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Lay et al.

[11] **3,857,002**

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[54] **SAFETY MECHANISM FOR LAUNDRY APPLIANCES WITH DOOR LATCH FOR ACTUATING MAIN SWITCH**

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[73] Assignee: **Westinghouse Electric Corporation**, Pittsburgh, Pa.

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[52] **U.S. Cl.** ..... **200/61.64**, 134/58 DL, 200/318

[51] **Int. Cl.** **H01h 3/16**

[58] **Field of Search** ..... 134/57 DL, 58 DL; 200/50 A, 61.62, 61.64, 61.7, 169 R, 153 T, 200/61.67, 318, 321

[56] **References Cited**

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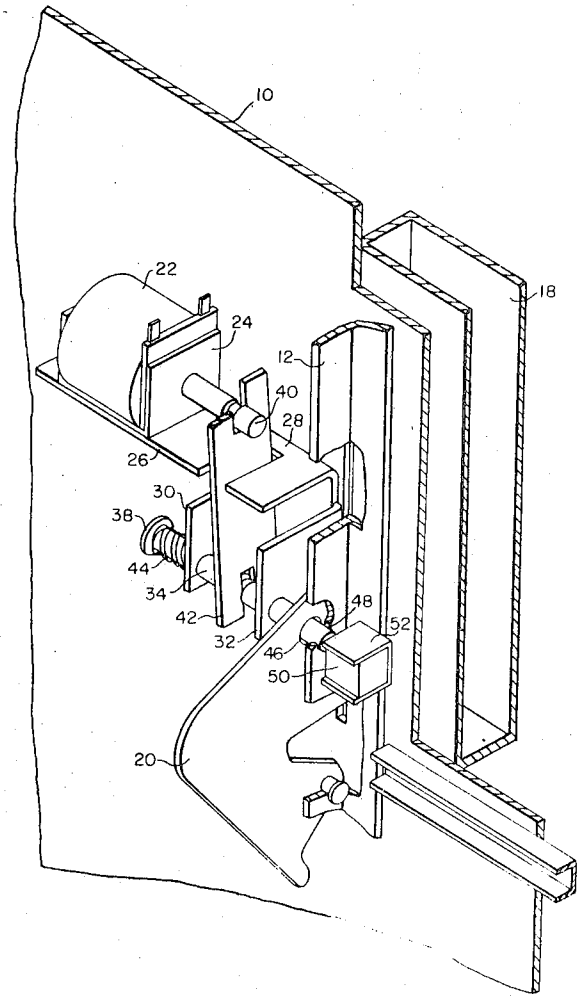
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Assistant Examiner—Gerald P. Tolin
Attorney, Agent, or Firm—F. A. Winans

[57] **ABSTRACT**

A normally open main switch is shown positioned so as to be closed by the movement of door lock structure to the locked position. The door lock structure includes a solenoid for energizing a locking pin which can assume a proper locking position, and therefore close the main switch, only when the door is closed. Failure of the lock to assume the locking position for any reason will prevent operation of the appliance. The door lock solenoid is connected in the control circuit through two parallel lines, each having a switch. The switch of one line is closed whenever the machine is "on" and the switch of the remaining line is closed whenever the machine is in a spin condition. Thus, turning the machine to an "off" position will deenergize the solenoid to release the door lock structure except when the machine is in the spin condition. Then the further step of advancing the cam controlled switch to beyond the spin portion of the cycle is also required thereby preventing the door from being immediately opened and permitting the spinning tub to coast to a somewhat slower rpm before it is accessible.

8 Claims, 3 Drawing Figures



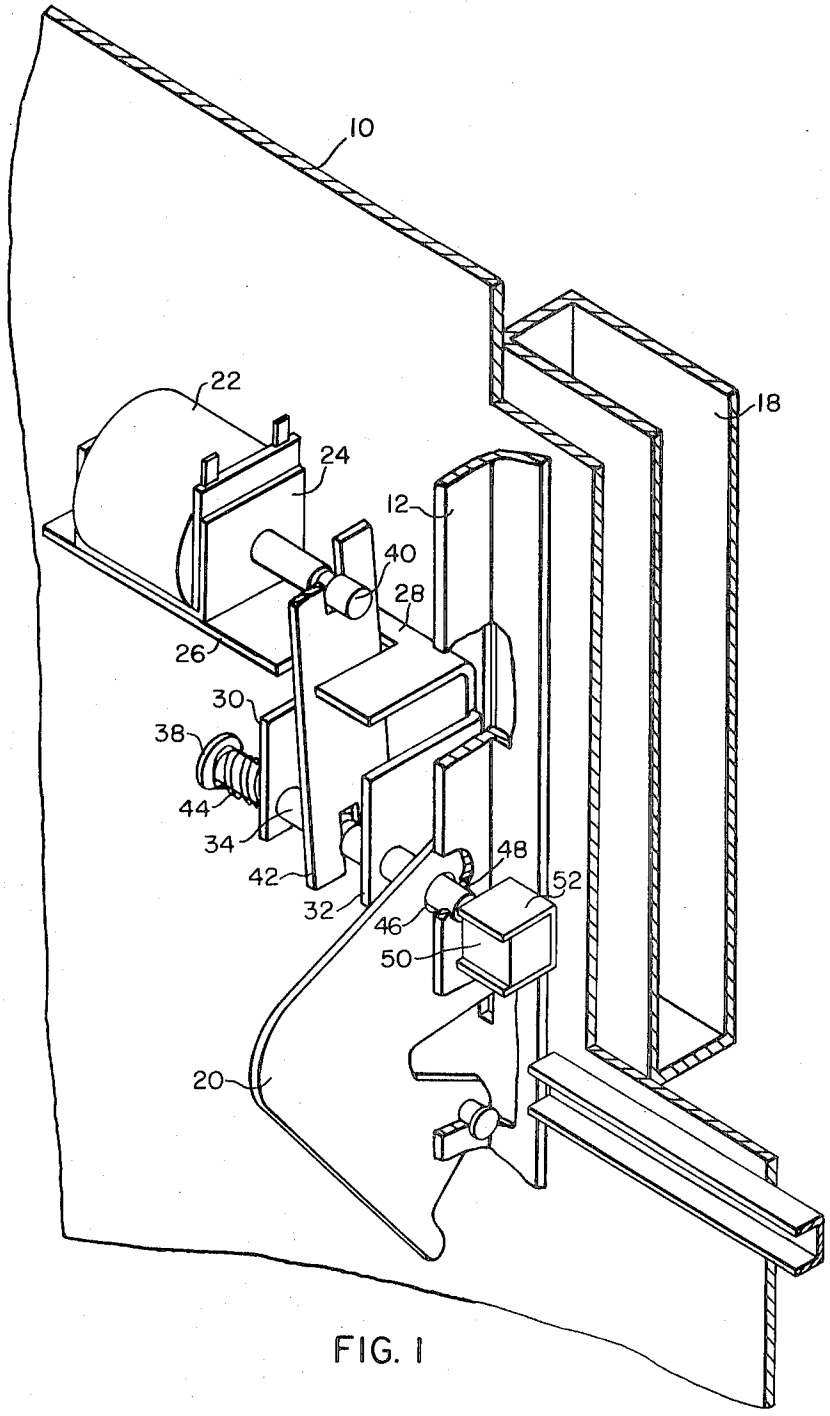


FIG. 1

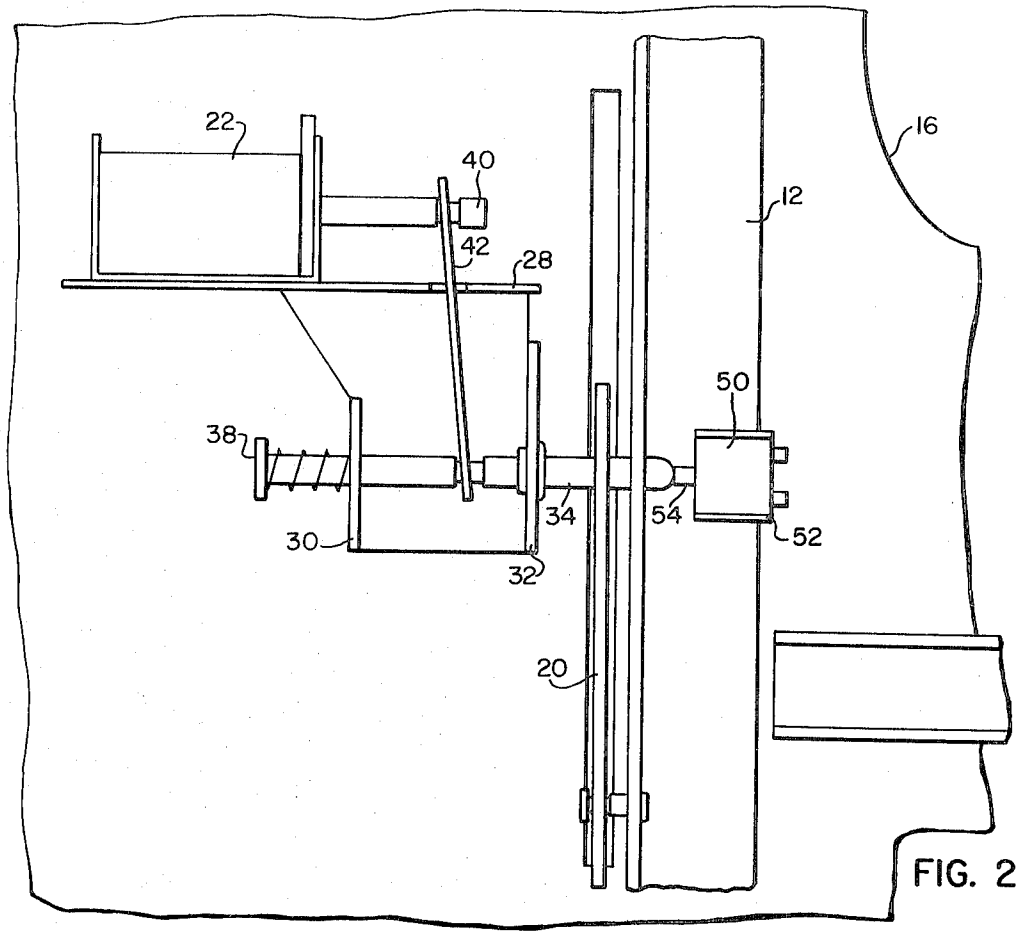

22
40
42
28
16
12
50
38
34
54
52
30
32
20

FIG. 2

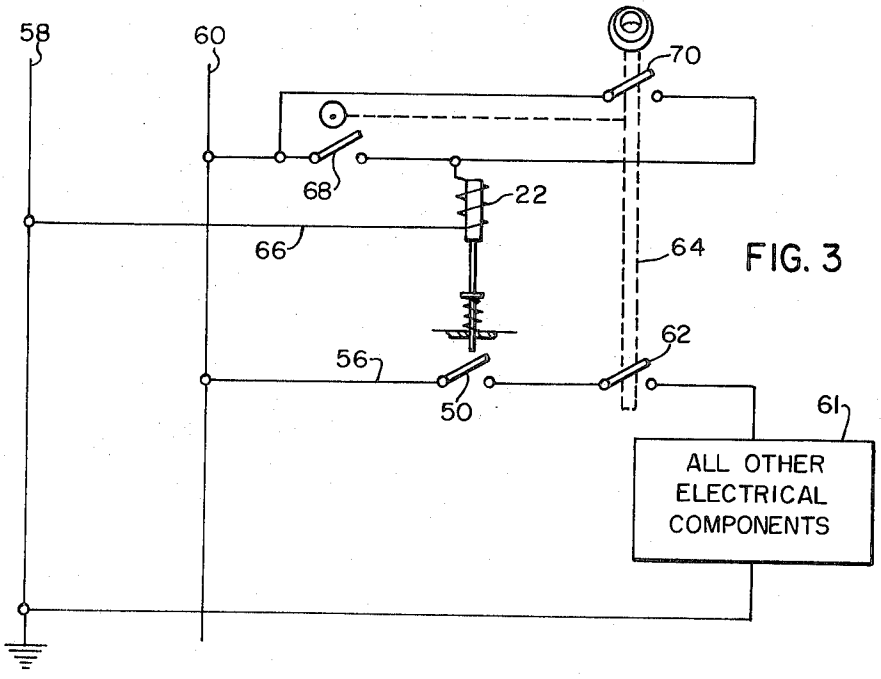

58
60
70
68
22
66
64
56
62
50
61
ALL OTHER ELECTRICAL COMPONENTS

FIG. 3

SAFETY MECHANISM FOR LAUNDRY APPLIANCES WITH DOOR LATCH FOR ACTUATING MAIN SWITCH

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a door lock actuated main switch for an appliance and more particularly to a fail-safe arrangement whereby the switch and thus the appliance is not actuated until or unless the door lock is properly positioned in a locking attitude. Failure of the door lock to be in such position prevents the appliance from being operated.

2. Description of the Prior Art

It is well known in the art, for purposes of safe operation, to include in the control circuit of an appliance a normally open main switch which was either closed by the door or made accessible for manual closing only after the door had been closed. This prevented operation of the machine whenever the door was open. Also, the high speed rotation of the clothes containing tub during the spin portion of the wash cycle has been recognized as a potential source for injury and thus it is common practice to include a door lock structure, generally energized through a solenoid, which is actuated during the spin portion of the cycle. In this manner, whenever the machine was in spin for all practical purposes the door would be locked. However, under known prior art arrangements, failure of the door locking structure to assume the locked position would not prevent the machine from operating and reliance upon the door lock structure would lead one to assume that if the door could be opened the machine was not in spin. And, although opening the door would immediately de-energize the machine through the normally open switch, the continued rotation of the clothes tub as it coasted to a stop provided a period during which an injury might occur.

SUMMARY OF THE INVENTION

The present invention provides a door lock structure which by movement to its locking position actuates a switch to energize the machine. To assume the locked position, both the door must be in its closed position and the door lock solenoid must be energized. If either condition does not exist, the machine can not be operated. And, in the alternative, should the solenoid or its electrical connections malfunction during the cycle, the locking structure is spring biased to a non-locking position which immediately de-energizes the appliance. Thus, failure of the locking function prevents operation of the machine.

Further, the locking solenoid is controlled through a circuit that includes two parallel lines each having a switch. The first switch is closed upon energization of the machine and the second switch is closed only during the spin portion of the cycle. Thus, to unlock the door during any portion of the cycle other than spin, only the first contacts must be separated as by a manually operated push-pull switch; however, during spin in additon to this, the second switch must also be opened, as by rotating the timer beyond the spin portion of the cycle. This second or subsequent operation requires a certain additional elapsed time before the door is unlocked giving the tub an additional amount of time to coast to a slower, safer speed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a rear perspective view of the portion of the appliance housing having the locking structure and the switch of the present invention mounted thereon;

FIG. 2 is a rear elevational view similar to FIG. 1; and

FIG. 3 is a line schematic of the electrical connection of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, the door lock and switch of the present invention is seen as mounted on the back of the front panel 10 of the housing of a front opening clothes washer such as shown in copending application Ser. No. 221,183 having a common assignee as the present invention. As therein seen, the front panel 10 includes a vertically extending "L-shaped" strengthening structural member 12 and a horizontally extending "U-shaped" strengthening structural member 14. The front panel 10 further defines an access opening 16 covered by a swing-down hingedly mounted door 18. The hinge member 20 (only one being shown) of the door 18 extends through a slot in the front panel generally adjacent the vertical member 12. For a further description of the door and hinge arrangement on such a washer, reference is made to U.S. Pat. No. 3,602,662 also of common assignee.

The door locking structure utilized in the present invention is of the type presently used on front-loading clothes washers manufactured and sold by the assignee. This structure includes a solenoid 22 mounted in a U-shaped saddle clamp 24 which is secured to a mounting bracket 26 which includes a horizontally oriented shalf 28 and two spatially subadjacent vertically oriented flange members 30, 32. A locking pin 34 is received in appropriately placed apertures in the vertical flanges for guided horizontal movement. The locking pin extends on either side of the spatially separated flanges and includes a rounded head 36 at one end and an enlarged annular flange 38 at the opposite end. The movable armature 40 of the solenoid 22 is linked to the locking pin to transmit the movement of the solenoid to the locking pin through a lever member 42 extending through and fulcrumed by an appropriate slot in the shelf 28 and joining the end of the armature to an intermediate portion of the locking pin generally in between the vertical flanges. Thus it is seen that the horizontal movement of the armature in one direction is transmitted into a horizontal movement of the locking pin in the opposite direction. A coil spring 44 encircles the locking pin between the annular flange of the locking pin and the vertical flange of the mounting bracket and is biased to oppose the movement of the locking pin in the direction it moves when the solenoid 22 is energized.

Further it is seen that the locking structure is so disposed that the movement of the pin is transverse to the movement of the hinge 20 as the door is opened or closed. The hinge 20 includes an aperture 46 in alignment with an aperture 48 in the vertical member 12 and the locking structure is mounted so that the locking pin is received within these two apertures whenever the solenoid is energized. Thus, with the locking pin extending from the vertical flange of the mounting bracket through the hinge 20 and also through the ver-

tical member **12,** the hinge is prevented from movement and the door is prevented from opening. Subsequent de-energization of the solenoid permits the locking pin to move out of such locking engagement due to the normal bias of spring **44** restoring the structure to an unlocked position. It is to be noted that the locking pin can assume a locking position only when the door is in the fully closed position, otherwise the pin would strike the hinge without being received through the aperture **46.**

Heretofore, the door lock structure, above described, was connected in the control circuit of the clothes washer so that the solenoid **22** was energized during the spin mode of the wash cycle. However, failure of the locking pin to assume the locking position for any reason (i.e. either mechanical or electrical malfunction) in no way altered the operation of the machine and thus left the door available to be immediately opened.

In the present invention, a normally opened switch **50** is mounted, as by bracket **52** on the side of the vertical member **12** opposite the door lock structure and includes a plunger **54** in alignment with and extending toward, the apertures **46** in the hinge end **48** in the flange of the vertical member. In this position, when the locking pin **34** extends through apertures **46, 48** when in the proper locking position, the locking pin also extends far enough to the press plunger **54** and close switch **50.** Thus, it is seen, whenever the door is locked by pin **34,** the normally open switch is closed and, alternatively, whenever the locking pin is in any position other than the locking position, switch **50** is open. Any failure or malfunction of the locking structure for whatever reason thus results in switch **50** being open.

Referring now to FIG. **3,** it is seen that switch **50** is included in the line **56** extending across the main power supply lines **58, 60** and to which are connected all other electrical components including the main drive motor and timer switches, represented by box **61,** of the washing machine. Line **56** further includes a line switch **62** coupled to a manually reciprocable shaft **64** of the timer so that in addition to switch **50** being closed the line switch **62** must be manually closed before the main drive motor will function. The door lock solenoid is connected in a line **66** across the supply lines. Line **66** includes two switches connected in parallel. Switch **68** being controlled by a rotatable cam within the timer that closes the switch during the spin portion of the cycle and switch **70** which is also operably connected to the timer shaft **64** in the same manner as line switch **62.** Thus, it is seen, the door lock solenoid can be energized through either switch **68** or switch **70,** and during the spin portion of the cycle is energized through both of them.

Assuming the door of the machine is closed, the wash cycle is initiated by manipulating shaft **64** (i.e. either pushing or pulling) to close line switch **62.** This same motion closes line switch **70** to energize the lock solenoid so that the locking pin is moved into a locking position and the switch **50** is closed. With both switch **50** and line switch **62** being closed all functions of the machine are energized as controlled by the timer. Also, it is seen that if the locking pin should for some reason not close switch **50,** the machine will not be energized and thus any failure of the lock results in a safe condition of the machine. Further, during the spin dry portion of the cycle the timer closes switch **68** so that the lock solenoid is energized through both switches **68** and **70.** If it is desirable to open the door during this portion of the cycle it is seen that it is necessary to, in addition to manipulating the timer shaft to open line switch **62** and thereby open line switch **70,** additionally manually advance the timer beyond the spin portion of the cycle to permit switch **68** to open. This additional elapsed time to accomplish the opening of both switches, provides an additional time delay, after the machine has been de-energized, before the lock solenoid is de-energized and the locking pin withdrawn to permit access to the high speed rotating tub. This additional time ultimately results in the door being opened at a lower speed.

We claim:

1. A safety mechanism for an automatic laundry appliance having a cabinet defining an access opening, door means hingedly supported on said cabinet for movement between open and closed positions and electrical circuit means for energizing said appliance in accordance with a predetermined program including energization of a main drive motor to a high speed drive operation and including a manually controlled main line switch, said mechanism comprising:

means for locking said door means in said closed position, said locking means including:

a locking pin movable between a first position preventing opening of said door means and a second position permitting opening of said door means;

spring means normally biasing said pin toward said second position;

electrically actuated means for moving said pin from said second position to said first position, said means electrically connected in said control circuit through first switch means; and,

second switch means connected in said circuit for energizing said main motor when closed, said second switch means being mounted generally adjacent and in the path of movement of said locking pin so as to be moved to a closed position in response to said pin moving from said second position to said first position.

2. A safety mechanism according to claim **1,** wherein said door means includes means preventing movement of said locking pin from said second position to said first position when said door is in any position other than said closed position.

3. A safety mechanism according to claim **2,** wherein said door means including said means preventing movement of said locking means comprises:

a movable hinge member in facing relationship with a portion of said cabinet, said hinge member defining an aperture generally concentric with an aperture in said portion of said cabinet when said door means is in a closed position; and wherein,

said locking pin is mounted for movement into both said apertures and generally transverse with respect to the movement of said door means to prevent relative movement between said door means and said cabinet when said locking pin is in said first position.

4. Structure according to claim **3,** wherein said second switch means comprise a normally open switch mounted adjacent said portion of said cabinet and on the side opposite said locking pin when said locking pin is in said second position and disposed in axial alignment with said locking pin whereby said second switch

is closed by said locking pin moving to said first position.

5. Structure according to claim 4, wherein said first switch means includes two normally open switches electrically connected in parallel, one of said normally open switches comprising time-controlled contacts and the other of said normally open switches including manually controlled contacts.

6. Structure according to claim 5, wherein said time-controlled contacts are closed during said energization of said drive motor to a high speed drive operation.

7. Structure according to claim 6, wherein said manually controlled contacts and said manually operated main line switch are mechanically coupled for generally simultaneous operation whereby manual closure of said main switch also closes said manually operated contacts.

8. Structure according to claim 7, wherein said manually controlled main line switch and said second switch means are series connected with said main motor in said circuit.

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