Feb. 14, 1967 E. W. ISLER 3,304,392

SPACE SAVING ELECTRICAL TERMINAL

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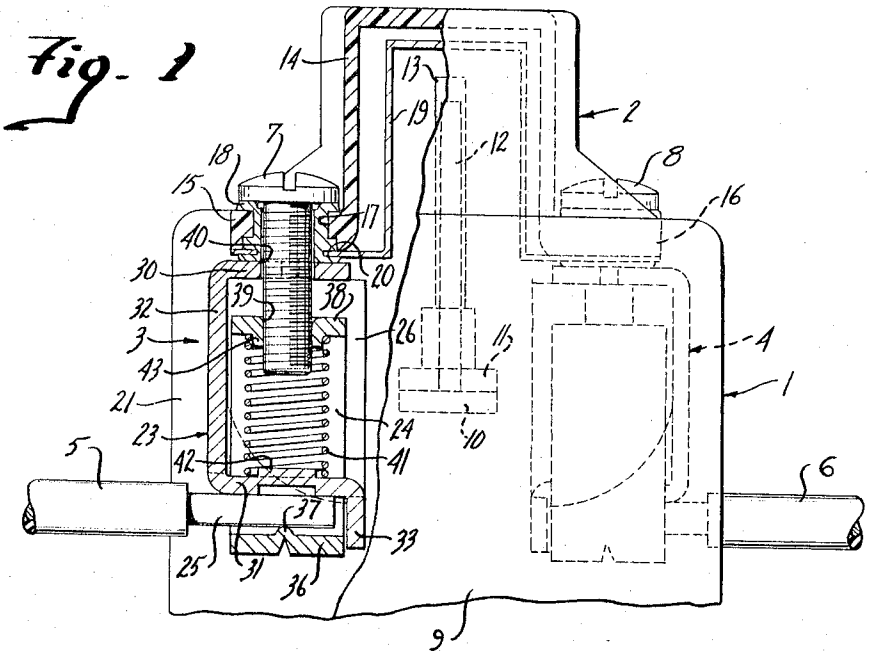
Fig. 1



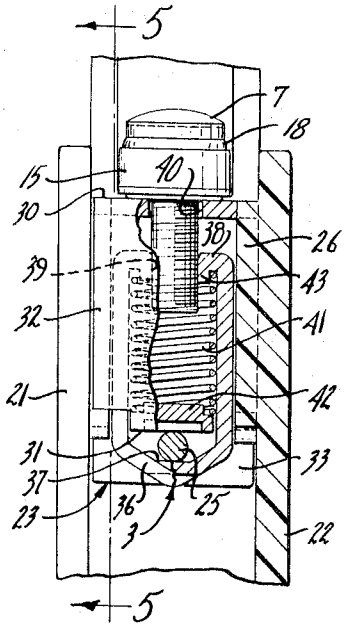


Fig. 2

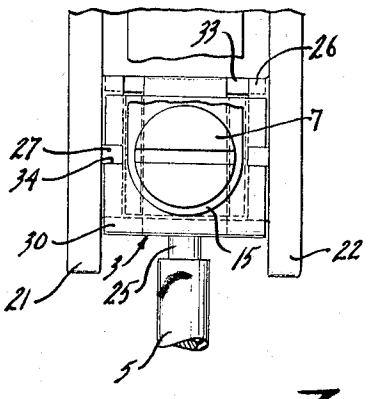


Fig. 3

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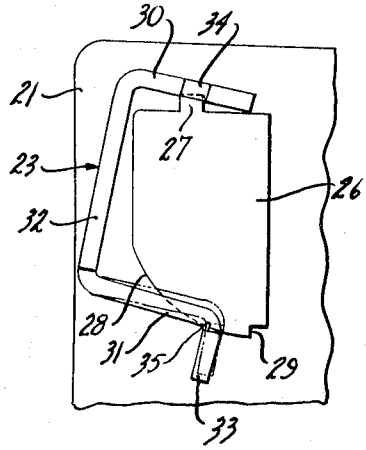
Fig. 4.



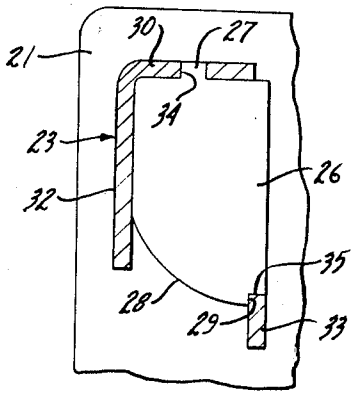


Fig. 5.

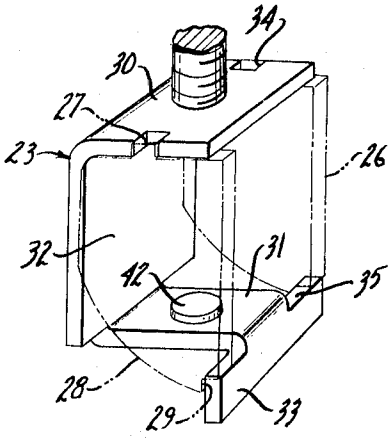


Fig. 6.

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United States Patent Office 3,304,392 Patented Feb. 14, 1967

3,304,392

SPACE SAVING ELECTRICAL TERMINAL

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Filed Feb. 11, 1965, Ser. No. 431,796
6 Claims. (Cl. 200—124)

This invention relates to a space saving electrical terminal and particularly a space saving terminal for a thermally responsive relay having a heating element separably mounted with respect to the switching mechanism.

In the protection of electrical equipment against damage due to excessive currents, thermal overload devices have been proposed in various arrangements. Generally, the load current or a current proportional thereto energizes a heating element to operate a control switch or the like in response to excessive load currents. While satisfactory switch mechanisms have been suggested, they have not been as small and compact as desired for many applications. One of the problems encountered is the interconnection of the heating element and the electrical connections thereto in a small, compact arrangement and which permits ready repair and replacement.

A single relay construction can generally be employed in various electrical circuits of different ratings with the relay being coordinated by use of an appropriately rated heating coil for the given installations. This requires that the heating coil be conveniently inserted for this purpose as well as for subsequent repair and replacement. Generally, a heating element is secured to the switch by suitable mountinig screws and a separate electrical connecting lug assembly is connected thereto. This increases the total size required to accommodate the various connecting components.

The present invention is particularly directed to a terminal unit for selective clamping engagement with a bared conductor and having a contact bolt or other releasable means which may be employed to simultaneously physically interconnect the heating or other trigger element to the relay body structure proper while completing the electrical connection to the incoming terminal bared conductor. Generally, in accordance with this aspect of the present invention, the heater element is secured overlying a portion at least of the relay body structure with mounting screws mounted to opposite sides thereof and passing downwardly through a portion of the body structure into operative engagement with releasable circuit connecting contactors or terminal units. The terminal units are secured within suitable recesses immediately beneath the mounting location to the relay proper. Thus, when it is desired to connect the heating element to the terminal units, the element is placed in position and the mounting screws passed downwardly into the terminal units. This will simultaneously physically mount the heating element on the switch body and make the connection to the terminal units which are located beneath and in alignment with the mounting members. The terminal units each include a clamp unit which is drawn up by tightening of the mounting bolt such as to provide a firm electrical connection to the incoming lead. This assembly therefore minimizes the overall width of the assembly.

In accordance with an improved and unusual construction of the present invention, the terminal units include a first clamping member which is releasably connected by the spring tension in the member itself to suitable locking stops or abutments on adjacent walls of the relay body or the like. A clamping member is passed at least partially around the mounting member to form an adjustable opening within which the power lead is disposed. The opposite end of the clamp member is interconnected through a

threaded connection to the mounting bolts such that the tightening of the mounting bolt will draw the clamping member upwardly into clamping engagement with the mounting member and simultaneously pull the heater downwardly into firm mounted engagement to the relay body.

The present invention thus provides a small and compact terminal unit which may be incorporated to form a relay unit having a thermally responsive element and provides a very simple and ready means for assembly and disassembly of the components. As a result, maintenance and replacement of the heater and related components is facilitated.

The drawings furnished herewith illustrate a preferred embodiment of the present invention in which the above features and advantages are clearly set forth as well as others which will be clear from the following description of the drawings.

In the drawings:

FIG. 1 is an elevational view of the relay with one half of the unit broken away to show the inner details of construction;

FIG. 2 is a partial side elevational view of FIG. 1 with parts broken away and sectioned;

FIG. 3 is a partial top elevational view with parts broken away;

FIG. 4 is a view showing the installation of a portion of a terminal component in FIGS. 1–3;

FIG. 5 is a view taken on line 5—5 of FIG. 2 illustrating the assembled terminal component; and

FIG. 6 is a perspective view of a terminal component shown in FIGS. 1–5.

Referring to the drawings and particularly to FIG. 1, the illustrated relay unit includes a switch structure 1 upon which a heating unit 2 is secured with similar mounting and terminal assemblies or units 3 and 4 releasably secured within opposite sides of the switch structure 1. Conductors 5 and 6 are connected respectively to the units 3 and 4 to provide for current flow through the heater unit 2 as hereinafter developed. In accordance with the present invention, mounting and contact bolts 7 and 8 pass through opposite flanges of the heater unit 2 and into the contact units 3 and 4 to provide for a simultaneous attachment of the heater unit 2 to the switch structure 1 and firm electrical engagement of the conductors 5 and 6 within the contact units 3 and 4. Thus, when it is desired to disassemble the unit 2 from structure 1, it is merely necessary to remove the two screws or bolts 7 and 8 to allow complete disassembly, as presently described.

The present invention is particularly directed to the construction of the contact or terminal units 3 and 4 to allow the simultaneous mount and electrical circuit connection of unit 2 through the single contact bolts 7 and 8 and consequently the other components are only briefly discussed.

Thus, the switch structure 1 may be of any suitable construction and preferably will take the form of an insulating body or housing 9 of a generally rectangular configuration. A switch 10 is mounted within the body and is spring loaded to a predetermined disabling position. A ratchet 11 is rotatably carried by a spindle 12 and holds the switch 10 in the enabling position against the spring loading thereof. The spindle 12 projects upwardly into a solder chamber or pot 13 which is filled with solder or other suitable heat sensitive material. When the solder chamber 13 is heated to a selected level, the solder or other material will melt and release the spindle 12 whereby the ratchet 11 turns and the switch 10 is actuated. Such structures are well known in the art; for example, one such switch arrangement is generally shown in Patent No. 2,597,068 to H. E. Cobb.

The heating unit 2 which is coupled to heat the solder chamber 13 includes an electrically insulating housing or cover 14 having a generally rectangular U-shaped cross section with end flanges 15 and 16. The cover 14 rests on the switch housing 9 with the flanges 15 and 16 aligned with the terminal units 3 and 4. Each of the flanges 15 and 16 includes an aperture 17 as most clearly shown in FIG. 1 and includes a metal ferrule 18 passing through the opening and having outwardly bent lips bearing on the adjacent end faces of the corresponding flange. A hat-shaped heating element 19 is disposed within the cover 14 with the opposite ends peripherally embedded within the lower lip of the metal ferrule 18 as at 20. The illustrated heating element 19 is generally a strip-like member extending laterally from one of the ferrules 18 and then upwardly along the side wall of the housing or cover 14, across the top and down the opposite side and then laterally to the opposite ferrule. It thus passes over and around the solder chamber 13. If the current through the heating element 19 is excessive, the solder in chamber 13 melts to release the spindle 12 and allow movement of switch 10 to the disabling position.

In accordance with the present invention, mounting and contact bolts 7 and 8 pass directly through the ferrule and thread into the terminal units 3 and 4 to provide for a simultaneous mounting of the heating unit 2 and connection of the leads 5 and 6 to the opposite ends of heating element 19.

Generally, in the illustrated embodiment of the present invention, the insulated body or housing 9 of structure 1 includes a pair of laterally spaced front and back walls 21 and 22 at each side of the housing within which units 3 and 4 are mounted.

As the terminal units 3 and 4 are essentially identical in construction and mounting, the unit 3 will be described for purposes of illustrating the present invention and corresponding elements of unit 4 will be identified by similar primed numbers.

Generally, terminal unit 3 includes a C-shaped mounting frame 23 releasably secured between the walls 21 and 22 of the insulated body or housing 9. A clamping collar or yoke 24 encircles the lower member of frame 23 and defines a clamp unit within which the bare end 25 of the incoming conductor 5 is releasably clamped. The mounting bolt 7 which projects downwardly through the flange 15 of the cover 14 is threaded into the collar 24 and when drawn up provides interengagement of the heating unit 2 to the collar 24 and through the mounting frame 23 to the housing 9 while simultaneously tightly clamp conductor 5 to unit 3.

More particularly, as shown in FIGS. 2, 4 and 5, each of the side walls 21 and 22 is similarly formed with a camming and locking protrusion 26 on its interior face to which frame 23 is releasably secured. The protrusion 26 is generally rectangular with a locking tab 27 projecting upwardly from its top edge. The outer, lower corner is curved as at 28 to define a cam surface extending along the bottom edge of the protrusion and terminating in a locking notch 29 on the inner, lower corner.

Frame 23 is generally a U-shaped strap conductor having a top leg or wall 30 and a parallel bottom wall 31 interconnected to each other by a vertical wall 32. Additionally, a depending clamping leg 33 is integrally secured to the inner free edge of the bottom wall 31.

As most clearly shown in FIGS. 4–6, the top wall 30 of frame 23 includes a clamping edge slot or recess 34 in each side edge. The recesses 34 mate with the tabs 27 of the corresponding protrusion 26 and prevent the top portion of the mounting frame 23 from moving outwardly between the walls 21 and 22 in the assembled position. The bottom wall 31 is somewhat narrower than the distance between protrusions 26 and projects inwardly therebetween with the depending lip 33 extending laterally thereof.

Each upper edge 35 of the depending clamping leg 33 to the immediate opposite sides of the bottom wall 31 defines a clamping surface or edge which interengages with the corresponding locking notch 29 and thereby holds the frame 23 firmly clamped between the side walls 21 and 22 within the housing 9. During assembly, as shown in FIG. 6, the frame 23 is rotated to generally align the notches 34 with the corresponding tabs 27. The clamping edges 35 of lip 33 then bear on corresponding cam surfaces 28. The frame 23 can then be pushed inwardly with the walls 30 and 31 spreading apart as a result of the surfaces 28 until the frame 23 is in the vertical position, at which time the lips 33 are aligned with and snap into the notches 29 to provide the interconnection therebetween. The frame 23 is assembled with housing 9 with yoke 24 in place. The yoke 24 is omitted in FIGS. 4 and 6 for purposes of clearly showing the frame mounting.

The yoke 24 is generally a rectangular member having an internal diameter corresponding to the width of the bottom wall 31 and with the outer dimension falling within the width of the clamping protrusions 26. The yoke includes a lower clamping wall 36 provided with a laterally extending indented portion or contact adge 37 to provide a firm electrical engagement with the bare wire 25 of the conductor 5 which is clamped between wall 36 and bottom wall 31, as shown.

The top attachment wall 38 of yoke 24 includes a threaded opening 39 aligned with a bolt opening 40 in the top wall 30 of the mounting frame 23 to receive the mounting bolt 7 which passes downwardly through the ferrule 18 and the aligned opening 40 in the mounting frame 23 and threads into the threaded opening 39. Tightening of bolt 7 pulls upwardly on the collar or yoke 24 to move the contact edge 37 into firm engagement with the wire 25. Simultaneously it will pull downwardly on the flange 15 of heating element housing 14 to firmly attach the heating unit 2 to the top wall 30 of mounting frame 23.

A coil spring 41 is disposed between the top side of the bottom wall 31 and the underside of the top wall 38 of the yoke 24 to continuously urge the yoke upwardly. Thus, during assembly, the yoke 24 is held in position to receive the inner end of the clamping bolt 7.

The coil spring 41 is held in place by suitable coil retaining projections 42 and 43 formed respectively on the bottom wall 29 of the mounting frame 23 and the top wall 38 of the yoke 24.

Assembly of the structure of the present invention is summarized as follows. The terminal units 3 and 4 are attached to the housing 9 of switch structure 1 as shown in FIGS. 4–6. The heating unit 2 is disposed upon structure 1 with the flanges 15 and 16 aligned with openings 40 and 40′. Conductors 5 and 6 are inserted within the corresponding units 3 and 4 and bolts 7 and 8 are threaded into openings 39 and 39′ to simultaneouly attach unit 2 and clamp conductors 5 and 6 to the units 3 and 4. As a result, a single pair of mounting and circuit connecting bolts 7 and 8 is required to complete both the electrical connection and the attachment of the heating element to the switch structures.

The present invention thus provides a substantial overall reduction in the size and compactness of the thermal relay unit with the number of components and the connection thereof reduced and simplified.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A thermal overload device, comprising

a switch unit having a housing with a pair of terminal recesses in opposite side walls of the housing and having terminal mounting protrusions within the recesses, said switch unit having a heat sensitive switch

means and means to secure the switch means within the housing,

a pair of terminal units, one in each recess and each terminal unit including a mounting frame held in fixed relation within the corresponding recess by cooperative interlocking engagements with the protrusions, each mounting frame having a conductive support wall at one end of the recess and an aligned terminal wall at the opposite end, each unit further including a movable terminal clamp having connected inner and outer walls on opposite sides of the terminal wall in alignment with the support wall and the terminal wall, the outer wall being adapted to tightly clamp a lead between the terminal wall and the outer wall by moving of the clamp toward the support wall,

a heating unit including a heating element located within a cover having flanges aligned with the recesses and resting upon the corresponding conductive support walls, each flange including a metallic portion connected to the heating element and engaging the conductive support wall, and

securement means secured to the flanges and to the corresponding inner wall of the terminal clamp and movable to draw the terminal clamp toward the corresponding flange to tightly clamp the heating unit to the support wall and to hold the terminal clamp in lead clamping engagement with respect to the terminal wall.

2. In a thermal overload device,

a switch unit having a housing of insulating material with a spring-loaded switch disposed in the housing and having a heat fusible unit connected to the housing and the switch to support the switch, said housing having laterally spaced end walls defining terminal recesses at opposite ends of the housing, each end wall having a similar protrusion on the inner surface of the walls, each protrusion having a lower outer corner which is rounded to define a camming surface,

a terminal unit disposed within each of the recesses and each of the terminal units including a generally C-shaped mounting frame of a resilient material with a top wall and a parallel bottom joined by a vertical wall shorter than the depth of one of the protrusions, said bottom wall being of a width less than the distance between the protrusions, said frame further including a depending lip integral with the outer edge of the bottom wall and of a width greater than the bottom wall, a yoke encircling the bottom wall and having a threaded opening in the top wall thereof,

separate means for releasably holding the mounting frames within the corresponding recesses and each separate means including cooperative mating projections and notches in the top walls of the protrusions and the mounting frame and in the lower walls of the protrusions and the depending lip, said depending lips riding on said camming surfaces during assembly of the mounting frames,

a heating element assembly overlying the switch unit and including a cover with end flanges resting upon the top walls of the frames, each flange being apertured and including a metallic conductor attached to the lower surface thereof and to the adjacent end of a heating element, and

separate securement means passing one each through the flanges and the top wall of the corresponding yokes to physically mount the heating assembly to the switch unit and draw the yoke upward into clamping position with respect to the bottom walls of the corresponding mounting frames.

3. In a thermal overload device,

a switch unit having an insulating housing with a spring-loaded switch therein and held in a stressed position by fusible means, said housing having laterally spaced end walls defining terminal recesses at opposite sides of the housing, each end wall having a protrusion,

a pair of terminal units disposed one each within the recesses and each terminal unit including a mounting frame having a top wall aligned with the upper end of the protrusions and a bottom wall secured to the top wall by an integral vertical wall, said bottom wall being of a width less than the distance between the protrusions and disposed between the protrusions, said frame further including a depending lip integral with the edge of the bottom wall and of a width greater than the bottom wall to define a pair of clamp edges on the upper edge of the lip, a yoke encircling the bottom wall and having an opening in the top wall thereof,

separate means releasably interconnecting each of said frames to the housing and including cooperative projections and mating notches formed in the protrusions and the aligned portions of the mounting frame,

a heating element assembly overlying the switch unit and including an insulating cover with end flanges aligned one each with the top the walls of the frames, said flanges resting on the aligned top walls and being apertured and including electrical conductors attached to the opposite ends of a heating unit and forming the bottom surface of the flanges, and

separate means passing through the apertures of the flanges and the corresponding top walls of the yokes to physically mount the heating assembly to the switch unit and tighten the yokes with respect to the frames.

4. In a thermal overload device,

a switch unit having a generally rectangular housing of insulating material with a spring-loaded switch mounted in the housing and held in a selected switching position by a shaft in a solder pot which projects upwardly from the housing, said housing having laterally spaced end walls defining a terminal recess and having attachment protrusions on the inner surface of the walls, each protrusion having a generally rectangular configuration with an upwardly projecting tab on the top edge and a curved lower outer corner and a notched inner lower corner,

a pair of terminal units disposed within the recesses and each terminal unit including a mounting frame having a top wall aligned with the upper edge of the corresponding protrusions with mating notches meshing with the tabs and a parallel bottom wall secured to the top wall by an integral vertical wall, said bottom wall being spaced from the top wall a distance less than the length of the protrusions and being of a width less than the distance between the protrustions to permit movement therebetween, said frame further including a depending lip integral with the edge of the bottom wall and of a width greater than the bottom wall to define a pair of clamp edges on the upper edge of the lip engaging the notches of the lower corners of the protrusions, each terminal unit further including a yoke encircling the bottom wall of the mounting frame and having a threaded opening in the top wall thereof,

a heating element assembly overlying the switch unit and including a hat-shaped cover with end flanges resting upon the top walls of the frames, said flanges including conductive ferrules attached to opposite ends of a heating unit, and

bolt means passing through the ferrules and threading into the threaded opening in the corresponding yokes to physically mount the heating assembly to the switch unit and provide direct electrical connection to the terminal unit.

5. In an electrical device,

an insulating housing for a load means, said housing having laterally spaced end walls definig terminal

recesses at opposite sides of the housing, each end wall having an inner protruding surface,

a pair of terminal units disposed one each within the recesses and each terminal unit including a mounting frame having a top wall aligned with the upper end of the protruding surface and a bottom wall secured to the top wall by an integral vertical wall and disposed between the protrusions, said bottom wall being of a width less than the distance between the protruding surfaces, said frame further including a depending lip integral with the edge of the bottom wall and of a width greater than the bottom wall to define a pair of clamp edges on the upper edge of the lip, a yoke encircling the bottom wall and having an opening in the top wall thereof with a clamp means passing through the top wall of the mounting frame and secured within the opening in the yoke for selective positioning of the yoke with respect to the mounting frame, and

means releasably interconnecting said frame to the housing and including cooperative projections and mating notches formed in the protrusions and the aligned portions of the mounting frame.

6. In an electrical device,

a housing of insulating material for an electrical load means, said housing having laterally spaced end walls defining a terminal recess and having attachment protrusions on the inner surface of the walls, each protrusion having a generally rectangular configuration with an upwardly projecting tab on the top edge and a curved lower outer corner and a notched inner lower corner, and

a terminal unit disposed within the recess and including a mounting frame having a top wall aligned with the

upper edge of the protrustions with notches mating with the tabs and a parallel bottom wall secured to the top wall by an itegral vertical wall, said bottom wall being spaced from the top wall a distance less than the length of the protrusion and being of a width less than the distance between the protrusions to permit movement therebetween, said frame further including a depending lip integral with the edge of the bottom wall and of a width greater than the bottom wall to define a pair of clamp edges on the upper edge of the lip engaging the notches of the lower corner portion of the protrusions, each terminal unit further including a yoke encircling the bottom wall of the mounting frame and having a threaded opening in the top wall thereof and a bolt means passing through the top wall of the mounting frame and threaded into the top wall of the yoke.

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