Feb. 16, 1943. M. C. HARROLD 2,311,048

ELECTRIC SWITCH

Filed Dec. 31, 1940

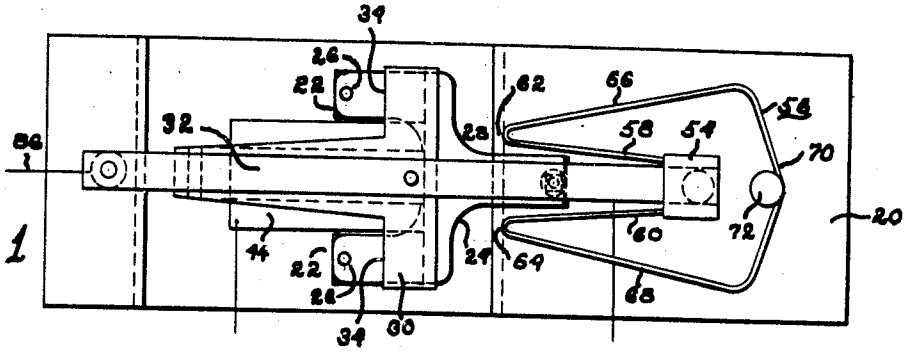


Fig. 1

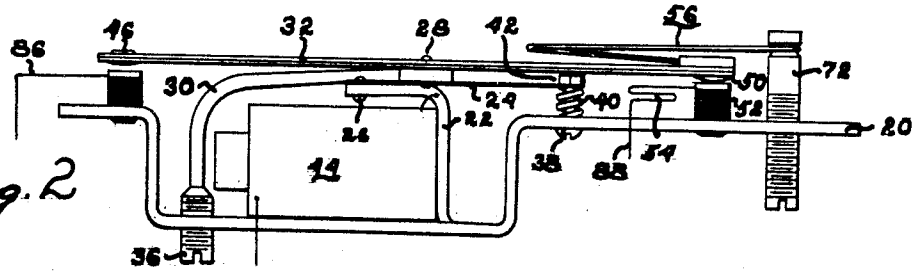


Fig. 2

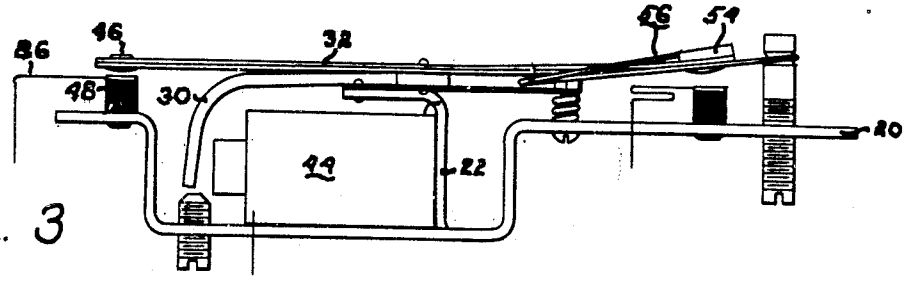


Fig. 3

Fig. 4

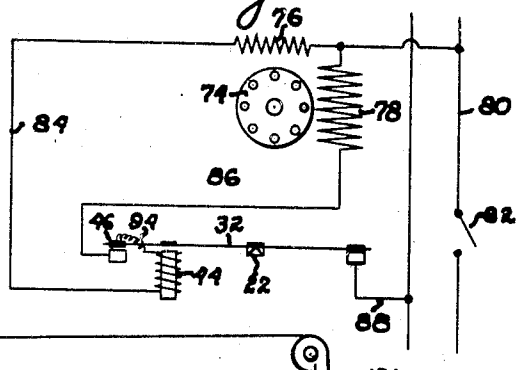
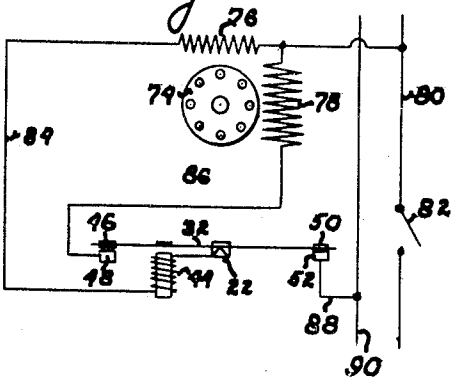


Fig. 5



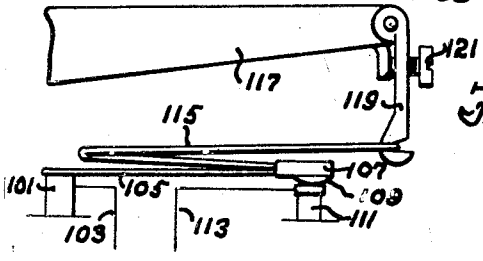


Fig. 6

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ELECTRIC SWITCH

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13 Claims. (Cl. 200—88)

This invention relates to refrigerating apparatus and more particularly to motor controls and electrical controls.

It is an object of my invention to provide an improved and simplified motor control which will adequately control the starting and running of the electric motor and provide automatic protection against overloads.

It is another object of my invention to provide an improved and simplified snap-acting mechanism providing excellent current-carrying properties which can be used either with a bimetal or another operating means.

It is still another object of my invention to provide an arrangement wherein a single bimetal strip may be caused to perform two control functions.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a top view of my improved motor control;

Fig. 2 is a view in elevation of my improved motor control with the overload contacts in closed position and the electromagnet energized and with the starting bimetal heated sufficiently to open the starting contacts;

Fig. 3 is a view similar to Fig. 2 in which the overload contacts are in open position and the electromagnet is consequently deenergized;

Fig. 4 is a wiring diagram showing the motor control embodied in an electric motor circuit in one arrangement;

Fig. 5 shows the motor control embodied in an electric motor circuit in the arrangement shown in Figs. 1 to 3; and

Fig. 6 shows the snap-acting mechanism embodied in another form of control.

Briefly, I have shown an electric motor starting and overload control including an electromagnet having a pivoted armature carrying a single bimetal strip in which one end serves to limit the energization of the starting winding and the other end serves as an automatic overload control for the motor. A loop of spring wire is arranged so as to control the automatic overload portion of the bimetal strip with a double toggle type snap action.

Referring to the drawing and more particularly to Fig. 1 there is shown a motor control including a base 20, which may be formed of metal or any other suitable material. Extending upwardly from the base are a pair of supports designated by the reference character 22. Fastened to the supports 22 is a leaf spring hinge construction including the leaf spring 24 which is fastened by the rivets 26 to the supports 22 and fastened by the rivet 28 to a pivoted armature 30. The rivet 28 also fastens a bimetal strip 32 to the armature 30. The pivoted armature 30 is provided with knife edges 34 which are adapted to rock upon the supports 22 with the leaf spring 24 in between. The leaf spring connects the armature 30 to the supports 22 but allows the armature to rock upon the knife edges 34. A set-screw 36 extending through the base 20 limits the movement of the armature 30 in a counter-clockwise direction.

The leaf spring 24 extends to an adjusting screw 38 extending upwardly from the base. This adjusting screw 38 is provided with a spring 40 and a nut 42 which is prevented from rotating by a lip which is turned up at the end of the leaf spring hinge. By adjusting the screw 38, the nut 42 is raised or lowered in order to raise or lower the end of the leaf spring 24, which is held between the nut 42 and the spring 40. This changes the angularity of the leaf spring 24 and thus changes the position of the armature 30 when it is in open position and also changes the opening force of the armature 30, which opposes the attraction of its electromagnet 44.

The electromagnet 44 is located between the supports 22 and the lower end of the armature 30. The left end of the bimetal strip 32 carries the starting contact 46 which is adapted to make contact with a stationary contact mounted upon an insulated post 48 which is fastened to the base 20. The other end of the bimetal strip 32 carries the overload contact 50, which is adapted to make contact with a stationary contact mounted upon an insulated post 52 which is fastened to the base 20.

The contact 50 also serves as a rivet for fastening the bracket 54 to the end of the bimetal. This bracket 54 rigidly holds the two ends of a spring wire loop 56 which serves as a double toggle type snap-acting mechanism for the right end portion of the bimetal strip 32. This loop 56 includes the arms 58 and 60 which have their ends extending into opposite sides of the bracket 54 to which they are securely fastened. These portions 58 and 60 extend substantially parallel to the bimetal strip until they terminate at the sharp bends 62 and 64. From the sharp bends 62 and 64 the portions 66 and 68 extend in the opposite direction, generally parallel, to the portions 58 and 60 as well as the bimetal strip 32. These portions 66 and 68 terminate in a looped portion 70 which is hooked over the adjusting screw 72 with sufficient tension to properly stretch the bimetal 32 and the loop 56 of spring wire. The tension should be such as to cause the end of the bimetal strip to snap to open and closed positions when heated and cooled as illustrated in Figs. 2 and 3. The spring wire loop 56 constitutes a double toggle type snap-acting

mechanism without any frictional connections so that it will be more accurate than toggle mechanisms of other types.

In Fig. 5, there is shown diagrammatically an electric motor 74 having a main winding 76 and a phase winding 78. The junction of these two windings is connected to a supply conductor 80 under the control of a suitable control switch 82. The other end of the main winding 76 is connected by the conductor 84 to the electromagnet 44 which in turn is connected to the support 22. The phase winding 78 is connected by the conductor 86 to the contact post 48 which in turn connects to the movable contact 46 provided upon the end of the bimetal 32. This end of the bimetal 32 carries the phase winding current while the other end carrying the contact 50 carries both the main and the phase winding current. The contact 50 connects to the contact post 52 which in turn may be connected to a heater 54 for applying additional heat to the bimetal 32, if this is found necessary. This heater 54 is connected by the conductor 88 to the supply conductor 90.

In this system, when the switch 82 is closed, current will flow from the conductor 80 through the main winding 76, the conductor 84, electromagnet 44 and the right end of the bimetal strip through contacts 50 and 52 and the conductor 88 to the conductor 90. This will cause electromagnet 44 to attract its armature 30 and to cause the contact 46 to engage the contact on top of the insulating post 48. This will cause current to flow through the phase winding 78, the conductor 86 and the contact 46 as well as the entire length of the bimetal strip 32. This energization will cause the motor 74 to start and pick up speed.

The system is provided with two means for deenergizing the phase winding. It is well known that, as an electric motor picks up speed, the current consumption falls off. This reduces the flow of current through the electromagnet 44 and the opening force provided by the leaf spring 24 will cause the contact 46 to be raised when the current falls off sufficiently. The other opening means is the bimetal 32 itself which will be heated by the flow of the phase winding current through it so that it will curl upwardly and lift the contact 46 away from the post 48 to deenergize the phase winding. Thus, whichever of these means is first, will control the opening of the phase winding contacts. Under normal voltage conditions the electromagnet 44 will open the contacts prior to the opening by the bimetal 32, but under high voltage conditions the electromagnet 44 does not open the contacts soon enough so that the bimetal 32 takes care of this under those circumstances.

In Fig. 4, the circuit is substantially the same and all parts of the circuit with one exception are given the same reference characters. The difference between the circuit of Fig. 5 and circuit of Fig. 4 is that, instead of the electromagnet 44 being connected to the support 22, the electromagnet 44 is connected by a pig-tail connection 94 with the contact 46. With this construction the entire motor current passes through the bimetal 32 from one end to the other. This provides a greater heating effect upon the left portion of the bimetal 32 so that this bimetal may be made wider than in the other construction. In all other respects the circuits are the same and the circuit and the control operates in the same manner.

In Fig. 6 I have shown my snap-action mechanism incorporated in an ordinary switch. In this switch, there is provided a supporting means 101 which is connected to the source conductor 103. The current-carrying flexible strip of spring metal 105 has one end anchored to the supporting means 101 and extends in cantilever fashion therefrom to a bracket 107 which is fastened to the end of the strip 105 by the movable contact 109. This movable contact 109 is adapted to make contact with the stationary contact provided upon the top of the insulating post 111. This stationary contact is connected to the other source conductor 113. My wire loop snap-acting mechanism 115 is connected to the bracket 107 as shown in Figs. 1, 2 and 3, and the spring wire is made in the same form shown in these figures. However, in Fig. 6, instead of the wire loop 115 hooked over the adjusting screw 72 it is looped over the end of an adjustment lever 119 provided upon the end of a lever arm 117. The adjustable lever 119 holds the flexible strip 105 and the spring wire loop snap-acting mechanism 115 in a stretched condition. A set-screw 121 is provided for adjusting the tension applied to the spring wire loop 105. A bellows or any other suitable means may be used to operate the lever 117 to cause the contact 109 to be snapped to open and closed positions just as is shown in Figs. 2 and 3. Thus it will be seen that this simple snap action mechanism may be applied to different types of contact problems.

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, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In combination, a supporting means, a flexible strip anchored at one point to said supporting means and extending in cantilever fashion therefrom to provide a movable extension, spring means having a first portion rigidly connected to said extension and extending therefrom in a direction substantially parallel to the strip to a first point adjacent the anchorage of the strip and a second portion extending from said first point to a second point adjacent the rigid connection, and means connected to the spring means for holding the flexible strip in tension.

2. In combination, a supporting means, a flexible strip anchored at one point to said supporting means and extending in cantilever fashion therefrom to provide a movable extension, spring means having a first portion rigidly connected to said extension and extending therefrom in a direction substantially parallel to the strip to a first point adjacent the anchorage of the strip and a second portion extending from said first point to a second point adjacent the rigid connection, and means connected to the spring means for holding the flexible strip and the spring means in a stretched condition.

3. In combination, a supporting means, a flexible strip anchored at one point to said supporting means and extending in cantilever fashion therefrom to provide a movable extension, spring means having a first portion rigidly connected to said extension and extending therefrom in a direction substantially parallel to the strip to a first point adjacent the anchorage of the strip and a second portion extending from said first point to a second point adjacent the rigid connection, said flexible strip being provided with means for causing itself to snap to opposite sides

of said spring means under the control of said spring means.

4. In combination, a supporting means, a bimetal strip connected to and extending from the supporting means, a double-back type means having a first portion rigidly connected to a point upon said strip and extending from said point generally parallel to the strip to a second point adjacent the connection of the strip with the supporting means and having a second portion extending from said second point to a third point adjacent the rigid connection, a spring means connecting to said second portion adjacent said third point and means connecting to said spring means adjacent said third point, said strip and said first and second portion being displaced to allow the strip to move to opposite sides of the dead-center position.

5. An electrical control including an electromagnet and a movable armature for said electromagnet, a bimetal strip supported upon said armature having its ends extending in opposite directions therefrom, contact mechanisms connected to said strip on opposite sides of said armature, and a snap-acting mechanism for controlling the operation of one of the contact mechanisms independently of the other, said other contact mechanism being operated by the movement of the strip.

6. An electrical control comprising a supporting means, a bimetal strip supported at an intermediate point upon said supporting means and having portions extending in opposite directions therefrom, a contact mechanism connected to and operated by each of said portions, and a snap-acting mechanism for controlling the operation of one of the contact mechanisms independently of the other.

7. In combination, a supporting means, a flexible strip anchored at one point to said supporting means and extending in cantilever fashion therefrom to provide a movable extension, spring means having a first portion rigidly connected to said extension and extending therefrom in a direction substantially parallel to the strip to a first point adjacent the anchorage of the strip and a second portion extending from said first point to a second point adjacent the rigid connection, means connected to the spring means for holding the flexible strip in tension, and switch contact means connected to and operated by said movable extension.

8. In combination, a supporting means, a flexible strip anchored at one point to said supporting means and extending in cantilever fashion therefrom to provide a movable extension, spring means in the form of spring wire having two portions rigidly connected to said movable extension and extending therefrom in a direction substantially parallel to the strip to points upon opposite sides of the strip adjacent the anchorage of the strip, said spring wire extending substantially in the opposite direction from said points to a third point adjacent the rigid connection, and means connected to the spring means for holding the flexible strip in tension.

9. In combination, a supporting means, a flexible strip anchored at one point to said supporting means and extending in cantilever fashion therefrom to provide a movable extension, spring means in the form of spring wire having two portions rigidly connected to said movable extension and extending therefrom in a direction substantially parallel to the strip to points upon opposite sides of the strip adjacent the anchorage of the strip, said spring wire extending substantially in the opposite direction from said points to a third point adjacent the rigid connection, means connected to the spring means for holding the flexible strip in tension, and a control device operated by the movement of said movable extension.

10. In combination, a supporting means, a flexible strip anchored at one point to said supporting means and extending in cantilever fashion therefrom to provide a movable extension, spring means in the form of spring wire having two portions rigidly connected to said movable extension and extending therefrom in a direction substantially parallel to the strip to points upon opposite sides of the strip adjacent the anchorage of the strip, said spring wire extending substantially in the opposite direction from said points to a third point adjacent the rigid connection, means connected to the spring means for holding the flexible strip in tension, and means for providing relative movement between the portion of the spring wire adjacent said third point and the rigid connection.

11. In combination, a supporting means, a flexible strip anchored at one point to said supporting means and extending in cantilever fashion therefrom to provide a movable extension, a unitary member having a first portion rigidly connected to said extension and extending therefrom in a direction substantially parallel to the strip to a first point adjacent the anchorage of the strip and a second portion extending from said first point to a second point adjacent the rigid connection, said strip and said first and second portions being displaced to allow the strip to move to opposite sides of the dead-center position, a portion of said unitary member being resilient, and means connected to said unitary member adjacent said second point for holding said flexible strip in a stretched condition.

12. In combination, a supporting means, a movable member connected at one point to the support and extending in one direction therefrom, a spring wire member having a first portion connected to said movable member at another point and extending directly from said another point substantially in a straight line to a first point adjacent said one point and a second portion extending substantially in a straight line directly from said first point to a second point adjacent said another point, and means connected to the spring wire member adjacent said second point for placing the spring wire member and the movable member in tension.

13. In combination, a supporting means, a flexible strip anchored at one point to said supporting means and extending in cantilever fashion therefrom to provide a movable extension, a spring wire member having a first portion rigidly connected to said extension and extending therefrom in a direction generally parallel to the strip to a first point adjacent the anchorage of the strip and a second portion extending from said first point to a second point adjacent the rigid connection, and means connected to the spring member for holding the flexible strip in tension.

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