Aug. 10, 1943. J. F. FRESE 2,326,529

OVERLOAD CUTOUT FOR ELECTRIC CIRCUITS

Filed Feb. 2, 1942 3 Sheets-Sheet 1

FIG. 1.

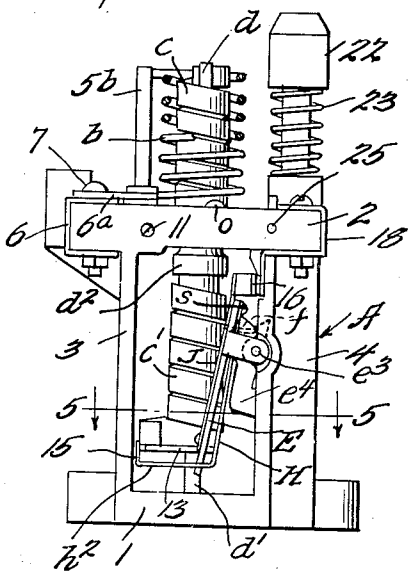


FIG. 2.

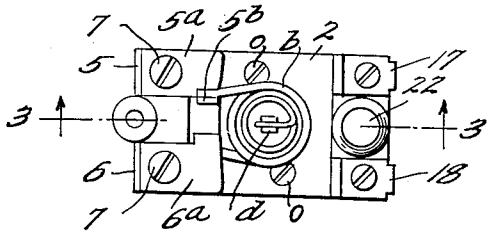


FIG. 3.

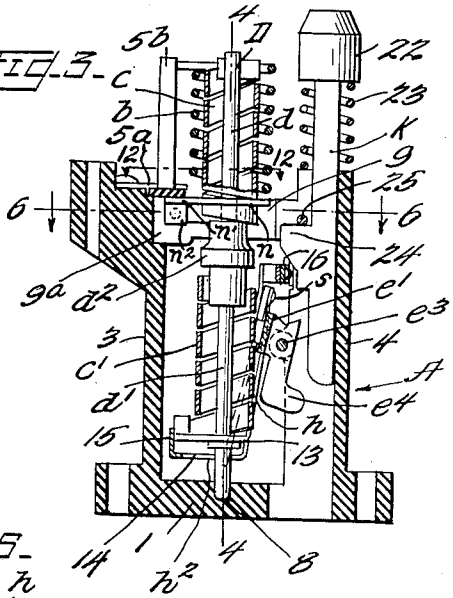


FIG. 4.

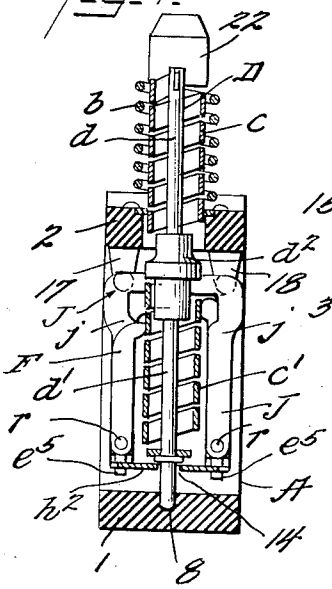


FIG. 5.

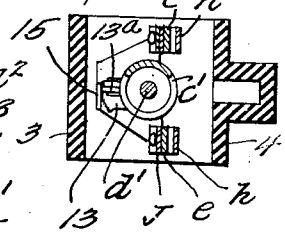


FIG. 5a.

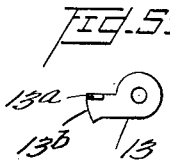
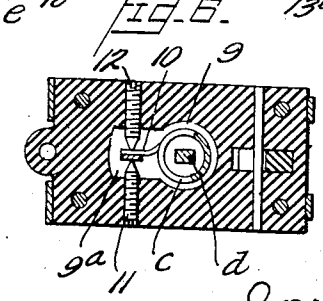


FIG. 6.



Inventor

Joseph F. Frese

By Robert Watson

Attorney

Aug. 10, 1943. J. F. FRESE 2,326,529

OVERLOAD CUTOUT FOR ELECTRIC CIRCUITS

Filed Feb. 2, 1942 3 Sheets-Sheet 2

FIG. 7.

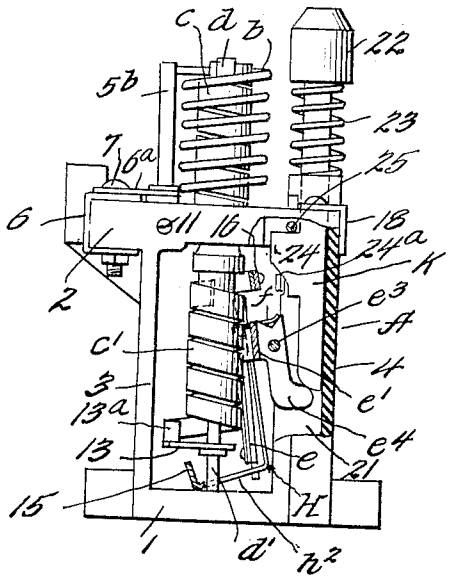


FIG. 9.

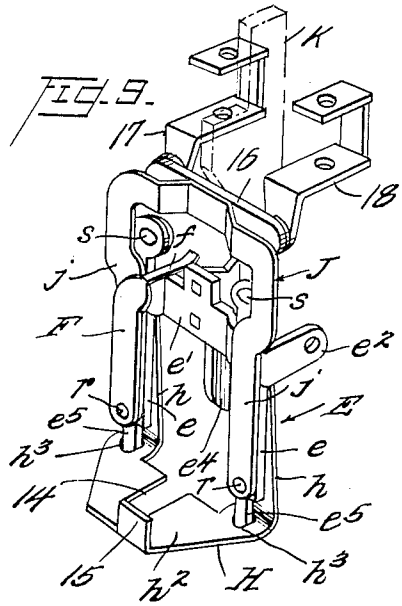


FIG. 8.

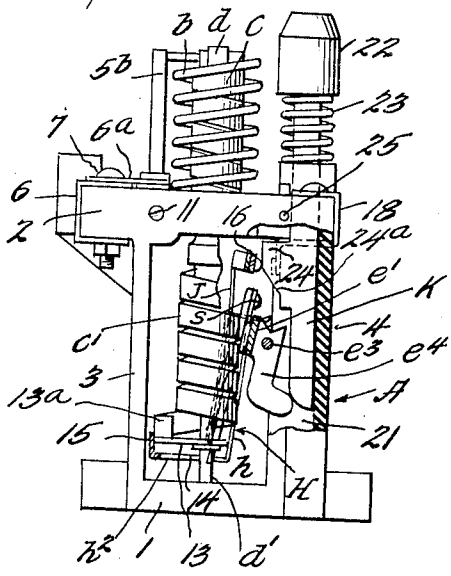
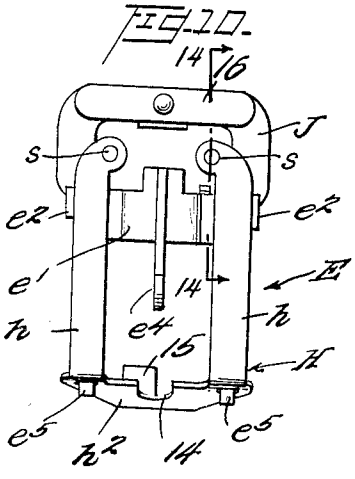


FIG. 10.



Inventor

Joseph F. Frese

By

Robert Watson

Attorney

Aug. 10, 1943. J. F. FRESE 2,326,529

OVERLOAD CUTOUT FOR ELECTRIC CIRCUITS

Filed Feb. 2, 1942 3 Sheets-Sheet 3

FIG. 11.

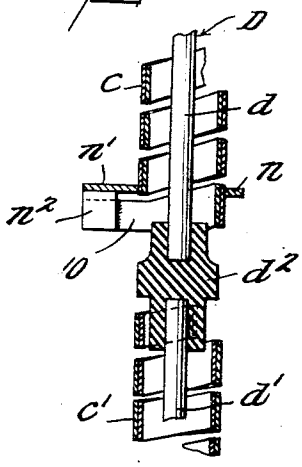


FIG. 12.

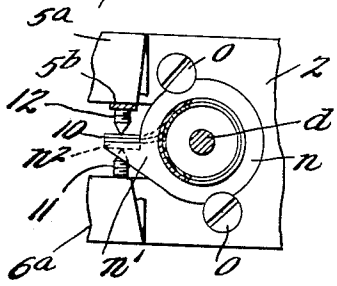


FIG. 13.

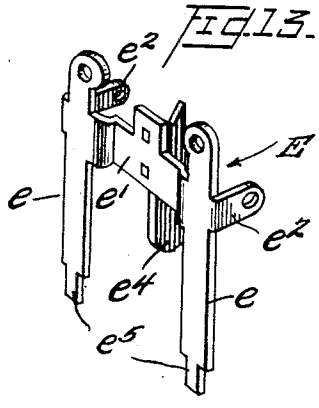
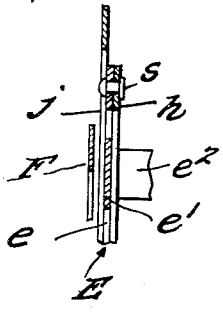


FIG. 14.



Inventor
Joseph F. Frese

By Robert H. Watson
Attorney

Patented Aug. 10, 1943 2,326,529

UNITED STATES PATENT OFFICE

2,326,529

OVERLOAD CUTOUT FOR ELECTRIC CIRCUITS

Joseph F. Frese, Baltimore, Md., assignor to Monitor Controller Company, Baltimore, Md., a corporation of Maryland

Application February 2, 1942, Serial No. 429,334

3 Claims. (Cl. 200—116)

This invention relates to a thermally-responsive overload cut out for electric circuits, particularly adapted for protecting electric motors from injury by excessive current in the armature circuit of the motor, due to overload. The invention comprises an overload coil adapted to be connected in series with the armature of a motor and two thermally responsive coils, one affected by the temperature in the overload coil, for causing the operation of a switch, and the other affected only by atmospheric temperature and adapted to compensate for changes in atmospheric temperature so that the operation of the switch will be the same at all room temperatures.

In the accompanying drawings,

Figure 1 is a side elevation of the device showing the parts in normal position, the switch of the controlled circuit being closed;

Figure 2 is a top plan view of Figure 1;

Figure 3 is a vertical section on the line 3—3 of Figure 2;

Figure 4 is a vertical section on the line 4—4 of Figure 3;

Figure 5 is a section on the line 5—5 of Figure 1;

Figure 5a is a plan view of the arm which connects the lower end of the lower thermally responsive coil pivotally to the spindle and serves as a device for retaining and releasing the latch;

Figure 6 is a section on the line 6—6 of Figure 3;

Figure 7 is a side view of the device, partly in section, showing the lever and switch in tripped positions;

Figure 8 is a similar view illustrating the operation of resetting the lever and switch;

Figure 9 is a perspective view of the lever and switch;

Figure 10 is an elevation of the lever and attached switch member, looking from right to left in Figure 9;

Figure 11 is a central vertical section through parts of the upper and lower bi-metallic coils, the guide ring which surrounds the lower part of the upper coil, and the insulating coupling which joins the spindle parts;

Figure 12 is a section on the line 12—12 of Figure 3;

Figure 13 is a detail perspective view of the switch lever, and

Figure 14 is a section on the line 14—14 of Figure 10.

In the drawing A indicates a frame of insulating material, such as hard rubber, comprising a base 1, a top piece 2 and parallel upright parts 3 and 4, spaced apart and connecting the top and bottom pieces near their ends. U-shaped metal clips 5 and 6, spaced apart, are secured to one end of the top piece and constitute terminals to which wires forming part of the armature circuit of an electric motor may be attached and to which the terminals of a wire coil *b* are attached so that it will be included in the armature circuit. The coil *b*, which heats when the motor is overloaded is vertically arranged above the central portion of the top piece and has its terminals secured to flat pieces of metal 5a and 6a which rest upon the clips 5 and 6, respectively, and are secured thereto by screws 7 which extend through the clips and the top piece of the frame. As shown in Figures 1 and 2, the lower end of the overload coil *b* is secured to the metal part 6a while the upper end of the coil is secured to a metal post 5b extending upward from the part 5a. By these connections the coil is held securely with its axis extending vertically.

Within the overload coil *b* and concentric with it, although not in contact with it, is a bi-metallic thermally responsive coil *c* the upper end of which is turned radially inward and secured within a slot in the upper end of a spindle D the lower end of which is journalled in a socket 8 in the base piece of the frame. The spindle D is composed of two metal rods *d* and *d'*, rigidly connected together by a coupling d^2 of insulating material, such as hard rubber, so that the several parts of the spindle turn as a unit. The top piece of the frame has a central opening 9 through which the spindle extends and into which the lower end of the coil *c* extends. This opening, partly circular in form, has a lateral recess 9a. The lowermost convolution of the coil *c* has its end portion 10 bent radially outward and this end portion extends into the recess 9a between two pointed adjusting screws 11 and 12, as shown in Figure 6. A ring *n* is arranged upon the part 2 of the frame, to guide and center the lower end of the coil *c*. This ring is held in place upon the part 2 of the frame by screws o the heads of which project over the edge of the ring. These screws hold the ring in place on the top piece, but do not prevent a limited circumferential adjustment of the ring. The ring has a projection *n'* which extends over the lateral recess 9a in the frame and the end portion n^2 of this projecting part is bent downwardly and welded to the end portion 10 of the coil *c*. The welded ends of the coil and ring extend between

the adjusting screws 11 and 12 as shown in Figures 6 and 12. These adjusting screws, which are threaded into aligned openings in the top piece, are set so that they bear against opposite sides of said welded joint and lock the lower end of the coil *c* in any desired position of adjustment. By adjusting the screws the position of the end of the coil may be adjusted. As the upper end of the coil *c* is secured to the spindle D while its lower end is held against rotation, any expansion or contraction of the coil *c* caused by changing temperature in the surrounding overload coil *b*, will cause an adjustment of the spindle D. To offset the effect of atmospheric temperature on the expansion and contraction of the coil *c* a compensating bi-metallic coil *c'* is arranged about the lower half *d'* of the spindle. This latter coil has its upper end secured to the coupling d^2, while its lower end is connected to the side of a small metal arm 13 which is journalled on the part *d'* of the spindle and has at one side an upturned flange 13^a to which the lower end of the coil *c'* is secured. The outer end 13^b of this arm is curved concentrically with the axis of the spindle, as shown in Figures 5 and 5^a.

The coils *c* and *c'* are wound in the same direction. As the coil *c* is anchored at its lower end and secured at its upper end to the spindle, when this coil expands or contracts it turns the spindle as an entirety, including the coupling d^2, the movement being clockwise, as viewed from above, when the coil expands. As the upper end of the lower coil *c'* is secured to the coupling this coil will be moved by the spindle, but as the coil *c'* is affected by atmospheric temperature only it will contract in cold weather and adjust the arm 13 clockwise on the spindle, while in hot weather this adjustment will take place in the counter clockwise direction, assuming the thermally responsive coils to be wound and connected as shown and described. The position of the arm 13 will therefore always be that to which it would be adjusted by the coil *c* if affected only by heat from the overload coil.

A switch lever E, comprising parallel side pieces *e*, connected by a cross piece *e'* and having parallel supporting arms e^2 projecting at a right angle from the side pieces, is pivotally mounted upon a pivot pin e^3 which extends through perforation in the arms and a perforation in the part 4 of the frame. Secured centrally to the cross piece *e'* is an arm e^4 by which the frame may be rocked about its pivotal axis, as hereinafter described.

A spring latch H, adapted to engage the arm 13, is secured to one side of the lever. This latch, which is made of thin resilient sheet metal, comprises two parallel arms *h* riveted at their upper ends to the lever as shown at *s* and having a foot h^2 projecting approximately at a right angle to said arms, this foot having a slot 14 through which the lower part *d'* of the spindle extends, this foot tapering as shown in Figures 5 and 9 and having a short upturned flange 15 at its end adapted to frictionally engage the curved surface of the arm 13 on the spindle, as shown in Figures 1, 3 and 8. The lower ends e^5 of the lever arms are of reduced width and extend loosely through holes h^3 in the foot of the latch so that the lever may move the foot positively from the unlatched position shown in Figure 7 to the position where the part 15 on the latch may spring upwardly into frictional engagement with the curved end of the arm 13, as shown in Figures 1, 3, 7 and 8.

The lever has, secured to the side opposite that to which the latch is secured, a U-shaped switch-member J, shown best in Figure 9, made of thin resilient metal, the arms *j* of this member being secured at their lower ends to the lever by rivets *r*, and to the upper central part of the member is secured a contact strip 16 adapted to engage and electrically connect stationary contacts on terminals 17 and 18 for the circuit which is to be controlled, these terminals being secured to the top piece of the frame at the end of the top piece opposite to that on which the terminals 5 and 6 are mounted.

While the circuits are not shown, it will be understood that in operation the overload coil *b* will be connected in the motor circuit and a relay magnet used to control the opening and closing of the motor circuit, will have its coil connected in the circuit which includes the terminals 17 and 18 so that while the motor may operate when the relay circuit is closed at these terminals it will stop when the relay circuit is opened. Figures 1 and 3 show the parts in normal running position and Figure 7 shows the positions of the parts after the switch controlling the relay circuit has been opened by reason of overload in the armature circuit of the motor.

A vertically movable flat rod K, of insulating material, is arranged in the vertical slot 2^i in the part 4 of the frame, and this rod extends through a slot in the top piece 2 and has a knob 22 at its upper end. A spring 23 between the knob and the top piece normally holds the rod in an upper position. The rod has projecting from one edge a shoulder 24 which normally engages a stop pin 25 to limit the upward movement of the rod.

To start the motor the rod is pushed downward. During the first part of its downward movement a cam surface 24^a on the shoulder 24 engages the contact piece 16 and moves it to open position as shown in Figure 8, thereby opening the controlled circuit. Further downward movement of the rod K causes its lower end to engage the arm e^4 on the lever and rock it so that the latch will engage the end of the arm 13 and be frictionally retained thereby, as shown in Figure 8. The knob 22 is then released and, as the rod K moves upward, the cam on the rod releases the contact piece 16 and the latter moves to close the controlled circuit.

The foregoing statement of operation is on the assumption that the arm 13 on the spindle is in position to be engaged by the latch, but if, by reason of overload, the arm 13 has been moved out of its normal position, then, upon depressing the rod K the latch will not be retained in the position shown in Figure 8 and, upon release of the rod, the lever, latch and contact member 16 will return to the positions shown in Figure 7 and the controlled circuit will not be closed. If, however, the arm 13 is in its normal position when the rod K is depressed, said arm will be engaged by the latch and the latch and lever will be held in the positions shown in Figure 1 after the rod K is released. As the shoulder 24 moves to its uppermost position, out of engagement with the contact member 16, the latter will move into engagement with the contacts on the terminals 17 and 18 of the controlled circuit, closing the latter.

While the motor is running without overload, the arm 13 will be engaged by the latch, but, if overloaded, the arm 13 will be moved clockwise from the positions shown in Figures 1 and 5, out of engagement with the flange 15 on the latch,

and the latch, lever and contact member **16** will then move to the positions shown in Figure 7.

In order to give the lever, latch and switch contact member **16** a positive and quick movement from the positions shown in Figure 1 to the positions shown in Figure 7, I provide a flat spring-metal strip F, which lies against one of the arms *j* of the switch member J and is secured at its lower end to the lever and switch member by one of the rivets *r*. Attached to the upper end of the spring F is an arm *f* which, as the lever is brought to switch closing position, bears against the part **4** of the frame. As the spring is attached to the lever below the axis of the latter and the part *f* engages the part **4** of the frame above the axis of the lever, the lever and the attached switch member will be spring-pressed in the direction to cause a quick movement of the parts from the position in Figures 1 and 8 to that shown in Figure 7 when the latch is released from the part **13** by reason of overload in the motor circuit.

What I claim is:

1. An overload cutout device for electric circuits comprising a suitable supporting frame, an overload coil mounted on the frame, a spindle extending axially through and beyond said coil, two thermally responsive coils surrounding said spindle, one of the latter coils being within the overload coil and having one end secured to the frame and its other end secured to the spindle, and the other thermally responsive coil being external to the overload coil and having one end secured to the spindle and its other end free to turn, a tripping device journalled on the spindle and connected to the free end of the last mentioned coil, a switch, comprising a lever and contact member, and a latch carried by said lever and adapted to engage and be held by said triping device while the spindle is in normal position and to be released when the spindle is moved in response to heating caused by excess current in the overload coil.

2. An overload cut out for electric circuits comprising a suitable supporting frame, an overload coil mounted on the frame with its axis extending vertically, a spindle extending axially through and below said coil, said spindle composed of two metal rods joined end to end by a coupling of insulating material, two thermally responsive coils, wound in the same direction, surrounding said spindle, one of the latter coils being within the overload coil and having its lower end adjustably secured to the frame and its upper end attached to the spindle, and the other thermally responsive coil having its upper end secured to the coupling and its lower end free to turn, a tripping device movable by said lower end, and a switch adapted to be held in closed position by said tripping device when the latter is in normal position and to be released therefrom when said device is moved from normal position in response to heating caused by excess current in the overload coil.

3. An overload cut-out device for electric circuits comprising a suitable supporting frame, an overload coil mounted thereon, a spindle extending axially through and beyond said coil, two bi-metallic thermally responsive coils, wound in the same direction, surrounding said spindle, one of the bi-metallic coils being arranged within the overload coil and having one end secured to the frame and its other end secured to the spindle, and the other bi-metallic coil being without the overload coil and having one end secured to the spindle and its other end free to turn, a tripping device connected to the free end of the last mentioned coil, a switch comprising a lever and a switch member spring-pressed toward open position, a latch, carried by said lever, adapted to engage said tripping device when the lever and switch member are moved toward switch-closing position, and means for moving the lever and latch to the latching position and then permitting the switch to close, if the latch engages and is held by said tripping device.

JOSEPH F. FRESE.