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COMPONENT MOUNTING SYSTEM

The present invention relates to a system for mounting components arranged to slide out from a housing to facilitate access to the components. Such a system might be used, for example, in a telephone exchange, where the components are typically mounted on a card with each card carrying, e. g., a number of integrated circuits, and, in the case of an exchange for use with broadband optical networks, solid state opto-electronic devices. One example of such a system is disclosed in our earlier granted European patent 397706.

When the components form part of a circuit on a card, it is important that the mounting system should enable access to the card, without requiring the components on the card to be decoupled from the larger system of which they form a part. Accordingly it is necessary to provide a connection, in the form of electrical wiring or optical fibres as appropriate, extending from the card via the housing for connection to the rest of the system. The system might be of a type where the card can be pulled into an extended position for access. The connection must then be of sufficient length to extend between the housing and the card when the card is pulled out of the housing into its extended position. In practice, it is found that wiring or fibre optic cabling between the housing and the card tends to suffer damage as the card is moved in and out and, particularly in the case of fibre optic cables, this leads to degradation or in some cases complete failure of the connection between the card and the rest of the system.

According to the present invention, there is provided a component mounting system comprising a housing, a mounting member for supporting one or more components and mounted for relative movement with respect to the housing between a closed position in which the mounting member is at least

partially received within the housing and an open position in which the mounting member projects outside the housing, a connecting element extending in use of the system from the housing to the mounting member, and a support member located in the housing for supporting the connecting element, said support member being mounted in the housing by means allowing relative movement therebetween during at least part of the movement of the mounting member between the closed and open positions, so as to follow the movement of the mounting member.

The support arrangement may be such that as the mounting member is pulled out tightening the cable the cable conforms to the support member. By providing a curved support member with a minimum radius of curvature, this is found to be effective to prevent the development of kinks in the cable by ensuring that the radius of curvature of the cable is never less than that of the support member. This markedly improves the reliability of the mounting system, virtually eliminating failure due to cable breakage or damage. As well as being suitable for mounting cards carrying optoelectronic circuits the system of the present invention might be used, e.g., to mount splice/storage trays containing lengths of cable.

Preferably the connecting cable is a flexible duct having a bore of between 2mm and 7mm diameter.

Preferably the mounting member is mounted on one end of an arm, the other end of the arm being mounted to the housing, and the support member is integrally formed with the other end of the arm. Alternatively, the mounting member may be arranged to be removable from the housing, the mounting member once removed being freely oriented for access to the components mounted thereon.

Preferably the system further comprises a restraining member, at least part of the restraining member projecting radially away from the support member in a plane spaced from and generally parallel to a main wall of the housing, the connecting cable being constrained between the main wall of

the housing and the restraining member as it conforms to the support member.

Preferably the support member includes a curved wall substantially perpendicular to the main wall of the housing and the restraining member includes one or more radial lugs formed integrally with the curved wall.

Preferably the one end and other end of the arm are arranged to run in longitudinal slots formed in the mounting member and in the main wall of the housing respectively and providing a three-position slider.

Preferably, as mentioned above, the support member has a surface, against which the connecting element is bent, which surface defines a curve whose curvature is such that, when the connecting element conforms to that surface, the connecting element does not kink. Preferably this curvature is such that, when the connecting element comprises an optical fibre, the optical fibre is prevented from bending to a radius smaller than its minimum permissible bend radius.

A system in accordance with the present invention will now be described by way of example, with reference to the figures of the accompanying drawings in which:

Figures 1a and 1b are perspective views of a first embodiment in partially closed and open positions respectively;

Figures 2a to 2c are diagrams illustrating closed, intermediate and open positions of the connecting member in the first embodiment;

Figures 3a and 3b are perspective views of a second embodiment in partially closed and open positions respectively;

Figures 4a to 4d show the connecting ribbon in the second embodiment in closed, intermediate and open positions respectively and a cross-section through a sub-housing;

Figure 5 is a perspective view showing a number of cards mounted in a rack;

Figure 6 is a perspective view of a third embodiment in the open position;

Figure 7 is a perspective view of the embodiment of Figure 6 in the closed position;

Figures 8a to 8c are side elevations showing the embodiment of Figure 6 in closed, partially opened and fully opened positions respectively; and

Figure 9 is a cross-section.

A mounting system includes a number of cards 1 fixed to a mounting plate 2. The mounting plate 2 is mounted via an arm 3 to a housing 4. The ends of the arm 3 run in longitudinal slots 5, 6 formed in the housing and in the mounting plate respectively. The arm 3 and the slots 5, 6 in cooperation provide a three-position slider enabling the mounting plate and the cards to be drawn clear of the housing to allow access to the components on the cards.

In the present example, the components on the cards 1 include a number of opto-electronic devices. The circuits formed on the cards are connected to other circuits mounted in different housings by a tube 7 containing a number of fibre optic cables each provided within an individual smaller tube 20 respectively. The tubes 20 at one end extend through the mounting plate 2 to the circuits on the cards 1 and at the other end pass through the housing 4 and are terminated in a breakout unit for connection to other circuits. The blown fibre duct 21 connects at the breakout unit 22 from external circuits. The tube 7 may alternatively extend externally of the housing to form a continuous blown fibre duct without requiring a breakout 22.

A generally semi-circular upstanding wall 13 is formed on the end of the arm 3 nearer the housing 4. This wall provides a controlled radius around which the connecting cable 7 is tightened as the cards are moved between open and closed positions. Face 28 of the mounting plate 2 can be provided with optical connectors.

Figures 2a to 2c show the position of the connecting member with respect to the curved wall on the end of the arm as the system is moved between the closed and open positions. It will be noted that there is a "trombone" action: in the closed position the duct is in the form of an extended oval, with ends curved at a radius limited by the curved wall 13. In the open position the duct is in the form of a circle, the minimum radius of which is limited by the curved wall 13, with the ends extending away therefrom. At the extreme positions the duct conforms closely to the curved wall.

Typically in the extreme positions the duct is wound tightly around the former 13 and its counterpart. In the intermediate position however there is slack in the duct and in this position the upstanding side walls 8, 9 formed on the longitudinal edges of the main wall of the housing 4 serve in conjunction with the lugs 25 on the semi-circular wall 13 to hold the cable in the plane parallel to the main wall of the housing 4. Thus in combination they act as a restraining member. In an alternative embodiment (not shown) a continuous lip is used in place of the lugs on the semi-circular wall 13.

Figures 3a and 3b show an alternative embodiment. In this Figure the cards 1 are omitted for clarity. In this example, in addition to the fibre optic cable 7 extending between the cards and the housing 4 there is also provided a ribbon cable 14 providing an electrical connection. Standard connectors 11, 12 are provided at either end of the cable fixed to the housing and the mounting plate respectively. In this embodiment, the mounting plate includes in addition to a main wall 2a perpendicular side walls 2b, 2c. A downwardly facing channel 2d extends perpendicularly from the lower longitudinal edge of the main wall 2a. The connector for the ribbon cable is fixed at the end of the channel 2d nearest the housing. An upwardly facing channel of corresponding dimensions is formed in a bottom wall of the housing. When the system is in the

closed position the downwardly and upwardly facing channels together define a sub-housing which holds the ribbon cable with the cable folded back on itself. As shown in Figures 4a to 4c, as the cards are extended the ribbon cable unfolds in a controlled fashion.

Typically a number of mounting systems of the type disclosed above will be mounted side-by-side in a rack 30, as shown in Figure 5. A number of plates 2 carrying cards 1 are located in the rack 30 and are movable by means of arm 3 in the associated slot. In the Figure, the arrangement is shown reversed to that of Figure 1 so that face 28 is now in front. In addition as shown, fibre and splice storage trays 31 could also be accommodated within rack 30.

Figures 6 to 9 show a further alternative embodiment. In this embodiment, the housing includes in addition to a main wall 4'a, upper and lower walls 4'b, 4'c extending transversely from the main wall 4'a and downwardly and upwardly extending lips 4'd, 4'e formed on the ends of upper and lower walls 4'b, 4'c remote from the main wall 4'a. These together define a channel in which a mounting member 2' and cards 1' slide freely.

The mounting member in this example is a box 2' which may be used to hold a number of cards 1' and or fibre and splice storage trays. The box 2' is not in this example joined to the housing 4' by an arm and so is free to be pulled entirely clear of the housing as shown in Figure 6. It can therefore be orientated in different planes to facilitate access to the components it houses. As in the previous embodiments, the cable 7' connecting the cards 1' to the rest of the system is wound round a radiused member and conforms to that member as the box and cards 1', 2' are moved with respect to the housing 4'. In this embodiment the radiused member comprises two parts R1, R2. Each of these parts is generally semi-circular in plan so that in the position shown in Figure 6 and Figure 8a with the two parts abutting, the radiused member as a whole is generally circular. As shown in the Figures, one of the parts, R1

projects into the channel for the box and cards 1', 2'. This part runs in a slot 5' formed in the main wall 4'a of the housing. When the mounting box 2' is re-inserted in the channel and pushed back towards the closed position, then the rearwardly facing edge of the box 2' abuts a forwardly facing diametric wall of the one part R1 of the radiused member and then pushes that part of the radiused member home into the fully closed position shown in Figure 8a. To move the system back into the open position, the box 2' is pulled forward tightening the cables 7' around the one part of the radiused member R1, thereby pulling that part forwards.

The other part of the radiused member R2 lies wholly within a cavity formed by the main wall 4'a of the housing and a peripheral secondary wall 4'f which defines the inner edge of the channel in which the box 2' runs.



CLAIMS

1. A component mounting system comprising a housing, a mounting member for supporting one or more components and mounted for relative movement with respect to the housing between a closed position in which the mounting member is at least partially received within the housing and an open position in which the mounting member projects outside the housing, a connecting element extending in use of the system from the housing to the mounting member, and a support member located in the housing for supporting the connecting element, said support member being mounted in the housing by means allowing relative movement therebetween during at least part of the movement of the mounting member between the closed and open positions, so as to follow the movement of the mounting member.

2. A system according to claim 1, wherein said support member is attached to the mounting member so that movement of the mounting member relative to the housing acts on the support member to follow the movement of the mounting member.

3. A system according to any one of the preceding claims, further comprising an additional support member for the connecting element, the connecting element being disposed about both support members in use of the system, the additional support member being fixedly mounted with respect to the housing so that the two support members are closer together when the system is in said open position with respect to the closed position.

4. A system according to any one of the preceding claims wherein the support member comprises a radiused portion about which, in use of the system, the connecting member conforms during at least part of the movement of the mounting member between the closed and the open portions.



5. A system according to claim 4, further comprising a restraining member, at least part of the restraining member projecting radially away from the support member in a plane spaced from and generally parallel to a main wall of the housing, the connecting cable being constrained between the main wall of the housing and the restraining member as it conforms to the support member.

6. A system according to claim 5, in which the support member includes a curved wall substantially perpendicular to the main wall of the housing, and the restraining member includes one or more radial lugs formed integrally with the curved wall.

7. A system according to any one of the preceding claims, in which the mounting member is arranged to be removable from the housing, the mounting member once removed being freely oriented for access to the components mounted thereon.

8. A system according to any one of the preceding claims, in which the mounting member is mounted on one end of an arm, the other end of the arm being mounted to the housing, and the support member is integrally formed with the other end of the arm.

9. A system according to claim 8, in which the one end and the other end of the arm are arranged to run in longitudinal slots formed in the mounting member and in the main wall of the housing respectively and providing a three-position slider.

10. A system according to any one of claims 1 to 7, in which the housing includes means defining a channel for guiding the movement of the mounting member with respect to the housing, the support member including at least a first portion projecting into the path of the mounting member and arranged to run in a longitudinal slot in the housing, in



use the mounting member abutting the said first portion to push that portion along the housing towards one end as the mounting member is moved from the open position to the closed position.

5 11. A system according to claim 10, in which the support member includes a further portion fixed adjacent the end of the longitudinal slot remote from the one end of the housing, the first portion and further portion together forming a generally cylindrical surface to which the
10 connecting cable conforms when the first portion is at the said end of the longitudinal slot.

12. A system according to any one of the preceding claims including cooperating downwardly and upwardly facing channels extending from the housing and the mounting member
15 and together defining a sub-housing for a ribbon cable connecting the housing to the mounting member.

13. A system according to any of the preceding claims, wherein said connecting element comprises at least one optical fibre and the support member or members define a
20 minimum radius of curvature for the connecting element.

14. A system according to any one of the preceding claims in which the connecting cable comprises a flexible duct having a bore of between 2 and 7mm diameter.

15. A system as claimed in claim 14, wherein the duct
25 includes at least one optical fibre package, the package being a loose fit within the said bore.

16. A system as claimed in claim 15, wherein the fibre package has an external diameter of between one tenth and one half of the diameter of said bore.



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17. A system as claimed in claim 15 or claim 16, wherein said package is a blowable fibre unit.

18. A system substantially as hereinbefore described with respect to the accompanying drawings.