PATENT SPECIFICATION (11) 1596006

1596006

(21) Application No. 11763/78 (22) Filed 23 March 1978 (19)
(31) Convention Application No. 52/034255 (32) Filed 23 March 1977 in
(33) Japan (JP)
(44) Complete Specification published 19 Aug. 1981
(51) INT. CL.³ H01R 13/62
(52) Index at acceptance
H2E 111 CD

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(54) ELECTRICAL CONNECTOR

(71) We, BUNKER RAMO CORPORATION, a Corporation organised and existing under the laws of the State of Delaware, United States of America, of 900 Commerce Drive, Oak Brook, Illinois, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to the field of electrical connectors, and more particularly to connectors with devices for facilitating the coupling and uncoupling of the electrical connectors.

Electrical connectors are used in almost every modern day electronic and electrical device. The use of electrical connectors facilitate service of the device by permitting removal of individual components of the device for repair or replacement. Due to the trend of miniaturization in the electronic industry, these connectors are frequently very small and often must be positioned in cramped areas, making the coupling and uncoupling of the connectors very difficult.

In order to assure proper electrical connection, it is necessary that the conductors of the mating connectors be biased towards each other with a certain minimum contact pressure. This pressure causes a certain amount of friction when the two connectors are coupled or uncoupled. With the modern multi-conductor connectors containing a large number of individual contact, this frictional force becomes very significant.

Due to the friction and the cramped quarters, it is often very difficult to couple or uncouple electrical connectors in complicated electronic devices. Additionally, one or both of the connectors is often supported by a relatively fragile circuit board which is not capable of withstanding the force required to couple or uncouple the connector. Therefore, very expensive electronic equipment is often damaged by improper or careless connection of the connectors.

Prior art connectors include various handles to facilitate grasping of connectors in hard to get to places, but a need exists for a means to decrease the amount of force applied to a connector and its mounting during the connection process, without decreasing the contact pressure of the individual contacts.

According to the present invention there is provided an assembly comprising two mating electrical connectors and a device for coupling and uncoupling the connectors, including at least a lever pivotally mounted on each of two opposite sides of one of the connectors; and at least one lever engagement means on each of two opposite sides of the other of the connectors, one of said lever and lever engagement means comprising a projection and the other comprising a slot for slidably and pivotably receiving the projection; whereby movement of the levers in one direction causes a corresponding movement of the connectors toward each other, and movement of the levers in the opposite direction causes relative movement of the connectors away from each other, each lever includes a manually engageable end, the slot being closer to the pivot point of the lever than the manually-engageable end is to said pivot point, so that the lever provides a mechanical advantage for coupling and uncoupling the connectors, the levers being arranged with their respective manually engageable ends in facing relationship and a single handle slidably and pivotably coupled to the manually engageable ends of the levers so that movement of the handle means toward the said one connector causes movement of both levers in the said one direction and movement of the handle means away from the said one connector causes movement of the levers in the opposite direction.

The invention will now be described in

detail with reference to the accompanying drawings which include a preferred embodiment of the device for coupling and uncoupling electrical connectors according to the present invention.

In the drawings:

Figures 1a, b and c are front elevational, plan and side elevational views, respectively, of a pair of mating electrical connectors;

Figures 2a and b are partial front elevational views of the connectors of Figure 1 in partially coupled configurations;

Figures 3a, b, c, d and e are detail views showing alternate embodiments of the lever and engagement member;

Figure 4 is a front elevational view of a pair of mating connectors with a coupling device, according to the present invention.

As shown in Figures 1a, b, and c, electrical connector 1 includes extending side members 2a and 2b. Each of these side members terminates in two parallel finger-like extensions 3a1, 3a2, 3b1, 3b2. Engagement members 4a and 4b extend between respective pairs of the finger-like extensions. In the particular embodiment shown, the connector 1 includes sideways extending connection pins 5 adapted to be connected to a printed circuit board.

Mating electrical connector 6 includes cable passageway 7 and parallel extending housing members 8a and 8b. Pivotally mounted levers 9a and 9b are mounted between the members 8a and 8b, and include manually engageable ends 10a and 10b, respectively. The manually engageable ends may include a bent-over portion 11a and 11b to facilitate grasping of the levers.

The other ends 12a and 12b of the levers 9a and 9b, respectively, include slots 13a and 13b for slidingly and pivotally engaging the members 4a and 4b, respectively. The levers 9a and 9b pivot about the pivot points 14a and 14b, and the distance between the slot 13a and the pivot 14a is preferably considerably shorter than the distance between the pivot 14a and the manually engageable end 10a of the lever 9a. In this way, a considerable mechanical advantage may be provided by the lever, and the force required to couple and uncouple the connectors is reduced by the ratio of the two lengths.

As shown in Figures 1a, b, and c, the two levers may conveniently be arranged such that their manually engageable ends 10a and 10b are in a facing relationship. This greatly facilitates simultaneous movement of the levers, since a technician can easily place one of his fingers under each of the folded over portions 11a and 11b, and pull the levers away from the connectors in order to uncouple the connectors. On the other hand, in order to couple the connectors, a technician can simply press the two levers toward the connectors with one or two fingers. Due to the mechanical advantage of the levers, the force applied to the connectors and therefore the force applied to the connector mountings is greatly reduced. This greatly reduces the chances of damaging the delicate circuit board or other electrical equipment on which the connectors are mounted.

Figure 2a shows a portion of the electrical connectors in the uncoupled position. In this position, the engagement member 4a is just entering the slot 13a and the electrical contacts 15 have not yet entered the connector 6. In order to fully couple the two connectors, a small amount of force is applied to the manually engageable end 10a of the lever 9a to cause its movement in the direction of arrow A. This causes a corresponding rotation of the end 12a in the direction of the arrow B. Since the engagement member 4a is in contact with the wall of the slot 13a, the connectors are caused to move toward each other in the direction of arrow C.

In a similar manner, when the connectors are to be uncoupled, the manually engageable end 10a is moved in the direction of the arrow A′ (opposite to the direction A) causing a corresponding movement of the end 12a in the direction of the arrow B′ and the separation of the two connectors as indicated by the arrow C′ in Figure 2b.

Although the engagement member 4a is shown to be cylindrical in Figures 1 and 2, Figure 3a shows an alternate form of engagement member 15a which is rectangular in cross-section. The slot 13a′ is enlarged to prevent binding.

If desired, the engagement member can take the form of two walls forming a slot 16a. The protrusion 17a of the lever freely slides and rotates within the slot 16a.

Figures 3c, 3d, and 3e show an alternate forms in which the lever 9b′ is pivotally mounted to the connector 1. Accordingly, the engagement member 15b is mounted on the connector 6.

Additionally, in Figure 3c, the lever 9b′ includes a protrusion 23 which engages a stop 24 to limit movement of the lever. In this way, the lever 9b′ will be in a position which ensures easy engagement of the member 15b in the slot 13b′ when the connector 6 is to be coupled to the connector 1.

It is often advantageous to provide a latching mechanism which prevents inadvertent disconnection of the connectors as a result of an accidental force applied to the connectors due to acceleration of the apparatus or a strain on the cable. Such a locking mechanism is shown in Figure 3d and includes tab 18b on the end of resilient arm 19b of lever 9b″. When the connectors are fully coupled, the tab 18b engages the upper wall of the slot 20b on connector 6. Due to the mechanical advantage provided by the

lever 9b″, a tremendous force applied between connectors 1 and 6 results in only a relatively small force applied to the locking mechanism. Therefore, the locking mechanism is capable of holding the connectors together against a relatively large force, whereas only a relatively small force is required at the manually engageable end of lever 9b″ in order to disengage the locking mechanism.

If further security is required, holes 21b and 22b may be provided in levers 9b‴ and connector 6, respectively. When the connectors are fully coupled, a pin or wire seal (not shown) may be inserted through the two holes in order to positively prevent disconnection of the electrical connectors.

Figure 4 shows an embodiment of the present invention, which is similar to the assembly of Figures 1 and 2 but includes handle member 25 slidably and pivotally connected to the ends 10a′ and 10b′ of the levers by means of slot 26. According to this embodiment, both levers can be moved simultaneously by movement of the handle member 25. Finger opening 27 provides a convenient grasping point for the handle member so that the connectors 1 and 6 may be coupled or uncoupled with one finger. As the handle member 25 is pulled away from the connector 6, the levers are moved in a direction separating the connectors. Since the two levers move together, the connector 6 is pulled straight out of the connector 1, and the possibility of the connectors binding or of the contacts being damaged due to a twisting movement of the connector 6 is eliminated.

WHAT WE CLAIM IS:—

1. An assembly comprising two mating electrical connectors and a device for coupling and uncoupling the connectors, including at least a lever pivotally mounted on each of two opposite sides of one of the connectors; and at least one lever engagement means on each of two opposite side of the other of the connectors, one of said lever and lever engagement means comprising a projection and the other comprising a slot for slidably and pivotably receiving the projection; whereby movement of the levers in one direction causes a corresponding movement of the connectors toward each other, and movement of the levers in the opposite direction causes relative movement of the connectors away from each other, each lever includes a manually engageable end, the slot being closer to the pivot point of the lever than the manually-engageable end is to said pivot point, so that the lever provides a mechanical advantage for coupling and uncoupling the connectors, the levers being arranged with their respective manually engageable ends in facing relationship and a single handle slidably and pivotably coupled to the manually engageable ends of the levers so that movement of the handle means toward the said one connector causes movement of both levers in the said one direction and movement of the handle means away from the said one connector causes movement of the levers in the opposite direction.

2. An assembly according to claim 1, further comprising latching means for releasably preventing movement of the levers in the opposite direction when said connectors are coupled.

3. An assembly according to claim 1 or 2, further including a stop for limiting movement of the levers in the said opposite direction.

4. An assembly according to any of the preceding claims in which the said projection comprises a pin and the slot is open-ended for engagement with the pin.

5. An assembly substantially as hereinbefore described with reference to Fig. 4 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon) Ltd.—1981. Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1596006 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

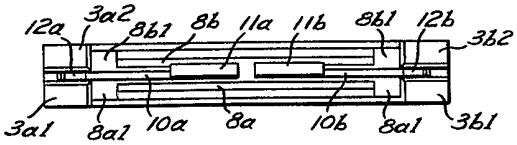

Fig. 1B

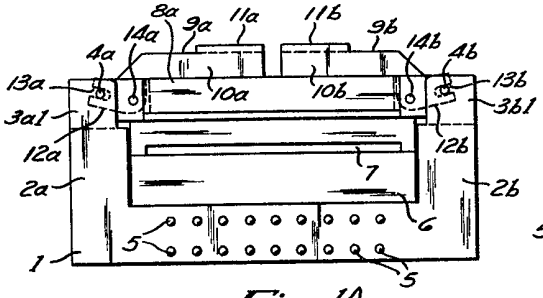

Fig. 1A

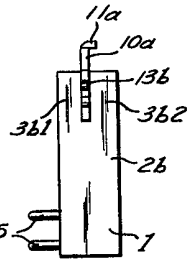

Fig. 1C

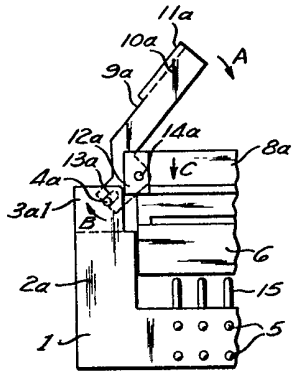

Fig. 2A

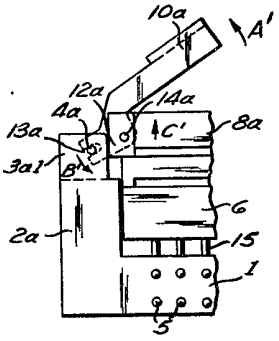

Fig. 2B

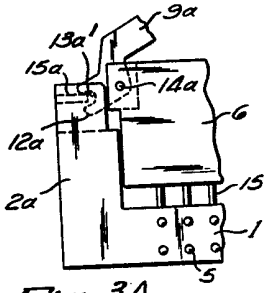

Fig. 3A

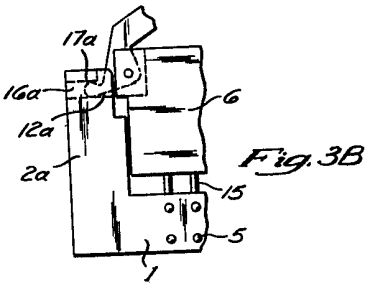

Fig. 3B

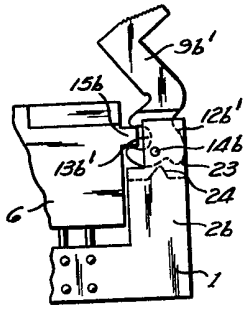

Fig. 3C

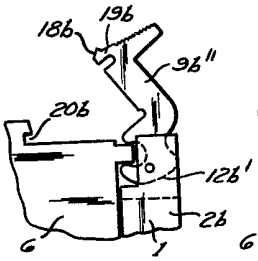

Fig. 3D

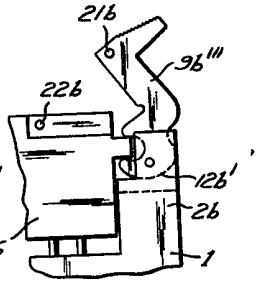

Fig. 3E

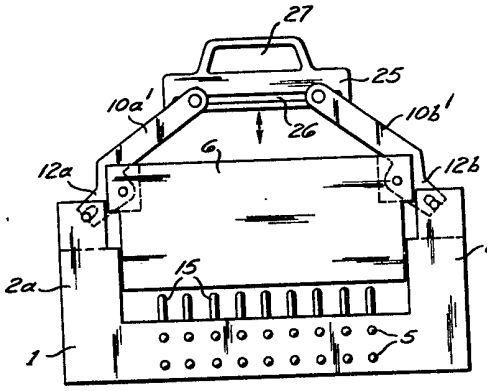

Fig. 4