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CONNECTOR COVER

Detailed Description of Invention

(Technical Field of Invention)

This invention relates to a connector cover for protecting a mating opening of a connector to receive a mating connector.

(Prior Art)

It is well known that a cover is used to protect the mating opening of said connector, which is for receiving a mating connector. Examples of such connector covers are disclosed in US Patent 5,096,428 and US Patent 4,258,970. The former shows a cover to cover a whole elongated mating opening of a connector. A portion of the cover, which is located in the mating opening, is frictionally engaged with the mating opening such that the cover is kept on the connector.. The latter discloses a cover for protecting a mating opening of a circular connector. The cover has retention means to be engaged with locking means formed on a

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connector housing of the connector.

(Problem to be Solved)

Advantageously the cover disclosed in USP 5,096,428 is sufficiently miniaturized. The cover is not so large when compared with the connector. However, the cover might be undesirably released from the connector, since the retention force is not large. Therefore, sufficient protection of the mating opening is not assured during the lifetime of the device including the connector. On the other hand, the cover disclosed in USP 4,258,970 can provide relatively large retention force. However the cover size is relatively large. In addition, the cover have to be correctly aligned with the connector housing by the installer in order to attach it. Therefore, it requires much labor. Furthermore, the cover might be undesirably released from said connector since a portion of the locking arm is projected outward.

Therefore, the purpose of this invention is to provide a miniaturized connector cover which is to be kept on a connector with relatively large retention force. It is preferable that the connector cover can be released if desired in a relatively easy way.

(Means to Solve the Problem)

This invention provides a connector cover to be attached to a connector having a substantially rectangular mating opening for receiving a mating connector and a locking portion located on one inner surface of said mating opening for locking said mating connector, where said mating opening is covered by said connector cover when said connector cover is attached to said connector, comprising a flat plate portion having a larger area than said mating opening to

cover said mating opening, a locking arm extending out of said flat plate portion to be engaged with said locking portion, and at least one engaging surface to be abut against an opposite inner surface opposite to said one inner surface at least at a first position close to an opening edge of said mating opening and a second position spaced away from said opening edge.

Preferably, said connector cover further comprises engaging portions to be engaged with said mating opening to stop lateral movement of said connector cover attached to said connector.

Preferably, said locking arm projects away from said flat plate portion and then extends back toward said flat plate portion via a U-shaped portion to be ended in the vicinity of said flat plate portion, and has a locking projection thereon to be engaged with said locking portion.

Preferably, said locking arm has a larger width than said locking projection in the vicinity of a leading end of said locking arm and adapted to be engaged with a portion of said one inner surface at both sides of said larger width.

Preferably, said connector cover further comprises supplemental walls projecting from said flat plate portion to extend in the height at both sides of said locking arm and adapted to be engaged with said one inner surface at a position closer to said flat plate portion than said locking projection when said connector cover is attached to said connector.

Preferably, said at least one engaging surface is formed at bottom ends of a pair of horizontally spaced vertical walls projecting out of said flat plate portion and extending in the height direction.

Preferably, said engaging portions include a pair of ribs coupled with both



of said vertical walls and said flat plate portion.

Preferably, a pair of projections having smaller projecting size than said locking projection and being located at said both sides close to said leading end of said locking arm are provided to be engaged with said portion of said one inner surface of said mating opening.

(Embodiment of Invention)

A preferable embodiment of connector cover according to this invention will be explained hereinafter with reference to attached drawings.

Figure 1 is a perspective view showing a connector cover according to this invention together with a connector.

A connector cover 10 is adapted to be attached to a substantially rectangular mating opening 101 of a connector 100. The connector 100 has a flange 110. The flange 110 is used for mechanically securing the connector 100 to a panel of an apparatus (not shown). The connector 100 is attached to the panel such that the mating opening 101 can be accessed from outside through an opening formed in the panel. The mating opening 101 is usually covered by the connector cover 10 attached thereto. However, in order to connect a mating connector (not shown) to this connector 100, the connector cover 10 is released from the mating opening 101. Figure 1 shows a pair of different mating projection structures 170, 180 to be mated with a mating connector. Namely, the connector cover 10 is used to protect these structures 170, 180.

Figure 2 shows a detailed structure of the connector cover, where (a) is a plan view, (b) is a front view, (c) is a side view, (d) is a cross section view along the line D-D in (a).

A connector cover 10 has a flat plate portion 20 for covering the mating opening 101 of the connector 100. One surface or an inner surface 21 of the flat plate portion 20 is to be faced toward the mating opening 101, while the opposite surface or outer surface 22 is to be faced outward. A plurality of projecting structures can be seen on one surface 21, which will be explained hereinafter. On the other hand, the opposite surface 22 includes a plurality of horizontal ribs 23. These ribs 23 make it easier to for an installer to actuate the connector cover 10 by his or her fingers when the installer attach the cover 10 to the connector 100. It is also notable that a curved smooth surface 25 is formed along a total length of the opening edges of opposite surface 22 of the flat plate portion 20.

A flat plate portion 20 has a recess 26 at a top edge 24a thereof. A locking arm 50 is formed corresponding to this recess 26. The locking arm 50 projects out of one surface 21 of the flat plate 20. The locking arm 50 has an extending base 59, a U-shaped portion 55 and an extending portion 56 extending backward toward the flat plate portion 20 at a higher position. Therefore, a free end 51 of the locking arm 50 is facing toward a space 27 determined by the recess 26 and terminated at a coplanar surface with respect to one surface 21. It is also notable that the locking arm 50 is not extended out of the size of flat plate portion 20.

Furthermore, as shown in Figure 2, a pair of upwardly projecting projections 52 are formed in the vicinity of the free end 51 of the locking arm 50. The projections 52 are spaced in the width direction. The locking arm 50 also includes a single locking projection 53 projecting upward at a position spaced from the free end 51 at the center position in the width. The locking projection 53 has larger projecting size than the projections 52.

The locking projection 53 is utilized as locking means for locking the connector cover 10 onto a mating opening 101 of the connector 100. The locking projection 53 has a locking shoulder 54 having a surface which is slightly angled with respect to a top surface of the extending portion 56. The locking projection 53 has another angled surface 57 at the opposite side of the locking shoulder 54.

On the other hand, each of the projections 52 includes an angled surface 61 continuously extending from the free end 51, a top end 62 and a shoulder 63 facing opposite to the locking shoulder 54 of the locking projection 53. The shoulder 63 is configured to have an acute angle with respect to the top surface of the extending portion 56. A gap between the pair of projections 52 becomes narrower as it is spaced from the free end 51.

A pair of first walls 70 are projected from the inner surface 21 of the flat plate portion 20 to extend in the height close to both side edges 24b of the flat plate portion 20. The first wall 70 includes a flat bottom engaging surface 71, straight leading end 72 extending in the height, and a curved edge portion 73 located at the upper side of the leading end 72. An outer side surface 74 of each first wall 70 has a horizontally extending rib 75 that is also coupled with the flat plate portion 20. The rib 75 locates close to the border between the straight leading end 72 and a curved edge portion 73, and terminates at the angled surface 76. The first walls 70 of the connector cover 10 are adapted to be received in the side channels 102 of the connector 100 (see Figure 1) having relatively low height size.

The connector cover 10 further comprises second walls 80. The second walls 80 locates at both sides outside of the locking arm 50 and inside of the pair of first walls 70. Each of the second walls 80 has relatively small height compared

to the first wall 70, and located to cover the sides of free end 51 and the extending base 59 of the locking arm 50. A top end of the second wall 80 has a horizontal surface 81, and a angled or curved corner portion 82. It is also notable that the projecting size of the second wall 80 which is determined by a length between the flat plate portion 20 and a leading end 83 is relatively small compared to the projecting size of the first wall 70.

Figure 3 is a cross section view showing a cover attachment preparing stage or a cover released stage. Figure 4 is a cross section view similar to the Figure 3, showing a cover attached to the connector. Figure 5 is a cross section view similar to Figure 3, showing an alternative cover attachment preparing stage. In these figures, the contacts are not shown.

The operation for attaching the connector cover 10 will be explained hereinafter. At the first stage, the connector cover 10 is roughly aligned to the mating opening 101 in the connector 100. Then the connector cover 10 is pushed toward the mating opening 101 such that the first and second walls 70, 80 and locking arm 50 are received in the mating opening 101. Thereby the first walls 70 are inserted into side channels 102 as explained above. The locking projection 53 of the locking arm 50 is engaged with locking shoulder 130 formed on a top side inner surface 151, thereby the connector cover 10 is kept on the connector 100, as shown in Figure 4.

It is notable that at the initial alignment stage for attaching the connector cover 10, the cover 10 can be oriented toward various directions as shown in Figure 3 or 5. The connector cover 10 is moved from various preparing stages of various orientations such as shown in Figure 3 or 5 to a single locking position

shown in Figure 4. Namely, it is notable that the connector cover 10 can be easily inserted into the mating opening 101, even when the flat plate portion 20 is angled in desired large or small angle or perpendicularly oriented at the initial preparing stage.

If flat plate portion 20 of the connector cover 10 is angled in a relatively large angle as shown in Figure 3, the bottom engaging surface 71 is firstly engaged with the bottom opening edge 108 of the mating opening 101. Then the connector cover 10 is rotated toward the direction of ARROW A shown in Figure 3 with the surface 71 being slid on the bottom edge 108. At the final stage, locking arm 50 is deflected, and then the locking projection 53 rises over the engaging wall 115 of the connector 100 to be locked with locking shoulder 130. The angled surfaces 76 of the ribs 75 formed along outer surface of the first walls 70 guides the insertion of the connector cover 10 by cooperating with side opening edges 109 in the channels 102 and side surfaces 122 in the channels 102 so that the cover 10 is smoothly received into the mating opening 101.

On the other hand, if the flat plate portion 20 is perpendicularly oriented or has slightly angled orientation, as shown in Figure 5, the connector cover 10 is mainly slid into the mating opening 101 in the direction shown by ARROW B, though it might be slightly rotated during the insertion. Then the locking arm 50 is deflected and the locking projection 53 goes over the engaging wall 115 to be locked by the locking shoulder 130. The angled surfaces of the ribs 75 also guide the insertion of the connector cover 10.

As shown above, the connector cover 10 is locked at a single locking position that is shown in Figure 4. When the cover 10 is kept at the locking

position, the locking projection 53 is engaged with the locking shoulder 130 as explained above, and the projections 52 abut the engaging wall 115 inside the mating opening 101, and the bottom engaging surfaces 71 of the first walls 70 abut the bottom inner surface 118 inside the mating opening 101 in the desired length away from the flat plate portion 20. It is notable that the locking arm 50 provides the connector cover 10 with downward biasing force such that the cover 10 is securely retained on the connector 100. It is also notable that the top horizontal surface 81 can stop upward movement of the connector cover 10 by cooperating with the engaging wall 115 in order to prevent the locking arm 50 from being damaged. In addition, it is also notable that the connector cover 10 is prevented from being moved freely in the lateral direction, since the ribs 75 locate close to the side surfaces 122.

As explained above, it is assured that the connector cover 10 is kept on the connector 100, since the movement of the connector cover 10 is advantageously prevented and the locking projection 53 of the locking arm 50 is effectively engaged with the locking shoulder 130. In addition, because the free end 51 of the locking arm 50 does not extend over the flat plate portion 20, usually it cannot be accessed from outside. Therefore undesirable release of the connector cover 10 is prevented.

A special tool (not shown) is used for releasing the connector cover 10. The tool is inserted into the space 27 to be engaged with the locking arm 50 such that the locking arm 50 is deflected to release the engagement between the locking projection 53 and the locking shoulder 130. The operator can actuate the tool in a desirable manner to release the connector cover 10 from the connector 100.



Especially the shoulder 63 of the projections 52 can be engaged with the tool, thereby the connector cover 10 can be pulled out of the mating opening 101 of the connector 100. The angled surfaces 61 of the pair of projections 52 make it easier to insert the tool. The connector cover 10 is rotated toward the rotation direction A' opposite to the direction A (see Figure 3), while the connector cover 10 is pulled out of the connector 100 by actuating the tool, such that the cover 10 is moved from the locking position shown in Figure 4 to the released position shown in Figure 3.

The engagement between the engaging wall 115 and the second walls 80 of the connector cover 10 for preventing the damage of the locking arm 50 is released while the rotation movement to release the cover 10. However it is notable that the engagement between the curved edge portions 73 of the first walls 70 and the top side shoulders 112 in the mating opening 101 can stop upward movement of the connector cover 10. Therefore the damage of the locking arm 50 is advantageously prevented even in this transition stage.

As explained above, the connector cover 10 according to the present embodiment can be oriented to various directions when it is in an initial attachment preparing position. Therefore, the installer can easily attach the connector cover 10 onto the connector 100. On the other hand, the cover 10 can not be undesirably released from the connector 100, since a special tool is necessary to release the cover 10 from the connector 100. However, advantageously the cover 10 can be easily released from the connector 100 when the tool is used.

It is obvious that some modifications can be made by an artisan within the scope of the present invention. For example, the cover also can be applied to an

optical connector though above embodiment shows an electrical connector.

(Advantage)

The connector cover according to the present invention is characterized by comprising a flat plate portion having a larger area than a mating opening to cover the mating opening, a locking arm extending out of the flat plate portion to be engaged with a locking portion, and at least one engaging surface to be abut against an opposite inner surface opposite to one inner surface at least at a first position close to an edge of the mating opening and a second position spaced away from the edge. Therefore, the cover can be easily attached to a connector by the installer, since the cover can be oriented to various directions in the initial preparing stage. In addition, the cover can be surely kept on the connector, and it is not undesirably released.

Brief Description of Drawings

(Figure 1)

Perspective view showing a connector cover according to this invention together with a connector.

(Figure 2)

Drawings showing the detail structure of the connector cover, where (a) is a plan view, (b) is a front view, (c) is a side view, (d) is a cross section view along the line D-D in (a)

(Figure 3)

A cross section view showing a cover attachment preparing stage or a cover released stage.

(Figure 4)

A cross section view similar to Figure 3, showing the cover attached to the connector.

(Figure 5)

Another cross section view similar to Figure 3, showing an alternative of a cover attachment preparing stage.

(Description of Reference Numerals)

- 10 connector cover
- 20 flat plate portion
- 50 locking arm
- 53 locking projection
- 71 engaging surface (bottom surface)
- 75 engaging portion (rib)

- 80 supplemental wall (second wall)
- 100 connector
- 101 mating opening
- 118 opposite inner surface (bottom inner surface)
- 130 locking portion (locking shoulder)
- 151 one inner surface (top inner surface)



Claims

1) A connector cover to be attached to a connector having a substantially rectangular mating opening for receiving a mating connector and a locking portion located on one inner surface of said mating opening for locking said mating connector, where said mating opening is covered by said connector cover when said connector cover is attached to said connector, comprising:

a flat plate portion having a larger area than said mating opening to cover said mating opening;

a locking arm extending out of said flat plate portion to be engaged with said locking portion, and

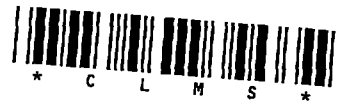
at least one engaging surface to be abut against an opposite inner surface opposite to said one inner surface at least at a first position close to an opening edge of said mating opening and a second position spaced away from said opening edge.

2) The connector cover of claim 1, wherein said connector cover further comprises an engaging portion to be engaged with said mating opening to stop lateral movement of said connector cover.

3) The connector cover of claim 1, wherein said locking arm projects away from said flat plate portion and then extends back toward said flat plate portion via a U-shaped portion to be ended in the vicinity of said flat plate portion, and has

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a locking projection thereon to be engaged with said locking portion.

4) The connector cover of claim 3, wherein said locking arm has a larger width than said locking projection in the vicinity of a leading end of said locking arm and adapted to be engaged with a portion of said one inner surface at both sides of said larger width.

5) The connector cover of claim 3, wherein said connector cover further comprises supplemental walls projecting from said flat plate portion to extend in the height at both sides of said locking arm and adapted to be engaged with said one inner surface at a position closer to said flat plate portion than said locking projection when said connector cover is attached to said connector.