigidly secured against the inner surface of door panel **7** of the door. Arm **18** is joined to a movable arm **19** by a connecting curved portion **20**. Portion **20**, in effect, serves as a pivot for arm **19**, as will appear more clearly herebelow. The free end **21** of spring arm **19** is positioned so as to bear against the end **22** of member **14**.

A member **23** having a manually operable portion **24** extending through an opening **25** in door part **7** is pivotally secured so that part **24** may be flipped to an "up" or a "down" position in the usual manner. Securement of member **23** is achieved by providing a U-shaped indentation **26** in part **18** of spring **17**. Indentation **26** cooperates with the wall **7** to enclose a pivot pin **27** formed as a part of member **23** and extending from the main body thereof on each side (see FIGURE 3). It will readily be seen that as handle part **24** is moved up and down, pin **27** will pivot within the enclosure formed by identation **26** and wall **7**.

Within space **6** inside the hollow door, member **23** has a body portion **28** with an opening **29** formed therein. In the opening there is pivotally secured the end **30** of a longitudinally rigid link member **31**. The link member has a necked-down section **32** adjacent its other end (FIGURE 3) which is pivotally secured to an intermediate portion **33** of spring arm **19**. Link **31** is

thus positioned in space 6 with its length extending generally between panels 7 and 8.

It will readily be seen that the distance between pivot points 30 and 32 of link 31 is constant, and that end 30 of link 31 is moved in an arc about the center of rotation represented by the pin portion 27 of member 23. Consequently, in view of the retention of section 32 within opening 34 of spring arm 19, and as the distance of point 30 from wall 7 increases during pivoting of member 23, the distance of point 32 therefrom must necessarily also increase. This has the ultimate result of pushing spring arm 19 toward panel 8 by pivoting the arm 19 about curved portion 20 as a pivot point.

This movement of spring arm 19, away from panel 7 and toward panel 8, causes end 21 of spring arm 19 to move from the position shown in FIGURE 1 to the position shown in FIGURE 2. Because end 21 bears against the end 22 of member 14, member 14 is pushed in, against the action of spring 15, to the position shown in FIGURE 2. This constitutes an exceedingly simple and easy way of transmitting the desired force to push in operating member 14 by pivoting motion of handle part 24. There are no camming surfaces to develop high frictional forces; rather, force transmission is through pivoting members.

It will be seen that with the member 24 in the position of FIGURE 2, the operating member 14 is in the depressed condition when the door is closed, that is, it operates the switch so that, if the switch controls a lighting circuit, the lighting circuit is opened when the door is closed. However, even with the door closed the member 14 may be released to permit the lighting circuit to be completed by pivoting the member 24 downwardly to the position of FIGURE 1; in this position, member 14 assumes the same position it would have if the door were open.

It will also be seen that there is an over-center toggle-type relationship provided. In other words, with the structure in the position of FIGURE 2, the forces transmitted from member 14 through spring arm 19 to link 31 tend to cause member 23 to pivot in a clockwise direction; this maintains member 23 in the position of FIGURE 2, with portion 35 thereof abutting against the inside surface of panel 7. On the other hand, when handle 24 is moved up to the position of FIGURE 1, pivot point 30 moves over center, i.e., to the other side of a straight line joining pin 27 and point 32. This results in a transmission of forces from member 14 tending to cause member 23 to pivot counterclockwise. Consequently, member 14 also helps maintain member 24 in the position of FIGURE 1.

Referring now to FIGURES 3 and 4, opening 34 is actually one slot, or line, of a cross-shaped opening 36. Opening 36 also has a slot 37, at substantially right angles to, and somewhat longer than, slot 34. Slot 34 is formed to be substantially parallel to the axis of opening 29. Link 31 is a wire member bent to the shape best shown in FIGURE 3. The shape of the link and the shape of opening 36 permit an exceedingly quick and easy assembly at the factory: link 31 may be inserted in slot 37, and then, when the necked-down section 32 is within the opening, the link may be turned 90° so as to fit within slot 34. In this position it is then a simple matter to spread apart the two ends 38 and 39 of link 31 so that they may enter opening 29. Then the ends may be released, and the spring characteristics of link 31 will cause the ends to approach each other, either in abutting relationship or adjacent thereto, as shown in FIGURE 3. This makes the assembly of link 31 to member 23 and spring arm 19 a very simple matter, requiring very little time.

It will be understood that, while in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made thereon without departing from the invention, and it is therefore intended in the apended claims to cover all such equivalent variations as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a device having a switch-operating member biased to extend forwardly from a door frame, and a hollow door arranged to close against the frame, the door having an opening on its inner side through which the member extends when the door is closed, the improvement comprising:
   (a) a pivotally mounted manually-operable member extending from the outer side of said door and movable between first and second positions;
   (b) an arm pivotally mounted within said door and positioned with its free end bearing against said switch-operating member when said door is closed;
   (c) and a rigid link member pivotally mounted at its one end to said manually operable member and at its other end to said arm intermediate the ends thereof, said manually operable member in its first position causing said arm to push said switch-operating member toward said door frame to its operative position, said manually operable member in its second position causing said arm to pivot away from said door frame and permit said switch-operating member to return to its biased position.

2. The device defined in claim 1 wherein said arm is a spring which pivots by deforming about one end thereof which is secured to said door.

3. The device defined in claim 1 wherein said link transmits force from said switch-operating member to maintain said manually operable member in its first position when said manually operable member is in that position, said link passing over center so as to transmit force from said switch-operating member tending to keep said manually operable member in its second position when said manually operable member is in that position.

4. The apparatus defined in claim 1 wherein said link member is formed of a single continuous piece of wire having its two ends aligned with each other to form one end of said link, and having a necked-down portion forming the other end thereof, said arm having a cross-shaped opening formed therein with a longer and a shorter slot, said manually operable member having an opening therein substantially parallel to said shorter slot and within which said aligned ends of said wire are received to provide the pivotal mounting for said link member.

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