Sept. 16, 1958 R. W. DE LANCEY 2,852,640

TIME DELAY DEVICE

Filed Oct. 6, 1955

Fig. 3.

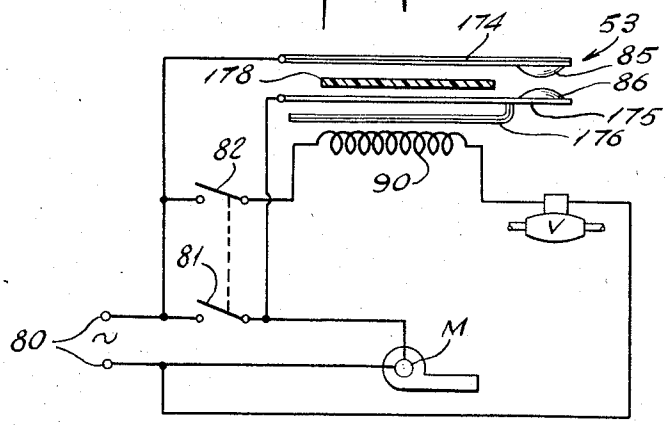


Fig. 1.

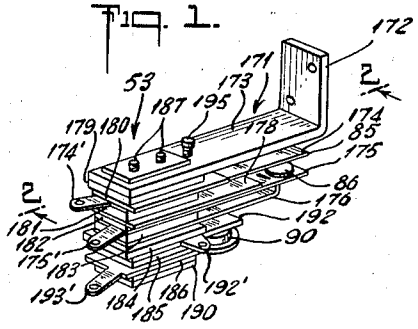
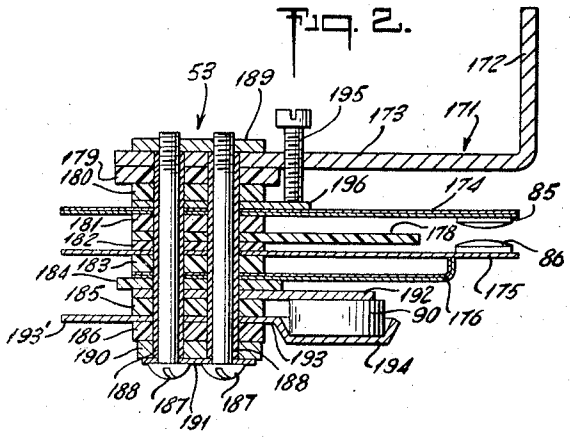


Fig. 2.



INVENTOR
RALPH W. DELANCEY
BY
ATTORNEY

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2,852,640

TIME DELAY DEVICE

Ralph W. DeLancey, Des Plaines, Ill., assignor, by mesne assignments, to Controls Company of America, Schiller Park, Ill., a corporation of Delaware

Original application August 10, 1954, Serial No. 448,966. Divided and this application October 6, 1955, Serial No. 538,883

1 Claim. (Cl. 200—122)

This invention relates to electrical control devices and more specifically to an electric switch and associated time delay means which may be used among other things to control two circuits independently with time delays being introduced upon the initiation of one circuit and the interruption of another circuit.

This application is a division of my copending application Serial No. 448,966, filed August 10, 1954, entitled Electrical Control Devices.

In many electrically operated devices, the requirement often exists for the operation of two or more of the components in a predetermined order. One such application is the conventional oil burner wherein it is desirable to initiate the delivery of air into a combustion chamber before the admission of oil and to halt the admission of oil when the demand for heat has been satisfied and before the supply of air is interrupted. While this method of operating an oil burner is extremely desirable in order to eliminate smoke and materially retard the accumulation of carbon and soot on the internal areas of the furnace, the relative high cost and complication of controls for the attainment of this end has prohibited their general use in average oil burner installations.

Accordingly one object of the invention resides in the provision of an improved time delay control incorporating at least two time delay devices that may be used to control one or two circuits and characterized by its simplicity, dependability and low cost.

Another object of the invention is an improved heat responsive switch assembly including an associated heater wherein the switch is automatically compensated for changes in ambient temperature and the switch and heater may be used to control two independent circuits in a predetermined manner and with a high degree of stability and dependability.

Still another object of the invention is an improved thermal time delay control device.

The accompanying drawings show, for purposes of illustrating the present invention, an embodiment in which the invention may take form, it being understood that the drawings are illustrative of the invention rather than limiting the same.

In the drawings:

Figure 1 is a perspective view of one embodiment of a switch in accordance with the invention;

Figure 2 is a cross sectional view of the embodiment of Figure 1 taken along the line 2—2 thereof; and

Figure 3 is a circuit diagram illustrating an application of the switch of Figure 1 in oil burner installations.

Referring now to the drawings and more specifically to Figures 1 and 2, the switch **53** embodies a pair of temperature compensated bimetallic elements and a negative temperature coefficient resistor. The control devices of the switch are mounted on and carried by an angle bracket **171** having a mounting leg **172** and a switch supporting leg **173**. The contacts **85** and **86** for controlling one circuit are carried respectively by a strip **174** preferably bimetallic, and a leaf spring **175** of Phosphor bronze or the like. Movement of contact **86** and spring **175** is effected by an L-shaped bimetallic element **176** heated by a negative temperature coefficient resistor **90**. A heat baffle **178** is disposed between the bimetal element **174** and contact spring **175** to shield the element **174** from the heat generated by resistor **90** when the latter functions to heat the element **176** and cause contacts **85** and **86** to close.

The elements of this switch are held in predetermined spaced relationship by a plurality of insulating spacers **179** to **186** and a pair of screws **187** extending through insulating bushings **188** and threaded into a plate **189** on the back side of the mounting bracket **171**. In order to prevent damage to insulator **186**, metal plates **190** and **191** may be interposed between the heads of screws **187** and insulator **186** as illustrated.

The negative temperature coefficient resistor **90** is held in close proximity to the bimetallic element **176** by a pair of flat electrically conductive spring members **192** and **193** having terminals **192'** and **193'**, respectively, for connection to a circuit. The member **193** includes a cup-like part **194** for retention of resistor **90**. The contact carrying members **174** and **175** also terminate in terminals **174'** and **175'** for connection to an electric circuit. The member **175** is sprung backwardly to rest against and follow the movement of the bimetallic element **176**. Both bimetallic elements **176** and **174** are arranged to move in the same direction with changes in ambient temperature so that the spacing between contacts **85** and **86** normally remains the same. Upon heating, element **176** shifts relatively to the element **174** to close the contacts. The spacing between contacts **85** and **86** is adjustable by means of a screw **195** threaded in a cooperating opening in bracket part **173** and bearing against the plate **196** which in turn lies against the root end of the bimetallic contact carrying member **174**.

The switch as described above embodies means for ambient temperature correction, adjustment of the contacts to vary the time delay in opening and a negative temperature coefficient resistor that may be used to control the operation of an external circuit as well as heating the bimetallic elements. For instance, this resistor may be used to provide delayed operation of an oil valve in oil burning equipment and the bimetallic switch to delay interruption of the blower motor on the burner after the demand for heat has been satisfied. This application is illustrated in Figure 3. In this figure M denotes the blower motor of an oil burner connected to a suitable source of energy **80** through a switch **81** that may be the switch used in conventional oil burner installations. Thus when there is a demand for heat switch **81** will close to start motor. At the same time switch **82** is closed to energize the oil controlling means represented by the valve V through the negative temperature coefficient resistor **90**. The nominal or cold temperature resistance of resistor **90** is relatively high and will prevent sufficient flow of current to operate the valve. Thus upon starting only the blower motor M will function. Since the resistor **90** decreases in value as it heats in response to the current flowing through it, its resistance will fall, after a predetermined time interval to a value that will operate valve V and supply oil to the burner. In this way oil is not fed to the burner until an adequate supply of air is being furnished by the blower.

In addition to delaying admission of oil to the burner, the heater **90** also heats the bimetallic element **176** and causes contacts **85** and **86** to close and bypass the motor control switch **81**.

After the demand for heat has been satisfied, both switches **81** and **82** are automatically opened. This will immediately de-energize valve V to stop the supply of

oil but inasmuch as contacts **85** and **86** are closed the motor M will continue to supply air for an interval of time determined by the rate of cooling of the bimetallic elements **174** and **176**. In this way the motor M is started prior to the admission of oil and continues to run for a time after the oil supply is interrupted.

From the above it is apparent that the switch may be used to control other devices required to function in a predetermined sequence or the resistor **90** and contacts **85** and **86** can be connected with a device to be controlled so that a time delay is interposed on both starting and stopping the controlled device.

While only one embodiment of the invention has been illustrated and described it is apparent that modifications, changes and alterations may be made without departing from the true scope and spirit thereof.

What is claimed is:

A temperature responsive switch comprising a first bimetallic element fixedly mounted at one end, a contact carried on the other end thereof, a second contact and a flexible mount therefor positioned for cooperation with the said first contact, a second bimetallic element associated with and controlling the position of said second contact, said second bimetallic element being arranged to move in the same direction as said first element and maintain substantially uniform contact spacing with

changes in ambient tempertaure, a heat baffle between the first bimetallic element and the support for said second contact and a heater including a negative temperature coefficient resistor associated with said second bimetallic element for heating it relative to the first element to actuate said contacts.

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