

CONNECTOR ASSEMBLY FOR ELECTRICAL COMPONENTS

The present invention generally relates to connector assemblies for electrical components. More specifically, the invention relates to connector assemblies having a pair of connectors which are suitable for establishing electrical connection between elongate straight lamps, glass fuses and the like and an external electrical circuit via a terminal portion of an electrical lead.

An example of a conventional connector assembly is disclosed in Japanese Utility Model Publication No. 50-36658, which discloses a fuse box having a resilient metal strip (a good conductor) of U-shaped cross-section. In addition, a pair of open slots are formed in both sides of the strip. Fuse holders, which are provided with tapered surfaces that incline inwardly are provided at both ends of the metal strip and are in the shape of a circular arc for clamping respective ends of a cylindrical fuse therebetween.

Coupling projections, equipped with a pair of concave locking members that are located in opposition to the slots of the holders, are provided on the edge of the fuse holder attachment member of the fuse box body. Moreover, a fuse

box made of insulating material is provided with a plurality of pairs of square through-holes so as to allow mounting of the holders from beneath the surface of the fuse box.

Coupling projections, equipped with concave locking members, are provided on the edge of the attachment member containing the through-holes of the fuse box body. By providing slots that engage these projections on the side of the fuse holders, one side of the slots engages the concave locking members of the coupling projections resulting in coupling therebetween which allows attachment and removal of the fuse holders.

In the prior art described above, the fuse or straight lamp holders are typically connected to another conducting member, lead wires, etc. via the fuse holders by means of soldering, or by means of caulking band-shaped conducting strips having a small width, commonly referred to as bus-bars. Thus, in the case of this prior art structure, the use of connecting tools, such as a soldering iron or caulking tool, is required. As a result, connection is typically not possible in confined, dark locations (such as inside an automobile engine compartment).

In addition, in order to install the fuse or straight lamp holders on conducting metal plates (such as those of the automobile body and chassis), it is necessary to place special insulating bushings between each of the fuse or straight lamp holders thus making installation both cumbersome and laborious. Moreover, since the contact members of the fuse or straight lamp holders generate heat

due to the flow of current, the entire fuse box is required to be made of expensive, heat-resistant plastic.

It would be desirable to be able to provide a connector assembly which enabled other conducting members to be connected easily and reliably thereto without the use of connecting tools, and which enabled the components of the assembly to be connected together with a single, simple manipulation.

According to the present invention, there is provided a connector assembly for electrical components including a connector subassembly and an attachment member to which the connector subassembly is coupled, the connector subassembly comprising an electrically insulating base and a pair of electrical connectors, the insulating base having a pair of holes formed therein each to receive an associated one of the connectors, a pair of protrusions being formed in each hole to project inwardly from opposite sides of said hole, each connector having formed therein corresponding openings which, on location of the connectors in the holes in the base, receive therein said protrusions to secure the connectors to the base, said connectors each including a substantially U-shaped connector portion for receiving therein, and establishing electrical contact with, an electrical component, and a plug-in receptacle integrally formed with said connector portion, the attachment member having formed therein an insert opening the size of which is slightly larger than that of the base of the connector subassembly, a plurality of flanges formed on the insulating base to project outwardly therefrom,

and a plurality of locking tabs formed on the insulating base or on the attachment member, said flanges and locking tabs co-operating with one another whereby the flanges on the insulating base engage below the defining edge region of the insert opening in the attachment member to locate the connector subassembly in the attachment member.

With such an arrangement straight lamps or glass fuses can be securely clamped between the connectors, and a tab terminal or bus-bar can be securely inserted directly into the plug-in receptacle so as to connect the lamp or fuse electrically to a desired circuit.

In one embodiment of the invention, the plurality of locking tabs and flanges are formed on the insulating base to project outwardly therefrom, said tabs and flanges being spaced from one another to define an engagement space therebetween for accommodating respective portions of said defining edge regions of the insert opening in the attachment member.

Preferably the attachment member includes a plurality of relief slots formed therein at positions aligned with associated ones of said locking tabs and spaced from the defining edge regions of the insert opening in the attachment member such as to allow the attachment member to respond resiliently in the vicinity of said relief slots on insertion of the insulating base into said insert opening in the attachment member.

In an alternative embodiment of the invention, the inside edge of the insert opening in the attachment member is provided with a plurality of stepped recesses therein each to support thereon the ends of an associated locking tab.

In a still further embodiment of the invention, a plurality of resilient locking tabs are formed on the attachment member to extend downwardly from the inside edge of the insert opening therein, whereby, on insertion of the insulating base into the insert opening of the attachment member, the resilient locking tabs engage the insulating base to urge the flanges thereon against the underside of the attachment member and to locate the connector assembly in the attachment member.

By way of examples only, embodiments of the invention will now be described in more detail with reference to the accompanying drawings of which:

Figs. 1A and 1B are perspective views of an embodiment of the invention wherein the connector and the insulating base used in this invention are separated from one another;

Fig. 2A to 2J are perspective views of embodiments of the invention wherein the connector assembly and attaching material are separated from one another;

Fig. 3A to 3J are perspective views of embodiments of the invention in use following assembly of the connector assembly and attaching member;

Fig. 4 to Fig. 6F are cross-sectional views depicting the procedure by which the insulating base is attached to the attaching member;

Fig. 7 is a perspective view of the attaching material

and connector assembly of an embodiment of the invention;

Fig. 8 is a perspective view following assembly of that mentioned above, and

Fig. 9 to Fig. 11E are cross-sectional views which depict the procedure by which the insulating base is attached to the attaching member of another preferred embodiment of this invention; and

The preferred embodiments of this invention will be described with reference to the drawings. Referring to Figs. 1A and 2A, the basic construction of the first embodiment of this invention consists of a plurality of locking tabs 2a and flanges 2b projecting from the side of an insulating base 1, the insulating base 1 being of heat-resistance plastic or the like moulded into the shape of a nearly rectangular frame. A pair of connector insertion holes 3 is formed in the insulating base 1, the base 1 including two pairs of projections 4 projecting in opposition to each other from the sides of respective insertion holes 3. A pair of metal clamps 5 are provided, in for which resilient, generally U-shaped strips and a plug-in receptacle 6 are formed into a single unit with one such unit being provided to constitute each of two connectors 7. The two connectors 7 are mounted into the pair of connector insertion holes 3. The pair of projections 4 thus extend through attachment holes 8 formed in the bases of the clamps 5, thus forming the connector assembly 9 as shown in Fig. 2A. In addition to an engaging hole 10 which is slightly larger than the flat peripheral

contour of the insulating base 1, relief slots 111 are formed at respective locations in opposition to each of the locking tabs 2a so as to form the attaching member 12 as shown in Fig. 2A.

The connector assembly 9 may then be engaged with the attaching member 12 at engaging hole 10 as shown in Figs. 3A and 6A with the locking tabs 2a and the flanges 2b in the manner as shown in Figs. 4 and 5.

A specific example of the attaching component of the connector of this invention will now be described. In this regard, two insertion holes 3 of the two connectors 7 are formed at a specified interval in the upper surface of the insulating base 1 as shown in Fig. 1A by moulding of a heat resistant plastic. The insertion holes 3 extend completely through the base 1 and thus are open at the base's lower surface as is shown in Fig. 1A. A pair of projections 4 which engage with the connector 7 are provided on the inner surfaces of opposing walls of each insertion hole 3.

As shown also in Fig. 1A, conducting strips made of conductive leaf spring material such as phosphor bronze, nickel silver or beryllium copper are stamped out in the shape resembling a cross on a base. The strips are bent into a shape that generally resembles the letter 'U' by forming a bottom portion between the arms of the cross and bending the arms upward to form a pair of clamps 5 which serve as the clamping receptacle members. Plug-in receptacles 6, which extend from the sides of the bottoms of clamps 5, are formed in a single plane into a shape

which resembles eyeglasses and then bent parallel with the pair of clamps 5.

Raised ribs 18 are formed on the bases of the clamps 5 in order to strengthen attaching holes 8, which projections 4 of connector insertion holes 3 project through, and to obtain funnelling effects for dissipation of heat by forming gaps between the inner walls of connector insertion holes 3 and said clamps 5.

Thus, as shown in Fig. 2A, connectors 7 fit inside projections 4, that are provided in opposition to each other on the opposing inner walls of connector insertion holes 3 of the insulating base 1, with a snap action utilising the resiliency of clamps 5 through attachment holes 8 that are formed on each of the bases of the pair of clamps 5 to form the connector assembly 9.

In addition, as shown in Fig. 2A, attaching member 12 may be made of plastic or metal sheet, having engaging hole 10 slightly larger than the flat contour of the insulating base 1, and relief slots 111 which are formed at each of the locations that are in opposition to the locking tabs 2a. Thus, the connector assembly 9 is inserted into engaging hole 10 of attaching member 12 and mounted in position with the locking tabs 2a and flanges 2b as shown in Fig. 3A according to the sequence shown in Fig. 4 through Fig. 6A.

More specifically, in this case, connector assembly 9 can be easily mounted in the manner of a so-called 'cassette locking mechanism' with a single clicking action

as a result of the edges of engaging hole 10 of attaching member 12 being pushed open in the direction in which relief slits 111 become narrower in opposition to the resiliency of attaching member 12 due to the inclination of the surfaces of locking tabs 2a of insulating base 1 as shown in Fig. 5.

Thus, in this mounted state the vertical movement of insulating base 1 with respect to attaching member 12 is restricted by the tab edges of locking tabs 2a and the upper surfaces of flanges 2b each being in contact with the upper and lower surfaces, respectively, of attaching member 12 thus preventing rattling. Horizontal movement of insulating base 1 is restricted by the inner edge of engaging hole 10 of attaching member 12, thus preventing rattling. Furthermore, when attaching member 12 is made of metal, the portions between relief holes 111 and engaging hole 10 should be formed so that the material thickness is small. In addition, straight lamp L or connection conductors 1 such as glass fuses may be inserted between the pairs of clamps 5.

Figs. 7 through 11A indicate another embodiment of this invention in which the lower surface of insulating base 1 is in the same plane as the lower surface of attaching member 12 in the attached state wherein the inner edge of engaging hole 10 of attaching member 12 is elevated in the form of a raised frame as shown in Fig. 11A. Furthermore, in each of the drawings of Figs. 7 through 11A, those portions that are indicated with the same numbers as the embodiment indicated in Figs. 1A through 6A

are either identical or equivalent to each of the portions indicated in that embodiment.

The following describes a second embodiment of this invention. The basic construction is similar to that of the first embodiment. A description is given of a specific example of the attachment component of the connector in this embodiment referring to Figs. 1B, 2B, 3B and 6B.

Two insertion holes 3 of the two connectors 7 are formed at a specified interval in the upper surface of the insulating base 1 as shown in Fig. 1B by moulding of a heat-resistant plastic. The insertion holes 3 extend through the base 1 to its lower surface. In addition, a pair of projections 4 which engage with the connector 7 are provided on the inner surfaces of the walls that face each other and which define the insertion hole 3.

As shown in Fig. 1B, conducting strips made of conductive leaf spring materials such as phosphor bronze, nickel silver or beryllium copper are stamped out into a severed cross-shaped disc. The strips are then bent into a shape that generally resembles the letter 'U' by forming a bottom portion between the arms of the cross and bending the arms upward to form a pair of clamps 5 which serve as the clamping receptacle members. Lead wire connectors 66 (which extend from the bottom sides of the clamps 5) are formed, for example, by bending parallel to these clamps 5. The lead wire connector 66 may furthermore be a simple projection, and moreover, may be soldered or caulked to the bottom section between clamps 5.

Raised ribs 18 are formed on the bases of the clamps 5

in order to strengthen the attaching holes 8. The raised ribs 18 thereby allow funnelling effects to be achieved for dissipation of heat due to gaps that are formed between the inner walls of connector insertion holes 3 and the clamps 5. The projections 4 of the connection insertion holes 3 are adapted to extend into the attaching holes 8. Thus, as shown in Fig. 2B, connectors may be coupled to the projections 4 of the insulating base 1 by pressing them into the insertion holes 3 with a 'clicking' action utilising the resiliency of clamps 5 until the projections 4 extend into the attachment holes 8 that are formed on each of the bases of the pair of clamps 5. In this manner, the connector assembly is formed.

The following describes a third embodiment of this invention having a basic construction similar to that of the first embodiment. A description is given of the attaching member in this embodiment referring to Figs. 2C, 3C, and 6C. As shown in Fig. 2C, attaching member 12 is provided with an engaging hole 10 slightly larger than the flat contour of the insulating base 1 using plastic and metal sheet material. Attaching member 12 furthermore includes supports 112 consisting of step-like notches at each of the four locations in opposition to the locking tabs 2a.

Thus, when the connector assembly 9 is inserted into engaging hole 10 of the attaching member 12 to deflect the locking tabs 2a to the inside at the inner edge of engaging hole 10 in opposition to their resilient force, the lower ends of locking tabs 2a first move away from the

upper surface of attaching member 12 and then snap back into place. In such a manner, the connector assembly 9 is able to engaged with attaching member 12 in the manner of a so-called 'cassette locking mechanism' such that it is securely engaged as shown in Fig. 3C and 6C. As a result, the upper and lower surfaces in the vicinity of the inner edge of engaging hole 10 of the supports 112 may be connected to engaging hole 10 and engaged in a single action by means of the lower ends of locking tabs 2a and the upper surfaces of flanges 2b, respectively.

Since the supports 112 support the ends of locking tabs 2a, the supported states of locking tabs 2a are able to be maintained. Thus the insulating base 1 does not 'rattle' with respect to attaching member 12 even when an external force is applied in a downward direction. Straight lamp L or connection conductors 1 such as glass fuses are used by inserting the same between the pairs of clamps 5.

The following describes a fourth embodiment of this invention, In this embodiment, the locking tabs provided on the sides of insulating base 1 are in the form of resilient tabs as shown in Figs. 2D, 3D and 6D.

As shown in Fig. 2D, attaching member 12 defines an engaging hole 10 slightly larger than the flat contour of the insulating base 1 using plastic and metal sheet materials. Notches 114 are formed at each of the four locations in opposition to the resilient locking tabs 2a. Thus, the connector assembly 9 may be inserted into engaging hole 10 of attaching member 12 causing the

resilient locking tabs 2a to be deflected to the inside in opposition to their resilient force at the location of engaging hole 10. The inserted state is shown in Fig. 6D.

The following describes a fifth embodiment of this invention. As shown in Fig. 2E, the construction of this further embodiment consists of a plurality of flanges 2b projecting from the side of insulating base 1. As before, insulating base 1 is formed of a heat-resistant plastic moulded into the general shape of a rectangular frame. A pair of connector insertion holes 3 are formed in insulating base 1 and include two pairs of projections 4 projecting in opposition to each other from the sides of insertion holes 3. A pair of resilient U-shaped clamps 5 having a plug-in receptacle 6 are formed into a single unit with one such unit being provided for each of the two connectors 7.

The two connectors 7 are mounted into the pair of connector insertion holes 3 such that the pair of projections 4 extend through attachment holes 8 formed in the bases of the clamps 5, thereby forming the connector assembly 9 as shown in Fig. 2E.

As shown in Fig. 2E, in addition to being provided with an engaging hole 10 slightly larger than the flat contour of the insulating base 1, attaching member 12 includes resilient hooks 113 projecting downwardly on the edge of engaging hole 10.

Thus, when the connector assembly 9 is inserted into engaging hole 10 of attaching member 12 in opposition to the resilient force of resilient hooks 113, resilient hooks

113 first move away from the lower edge of insulating base 1 and then snap back into original position. The connector assembly 9 is able to be attached to attaching member 12 in the manner of a so-called 'one touch operation' such that the hook surfaces of resilient hooks 113 make contact with the lower surface of insulating base 1 while the flanges 2b make contact with the lower surface of attaching member 12 as shown in Figs. 3E and 6E.

The following describes a sixth embodiment of this invention. Although the basic composition is similar to the third embodiment of this invention, as shown in Figs. 2F, 3F and 6G, each of the two connectors 7 that is used in this embodiment is equipped with lead wires 6 and clamps 5 forming resilient U-shaped conductive strips as shown in Fig. 1B.

The following describes a seventh embodiment of this invention. The basic construction of this embodiment is similar to that of the fourth embodiment and has the characteristic of using connector 7 equipped with lead wire 6a as shown in Figs. 2G, 3G and 6G for each of the two connectors.

The following describes an eighth embodiment of this invention. The basic construction is similar to that of the fifth embodiment and has the characteristic of using connector 7 equipped with lead wire 6a as shown in Figs. 2H, 3H and 6H for each of the two connectors.

A ninth embodiment of this invention is shown in Fig. 2I. As is shown therein, the basic construction of this embodiment consists of a plurality of locking tabs 2a and

flanges 2b projecting from the side of insulating base 1. Insulating base 1 is again formed of a plastic and moulded into the shape of a near rectangle. A pair of connector insertion holes 3 are formed in insulating base 1, and include two pairs of projections 4 projecting in opposition to each other from the sides of insertion holes 3. In addition, a pair of resilient U-shaped clamps 5 and a plug-in receptacle 6 are formed into a single unit with one such unit being provided for each of the two connectors 7. The two connectors 7 are mounted into the pair of connector insertion holes 3 with the pair of projections 4 through attachment holes 8 formed in the bases of the clamps 5, thus forming connector assembly 9.

Attaching member 12 defines an engaging hole 10 that is slightly larger than the flat contour of the insulating base 1.

The connector assembly 9 may thus be engaged with the attaching member 12 at engaging hole 10 as shown in Figs. 3I and 6I with the locking tabs 2a and the flanges 2b.

Thus, as shown in Fig. 2I, connectors 7 fit inside projections 4, that are provided in opposition to each other on the opposing inner walls of connector insertion holes 3 of the insulating base 1, with a clicking action utilising the resiliency of clamps 5 until the projections 4 extend through the respective attachment holes 8.

In addition, the attaching member 12 includes bevelled notches 115 located in its lower surface at each location corresponding to the location of the locking tabs 2a.

These projections 15 thus function as insertion guides for locking tabs 2a.

Thus, the connector assembly 9 is inserted into engaging hole 10 of attaching member 12 as shown in Fig. 6I and is mounted in position with the locking tabs 2a and flanges 2b as shown in Fig. 3I

The following describes a tenth embodiment of this invention, the basic construction of which is similar to that of the ninth embodiment and has the characteristic of using connectors 7 equipped with lead wire 6a as shown in Figs. 2J, 3J and 6J for each of the two connectors.

Since the invention is constructed as has been described in the previous explanations, the present invention offers the following advantages as will be understood from the following discussion.

In the attachment component of the connector of this invention, the locking tabs 2a are formed on insulating base 1 of connector assembly 9 and are securely moulded in a single unit with insulating base 1. The locking tabs 2a are therefore mechanically strong thereby preventing indiscriminate movement of the insulating base after it is mounted onto the attaching member. In addition, in the assembled components of connectors 7, since connectors 7 are surrounded by insulating base 1, the invention allows the two connectors 7 to be mounted with favourable compatibility through insulating base 1 regardless of whether they are mounted on conducting or insulating plates. Furthermore, since insulating member 1 is comparatively small in size (and thereby requires only a

minute amount of resin to make), it achieves adequate cost effectiveness even if it is moulded from relatively expensive, heat-resistant plastic. It also has the advantage of being lower in overall cost since it does not require the use of expensive, heat-resistant plastic for the comparatively large insulating sheet used for the attaching member.

In this invention in particular, when installing a large number of straight lamps or fuses in a confined area, insulating base 1 with the two connectors already engaged can be mounted in the manner of a so-called 'cassette locking mechanism' within engaging hole 10 of attaching member 12 with locking tabs 2a. The invention thus has another advantage of allowing the straight lamps or fuses to be arranged and installed easily and systematically. Moreover, the embodiment of this invention, in which a pair of clamps 5 and a plug-in receptacle 6 having a plug-in connector are formed on a single connector 7, can be manufactured at a low cost both in terms of conserving space and conserving resources. Moreover, a straight lamp or glass fuse may be securely held by the pairs of clamps 5, as well as allowing a direct connection of a tab terminal or bus-bar by securely inserting the same into the plug-in receptacle 6. Soldering and caulking tools required in the prior art are thus no longer necessary. As a result, the invention advantageously allows connection work to be performed easily even in confined and dark areas (such as that in the engine compartment of an automobile).

CLAIMS

1. A connector assembly for electrical components including a connector subassembly and an attachment member to which the connector subassembly is coupled, the connector subassembly comprising an electrically insulating base and a pair of electrical connectors, the insulating base having a pair of holes formed therein each to receive an associated one of the connectors, a pair of protrusions being formed in each hole to project inwardly from opposite sides of said hole, each connector having formed therein corresponding openings which, on location of the connectors in the holes in the base, receive therein said protrusions to secure the connectors to the base, said connectors each including a substantially U-shaped connector portion for receiving therein, and establishing electrical contact with, an electrical component, and a plug-in receptacle integrally formed with said connector portion, the attachment member having formed therein an insert opening the size of which is slightly larger than that of the base of the connector subassembly, a plurality of flanges formed on the insulating base to project outwardly therefrom, and a plurality of locking tabs formed on the insulating base or on the attachment member, said flanges and locking tabs cooperating with one another whereby the flanges on the insulating base engage below the defining edge region of the insert opening in the attachment member to locate the connector subassembly in the attachment member.

2. A connector assembly as claimed in claim 1 in which the plurality of locking tabs and flanges are formed on the



insulating base to project outwardly therefrom, said tabs and flanges being spaced from one another to define an engagement space therebetween for accommodating respective portions of said defining edge regions of the insert opening in the attachment member.

3. A connector assembly as claimed in claim 2 in which the attachment member includes a plurality of relief slots formed therein at positions aligned with associated ones of said locking tabs and spaced from the defining edge regions of the insert opening in the attachment member such as to allow the attachment member to respond resiliently in the vicinity of said relief slots on insertion of the insulating base into said insert opening in the attachment member.

4. A connector assembly as claimed in claim 2 in which the inside edge of the insert opening in the attachment member is provided with a plurality of stepped recesses therein each to support thereon the ends of an associated locking tab.

5. A connector assembly as claimed in claim 1 in which a plurality of resilient locking tabs are formed on the attachment member to extend downwardly from the inside edge of the insert opening therein, whereby, on insertion of the insulating base into the insert opening of the attachment member, the resilient locking tabs engage the insulating base to urge the flanges thereon against the underside of the attachment member and to locate the connector assembly in the attachment member.

6. A connector assembly substantially as described with reference to and as illustrated by the accompanying drawings.

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