Oct. 18, 1960 K. O. SISSON 2,956,426

DOMESTIC APPLIANCE

Filed June 27, 1957 2 Sheets-Sheet 1

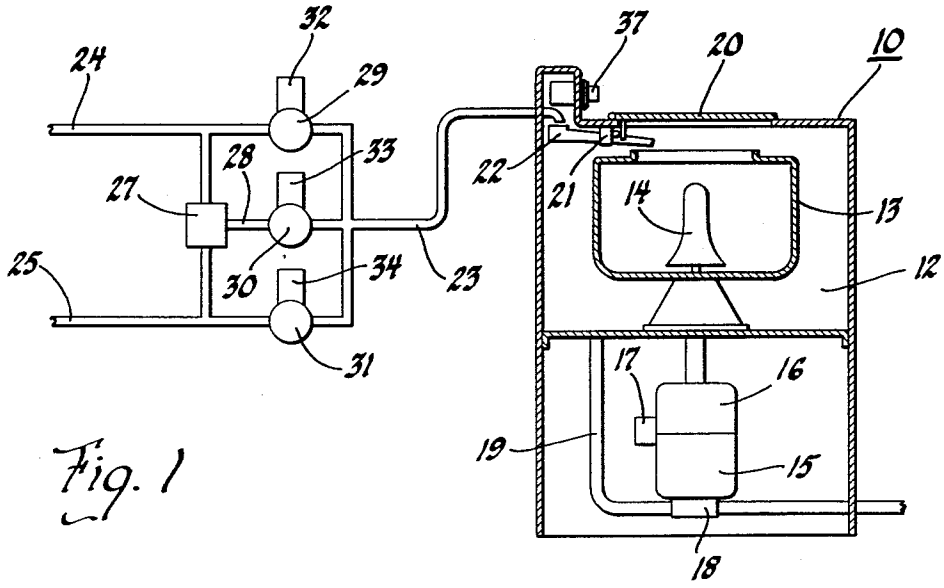

Fig. 1

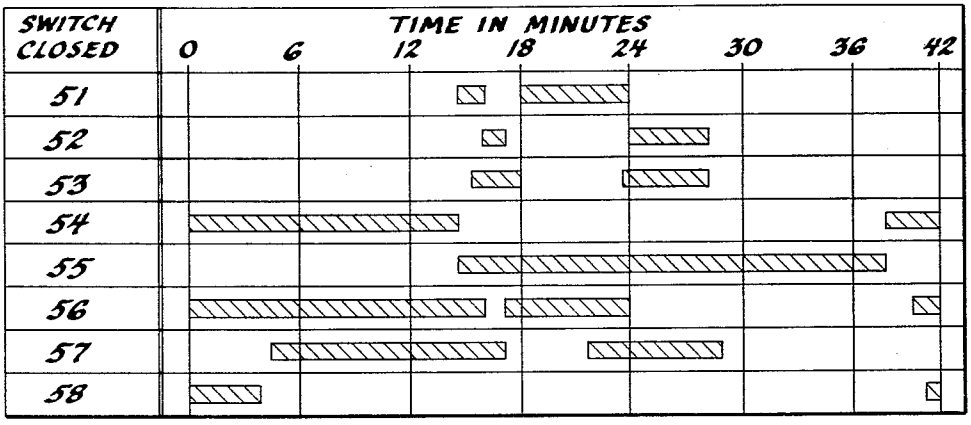

Fig. 3

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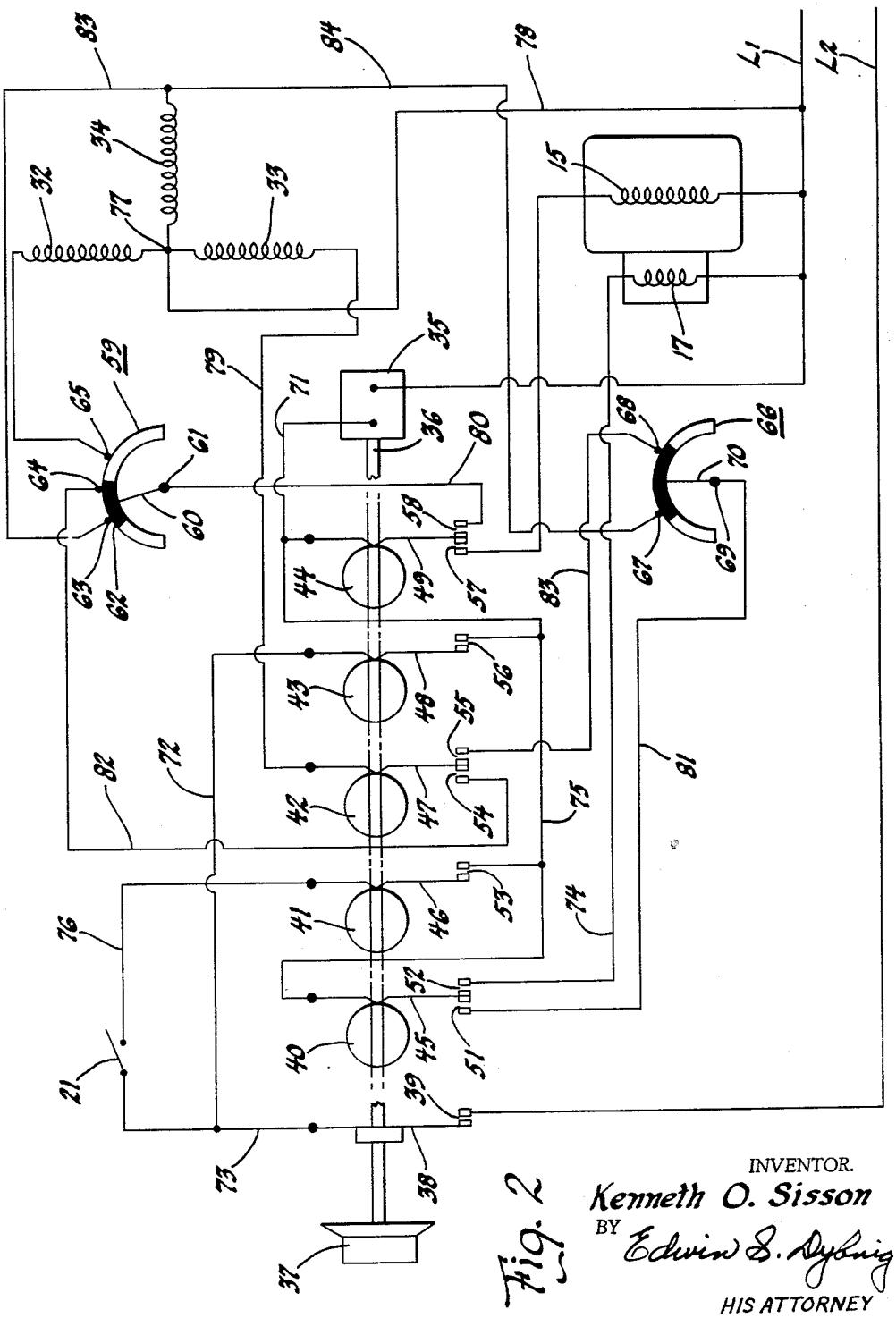

Fig. 2

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United States Patent Office 2,956,426 Patented Oct. 18, 1960

2,956,426

DOMESTIC APPLIANCE

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Filed June 27, 1957, Ser. No. 668,484

1 Claim. (Cl. 68—12)

This invention relates to a domestic appliance and more particularly to a water temperature control system for controlling the temperature of water being supplied to the tub of a washing machine. My copending application Serial No. 668,485 filed June 27, 1957, relates to another water control system for a washing machine.

An object of the invention is to provide a washing machine with solenoid operated valve apparatus that operates to control the temperature of water being supplied to the tub of the machine, the control apparatus including a wash selector switch and a rinse selector switch both connected wtih a voltage supply and with the solenoid valve apparatus for controlling the temperature of both the wash water and rinse water that is supplied to the tub of the machine, and wherein the wash selector switch and the rinse selector switch may be preset prior to a washing operation.

Another object of this invention is to provide a water temperature control system for a washing machine which includes a solenoid operated valve, a rinse selector switch, a wash selector switch, and a timer operated switch mechanism all connected with a voltage supply, and wherein the timer operated switch mechanism alternately places the solenoid valve either under control of the wash selector switch or under control of the rinse selector switch.

A further object of this invention is to provide a water temperature control system for a washing machine which includes a plurality of solenoid operated valves that control the passage of water between a plurality of the water inlet pipes and the tub of the machine, the system including a wash selector switch connected with the solenoids for controlling the passage of wash water into the tub, and a rinse selector switch connected with the solenoids for controlling the passage of rinse water into the tub, each switch having a plurality of temperature settings, there being switch means in the circuit for alternately placing either the wash selector switch or the rinse selector switch in sole control of the solenoid operated valves.

Still another object of this invention is to provide a water temperature control system for a washing machine which includes a plurality of solenoid operated valves that control the passage of water between a plurality of water inlet pipes and the tub of the machine, the system including a wash selector switch for controlling the solenoid valves and a rinse selector switch for controlling the solenoid valves, there being a timer operated switch mechanism for alternately directly connecting the solenoids of the valves in a circuit with the rinse selector switch or wash selector switch without the use of relays or other similar auxiliary circuit apparatus.

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:

Figure 1 is a diagrammatic illustration of the washing machine of this invention showing the water supply apparatus for the washing machine;

Figure 2 is an electric circuit diagram of the control circuit of the washing machine of this invention; and

Figure 3 is a sequence chart showing the times at which the timer operated switches shown in Fig. 2 are closed.

Referring now to the drawings and more particularly to Fig. 1, a washing machine generally designated by reference numeral **10**, has an outer tub **12** and an inner tube **13**. A vertically reciprocable agitator **14** is disposed within the tub **13** and is driven by an electric motor **15** through a transmission **16**. A spin solenoid **17** controls the transmission so as to provide for either vertical reciprocation of agitator **14** or high speed rotation of tub **13**. When the electric motor **15** is energized the agitator **14** is vertically reciprocated and when the motor **15** and spin solenoid **17** are both energized, the tub **13** is rotated at high speed for spinning water out of the inner tub **13** into the outer tub **12**. The transmission mechanism and spin solenoid may be of the type shown in the patent to Kendall Clark, 2,422,395, dated June 17, 1947. The outer tub **12** is exhausted of water by a pump **18** that is driven by electric motor **15** and which is connected to the tub **12** by pipe **19**. The top of the washing machine has an access opening that is closed by a door **20** which is pivoted to the outer cabinet of the machine. The door actuates a normally open door switch **21** to its closed position when the door is in a closed position.

The water filling apparatus for the washing machine includes a spout **22** having an outlet located over the top opening of tub **13**. This spout is fed by a pipe **23** which is connected through solenoid valve apparatus to a hot water pipe **24** and a cold water pipe **25**. The pipes **23**, **24** and **25** and the solenoid valve apparatus are preferably located within the washing machine but are shown exteriorly thereof for clarity of explanation. The hot water pipe **24** and the cold water pipe **25** are connected with suitable hot and cold water supply means. These pipes are directly connected with a thermostatic mixing valve **27** of any well known construction, which mixes the hot and cold water to provide a water temperature that is intermediate the temperatures of the hot and cold water temperatures and which may be termed a "warm" temperature. The warm water exits from thermostatic mixing valve **27** into a pipe **28**. The flow of water between pipes **24**, **25** and **28** and pipe **23** is controlled by conventional solenoid operated valves **29**, **30** and **31** which are normally closed and are operated to an open position by solenoids **32**, **33** and **34**. When solenoid **32** is energized, hot water is supplied to the tub of the washing machine. When solenoid **33** is energized, warm water is supplied to the tub of the washing machine, and when solenoids **33** and **34** are both energized, water at a "cool" temperature is supplied to the tub of the washing machine.

Referring now to Fig. 2, a circuit diagram of the control circuit of the washing machine is shown. The various operations of the washing machine are controlled by a sequential electrical controller or timer which includes an electric timer motor **35** that rotatably drives a shaft **36**. The shaft **36** is connected with a control knob **37** which rotates with shaft **36**. The control knob **37** and shaft **36** may also move axially to move an electric contactor **38** which cooperates with an electric contact to form a switch **39**. When the shaft **36** is pushed in so as to move it rightwardly in Fig. 2, the switch **39** is closed. The shaft **36** carries a plurality of cams designated, respectively, by reference numerals **40**, **41**, **42**, **43** and **44**. These cams, respectively operate electrical conducting contactors **45**, **46**, **47**, **48** and **49**. The contactor **45** is associated with two electrical contacts to form electric switches **51** and **52**. In a like manner contactors **46**, **47**, **48** and **49** cooperate with associated

electric contacts to form switches 53, 54, 55, 56, 57 and 58. The cams 40, 41, 42, 43 and 44 are designed to close the switches 51, 52, 53, 54, 55, 56, 57 and 58 during certain intervals of time, as indicated by the chart in Fig. 3. Thus, as timer motor 35 rotates shaft 36, the cams close the timer operated switches for predetermined intervals of time, as indicated by the chart in Fig. 3.

The control circuit of Fig. 2 includes a selector switch generally designated by reference numeral 59, which controls the energization of solenoids 32, 33 and 34 during the time when wash water is being supplied to the tub of the washing machine. This switch has a movable electrically conductive contactor 60 connected with a fixed contact or terminal 61. The contactor 60 is connected with an arcuate conductor portion 62 which selectively engages contacts 63, 64 and 65. When the movable contactor 60 is in the extreme counter-clockwise position the contacts 61, 63 and 64 are connected together, whereas when the contactor 61 is in a vertical position, the contacts 61 and 64 are connected together. When the contactor 60 is in an extreme clockwise position, the contacts 61 and 65 are connected together.

A similar selector switch generally designated by reference numeral 66 controls the energization of solenoids 32, 33 and 34 during the time rinse water is being supplied to the tub of the washing machine. This switch includes fixed contacts 67, 68 and 69 and a movable electrical conductive contactor 70. When the movable contactor 70 is in the extreme counter-clockwise position the contacts 67 and 69 are connected together and when the contactor 70 is in the extreme clockwise position, the contacts 68 and 69 are connected together. With the contactor 70 in a vertical position, the contacts 67, 68 and 69 are connected together.

The electric motor 15 has one side connected directly to a power input line L_1 and has its other side connected with timer operated switch 57. The other power input line is designated by reference numeral L_2 and the two power lines are connected with a suitable source of voltage. The movable contactor 49 is connected with a line 71 that is, in turn, connected with one side of switch 56. The opposite side of switch 56 is connected to a line 72, that is in turn connected to a line 73 which leads to one side of switch 39. The opposite side of switch 39 is connected directly with power input line L_2. The spin solenoid 17 has one side directly connected to line L_1 and has its other side connected to one side of switch 52 via line 74. The opposite side of switch 52 is connected with a line 75 that is, in turn, connected with one side of switches 53 and 56. The opposite side of switch 53 is connected in series with lid operated switch 21 via a line 76. From an inspection of Figs. 2 and 3 it can be seen that the motor 15 is energized when switches 57, 56 and 39 are closed. These switches are closed during the agitation cycle of the washing machine to vertically reciprocate agitator 14. During the spin cycle of the washing machine, when the tub 13 is spun at high speed, the motor 15 is energized through switches 57, 53 and through lid switch 21. The spin solenoid during this period is energized via switches 52, 53 and lid switch 21. It thus can be seen that an opening of the lid switch 21, which may be accomplished by opening door 20, will operate to open the circuit to both motor 15 and spin solenoid 17 to terminate spinning of the tub. The lid switch 21, when in an open position, will not terminate the vertical reciprocation of agitator 14 during the agitation cycle of the washing machine, however, due to the fact that a circuit is completed to the motor at this time via timer operated switches 56 and 57. It thus is apparent that the lid switch only operates to terminate operation of motor 15 during the high spin period of tub 13 when timer switches 52 and 53 are closed.

The solenoids 32, 33 and 34 that operate valves 29, 30 and 31 are connected together at a common tie-point 77. This common tie-point is connected directly to input power line L_1 via line 78. The opposite side of solenoid 32 is connected directly with switch contact 65. The opposite side of solenoid 34 is connected directly with contact 63 of switch 59 and with contact 67 of switch 66. The solenoid 33 is connected to movable contactor 47 via line 79. The terminal 61 of switch 59 is connected to one side of switch 58 via line 80. The fixed contact 69 of switch 66 is connected to one side of switch 51 via line 81. The fixed contact 64 of switch 59 is connected to one side of switch 54 via line 82. The fixed terminal 68 of switch 66 is directly connected to one side of switch 55 via line 83.

The user of the washing machine desiring to set the machine into operation rotates the knob 37 to a "start" or "wash-fill" position and axially moves control shaft 36 to close switch 39. In this position the switches 54, 56 and 58 are closed, as indicated by the sequence chart of Fig. 3 and the timer motor 35 is energized to begin rotation of shaft 36. Assuming that the wash selector swtitch 59 is in the position shown in Fig. 2, the solenoids 34 and 33 are energized thereby providing the washing machine tub with water at a "cool" temperature. The solenoid 33 in this position of the timer and selector switch 59 is energized via line 79, switch 54, line 82, switch 59, line 80, switch 58, switch 56, and line switch 39. The solenoid 34 is energized via line 83, selector switch 59, switch 58, switch 56, and through line switch 39. In this position of wash selector switch 59 wash water at a cool temperature is supplied to tub 13 due to the fact that warm water and cold water from lines 28 and 25, respectively, are being mixed and supplied to the tub 13. If the selector switch 59 were in its vertical intermediate position at this time, only warm water would be supplied to tub 13 as only the solenoid 33 would be energized, as is apparent from the circuit of Fig. 3. If the selector switch were in the extreme clockwise position so as to connect contacts 61 and 65, only solenoid 32 would be energized to supply hot water only to the tub 13. The tub continues to fill with water as long as timer operated switches 54, 56 and 58 are closed, and when switch 58 opens the wash-fill cycle of the washing machine is ended.

When timer operated switch 58 opens, due to continued rotation of shaft 36, timer operated switch 57 closes to energize the electric motor 15, thereby vertically reciprocating agitator 14. This vertical reciprocation of agitator 14 agitates the clothes within tub 13 during the agitation cycle of the washing machine. Following the agitation cycle of the washing machine, switches 52 and 53 are closed and switch 56 opens to provide an energizing circuit for spin solenoid 17 through the lid switch 21. At this point in the cycle the tub 13 is rotated at high speed to centrifuge the water into the outer tub 12. The spin cycle continues until switch 52 opens, whereupon switch 56 once more closes.

Immediately following the high speed spin cycle, the washing machine tub 13 is filled with rinse water. Assuming that the rinse selector switch 66 is in the position shown in Fig. 2, a circuit is completed for solenoids 33 and 34 to provide a rinse water at a "cool" temperature by the mixture of cold water and warm water from pipes 25 and 28. The solenoid 33 is energized via line 79, switch 55, line 83, rinse selector switch 66, line 81, switch 51, switch 56 and through switch 39 to line L_2. The solenoid 34 is energized via line 84, rinse selector switch 66, line 81, switch 51, switch 56 and through line switch 39 to line L_2. If the movable contactor of rinse selector 66 were at this time in the extreme counter-clockwise position, only cold water would be supplied to the tub 13, as in this position only the solenoid 34 is energized. If the rinse selector switch were at this time in the extreme clockwise position, only solenoid 33 would be energized to supply warm water from pipe 28 to the tub

13 of the washing machine. It thus can be seen that the rinse selector switch 66 may be set at three different positions to provide for three rinse water temperatures for the washing machine.

It can be seen from the foregoing that the wash selector switch 59 is connected with the solenoids 32, 33 and 34 during various settings of the switch by the timer operated switches 54, 56 and 58. On the other hand, the rinse selector switch 66 is at other times connected in circuit relationship with solenoids 32, 33 and 34 by timer operated switches 51, 55 and 56 for the various positions of the rinse selector switch. With such an arrangement the wash selector switch 59 has exclusive control over the solenoids during the time the washing machine is being filled with wash water, and the rinse selector switch has exclusive control over the solenoids during the time the washing machine is being supplied with rinse water. Thus, assuming that the wash selector switch 59 is in a fully clockwise position to connect contacts 61 and 65, the solenoid 32 is energized to provide hot water during the supplying of wash water to the washing machine. This circuit may be traced via line 78, through solenoid 32, through selector switch 59 via line 80, switch 58, switch 56, line 72, line 73, and back through line switch 39 to line L_2. If at the same time the rinse selector switch 66 is in an extreme counter-clockwise position so as to energize solenoid 34, cold water will be supplied to the washing machine during the rinse cycle. This circuit may be traced via line 78, through cold solenoid 34, via line 84, through rinse selector switch 66, through line 81, through switch 51, through switch 56, line 72, line 73, and via line 39 back to power input line L_2. It can be seen that setting of the selector switch to provide hot water to the washing machine in no way affects the control by the rinse selector switch which was set to provide cold water during the rinse cycle of the washing machine. The same is true of the other settings of switches 59 and 60, and the switches 59 and 66 thus have separate control over the solenoids during all settings of the switches.

At some point very near the end of the rinse-fill cycle of the washing machine the switch 57 is closed, as indicated from the chart of Fig. 3, to provide vertical reciprocation of agitator 14 during the supplying of rinse water to the tub. After the rinse cycle is completed, the switches 52 and 53 are closed to provide for high speed spinning of the tub, whereupon the rinse water is centrifugally thrown into outer tub 12 and is exhausted to drain. The cycle of the machine ends when the high speed spin cycle is completed and this occurs when switches 52 and 53 open for the second time, as shown in the chart of Fig. 3.

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 claim which follows.

What is claimed is as follows:

In combination with a washing machine having a tub, conduit means for conducting water to said tub, a cold water inlet pipe, a hot water inlet pipe, a mixed water inlet pipe, a first solenoid operated valve including a first solenoid connected between said cold water inlet pipe and said conduit means, a second solenoid operated valve including a second solenoid connected between said hot water inlet pipe and said conduit means, a third solenoid operated valve including a third solenoid connected between said mixed water inlet pipe and said conduit means, a timer, first, second, third and fourth timer operated switches periodically closed by said timer with said first and third switches being both closed during a certain period of time and said second and fourth switches both being closed during a second different period of time, an input power lead directly connected to one side of all of said solenoids, a wash selector switch having a first terminal connected with a movable contactor and having second, third and fourth terminals, said contactor having a first position wherein said first terminal is connected with said second and third terminals, a second position wherein said first terminal is connected with said third terminal and a third position wherein said first terminal is connected with said fourth terminal, a rinse selector switch having a first terminal connected with a movable contactor and having second and third terminals, said rinse switch contactor having a first position wherein said first terminal is connected with said second and third terminals, a second position wherein said first terminal is connected with said second terminal and a third position wherein said first terminal is connected with said third terminal, means directly connecting an opposite side of said first solenoid with said second terminal of said wash selector switch and with said second terminal of said rinse selector switch, means directly connecting an opposite side of said second solenoid with the fourth terminal of said wash selector switch, means directly connecting the opposite side of said third solenoid with one side of said second and third timer operated switches, means connecting the third terminal of said wash selector switch to an opposite side of said second timer operated switch, means connecting the third terminal of said rinse selector switch to an opposite side of said third timer operated switch, means connecting the first terminal of said wash selector switch to one side of said fourth timer operated switch, means connecting the first terminal of said rinse selector switch with one side of said first timer operated switch, and a second power supply lead connected to the opposite side of said first and fourth timer operated switches.

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