

Sept. 7, 1965

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LID SWITCH AND LID LATCH MECHANISM FOR  
CLOTHES WASHING MACHINES

3,205,031

Filed March 29, 1962

3 Sheets-Sheet 1

FIG. 1

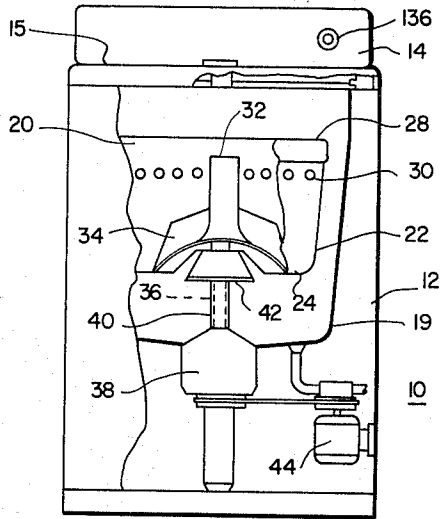


FIG. 2

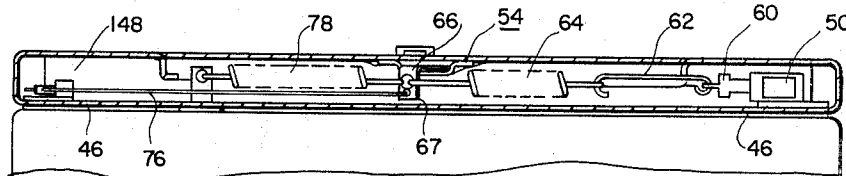
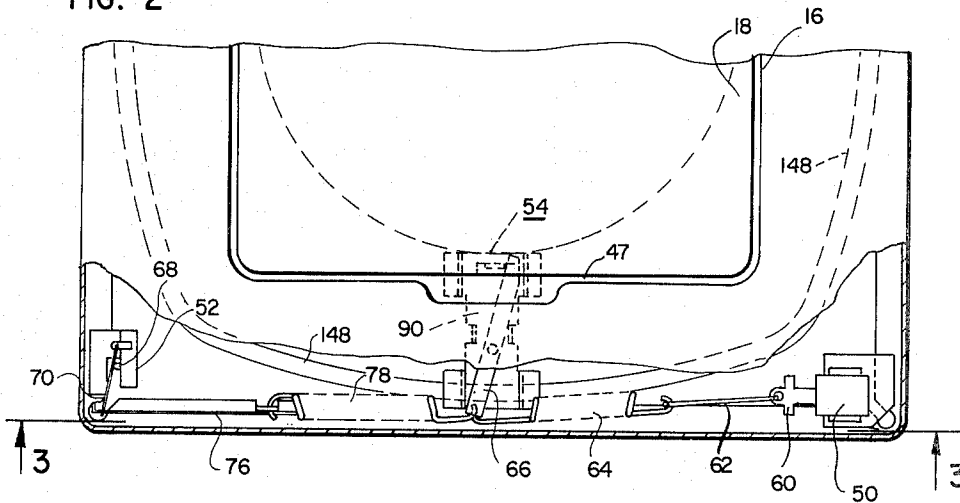


FIG. 3

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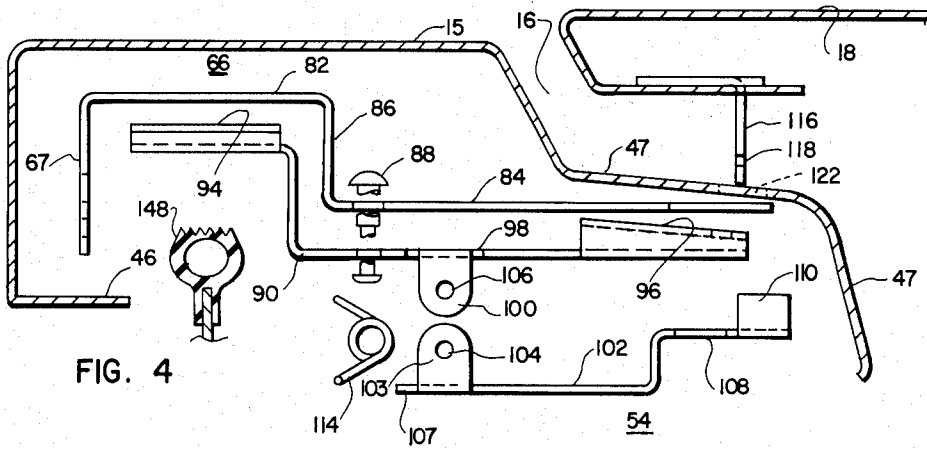


FIG. 4

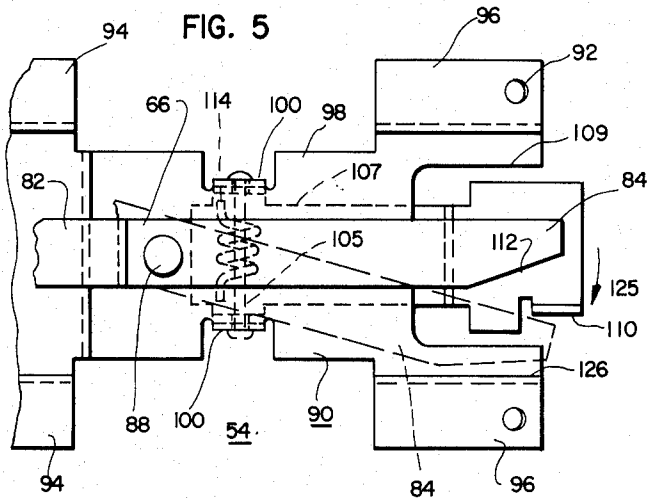


FIG. 5

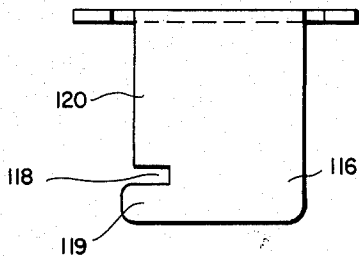


FIG. 6

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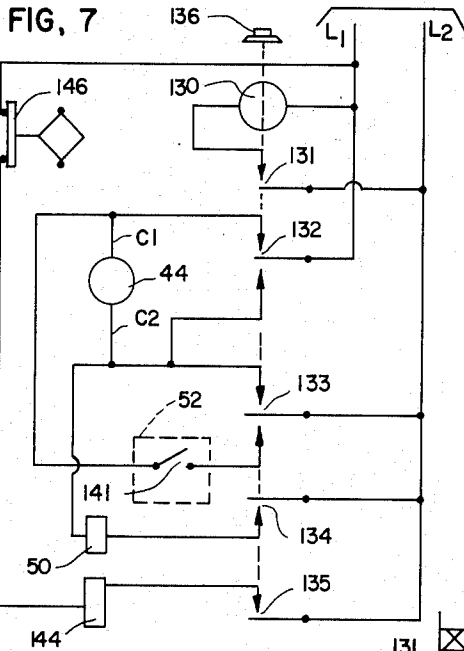


FIG. 8

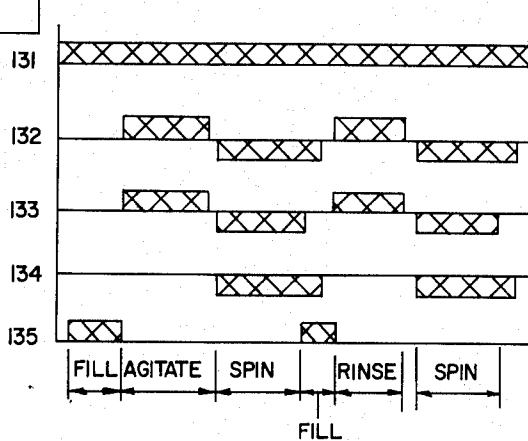
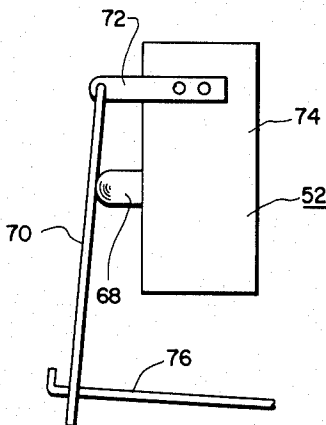


FIG. 9



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3,205,031

## LID SWITCH AND LID LATCH MECHANISM FOR CLOTHES WASHING MACHINES

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 Filed Mar. 29, 1962, Ser. No. 183,479  
 4 Claims. (Cl. 312-223)

The present invention relates to clothes washing machines and more particularly to switching and latching mechanisms for such machines.

It is generally known that when a clothes washing machine of the centrifugal extraction type is rotated at high speeds to effect the extraction, the interior of the machine presents a serious hazard to the careless machine user. Thus, when a careless user or careless child places an arm through the open lid into the machine during spin, the rapidly spinning basket and agitator shaft may catch and twist the arm before the machine can be shut off. It has therefore become a common practice to employ lid switches which shut down the machine on opening the machine lid to alleviate the possibility of hands being inserted into the machine while the machine is being rotated rapidly. Another expedient frequently employed, is to latch the lid shut during this high speed rotation so that the machine lid can not be opened during this high speed phase of the cycle. Many constructions have been used to effect one or both of these safety devices, and it is to improved combined lid switch and lid latch constructions that this invention is directed.

The combined switch of my invention employs a solenoid actuated lid latch which is actuated to latch the lid shut and which on latching closes the lid switch circuit to start and maintain the spin operation of the washing machine. In this manner, the lid is held in its latched condition whenever the basket is rotated at high speed. It is a particular feature of this invention that the lid cannot be opened during the spin cycle, except by moving the timer control knob to a position other than that establishing high speed rotation. Such knob movement would also result in the stoppage of the high speed rotation. In the invention, a mechanical arrangement is provided so that when the lid is not fully closed, the lid switch cannot be closed and the spin circuit of the washing machine drive motor cannot be energized. It is therefore another feature of this invention to insure that once the lid is open, the lid switch cannot be manually closed by an imprudent or impatient machine user.

Therefore this machine has as its object to provide an improved lid switch and lid latch arrangement for a clothes washing machine.

It is another object of the invention to provide in a washing machine lid switch and lid latching arrangement, an interlock which holds the lid switch inoperative during all periods when the machine lid is not closed, and maintains this interlock effective until the lid is restored to its closed position.

Other objects, features and advantages of the invention will be apparent from a detailed description of the presently preferred embodiment thereof read in connection with the accompanying drawings in which:

FIG. 1 is a front elevational view partially broken away of a clothes washing machine utilizing my invention;

FIG. 2 is a partial plan view of the top front portion of the machine of FIG. 1 with a portion broken away;

FIG. 3 is a front elevational section viewed along line 3-3 of FIG. 2;

FIG. 4 is an exploded side view of the components of the latch assembly positioned relatively with respect to the loading opening and the lid;

FIG. 5 is a partial plan view of the latch assembly of FIG. 4 in an assembled state;

FIG. 6 is a side elevational view of the latch actuating finger;

FIG. 7 is a simplified schematic drawing of a circuit for use with my invention;

FIG. 8 is a cam diagram for the circuit of FIG. 7; and

FIG. 9 is a detailed view showing the construction and connection of the lid switch.

In FIG. 1 there is shown a clothes washing machine 10 which includes an outer appearance cabinet 12 at the rear of which there is a controls console 14 extending vertically above the top machine surface 15. The top surface of the machine in front of the console is fashioned with a loading opening 16 allowing access to the machine interior. This opening is approximately centrally located in the machine top surface 15 and is normally covered by a rear hinged lid 18 which may be opened to reach the machine interior.

Within the machine there is a large imperforate stationary drain tub 19, and within the tub a centrally located wash receptacle 20 rotatable on a vertical axis. This receptacle has a generally imperforate cylindrical sidewall 22 extending from its horizontal base 24. The receptacle in a conventional manner has an open circular face adjacent the loading opening. About the sidewall upper periphery, a heavy density balance ring 28 is mounted to provide a comparatively large moment of inertia for the receptacle. Below the balance ring, a horizontal line of extraction apertures 30 is perforated in the otherwise imperforate sidewall. These apertures, in generally known manner, are used to extract water from the clothes and receptacle to the tub for drainage as the receptacle is being spun at high speed. Upstanding centrally above the receptacle base 24 is an agitator mechanism which includes a central column 32 and radially extending vanes 34. Depending from the agitator column is a central agitator drive shaft 36 which extends through drain tub 19 to a coupling to suitable mechanisms (not shown) within the transmission casing 38 for oscillation of the agitator mechanism. Coaxially surrounding the agitator shaft is a spin tube 40 which is connected at its upper extremity to a rotary hub 42. Hub 42 is in driving connection with base 24 of the receptacle for rotating the receptacle on rotation of the spin tube. The lower end of tube 40 is secured to the outside of transmission housing 38 for mutual rotation. To impart rotational force to housing 38 and oscillatory motion to the internal drive mechanism, there is provided a drive motor 44 which may be of the reversible type. The motor is physically mounted to the adjacent sidewall of the housing and has a drive pulley and V belt connection to transmission housing 38.

Utilizing a reversible drive motor as drive motor 44, it is known that rotation of the motor in one direction actuates the internal transmission mechanism to oscillate the agitator and operation of the motor in the reverse direction rotates receptacle 20 at high speed. In most machines, rotation of the receptacle also causes high speed rotation of the agitator, although this need not be the case. Mechanisms for accomplishing these actions are well known in the art, and, per se, are not a part of the present invention.

Now turning to FIGS. 2, 3 and 4, it can be seen that spaced below top surface 15 there is an inturned horizontal flange surface 46 within which the lid control mechanism to be described is mounted. This mechanism is located in front of the loading opening 16 along flange surface 46 and comprises the combined lid latch and switch mechanism. It can be seen in FIGS. 2-4, that the lid switch and latch mechanism are generally prevented from being contacted by the user due to the top surface

construction and the integral flange 47 surrounding the loading opening 16. The lid switch and latch mechanism includes at one front corner of the machine, a conventional electromagnetic solenoid 50 and at the opposite front corner a snap switch 52. Midway between these components, along the centerline of the lid is the mechanical latch assembly 54. Interconnecting the switch, solenoid and latch assembly are a plurality of tension springs and links which will be described more fully.

Solenoid 50 is mounted to flange 46 below the top surface 15 with its plunger 60 extending horizontally inwardly, and laterally across the machine 10 toward the loading opening 16. The plunger has connected thereto by suitable means a first rigid, motion transmitting link 62. At its opposite end, link 62 is connected to one end of a helical tension spring 64. The opposite end of tension spring 64 is fastened to the vertically disposed rear leg 67 of pivotal latching arm 66. In this way, the plunger is operatively connected to latch arm 66 in series through link 62 and spring 64.

Shown in detail in FIGS. 2 and 9 is the snap switch 52, which is mounted in one front corner of flange 46. The switch mechanism includes an actuating button 68 directed away from loading opening 16 and isolated from casual contact by the user or by the machine elements. A pivot blade 70 is affixed pivotally by means of an intermediate support arm 72 to the body 74 of snap switch 52. The pivot blade 70 operatively extends past the actuate button 68 to a connection to a connecting link 76. Link 76 which may be a rigid wire motion transmitting link extends from the blade connection to a securement to the vertical rear leg 67 of latch arm 66.

As seen best in FIG. 3, there is also connected to the rear leg 67 of latch arm 66 a tension spring 78 which extends in parallel to link 76 for a portion of the length of link 76. The remote end of spring 78 is anchored to a stationary mount on the flange surface 46. With this interconnection of solenoid, switch and latch assembly; energization of solenoid 50 draws plunger 60 into the solenoid opening. This plunger movement is transmitted through link 62 and tension spring 64 to the latch arm, resulting in the movement of the rear leg 67 of latch arm 66 toward the solenoid. This movement of the latch leg 67 draws link 76 toward the solenoid and results in blade 70 being drawn tightly against actuate button 68, closing the switch circuit. Release of the solenoid allows latch arm leg 67 to restore under the effect of the anchored spring 78 and causes switch 52 to open its internal circuit.

Now viewing the latch assembly 54 of FIGS. 4 and 5 in greater detail, there can be seen the latch arm 66 which includes the depending rear leg 67, a raised center portion 82, and a riser 86 leading downwardly to the horizontal offset extension 84. Rear leg 67, as previously mentioned, has connected in multiple thereto, spring 64, link 76 and the anchored return spring 78. The latch arm 66 is pivoted at a point along extension 84 near vertical riser 86. A suitable rivet 88 or the like mounts the latch arm 66 to a stationary mounting bracket 90 in a manner allowing horizontal movement of arm 66 relative to the stationary bracket 90. This bracket has a complex stepped shape (see FIG. 4) to match the offset shape of latch arm 66. Bracket 90, in turn, is mounted stationarily to the underside of top surface 15 within the area covered by flange 47 at the front edge of the loading opening 16. To mount the bracket to the underside of the top surface, there are formed a plurality of suitable mounting ears, the front ears of which are each equipped with suitable circular holes 92 for securement to the top wall 15. The ears include at the latch assembly end remote from the loading openings a pair of horizontally disposed, spaced ears 94 for mounting which are pressed against the adjacent horizontal underside of top surface 15. At the loading opening end, bracket 90 includes an oblique set of ears 96 angled to match the obliqueness of the flange 47 adjacent opening 16. This latter set of ears 96 ex-

tends on either side of the pivotal latch extension 84 and aids in limiting the travel of the latch arm in a horizontal plane. Between and below the ear sections, bracket 90 has a narrow, horizontal midsection 98 from which depend on either side a pair of parallel depending mounting lugs 100. These lugs are used to pivot an interlock member 102 for vertical movement with respect to the underside of bracket 90. The interlock member 102 includes suitable upstanding mounting lugs 103 perforated with mounting holes 104 matching holes 106 in lugs 100, and through which a pivot shaft 105 is secured. By this construction, the interlock member 102 is positioned generally parallel to and below the bracket 90 and is pivotal vertically about shaft 105. The interlock member 102 has an offset shape stepped from a mounting end 107 spaced below the bracket to a free end 108 positioned in its operative position directly below the horizontal surface of bracket 90. In FIG. 5, it can be seen that the front end of bracket 90 has an enlarged cutout 109. This cutout is below the free end of extension 84 and generally above interlock member 102. The free end of the interlock member 102 includes a vertically disposed tab 110 which is positioned to lie adjacent the outer ends of extension 84 and bracket 90 while protruding upwardly through the cutout 109 in bracket 90. Toward the rear end 107 of member 102, there is fitted about pivot shaft 104 in the area between the bracket 90 and interlock member 102, a helically wound torsion spring 114 which is positioned to exert downward pressure on the rear end 107 of interlock member 102 and to impel the member free end 108 upwardly. With the free end 108 directly below bracket 90, tab 110 extends upwardly past the level of the bracket midsection 98 within the area defined by cutout 109.

To complete the structure, there is secured to and depending from the edge of the lid a latch finger 116. This finger 116 includes a horizontally incised notch 118 above its lower toe section 119. This toe projects horizontally a distance past the projection of the upper finger vertical surface 120 (FIG. 6). On closure of the lid, this finger extends through a suitable opening or slot 122 (FIG. 4) in the sloping flange 47 of loading opening 16 to assume a latching position adjacent latch mechanism 54. It should be noted that slot 122 should only be wide enough to accept the lid finger 116 and not wide enough to accept a normal human finger, for obvious reasons.

Shown in FIG. 7 is a simplified control circuit utilizing the invention. The circuit includes a conventional timer motor 130 which actuates a plurality of cam controlled contacts 131, 132, 133, 134 and 135 in a specific timed sequence indicated by the cam chart of FIG. 8. The timer motor is started by a rotation of control knob 136 to the start position. In a generally known manner, the timer motor returns the camshaft (not shown) from the start position through the operative cycle to the completed position at a predetermined rate actuating the contacts in a sequence as shown in FIG. 8. In addition to the timer, the circuit of FIG. 7 includes a reversible drive motor 44, the latching solenoid 50, contacts 141 of switch 52 and a conventional water inlet solenoid 144. The circuit to solenoid 144 includes a set of normally closed contacts 146 which are controlled by the operation of drive motor 44 and open on acceleration of the motor to a predetermined switch-operating speed.

The operation of the circuit of FIG. 7 is as follows: When the knob 136 is rotated to the start position, cam contacts 131 close to complete a circuit from lead L1 through the timer motor 130 and contacts 131 to lead L2. Shortly thereafter, contacts 135 close to complete an obvious energizing circuit through normally closed contacts 146 to solenoid 144. Solenoid 144 on energization initiates the fill of liquid to the receptacle on a timed basis. At the conclusion of the time period for fill as indicated on the cam chart (FIG. 8), the solenoid is

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deenergized by the opening of contacts 135. At about the time that fill contacts 135 open, contacts 132 and 133 close to their upper stationary contacts. A circuit is then closed from lead L1 through contact 132 and its upper stationary contacts, conductor C1, drive motor 44, conductor C2, contacts 133 (upper) to lead L2. On acceleration of the motor, contacts 146 open to further open the circuit to solenoid 144. Operation of the motor 44 in this rotative direction drives a suitable transmission mechanism (not shown) to cause the agitator column 32 to oscillate, thereby oscillating the agitator vanes to wash the clothes in receptacle 20. It can be seen that in the operation of the machine during fill and agitate, the lid switch and latch mechanism is inoperative and has no part in functioning of the machine. The reasons for the non-functioning of the lid mechanism may be recognized from an appreciation of the nature of fill and the following oscillation and their inherent lack of danger even to negligent users.

Following the conclusion of the timed agitate period, contacts 132, 133 and 134 all close to their lower stationary contacts. A circuit may be traced from lead L1 through contact 132 and its stationary lower contact, conductor C2, drive motor 44, conductor C1 to contacts 141 and lower contacts at 133 to lead L2. It can be seen that contacts 141 (of lid switch 52) are in series with the motor 44 and must be closed in order to energize the motor. In parallel with motor 44 is a circuit from lead L1 through contact 132, and its lower stationary contact to solenoid 50, and contacts 134 to lead L2. This solenoid is energized to engage the latch assembly to the lid and to thereby hold the lid firmly latched until the completion of the high speed spin period. Engagement of the latch assembly also serves to mechanically close lid switch 52 and its contacts 141 to energize the drive motor in the spin direction as described. During this spin period, the receptacle and agitator are rotated at a high speed to extract water from the receptacle and clothes borne thereby. This high speed rotation, normally at a rate of about 600 r.p.m. can constitute a serious hazard to the negligent machine user. Thus, in order to energize the drive motor for spin, series contacts 141 of switch 52 must be closed and remain closed. By latching the lid shut, the action of solenoid 50 insures that no penetration to the machine interior can be made by the careless user without shutting off the machine at contacts 141.

Now turning the mechanical operation of the mechanism for this spin operation, it can be understood that from FIGS. 2-5 as lid 18 is being closed, latch finger 116 is depressed through slot 122 and continues on downwardly against the free end 108 of interlock member 102. This depression of free end 108 causes member 102 to pivot downwardly against the bias of spring 114 and lowers tab 110 below the level of horizontal extension 84. At the start of spin, solenoid 50 is energized. Energization of solenoid 50 draws plunger 60, link 62, spring 64 and rear leg 67 of latch arm 66 toward the solenoid. The front end 84 of the arm 66 moves unimpededly (once tab 110 has been lowered) in the direction opposite the direction of arrow 125 into engagement with notch 118, thereby locking the lid to the machine frame. During the period in which arm 66 was moving toward this lock engagement, it was drawing link 76 toward the solenoid, closing switch button 68 and thereby closing contacts 141 in the energizing circuit to drive motor 44. When the motor circuit is completed for spin, motor 44 accelerates into spin and during this spin period, the solenoid is held energized to maintain series contacts 141 closed to the drive motor circuit. Electrically, the solenoid energization circuit is held closed at contacts 132 and 134 throughout spin and can only be opened by opening of these contacts. Mechanically, the notch 118 and the horizontal toe 119 of finger 116 hold latch arm 66 firmly to deter attempts to raise lid

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18 during the period of operation of solenoid 50. The spin operation progresses during this period with lid 18 firmly latched in place.

At the conclusion of spin, lower contacts 133 open first, opening the circuit to motor 44. Solenoid 50 remains energized for a period thereafter through closed contacts 134 and 132 (lower). These contacts remain closed for a timed period following release of contacts 133 and resulting deceleration of motor 44. After a time delay sufficient to allow motor 44 to decelerate, contacts 132 (lower) and 134 restore to open the circuit to solenoid 50. The solenoid restores, releasing the latch assembly and allowing lid 18 to be opened if desired. Meanwhile the timed cycle continues into rinse fill, rinse agitate and spin-out of rinse water. During this latter spin-out, solenoid 50 is again energized and latched throughout the spin operation as previously described.

It should be noted that before it is physically possible to open lid 18, solenoid 50 must be released, so that the engagement of latch arm 66 and lid finger 116 is released. Following such restoration of solenoid 50, and release of the solenoid induced bias on latch arm 66, the bias of the anchored return spring 78 acts on the latch arm 66, to result in the pivotal movement of the arm extension 84 in the direction indicated by arrow 125 (FIG. 5). Bias on the latch arm in this direction moves the arm extension 84 to a position with its oblique surface 112 adjacent ear 126 (the lower oblique ear as seen in FIG. 5) of bracket 90. Thereafter, opening of the lid will retract finger 116 through slot 122. Retraction of the finger and removal of its pressure on interlock member 102 causes the member free end 108 and its appendant tab 110 to rise under the effect of the bias exerted by torsion spring 114. Tab 110 will rise to a position vertically adjacent the upper ear surface 96. Tab 110 thereafter remains as an impediment to the return motion of latch arm 66. As mentioned, extension 84 is normally biased to remain horizontally adjacent ear 126 in the position shown dotted in FIG. 5. With the lid open, tab 110 extends upwardly through the area normally traversed by this offset arm extension 84 in its path toward latch engagement with finger 116. Thus, if solenoid 50 is energized while the lid is open, plunger 60 will be attracted into the solenoid and will draw link 62 and spring 64 toward the solenoid. Latch arm 66 will not be able to pivot its extension 84 past the impediment to motion afforded by raised tab 110. As a result, spring 64 will expand and latch arm 66 will remain stationary and will hold link 76 in a position retaining switch 52 unactuated. With the switch unactuated, contacts 141 cannot close and the drive motor cannot be energized.

With this general description of the operation of the device, one major feature of the invention may now be understood. It has been pointed out previously that the engagement of latch arm extension 84 with finger 116 is maintained throughout spin. Release of the solenoid 50 releases the bias of spring 64 on the latch arm 66, so that thereafter the bias of anchored spring 78 can release the latching engagement. On the imposition of the bias of spring 78, the arm extension 84 is moved in the direction of arrow 125 before the lid can be raised. Thus, the lid can not be raised until the extension 84 of arm 66 has assumed its unoperated position adjacent ear 126. At any time after this, when lid 18 is raised, tab 110 is allowed to rise. By this construction, it is insured that tab 110 cannot be raised before extension 84 has restored to its unoperated position adjacent ear 126. In this way, the tab can not block the extension arm 84 from movement in the direction of arrow 125. This feature precludes the possibility of a false signal to the solenoid and switch that the lid is closed.

By using the construction set out, the mechanism retains the lid latched during the motor operation in the spin direction. Once latched, the lid cannot be opened without shutting off the machine. Further, if the lid is open

or ajar, or in any event not fully closed at the start of spin, latch arm 66 cannot pivot its extension 84 the full distance to engagement with notch 118. Failure of arm 66 to travel this full distance will result in switch 52 remaining open and retaining the motor circuit open for spin.

As a general feature of construction it may be noted that rear ears 94 of bracket 90 are not positively mounted to the top surface 15 but instead are compressed against the surface underside by the upward pressure exerted by gasket 148. Gasket 148, as can be seen in FIG. 2, surrounds the lid 18 and is mounted astraddle a flange (not shown) upwardly directed from the cabinet body inwardly of flange 46. This gasket tends to divide the area under top surface 15 into an area in communication with the access opening and basket area, and a second area outwardly thereof gasketed to prevent moisture and water from reaching this second area. The electrical components, switch 52 and solenoid 50, are mounted in this second area and are thereby protected by the intermediate barrier or gasket from contact with moisture and the like.

The gasket itself may be an extruded member of such material as polyvinyl chloride with a hollow sealing cross-section which can readily be compressed to conform to the shape of the adjacent top surface or intervening depending members such as ears 94. By this construction, the lid latch mechanism is in the area adjacent the access opening and lid, while the springs and electrical components are protected from moisture and spray by the gasket compressed about and conforming closely to the shape of the underside of bracket 90.

While there has been described what is at present thought to be a preferred embodiment of the invention, it will be understood modifications may be made therein generally and most specifically many modifications may be made in the circuit utilized herein, and it is my intent to cover in the appended claims, all such modifications which fall within the true spirit and scope of the invention.

What is claimed is:

1. A combined lid latch and lid switch arrangement for a clothes washing machine in which there is an outer casing having an opening therein and a lid hinged to the casing, and in which the lid is movable from a closed position to an open position, the combined arrangement comprising:

- (a) a switch mechanism,
- (b) a solenoid adapted to be energized for predetermined periods,
- (c) a latch arm operably secured to both said switch mechanism and said solenoid,
- (d) means for drawing said arm in a first direction on energization of said solenoid,
- (e) means responsive to movement of said arm in said first direction for closing said switch mechanism,
- (f) a latch member depending from the lid for engaging said arm and latching the lid to the casing when said arm has been drawn in said first direction,
- (g) means responsive to deenergization of said solenoid for moving said arm in a direction opposite said first direction and releasing said engagement,
- (h) and a blocking member released by movement of the lid out of the the closed position for thereafter blocking any movement of said latch arm toward engagement.

2. In an arrangement as claimed in claim 1, means for biasing said blocking member into an arm blocking position on opening of the lid, said member responsive to reclosure of the lid for movement of said arm out of blocking position.

3. A combined lid latch and lid switch arrangement for a clothes washing machine in which there is an outer

casing having an opening therein and a lid hinged to the casing, and in which the lid is movable from a closed position through a plurality of partially open positions to a fully open position, the combined arrangement comprising:

- (a) a switch mechanism stationarily mounted in one corner of the casing,
- (b) a solenoid stationarily mounted at another corner of the casing,
- (c) a latch arm with one end operably secured to both said switch and said solenoid,
- (d) means for drawing said arm in a direction toward said solenoid on actuation of said solenoid,
- (e) means responsive to said movement of said arm for closing said switch,
- (f) a latch member depending from the lid,
- (g) said latch arm being adapted to engage with said latch member for latching the lid to the casing when said arm has been drawn toward said solenoid,
- (h) means responsive to release of said solenoid for moving said arm out of said engagement,
- (i) and a blocking arm released by movement of the lid out of the closed position for thereafter blocking any movement of said arm toward switch closing position while the lid is open.

4. A combined lid switch and lid latch mechanism for a clothes washing machine including an outer casing having an opening and a lid arranged for movement between open and closed positions relative to the opening comprising, in combination:

- (a) an electric switch device fixed within the casing,
- (b) an electric solenoid fixed within the casing in spaced relation to said switch device, said solenoid having an armature,
- (c) means for energizing said solenoid for predetermined time periods,
- (d) a latch arm mounted within the casing for movement to a first or a second position relative to the lid respectively to engage therewith or disengage therefrom when the lid is in closed position,
- (e) link means extending between said armature and said latch arm,
- (f) switch actuation means extending between said latch arm and said switch device,
- (g) spring means biasing said latch arm to assume its second position while causing said switch actuation means to operate said switch device to open circuit condition,
- (h) said solenoid being adapted upon energization to displace said latch arm to its first position while causing said switch actuation means to operate said switch device to closed circuit condition,
- (i) a blocking member pivotally mounted within the casing in operative relation to said latch arm,
- (j) means effective upon closure of the lid to move said blocking member out of the path of movement of said latch arm,
- (k) and spring means effective upon opening the lid to move said block member to a position preventing said armature from moving said latch arm to its first-named position.

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