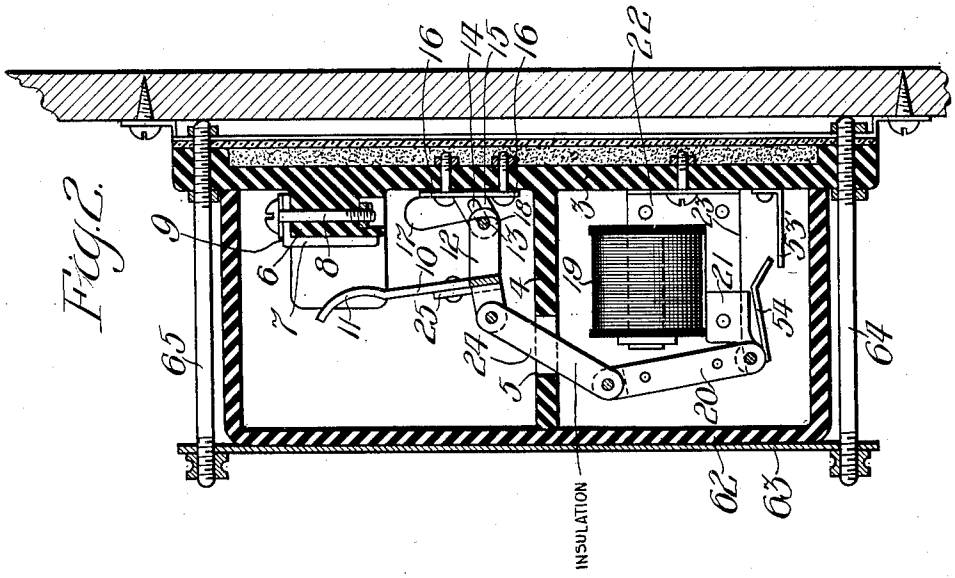
Jan. 3, 1928. 1,654,646

W. G. HARTWIG

ELECTROMAGNETIC CONTACTOR

Filed Jan. 22, 1923

Fig. 2.



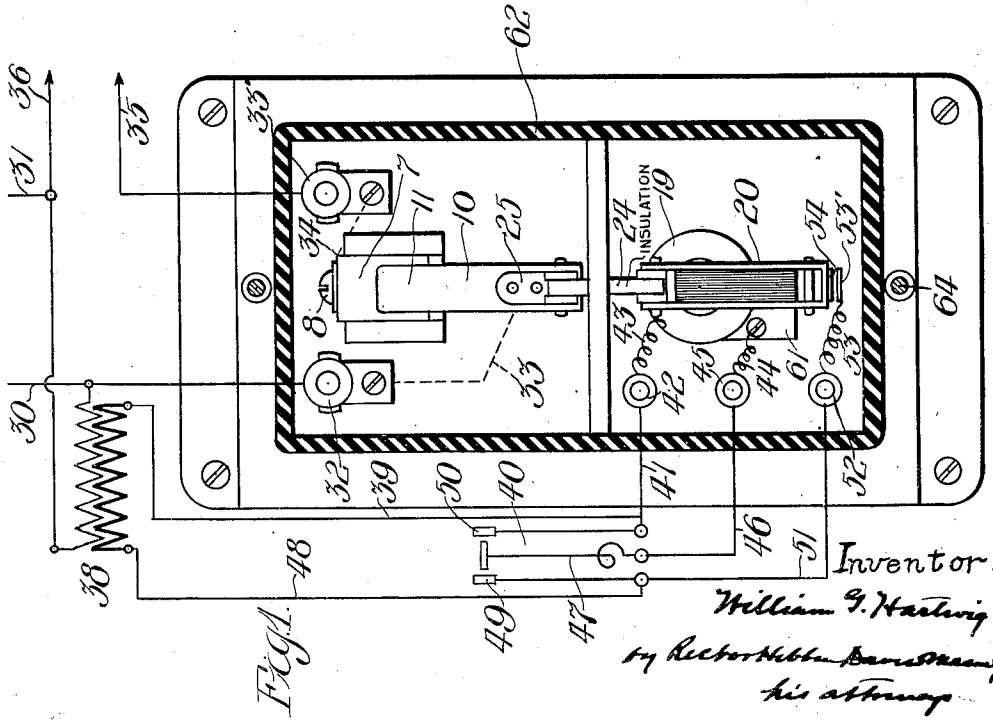


Fig. 1.

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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC CONTACTOR.

Application filed January 22, 1923. Serial No. 614,069.

My invention is designed more particularly for use in connection with heating or cooling apparatus, though in some of its features, as will hereinafter appear, it is well adapted for a variety of purposes in which current of some amperage is to be controlled. In temperature control systems such as that chosen for exemplification of my invention, heating or cooling means and a thermostat controlling the same are located in the inclosure, compartment or the like, the temperature of which is to be regulated. Where a low temperature is to be maintained, a cooling means such as an ice machine is connected to heat absorbing coils of pipe in said inclosure and the thermostat is used to control the operation of the motor, closing its circuit when the temperature rises above a predetermined point and opening its circuit when the temperature falls below a predetermined point. Where a relatively high temperature is to be maintained the temperature regulating means is commonly an electric heating coil, the circuit of which is controlled by a thermostat which may be in circuit with an electromagnet directly or indirectly operating the movable contact member of the contactor. The thermostats commonly employed for such purposes are either of the bi-metallic movable arm type or of the thermometer type, both of which are of somewhat delicate construction and not well adapted for carrying large currents and this is particularly true of the thermometer type of thermostat which I have found more desirable for use in systems of this kind in the respect that it is more sensitive and accurate in operation than the other. It is therefore important that the electromagnetic means be such as may be operated by a comparatively small low voltage current.

As the contactor carries a considerable current, heating or power, unless provision is made to the contrary, it rapidly is eaten away by the discharge on breaking the circuit and furthermore the movable contact is inclined to stick to the stationary contact. In my improved contactor the mechanical construction is such that when the heating or power circuit is opened the movable contact immediately is widely separated from the stationary contact thus avoiding destructive arcing and the movable contact closes against the stationary contact with a rolling action so that the line of actual contact is slightly shifted after contact is first made, thus preventing sticking of the contacts together. Furthermore the connections for operating the contactor properly from the electromagnetic device are such that a comparatively small low voltage current is sufficient to properly operate the movable element of the contactor and hold it firmly against the stationary contact when the circuit through the contactor is closed.

Furthermore in my improved contactor provision is made for so insulating the low voltage electromagnetic device from the contactor proper that all possible danger of the high voltage current getting into the low voltage circuit is obviated.

In the drawing accompanying and forming a part of this application I have described a preferred embodiment of the invention; it is to be understood, however, that the specific disclosure is for the purpose of exemplification only and that the scope of the invention is defined in the following claims in which I have endeavored to distinguish it from the prior arts so far as known to me without, however, relinquishing or abandoning any portion or feature thereof.

In the drawing Fig. 1 is a side elevation of a panel with my improved contactor attached thereto, the cover of the contactor being shown in vertical section and the connections in diagram; Fig. 2 is a vertical section through the panel, contactor and casing, parts being shown in elevation.

The base 3 of the contactor is made of suitable insulating material and is designed to have the contactor proper and electromagnetic operating means properly spaced thereon and separated by a wall 4 of insulating material which is preferably formed integral with the base. Said wall is formed with an opening 5, having a purpose which will presently appear. The base is formed with a rectangular boss or block 6, to which the stationary contact member 7 of the contactor is attached preferably by a screw bolt 8, extending through the turned-over flange 9 of said contact and the boss 6. The screw bolt also affords means for securing the lead to the stationary contact.

The movable contact comprises the arm 10, the outer end of which is bent or formed in a curve 11, which engages and rocks upon the flat stationary contact member. A pair

of lugs 12, which may be struck up from the sheet metal of the arm 10 extend substantially perpendicular thereto and carry a pivot pin 13 between their respective ends. The pivot pin extends through inclined slots 14 in lugs 15 on a bracket plate 16, so that it is not only free to revolve in said slots but also slides therein when the movable contact is operated to close or open the circuit. A spring 17 is attached to the bracket 16 and is bent backwardly in a loop, its free end 18 extending beneath the pivot 13 and forcing the latter outwardly to the ends of the slots.

The electro-magnetic operating device is as above stated separated from the contactor by the insulating wall 4. It is shown as comprising an electro-magnet 19, the armature 20 of which is pivoted to a bracket 21 mounted on the same support 22 as the electro-magnet, an arm or projection 23 being formed on the support for this purpose. The armature 20 is connected by a link 24 to a bracket 25 riveted to arm 10 of the movable contact. It will be seen that the construction is such that when the armature is attracted the movable contactor is first swung about the pivot 13 until the curved portion thereof engages the stationary contact and further pressure of the link forces the pivot pin 13 along the slots against the pressure of spring 17 so that the curved end of the movable contact member rocks, and to some slight extent slides upon the fixed contact. The motion is such that any tendency to stick by reason of incipient fusion at the moment of closing the contacts is overcome and the friction between the contacts keeps them in good conductive condition. Obviously when the armature of the electro-magnetic device is released and retracted the movable contact is rapidly withdrawn to such a distance that substantial arcing is avoided. It will be observed that as the armature approaches the magnet the toggle composed of armature 20 and link 24 straightens so that the power applied increases not only by reason of the increased magnetic field but also because of the mechanical action of the toggle.

In Fig. 1 of the drawing I have shown diagrammatically the wiring of the device as applied to a cooling system in which a motor such as that of an ice machine is controlled. The leads 30, 31 extend to some source of alternating current which ordinarily would be of about 110 volts. The lead 30 is attached to a post 32 which is connected by wire 33 at the back of the device to the bracket plate 16 which supports the movable element of the contactor and is in electrical connection therewith. The other binding post 33′ of the contactor is connected to the stationary contact thereof by wire 34, and to motor by wire 35. The circuit of the motor or heating device as the case may be is from line 30 through binding post 32, wire 33, movable contact element 10, stationary contact 7, wire 34, binding post 33′, wire 35, the motor, wire 36 and wire 31 to line.

The low voltage transformer 38 is connected to the "off" contact 50 of a two-contact thermostat 40 by wire 39, and by wire 41 to binding post 42 of the electro-magnetic device. Binding post 42 is connected by wire 43 to one of the terminals of the magnet coil. The other terminal of the coil of the electro-magnet is connected to or grounded upon the base or support 61 of the electro-magnet and the latter connected by wire 44 to binding post 45. Post 45 is connected by wire 46 to the common neutral bi-metallic arm contact 47 of the thermostat. The other terminal of the secondary of the transformer 38 is connected by wire 48 to the "on" contact 49 of the thermostat and also by wire 51 to binding post 52 of the electro-magnetic device. Said binding post is connected by wire 53 to a stationary contact 53′. The latter is engaged by a movable contact strip 54 attached to the armature when the latter is in attracted position. The movable contact 54 is grounded or in electric contact with the base 22 of the electro-magnet through the post 23.

Assuming as heretofore that the device is used to control the circuit of the motor of a refrigerating machine, when the temperature reaches the upper pre-determined limit, the common element 47 of the thermostat makes contact with the "on" stationary contact 49 whereupon a circuit is closed through the coil as follows: from the secondary of the transformer through wires 39, 41, post 42, wire 43, the coil of the electromagnet, support 22, wire 44, post 45, wire 46, switch 47, and wire 48 to the transformer. The magnet thus energized attracts its armature closing the contactor in the manner heretofore described and at the same time, swinging contact 54 into engagement with contact 53′. Thus an additional path is closed from the terminal of the electro-magnet and support 22 through arm 23, contacts 54, 53′, wire 53, post 52, wires 51, 48. Therefore when the temperature drops sufficiently to cause contact 47 to disengage contact 49, the electro-magnet will continue to hold the contactor in closed position. This condition will continue until the temperature has dropped sufficiently to cause the common contact 47 of the thermostat to engage "off" contact 50, whereupon the coil of the electro-magnet is short-circuited through the following path: wire 39, contacts 50, 47, wires 46, 44, base 61, contacts 54, 53′, wire 53, post 52 and wires 51, 48. The electro-magnet is thus de-energized releasing its armature and the contactor is then opened.

By making the contacts 54, 53′, or either

of them, of metal of a suitable degree of resilience, the opening movement of the armature is assisted in an obvious manner.

As heretofore stated, insulating intermediate wall 4 prevents the high voltage current being communicated to the electro-magnetic device, the mechanical connection or link 24 being likewise of insulating material. Preferably the device is provided with a cover 62 extending over both the contactor and the electro-magnetic device which is held in place by a locking strip 63 secured on posts 64, 65, by suitable thumb nuts.

I claim:

1. In a device of the class described, a stationary contact, a movable contact, one of said contacts being curved to rock upon the other, a pivoted arm carrying the movable contact, a pivot for said arm, a bracket having a slotted ear through which the pivot extends and a spring connected to the bracket and bearing upon the pivot.

2. In a device of the class described, a stationary contact, a movable contact, one of said contacts being curved to rock upon the other, an arm carrying the movable contact, a pivot on said arm, a bracket having a slotted ear in which said pivot is movably mounted, a spring normally holding the pivot in one end of said slot and means for rotating said arm on its pivot and forcing the pivot to the other end of said slot against the pressure of said spring.

3. In a device of the class described, a stationary contact, a movable contact, one of said contacts being curved to rock upon the other, a pivoted arm carrying the movable contact, a pivot for said arm, a bracket, a pair of slotted lugs on the bracket through the slots of which the pivot extends, and a spring intermediate said bracket and pivot and normally forcing the latter to the outer ends of the slots.

4. In a device of the class described, a stationary contact, a movable contact comprising a curved portion adapted to engage and rock upon the stationary contact, a pivoted arm carrying the movable contact, a pivot on said arm, a plate having slotted lugs through which the pivot pin extends and a spring intermediate the plate and pivot pin.

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