

CLAMP TYPE CONNECTION DEVICE

The present invention generally relates to clamp-type electrical connectors suitable for connecting a straight tube-type lamp, a glass tube fuse and the like to external pieces, such as tab terminals and the like.

Electrical connectors of a type similar to those of the present invention are described, for example, in Japanese Utility Model Publication no. 50-36658. The connection devices disclosed in Japanese Utility Model Publication no. 50-36658 are characterised by comprising fuse-receiving fittings composed of a metal plate of an resilient conducting member bent to a C-shaped cross section and having a pair of elongate slots defined on opposite sides thereof. The metal plate has tapered surfaces inclining inwardly and arc-shaped supports for clamping the opposite ends thereof. Locking lugs including a pair of locking recesses confronting the elongate slots of the receiving fittings are disposed at the side edges of a fuse box main body where the fuse receiving fittings are mounted. In such a manner, the fuse box main body (formed of an insulating material) is provided with a number of rectangular through hole pairs to enable the receiving

fittings to be mounted from the lower surface. The locking lugs (including the locking recesses) are disposed at the side edges of the mounting through holes of the fuse box main body. The elongate holes engageable with the lugs are defined on the sides of the fuse-receiving fittings so that one side of each elongate hole is engaged with the locking recess of a respective locking lug. As a result, the fuse-receiving fittings are detachably coupled to the main body.

In the above-described conventional connector device, the fuse receiving fitting is connected to other conductive members in such a manner that a lead wire or the like is connected to the fuse-receiving fitting by means of soldering or by means of a caulked narrow band-shaped conductive plate (typically known as a bus bar).

Therefore, the conventional connecting devices are problematic since the task of connecting the lead wires can be particularly difficult - especially when the task is being performed in a small and/or dark space (such as the engine compartment of an automobile and the like). In addition, tools for wire connection, such as soldering irons, caulking tools and the like are usually required.

It would be desirable to be able to provide a clamp-type connection device which enabled other conductive members to be connected easily and securely to a holding socket type connector.

According to the present invention, there is provided a clamp type connection device comprising an electrically-insulating substrate on which are mounted a plurality of electrical connectors, the substrate having a connector

mounting portion on which are formed, for each connector, a pair of opposed lugs, each connector being of a resilient, electrically-conducting material and including a pair of opposed clamping pieces in each of which is formed a mounting hole, and, integral with said clamping pieces, a connection piece adapted to receive therein a plug-in contact wherein resilient electrical connection is made between the connection piece and said contact, the connectors being mounted on the connector mounting portion of the substrate by engagement of said lugs with a respective one of the mounting holes in the clamping pieces, each clamping piece having a pair of raised ribs formed thereon which engage with a surface of the connector mounting portion to establish a space between said clamping piece and said surface of the connector mounting portion.

The space formed between the inner surface of the mounting portion and the outer surface of the connector by the raised ribs enables heat from the connector to be dissipated by the chimney effect of the space. The raised ribs also increase the flexural rigidity of the base of the pair of the clamping pieces.

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

Fig. 1 is a perspective view showing the state that connectors are separated from an insulation substrate;

Fig. 2 is a perspective view of the above connectors and the insulating substrate in use after they have been assembled;

Fig. 3 is a perspective view of an unfolded embodiment of the connector;

Fig. 4 is a perspective view showing an embodiment of a connector applied to a device according to the present invention;

Fig. 5 to Fig. 10 are perspective views of other embodiments of the connector shown in Fig. 4;

Fig. 11 is a perspective view showing the state that the connectors shown in Fig. 10 are separated from an insulating substrate;

Fig. 12 is a perspective view of the above connectors and the insulating substrate in use after they have been assembled;

Fig. 13 is a separated perspective view showing a case in which another insulating substrate is used in place of the insulating substrate shown in Fig. 11;

Fig. 14 is a perspective view showing connectors using the unfolded embodiment shown in Fig. 14;

Figs. 15 and 16 are perspective views showing connectors using the unfolded embodiment shown in Fig. 14;

Fig. 17 to Fig. 71 are diagrams showing other embodiments according to the present invention, wherein:

Figs. 17 to Fig. 28, Figs. 34 to Fig. 46, and Fig. 52 to Fig. 65 are perspective views of the main parts of other embodiments according to the present invention, respectively; and

Fig. 29 to Fig. 33, Fig. 47 to Fig. 51, and Fig. 66 to Fig. 71 are cross-sectional views of other embodiments according to the present invention.

As shown more specifically in Fig. 1, the connection device according to the present invention includes connectors 2 mounted on an insulation substrate 1. The insulation substrate 1 has a connector mounting portion 12 formed thereon which includes confronting lugs 13,13. Each of the connectors 2 is integrally provided with a pair of clamping pieces 22, 22 composed of resilient conductive plates as shown in Figs. 1 and 4 and a connection piece 23 into which a terminal can be plugged.

The above connectors 2 are mounted on the socket mounting portion 12 by means of lugs 13 engaging a respective one of the mounting holes 27 defined on the base of the clamping pieces 22.

The insulation substrate 1 is made, for example, by plastics moulding techniques, and as shown in Fig. 1, has mounting portions 12 for receiving a pair of connectors 2 defined on the upper surface thereof at prescribed intervals.

The mounting portions 12 each project outwardly with respect to the upper surface of the substrate 1 and are opened at the lower surface thereof. A pair of lugs 13 to be engageably locked with a respective connector 2 defined on the confronting inner walls of the mounting portion 12 is also provided.

The connector 2 is formed as shown in Figs. 1 and 4 in such a manner that a conductive plate 21 (preferably formed of a conductive spring plate of phosphor bronze, nickel silver, beryllium copper or the like) is punched substantially into the shape as shown in Fig. 3 - that is,

substantially bent to a U-shape to form a bottom at a separating portion. Thus, a pair of the clamping pieces 22 serving as a holding socket are provided. The connection piece 23 extending from a side of the above bottom is substantially formed to the shape shown in Fig. 4 at the same level with the bottom and is bent in parallel with the pair of the clamping pieces 22.

The pair of clamping pieces 22 define the mounting holes through which the lugs 13 in the socket mounting portion 12 are locked. The clamping pieces 22 also define a pair of raised ribs 28 for reinforcing the clamping pieces 22 and for establishing a space between the inner wall of the socket mounting portion 12 and the connector 2 so as to provide a vent (chimney) to allow for heat dissipation.

As shown in Fig. 2 each of the connectors 2 is mounted in such a manner that the mounting holes 27 defined on each base of the pair of the clamping pieces 22 are inserted into the lugs 13 confrontingly disposed on the confronting wall surfaces of the connector mounting portion 12 of the above insulating substrate 1.

After the connectors 2 have been mounted, known tab terminals 4 to which lead wires 3 are connected under pressure are press-fitted tightly into a respective one of the connecting portions a-a of the connection pieces 23. The conductive members 5a, 5a of a straight tube-type lamp 5 are then mounted between the pair of the clamping pieces 22.

Members shown by reference numeral 6 in Fig. 2 are

band-shaped narrow conductive plates known as 'bus bars' and can be used with the upright portions 6a, 6a thereof tightly inserted into the connection portions of the connection pieces 23 of the above-described connector 2. In this case, however, grooves 1a are preferably defined on the surface of the insulating substrate 1 to accommodate the band-shaped narrow conductive plates 6.

The connection piece 23 of connector 2 in the present invention can be formed in many different orientations as shown in Figs. 5 to 10.

A connector shown in Fig. 10 can be mounted as shown in Fig. 12 through a state shown in Fig. 11. In this case, however, it is preferable either that (i) a pair of ribs 1b, 1b project from the insulating substrate 1 to regulate the position of the connection piece in the horizontal direction (as shown in the above respective Figs.) or (ii) that grooves 1a are defined on the surface of the insulating substrate 1 to regulate the position of tab terminals 4 and lead wires 3 as shown in Fig. 13.

It should be noted here that like reference numerals in Figs. 1-2 and 11-13 refer to like structural elements.

The clamp type connection device according to the present invention can include a conductive plate 21a having a shape shown in Fig. 14 by folding it to shapes shown in Figs. 15 and 16. The embodiments shown in Figs. 15 and 16 are essentially the same as the previous embodiments, except that the connection piece is asymmetrical. Thus, a tab terminal 4 and a partially cutout cylindrical connection plug 4a can be inserted into a single connection

piece portion for use.

As shown in Figs. 17 to 20, the clamp type connection devices according to the present invention can comprise an insulating substrate 1 having a connector mounting portion 12 provided with confronting lugs 13 formed thereto as shown in Fig. 17. Connectors 2 each integrally provided with a pair of clamping pieces 22 and made of a resilient conductive plate formed to a shape shown in Fig. 19 are also provided. In addition, these embodiments have dual connection pieces 23 as shown in Figs. 17 and 20. The connectors 2 are mounted on the connector mounting portion 13 by means of the lugs 13 extending into the mounting holes 27 formed at each base of the clamping pieces as shown in Figs. 18 and 29.

In the above embodiments, the connection piece 23 can be formed in different orientations as shown in Figs. 21 to 26.

Furthermore, a conductive plate having a shape shown in Fig. 27 maybe formed into a shape as shown in Fig. 28. Such a dual side face contact asymmetrical connection piece 23 having a conductive piece 23a may be integrally formed with a connector 2.

Note that each of Figs. 29 to 33 is a cross-sectional view of a main part of an embodiment of a connector 2 mounted on an insulating substrate 1, wherein the same reference numerals as used in the above embodiments are used to designate the same structural components.

Since the above embodiments shown in Figs. 17 to 33 include dual side face contact type connection pieces 23,

the tab terminal 4 and the narrow conductive plate 6 (bus bar) are in tight press-fitted contact so that electrical resistance is minimised and thus less heat is produced therefrom.

The clamp type connection device according to the present invention can also be provided as shown in Figs. 34 to 51.

More specifically, as shown in Figs. 34 to 37, a clamping type connection device comprises an insulating substrate 1 having a connector mounting portion 12 provided with confronting lugs 13. Connectors 2 each provided with a pair of clamping pieces 22 are made from a resilient conductive plate formed into a shape shown in Fig. 36. Mounting holes 27 are defined on each base of the clamping pieces 22. A confronting conductive piece 25 is formed by folding a conductive piece 23a which projects from the base 2a of each of the connectors 2 into a U-shape as shown in Figs. 34 and 37. The above-described connectors 2 are mounted on the connector mounting portion 12 by engaging the lugs 13 within mounting holes 27 of the substrate 1 as shown in Figs. 35, 47 and 50.

When the outer surface of the confronting conductive piece 25 is pressed by support pieces 24a (formed by folding a conductive plate shown in Fig. 34 into a U-shape at the sides 23b of a conductive piece 23a) as shown in Fig. 46, the strength by which the tab terminal 4 is inserted into the piece 23 is increased.

Note that, as shown in Figs. 36 and 45, when a slit is defined at substantially the centre of the confronting

conductive piece 5, the single confronting conductive piece is divided into two portions and tab terminals 4 having a different thickness can be especially tightly inserted to the opposite sides thereof using the slit S as a borderline.

In another embodiment, the connection piece 23 composed of dual side face type contact resilient pieces integrally formed with the connector 2 can also be provided in different orientations as shown in Figs. 38 to 44.

Note that each of Figs. 47 to Fig. 51 is a cross sectional view of a main part of an embodiment of a connector 2 mounted to an insulating substrate 1, wherein the same reference numerals as used in the above embodiments are used to designate the same structural members.

The lamp type connection device according to the present invention can also be achieved as shown in Figs. 52 to 71.

More specifically, as shown in Figs. 52 to 55, a clamping type connection device comprises an insulating substrate 1 having a connector mounting portion 12 provided with confronting lugs 13 shown in Fig. 52. Connectors 2 are each provided with a pair of clamping pieces 22 made of a conductive plate having resiliency as shown in Fig. 54. Mounting holes 27 are defined in each base of the clamping pieces 22. A confronting conductive piece 25 is folded into a U-shaped portion 24 from the side 23b of a conductive piece 23a which projects from the base 2a of each of the connectors 2 as shown in Fig. 55. The

connectors 2 are thus mounted on the connector mounting portion 12 by engaging the lugs 13 with the mounting holes 27 as shown in Fig. 53 and 66.

Note that, as shown in Fig. 54 and 64, when a slit S is defined at substantially the centre of the confronting conductive piece 25, the single confronting conductive piece is divided into two portions and tab terminals 4 having a different thickness can be especially tightly inserted into the opposite sides thereof using the slit S as a border-line.

In this embodiment, the plug-in connection piece 23 can be formed in different orientations as shown in Figs. 56 to 63. Alternatively, two confronting conductive pieces 25, 25 can be formed as a pair.

More specifically, the pair of conductive pieces may be formed in such a manner that a conductive plate having a flat shape as shown in Fig. 64 may be formed into the shape shown in Fig. 65 so that the confronting conductive pieces 25 of dual side face contact type symmetrical piece 23 are integrally formed with the connector 2.

Each of Figs. 66 to 71 is a cross sectional view of a main part of an embodiment of a connector mounted to an insulating substrate 1, wherein the same numerals as used in the above-described embodiments are used to designate the same structural members.

Since a pair of clamping pieces 22 and the connection piece 23 are integrally formed with a single connector 2, the devices of the present invention can be realised using less resources at lower costs. Furthermore, a straight

tube lamp, glass tube fuse or the like can be held tightly by the pair of clamping pieces 22 in use. The tab terminal 4, narrow conductive plate 6 (bus bar), the partially cutout cylindrical connection plug 4a or the like can also be directly and tightly inserted into the connection piece 23. As a result, contact resistance can be minimised and thus less heat is produced. Finally, soldering irons, caulking tools and the like required by conventional connector devices are not needed according to the present invention. Thus, the present invention has many beneficial effects. For example, the task of connecting wires and the like can now be easily carried out in a narrow and/or dark location (such as the engine compartment of an automobile).

Since the mounting holes 27, 27 are defined on each base of a pair of clamping pieces 22 and the raised ribs 28 are defined at the outside surface thereof, resistance heat produced by electrical current during operation can be effectively dissipated by the chimney effect provided by the space defined between the connector 2 and a mounting portion 12. Thus, the insulating substrate, as well as the lead wire insulation, are not adversely affected by such heat. In addition, the flexural rigidity of the bases of the clamping pieces is maintained.

Since the outer surface of the confronting conductive piece 25 can be pressed by the support piece 24, an external conductive piece such as a tab terminal 4 can be more tightly inserted into the connection piece 23. Thus, electrical contact can be maintained for prolonged time

periods and thus contact resistance can be maintained at reduced levels in use.

CLAIMS

1. A clamp type connection device comprising an electrically-insulating substrate on which are mounted a plurality of electrical connectors, the substrate having a connector mounting portion on which are formed, for each connector, a pair of opposed lugs, each connector being of a resilient, electrically-conducting material and including a pair of opposed clamping pieces in each of which is formed a mounting hole, and, integral with said clamping pieces, a connection piece adapted to receive therein a plug-in contact wherein resilient electrical connection is made between the connection piece and said contact, the connectors being mounted on the connector mounting portion of the substrate by engagement of said lugs with a respective one of the mounting holes in the clamping pieces, each clamping piece having a pair of raised ribs formed thereon which engage with a surface of the connector mounting portion to establish a space between said clamping piece and said surface of the connector mounting portion.

2. A device as claimed in claim 1 in which each connection piece is in form of a double sided surface type contact piece and can receive therein two plug-in contacts.

3. A device as claimed in claim 1 in which each connection piece includes a confronting conductive piece formed by folding a conductive piece which projects from the base of the connector into a U-shape.

4. A device as claimed in claim 1 in which each connection piece includes an integral support piece which is folded back into the connection piece to press against a



surface thereof to increase the resilient engagement of the connection piece with a contact plugged therein.

5. A device as claimed in claim 3 in which a slit is formed substantially centrally of each confronting conductive piece.

6. A clamp-type connection device substantially as described with reference to and as illustrated by any of the accompanying drawings.

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