Aug. 15, 1933. H. C. DOANE 1,922,422

RELAY

Filed Aug. 22, 1930

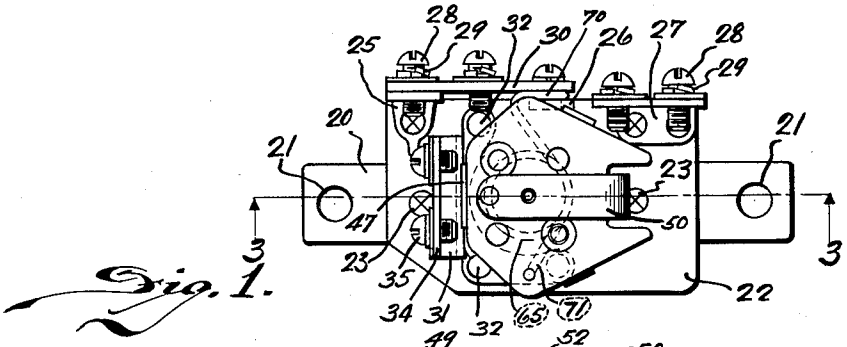


Fig. 1.

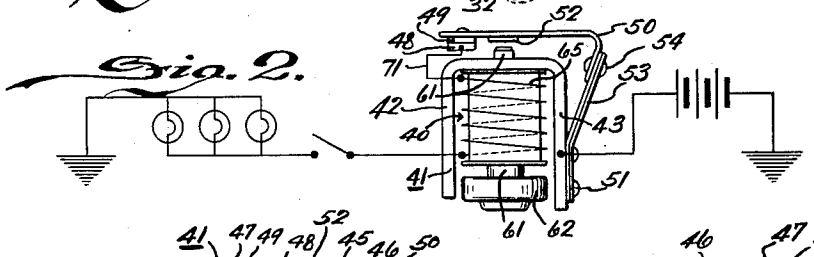


Fig. 2.

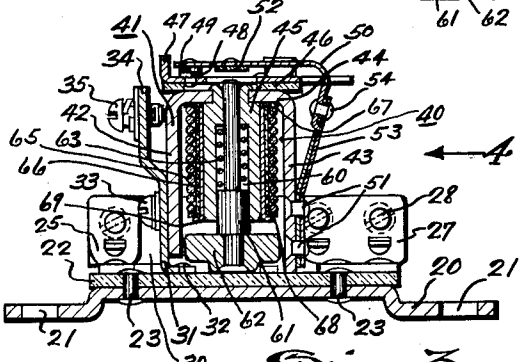


Fig. 3.

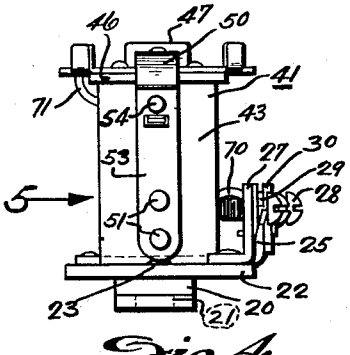


Fig. 4.

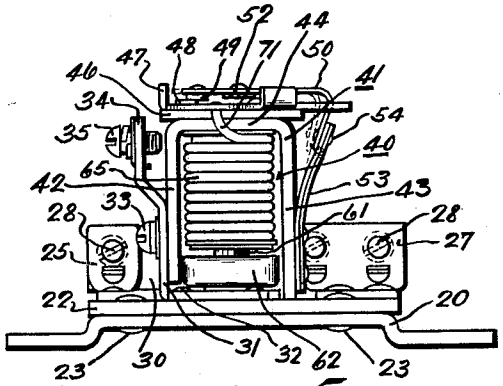


Fig. 5.

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1,922,422

RELAY

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Application August 22, 1930. Serial No. 477,048

9 Claims. (Cl. 200—87)

This invention relates to current regulators for current controlling devices, and has among its objects to provide a device that will safeguard the working circuit or circuits of the accessories about an automotive vehicle.

A further object of the invention is to provide a current limiting relay device that will be responsive to over-loads impressed upon a circuit, so as to reduce source depletion and fire hazard.

It is a further object of the invention to provide a device of the class described, in which contacting elements are maintained in clean electrical condition and thus contributory to efficient operation.

A further object of the invention is to provide means for cleaning the electrical contacts, and for varying the conductive engagement therebetween.

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 embodiment of one form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a plan view of a current limiting device involving the invention.

Fig. 2 is a wiring diagram illustrating the application of the improved relay in the work circuit of an automotive vehicle.

Fig. 3 is a longitudinal section of the current limiting device substantially as indicated by the line and arrows 3—3 of Fig. 1.

Fig. 4 is an end elevation of the same substantially as indicated by the arrow 4 of Fig. 3.

Fig. 5 is a side elevation of the current limiting device substantially as indicated by the arrow 5 of Fig. 4, and illustrating certain parts thereof in a shifted position from that illustrated in Fig. 3.

With particular reference to the drawing, 20 indicates a mounting bracket apertured at 21 for securing the same to any desirable support, and carries a nonconducting plate 22 by rivets 23, which plate provides a foundation for the current limiting device thereto attached. Along one side of the foundation plate 22 is secured a plurality of terminal brackets 25, 26 and 27 that provide for various electrical connections for various parts of the device, as will presently appear. All of the work device may be connected with leads secured to the clips by one or more of the terminal screws 28 with lock washers 29. Facilitating electrical connection between the members 25 and 26 there is provided a connecting bar or bridge member 30 with a centrally disposed terminal screw as is illustrated in Fig. 1. Aside from the extent noted, each of the terminal brackets are insulated from each other and from other contributing elements of the structure.

On the insulating member 22 there is secured a bracket member 31 by rivets 32, that aids in supporting an electro-magnet device 40 by screws 33 driven into one leg thereof. The bracket 31 is extended and offset to form a terminal bracket 34 carrying the screw devices 35, substantially as illustrated in the drawing. The electromagnet 40 comprises the form illustrated in the drawing and comprises in main a U-shaped magnet frame 41 having the parallel legs 42 and 43, joined by the bridge piece 44, and centrally apertured to receive and retain a cylindrical pole piece 45. On the bridge piece 44 there is secured an insulating disc 46 that supports a contact supporting plate 47; both the members 46 and 47 being apertured coaxial with the pole piece 45.

To the plate 47 is secured a fixed contact 48 that cooperates with a movable contact 49 supported by a leaf spring conductor 50 of the form illustrated in the drawing, and that is secured to the leg 43 of the magnet frame by rivets or other devices 51. The spring conductor is so constructed and mounted with respect to a bimetallic hinge 53, that a tension is provided in the leaf spring conductor that tends to urge the conductor into a normal position, consequently the conductor urges the contact 49 into engagement with the contact 48. In the form illustrated, the contacts 48 and 49 are disposed at one side of the pole piece 45, and substantially over the leg 42 of the magnet frame, so that the spring leaf conductor 50 in making connection with the leg 43 lies over the central apertures of the contact supporting plate, and also over the pole piece 45. At a point coaxial with the pole piece a pad 52 is provided that operates as an engaging piece for an armature rod of the electromagnet. The spring leaf 50 is attached to the magnet frame through the office of a bimetallic hinge 53 secured thereto by a rivet or like device 54.

The cylindrical pole piece 45 is provided with a stepped bore 60 as illustrated in Fig. 3, so as to be in end alignment with the pad 52 and provides for reception of an armature rod 61 supporting an armature 62 disposed between the legs 42 and 43 of the magnet at the lower end of the pole piece 45. In the enlarged recess of the pole piece 45, and disposed about the armature rod 61, there is a light spring 63 that operates to resiliently separate the armature 62 from the pole piece 45, yet allows the same to move upwardly and

carry with it the rod 61 when the magnet is energized. A magnet winding 65 is disposed about the pole piece 45, and is insulated therefrom by a dielectric sleeve 66 and heads 67 and 68 carried by a nonmagnetic sleeve 69 in frictional engagement with the pole piece 45.

The winding 65 provides a terminal 70 attached to the terminal clip 26 and thus has electrical engagement with the bar 30 and the clip 25. A terminal 71 at the other end of the winding is attached to the contact supporting plate 47 and thus has electrical connection with the spring leaf conductor 50 through the contacts 48 and 49. From this it will be observed that if a current source, such as a battery, is connected with the terminal clip 34, and if work devices are electrically connected with the bar 30, that the relay device is then in series with the circuit as is exemplified by the following tracing.

With the device in its normal position of rest, and for such voltage pressures upon the work circuit as the work devices are designed to respond to, the electrical impulse follows from the terminal member 34 through the magnet frame 41 to the rivets 51, where, in the preferred form it makes its way to the spring leaf conductor 50 by means of the bimetallic hinge 53, and thence through the contacts 49 and 48 to the plate 47 where electrical connection is made with the lead 71 through the winding 65 to the other lead 70, and thence to the terminal clip 26 from whence it makes its way to the various work devices coupled to the bridge member 30.

The relative position of the device in the circuit is fully illustrated in Fig. 2, to which reference is now made. The device is normally calibrated to permit the usual current required by the work devices, such as the lights or other instruments connected in the circuit, to function without response to the voltage pressure they may require. However, if this current demanded by the work devices is exceeded to any appreciable extent, such as by a short circuit, then the magnetic influence of the current passing through the magnet winding operates upon the armature 62 to separate the contacts 48 and 49. The circuit is then opened and the magnet winding deenergized, which allows the armature 62, by reason of the spring 63, to return to its normal positon allowing the contacts 48 and 49 to again close. This action continues rapidly, but the frequency of the vibration is lowered by the use of the nonmagnetic sleeve 69 placed over the core 45. The vibrating action reduces the current to a value that prevents rapid or excessive over-heating of the wires, or an excessive drain on the battery, and at the same time products a rattling sound that gives a warning of a short circuit, or over-voltage impression.

Normally the contact tension, or the conductive engagement of the points 48 and 49, is only a few ounces and there is some tendency of the surfaces of the contacts to corrode when the device is not subject to short circuits, or is subject to disuse. When a short circuit is produced the contacts are automatically cleaned by the hammering of the one upon the other due to the vibratory action of the electromagnet. However, a short circuit seldom occurs, and the corrosive action on the points is sufficient in time to prevent the normal flow of current therethrough. In consequence thereof the work devices fail to function. Further, by reason of high production in manufacture it frequently happens that the contacting surfaces of the members 48 and 49 are not perfectly flat, but that the conductive engagement thereof is in substance a pair of contacting points. During normal service the vibration of a car is sometimes sufficient to move one of the contacts from its original position on to a portion of the surface of the other contact that has been oxidized or otherwise corroded, thus establishing a film of insulation between the contact points and preventing a flow of current therethrough.

The instant invention solves these problems in a novel way as will appear in part from the structural description that has preceded, and its operation will now follow. The normal change in temperature of the atmosphere is made to alter the relation of the contacts 48 and 49 from the position illustrated in Fig. 3 to that position illustrated in Fig. 5, through the agency of the bimetallic element 53. This is accomplished in the following manner: heat moves the bimetallic element 53 about an arc, from the position shown in dot-and-dash lines to that position as shown in Fig. 5, tending to separate the contacts 48 and 49, but the tension provided in the conductor 50 is sufficient to overcome the action of the bimetallic element attempting to raise the contact 49 from contact 48, consequently the contacts remain in engagement with each other, thus providing a wiping action across the contacts. Assuming that the bimetallic element is made up of a strip of material H having a high rate of expansion, and a strip of material L having a low rate of expansion, and is positioned as illustrated in the drawing, then a decrease in temperature operates to move the upper contact 49 toward the left as viewed in the drawing, at the same time increasing the conductive engagement between the contact points. On the other hand, a rise in temperature experienced by the bimetallic element will operate to move the upper contact toward the right hand of the drawing in relation to the fixed contact, substantially as illustrated in Fig. 5, and incidentally decreasing the conductive engagement between the contact points. This movement of the contact 49 over the contact 48 tends to keep the contacting surfaces clean of corrosion, oxidation or other deposits.

In addition to providing the cleaning action, the bimetallic elements or temperature responsive means also has the effect of automatically adjusting the calibration of the device for cold weather driving conditions. This is desirable inasmuch as the instantaneous current required by cold incandescent lamps is several times the normal operating current, and, inasmuch as this instantaneous increase in current is sometimes sufficient to cause enough magnetism in the winding 65 to actuate the armature 62 whereby the contacts 48 and 49 would be separated. Under these conditions when the surfaces of the contacts come together again they may not have the same relation, and may be separated by a film of foreign material which would operate to maintain a break in the circuit. The temperature responsive means operating at successive changes of temperature in the region about the circuit controlling device operate to keep the points of the contacts free from such foreign material, and thereby maintain the device in a high state of efficiency.

The introduction of the bimetal, also serves another purpose that affords further protection to the wiring of the circuit and the battery, when the same is short circuited by any means. That

is, when a short circuit is produced in the work circuit the magnet operates to open the circuit through the contacts 48 and 49 at rapidly succeeding intervals. This rapid opening and closing of the contacts is accompanied by a certain amount of arcing that develops heat passing along the conductor 50 to the bimetal hinge 53. This temperature change so conducted manifests in a bending of the bimetallic element 53 sufficient to reduce the tension of the spring leaf conductor 50 and thereby varies the conductive engagement between the contact points 48 and 49, or the tension of the spring conductor 50. In response to this, there is a corresponding change in the amount of current flowing in the circuit through the contact points.

If the temperature rise becomes excessive, the bimetallic element will operate to actually separate the contacts, and they will remain apart until the bimetal has cooled sufficiently to restore the normal position and reaccomplish their conductive engagement, whereupon the points will again vibrate by reason of the closed circuit until the action of the bimetal will again completely open the circuit. The resultant action therefore is sufficient not only to reduce the amount of current carried by the circuit when the points are vibrating, but also to introduce a time interval sufficient to prevent an injurious rise in temperature in any part of the circuit, and likewise prolong discharge of the battery.

While the form of embodiment of the present 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 a current limiting device, the combination comprising; a pair of contacts, one of which is movable; a lever carrying one of the contacts; electromagnetic means for actuating the lever so as to move the movable contact; and temperature responsive means connecting the lever with a stationary part and so constructed and arranged as to move said lever in a direction such as to cause the movable contact to move across the face of the stationary contact while in engagement therewith.

2. A current limiting device comprising in combination; a magnet relay providing a pair of contacts, one of which is movable; a leaf spring conductor carrying said movable contact, said spring conductor being constructed and arranged so as to urge said contact into engagement with the other contact; a temperature responsive means connecting the leaf spring conductor with a stationary part, said means operable under certain circuit conditions to move said conductor in a direction to cause the movable contact to slide over the face of the stationary contact while in engagement therewith.

3. In a current limiting device the combination comprising; a pair of contacts normally in conductive engagement, one of which is movable; a lever carrying one of the contacts; means operable to separate the contacts; and temperature responsive means connecting the lever with a stationary part and operable in response to a predetermined temperature to shift said lever in a direction such as to cause the movable contact to slide across the face of the other contact for varying the conductive engagement of said contacts while in closed position to maintain the engaging surfaces thereof free from insulating films.

4. In a current limiting device the combination comprising; a pair of contacts one of which is movable; a support for one of said contacts; electro-magnetic means for actuating the support so as to move the movable contact; temperature responsive means connecting said support with a stationary part and operable to move said support in a direction to cause said movable contact to move across the face of the stationary contact while in engagement therewith.

5. In a current limiting device the combination comprising; a pair of contacts, one of which is movable, a lever carrying one of said contacts; means operable to separate the contacts in response to certain electrical potential; bi-metallic means connecting said lever with a stationary part and operable in response to certain other electrical potential for moving said lever to cause said movable contact to move over the other contact to vary the conductive engagement thereof.

6. A switch, comprising in combination; a pair of contacts, one of which is movable; a lever carrying the movable contact; means for moving the lever laterally to separate the contacts; and temperature responsive means connecting the lever with a stationary part and so constructed and arranged as to move the lever in a direction such as to cause the movable contact to move across the face of the stationary contact while in engagement therewith.

7. A switch, comprising in combination; a pair of contacts, one of which is movable; a leaf spring conductor carrying the movable contact and adapted to urge said contact into engagement with the other contact; means for moving the leaf spring laterally to separate the contacts; a bimetallic hinge connecting the leaf spring with a stationary part, said hinge operable under certain circuit conditions to move the leaf spring in a direction to cause the movable contact to slide over the face of the second mentioned contact while in engagement therewith.

8. A switch comprising in combination; a pair of contacts, one of which is movable; a resilient member carrying the movable contact and urging said contact into engagement with the other contact; means for moving the resilient member to separate the contacts; and temperature responsive means connecting the resilient member with a stationary member and operable in response to certain temperature conditions to change the position of the resilient member so as to cause the movable contact to slide across the face of the other contact while in engagement therewith.

9. A switch comprising in combination; a pair of contacts, one of which is movable; a lever carrying the movable contact; means for moving the lever laterally to separate the contacts; a temperature responsive means connecting the lever with a stationary part, said means operable under certain circuit conditions to shift said lever to cause the movable contact to slide over the surface of the stationary contact while in engagement therewith to free the engaging surfaces of said contacts of insulating films.

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