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TIME DELAY SWITCH FOR FLUORESCENT LAMPS

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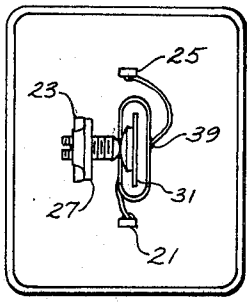


FIG. 2

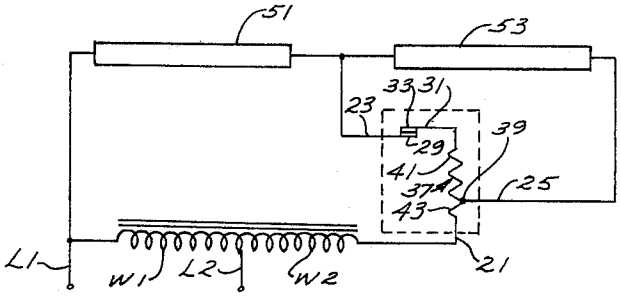


FIG. 3

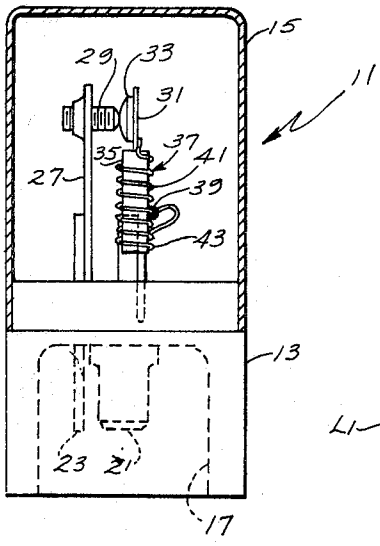


FIG. 1

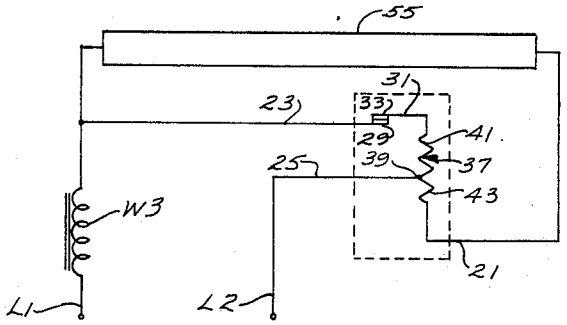


FIG. 4

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TIME DELAY SWITCH FOR FLUORESCENT LAMPS

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ABSTRACT OF THE DISCLOSURE

A thermal time delay switch is disclosed for automatically starting and then operating a fluorescent lamp. The switch includes a heating element having a pair of sections one of which is energized to open the switch for starting a fluorescent lamp and the other of which is energized during operation of the lamp to prevent the switch from resetting.

This invention relates to time delay switches and more particularly to a thermal time delay switch for automatically starting and operating fluorescent lamps.

Among the several objects of the invention may be noted the provision of a time delay switch for automatically starting and then operating a fluorescent lamp; the provision of such a switch which will start a pair of lamps connected in series across a source providing a voltage sufficient to start one of the lamps; the provision of such a switch which is automatically prevented from resetting during operation of a lamp controlled thereby; and the provision of such a switch which is reliable and which is relatively simple and inexpensive. Other objects and features will be in part apparent and in part pointed out hereinafter.

Briefly, thermal time delay apparatus of this invention is operative to automatically start and then operate a fluorescent lamp from an electric power source which includes an inductive ballast. The delay apparatus incorporates a snap-acting thermostatic switch which is movable from a first position constituting a closed position to a second position constituting an open position when heated above a predetermined operating temperature. A heating element having first and second sections is disposed in heat exchange relationship with the thermostatic switch for heating the switch to cause it to snap to the closed position. The apparatus also includes circuit means controlled by the thermostatic switch for shunting the lamp and energizing at least the first heater section upon initial energization of the lamp when the switch is closed and for energizing the second section alone in series with the lamp after a predetermined delay during which the thermostatic switch is heated to its operating temperautre. The opening of the thermostatic switch causes an inductive pulse for starting the lamp and the continued energization of the second section prevents the switch member from returning to its closed position while the lamp is energized.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings in which several of various possible embodiments of the invention are illustrated,

FIG. 1 is a side view, with parts broken away of a thermal time delay switch of this invention;

FIG. 2 is a top view of the switch of FIG. 1 with the cover removed;

FIG. 3 is a schematic circuit diagram of the switch of

FIGS. 1 and 2 employed in a circuit for starting a pair of fluorescent lamps; and

FIG. 4 is a schematic circuit diagram of a circuit employing the switch of FIGS. 1 and 2 for starting a single fluorescent lamp.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now to FIG. 1, there is indicated generally at **11** a thermal time delay switch of this invention. Switch **11** includes a base member **13** formed of a synthetic resin or other insulating material and upon which the switch components are mounted and a metal cover **15** for enclosing the operating components. The base **13** includes a recessed socket **17** within which are located three spade terminals **21**, **23** and **25** which have portions extending through the base **13** into the area enclosed by the cover **15**. Terminal **23** carries an extension **27** through which is threaded an adjustable stationary contact **29**.

Also mounted on the base **13** is a bimetallic snap-acting switch member **31** which is electrically insulated from the terminals **21**, **23** and **25**. The bimetal switch member **31** is shaped or formed so as to constitute a non-developable surface, e.g., a section of a spherical surface, over at least a portion of the area of the member so as to be snap-acting in a conventional manner. Member **31** carries a contact **33**. When member **31** is relatively cool, the contact **33** occupies a first position in which that contact is in engagement or electrical contact with the fixed contact **29** thereby constituting a closed position. When the switch member **31** is heated above a predetermined operating temperature the snap-action of the bimetal member moves its contact **33** to a second position in which movable contact **33** is spaced away from the fixed contact **29** thereby constituting an open position.

An electrically insulating sleeve **35** surrounds the bimetal switch member **31** and around the sleeve is wound a resistance heating element indicated generally at **37**. The heating element is thus in heat exchange relationship with member **31** for causing it to operate. The upper end of the heating element winding is connected to the switch member **31** and its lower end is connected to the terminal **21**. The heating winding includes a tap as indicated at **39** which divides the heating element **37** into two portions or sections, an upper resistance section **41** and a lower resistance section **43**. This tap is connected to the terminal **25**.

Referring now to FIG. 3, the circuit shown there employs a pair of fluorescent lamps **51** and **53** which are connected in series. Electric power for energizing the lamps **51** and **53** is provided through supply leads L1 and L2 from a source providing a voltage sufficient to start one of the lamps when applied through an appropriate ballast. For this purpose, the source or supply presented to the lamps includes an inductive ballast of the autotransformer type comprising a pair of loosely coupled windings W1 and W2 connected as shown. The end of the lamp **51** opposite the common junction between the lamps is connected to the one side of the source at the lead L1 and the other end of the other lamp (**53**) is connected, through the terminal **25**, to the tap **39** of the heating element. The one end of the heating element is connected, through the terminal **21**, to the winding W2 which constitutes the other side of the source presented to the lamp circuit. The terminal **23** which carries the stationary switch contact **29** is connected to the common junction between the tubes **51** and **53**.

Upon initial energization of the lamp circuit, the bimetal switch element **31** is relatively cool and thus the switch is closed, thereby shunting the lamp **53** with the portion **41** of the resistance of the heating element. Ac-

cordingly, substantially the entire source voltage is applied across the lamp **51**. As noted previously, this source voltage, when applied through an inductive ballast as shown, is sufficient to start one lamp and thus the lamp **51** ignites and draws current through both sections of heater element **37**. After a delay during which the bimetal switch member **31** heats to its operating temperature, the switch member snaps to the second or open position. The snap opening of this circuit generates a substantial inductive pulse due to the current being drawn by the lamp **51** through the ballast winding W2 and this inductive pulse starts the other lamp **53**. The current drawn by the pair of serially connected lamps flows through the portion **43** of the resistance of the heating element, and sufficient heat is thereby generated in this section or portion of element **37** to prevent the bimetal switch member from returning to its first or closed circuit position. Thus the lamps **51** and **53** will continue to be lit until otherwise deenergized. When the lamps are subsequently deenergized, the switch element **31** cools down and resets thereby becoming ready for another start cycle.

In the circuit illustrated in FIG. 4, a single fluorescent lamp **55** is selectively energized from a source including an inductive ballast W3. One end of the lamp is connected to the side of the source including the ballast together with the delay switch terminal **23**. The heating element tap **39** is connected, through terminal **25**, to the other side of the source and the heating resistance section **43** is connected, through terminal **21**, to the other end of lamp **55**.

Upon initial energization of this lamp circuit, the section **41** of the heating element is energized from the source until the thermostatic switch opens. At this point, the current being drawn through the inductive ballast W3 by this heater section causes an inductive pulse which starts the lamp **51**. Thereafter, the current drawn by the lamp through the section **43** of the resistance heating element keeps the thermostatic switch from resetting.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Thermal time delay apparatus for automatically starting and then operating a fluorescent lamp from an electric power source which includes an inductive ballast; said apparatus comprising:

a snap-acting thermostatic switch which is movable from a first position constituting a closed position to a second position constituting an open position when heated above a predetermined operating temperature;

a heating element disposed in heat exchange relationship with said switch for heating said switch to cause it to snap to said second position, said heating element having first and second sections; and

circuit means controlled by said switch for shunting said lamp and energizing at least said first heater section upon initial energization of said lamp when said switch is closed and for energizing said second section alone in series with said lamp after a predetermined delay during which said switch is heated to its operating temperature, the opening of said switch causing an inductive pulse for starting said lamp and the continued energization of said second section preventing said switch from returning to said first position while said lamp is energized.

2. Apparatus as set forth in claim **1** wherein said switch includes a bimetal operating member.

3. Apparatus as set forth in claim **2** wherein said bimetal member forms a nondevelopable surface to provide snap action.

4. Apparatus as set forth in claim **3** wherein said heating element comprises a resistance winding around said bimetal member.

5. Apparatus as set forth in claim **4** including an electrically insulating sleeve separating said winding from said member.

6. A thermal time delay switch for automatically starting and then operating a pair of fluorescent lamps from a source providing a voltage sufficient to start one lamp, said lamps being connected in series with a common junction therebetween and with the other end of one of said lamps being connected to one side of said source, said source including an inductive ballast; said switch comprising:

first terminal means for connection to said common junction;

a snap-acting thermostatic switch member which is movable from a first position in contact with said first terminal means to a second position spaced therefrom when said switch member is heated above a predetermined operating temperature;

second and third terminal means;

a resistance type heating element disposed around said switch member for heating said member to cause it to snap to said second position, one end of said heating element being connected to said switch member and the other end being connected to said second terminal means for connection to the other side of said source, said heating element having an intermediate tap connected to said third terminal means for connection to the other end of said other lamp whereby, upon initial energization of the lamp circuit from said source, said other lamp is shunted by a portion of the resistance of said heating element due to the contact of said switch member with said first terminal and substantially the entire source voltage is applied across said one lamp thereby starting it and whereby, after a delay during which said switch member is heated to its operating temperature, said switch member snaps to said second position thereby causing an inductive pulse for starting said other lamp, the current drawn by said lamps flowing through said tap thereby energizing another portion of the resistance of said heater element for preventing said switch member from returning to said first position.

7. A switch as set forth in claim **6** wherein said ballast is of the autotransformer type.

8. A thermal time delay switch for automatically starting and then operating a fluorescent lamp from an electric power source which includes an inductive ballast, one end of said lamp being connected to one side of said source; said switch comprising:

first terminal means for connection to said one side of said source;

a snap-acting thermostatic switch member which is movable from a first position in contact with said first terminal means to a second position spaced therefrom when said switch member is heated above a predetermined operating temperature;

second and third terminal means; and

a resistance type heating element disposed around said switch member for heating said member to cause it to snap to said second position, one end of said heating element being connected to said switch member and the other end being connected to said second terminal for connection to the other end of said lamp, said heating element having an intermediate tap connected to said third terminal means for connection to the other side of said source whereby, upon initial energization of the lamp from said source, the lamp is shunted by a portion of the resistance of said heating element due to the contact of said switch member with said first terminal and whereby, after a delay during which said switch member is heated to its operating temperature, said

switch member snaps to said second position thereby causing an inductive pulse for starting said lamp, the current thereafter drawn by said lamp flowing through said tap thereby energizing another portion of the resistance of said heater element for preventing said switch member from returning to said first position.

9. A thermal time delay switch comprising:

first terminal means;

a snap-acting bimetal switch member which is movable from a first position in contact with said first terminal means to a second position spaced therefrom when said switch member is heated above a predetermined operating temperature;

second and third terminal means;

an electrically insulating sleeve disposed around said switch member;

a resistance heating element wound around said sleeve for heating said switch member for causing it to snap to said second position, one end of said heating element being connected to said switch member and the other end being connected to said second terminal means, said heating element having an intermediate tap connected to said third terminal means to provide for reduced energization of said heating element.

10. A switch as set forth in claim **9** wherein said first terminal means includes an adjustable stationary contact.

11. A switch as set forth in claim **9** including an insulating base upon which said first, second and third terminals and switch member are mounted and thereby insulated from each other.

12. A switch as set forth in claim **9** including a cover for enclosing and protecting said switch member and said heating element.

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