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3,230,296

CONTACT TERMINAL ASSEMBLY WITH DIFFERENT GEOMETRIC CONFIGURED
CONTACTS ON EITHER SIDE OF A PLATE
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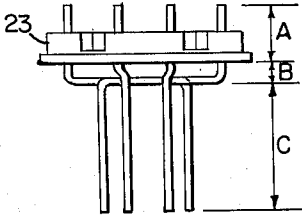


FIG. 4

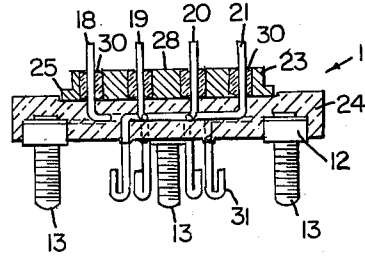


FIG. 1

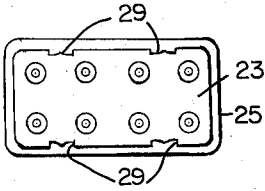


FIG. 5

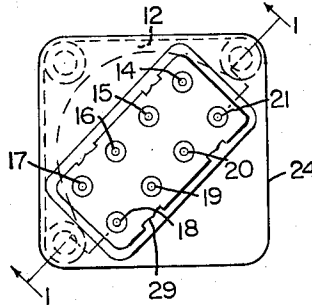


FIG. 2

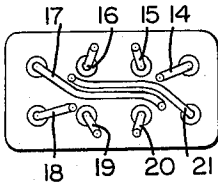


FIG. 6

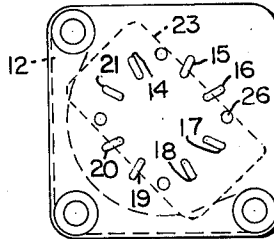


FIG. 3

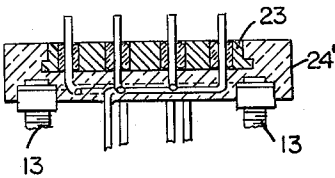


FIG. 7

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CONTACT TERMINAL ASSEMBLY WITH DIFFERENT GEOMETRIC CONFIGURED CONTACTS ON EITHER SIDE OF A PLATE

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7 Claims. (Cl. 174-50.6)

The present invention relates to improved contact terminal assembly and to means and methods of adapting contact terminals of electrical devices to fit prescribed electrical contact connectors.

Many electrical devices are currently designed having a plurality of elongated outwardly extending parallel leads. The leads generally define specific geometric outlines on terminal plates from which they extend. In some cases, it is desirable to attach this plurality of leads to connectors having lead connecting means arranged in a different geometric outline than the leads of the previously designed device.

This situation has arisen particularly in the case of conventional rotary relay devices. Normally rotary relay devices have a plurality of outwardly extending parallel leads arranged to define a rectangular outline or geometric form while compact, contact female receptacles for these relays have been designed having circularly arranged female contact elements. In order to overcome the problem created by mismatching of these components, it is possible to build rotary relay devices which have circularly arranged outwardly extending leads. However, frequently such modified relays must be constructed with greater overall dimensions than previously used relays.

It is an object of this invention to provide a compact, contact terminal construction which adapts terminal leads of an electrical device to fit specifically designed electrical connectors for the device.

It is another object of this invention to provide a construction in accordance with the preceding object which is extremely rugged and durable; yet, is relatively easy and inexpensive to manufacture and provides outstanding insulating characteristics.

It is another object of this invention to provide a method for constructing a device in accordance with the preceding objects which method is free from complexity and enables standard electrical devices having parallel outwardly extending leads in a specific geometric outline to be adapted for use with connectors having connecting means arranged in other geometric configurations.

According to the invention the contact terminal assembly or adapter comprises a terminal plate having a plurality of apertures extending from one side of the plate to the other side. Parallel leads are positioned in the apertures preferably normal to the plane of the terminal plate. Conventional sealing means are used to secure the leads in the plate apertures. Intermediate portions of the leads are bent so as to form outwardly extending outer end portions of the leads parallel to each other and parallel to inner end portions of the leads. The outer ends of the leads define a different geometric outline than the inner ends of the leads. An insulating material is then molded about the bent portions of the leads to firmly lock the bent portions in the desired relationship to each other and to the terminal plate. In a preferred form, a plurality of parallel leads defining a rectangular outline at inner ends, are bent on one side of the transfer plate, each lead at two right angles, to form the leads into a circularly arranged parallel grouping at outer end portions.

According to the method of this invention, a transfer plate having a plurality of parallel leads extending there-

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through is provided. The leads are then bent on one side of the plate with two right angles in each leads so that outer ends of the leads on one side of the plate are arranged in a circular configuration while the inner ends of the lead on another side of the plate retain their original rectangular outer outline. The bent portions of the leads are then encapsulated in a molding insulating material which is preferably hermetically sealed to one side of the terminal plate during the molding procedure.

Other features, objects and advantages of the invention will be better understood and appreciated from the following detailed description of one embodiment thereof selected for purposes of illustration and shown in the accompanying drawing, in which:

FIG. 1 is a cross-sectional view of a preferred embodiment of a terminal plate assembly of this invention taken through line 1-1 of FIG. 2;

FIG. 2 is a top plan view thereof;

FIG. 3 is a bottom view thereof;

FIG. 4 is a side view of an uncompleted form of the device of FIG. 1.

FIG. 5 is a top view thereof;

FIG. 6 is a bottom view thereof; and,

FIG. 7 is a cross sectional view of an alternate embodiment of the contact terminal assembly of this invention.

Referring now to the drawings and in particular FIGS. 1-3, a contact terminal assembly 11 is illustrated having a terminal plate 23, eight leads 14-21, an insulating molded member 24 and a reinforcing angle bracket 12.

The terminal plate 23 is preferably metallic and rectangular in shape and has an outwardly extending continuous lower lip 25 adapted to receive a casing of an electrical device such as a rotary relay (not shown). Attachment recesses 29 (FIG. 2) are provided on the plate for mechanical attachment of relay components within the casing. An inner raised surface 28 of the terminal plate 23 faces the rotary relay when the contact terminal assembly is attached to the casing and electrical device. Preferably eight circular bores or apertures are provided in the plate and define a rectangular outline on both sides of the terminal plate.

Preferably eight metallic contacts or elongated leads 14-21 are provided, one in each aperture of the terminal plate 23. These leads 14-21 are preferably made of a stiff, resilient, electrically conductive metallic material of conventional nature. The ends of the leads can be inserted into a female socket or soldered and electrically joined by conventional means to an electrical device on the inner side 28 of the terminal plate and the outer side of the contact terminal assembly. The leads each comprise three distinct portions. As illustrated by the arrows in FIG. 4, the first portion of each lead comprises elongated parallel inner end portions A, hermetically sealed to the terminal plate by conventional insulating means 30. The insulating means 30 may be glass or plastic sealing means but is preferably a mica-glass combination as will be described later with relation to the insulating molded member 24. The end portions A are parallel to each other and define a generally rectangular outline on the inner surface of the terminal plate 23. Portions B of the leads are each bent at right angles to form the rectangularly arranged leads into a circular defining outline as most clearly shown in FIGS. 3 and 6. Intermediate bent portions B of the leads lie generally parallel to the transfer plate and have two successive right angle bends as most clearly shown in FIG. 4. In a preferred embodiment, leads 17 and 21 are bent to run transversely to the rectangular terminal plate 23 while leads 14 and 18 are bent inwardly and leads 15, 16, 19 and 20 are bent outwardly (FIG. 6). The particular bending pattern may vary considerably depending upon the spe-

cific connector which is to be used with the contact terminal assembly. However, it has been found that the specific arrangement shown is highly desirable for use in rotary relay devices to form a compact circular arrangement of outwardly extending leads. The leads are spaced a sufficient distance apart to allow good insulating properties between leads, yet, prevent oversizing of the component. The outermost portions C of the leads extend parallel to each other and parallel to the inner end portion A, thus, each of the lead end portions C is perpendicular to the terminal plate 23. In the preferred embodiment shown in FIGS. 1 and 3, extreme outer ends C of each lead are bent back to form J-shaped connection ends 31.

An insulating molded member 24 is preferably a square, planar member imbedding the bent portions B of the leads and containing a reinforcement angle member 12. The angle member or bracket 12 carries three downwardly extending, threaded shafts 13 (FIG. 1) for use in mounting and supporting the contact terminal assembly on connectors or other bases as desired.

In a preferred form, as most clearly shown in FIGS. 2 and 3, the terminal plate 23 is diagonally mounted on the molded member 24 to conserve space. It is a feature of this invention that the casing for the rotary relay (not shown) can have a cross-section corresponding to the rectangular outline of the terminal plate 23. This construction is compact and highly efficient. As shown in FIG. 3, leads 19 and 20 extend outwardly from the molded member 24 and are substantially adjacent outer-side edges of the transfer plate 23 when in their bent positions. In order to duplicate this spacing of the leads, without utilizing this invention, one would ordinarily have to employ a circular housing for the rotary relay or a rectangular housing of much larger dimension than can be employed with the use of this invention. The outward bending of the leads is a significant factor in allowing compact components to be made defining any desired lead outline or connection to connecting members.

In a preferred form the molding material used to mold the insulating plate 24 is a glass-mica insulating material such as "Havelex" material produced by Haveg Industries, Inc., of Taunton, Massachusetts. "Havelex" 2100 is particularly useful due to its good insulating properties, high strength and outstanding low linear coefficient of expansion. Properties of this material and other desirable "Havelex" materials are outlined in table form as follows:

TABLE

	"Havelex" 2100	"Havelex" 2803	"Havelex" 2802	"Havelex" 1230
Resistance to heat (continuous), ° F.	1,000	700	700	700
Specific Gravity	2.94	2.64	3.89	2.65
Specific Volume, c. in./lb.	9.4	10.5	7.1	10.5
Tensile Strength, p.s.i.	6,000	6,000	6,000	6,000
Modulus of Elasticity (tension), 10 ³ p.s.i.	70	80	72	90-110
Compressive Strength, p.s.i.	29,000	29,000	26,000	30,000
Flexural Strength, p.s.i.	13,000	13,000	13,000	19,000
Impact Strength (notched izod), in lbs.	0.6	0.6	0.7	1.6
Thermal Conductivity (10 ⁻⁴ cal./sec./sq. cm./° C./cm.)	9.5	9.5	13.0	9.7
Specific heat (cal./° C./gm.)	0.11	0.24	0.13	0.23
Volume Resistivity, ohm/cm.	4.3×10 ¹⁴	4×10 ¹²	5×10 ¹²	1.5×10 ¹³
Dielectric Strength (short time test), volts/mil.	350	400	400	400
Dielectric Constant 60~	6.7	6.9	9.25	6.6
Dielectric Constant 10 ⁶ ~		6.9	9.2	
Dissipation (power) Factor 10 ⁶ ~	.002	.0042	.0017	.002
Arc Resistance, seconds	300+	240	250	250
Burning Rate	None	None	None	None
Water Absorption (24 hours), percent	Nil	Nil	Nil	Nil
Linear coef. of expansion, ° C. 4.9×10 ⁻⁶ .				

Although mica-glass materials are preferred for use in the insulating molded member, other insulating materials

having high mechanical strength and good insulating properties which are easily molded may also be employed if desired. Examples of other insulating materials include thermoplastic and thermosetting resins such as phenol formaldehyde resins, polyethylene, polystyrene, etc.

In a preferred form of the method of this invention, leads 14-21 are first bonded into position in the terminal plate 23. Preferably, the leads are bent as described above (as best shown in FIGS. 4 and 6) previous to bonding in the terminal plate.

In a third step, the terminal plate 23 and bent leads are then set in a mold and the molded member 24 is molded into the position shown in FIG. 1. The bracket 12 is preferably placed in the mold and imbedded during the molding operation. Conventional molding procedures are employed for the specific material of the member 24 being used. The material is introduced into the mold in fluid form and forced into contact with the terminal plate, bracket 12 and fills the mold cavity. When using "Havelex" materials as described, a molding temperature of about 800° F. and pressure of at least three tons per square inch is employed with a mold dwell time of at least three minutes.

Terminal ends 31 are preferably bent subsequent to the molding step. In some cases the bent portions B may be formed after the leads are bonded to the terminal plate 23 and just before the molding step. Holes 26 in member 24 may be formed during the molding step if desired to facilitate locating and positioning of the member 24 on a mounting base.

In another embodiment of the invention the bent leads and terminal plate can be positioned in the mold cavity prior to sealing of the leads to the plate. In this embodiment the leads are sealed to the plate and sealing means 30 are formed integral with the molded member 24.

An alternate embodiment of the invention is shown in FIG. 7, wherein all parts of the assembly are similar to the embodiment illustrated in FIGS. 1-3 with the exception that the molded member 24' completely encases a peripheral edge of the transfer plate and inner side 28 of the transfer plate 23 is continuous with the inner surface of the molded member 24. This embodiment of the invention may be used with varying sized and dimensioned casings which can be attached directly to the molded member 24.

It is evident that those skilled in the art may now make numerous modifications of and departures from the specific embodiments described herein without departing from the inventive concepts. For example, the number of leads employed may vary and the outlines to be formed may vary. In some cases it may be advantageous to have inner ends of the lead forming a circular outline on the transfer plate with the outer leads bent to form a rectangular outline. Consequently the breadth of this invention is to be construed as limited only by the spirit and scope of the appended claims.

What is claimed is:

1. A contact terminal adapter comprising a rigid metallic terminal plate having a generally rectangular configuration and defining a plurality of apertures passing from an inner side to an outer side thereof,

a plurality of elongated metallic, electrically conductive leads positioned one in each said plurality of apertures,

said leads being sealed to said plate by insulating means, said leads comprising inner parallel ends, bent portions extending beyond said outer side and outer parallel ends with said outer parallel ends of each of said leads being parallel to said inner parallel ends, said inner ends defining a rectangular outline and said outer ends defining a circular outline, and,

a molded means enclosing said bent portions and forming a reinforcing and mounting means.

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2. A contact terminal adapter in accordance with claim 1 and further comprising a rigid support bracket embedded in said molded means and having means thereon for attaching said contact terminal adapter to a supporting base.

3. A contact terminal adapter in accordance with claim 1 wherein said molded means and said insulating means comprising a mica-glass molded insulating material having a linear coefficient of expansion of approximately 4.9 times 10^{-6} per degree centigrade.

4. A contact terminal assembly in accordance with claim 1 wherein extreme outer portions of said outer ends are J-shaped.

5. A contact terminal assembly in accordance with claim 1 wherein said molded plate consists essentially of a mica-glass insulating material.

6. A contact terminal assembly comprising a rigid, substantially flat terminal plate defining a plurality of apertures passing from an inner side of the plate to an outer side of the plate,

a plurality of elongated metallic, electrically conductive, leads hermetically sealed one in each of said plurality of apertures,

said leads comprising inner parallel ends, bent portions extending beyond said outer side, and outer parallel ends with said outer parallel ends of each of said leads being parallel to said inner parallel ends,

a molded plate embedding said bent portions and forming an insulating, reinforcing and mounting means for said terminal plate,

said inner ends defining a first geometric outline on said terminal plate where said leads pass through said plate and said outer ends defining a second different geometric outline,

said molded plate comprising a substantially planar member having a square outer configuration and said terminal plate defining a rectangular outer configuration with said terminal plate transversely mounted on a surface of said molded plate.

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7. A contact terminal adapter comprising a rigid metallic terminal plate having a geometric configuration and defining a plurality of apertures passing from an inner side to an outer side thereof,

a plurality of stiff, elongated metallic, electrically conductive leads positioned one in each said plurality of apertures,

said leads being sealed to said plate by insulating means, said leads having inner ends parallel to one another and extending from the inner side of the plate and conforming in outline to the geometric configuration of the plate and having outer ends beyond the outer side of the plate parallel to the inner ends and defining in outline a geometric configuration different from the geometric configuration of the inner ends, said leads also having bent portions adjacent the outer side of the plate interconnecting the inner and outer ends,

and molded means enclosing said bent portions and forming a reinforcing and mounting means.

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