

Oct. 5, 1948.

C. W. KUHN

2,450,600

OVERLOAD PROTECTIVE DEVICE

Filed May 9, 1945

2 Sheets-Sheet 1

Fig. 1

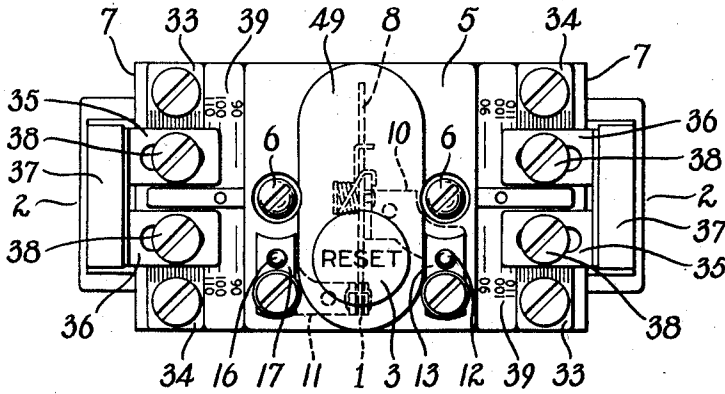


Fig. 2

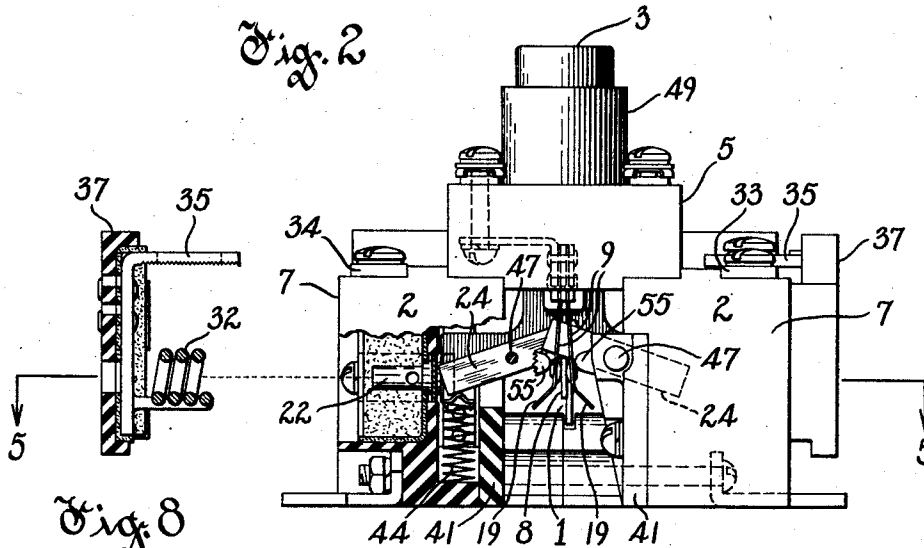


Fig. 8

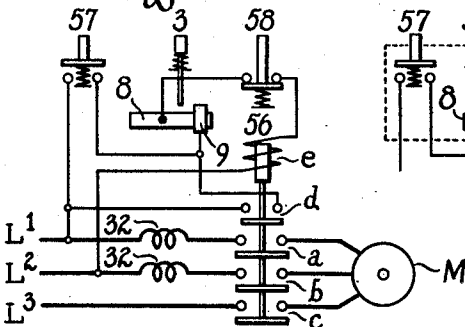
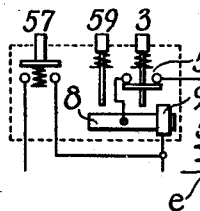


Fig. 9



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2 Sheets-Sheet 2

Fig. 3

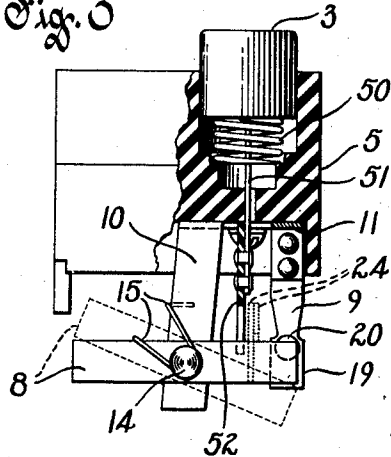


Fig. 4

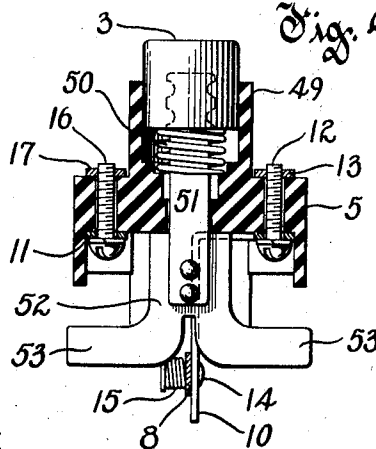


Fig. 5

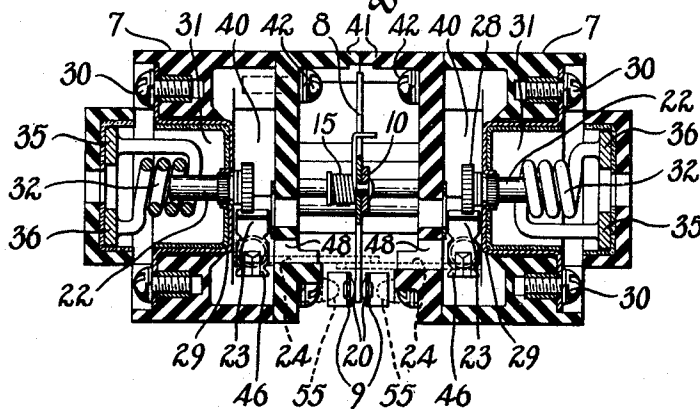


Fig. 6

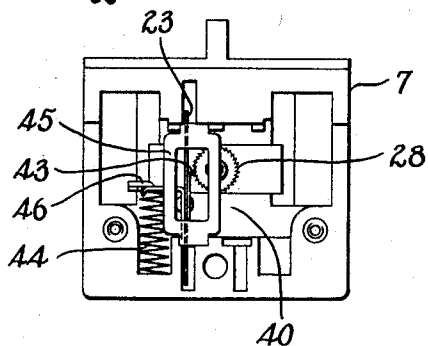
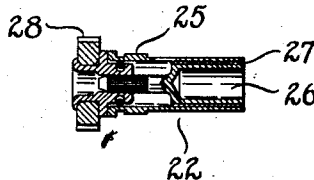


Fig. 7



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UNITED STATES PATENT OFFICE

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OVERLOAD PROTECTIVE DEVICE

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6 Claims. (Cl. 200—124)

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This invention relates to overload protective devices for electric circuits and while not limited thereto is particularly applicable to thermal protective devices of the self-soldering type.

The invention has among its objects to provide an improved overload protective relay which is highly shock-proof, or in other words, capable of performing properly and withstanding damage when subjected to severe shocks such as are encountered aboard naval vessels upon bombing or torpedoing thereof.

Another object is to provide a relay of the above character which is rugged and inexpensive in construction, exceedingly reliable in operation and capable of ready adjustment for response at selected overload current values.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate an embodiment of the invention which will now be described, it being understood that various modifications may be made in the embodiment illustrated without departing from the spirit and scope of the appended claims.

In the drawings,

Figure 1 is a front elevational view of a relay embodying the invention;

Fig. 2 is a view of the underside of the relay shown in Fig. 1, with portions of the relay broken away and shown in section, and a part thereof being shown in a detached position;

Figs. 3 and 4 are detail sectional views of certain of the relay parts illustrated in Figs. 1 and 2;

Fig. 5 is a sectional view taken substantially on line 5—5 of Fig. 2;

Fig. 6 is a side elevational view of one of the thermal overload responsive elements illustrated in Figs. 1 and 2;

Fig. 7 is a sectional view of one of the self-soldering overload responsive elements illustrated in Fig. 5;

Fig. 8 is a diagrammatic view illustrating the circuit connections for the relay shown in Fig. 1, and

Fig. 9 is a diagrammatic view illustrating a modification of the relay shown in Fig. 1.

Referring to Figs. 1 and 2, the same illustrate an overload relay including a normally closed switch 1 and a pair of overload devices 2—2, either of which is responsive to effect opening of said switch. The overload devices are arranged on opposite sides of switch 1 and are resettable by a push button 3.

More specifically, switch 1 and push button 3 are mounted upon an insulating base 5 which is

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secured by screws 6 to the front faces of spaced rectangular insulating bases 7—7 associated with the overload devices 2—2. Switch 1 is mounted upon the rear face of insulating base 5 and is provided with an elongated movable contact blade 8 and a pair of stationary spring contact fingers 9 for yieldingly engaging one end of said blade. Contact blade 8 and contact fingers 9 are carried by brackets 10 and 11, respectively, which are mounted within a recess formed in the rear face of base 5. Bracket 10 is secured to base 5 by a screw 12 which threads into a terminal plate 13 mounted upon the front face of said base. Contact blade 8 is rotatably supported at a point midway between its ends upon a pivot pin 14 carried by bracket 10 and the same is biased to move in a counterclockwise direction toward the full line position illustrated in Fig. 3 by a coil spring 15 mounted upon said pin. Bracket 11 is fixed to base 5 by a screw 16 which threads into a terminal plate 17 mounted upon the front face of base 5. Contact fingers 9 are secured at one end to bracket 11 by rivets 18 and the free ends thereof are provided with outwardly bent portions 19 for receiving blade 8 therebetween. Each of the contact fingers 9 has a silver contact button 20 secured thereto and upon biased movement of blade 8 into the full line position shown in Fig. 3 fingers 9 are spread apart to yieldingly hold said contact buttons in engagement with opposite sides of said blade.

The insulating bases 7—7 associated with overload devices 2 are arranged in opposed relation on opposite sides of contact blade 8. Said overload devices are of like construction, each being provided with an overload responsive element 22 of the self-soldering type, and a spring biased trip member 23 which is normally held in a retracted position by said element and which operates upon response of said element to move contact blade 8 out of engagement with its associated fingers 9 through the medium of a pivoted insulating lever 24.

As shown in Fig. 7, each of the overload responsive elements 22 comprises a stationary tubular member 25, a stem 26 located within said tubular member and having one end secured thereto by a solder connection 27, and a ratchet wheel 28 which is fixed to the opposite end of said stem. Each of the overload elements 22 is carried by a U-shaped bracket 29 which is secured by screws 30 within a recess 31 formed in the outer face of its associated insulating base 7. Each of the overload responsive devices 22 is surrounded by a heater coil 32 which extends into the recess 31 in

its associated base 7 and is electrically connected to a pair of terminal plates 33 and 34 mounted upon the front face of said base. As shown in Fig. 5, each of said heater coils is carried by a pair of L-shaped terminal members 35 and 36 which are secured to an insulating plate 37. As shown in Figs. 1 and 2, terminal members 35 and 36 are adjustably secured to their associated terminal plates 33 and 34 by screws 38 to permit axial adjustment of heater coils 32 with respect to their associated overload elements 22. Also as shown in Fig. 1, the front faces of bases 7 are provided with indicia 39 for indicating various settings of heater coils 32.

As shown in Fig. 5, trip members 23 are arranged below their associated ratchet wheels 28 and are held in assembled position within recesses 40 formed in the opposing faces of bases 7 by insulating cover members 41 which are secured to said bases by screws 42. Each of the trip members 23 comprises an elongated spring strip having a latch part 43 fixed thereto for engaging its associated ratchet wheel 28 to normally hold the same in a retracted position shown in Fig. 6 against the action of a coil spring 44. Also as shown in Fig. 6, each of the trip members 23 is slidably supported within the recess 40 in its associated base 7 by a sheet metal bracket 45, and each has an arm 46 fixed thereto which is engaged by spring 44.

The levers 24 associated with trip members 23 are pivotally supported at points midway between their ends upon pivot pins 47 carried by cover members 41. As shown in Fig. 5 cover members 41 are provided with openings 48 for receiving levers 24, and as illustrated by dotted lines said levers extend between contact blade 8 and arms 46 of their associated trip members 23.

Levers 24 are normally positioned as shown in Fig. 2, and with the same in this position contact blade 8 is held by spring 15 in engagement with contact fingers 9 to establish circuit between terminal plates 13 and 17. Upon a given overload current condition in either of the heater coils 32 the corresponding overload element 22 is rendered responsive by fusion of solder connection 27 to permit movement of its associated trip member 23 out of the normal retracted position shown in Fig. 6 under the action of spring 44. When either of the trip members 23 is moved out of its normal retracted position the lever 24 associated therewith is rotated out of the position shown in Fig. 2 to move contact blade 8 out of engagement with contact fingers 9 for interruption of circuit between terminal plates 13 and 17. As is apparent, axial adjustment of heater coils 32 with respect to their associated overload responsive elements 22 varies the overload current values at which contact blade 8 is moved into circuit interrupting position.

As hereinbefore stated, the overload devices are resettable by a push button 3. As shown in Fig. 4, push button 3 is slidably supported within an opening in a projection 49 formed on the front face of base 5 and is biased to move forwardly under the action of a spring 50. Said push button is provided with a stem 51 which extends through an opening in base 5 and has an insulating member 52 fixed to the inner end thereof. Insulating member 52 is provided with side projections 53 which extend through openings 48 in cover members 41 for engagement with arms 46 on trip members 23. Push button 3 is normally held by spring 50 in the position shown in Fig. 4 and when the same is depressed projections 53 engage

arms 46 on trip members 23 to reset said trip members in the retracted position shown in Fig. 6 upon response of their associated overload elements 22. During resetting of trip members 23 contact blade 8 is moved into engagement with contact fingers 9 under the action of spring 15.

In connection with the foregoing it should be noted that contact blade 8 and levers 24 are balanced upon their associated pivots to render the same non-rotative under the action of accelerating forces caused by shock. Also the light spring strip construction of trip members 23 insures against release of said trip members from their associated ratchet wheels 28 under high shock conditions. Contact blade 8 is thus maintained in circuit closing position under the action of its associated spring 15 under shock conditions. For further shock-proofing of the relay the opposing faces of cover members 41 are provided with stop projections 55 shown in Figs. 2 and 5 for engaging contact fingers 9. These stop projections are spaced to limit to a very narrow range side play of contact fingers 9 when blade 8 is located therebetween.

The above described relay may be used as shown in Fig. 8 to control a 3 phase alternating current motor M through the medium of an electroresponsive switch 56. Switch 56 is provided with poles a, b and c for connecting motor M to a supply circuit indicated by lines L¹, L², L³ and the same is also provided with a pole d for establishing a maintaining circuit for its operating winding e. The energizing circuit for winding e is controlled by relay contacts 8 and 9 and also by a normally open start push button 57 and a normally closed stop push button 58. The heater coils 32 of the relay are each connected in one of the supply conductors for motor M. Upon depression of start push button 57 operating winding e of switch 56 is energized by a circuit extending from line L¹ through start push button 57 through relay contacts 9 and 8 through stop push button 58 and through said operating winding to line L². Switch 56 thus responds to energize motor M and upon release of start push button 57 winding e is maintained energized through the medium of relay contacts 8 and 9 and stop push button 58. The maintaining circuit for switch 56 is interrupted to effect stopping of the motor either by operation of stop push button 58 or by disengagement of contact blade 8 from contact fingers 9 in response to given overload conditions in the motor circuit. As hereinbefore set forth, contact blade 8 is returned to circuit closing position upon depression of reset button 3. Thus by closing the start push button 57 and depressing the reset push button 3 it is possible to energize switch 56 for emergency operation of motor M under overload conditions.

The control illustrated in Fig. 8 may be modified as shown in Fig. 9 by associating stop switch 58 with the reset button 3 to provide for stopping of motor M by depression of said reset button. In this form of control an emergency push button 59 is associated with contact blade 8 for maintaining the same in engagement with contact fingers 9 under overload conditions in the motor circuit. Thus by closing start push button 57 and depressing the emergency button 59 it is possible to energize switch 56 for emergency operation of motor M under overload conditions. As is apparent, the stop switch 58 and emergency push button 59 may be mounted upon base 5 of the aforescribed relay to provide a unitary structure.

What I claim as new and desire to secure by Letters Patent is:

1. In a circuit controller, in combination, a pivoted contact blade biased to rotate in one direction into a given extreme position, a stationary contact element having spreadable spring contact parts for yieldingly engaging said blade on opposite sides upon biased movement thereof into said extreme position, said spring contact parts having stationary stops associated therewith for limiting to a very narrow range play thereof under shock when said blade is disposed therebetween, and said blade being balanced upon its associated pivot to render the same non-rotative under the action of shock transmitted thereto through its associated pivot.

2. In a circuit controller, in combination, a pivoted contact blade having biasing means associated therewith for rotating the same in one direction toward a given extreme position, a stationary contact element having spreadable spring contact parts for yieldingly engaging said blade on opposite sides upon movement thereof into said extreme position, said blade being balanced upon its associated pivot to render the same non-rotative under the action of shock transmitted thereto through its associated pivot, an overload responsive device having a spring biased element normally held in a retracted position and releasable upon response of said device to move said blade out of engagement with said spring contact parts against the action of its biasing means, and a manual element operable to reset said spring biased element in its retracted position upon response of said overload device, said blade being moved into engagement with said spring contact parts under the action of its biasing means during resetting of said element in its retracted position.

3. In a circuit controller, in combination, a pivoted contact blade biased to rotate in one direction toward a given extreme position, a stationary contact element having spreadable spring contact parts for yieldingly engaging said blade on opposite sides upon biased movement thereof into said extreme position and an overload device associated with said blade and responsive to effect movement thereof against its bias out of engagement with said spring contact fingers, said overload device being operatively connected to said blade through the medium of a pivoted operating lever and said blade and said operating lever being balanced upon their associated pivots to render the same non-rotative under the action of shock transmitted thereto through said pivots.

4. In a circuit controller, in combination, a pivoted contact blade biased to rotate in one direction toward a given extreme position, a stationary contact element having spreadable spring contact parts for yieldingly engaging one end of said blade on opposite sides thereof upon biased movement thereof out of said extreme position, a pair of overload devices disposed on opposite sides of said blade, each of said overload devices being responsive to effect movement

of said blade out of engagement with said spring contact parts and each being operatively connected to said blade through the medium of a pivoted lever, said levers and said blade being balanced upon their associated pivots to render the same non-rotative under the action of shock transmitted thereto through their associated pivots.

5. In a circuit controller, in combination, a pivoted contact blade having biasing means associated therewith for rotating the same in one direction toward a given extreme position, a stationary contact element having spreadable spring contact fingers for yieldingly engaging one end of said blade on opposite sides upon biased movement thereof into said extreme position, a pair of overload responsive devices disposed on opposite sides of said blade, each of said overload devices being responsive to effect movement of said blade out of engagement with said spring contact fingers and each being operatively connected to said blade through the medium of a pivoted lever, said levers and said blade being balanced upon their associated device to render the same non-rotative under the action of shock transmitted thereto through their associated pivots, and a finger operated actuator for resetting of said overload devices upon response thereof, said blade being returnable under the action of its biasing means into engagement with said contact fingers during resetting of said overload devices.

6. In a circuit controller, in combination, a pivoted contact blade biased to rotate in one direction toward a given extreme position, a stationary contact having spreadable spring contact parts for yieldingly engaging said blade on opposite sides upon biased movement thereof into said extreme position, said spring contact parts having stationary stops associated therewith for limiting to a very narrow range play thereof under shock when said blade is disposed therebetween, and an overload device associated with said blade and responsive to effect movement thereof out of engagement with said spring contact fingers, said overload device being operatively connected to said blade through the medium of a pivoted operating lever, and said blade and said operating lever being balanced upon their associated pivots to render the same non-rotative under the action of shock transmitted thereto through said pivots.

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