

March 13, 1951

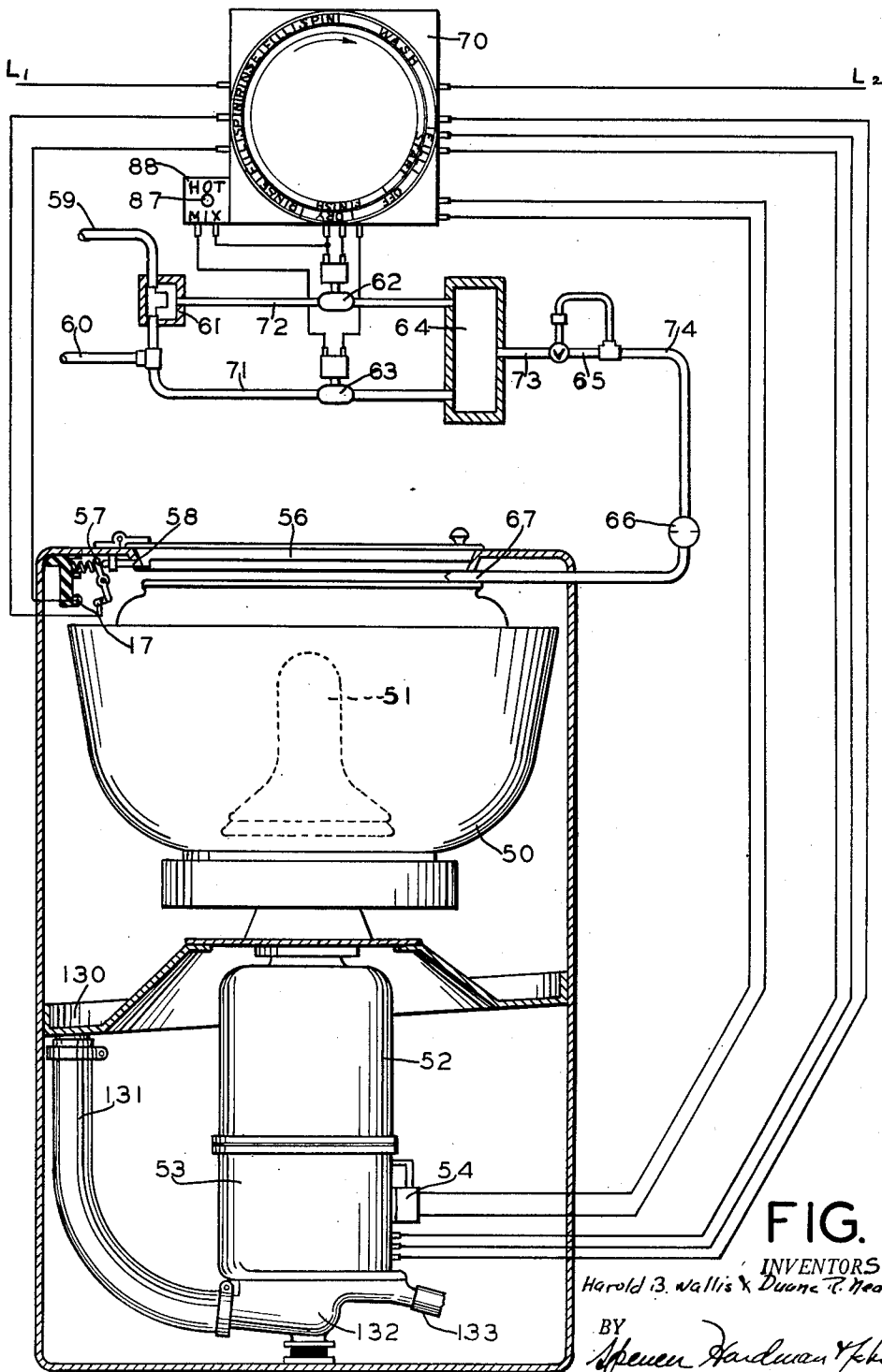
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SAFETY SWITCH FOR COVERS OF WASHING MACHINES

Filed Nov. 4, 1944

2 Sheets-Sheet 1



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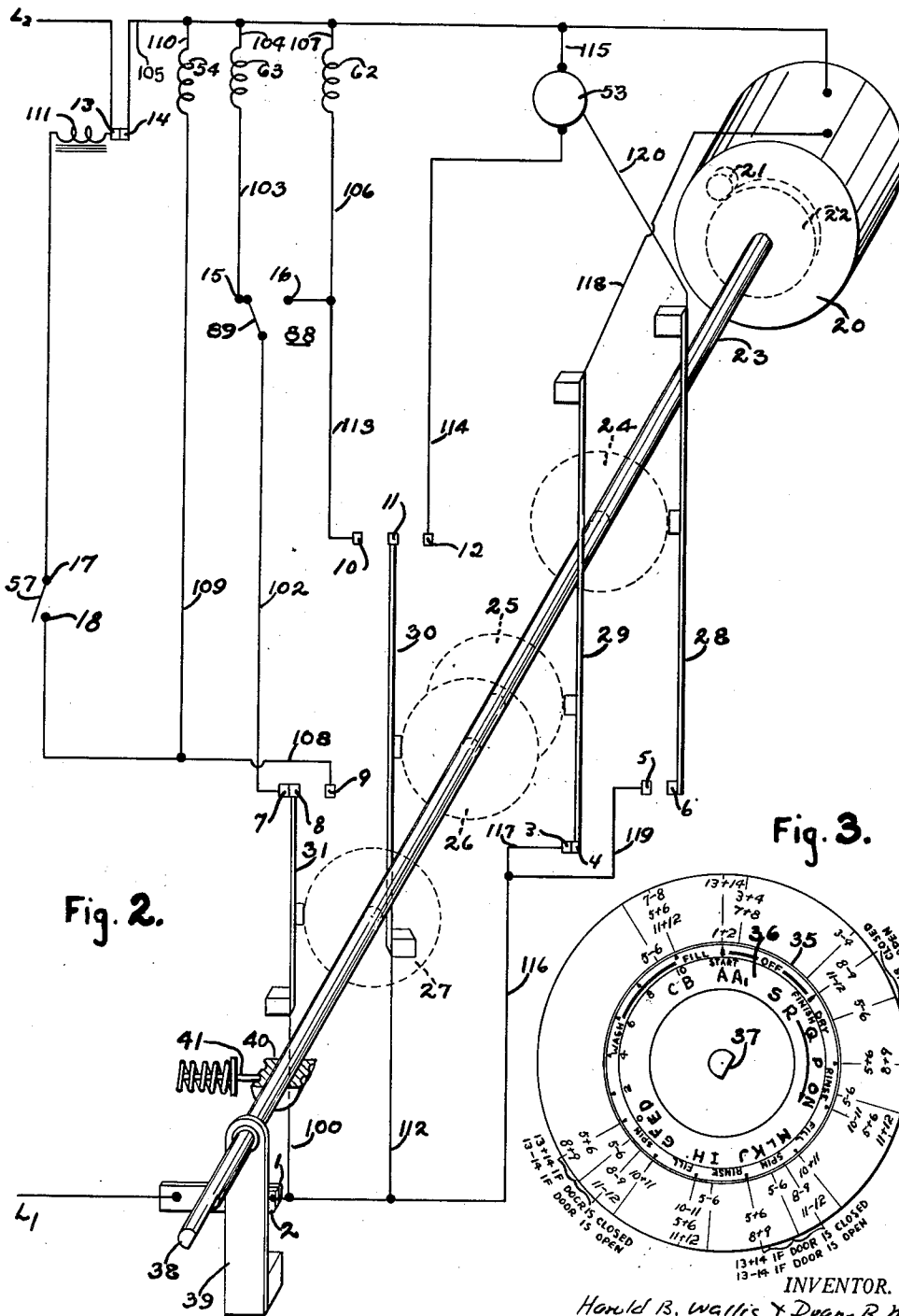
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2,544,867

SAFETY SWITCH FOR COVERS OF
WASHING MACHINES

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Application November 4, 1944, Serial No. 561,857

9 Claims. (Cl. 68-12)

1

This invention relates to washing machine, and more particularly to the automatic control of such washing machines.

An object of this invention is to provide a centrifugal washing machine with a control such that when the access door is opened during the centrifugal action all operations are automatically stopped. Also should the door remain open when centrifugal operation is reached, all operations are automatically stopped.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a diagrammatic representation of the washing machine and its controls;

Fig. 2 is a diagrammatic representation of the timer control, in combination with the electrical elements of the machine; and

Fig. 3 is a diagrammatic representation of the control knob for the timer, together with a diagram of the position of the contacts at various times.

A washing machine, according to this invention includes a tub 50, which may be centrifugally rotated to dry the clothes. An agitator 51 may be placed inside of the tub, for agitating the clothes prior to the centrifugal action. The tub 50 and agitator 51 are actuated through the medium of a transmission 52, which is actuated by a motor 53, the transmission being controlled by a solenoid 54. When the motor 53 is energized, together with the solenoid 54, the agitator is not reciprocated; but the tub 50 is centrifugally rotated at sufficient speed to wring the clothes. When the motor 53 is energized while the solenoid is deenergized, the agitator 51 is reciprocated. When the solenoid 54 is deenergized while the tub 50 is rotating, a braking action is applied to the tub 50, to stop it quickly. Any type of motor and transmission may be used for accomplishing this purpose, such, for example, as is disclosed in the copending application of Kendall Clark, S. N. 511,515, filed November 24, 1944, Patent No. 2,422,395, granted June 17, 1947, for Domestic Appliance.

An access door 56 is provided for introducing the clothes and detergent into the tub 50. A door switch 57, hinged at 18 and closing contacts at 17, is actuated by the rod 58 so that the contacts 17 are closed whenever the door 56 is opened, and vice versa.

A timer 70 is provided, which controls the flow

2

of electrical power from the lines L_1 and L_2 to the various electrical elements of the washing machine. The washing machine is filled with water from the hot water connector 60 and a cold water connector 59. These connectors discharge into a thermostatic mixing valve 61. The hot water connector also discharges into a hot water line 71. The mixing valve 61 discharges into a mixed water line 72. The lines 71 and 72 are controlled by solenoid valves 63 and 62 respectively, and discharge into a common outlet chamber 64. This chamber is connected by a line 73 to a constant pressure valve 65, which maintains a constant pressure of water on the line 74, which in turn discharges through a fixed orifice 66 and a nozzle 67 at a constant flow rate into the tub 50. The arrangement is such that the timer 70 opens the selected solenoid valve 62 or 63 for a sufficient length of time so that the constant volume discharge of water at the nozzle 67 fills the tub 50 to the correct level during each filling operation. The position of the handle 87 of the selector switch 88 determines whether the movable contact 89 of the switch 88 contacts 15 or 16. When the handle 87 is on the indication "Hot" contact 89 engages 15, and the hot water solenoid 63 is energized for the first filling operation. During the second and third filling operations, the mixed water solenoid 62 is energized regardless of the position of contact 89.

Fig. 2 shows the timer construction diagrammatically. It includes a timer motor 20 which moves a small gear 21 intermittently such as at one-half minute intervals. This gear in turn actuates a larger gear 22, which is fixed to a rotatable shaft 23. The shaft 23 carries a plurality of rotatable cams 24, 25, 26 and 27 which are in engagement with movable blades 28, 29, 30 and 31 respectively, and which carry movable contacts 6, 4, 11 and 8 respectively. The cams 24, 25, 26 and 27 have been indicated by dotted circles; but it is understood that they actually are irregularly shaped cams, so shaped that the movable contacts 6, 4, 11 and 8 are actuated at selected intervals of time, as indicated in Fig. 3. Fig. 3 shows the indications on the knob 36, which are inside of the circle 35. The numerals on the outside of circle 35 indicate the positions of the movable contacts at the various intervals of time, as the shaft 23 is rotated clockwise. The knob 36 is provided with an irregular orifice 37 which fits over the irregular end 38 of the shaft 23. The knob 36 is axially secured to the shaft 23, so that, when the knob 36 is moved slightly

3

axially, a movable contact 2 is moved into and out of contact with stationary contact 1, the movable contact 2 being carried by a movable blade 39 which has its upper end in axial engagement with the shaft 23. Whenever the knob 36 is pulled towards the operator, the contacts 1 and 2 are opened, and whenever the knob is pushed away from the operator, the contacts 1 and 2 are closed. A suitable snap acting mechanism is provided for allowing the shaft to be placed in these two axial positions. This may take the form of a double grooved ring 40 carried by the shaft 23 in which a spring-pressed pin 41 rides, so that the ring 40 snaps from one position to the other.

Whenever the movable contact 8 engages contact 9, the solenoid 54 is energized, so that the tub 50 is centrifugally rotated. However, since the switch 57 is closed whenever the door 56 is open, and switch 57 is in parallel with solenoid 54, all electrical elements are automatically de-energized, should the door 56 be open, or opened, during a period which normally is a spin period, as more fully hereinafter explained. Therefore, should the operator open the door while a centrifugal action is taking place, all operations are automatically stopped, including the operation of the timer. Also, if the door 56 should be left open during any previous operation, then, when the timer reaches a spin position, all operations, including that of the timer, are automatically stopped. The machine then remains inoperative until the operator closes the door 56, at which time the operations of the machine, including the timer, are resumed when they were automatically stopped by the open door.

Normally, when the door 56 is closed and the contacts 1 and 2 are closed in the inward position of knob 36, the energization of the various elements is as follows:

When 3 is on 7, one of the water solenoids 62 or 63 (depending on the selection at 89) is energized to introduce water (hot or tepid) into the tub 50. The electric current flow is from L₁, 1, 2, 100, 31, 8, 7, 102, 89 and, if 87 is on "hot," 15, 103, 63, 104, 105, 14, 13 to L₂. Should the handle 87 be on "mix," then the current branches from 89 to 16, 106, 62, 107, 105, 14, 13 to L₂.

When 8 is on 9 current flows from L₁, 1, 2, 100, 31, 8, 9, 108, 109, 54, 110, 105, 14, 13 and L₂. This energizes the spin solenoid 54 and causes rotation of tub 50. However, should the door 56 be open, or be opened, while 8 is on 9, then, instead of causing a rotation of tub 50, all operations are stopped by the flow of current from L₁, 1, 2, 100, 31, 8, 9, 18, 57, 17, solenoid 111, 13 and L₂. The energization of solenoid 111 pulls the safety switch 13 from 14. This allows current to continue to flow through solenoid 111; but disconnects all other electrical elements, 54, 63, 62, 53 and 20 from L₂, thus stopping all operations, including the timer, as long as the door 56 is open and the timer is on a "spin" position. When the door 56 is closed, switch 57 is opened, and solenoid 111 is deenergized, thus allowing safety switch contacts 13 and 14 to close on each other by spring action into their normally closed position. It should be noted that this control of the door 56 over the electrical circuits can only take place during a "spin" position of the timer, since that is the only time that contact 8 is on 9, and is the only time that solenoid 111 can be energized.

When 11 is on 10 (which never occurs while 8

4

is on 7) tepid water solenoid 62 is energized. Electric current flows from L₁, 1, 2, 112, 30, 11, 10, 113, 106, 62, 107, 105, 14, 13, to L₂. The tub 50 is filled with tepid water to the correct level during such an operation.

When 11 is on 12, the running winding of motor 53 is energized. Electric current flows from L₁, 1, 2, 112, 30, 11, 12, 114, 53, 115, 105, 14, 13, to L₂.

When 4 is on 3, the timer motor 20 is energized. Electric current flows from L₁, 1, 2, 116, 117, 3, 4, 29, 118, 20, 105, 14, 13 to L₂.

When 6 is on 5 the starting winding of motor 53 is energized. Electric current flows from L₁, 1, 2, 116, 119, 5, 6, 28, 120, 53, 115, 105, 14, 13 to L₂.

In the operation of the device, the door 56 is opened and clothes and detergent are placed in the tub 50. The door then should be closed and the knob 36 should be pushed away from the user to close contacts 1 and 2 and the knob 36 should be turned clockwise from the "off" position S (where the timer previously had stopped) to the start position at A. Just before reaching position A, the cams are actuated so that contact 3 closes on 4 and contact 7 closes on 8 as indicated at A'. This energizes the hot water solenoid and starts the flow of hot or tepid (as selected) water into the tub 50 to the correct level. At the same time the timer motor 20 is energized. The shaft 23, and knob 36 are then intermittently progressed from position A to position B, where contact 8 is moved away from 7; 6 is moved to 5; and 11 is moved to 12. This energizes the starting coil of motor 53. It also energizes the running coil of motor 53. The motor 53 is therefore started and caused to run on the starting running windings thereafter. Since the transmission solenoid 54 is deenergized, the agitator 51 is agitated. After a suitable interval of time, as at C, the starting winding of the motor 53 is deenergized by opening contacts 5 and 6. The washing operation continues (agitator action), for the selected number of minutes, until the position D is reached. Should the user desire a shorter washing period than the 10 minutes indicated on the timer, he may advance the knob 36 manually to a shorter period, such as to an 8, 6 or other minute period. When position D is reached contacts 5 and 6 are closed, as are also 3 and 9. The closing of contacts 8 and 9 energizes solenoid 54, if the door 56 is closed, and starts the tub 50 to spin. The starting winding of the motor 53 is again energized by the closing of contacts 5 and 6 because acceleration is necessary, and the motor is slowed down to a speed requiring the starting winding to aid in getting the tub up to speed. However, should the door 56 be opened while the spinning operation progresses or if the door had been left open, then no spinning of the tub can take place, and all operations of the machine, including that of the timer are interrupted by the opening of contacts 13 and 14 as previously described. The spinning operation empties the water in the tub 50 into sump 130 from whence it flows through pipe 131 and pump 132 into drain connector 133.

As the timer continues, the position E is reached where the starting winding is deenergized by the opening of contacts 5 and 6. When the position F is reached contact 8 is moved from 9 and 11 from 12. This deenergizes the solenoid 54 and the motor 53 and stops the spinning of tub 50. At position G 10 is closed on 11. This energizes the mixed water solenoid 62 and starts flow of

5

mixed water through the nozzle 67. The flow of water continues until position H, which is the correct length of time to fill the tub. At H, contact 11 is moved from 10 while the contacts 5 and 6, and 11 and 12 are closed. This stops the flow of water and energizes the starting and running windings of the motor 53 to reciprocate the agitator 51. At I, contact 6 is moved from 5, thus deenergizing the starting winding of motor 53, the motor 53 continuing to run on the running winding. From H to J, the agitator 51 is reciprocated. At J contact 6 closes on 5 while contact 8 closes on 9. If the door 56 is closed, the tub 50 starts to spin; but if the door is already open, then the tub does not spin and all operations cease until the door is closed, when they are resumed where they were stopped. At K the starting winding is deenergized by the opening of contacts 5 and 6. At L the spinning operation is terminated by the opening of contacts 8 and 9 and 11 and 12. At M the mixed water solenoid is opened by the closing of contacts 10 and 11. The filling operation continues until N is reached. The tub has then been filled with tepid water. At N, contacts 10 and 11 are opened while 5 and 6, and 11 and 12 are closed. This stops the filling operation and starts the reciprocation of the agitator, the motor 53 running on both its starting and running windings. At O the starting winding is deenergized by the opening of contacts 5 and 6. At P the contacts 5 and 6 are closed as are also contacts 8 and 9. This starts a spinning operation, the motor 53 running on both windings until position Q, when the starting winding is deenergized by the opening of contacts 5 and 6. At R the spinning operation is terminated by the opening of contacts 8 and 9 and 11 and 12. It should be noted that, if the door 56 should be opened at any time during the interval between P and R the spinning operation will be stopped together with the timer. If the door has been left open before the reaching of this spinning operation, the basket will not spin and the timer will stop.

After the spinning operation P to R, the timer continues to run until position S is reached when the contacts 3 and 4 are opened, thus deenergizing the timer motor 20. At this time the entire washing operation is terminated and the clothes may be removed from the machine. The knob 36 remains at S until the machine is used again.

The opening of the door 56 does not interfere with any of the filling or agitating operations A to D, F to J, and L to P. However, should the door 56 be open at, or be opened during, the spinning operation, all of the operations of the machine, including the timer operation, are stopped. These operations are resumed upon the closing of the door 56. This allows the user to inspect the interior of the machine at all times except when spinning is taking place. He can even inspect the machine during the spinning operation; but that operation is stopped until the door is closed.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A washing machine comprising: a centrifugally rotatable basket; agitating means for clothes in said basket; a power motor; transmission means to connect said motor to rotate said basket centrifugally and to agitate said clothes;

6

a liquid feeder for said basket; a door for access to said basket; a timer sequentially to establish a filling period, an agitation period and a spin period for said liquid feeder, agitation means and basket respectively; a door-operated controller having means operable, when said door is closed, to enable said timer to establish and continue all of said periods; said controller having means, when said door is opened, operable to enable said timer to establish said filling and agitation periods and to disable said timer to establish and continue said spin period; said last named means being effective to stop said timer if said door is opened during a spin period.

2. A washing machine comprising: power lines adapted to be connected to a source of power; a rotatable tube; an agitator in said tub; a power motor; a transmission connecting said motor with said tub and agitator; a spin actuator for said transmission to cause spinning of said tub; liquid filling means for said tub; a power motor switch; a timer motor switch; a filling means switch; a spin switch; a timer motor actuating said switches at various intervals of time; a normally closed solenoid contactor in series with one power line and all of said switches; the solenoid of said contactor being in series with said line and said spin switch; a door switch in series with said solenoid and spin switch; and electrical connections from the other power line to the switches, power motor, timer motor, filling means, spin actuator, contactor and solenoid.

3. A washing machine comprising: power lines adapted to be connected to a source of power; a rotatable tub; an agitator in said tub; a power motor member; a transmission connecting said motor member, tub and agitator; a spin controller member controlling said transmission to cause rotation of said tub; a hot water fill valve member; a tepid water fill valve member; a timer motor member; a movable power motor and tepid water fill blade to control said power motor member and said tepid water fill valve member; a movable timer blade to control said timer motor member; a movable hot water fill and spin blade to control said hot water fill valve member and spin controller member; said timer motor member moving said blades at various intervals of time; stationary contacts for said blades, said last named blade having a spin stationary contact and a hot water fill contact selectively contactable by said blade; a normally closed solenoid switch in series with one power line and said stationary contacts, the solenoid of said solenoid switch being in series with said one line and with said spin stationary contact; a door switch in series with said solenoid and said spin stationary contact; and electrical connections from the other power line to said member, certain of said blades, certain of said contacts, certain of said switches, and said solenoid.

4. A control switch means comprising: a plurality of mechanism control switches; a timer motor sequentially actuating said switches; a safety switch in series with said mechanism control switches and timer; a door; means opening said safety switch when a certain one of said mechanism control switches is actuated and said door is open and closing said safety switch when said certain one of said mechanism control switches is not actuated and said door is either open or closed.

5. A control switch means comprising: a plurality of mechanism control switches; a timer motor sequentially actuating said switches; a

7

safety switch in series with said mechanism control switches and timer; a solenoid controlling said safety switch, said solenoid being in series with a certain one of said mechanism control switches to be electrically modified when said certain switch is actuated and to be electrically unmodified when said certain switch is not actuated.

6. A control switch means comprising: a plurality of mechanism control switches; a timer motor sequentially actuating said switches; a safety switch in series with said mechanism control switches and timer; a solenoid controlling said safety switch, said solenoid being in series with a certain one of said mechanism control switches to be electrically modified when said certain switch is actuated and to be electrically unmodified when said certain switch is not actuated; and a door controlled switch in series with said solenoid and certain switch.

7. A control switch means including: a plurality of mechanism control switches; a timer motor switch; a timer motor and cam means drivingly connected to operate said switches to produce sequentially a plurality of mechanical operation periods; a door switch adapted to be operated by a door providing access to said mechanical operations; said door switch, when said door is closed, enabling all of said switches; said door switch, when said door is open, enabling some of said mechanism control switches and said timer motor switch during corresponding mechanical operation periods and disabling another of said mechanism control switches and said timer motor switch during the corresponding mechanical operation period.

8. A control switch means comprising: a plurality of mechanism control switches; a timer motor switch; a timer motor actuating certain

8

of said switches at various intervals of time; a normally closed solenoid contactor in series with one line and said switches; the solenoid of said contactor being in series with said line and a certain one of said mechanism control switches; and a door switch in series with said solenoid and said certain switch.

9. A control switch means comprising: a plurality of mechanism control switch blades; a timer motor moving said blades at various intervals of time; stationary contacts for said blades, a certain one of said blades having a dangerous contact connected with a dangerous mechanism contactable by said blade; a normally closed solenoid switch in series with one line and said stationary contacts, the solenoid of said solenoid switch being in series with said one line and with said dangerous contact; and a door switch operated by a door providing access to said dangerous mechanism in series with said solenoid and said dangerous contact.

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