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(54) **AN IMPROVED ARC EXTINGUISHING DEVICE**

VERBESSERTE LICHTBOGENLÖSCHEINRICHTUNG

DISPOSITIF AMELIORE DE SUPPRESSION D'ARC

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(56) References cited:
CH-A- 531 785
FR-A- 2 179 815
FR-A- 2 613 872
US-A- 2 898 427
US-A- 3 071 666
US-A- 4 500 595
US-A- 4 612 426

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Description

Related Application

Related co-pending US-A-5 326 947 filed on even date herewith discloses one class of material compositions which is suitable for use in the present application. The entire teaching and disclosure of that co-pending application is incorporated herein by reference.

Field of the Invention

The present invention relates to circuit breakers, circuit interrupters, electrical distribution devices and the like, and more particularly, to an arc extinguishing device having an improved design for use therein.

Background of the Invention

Circuit breakers are commonly used to protect branch circuits in residential and commercial buildings against overload and fault conditions. Basically, a circuit breaker includes a separable pair of electrical contacts, a spring-operated mechanism for effecting separation of the contacts, and a tripping mechanism upon the occurrence of the overload or fault condition. A representative circuit breaker is fully set forth in U.S. Patent No. 2,889,429, issued to Kingdon et al. and U.S. Serial No. 722,050, issued October 26, 1992, to Cook et al., both commonly assigned to the assignee herein and incorporated herein by reference.

Circuit interrupters are also known from US-A-3 071 666.

An electric arc is produced each time the circuit breaker contacts are opened or closed. The detrimental effects from the arc on other internal components is most severe during interruption of the electrical contacts. An arc extinguishing mechanism is used to control and extinguish the arc and protect the other components of the circuit breaker.

For example, a common type of arc shield, which is placed in a recess or arc chamber of a circuit breaker is a series of spaced magnetic plates as illustrated in U.S. Patent No. 2,811,607 issued to Dorfman et al. Another type or arc extinguishing mechanism is set forth in U.S. Patent No. 2,898,427 issued to Nadeau, which discloses a one-piece u-shaped magnetic metallic member having a plurality of parallel slots with an arc runner portion to lead the arc to a venting passage. U.S. Patent No. 2,429,722 to Jennings discloses an arc extinguisher using insulating side members mounted between the legs of u-shaped magnetic members and the side walls of the breaker casing. Another example is U.S. Patent No. 4,616,200 issued to Fixemer et al. which discloses a molded arc barrier projecting into the arc chamber to shield the operating mechanism of the circuit breaker.

The need arises to distribute more power through enclosures which are the same size or smaller. This requires increasing the electrical rating of the circuit breaker to carry same voltage and current density while decreasing the size of the enclosure and the components therein like the arc extinguishing means. The design of the arc device must be smaller, yet able to extinguish the electrical arc created by a higher current.

Among the problems caused by increasing the electrical rating of a circuit breaker is the heat emitted by the arc created when interrupting the electrical contacts. Without dissipation of the arc and the heat build-up the other components of the circuit breaker will be damaged.

Summary of the Invention

According to the present invention as claimed there is provided an arc extinguishing device for disposition along a pre-determined path of movement between two electrical contacts in an electrical distribution device. The device includes a generally u-shaped cradle member having a bight portion defined by a bottom wall with two upstanding side walls. The cradle member is made of a thermoplastic resin. The cradle member includes at least one triad of slots. One of the slots is formed in each side wall extending from the top edge of the side wall substantially downward towards the bottom wall. The third slot is formed in the bottom wall of the cradle member. The triad of slots is positioned in the same plane extending perpendicular through the cradle member.

The arc device includes at least one u-shaped plate having a bight portion defined by a bottom bar with two upstanding side prongs. The plate bight portion has sufficient width to allow the movement of the electrical contacts between the two side walls. The thickness and width of the plate is pre-determined to fit the side prongs within the side wall slots and the bottom edge within the bottom wall slot. Each plate is retained in connection with the cradle member. The retaining means is integrally formed with the cradle member. In the preferred embodiments, the plate is made of a magnetic metal or a conductive plastic composition.

The present invention also includes an electrical distribution device which includes a housing and a pair of electrical contacts positioned within the housing. At least one contact is movable in and out of engagement with the other along a pre-determined path. The electrical distribution device further includes an arc extinguishing device disposed along the pre-determined path of movement. The arc device is of the same description discussed above.

A method of assembling an arc extinguishing device for disposition along a pre-determined path of movement between two electrical contacts in an electrical distribution device is included in the present invention. The method includes molding an arc extinguishing device having a cradle member of the above description from a thermoplastic resin. The method further includes the step of providing a u-shaped plate of the above de-

scription and nesting the plate in the triad of slots of the cradle member.

It is an object of the present invention to provide an arc extinguishing device which overcomes the aforementioned problems affecting interruption of circuit breakers in small enclosures.

Another object of the present invention is to provide an arc extinguishing device made of two or more compositions creating an anode-cathode fall therebetween in order to extinguish electric arcs of greater current in smaller spaces than the prior art.

A further object of the invention is to provide an improved arc extinguishing device which protects the other components of a circuit breaker from exposure to an electric arc at high fault levels.

Yet another object of the present invention is to provide an arc extinguishing device which allows flexibility of design with ease of assembly and economical manufacture.

Other and further advantages, embodiments, variations and the like will be apparent to those skilled in the art from the present specification taken with the accompanying drawings and appended claims.

Brief Description of the Drawings

In the drawings, which comprise a portion of this disclosure:

Fig. 1 is a side view of a circuit breaker according to the present invention wherein the side cover is removed showing the position of an embodiment of the inventive arc extinguishing device;

Fig. 2 is an enlarged, isolated perspective view of the embodiment of the arc extinguishing device illustrated in Fig. 1;

Fig. 3 is a top plan view of the u-shaped cradle member disassembled from the remainder of the arc extinguishing device embodiment illustrated in Fig. 2;

Fig. 4 is a front plan view of the u-shaped plate disassembled from the remainder of the arc extinguishing device embodiment illustrated in Fig. 2; and

Fig. 5 is an enlarged cross-sectional view of the arc extinguishing device embodiment along lines 5-5 in Fig. 3.

Detailed Description

Turning now to the drawings and referring specifically to Fig. 1, an example of an embodiment of the present embodiment is illustrated in the form of a remotely controlled circuit arrangement. The arrangement includes an insulating body or housing 10 open at one face with a detachable cover (not shown). A line terminal 12 and a load terminal 14 completes the circuit between a source and a load (not shown).

The circuit path beginning at the line terminal 12 carriers current through stationary and movable contacts 16 and 18. The circuit continues through a flexible copper conductor 20 which is connected between a carrier 22 and a bimetal member 24. The movable contact 18 may be formed as part of the carrier 22. A rigid conductive plate 26 is welded to the bimetal member 24 to carry current from the bimetal 24 to the load terminal 14.

The above-described current path is controlled remotely and locally by a number of different components. Some of the components are similar in structure and operation to the corresponding components in Square D Company Model Nos. QO-PL and QOE, and in U.S. Patent No. 4,623,859 and U.S. Serial No. 722,050 issued October 26,, 1992, both entitled "Remote Control Circuit Breaker," assigned to the instant assignee and incorporated herein by reference.

Local control of the circuit breaker arrangement is provided using the external operating handle 28 pivotally mounted about an axis 30 in the housing 10 to control the contact carrier 22. In response to the movement of the handle 28 to the right or left, the carrier 22 is moved counterclockwise or clockwise, respectively, by the action a biasing spring 32. The handle 28 moves the top of the carrier 22 to either side of the equilibrium position, so that the bottom of the carrier 22 biases the movable contact 18 to either the open or closed position.

The trip mechanism assembly includes an armature 34, the bimetal 24 and a yoke 36. Upon occurrence of a moderately sustained overload, from the contact-closed position the bimetal member 24 heats up and flexes to the right, causing the armature 34 and the yoke 36 to swing counterclockwise releasing the stand-off pressure of the end of the trip lever 38. The trip lever 38 swings clockwise about pin 40 and pulls the carrier 22 away from the stationary contact 16 to interrupter the current path.

Similarly, upon occurrence of an extensive current overload, the yoke 36 manifests a magnetic force that attracts and swings the armature 34 counterclockwise. The trip lever 38 then swings clockwise and the spring 32 pulls the carrier 22 interrupting the current path.

Remote control of the circuit breaker arrangement is provided using a motor 42 having a shaft 44 which rotates in one direction to pull the carrier 22 and interrupt the current path. Rotation of the shaft 44 in the opposite direction allows the carrier to be pulled by spring 32 to re-establish the current path.

During a short-circuit condition or interruption of the current path, energy is shunted around the bimetal member 24. A shunt terminal 46 extends from the load terminal 16 to an arc extinguishing device 50 to dissipate the arcing current. An arc yoke 52 attracts the arc and shunts the current around the bimetal member 24. The arc yoke 52 providing a grounding means for draining the electric potential generated by an interruption of the contacts 16, 18 from the arc device 50. Other types of electrical connections for grounding the arc device 50

are suitable for use with the present invention.

The arc extinguishing device 50 is illustrated in isolation in Figs. 2 through 5. The arc device 50 includes a generally u-shaped cradle member 54 having a bight portion 56 defined by bottom wall 58 with two upstanding side walls 60 and 62. The side walls 6p and 62 have an inside face 64 and an outside face 66 which terminate at the top edges 68 and 70, respectively. The width of the bight portion 56 is sufficient to allow movement of the electrical contacts between the two side walls 60, 62.

The cradle member 54 is formed with at least one triad of slots 72, 74 and 76. Slots 72 and 76 are formed in the side walls 60 and 62, respectively, extending from the top edges 68, 70 of the side wall substantially downward towards the bottom wall 58. The third slot 74 is formed in the bottom wall 58 of the cradle member. The triad of slots 72, 74, and 76 are positioned in the same plane extending perpendicular through the cradle member 54.

The arc device 50 includes at least one u-shaped plate like 72 having a bight portion 80 defined by a bottom bar 82 with upstanding side prongs 84 and 86. The bottom bar 82 has a bottom edge 88 and a top edge 90. The width of the plate bight portion 80 is sufficient to allow movement of the electrical contacts between the two side prongs 84, 86. The thickness and width of the plate 72 is predetermined to fit the side prongs 84, 86 within the side wall slots 72, 76 and the bottom edge 88 within the bottom wall slot 74.

The plate 78 is retained in connection with the cradle member 54 by a retaining wall 92 integrally formed with the cradle member 54. The retaining wall 92 upstands from the bottom wall 58 and extends between the two side walls 60, 62 of the cradle member. The retaining wall 92 abuts a face 94 of the plate. Formed with the retaining wall 92 is a flange 96 which extends perpendicularly towards the abutting face 94 of the plate. The flange 96 is positioned at a pre-determined height on the retaining wall 92 to abut the top edge 90 of the bottom bar of the plate and retain the plate 78 in position. Preferably, the flange 96 is made of a resilient material which allows the flange 96 to be bent in and out of position and reversible engage the top edge 90.

Other means for retaining the plate 78 in connection with the cradle member 54 are contemplated by the present invention. For example, the thickness of the plate 78 can be formed slightly greater than the size of the side wall slots 72, 76 to provide an interference fit therebetween.

The gases that are created during the interruption of the electrical contacts 16, 18 are vented through the bottom wall 58 of the cradle member.

Preferably, the bottom wall slot 74 is made larger than need to accommodate the bottom edge 88 of the plate. This positions a hole adjacent to the bottom edge 88 of the plate. It is suitable to form separate holes in the bottom wall 58 near the bottom edge 88 of the plate.

In the preferred embodiment of the inventive arc device 50, there are two triads of slots like 72, 74 and 76 formed in the u-shaped cradle member 54. Corresponding to the two triads are two u-shaped plates like 78.

Both side walls 60 and 62 have a thickness T and a length L as shown in Fig. 2. In the preferred embodiment, the thickness T of each side wall 60, 62 and substantially the entire arc device 50 is in the range of about 0.06 to 0.1 inches and preferably measuring about 0.0625 inches. The length L of the arc device 50 as measured along the top edges 68 and 70 is in the range of about 0.5 to 1 incudes and preferably measuring about 0.75 inches. The length L is sufficiently long to encompass a substantial portion of the path movement of the contact 18. The width of the bight 56 or the distance between the side wall 60 and 62 is sufficient to allow the contacts to pass between them.

The thickness of the plate 78 is about 0.094 inches. The distance between the top edge 90 and the bottom edge 88 of the bottom bar is about 0.25 inches. The width of the plate 78 is preferably greater than the width of the cradle member 54 so that the edges of the plate protrude beyond the outside face 66.

Preferably, the bight portion 80 of the plate is substantially smaller than the bight portion 56 of the cradle member. Then the bight portion 80 of the plate is closer to the movement path of the electrical contacts 16, 18 than the bight portion 56 of the cradle member. Thus, the plate 78 is more quickly exposed to the electric arc because of its closer spacial position.

The dimensional measurements of the arc device 50 are adjusted to accommodate the capacity of the circuit breaker. For the measurements discussed above, the capacity of the circuit breaker ranges from about 15 to 30.

Although a circuit breaker is illustrated, the present invention is suitable for protecting all types of electrical distribution devices such as circuit interrupters and the like. In practical applications, it is still desirable to have all electrostatic sensitive components insulated from direct contact with any part of the arc device 50.

The cradle member 54 of the arc device 50 is made of a thermoplastic resin. The preferred thermoplastic resins include nylon 6, nylon 6/6, nylon 11, nylon 6/12, and high-impact nylon. The most preferred thermoplastic base resin is a mineral-filled nylon having the trade name Minlon available from DuPont Company, as catalog number 10B40.

The plate 78 of the arc device 50 is made of a material which is more conductive than the cradle member 54 material to establish an anode-cathode fall therebetween. One class of conductive materials for the plate 78 are magnetic metals. Preferably, the magnetic metal used is nickel-coated steel.

Another class of conductive materials for making the plate 78 include conductive composites formed from adding a conductive modifier to a thermoplastic resin. The conductive plastic composites preferably have certain electrical properties. The US Department of De-

fense Handbook 263 describes three categories of plastic composites for use in electrostatic discharge protection. They are anti-static, static dissipative, and conductive. they are anti-static, static dissipative, and conductive. Although the resistivity characteristics of these three categories is not entirely settled, static dissipative composites are usually defined to have surface resistivities of greater than 10^5 and less than 10^9 ohms per square. Since static dissipative compsites are more conductive than anti-static composites, they dissipate electric potential more quickly. Also, because of their make-up, they more readily conduct the potential throughout the volume of the part. Thus, static dissipative composites allow more rapid bleed-off of electric potential. The ASTM Standard D-257 provides uniform procedures for determining the resistance of a material. These methods are used to determine both surface and volume resistivities of the composite.

The conductive composites do not change their static dissipative electrical resistivity properties over time because they are formed by compounding or mechanically blending a solid conductive modifier with a thermoplastic base resin. The homogeneity and level of dispersion of one or more conductive modifiers within the thermoplastic base resin are the important criteria affecting the performance of the composites. The resulting composites are permanent in their static dissipative properties with a surface resistivity less than 10^9 ohms per square and a volume resistivity preferably less than 10 ohms per centimeter.

Other components to the conductive composites are limited to those conventional additives like inhibitors, etc., needed for the composites to exhibit the requisite manufacturing or mechanical properties discussed below. These additives are present in small amounts relative to the thermoplastic base resin and the conductive modifier.

The conductive modifiers include electrically conductive powders and fibers. Preferred modifiers include carbon black powder, carbon graphite fiber, stainless steel fiber and powder, and nickel coated graphite fiber. Other types of metallic coatings are suitable for use on graphite fibers. The concentration of the conductive modifier is effective to have the composite exhibit static dissipative electrical resistivity properties and remove electric potential therefrom. A suitable weight percent concentration of the conductive modifier in the thermoplastic base resin is in the range of about 4 to about 20 percent. A more preferred range is about 5 to about 15 percent by weight. The metallic containing conductive modifiers like stainless steel and nickel graphite have concentrations in the lower area of this range, for example, about 5 to about 10 percent by weight. Since amorphous carbon black has a lower aspect ratio than graphite carbon, it needs concentrations in the higher end of the range to impart the desired electrical properties, like about 15 to about 20 percent by weight. The graphite fiber is preferred in the middle of the range, for example, about 10 to about 15 percent by weight. Preferably, the weight concentration of stainless steel fiber in nylon 6 is about 10 percent.

Composites containing carbon black powder as he conductive modifier are presently the most cost effective. However, a high percent loading is required and this can result in a composite with lessened mechanical properties in comparison to the unmodified base resin. If higher properties are needed, such as impact strength or stiffness, then another conductive modifier such as carbon fiber, is used to gain optimal properties.

The present invention also provides for using a magnetic material as the conductive modifier in a concentration effective to have the composite exhibit magnetic properties which increase the mobility and further dissipate the arc current. A preferred magnetic material as the conductive additive is stainless steel or nickel-coated steel. A suitable weight percent concentration of the conductive modifier in the thermoplastic resin is in the range of about 60 to 80 percent. Depending on the magnetic material selected as the conductive modifier, a weight percent less than this range improves the performance of the arc device because the composite is conductive However, the composite does not exhibit significant magnetic properties and the associated advantages.

the following thermoplastic base resins are suitable for use with the present invention in compounding composites with most types of conductive modifiers: polypropylene, nylon 6/6, nylon 6, nylon 11, nylon 6/12, high-impact nylon, polycarbonate, polystyrene, acrylonitrile butadiene styrene, high density polyehtylene, low density polyethylene, polysulfone, polybutylene terephthalate, polyethylene terephthalate, polyphenylene sulfide, polyester thermoplastic elastomer, polyetherimide, styrenic thermoplastic elastomer, and olefinic thermoplastic elastomer.

The following base resins are more compatible for compounding with carbon fiber, nickel coated graphite fiber and stainless steel as the conductive modifier: acetal, polyurethane thermoplastic, polyphenylene oxide, polyetheretherketone, phenylene ether co-polymer, polycarbonate/acrylonitrile butadiene styrene, polyarylether ketone, polyetherketoneetherketoneketone, polyphthalamide, and polyehterketoneketone. Other suitable base resins include perfluoroalkoxy, ethylene tetrafluoroethylene, and polyvinylidene fluoride.

The composite suitable for use by the present invention exhibit certain mechanical properties for constructing an arc device capable of being mounted within and withstanding the environment of an electrical distribution device like a circuit breaker. The composites exhibit structural integrity, good impact resistance and dimensional stability. furthermore, the composites exhibit a sufficient heat distortion temperature and achieve a UL temperature index of 100 C. degrees or greater, as measured by UL Subject 756B. Preferably, the composite is flame retardant

The following examples are set forth for the purposes of illustration and should not be construed as limiting.

EXAMPLES

Three sample type EH circuit breakers manufactured by the Square D Company were utilized wherein all the components were standardized but for the exceptions noted herein. The circuit breakers were single pole construction with a 30 amp, 277 volt rating. One type EH breaker was used as a control. The other two circuit breakers were modified by removing the tripping mechanism and replacing it with a smaller type QO tripping mechanism having a lower power rating than the type EH breaker.

Within each of the type QO tripping mechanisms was substituted an inventive arc device having a construction as illustrated in Fig. 2 herein. The cradle member for both inventive arc devices was made of mineral filled nylon supplied by the DuPont Company as Minlon 10B40. The cradle member was about 0.75 inches long and 0.0625 inches thick.

Each inventive arc device used two plates positioned in the slots formed in each cradle member. In the first inventive arc device, the plates were made of nickel-plated, cold rolled steel. In the second inventive arc device, the plates were made of a nylon 6 thermoplastic having a conductive modifier of stainless steel added thereto in the amount of about 10 percent by weight. This material was supplied by the RTP Company of Winona, MN as catalogue number RTP 0288-A-X-58759 Natural.

Each set of plates measured about 0.0938 inches thick. The distance between the top edge and bottom edge of the bottom bar was about 0.25 inches. The inventive arc devices had a smaller width, length and shape than the standard arc device used in the EH circuit breaker. The size of the arc device used in the type EH tripping mechanism prevented it from being positioned in the type QO tripping mechanism.

Each circuit breaker was subjected to a testing regime wherein the circuit breaker electrical contacts were closed on a high fault level measuring 240 vac., 14 ka, 1.5 ms. after voltage zero. The testing regime demonstrated that the performance of the inventive arc devices with the steel and conductive plastic plates was comparable. Furthermore, both inventive arc devices were able to extinguish significantly higher arc currents than the standard arc device sued in the tripping mechanism of the type QO circuit breaker.

The surface area of the cradle member 54 made of the thermoplastic resin appears to melt when attacked by the arc created by the interruption of the electrical contacts 16, 18. The surface area of the cradle member 54 substantially encloses the minute ablative particles which are disintegrated from the contacts. The liquefying of the thermoplastic surface appears to envelope the ablative particles, cool them, and then the surface of the thermoplastic material rehardens. Accordingly, the ablative particles are actually absorbed by the cradle member 54 surface.

The thermoplastic resin and other suitable composites also preferably emit hydrogen gas upon attack by an electric arc. The hydrogen gas emission further colls and extinguished the arc by a process known as outgassing.

In the preferred embodiments, the present invention provides an anode-cathode fall between the cradle member 54 and the plates 78. The effect created improves the ability of the arc device to extinguish arcs of higher energy than devices of the prior art.

Preferably, the cradle member 54 is molded by conventional techniques such as injection molding. It is desirable for the thermoplastic resin or other suitable composites to exhibit high flow properties for molding thin walls of the cradle member 54.

The plate 78 made of the magnetic metal is preferably formed by stamping or otherwise cutting the individual pieces from a sheet of material. The plate 78 is assembled to the cradle member 54 by manually inserting the side prongs 84, 86 into the slots 72, 76 and snapping the flange 96 into engagement with the top edge 90 of the plate.

The plate 78 made of a conductive composite is preferably molded by conventional techniques such as injection molding. The plate 78 is then nested in the cradle member 54 in a similar fashion as the plate made of magnetic metal.

Another method of making the arc device having a plate made of a conductive composite is with a two-part mold. One part of the mold forms the cradle member with a first thermoplastic composition. The second part of the mold forms the plate in the appropriate position with a second thermoplastic composition. The two part mold simultaneously nests the two parts, cradle member and plate, together during the molding of the two thermoplastic compositions. Although the cost of manufacturing an item with a two part mold is usually more expensive than the other methods described herein, this technique allows greater flexibility in design than can be inexpensively achieved with metal-forming techniques.

While particular embodiments and applications of the present invention have been illustrated and described, it is to be understood that the invention is not limited to the precise construction and compositions disclosed herein and that various modifications, changes, and variations which will be apparent to those skilled in the art may be made in the arrangement, operation, and details of construction of the invention disclosed herein without departing from scope of the invention as defined in the appended claims.

Claims

1. An arc extinguishing device for disposition along a

pre-determined path of movement between two electrical contacts in an electrical distribution device, the device comprising:

a generally u-shaped cradle member (54) having a bight portion (56) defined by a bottom wall (58) with two upstanding side walls (60,62), the bight portion having sufficient width to allow the movement of the electrical contacts between the two side walls, the cradle member made of a thermoplastic resin;
at least one triad of slots, one of the slots (72,74,76) being formed in each side wall extending from the top edge (70) of the side wall substantially downward towards the bottom wall, the third slot (74) being formed in the bottom wall of the cradle member, the triad of slots being positioned in the same plane extending perpendicular through the cradle member;
at least one u-shaped plate (78) having a bight portiondefined by a bottom bar (82) with two upstanding side prongs (84,86), the plate bight portion having sufficient width to allow the movement of the electrical contacts between the two side walls, the thickness and width of the plate being pre-determined to fit the side prongs within the side wall slots and the bottom edge within the bottom wall slot; and
means for retaining (92,96) the plate in connection with the cradle member, the retaining means integrally formed with the cradle member.

2. The device of claim 1 wherein the retaining means includes the thickness of the plate being slightly greater than the size of the side wall slots to provide an interference fit therebetween.

3. The device of claim 1 wherein the retaining means includes at least one retaining wall (92) for each plate integrally formed with the cradle member, each retaining wall upstanding from the bottom wall and extending between the side walls of the cradle member, each retaining wall abutting a face of the plate, each retaining wall having a flange (96) extending perpendicularly towards the abutting plate, the flange positioned at a pre-determined height on the retaining wall to disengagedly abut the top edge of the bottom bar of the plate and retain the plate in position.

4. The device of claim 1 wherein the bottom wall of the cradle member further includes at least one hole (74) therethrough for venting gases, the hole being positioned adjacent to the bottom edge of at least one plate.

5. The device of claim 1 wherein the bight portion of the plate is substantially smaller than the bight portion of the cradle member so that the bight portion of the plate is closer to the movement path of the electrical contacts than the bight portion of the cradle member.

6. The device of claim 1 wherein the device further includes two triads of slots formed in the u-shaped cradle member corresponding to two u-shaped plates.

7. The device of claim 1 wherein the width of the plate is greater than the width of the cradle member so that the side edges of the plate extend beyond the outside face of the cradle member.

8. The device of claim 1 wherein the cradle member thermoplastic resin is selected from the group consisting of mineral-filled nylon, nylon 6/6, nylon 6, nylon 11, nylon 6/12, and high-impact nylon.

9. An electrical distribution device comprising:

a housing (10);
a pair of electrical contacts (16,18) positioned within the housing, at least one contact (18) being movable in and out of engagement with the other along a pre-determined path;
an arc extinguishing device disposed along the generally u-shaped cradle (54) having a bight portion (56) defined by a bottom wall (58) with two upstanding side walls (60,62), the bight portion having sufficient width to allow the movement of the electrical contacts between the two side walls, the cradle member made of a thermoplastic material;
at least one triad of slots, (72,74,76), one of the slots being formed in each side wall extending from the top edge (70) of the side wall substantially downward towards the bottom wall, the third slot (74) being formed in the bottom wall of the cradle, the triad of slots being positioned in the same plane extending perpendicular through the cradle;
at least one u-shaped plate (78) having a bight portion defined by a bottom edge (82) with two upstanding side prongs (84,86) the bight portion having sufficient width to allow the movement of the electrical contacts between the two side walls, the thickness and width of the plate being pre-determined to fit the side prongs within the side wall slots and the bottom edge within the bottom wall slot; and
means (92,96) for retaining the plate in connection with the cradle, the retaining means integrally formed with the cradle.

10. The device of claim 9 wherein the retaining means

includes the thickness of the plate being slightly greater than the size of the side wall slots to provide an interference fit therebetween.

11. The device of claim 9 wherein the retaining means includes at least one retaining wall (92) for each plate integrally formed with the cradle member, each retaining wall upstanding from the bottom wall and extending between the two side walls of the cradle, each retaining wall abutting a face of the plate, each retaining wall having a flange (96) extending perpendicularly towards the abutting plate, the flange positioned at a pre-determined height on the retaining wall to disengagedly abut the top edge of the bottom bar of the plate and retain the plate in position.

12. The device of claim 9 wherein the bottom wall of the cradle further includes at least one hole (74) therethrough for venting gases, the hole being positioned adjacent to the bottom edge of at least one plate.

13. The device of claim 9 wherein the bight portion of the plate is substantially smaller than the bight portion of the cradle member so that the bight portion of the plate is closer to the movement path of the electrical contacts than the bight portion of the cradle member.

14. The device of claim 9 wherein the device further includes two triads of slots formed in the u-shaped cradle member corresponding to two u-shaped plates.

15. The device of claim 9 wherein the width of the plate is greater than the width of the cradle member so that the side edges of the plate extend beyond the side face of the cradle member.

16. The device of claim 9 wherein the housing further includes means for grounding the arc extinguishing device.

17. The device of claim 9 wherein the grounding means further includes an arc yoke mounted to the arc extinguishing device.

18. The device of claim 9 wherein the cradle member thermoplastic resin is selected from the group consisting of mineral-filled nylon, nylon 6/6, nylon 6, nylon 11, nylon 6/12, and high-impact nylon.

Patentansprüche

1. Lichtbogenunterdrückungsvorrichtung zur Anordnung längs einer vorbestimmten Bewegungsbahn zwischen zwei elektrischen Kontakten in einer elektrischen Verteilereinrichtung, bestehend aus:

einem u-förmigen Gabelteil (54), das ein Aufnahmeteil (56) hat, das durch eine Bodenwand (58) mit zwei nach oben gerichteten Seitenwänden (60, 62) gebildet ist eine ausreichende Breite hat, so daß die Bewegung der elektrischen Kontakte zwischen den beiden Seitenwänden ermöglicht wird, und das aus thermoplastischen Harz besteht;

wenigstens einer Dreiergruppe von Schlitzen, wobei wenigstens einer der Schlitze (72, 74, 76) in jeder Seitenwand sich von der Oberkante der Seitenwand im wesentlichen nach unten zum Boden erstreckend ausgebildet ist, der dritte Schlitz (74) in der Bodenwand des Gabelteils ausgebildet ist, und die Dreiergruppe von Schlitzen in der gleichen, sich senkrecht durch das Gabelteil erstreckenden Ebene angeordnet ist;

wenigstens einer u-förmigen Platte (78) mit einem Aufnahmeteil, das durch eine Bodenstange (82) mit zwei nach oben gerichteten seitlichen Vorsprüngen (84, 86) gebildet ist, wobei das Plattenaufnahmeteil eine ausreichende Breite hat, um die Bewegung der elektrischen Kontakte zwischen den beiden Seitenwänden zu ermöglichen, die Dicke und Breite der Platte so vorbestimmt ist, daß die seitlichen Vorsprünge in die Seitenwandschlitze und die Bodenkante in den Bodenwandschlitz passen; und

einer Einrichtung (92, 96), um die Platte mit dem Gabelteil in Verbindung zu halten, wobei die Halteeinrichtung mit dem Gabelteil einstückig ausgebildet ist.

2. Vorrichtung nach Anspruch 1, bei der die Halteeinrichtung die Dicke der Platte umfaßt, die etwas größer als die Größe der Seitenwandschlitze ist, um einen Pressitz dazwischen zu schaffen.

3. Vorrichtung nach Anspruch 1, bei der die Halteeinrichtung wenigstens eine Haltewand (92) für jede Platte hat, die mit dem Gabelteil einstückig ausgebildet ist, wobei sich jede Haltewand von der Bodenwand nach oben und zwischen den Seitenwänden des Gabelteils erstreckt, jede Haltewand an einer Fläche der Platte anliegt, jede Haltewand einen Flansch (96) hat, der sich senkrecht nach oben zur anliegenden Platte erstreckt, und der Flansch in einer vorbestimmten Höhe an der Haltewand angeordnet ist, um an der Oberkante der unteren Stange der Platte lösbar anzuliegen und die Platte in Position zu halten.

4. Vorrichtung nach Anspruch 1, bei der die Bodenwand des Gabelelements außerdem wenigstens eine Durchgangsöffnung (76) zum Ableiten von Gasen hat, die nahe der Bodenkante wenigstens einer Platte angeordnet ist.

5. Vorrichtung nach Anspruch 1, bei der der Aufnahmeteil der Platte wesentlich kleiner als der Aufnahmeteil des Gabelteils ist, so daß das Gabelteil der Platte näher an der Bewegungsbahn der elektrischen Kontakte als das Aufnahmeteil des Gabelteils liegt.

6. Vorrichtung nach Anspruch 1, bei die Vorrichtung weiterhin zwei Dreiergruppen von Schlitzen hat, die im u-förmigen Gabelteil entsprechend den beiden u-förmigen Platten ausgebildet sind.

7. Vorrichtung nach Anspruch 1, bei der die Breite der Platte größer als die Breite des Gabelteils ist, so daß sich die Seitenkanten der Platte über die Außenseite des Gabelteils hinaus erstrecken.

8. Vorrichtung nach Anspruch 1, bei der das thermoplastische Harz des Gabelteils aus der Gruppe ausgewählt ist, die aus mineraliengefülltem Nylon, Nylon 6/6, Nylon 6, Nylon 11, Nylon 6/12 und aus hochfestem Nylon besteht.

9. Elektrische Verteilervorrichtung, bestehend aus:

einem Gehäuse (10);

einem Paar elektrischer Kontakte (16, 18), die im Gehäuse angeordnet sind, wobei wenigstens ein Kontakt (18) längs einer vorbestimmten Bahn mit dem anderen in Eingriff bringen und von diesem lösbar ist;

einer Lichtbogenunterdrückungsvorrichtung, die längs der etwa u-förmigen Gabel (54) angeordnet ist, die ein Aufnahmeteil (56) hat, das durch eine Bodenwand (58) mit zwei nach oben gerichteten Seitenwänden (60, 62) gebildet ist, wobei das Aufnahmeteil eine ausreichende Breite hat, damit die Bewegung der elektrischen Kontakte zwischen den beiden Seitenwänden ermöglicht wird, und wobei das Gabelteil aus einem thermoplastischem Material hergestellt ist;

wenigstens einer Dreiergruppe von Schlitzen (72, 74, 76), wobei einer der Schlitze in jeder Seitenwand sich von der Oberkante (70) der Seitenwand im wesentlichen nach unten zur Bodenwand erstreckend ausgebildet ist, der dritte Schlitz (76) in der Bodenwand der Gabel ausgebildet ist, und die Dreiergruppe von Schlitzen in der gleichen Ebene angeordnet ist, die sich senkrecht durch die Gabel erstreckt;

wenigstens einer u-förmigen Platte (78) mit einem Aufnahmeteil, das von einer Bodenwand (82) mit zwei nach oben gerichteten seitlichen Vorsprüngen (84, 86) gebildet ist, wobei das Aufnahmeteil eine ausreichende Breite hat, damit die Bewegung der elektrischen Kontakte zwischen den beiden Seitenwänden ermöglicht wird, die Dicke und Breite der Platte so vorbestimmt ist, daß die seitlichen Vorsprünge in die Seitenwandschlitze und die Bodenkante in den Bodenwandschlitz paßt; und

einer Einrichtung (92, 96), um die Platte mit der Gabel in Verbindung zu halten, wobei die Halteeinrichtung mit der Gabel einstückig ausgebildet ist.

10. Vorrichtung nach Anspruch 9, bei der die Halteeinrichtung die Dicke der Platte umfaßt, die etwas größer als die Größe der Seitenwandschlitze ist, um einen Pressitz dazwischen zu schaffen.

11. Vorrichtung nach Anspruch 9, bei der die Halteeinrichtung wenigstens eine Haltewand (92) für jede Platte hat, die mit dem Gabelteil einstückig ausgebildet ist, wobei sich jede Haltewand von der Bodenwand nach oben und zwischen den Seitenwänden des Gabelteils erstreckt, jede Haltewand an einer Fläche der Platte anliegt, jede Haltewand einen Flansch (96) hat, der sich senkrecht nach oben zur anliegenden Platte erstreckt, und der Flansch in einer vorbestimmten Höhe an der Haltewand angeordnet ist, um an der Oberkante der unteren Stange der Platte lösbar anzuiiegen und die Platte in Position zu halten.

12. Vorrichtung nach Anspruch 9,bei der die Bodenwand des Gabelelements außerdem wenigstens eine Durchgangsöffnung (76) zum Ableiten von Gasen hat, die nahe der Bodenkante wenigstens einer Platte angeordnet ist.

13. Vorrichtung nach Anspruch 9,bei der der Aufnahmeteil der Platte wesentlich kleiner als der Aufnahmeteil des Gabelteils ist, so daß das Gabelteil der Platte näher an der Bewegungsbahn der elektrischen Kontakte als das Aufnahmeteil des Gabelteils liegt.

14. Vorrichtung nach Anspruch 9, bei der die Vorrichtung weiterhin zwei Dreiergruppen von Schlitzen hat, die im u-förmigen Gabelteil entsprechend den beiden u-förmigen Platten ausgebildet sind.

15. Vorrichtung nach Anspruch 9, bei der die Breite der

Platte größer als die Breite des Gabelteils ist, so daß sich die Seitenkanten der Platte über die Außenseite des Gabelteils hinaus erstrecken.

16. Vorrichtung nach Anspruch 9, bei der das Gehäuse außerdem eine Einrichtung zum Erden der Lichtbogenunterdrückungsvorrichtung aufweist.

17. Vorrichtung nach Anspruch 9, bei der die Erdungseinrichtung außerdem ein Lichtbogenjoch aufweist, das an der Lichtbogenunterdrückungsvorrichtung befestigt ist.

18. Vorrichtung nach Anspruch 9, bei der das thermoplastische Harz des Gabelteils aus der Gruppe ausgewählt ist, die aus mineraliengefülltem Nylon, Nylon 6/6, Nylon 6, Nylon 11, Nylon 6/12 und aus hochfestem Nylon besteht.

Revendications

1. Dispositif de suppression d'arc à disposer le long de la trajectoire prédéterminée du mouvement entre deux contacts électriques dans un dispositif électrique de distribution, le dispositif comprenant :

un élément de support (54) de forme générale en U ayant une partie de base (56) définie par une paroi inférieure (58) avec deux parois latérales verticales (60, 62), la partie de base ayant une largeur suffisante pour permettre le mouvement des contacts électriques entre les deux parois latérales, l'élément de support étant fabriqué en résine thermoplastique ;
au moins un groupe de trois fentes, une fente (72, 74, 76) étant formée dans chaque paroi latérale partant du bord supérieur (70) de la paroi latérale, sensiblement vers le bas, en direction de la paroi inférieure, la troisième fente (74) étant formée dans la paroi inférieure de l'élément de support, les trois fentes du groupe étant placées dans le même plan s'étendant perpendiculairement à travers l'élément de support ;
au moins une plaque en forme de U (78) ayant une partie de base définie par une barre inférieure (82) avec deux dents latérales verticales (84, 86), la partie de base plate ayant une largeur suffisante pour permettre le mouvement des contacts électriques entre les parois latérales, l'épaisseur et la largeur de la plaque étant prédéterminées pour adapter les dents latérales à l'intérieur des fentes des parois latérales et le bord inférieur à l'intérieur de la fente de la paroi inférieure;
des moyens de retenue (92, 96) de la plaque reliée à l'élément de support, les moyens de retenue étant intégralement formés dans l'élément de support.

2. Dispositif selon la revendication 1, dans lequel les moyens de retenue sont conçus tels que l'épaisseur de la plaque est légèrement supérieure à la dimension des fentes des parois latérales pour créer entre elles un assemblage à interférence.

3. Dispositif selon la revendication 1, dans lequel les moyens de retenue comprennent au moins une paroi de retenue (92) pour chaque plaque intégralement formée dans l'élément de support, chaque paroi de retenue s'élevant verticalement depuis la paroi inférieure et s'étendant entre les parois latérales de l'élément de support, chaque paroi de retenue butant sur une face de la plaque, chaque paroi de retenue ayant une bride (96) s'étendant perpendiculairement vers la plaque en butée, la bride positionnée à une hauteur prédéterminée sur la paroi de retenue étant prévue pour buter de manière amovible sur le bord supérieur de la barre inférieure de la plaque et retenir la plaque en position.

4. Dispositif selon la revendication 1, dans lequel la paroi inférieure de l'élément de support comprend encore au moins un orifice (74) à travers lequel des gaz sont évacués, l'orifice étant positionné adjacent au bord inférieur de la plaque au moins.

5. Dispositif selon la revendication 1, dans lequel la partie de base de la plaque est sensiblement plus petite que la partie de base de l'élément de support, afin que la partie de base de la plaque soit plus proche de la trajectoire du mouvement des contacts électriques que la partie de base de l'élément de support.

6. Dispositif selon la revendication 1, dans lequel le dispositif comprend encore deux groupes de trois fentes formées dans l'élément de support en forme de U en correspondance avec deux plaques en forme de U.

7. Dispositif selon la revendication 1, dans lequel la largeur de la plaque est supérieure à la largeur de l'élément de support, de manière que les bords latéraux de la plaque s'étendent au-delà de la face extérieure de l'élément de support.

8. Dispositif selon la revendication 1, dans lequel la résine thermoplastique de l'élément de support est sélectionnée dans le groupe comprenant les nylon chargé en minéraux, nylon 6/6, nylon 6, nylon 11, nylon 6/12, et nylon à forte résistance au choc.

9. Dispositif électrique de distribution comprenant :

un boîtier (10) ;
deux contacts électriques (16, 18) positionnés à l'intérieur du boîtier, un premier contact (18) au moins étant mobile pour venir en prise avec l'autre contact et se dégager de celui-ci, le long d'une trajectoire prédéterminée;
un dispositif de suppression d'arc disposé le long du support (54) généralement en forme de U, ayant une partie de base (56) définie par une paroi inférieure (58) avec deux parois latérales verticales (60, 62), la partie de base ayant une largeur suffisante pour permettre le mouvement des contacts électriques entre les deux parois latérales, l'élément de support étant construit en une matière thermoplastique ;
au moins un groupe de trois fentes (72, 74, 76), une fente étant formée dans chaque paroi latérale en partant du bord supérieur (70) de la partie latérale sensiblement vers le bas en direction de la paroi inférieure, la troisième fente (74) étant formée dans la paroi inférieure du support, les trois fentes du groupe étant positionnées dans le même plan s'étendant perpendiculairement à travers le support ;
au moins une plaque en forme de U (78) ayant une partie de base définie par un bord inférieur (82) avec deux dents latérales verticales (84, 86), la partie de base ayant une largeur suffisante pour permettre le mouvement des contacts électriques entre les deux parois latérales, l'épaisseur et la largeur de la plaque étant prédéterminées pour adapter les dents latérales dans les fentes des parois latérales et le bord inférieur dans la fente de la paroi inférieure ; et
des moyens (92, 96) pour retenir la plaque reliée avec le support, les moyens de retenue étant intégralement formés dans le support.

10. Dispositif selon la revendication 9, dans lequel les moyens de retenue sont conçus tels que l'épaisseur de la plaque est légèrement supérieure à la dimension des fentes des parois latérales, afin de créer entre elles un assemblage à interférence.

11. Dispositif selon la revendication 9, dans lequel les moyens de retenue comprennent au moins une paroi de retenue (92) pour chaque plaque, la paroi étant intégralement formée dans l'élément de support, chaque paroi de retenue s'élevant verticalement depuis la paroi inférieure et s'étendant entre les deux parois latérales du support, chaque paroi de retenue butant sur une face de la plaque, chaque paroi de retenue ayant une bride (96) s'étendant perpendiculairement vers la plaque en butée, la bride étant positionnée à une hauteur prédéterminée sur la paroi de retenue pour venir buter de manière amovible sur le bord supérieur de la barre inférieure de la plaque et retenir la plaque en position.

12. Dispositif selon la revendication 9, dans lequel la paroi inférieure du support comprend encore au moins un orifice (74) à travers lequel des gaz sont évacués, l'orifice étant positionné adjacent au bord inférieur de la plaque au moins.

13. Dispositif selon la revendication 9, dans lequel la partie de base de la plaque est sensiblement plus petite que la partie de base de l'élément de support, de manière que la partie de base de la plaque soit plus proche de la trajectoire du mouvement des contacts électriques que la partie de base de l'élément de support.

14. Dispositif selon la revendication 9, dans lequel le dispositif comprend encore deux groupes de trois fentes formées dans l'élément de support en forme de U en correspondance avec deux plaques en forme de U.

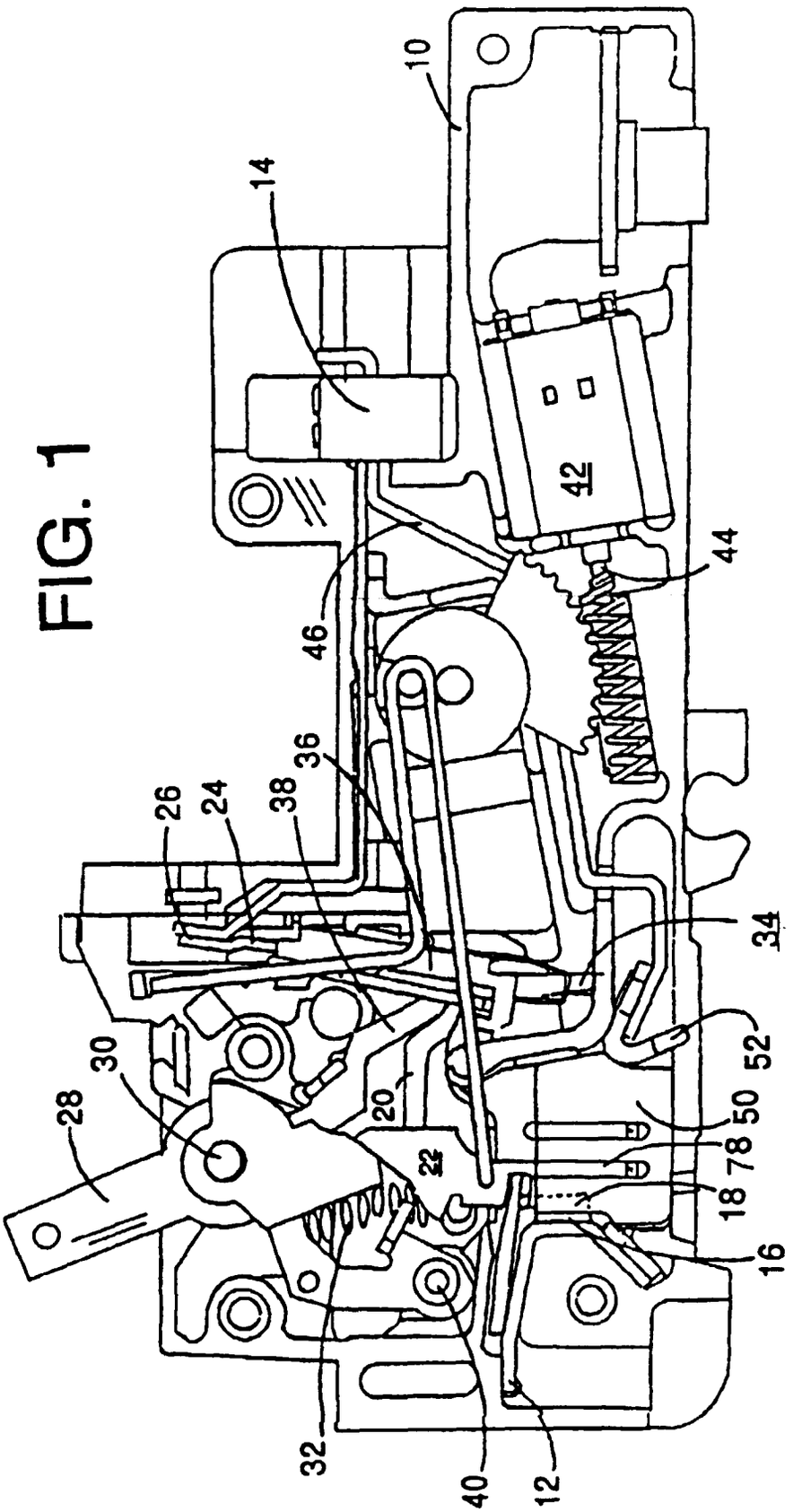
15. Dispositif selon la revendication 9, dans lequel la largeur de la plaque est supérieure à la largeur de l'élément de support, de manière que les bords latéraux de la plaque s'étendent au-delà de la face latérale de l'élément de support.

16. Dispositif selon la revendication 9, dans lequel le boîtier comprend encore des moyens pour mettre à la masse le dispositif de suppression d'arc.

17. Dispositif selon la revendication 9, dans lequel les moyens de mise à la masse comprennent encore un étrier à arc monté sur le dispositif de suppression d'arc.

18. Dispositif selon la revendication 9, dans lequel la résine thermoplastique de l'élément de support est sélectionnée dans le groupe comprenant les nylon chargé en minéraux, nylon 6/6, nylon 6, nylon 11, nylon 6/12, et nylon à forte résistance au choc.

FIG. 1



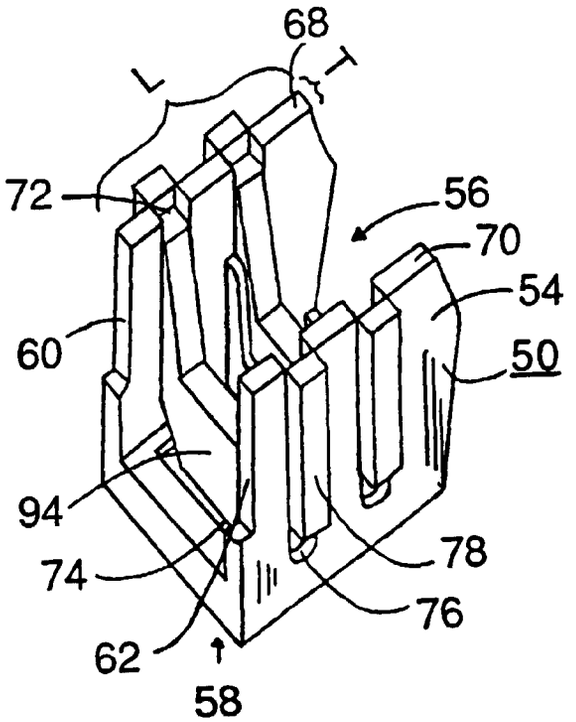


FIG. 2

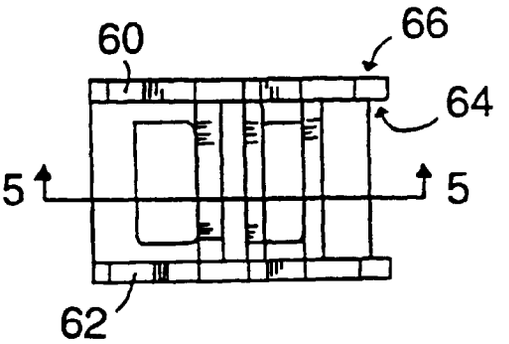


FIG. 3

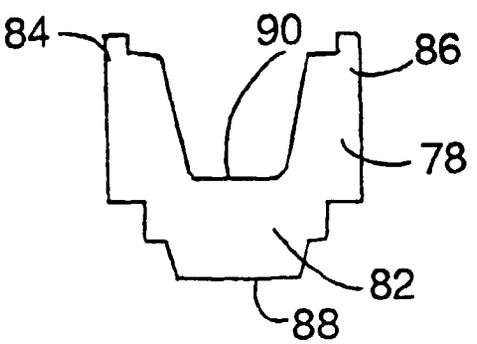


FIG. 4

FIG. 5