Oct. 31, 1933. H. L. VAN VALKENBURG 1,932,808

RELAY SYSTEM

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Fig. 1

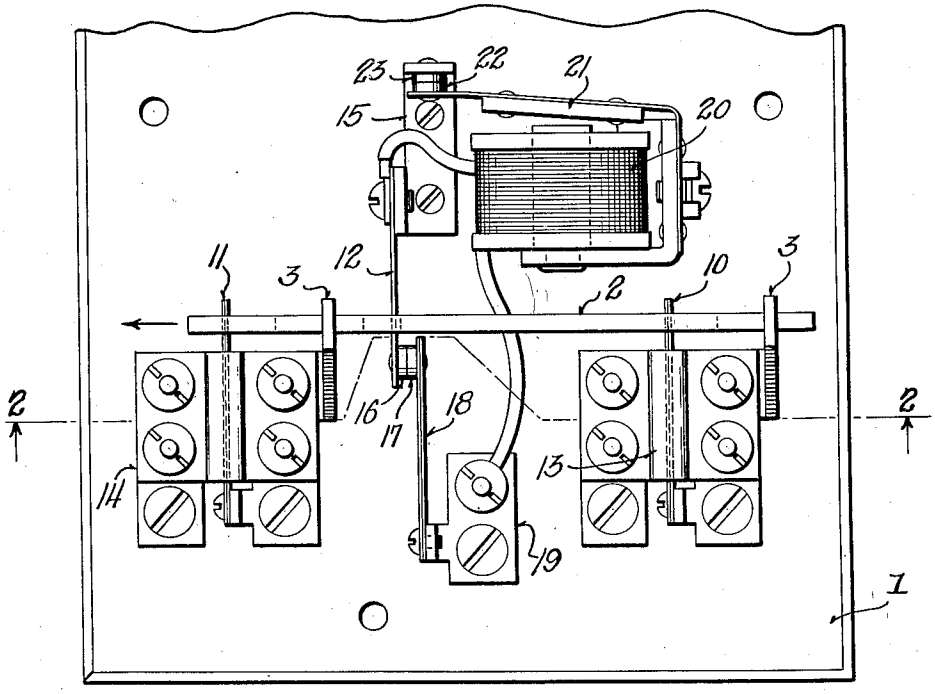
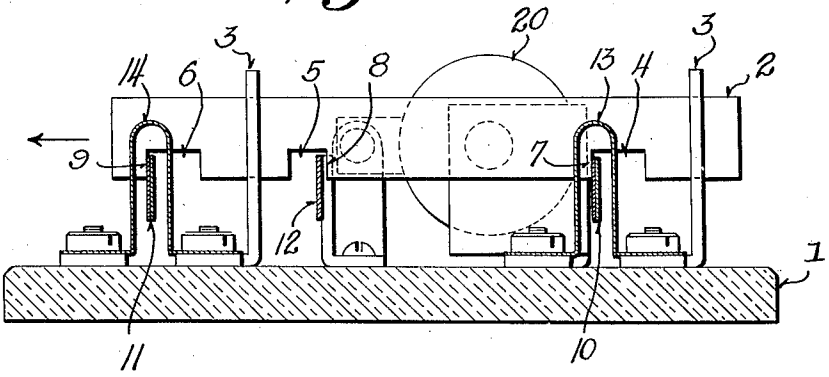


Fig. 2



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Fig. 3

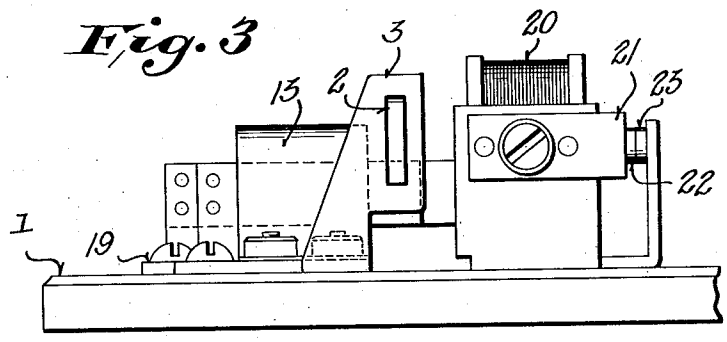
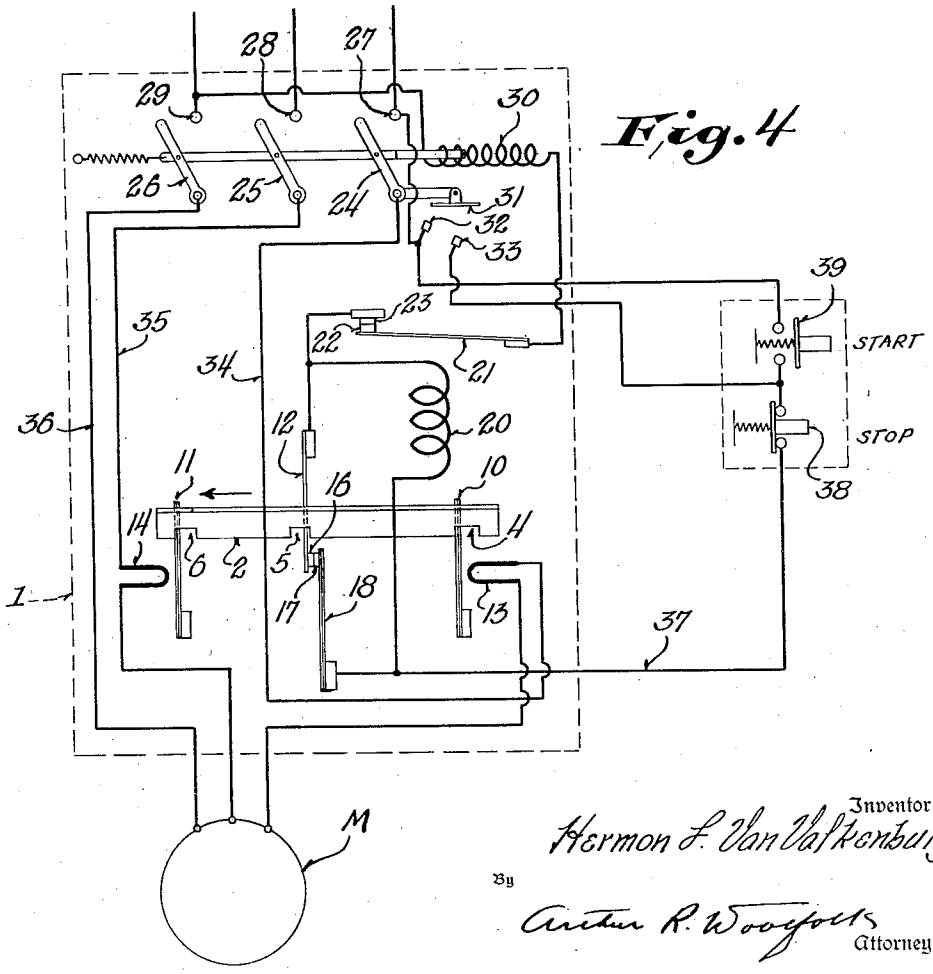


Fig. 4



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RELAY SYSTEM

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Application February 1, 1932. Serial No. 590,129

7 Claims. (Cl. 175—294)

This invention relates to relays and is particularly directed to a thermal overload relay.

Thermal relays as heretofore constructed have had certain defects. A serious defect that has heretofore existed is due to the fact that the ambient temperature changes affect the relay and consequently, if a relay is installed in a relatively warm place, its operation will be different from that if it had been installed in a cooler place. Also the temperature of the air surrounding the relay varies from time to time and consequently the operation of the thermal relay as heretofore constructed has not been precise but involved a variable quantity that materially affected its operation.

This invention is designed to overcome the defects noted above, and objects of this invention are to provide a novel form of thermal relay which is responsive to overload condition, but which compensates for ambient temperature changes, so that for any given setting or adjustment of the relay, its operation will be precise and will be determined solely by the overload condition, and will be wholly independent of the temperature changes in the air surrounding the relay, thereby securing a precise predetermined action for a definite overload.

Further objects are to provide a thermal relay which automatically resets itself when a manually or otherwise controlled switch or button is operated, such button or switch being either adjacent or remote from the thermal relay, as desired, and to provide a construction which may be readily controlled to open the circuit either manually or otherwise from a point adjacent to or remote from the relay itself, such relay and the starting and stopping devices in turn automatically controlling a main contactor.

Further objects are to provide a novel form of thermal relay which is so constructed that it may be used in a polyphase circuit, in a single phase circuit, or in a direct current circuit, the construction and novel arrangement of the relay enabling it to be used under any of these different conditions, and to provide a construction which answers all these requirements but nevertheless is very simple and is composed of easily produced parts which are not likely to get out of adjustment, but which, on the other hand, are sturdy and free from fragile or easily injured parts, thereby providing a thermal relay which is sturdy and reliable in its operation.

Further objects are to provide a thermal relay which insures a quick opening of the main contactor, which insures a quick opening of an auxiliary contact, although the control contact may itself open only slowly, in which means are provided to prevent arcing or pitting of the contacts, even of the contact associated with the thermostatic member itself.

Further objects are to provide a construction in which the thermal relay may be built either as a separate unit, or as a unitary member with the main contactor, and in which the control means for starting and stopping may be located either adjacent to or remote from the thermal relay, thereby providing the utmost flexibility in design to meet any of several different operating conditions.

An embodiment of the invention is shown in the accompanying drawings, in which:

Figure 1 is a fragmentary plan view of the thermal relay.

Figure 2 is a sectional view on the line 2—2 of Figure 1.

Figure 3 is a fragmentary end view of the thermal relay.

Figure 4 is a diagrammatic view showing the thermal relay with the main contactor and the control switches or buttons and a supply and load circuit.

Referring to the drawings, it will be seen that in the form of the invention chosen for illustration, the thermal relay is mounted on a panel 1 and comprises a reciprocatory insulating bar 2 slidably carried by spaced supports 3. This sliding bar is provided with notches 4, 5 and 6, see Figure 2, each of which is provided with shouldered portions 7, 8 and 9 respectively. Bimetallic thermostatic strips or members 10 and 11 normally bear against the shoulders 7 and 9 of the notches 4 and 6, and a spring strip 12 is positioned within the notch 5, but is spaced from the shoulder 8 thereof, as shown in Figure 2.

It is thus apparent that when the thermostatic members 10 and 11 move to the left, as viewed in Figures 1 and 2, that they will move the bar 2 in the direction of the arrow in Figures 1 and 2. However, there is a slight lost motion, as is obvious from an inspection of Figure 2, which allows a slight movement of the bar 2 before the shoulder 8 engages the spring finger 12.

Referring now to Figure 2, it will be seen that the thermostatic members 10 and 11 are carried at one end by suitable supports, and that they are surrounded by heating coils or heating members 13 and 14 which are placed in two of the phases of the load circuit, the device chosen for illustration being suitable for a three-phase load circuit, such as a three-phase motor circuit for instance.

The heating members 13 and 14 in the form shown are looped strips of conducting material of such a resistance that they will heat up for an overload and may be formed from any desired conducting material having the requisite characteristics. They are spaced slightly from their respective thermostatic members 10 and 11, but are in such proximity thereto that their heat is transmitted to these members, and consequently the motion of the members is responsive to load conditions.

It is to be noted from Figure 2 that either member 10 or 11 may independently actuate the bar 2, or that both members may simultaneously actuate the bar to thereby shift the bar to the left, as viewed in Figures 1 and 2, upon an overload in any of the phases of the polyphase circuit.

The spring strip 12 is secured at one end to a support or terminal member 15, see Figure 1, and at its other end is provided with a contact 16 which normally engages a contact 17 carried by a thermostatic member, such as the bimetallic strip 18, see Figure 1.

This bimetallic strip 18 is identically like the thermostatic members 10 and 11 and moves the same amount for any temperature variation as the members 10 and 11. It is anchored at one end to a terminal member 19 which is connected to the coil 20 of a magnetic relay provided with an armature 21. The armature 21 carries a contact 22 which normally engages the contact 23 as the armature is spring urged towards this position, as shown in Figure 1.

Referring to Figure 4, it will be seen that a main, magnetically closed contactor has been provided, which is diagrammatically shown as equipped with the contact arms 24, 25 and 26 which are adapted to engage the stationary contacts 27, 28 and 29 when the arms are rocked into closed position by means of the magnet coil or holding coil 30. The arms are urged towards open position by gravity or by means of a spring, as indicated diagrammatically in Figure 4. The contactor operates an auxiliary contactor consisting of a movable contact member 31 which bridges the stationary contacts 32 and 33 whenever the main contactor is closed.

The supply mains are connected, as indicated, to the stationary contacts 27, 28 and 29, and the contact arms 24, 25 and 26 are connected by means of the conductors 34, 35 and 36 to a motor M. However, two of the phases include the heating coils or members 13 and 14, as is obvious from an inspection of Figure 4, so that an overload in any phase will heat one or the other of the heating members and thereby actuate its corresponding thermostatic member to move the bar 2 in the direction indicated by the arrow in Figure 4 whenever an overload occurs.

There will, of course, be some heating of the members 13 and 14 due to the normal load, and lost motion, as previously described, has been provided so that the spring finger 12 is not moved due to the heating of the members 13 and 14 from the normal load conditions. However, when an overload occurs, the spring finger 12 is moved to the left, as viewed in Figure 4, and the contacts 16 and 17 are opened. These contacts are bridged around the coil 20 and consequently the coil 20 of the magnetic relay is energized and its armature 21 drawn downwardly, thereby separating the contacts 22 and 23 with a quick motion.

At this point it is to be noted particularly that even if the contacts 16 and 17 separate very slowly, nevertheless arcing cannot occur, as these contacts are merely bridged around the coil 20 and do not have the full line voltage. The actual break occurs between the contacts 22 and 23 and this break is very rapid.

When the contacts 22 and 23 separate, the circuit for the holding coil 30 is opened, as this circuit in the form shown extends from the stationary contact 29 of the main contactor through the armature 21, through the contacts 22 and 23, through the spring finger 12, through the contacts 16 and 17, to the thermostatic member 18, or else from the contact 23 through the coil 20, in either instance leading to the conductor 37. The conductor 37 is connected through the stop button or switch hereinafter described to the stationary contact 33 of the auxiliary contactor, through the movable contact 31 to the stationary contact 32, and thence to the movable arm 24 of the main contactor, which, under operative conditions, is in engagement with the main stationary contact 27.

It is obvious that if this holding circuit is opened, that the main and auxiliary contacts will, of course, open. This holding circuit may be opened by means of the thermostatic relay whenever an overload occurs, as the thermostatic members 10 and 11 will separate the contacts 16 and 17 in the manner previously described, thereby energizing the coil 20 and quickly separating the contacts 22 and 23, which opens the holding circuit for the coil 30. The main contactor will thereafter open and will thus permanently open the holding coil circuit through the medium of the auxiliary contactor. In addition to this, the holding circuit may be opened by means of the manually or otherwise operated stop button or switch 38.

A starting button or switch 39 is also provided and serves to connect the contact 32, which is permanently connected to the main contact 27, with the conductor 37, thereby energizing the holding coil circuit and closing the main contactor. When the main contactor closes, the auxiliary contactor bridges around the starting button or switch 39, as is apparent from Figure 4, and thus the main contactor stays closed until opened either by the remote control member 38 or by the thermal relay.

It is to be noted particularly that the thermal relay is precise in its operation and does not vary due to changes in the ambient temperature, as each of the thermostatic members 10, 18 and 11, see Figures 1 and 4, move the same amount and in the same direction for any given temperature change. However, if either the member 10 or 11 is heated excessively due to an overload, it will move the bar 2 in the direction indicated by the arrow and the shoulder 8 of the notch 5 will engage the spring finger 12 and thus open the bridge circuit around the magnetic relay coil 20, the sequence of operation thereafter occurring in the manner hereinbefore described.

At this point it is to be noted that the magnetic relay, as previously stated, quickly opens the circuit for the holding coil and thus arcing is prevented due to the quick opening of this circuit. The contacts 16 and 17, even if they slowly separate, will not produce arcing, as they merely bridge the coil 20 and do not have the full line voltage impressed thereon. The full line voltage does not, however, cause arcing at the contacts 22 and 23 of the magnet relay, as this magnet relay operates with extreme rapidity.

It is to be noted from Figure 4 that the main contactor and the auxiliary contactor may be

formed as a unitary structure with the thermal relay, and that this entire mechanism may be located at any desired point irrespective of the temperature conditions at such location, as the device is self-compensating.

Further it is to be noted that the start and stop buttons or switches may be located adjacent to or remote from the main panel, the remote arrangement being indicated in Figure 4.

It will be seen that it is the difference in temperature between two or more thermostatic members which operates the switch, or, in other words, which opens this circuit under overload or similar conditions. This construction, therefore, produces a temperature compensator which controls the opening and closing of the main contacts.

It is thus clear that this invention supplies a very simple and highly reliable type of thermal relay which automatically corrects or compensates for changes in the ambient temperature, which is precise in its operation, and which is easy to produce and install.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A thermal electromagnetic control system comprising a main contactor having magnetic operating means provided with a holding circuit, thermostatic means tending to hold said holding circuit closed, and load responsive thermostatic means tending to open said holding circuit.

2. A thermal electromagnetic control system comprising a main contactor having magnetic operating means provided with a holding circuit, thermostatic means tending to hold said holding circuit closed, and load responsive thermostatic means tending to open said holding circuit, said load responsive thermostatic means overcoming the effect of said first mentioned thermostatic means when the temperature of said load responsive thermostatic means exceeds the temperature of said first mentioned thermostatic means by a predetermined amount.

3. A thermal electromagnetic control system comprising a magnetically closed and held contactor for controlling a load circuit, said contactor having a holding circuit, thermostatic means responsive for changes in ambient temperature and having a contact, resilient means provided with a contact normally bearing against the said first mentioned contact, whereby said contacts tend to remain in engagement with each other for increase in the ambient temperature, a thermostatic means responsive to changes in the load circuit for moving said resilient means away from said first mentioned thermostatic means.

4. A thermal electromagnetic control system comprising a main contactor for controlling a load circuit, a holding coil for holding said main contactor closed, said holding coil having a holding circuit, a thermostatic member provided with a contact, a spring finger provided with a contact urged towards engagement with said first mentioned contact, a second thermostatic means responsive to changes in the load circuit, and a sliding bar adapted to operatively connect said second mentioned thermostatic means and said spring finger, whereby a differential action is produced between the two thermostatic means and whereby compensation for changes in ambient temperature is provided.

5. A thermal electromagnetic control system comprising a main contactor for controlling a load circuit, a holding coil having a holding circuit, a magnetic relay controlling said holding circuit and having an actuating coil, thermostatic means responsive to ambient temperature changes normally short-circuiting said actuating coil, and thermostatic means responsive to changes in the load circuit for opening the short circuit across said actuating coil.

6. A thermal electromagnetic control system comprising a multiple contactor for controlling a polyphase circuit, a holding coil for holding said contactor closed, said holding coil having a holding circuit, a magnetic relay controlling said holding circuit, thermostatic means responsible to ambient temperature variations normally short-circuiting the coil of said magnetic relay, and two thermostatic means, each responsive to variations in the load condition in a phase of the polyphase load circuit and each adapted to open the short circuit of the magnetic relay.

7. In a device of the class described, a contactor for closing a load circuit, a holding coil for holding said contactor in closed position and having a holding circuit, a magnetic relay for opening said holding circuit, said magnetic relay having a coil, auxiliary contacts controlled by said main contactor for closing said holding circuit, a starter switch for bridging said auxiliary contacts, a stop switch for opening said holding circuit, a thermostatic means responsive to ambient temperature changes normally short-circuiting the coil of said magnetic relay, and a second thermostatic means responsive to changes in the load circuit for opening the short circuit around said magnetic relay, whereby said load circuit may be controlled from the start and stop switches and is automatically controlled by the differential action of said two thermostatic means, said magnetic relay providing a quick break in the holding circuit.

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