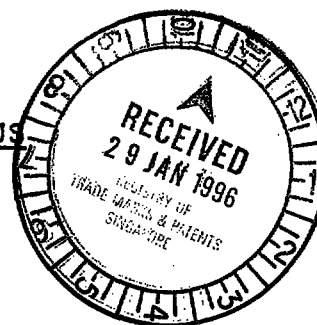


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CONDUCTIVE CONNECTOR APPARATUS

The present invention relates to a conductive connector apparatus suitable for applying when attaching an electrical component, such as an interior lamp, to the painted surface of a conductive plate such as the surface of an automobile body, and grounding said body.

This type of prior art involves performing body grounding by opening a hole in the painted surface of a conductive attaching body such as an automobile body and fastening together a lead wire and bus bar with screws.

An example of this type of prior art is described in Japanese Patent Utility Model Publication No. 4-49461.

In this example of the prior art, together with arranging a conductive member, having a bent piece inserted into a hole formed adjacent to an attachment hole of an insulated attached body, on the surface of said attached body, the surface of said attached body on which a conductive member is arranged makes

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planar contact with a conductive attaching body so that by tightly fastening said attached body to hole 8 of this conductive attaching body with a conductive screw inserted through said attachment hole, the end of the bent piece of said conductive member is connected to the inner surface of the hole of said conductive attaching body with said conductive screw while scratching off on the inner surface of the screw head.

In this example of the prior art, in the attaching of an interior lamp and so forth by fastening with screws to the automobile body, since there are no reinforcing members, particularly on the inner surface and periphery of the cylindrical attachment hole of a plastic attached body, the problem is encountered wherein a completely satisfactory attachment state cannot always be obtained due to the cracking, cutting, tearing or breaking off of the attached body due to the powerful twisting force of the set screws.

In addition, there is also the problem of the conductive member, integrated into a single unit with a bus bar, becoming displaced by the turning force of the screws.

In addition, since the attached body is attached by only its surface on which a conductive member is arranged making planar contact with an attaching body, there was also the problem of it being subjected to restrictions on its direction of attachment.

Namely, since handling of lead wires and bus bars is

troublesome at visible locations such as door switches and interior electrical components such as interior lamps, not to mention locations hidden from sight, and the screws would become loose due to vibrations and so forth, numerous problems arose such as requiring the use of spring washers.

Consequently, although there are other examples of the prior art which prevent partial damage to the attached body by the above-mentioned fastening by screws by embedding a reinforcing ring by insertion molding in line with the attachment hole, even in the case of such examples of the prior art, there is the problem of molding costs becoming expensive due to the need for means of plastic insert molding.

Therefore, although it is possible to consider simply tightly fitting or loosely fitting a reinforcing ring in the above-mentioned cylindrical attachment hole, in the case this is tightly fit, a press machine is required while also resulting in poor workability. In contrast, in the case said reinforcing ring is loosely fit, there are problems such as the ring easily falling out to the outside or still requiring the use of a spring washer.

It would be desirable to be able

to eliminate each of the above-mentioned problems,

for example by improving the shape of the attachment hole of the attached body by inserting a cylindrical bent piece, of which at least one side extending from a conductive member is formed into a flat surface, along the inner surface of the attachment hole itself of an attached body, followed by fastening the attached body to a conductive attaching body with a conductive screw.

Accordingly, the apparatus of the present invention reinforces the periphery of the above-mentioned attachment hole with the bent piece, and locks the conductive member in position without being displaced, thus accommodating the direction of attachment of the attached body and preventing loosening of the conductive screw by the resilient force of bending following fastening of the bent piece with the screw, and thereby eliminates the need for a spring washer.

In the composing of an apparatus which attaches a conductive member, arranged on the surface of an insulated attached body, to a conductive attaching member, the apparatus of the present invention is accomplished by arranging a conductive member, having a bent piece aligned with the inner surface of an attachment hole of an insulated attached body made of plastic and so forth, slightly protruding from said inner surface and inserted into this attachment hole, on the surface of said attached body, and said attached body making planar contact with

a conductive attaching body so that by tightly fastening said attached body to the hole of this conductive attaching body with a conductive screw inserted through the bent piece within said attachment hole, the bent piece of said conductive member is forcibly bent, and its end is connected to the inner surface of the hole of said conductive attaching body with said conductive screw while maintaining electrical continuity.

When the attached body is fastened in the hole of a conductive attaching body with a conductive screw inserted into the attachment hole of said attached body, since a conductive bent piece is present within the attachment hole of said attached body aligned along its inner surface, the inner surface and periphery of said attachment hole can be reinforced, thus enabling said attached body to be securely fastened to the painted surface of a conductive attaching body without being cut, torn or broken off by the twisting force of the conductive screw.

Moreover, during this fastening, since the bent piece of the conductive member is pushed against the painted surface of the conductive attaching body by the twisting force of the conductive screw, while the conductive screw is screwed into the hole of the conductive attaching body while forcibly pushing the projecting portion of the bent piece into an attachment hole with the inner surface of the head of the conductive screw, the conductive screw can be screwed in at a right angle to the conductive attaching

body.

In addition, by tightly fastening the attached body in the hole of the conductive attaching body with a conductive screw inserted through an attachment hole of said attached body, the projecting portion of the bent piece of said conductive member is forcibly pushed into the attachment hole by the powerful twisting force of said conductive screw, thus enabling the bent piece to make resilient contact with the inner surface of the head of the conductive screw by strongly bending the bent piece with slight looseness. Together with said conductive member being able to be connected to the inner surface of the hole of the conductive attaching body while maintaining electrical continuity, the conductive screw following this fastening is not inadvertently loosened by external disturbances such as vibrations and so forth due to the powerful resilient contact friction of said bent piece making secure resilient contact with the inner surface of its head portion.

According to another embodiment of the present invention, while the bent piece of a conductive member is pushed against the painted surface of a conductive attaching body by the twisting force of a conductive screw during fastening, since the conductive screw is screwed into an attachment hole while a projection provided on the bent piece forcibly scratches and cuts into the inner surface of the head portion of the conductive

screw, the conductive screw is screwed in at a right angle to the conductive attaching body.

Namely, as a result of the above-mentioned bent piece being tightly clamped by a projecting residual portion between the inside of the head of the conductive screw and the painted surface of the conductive attaching body in the state wherein the majority of its projection has been scratched and cut away, the above-mentioned conductive member can be favorably connected to the conductive attaching body at the inner surface of its hole through the conductive screw by means of its bent piece while maintaining electrical continuity.

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 cross-sectional view indicating a first embodiment of the present invention.

Fig. 2 is an exploded perspective view of the first embodiment of the present invention.

Figs. 3A and 3B are cross-sectional views during the course of assembly of the first embodiment of the present invention.

Fig. 4 is a cross-sectional view during the course of assembly of the first embodiment of the present invention.

Figs. 5A and 5B are perspective views indicating other

examples of bent pieces of the conducting member.

Figs. 6A and 6B are perspective views indicating other examples of bent pieces of the conducting member.

Figs. 7A and 7B are perspective views indicating other examples of bent pieces of the conducting member.

Fig. 8 is a cross-sectional view indicating another example of the present invention.

Fig. 9 is a cross-sectional view indicating another example of the present invention.

The following provides an explanation of a first embodiment of the present invention with reference to the drawings.

First, with respect to the basic constitution of the present invention, in the attaching of a conductive member arranged on the surface of an insulated attached body to a conductive attaching body while maintaining electrical continuity, a conductive member 5, in the form of a bus bar and so forth, having bent pieces 4a and 4b inserted as shown in Fig. 3A in attachment hole 2 of an insulated attached body 1 made of plastic

and so forth as shown in Fig. 2 and slightly projecting from said attachment hole 2 aligned along its inner surface, is arranged on the surface of the above-mentioned attached body 1, for example on flat groove 1a.

As a result of the surface of the above-mentioned attached body 1 on which the conductive member is arranged making planar contact with metal conductive attaching body 7 as shown in Fig. 4, and tightly fastening the above-mentioned attached body 1 to hole 8 of conductive attaching body 7 as shown in the same drawing, or to a nut welded to conductive attaching body 7 in place of this hole 8, with conductive screw 9, in the form of a tapping screw and so forth, inserted through the above-mentioned attachment hole 2, leading projection 3 of bent piece 4 of the above-mentioned conductive member 5 is forcibly pushed into attachment hole 2 by the powerful twisting force of the above-mentioned conductive screw 9, thus enabling bent piece 4b to be strongly bent with slight looseness and make resilient contact with the inner surface of the head of conductive screw 9 as shown in Fig. 1, resulting in the above-mentioned conductive member 5 being able to be connected to the inner surface of hole 8 of conductive attaching body 7 while maintaining electrical continuity.

The following provides an explanation of the operation of the present invention.

As a result of paint being peeled from the inner surface of hole 8 formed in conductive attaching body 7 during drilling or burring, the inner surface of the above-mentioned hole 8 or a nut welded to conductive attaching body 7 is electrically conductive.

In addition, when attached body 1 is fastened to hole 8 of conductive attaching body 7 with conductive screw 9 inserted through bent pieces 4a and 4b as shown in Fig. 3A inside attachment hole 2 of attached body 1, since conductive bent pieces 4a and 4b are present inside attachment hole 2 of attached body 1 and are aligned with its inner surface, the inner surface and periphery of attachment hole 2 can be reinforced by bent pieces 4a and 4b, thus enabling attached body 1 to be securely fastened to painted surface 7a of conductive attaching body 7 as shown in Fig. 1 without being cut or damaged by the twisting force of conductive screw 9, and without displacing the bus bar since one side of bent piece 4a is in the form of a flat surface.

During this fastening, while bent pieces 4a and 4b of conductive member 5 are pushed against the painted surface of conductive attaching body 7 by the twisting force of conductive screw 9, since conductive screw 9 is screwed into hole 8 of conductive attaching body 7 while projection 3 of bent pieces 4a and 4b is forcibly pushed into attachment hole 2 by the inner surface of the head of conductive screw 9, conductive screw 9 is screwed in and fastened at a right angle to conductive attaching

body 7 as shown in Fig. 1.

Following this fastening, conductive screw 9 does not become inadvertently loosened by external disturbances such as vibrations and so forth due to the powerful resilient contact friction of the above-mentioned bent piece 4b securely making resilient contact with the inner surface of its head.

Furthermore, the shape of bent pieces 4a and 4b to be formed on conductive member 5 is not limited to the above-mentioned curved cylinder, but rather various shapes of bent pieces 4a and 4b can be employed as shown in each of the drawings of Figs. 5A, 6A and 7A.

In addition, although an example of attaching attached body 1 is described in the above-mentioned embodiment wherein its surface on which conductive member is provided makes contact with conductive attaching body 7, as shown in Figs. 8 and 9, said attached body 1 may also be fastened with conductive screw 9 by having the surface of said attached body 1 on which a conductive member is not arranged make contact with conductive attaching body 7.

The following provides an explanation of a second embodiment of the present invention with reference to the drawings.

First, with respect to the basic constitution of this second embodiment, in the attaching of a conductive member arranged on

the surface of an insulated attached body to a conductive attaching body while maintaining electrical continuity, bent pieces 4a and 4b, having projection 3 which slightly protrudes from attachment hole 2 of insulated attached body 1 made of plastic and so forth as shown in Fig. 3B, are inserted into attachment hole 2, and conductive member 5, in the form of a brass bus bar and so forth, which is integrated into a single unit with bent pieces 4a and 4b, is arranged on the surface of the above-mentioned attached body 1, for example on flat groove 1a.

As a result of the surface of the above-mentioned attached body 1 on which the conductive member is arranged making planar contact with metal conductive attaching body 7, in the form of an automobile door or chassis, as shown in Fig. 4, and tightly fastening the above-mentioned attached body 1 to hole 8 of this conductive attaching body 7 as shown in the same drawing, or to a nut welded to conductive attaching body 7, with conductive screw 9, in the form of a tapping screw and so forth, inserted through the above-mentioned attachment hole 2, the leading ends of bent pieces 4a and 4b of the above-mentioned conductive member 5 can be connected to the inner surface of hole 8 of the above-mentioned conductive attaching body 7 with the above-mentioned screw 9 while maintaining electrical continuity.

During this fastening, while bent pieces 4a and 4b of

conductive member 5 is pushed against the painted surface of conductive attaching body 7 by the twisting force of conductive screw 9, since conductive screw 9 is screwed into attachment hole 2 while projection 3 of bent pieces 4a and 4b is forcibly scratched and cut by the inner surface of the head of conductive screw 9, conductive screw 9 is screwed in and fastened at a right angle to conductive attaching body 7.

Namely, as a result of the above-mentioned bent pieces 4a and 4b being tightly clamped by means of projection residual portion 3a between the inside of the head of conductive screw 9 and the painted surface of conductive attaching body 7 in the state wherein the majority of its projection 3 has been scratched and cut away, the above-mentioned conductive member 5 can be favorably connected to conductive attaching body 7 at the inner surface of its hole 8 through conductive screw 9 by means of its bent pieces 4a and 4b while maintaining electrical continuity.

In addition, following this fastening, conductive screw 9 does not become inadvertently loosened by external disturbances such as vibrations and so forth due to the powerful resilient contact friction resulting from the small residual portion 3a of projection 3 of the above-mentioned bent pieces 4a and 4b securely inserted and making contact with the inner surface of its head.

Furthermore, the shape of bent pieces 4a and 4b to be formed

on conductive member 5 is not limited to the above-mentioned curved cylinder, but rather various shapes of bent pieces 4a and 4b can be employed as shown in each of the drawings of Figs. 5B, 6B and 7B.

As a result of having the composition as explained above, the present invention offers the advantages described below.

When fastening attached body 1 to hole 8 of conductive attaching body 7 with conductive screw 9 inserted into attachment hole 2 of attached body 1, since conductive bent pieces 4a and 4b are present in attachment hole 2 of attached body 1 aligned with its inner surface, the inner surface and periphery of attachment hole 2 are able to be reinforced by bent pieces 4a and 4b, thus offering the advantage in terms of manufacturing since attached body 1 can be securely fastened to painted surface 7a of conductive attaching body 7 without being cut or broken off by the twisting force of conductive screw 9.

During this fastening, while bent pieces 4a and 4b of conductive member 5 are being pushed against painted surface 7a of conductive attaching body 7 by the twisting force of conductive screw 9, since conductive screw 9 is screwed into hole 8 of conductive attaching body 7 while projection 3 of bent pieces 4a and 4b is forcibly pushed into attachment hole 2 by the inner surface of the head of conductive screw 9, conductive screw

9 is able to be screwed in and fastened at a right angle to conductive attaching body 7, and is not inadvertently loosened by external disturbance in the form of vibrations and so on due to the powerful resilient contact friction of the above-mentioned bent piece 4b securely making resilient contact with the inner surface of its head, thereby offering the advantage of eliminating the need for a spring washer.

In addition, since projection 3 of bent pieces 4a and 4b of the above-mentioned conductive member 5 is forcibly pushed into attachment hole 2 by conductive screw 9 inserted in hole 8 of conductive attaching body 7 through attachment hole 2 of the above-mentioned attached body 1 due to the powerful twisting force of the above-mentioned conductive screw 9 as shown in Fig. 1, enabling it to make resilient contact with the inner surface of the head of conductive screw 9 as shown in Fig. 1 as a result of strongly bending bent piece 4b with slight looseness, the above-mentioned conducting member 5 is able to be connected to the inner surface of hole 8 of conductive attaching body 7 while maintaining electrical continuity, thereby offering numerous advantages including being able to reliably maintain a state of electrical continuity for a long time.



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CLAIMS

1. A conductive connector apparatus for ensuring electrical continuity between a conductive member of the apparatus and a conductive attaching body in which is formed a screw-receiving hole, the apparatus comprising an insulated attached body in which is formed a hole for alignment with the hole in the conductive attaching body on planar contact of the insulated attached body with the conductive attaching body, the bore of said hole in the insulated attached body including at least one flat portion thereon, a conductive member including a portion thereof arranged on a surface of the insulated attached body, and a bent piece located in, to line at least part of, the hole in the insulated attached body, said bent piece including a flat portion aligned with said flat portion of said hole, and a conductive screw extending through the hole in the insulated attached body to be received in the receiving hole in, to make conductive contact with, the conductive attaching body, the screw head making conductive engagement with said conductive member whereby there is electrical continuity between the conductive member and the conductive attaching body.

2. Apparatus as claimed in claim 1 in which the bent piece of the conductive member extends through, to protrude from, the hole in the insulated attached body whereby, on tightening of the screw into the conductive attaching body, said bent piece forcibly engages both the screw head and the conductive attaching body.

3. Apparatus as claimed in claim 1 in which the end of



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the bent piece of the conductive member remote from the portion thereof arranged on a surface of the insulated attached body has a plurality of projections thereon which protrude from the hole in the insulated attached body whereby, on tightening of the screw into the conductive attaching body, said bent piece forcibly engages both the screw head and the conductive attaching body with said projections cutting into the adjacent surface of the screw head or the conductive attaching body.

4. Apparatus as claimed in any one of claims 1 to 3 in which the bent piece is of generally D-shape in transverse section.

5. Apparatus as claimed in any one of claims 1 to 3 in which the bent piece is of generally rectangular shape in transverse section.

6. Apparatus as claimed in any one of claims 1 to 3 in which the bent piece is of generally U-shape in transverse section with a flat base thereto.

7. A conductive connector apparatus substantially as described with reference to and as illustrated by the accompanying drawings.

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