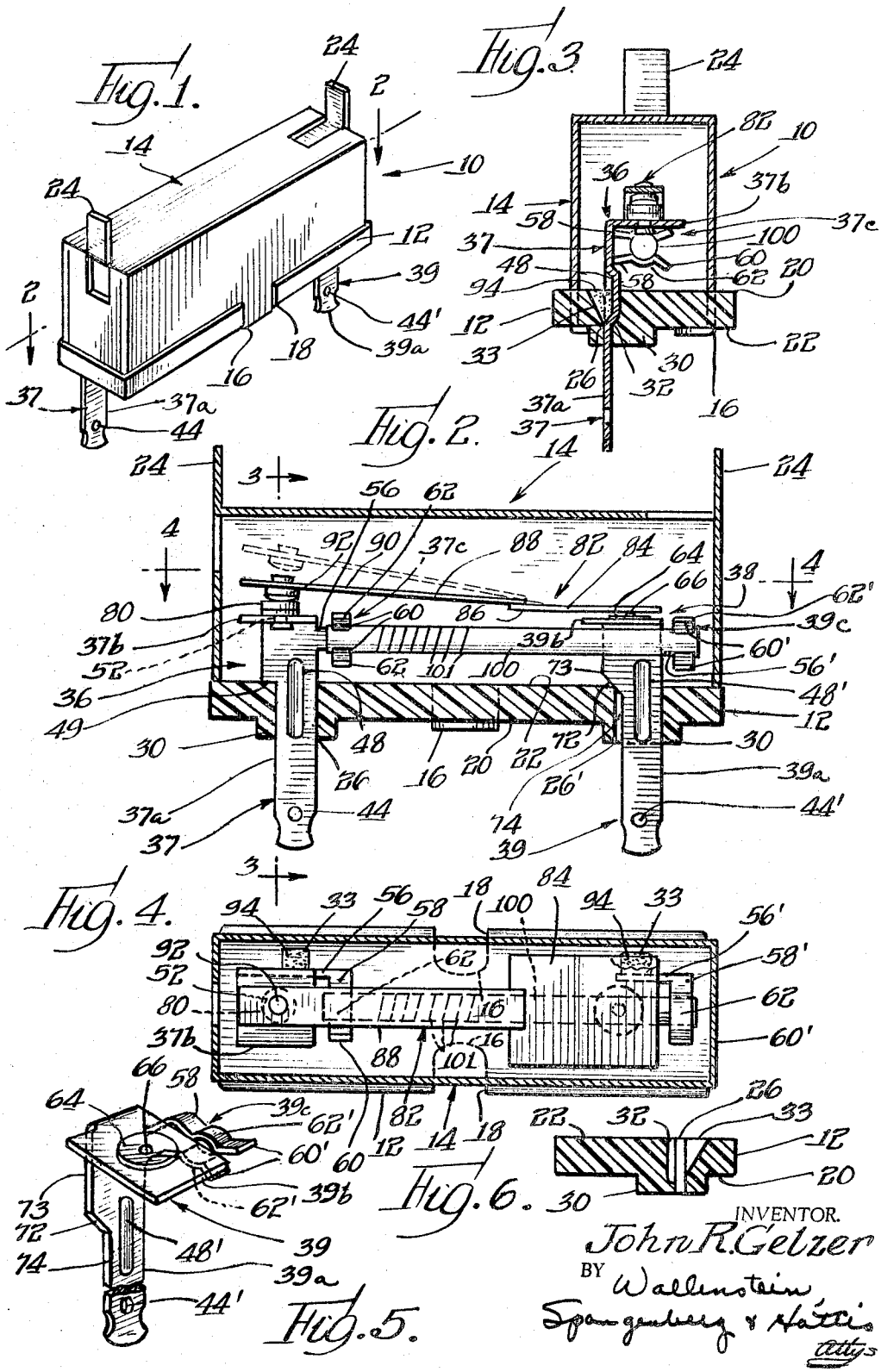
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THERMOSTATIC SWITCH OF THE REMOTE RESETTING TYPE

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THERMOSTATIC SWITCH OF THE REMOTE RESETTING TYPE

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This invention relates to an improved overload protection thermostatic switch of the remote resetting type having an insulating base which carries a stationary contact and a thermostatic member provided with a movable contact normally engaging the stationary contact at a predetermined temperature value of the thermostatic member. Thermostatic switches of this type usually are provided with a heating element connected across the switch contacts and which, under an overload condition in the circuit which opens the contacts, limits current flow in the circuit and provides sufficient heat to maintain the contacts in an open position. When the abnormal condition in the circuit has been remedied or relieved, and the circuit is momentarily open by a remote switch to cause the limited current to cease flowing in the heater element, the contacts re-engage to permit current to flow through the circuit.

Heretofore, overload protection thermostatic switches of the type wherein the heating element was placed in parallel with the contacts, were limited to use in low voltage circuits where relatively high currents were involved. In circuits of this character, low values of heating element resistance were capable of providing the heat required to keep the contacts open. However, in circuits of higher voltage, where the necessary heating element resistance becomes comparatively high, it was not readily possible with previously manufactured overload protection thermostatic switches to obtain resistance values of sufficient magnitude to provide the heat required to maintain the contacts in an open position. This inherent shortcoming of heretofore manufactured overload protection thermostatic switches substantially restricted their utilization to low voltage circuits which excludes the commercial power line voltages of 110–220 volts.

Another disadvantage of overload protection switches as heretofore manufactured is that they did not structurally lend themselves to automatic assembly and calibration techniques.

It is an object of the present invention to provide an improved remote resetting overload protection thermostatic switch having utility in high voltage circuits, such as commercial 110–220 volt circuits.

It is also an object of the present invention to provide an improved overload protection thermostatic switch which is compact in size and can be completely automatically assembled and calibrated.

It is another object of this invention to provide an improved overload protection thermostatic switch which is manufactured from a relatively few, simple, inexpensive, standardized parts.

Other objects, advantages and features of this invention will become apparent as the description proceeds.

Briefly, the improved overload protection thermostatic switch of this invention comprises an insulating base having spaced terminal assemblies of unique construction secured thereon. Each terminal assembly includes a terminal member which acts not only as a terminal to which conductors can be soldered, but as a support for a stationary contact or movable thermostatic member and as a clip for a heater element. To that end, each terminal member is fabricated from a single die stamping to provide a circuit connecting portion, a table-like mounting platform or portion, and opposed, resilient extensions

forming an open-ended heater element retaining bracket or clip thereon. A stationary contact is carried on the mounting platform or portion of one of the terminal members and a bimetallic thermostatic member having a movable contact normally in engagement with the stationary contact is carried on the corresponding portion of the other terminal member. The terminal member carrying the thermostatic member is uniquely shaped to permit easy automatic calibration of the overload protection thermostatic switch by a unique weight calibration technique.

A heater element or coil, in the form of a resistor, advantageously is releasably carried by the heater element retaining clips of the terminal members. The heater element desirably has a film or coating of a resistance-forming material thereon in contact with the electrical circuit through the retaining clips of the terminal members. The surface of the heater element is provided with a helically shaped groove along a portion of its length to be located adjacent a portion of the thermostatic member and which functions to concentrate the heat at the appropriate place and to provide in a short space the relatively large resistance required. The heater element is connected in parallel with respect to the contacts of the overload protection thermostatic switch. The resistance values of the heater element can be varied by simply altering the number and/or spacing of the turns or convolutions of the grooves in the conductive coating or film carried on the surface thereof.

The insulating base has terminal-receiving openings into which the terminal assemblies can be dropped from the top of the base where the terminal member of the assembly, including the thermostatic member, pivots on the base to a degree proportional to a calibrating weight which is dropped on the thermostatic member. The insulating base has cement-receiving wells in the top of the base opening into the terminal-receiving openings. Cement is poured into the wells and hardened to fix the relative weight adjusted positions of the terminal members. The relative angular position of the terminal member carrying the stationary contact and the movable contact on the thermostatic member determines the contact pressure for the calibration conditions of the switch and so determines the temperature (current level) at which the switch opens.

The assembly of the switch is completed by snapping the heater tube on the terminal clips and dropping a cover onto the base and securing the cover to the base. The design of the switch just described enables the switch readily to be machine assembled and calibrated from only a few basic sub-assemblies.

In order that the invention may be fully understood, reference will now be made to the drawing wherein an exemplary embodiment of the overload protection thermostatic switch of the present invention is illustrated, it being understood, however, that variations both in construction and in material may be made without departing from the scope of the invention.

In the drawing,

FIG. 1 is a view in perspective of an embodiment of the overload protection thermostatic switch of the invention;

FIG. 2 is a vertical sectional view taken substantially along line 2—2 of FIG. 1;

FIG. 3 is a vertical sectional view taken substantially along line 3—3 of FIG. 2;

FIG. 4 is a horizontal sectional view taken substantially along line 4—4 of FIG. 2;

FIG. 5 is a view in perspective of an embodiment of one of the terminal members of the switch of FIG. 1; and

FIG. 6 is a transverse section through the insulating base with all of the switch components removed therefrom.

Referring now to FIG. 1 of the drawing, one form of the invention is generally designated at **10**. It includes an insulating base **12** which is substantially rectangular in shape and which may be formed from a heat resistant, electrical insulating material such, for example, as a phenolic condensation product, exemplified by Bakelite, or the like. A cap or housing **14** is provided for the insulating base **12**, and desirably is secured thereto by means of locking tongues or extensions **16—16** which are received in medial notches or cut-outs **18—18** in the sides of the base **12** and bent or crimped inwardly to engage the outer surface **20** of the base. The length and width of the cap or housing **14** are slightly less than the corresponding dimensions of the base **12**. Thus, when the cap or housing **14** is fixed in position on the base **12**, the margins of the open end of the cap or housing **14** rest on the inner surface **22** of the base **12**. The cap or housing **14** desirably has mounting tabs or extensions **24—24** which, in the embodiment illustrated, conveniently are struck from an end and top wall thereof.

The base **12** is provided with a pair of off-center openings **26** and **26'** which extend through integral, outwardly extending bosses **30—30** on the outer surface **20** of the base **12**. The openings **26** and **26'** preferably are countersunk at the inner face **22** of the base **12** to form elongated, transverse, recesses **32—32** on one side of the openings which extend partway through the base, and trough-like cement-receiving wells **33—33** on the other side of the openings. See FIG. 6.

The overload protection thermostatic switch **10** further includes terminal assemblies **36** and **38** which are suitably held in the openings **26** and **26'**, respectively, of the base **12**. The terminal assemblies **36** and **38**, advantageously include terminal members **37** and **39** which may be made by a die stamping operation. The terminal member **37** has a vertically extending lower body portion **37***a* and a platform portion **37***b* at the tip thereof. The body portion **37***a* has an opening **44** for receiving a lead wire from a circuit and a longitudinal rib **48** which fits into a recess **32** in the base **12** when the terminal assembly **36** is secured in the terminal-receiving opening **26**. The wider upper section of the body portion **37***a* is wider than the lower section and a horizontal transverse shoulder **49** is formed thereby which rests on the flat top of the insulating base **12**. The platform portion **37***b* has a contact receiving opening **52** therein. The terminal member **37** further includes an open-ended clip portion **37***c* joined to the platform portion **37***b* by an outwardly extending arm **56**. The clip portion **37***c* comprises opposed, resilient extensions **58—58** having outwardly diverging end portions **60—60** which are joined at their inner margins to outwardly curved socket-forming portions **62—62**.

The terminal member **39** essentially is similar in many respects to the terminal member **37**, and has a lower body portion **39***a* having an opening **44'** and a longitudinal rib **48'**, an upper platform portion **39***b*, and a clip **39***c* joined to the platform portion **39***b* by an arm **56'**. The clip portion **39***c* has opposed, resilient extensions **58'—58'** with outwardly diverging end portions **60'—60'** and outwardly curved socket-forming portions **62'—62'**. The terminal member **39**, however, differs structurally from the terminal member **37** in two important respects. Firstly, whereas the platform portion **37***b* of the terminal member **37** has a contact receiving opening **52** therein, the platform portion **39***b* of the terminal member **39** is provided with a raised section **64** which carries a dimple **66** in the center thereof, the function of which will be set forth in the description of the invention to follow. Secondly, whereas the wider upper section of the body portion **37***a* of the terminal member **37** has a horizontal downwardly facing shoulder **49**, the wider upper section of the body portion **39***a* of the terminal member **39** has an inclined downwardly facing shoulder or edge **72**, forming an obtuse angle with the adjacent margin edges **73** and **74** of the terminal member **39**. As will be made clear

hereinafter, the angulation of the shoulder or edge **72** performs an important function in the calibration of the preferred embodiment of the overload protection thermostatic switch of this invention.

The platform portions **37***b* and **39***b* of the terminal members **37** and **39** carry the stationary and movable contacts of the switch. Thus, a stationary contact **80** is secured, as by riveting, in the opening **52** in the platform portion **37***b* of the terminal member **37**. A thermostatic member in the form of a bimetal blade **82** is secured as by welding to the dimple **66** on the raised section **64** of the platform portion **39***b* of the terminal member **39**. The bimetal blade **82** has a relatively wide bimetallic compensator portion **84** anchored to the dimple **66** and having its low expansion side **86** on the bottom thereof and a relatively narrow bimetallic free end portion **88** having its low expansion side **90** on the top thereof. The dimple **66** raises the wide compensator portion **84** of the bimetal blade **82** from the platform portion **39***b* and thus permits the bimetal blade **82** to flex freely. The free end portion of the bimetal blade **82** has a movable contact **92** secured thereto as by welding or the like. The size and material of the bimetal blade are selected in accordance with the proposed current rating of the overload protection thermostatic switch.

In calibrating the overload protection thermostatic switch of the preferred form of this invention, the terminal assembly **36** including the terminal member **37** and the stationary contact **80** secured thereon, and the terminal assembly **38** including the terminal member **39** and the bimetal blade **82** secured thereto are first mounted on the insulating base **12** by inserting the lower sections of the terminal members **37** and **39** into the insulating base openings **26** and **26'** so that the movable contact **92** rests on the stationary contact **80**. As clearly shown in FIG. 2, the downwardly facing horizontal shoulder **49** of the terminal member **37** rests against the horizontal top or inner surface **22** of the base **12** which establishes a fixed orientation for the terminal member **37**. The inclined, downwardly facing shoulder **72** of the terminal member **39**, however, makes a point contact with the edge of the associated base opening **26'** which provides sufficient clearance for the terminal member **39** so that the latter can pivot in the plane of the bimetal blade. This characteristic is utilized in the calibration of the over load protection thermostatic switch **10**. After the terminal members **37** and **39** are so positioned in the openings **26** and **26'** of the insulating base **12**, a calibrating weight is applied to the central portion of the bimetal blade **82** which flexes the same and causes the terminal member **39** to tilt in a counterclockwise direction to a degree depending on the magnitude of the weight. The final pressure between the contacts **80** and **92** for a given current in the blade is determined by the weight adjusted angle of the terminal member **39**.

A suitable liquid, hardenable cement **94**, such as an epoxy cement or the like, is poured into the trough-like countersunk openings **33—33**, and while the calibrating weight remains on the bimetal blade, the cement is hardened to fix the weight-adjusted position of the terminal member **39** and to anchor the terminal member to the base **12**.

Assembly of the overload protection thermostatic switch is completed by mounting a heater element on the switches which are electrically connected across the contacts **80** and **92**. In the particularly preferred aspects of the present invention, this is achieved simply by snapping the ends of a substantially cylindrical, small diameter, resistor **100** into the socket-forming portions **62—62** and **62'—62'** on the clips **54** and **54'** of the terminal members **37** and **39**. The resistor **100** desirably takes the form of a rod of a nonconductive material, such, for example, as glass, having a low coefficient of thermal expansion. The rod of nonconductive material has a coating of a resistance forming material deposited on its outer surface which establishes

the necessary electrical contact across the clips **37***c* and **39***c*. In the embodiment of the invention illustrated, formation of the resistor **100** conveniently is accomplished by coating a glass rod with tin oxide or the like. To enable the resistor **100** to generate the amount of heat necessary to maintain the bimetal blade **82** in a flexed position when an overload condition occurs in a circuit in which the overload protection thermostatic switch is utilized, the coating is provided with an unbroken helical or spiral groove **101** at a predetermined point along its length which will be adjacent the free end portion **88** of the bimetal blade **82**. The spacing and number of convolutions or turns forming the groove **101** can be varied within wide limits to establish the desired heat generating properties of the resistor **100**. The versatility of the resistor **100** in this regard permits concentration of the heat generated by it under circuit overload conditions at a particular preselected portion of the bimetal blade **82**.

When the bimetal blade **82** is placed in varying environments at different temperatures, the compensator portion **84** of the bimetal will flex in one direction and the free end portion **88** thereof will flex in the opposite direction so that the movable contact **92** will in effect remain in the same position and will bear down on the stationary contact with the same pressure for a given current flowing through the bimetal blade. Since the compensator portion **84** of the blade **82** is much wider than the free end portion **88**, it has a much lower resistance and so most of the heat developed by flow of current in the blade will occur in the free end portion **88** thereof so that the position of the movable contact **92** or the pressure thereof against the stationary contact **80** will vary with the current flowing through the blade.

The overload protection thermostatic switch of the present invention can be used to advantage in low current circuits at commercial power line voltages, such as 110–220 volts. Generally speaking, these switches have current ratings of from about 1 to about 5 amperes, and will open at current overloads approximately 1½ times that of the normal current rating thereof. Resistors employed in switches of this character usually have a rating of from about 6,000 to 10,000 ohms. Overload protection thermostatic switches of this invention, having the indicated electrical properties, have been made approximately 1½ to 2 inches long, about ½ to ¾ inch wide, and, as measured from the top wall of the housing or cap **14** thereof to the bottom of the terminal members **37** and **39**, approximately 1 to 1½ inches high. Except for the important, but minor, modifications hereinabove described, the parts of the overload protection thermostatic switch are, for all practical purposes, standardized and particularly adaptable to assembly by automatic equipment.

While for the purpose of illustrating and describing the invention, a specific embodiment has been shown, it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A thermostatic switch assembly comprising: an insulating base, spaced terminals secured to said base for connecting the switch in an electrical circuit, said terminals each having an open-ended clip physically and electrically connected thereto, a stationary contact carried by one of said terminals, an electrically conductive heat responsive bimetallic member carried by the other of said terminals and having a contact thereon normally engaging said stationary contact, and a heating element releasably held in the clips of said terminals and spaced from said bimetallic member, said heating element acting electro-thermally to maintain said contacts in an open position when an overload condition occurs in said electrical circuit.

2. A thermostatic switch assembly comprising: an insulating base, spaced terminals secured in said base, said terminals having a circuit engaging portion for connecting the switch in an electrical circuit, said terminals further having a mounting portion and opposed, resilient extensions forming an open-ended clip thereon, a stationary contact carried on the mounting portion of one of said terminals, a thermostatic element carried by the mounting portion of the other of said terminals and having a movable contact thereon normally engaging said stationary contact, and a resistor releasably carried by the clips of said terminals, said resistor being connected in parallel with respect to said contacts and carrying an electrically conductive material in contact with said terminals, said resistor acting thermoelectrically to maintain said contacts in open position when an overload condition occurs in said electrical circuit.

3. A thermostatic switch assembly comprising: an insulating base, spaced terminals secured in said base, said terminals having means for connecting the switch in an electrical circuit, said terminals further having resilient, opposed portions forming resilient-open-ended holding means thereon, a stationary contact carried by one of said terminals, a thermostatic element carried by the other of said terminals having a movable contact thereon normally engaging said stationary contact, and means releasably retained in said open-ended holding means having deposited thereon an unbroken, electrically resistive material in contact with said terminals, said last mentioned means acting to maintain said contacts in an open position when an overload condition occurs in said electrical circuit.

4. A thermostatic switch assembly comprising: an insulating base, spaced terminals secured in said base for connecting the switch in an electrical circuit, said terminals each having an integral, resilient, open-ended clip physically attached and electrically connected thereto, a stationary contact carried by one of said terminals, a thermostatic element carried by the other of said terminals having a movable contact thereon normally engaging said stationary contact, a heating element releasably engaged in the clips of said terminals having deposited thereon an electrically resistive material in contact with said terminals, said heating element having a continuous helical groove in the conductive material thereof and acting electrothermally to maintain said contacts in an open position when an overload condition occurs in said electrical circuit, and a housing for said switch assembly.

5. A thermostatic switch comprising: an insulating base having an upper surface with a pair of spaced, vertical terminal-receiving openings extending through the base, a bimetal blade and terminal assembly including a first terminal member having a portion mounted in one of said openings, a stationary contact and terminal assembly including a second terminal member having a portion mounted in the other of said openings, said first and second terminal members each having a mounting portion and a clip portion physically attached and electrically connected thereto, a flexible ambient temperature compensated responsive bimetal blade extending generally transversely from the mounting portion of said first terminal member and having a relatively low resistance compensating base portion and a relatively high resistance free end portion with a movable contact thereon, a stationary contact on the mounting portion of said second terminal member normally in engagement with said movable contact, and a heating element engaged with the clip portion of each of said terminal members, said heating element having a resistance forming material on the outside thereof, the area of highest resistance of said material being positioned proximal to the relatively high resistance free end portion of said bimetal blade, whereby said blade will be caused to flex sufficiently to maintain said contacts in an open position when the switch is activated.

6. A thermostatic switch assembly comprising: an insulating base having an upper surface with a pair of spaced, vertical terminal-receiving openings extending through the base, a bimetal blade and terminal assembly including a first terminal member having a portion

mounted in one of said openings and having an integral electrically conductive mounting portion and a heating element-retaining portion and a flexible temperature responsive bimetal blade secured to the mounting portion of said terminal member having a free end portion with a movable contact thereon, said first terminal member further having pivot-forming shoulder means abutting an edge portion of its terminal-receiving opening at the upper surface of said base, a stationary contact and terminal assembly including a second terminal member having a portion mounted in the other of said openings and having an integral electrically conductive mounting portion and heating element-retaining portion and carrying a stationary contact on the mounting portion thereof which normally is in engagement with said movable contact, said second terminal member further having horizontal downwardly facing shoulder means abutting the upper surface of said base, and a heating element releasably held in the retaining portions of said terminal members in spaced relation with respect to said bimetal blade, said heating element acting electrothermally to maintain said contacts in an open position when said switch assembly is activated.

7. A thermostatic switch assembly comprising: an insulating base having an upper surface with a pair of spaced, vertical terminal-receiving openings extending through the base and cement-receiving wells respectively on the top of the base opening onto said terminal-receving openings, a bimetal blade and terminal assembly including a first terminal member having a portion mounted on one of said openings and having an integral electrically conductive mounting portion and heating element-retaining portion and a flexible temperature responsive bimetal

blade secured to the mounting portion of said terminal member having a free end portion with a movable contact thereon, said first terminal member further having pivot-forming shoulder means abutting an edge portion of its terminal-receiving opening at the upper surface of said base, a stationary contact and terminal assembly including a second terminal member having a portion mounted in the other of said openings and having an integral electrically conductive mounting portion and heating element-retaining portion and carrying a stationary contact on the mounting portion thereof which normally is in engagement with said movable contact, said second terminal member further having horizontal downwardly facing shoulder means abutting the upper surface on said base, and means for permanently fixing said first and second terminal members in a predetermined position relative to one another and to said base.

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