United States Patent

Goldman

[15] **3,648,219**

[45] **Mar. 7, 1972**

[54] ELECTRICAL CONNECTOR MOUNTING RAIL AND DISCONNECTING ASSEMBLY

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[22] Filed: **Jan. 15, 1970**

[21] Appl. No.: **3,015**

[52] **U.S. Cl.** .....**339/45 M,** 339/198 GA

[51] **Int. Cl.**.....**H01r 9/00,** H01r 13/62

[58] **Field of Search**.....339/45, 46, 75, 198, 196

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Assistant Examiner—Terrell P. Lewis
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[57] **ABSTRACT**

A mounting rail for mounting a plurality of uniform electrical connectors with their connecting ends in transverse alignment includes transverse locking members to engage corresponding recesses formed on the connector housing to prevent longitudinal displacement among the mounted connectors. The preferred rail is an elongated C-shaped channel member with locking lips formed on the inner surfaces of the upper and lower walls thereof, and mounting flanges may be provided at the forward or open end thereof for panel mounting. A disconnect assembly is also provided for "peeling" the longitudinally engaged banks of connectors, which preferably comprises a lever and cam apparatus.

4 Claims, 15 Drawing Figures

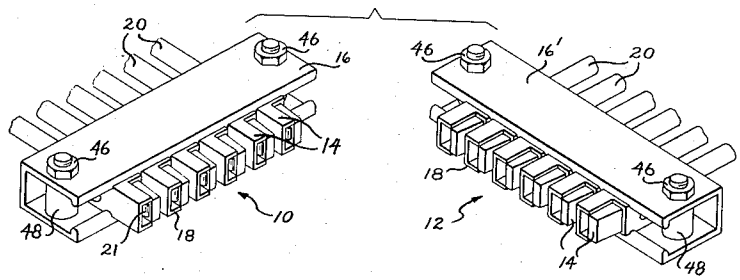


FIG. 1

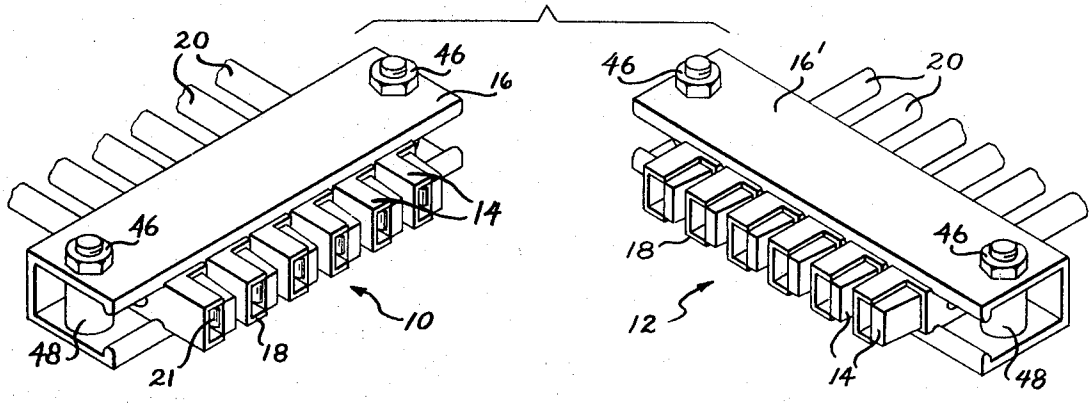
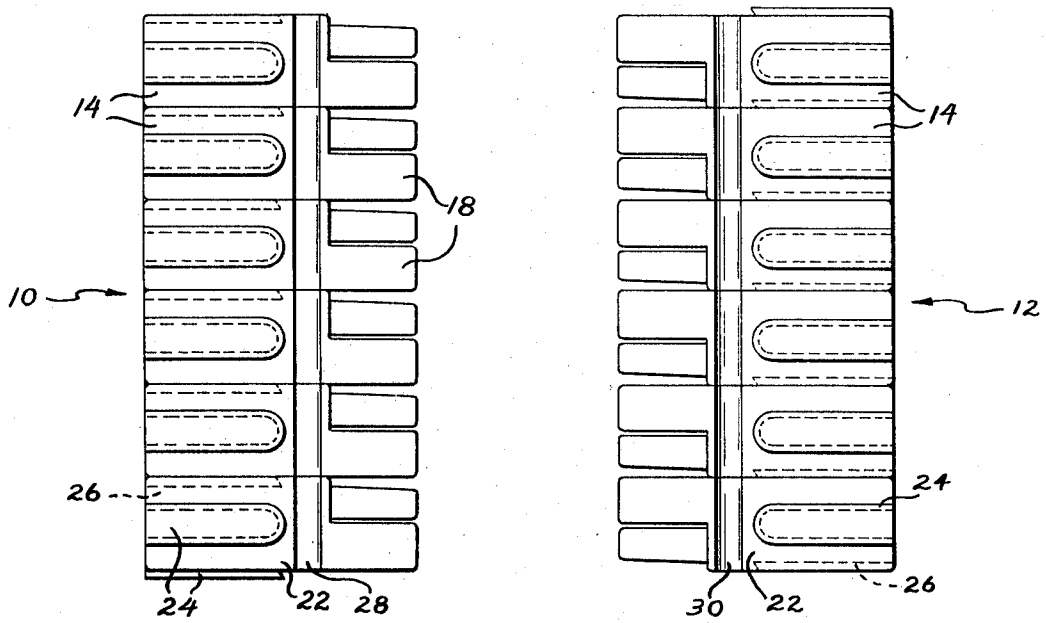


FIG. 2 PRIOR ART



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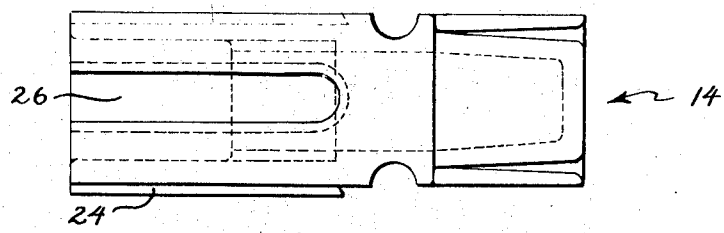


FIG. 3 PRIOR ART

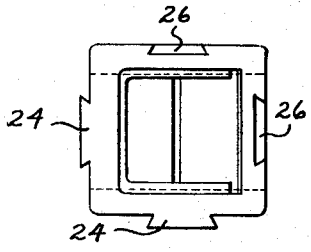


FIG. 4 PRIOR ART

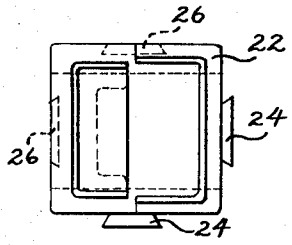


FIG. 5 PRIOR ART

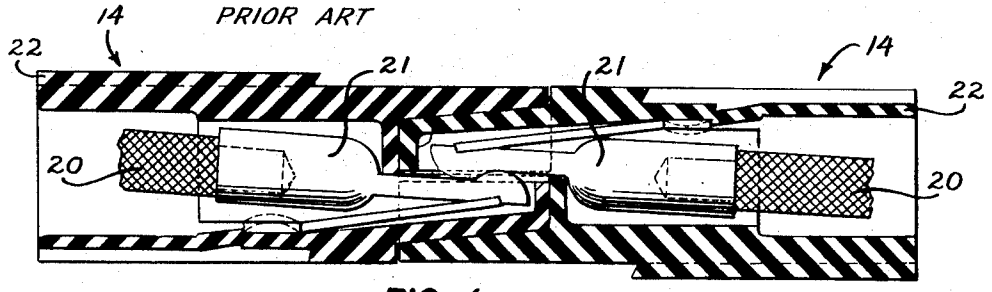


FIG. 6
PRIOR ART

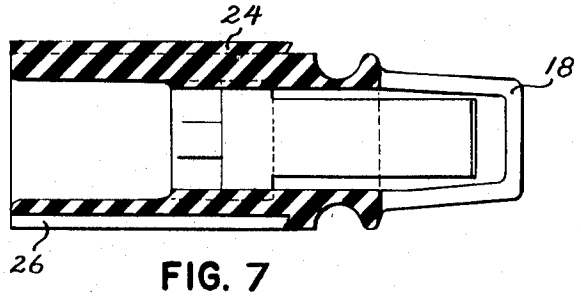


FIG. 7
PRIOR ART

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FIG. 8

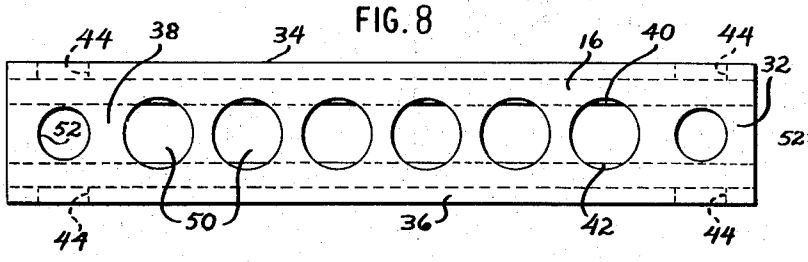


FIG. 9

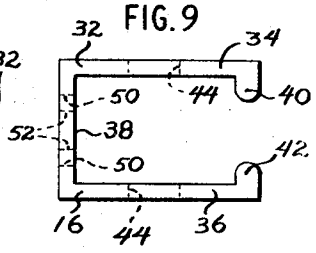


FIG. 10

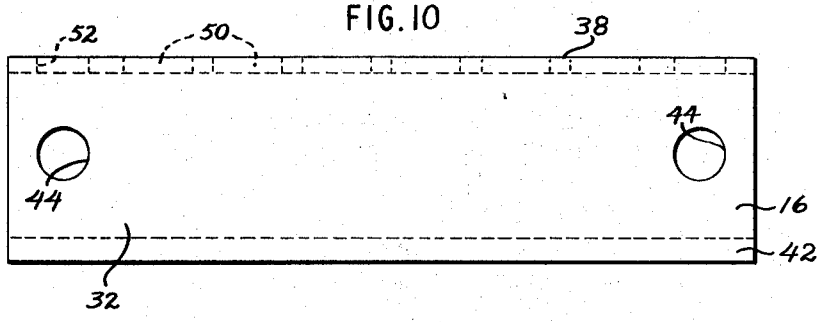


FIG. 11

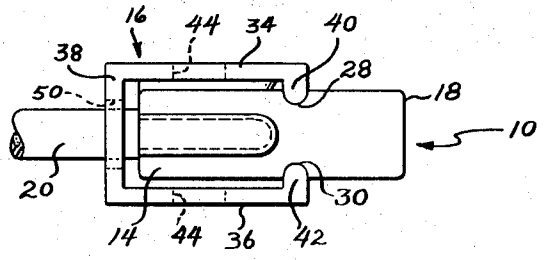
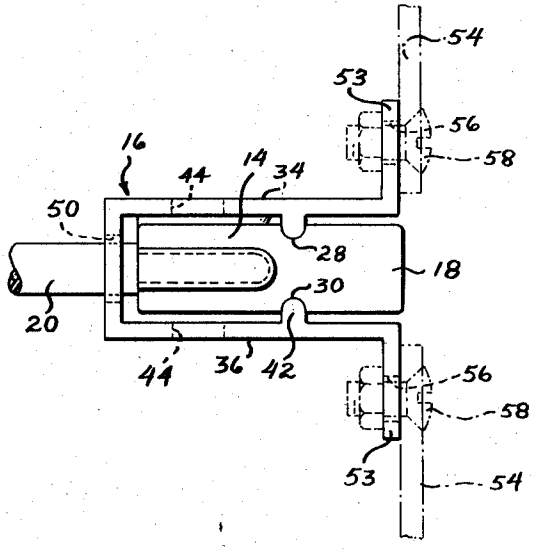


FIG. 12



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FIG. 13

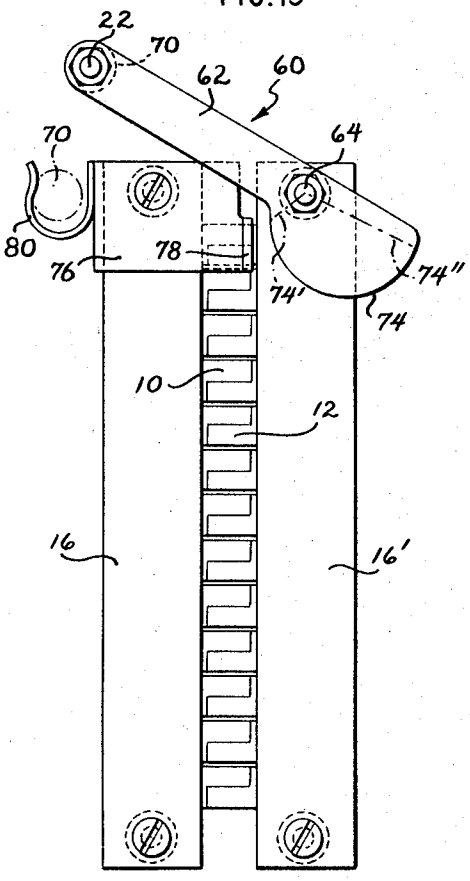
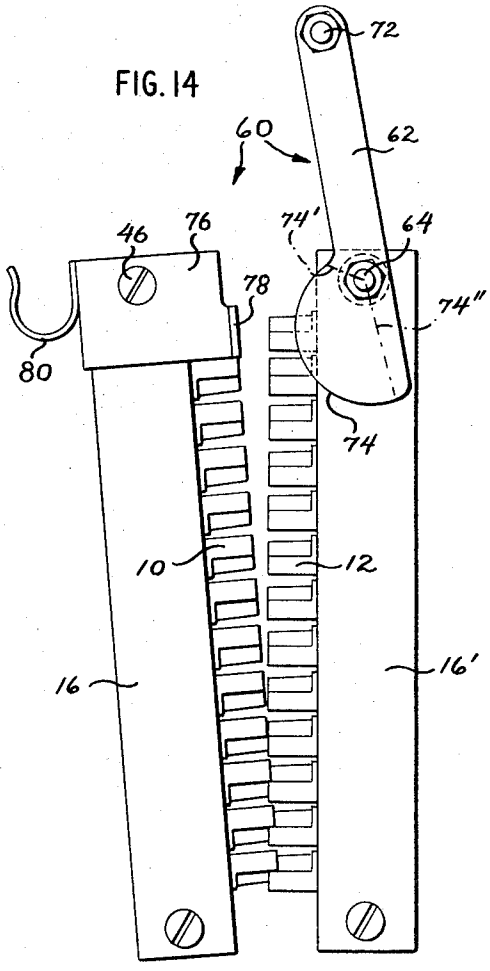


FIG. 14



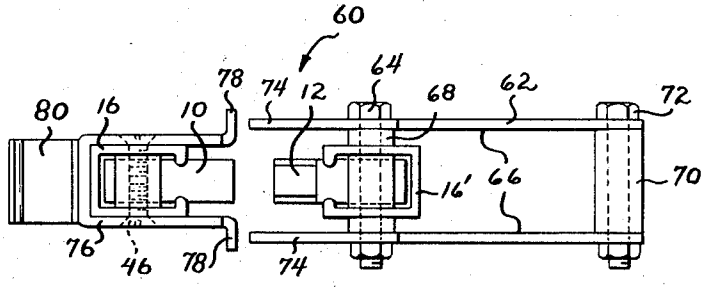


FIG. 15

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ELECTRICAL CONNECTOR MOUNTING RAIL AND DISCONNECTING ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates generally to electrical connectors and is more particularly concerned with a rail for mounting connectors to form an aligned bank and a disconnect assembly for disconnecting such bank assemblies.

It is an increasingly common practice to use printed circuit boards and the like in electrical circuitry to break down the various components of an electrical apparatus into modular units. When such units are interconnected it is generally desirable to interconnect a number of circuits at one time. To that end, the present invention contemplates a mounting rail and electrical connector assembly for securely mounting a plurality of connectors in bank form so that all connectors may be engaged "en masse" with a similar bank of connectors to rapidly close a number of circuits substantially simultaneously.

The invention further provides a disconnect assembly for facile and rapid disconnection of two engaged banks of connectors, which is particularly important in high current applications where frequently the resistance to separation of the connectors may not be manually overcome.

These objects and further objects, features and advantages of the invention will become apparent as the description of the preferred embodiment thereof proceeds with continued reference to the drawings wherein:

FIG. 1 is a perspective view of two banks of electrical connectors mounted in mounting rails in accordance with the invention;

FIG. 2 is an exploded plan view of the connector banks shown in FIG. 1;

FIG. 3 is a plan view of one of the electrical connectors shown in FIG. 1;

FIGS. 4 and 5 are end views of the connector shown in FIG. 3 as seen from the left and right hand ends;

FIG. 6 is a cross-sectional view of a pair of identical single pole connectors joined together;

FIG. 7 is a cross-sectional detail view of the insulating connector housing;

FIG. 8 is a rear elevation of a mounting rail in accordance with the preferred embodiment of the invention;

FIG. 9 is an end elevation of the mounting rail shown in FIG. 8;

FIG. 10 is a bottom elevation of the mounting rail shown in FIG. 8;

FIG. 11 is an end elevation of a connector bank and mounting rail assembly;

FIG. 12 is a view similar to FIG. 11 depicting a modified form of mounting rail for mounting with a panel;

FIG. 13 is an elevational view of two connector bank assemblies in longitudinal engagement with the preferred disconnecting assembly mounted at one end thereof;

FIG. 14 is a view similar to FIG. 13 showing the connector banks as partially disengaged by the disconnecting assembly; and

FIG. 15 is an end elevation of the preferred disconnecting assembly.

With initial reference to FIG. 1, two banks indicated generally at 10 and 12 of identical connectors 14 adapted for longitudinal telescopic engagement with each other are shown mounted in mounting rails 16 and 16', respectively, so as to present the connecting ends 18 of the connectors 14 in each bank 10 and 12 in aligned, transverse linear relationship to each other. Electrical cables indicated typically at 20 pass into each connector 14 and it should be understood each cable 20 has a terminal 21 which is secured within a connector 14 for electrical engagement with a similar terminal carried in a mated connector 14 in the manner such as disclosed in the patents referred to directly below.

The connector banks 10 and 12 are best seen with reference to FIG. 2 and are preferably composed of connectors 14 of the

type disclosed in U.S. Pat. Nos. 3,218,599 and 3,259,870. FIGS. 3 through 7 are taken from U.S. Pat. No. 3,259,870 and correspond to FIGS. 1 through 5 thereof. The connectors 14 are of uniform size and have elongated substantially rectangular housings 22 which are formed with longitudinal dovetailed tongues 24 on two sides thereof with corresponding longitudinal dovetailed grooves 26 formed on the opposite sides therefrom so that a plurality of the connectors 14 may be interlocked in side by side and/or stacked relationship to form a connector assembly or bank with the ends of the connector housings aligned and flush with each other. The connecting end 18 of each connector is adapted to detachably carry a terminal 21 secured to the end of the cable 20 and to longitudinally engage a similar connector 14 to bring the respective terminals into longitudinally overlapped, resiliently urged, floating frictional engagement or contact. Moreover, the housings 22 are formed with at least one and preferably two transverse locking recesses or semicircular grooves 28 and 30 on opposite sides thereof, which grooves 28 and 30 are also aligned when the connectors 14 are assembled into the banks 10 and 12.

Looking now at FIGS. 8–10, the retaining rail 16 preferably comprises an elongated C-shaped channel member 32 having an upper wall 34, a lower wall 36 and a rear wall 38. At least one and preferably two depending locking members or lips 40 and 42 are formed on the inner surfaces of the upper and lower wall 34 and 36, respectively, and are spaced from each other and from the rear wall 38 so as to define an opening for slideably receiving and engaging by transverse insertion the aligned locking grooves 28 and 30 of the connector bank 10, as shown in FIG. 11. It should thus be apparent that the locking lips 40, 42 cooperate with the aligned locking grooves 28, 30 to prevent longitudinal movement of the connectors 14 within the connector bank 10. Although only one row of connectors 14 is shown, it should be understood that several rows of the preferred connectors may be stacked and mounted in the rail 16 with a corresponding increase in distance between the locking lips 40 and 42. It should also be apparent that connector 14 other than those described herein and in any referenced patents may be employed with the invention by providing them with locking recesses similar to the grooves 28 and 30.

To prevent transverse movement of the connector bank 10 within rail 16, tightening means receiving apertures 44 are formed in the upper and lower walls 34, 36 at each end of the rail 16 to receive tightening means such as bolts 46 (see FIG. 1), which bolts 46 preferably carry cylindrical spacers 48. It should thus be appreciated that transverse displacement of the connector bank 10 may be frictionally prevented by tightening the bolts 46 to force the locking lips 40, 42 into the grooves 28, 30. Of course other conventional tightening means such as C-shaped clamps and the like may also be employed to perform the function.

In order to afford access to the mounted connectors 14, a plurality of cable access apertures designated typically at 50 are formed at equispaced points on the rear wall 38 so that the cables 20 may be longitudinally inserted in and retracted from the individual mounted connectors 14 without necessitating their removal from the retaining rail 16.

The rear wall 38 is also provided with two fastening means receiving apertures 52 so that the rail 16 may be mounted to any desired supporting structure at this point, if desired. In the modified version of the rail 16 shown in FIG. 12, the upper 34 and lower 36 walls are extended forward of the locking lips 40, 42 and outwardly extending depending mounting flanges 53 formed at the forward end thereof to lie substantially flush with the connecting end 18 of the connectors 14 to facilitate mounting the rail 16 to a panel shown broken away in phantom lines and indicated at 54. Of course, any conventional fastening means may be employed to mount the rail 16 to the panel 54, with the preferred mounting means comprising mounting holes 56 formed in the flanges 53 to receive screws 58.

In light of this description of the preferred embodiment of the mounting rail and connector bank assembly, its advantages will now be briefly reviewed. The mounting rail **16** may be inexpensively manufactured as from extruded aluminum or similar materials such as plastics and the like. The rail **16** is designed for rapid assembly and disassembly of the connector banks which may be accomplished merely by transversely inserting the connectors **14** into the rail. Once assembled, the locking lips **28** and **30** securely resist any relative longitudinal movement among the connectors and transverse movement of the connector is prevented by the tightening means **46**. The connector and rail assembly has particular utility in printed circuit boards adapted for high-current applications (over 15 amps) and is most advantageously employed in such applications with the disconnect assembly now to be discussed.

When the connector banks **10** and **12** are fully engaged as shown in FIG. **13**, it has been found that the cummulative affect of the resistance to separation of the individual connectors **14** makes it very difficult to rapidly disconnect the banks solely by manual manipulations, particularly when each bank includes more than a few connectors. The separation resistance of the preferred connectors **14**, as disclosed in the above-referenced patents, is produced by opposed rounded contact faces provided on the connector terminal which are resiliently urged into longitudinal hooked or interlocked floating contact during longitudinal engagement. The optimum method of disengaging individual connectors of this type is to skew or flex the connectors **14** with respect to each other to minimize this resistance to separation rather than to merely pull them longitudinally apart. Another characteristic of connectors of this type is that once the high points of the rounded terminal contact faces have passed each other during disengagement, the resilient means urging the terminals together produces a slight "spring away" effect to aid rather than oppose further separation of the connectors.

As shown in FIGS. **13–15**, the invention accordingly provides a disconnect mechanism indicated generally by reference numeral **60** for quickly disconnecting two banks **10** and **12** of longitudinally engaged connectors, which mechanism **60** is preferably adapted to flex the connector banks **10** and **12** so as to sequentially disconnect connectors with a minimum of force being required. The disconnect mechanism **60** includes an elongated lever member **62** pivotally mounted at one transverse end of the connector bank **12** about an axis mutually perpendicular to the longitudinal engagement direction and to the transverse extent of the aligned connecting ends **18** as by a pivot bolt **64** passing through the upper and lower walls **34**, **36**, of its rail **16'**. The lever member **62** preferably includes two identical elements **66** disposed on either side of and externally to the rail **16'** as seen in FIG. **10**. The lateral spacing between the elements **66** is maintained by equal length cylindrical spacers **68** and **70** confined between the members **66** by the pivot bolt **64** and by a handle bolt **72** joining the outer ends of the members **66**. It should be apparent that the handle bolt **72** and spacer **70** provide a convenient means or handle for rotating the lever member **62** about the pivot **64**.

The inner ends of the lever elements **66** are formed to define identical cam surfaces **74** having progressively increasing radii with respect to the pivot **64** from a minimum closing radius **74'** to a fully open radius **74''**.

The second element of the preferred disconnecting mechanism **60** includes a "C-shaped" bracket **76** secured around the rail **16** of connector bank **10** as by the tightening bolt **46** located at the disconnecting end of the rail **16**. The forward end of the bracket **76** is provided with outwardly extending depending flanges **78** which are flush with the connecting ends **18** of the connector bank **10**. The lateral spacing between the elements **66** is greater than the outer lateral dimensions of the bracket **76** and the outer portions of the flanges **78** are broken away so that the lever member **62** may be rotated to seat the handle **70** in a retaining hook **80** secured (as by welding) to the rear wall of the bracket **76** (as indicated in dotted lines in FIG. **13**) to hold the disconnect mechanism **60** in its nonoperative position.

When it is desired to disconnect the connector banks **10** and **12**, the handle **70** may be rotated out of the retaining hook **80** in a clockwise direction as seen in FIGS. **13** and **14** about the pivot **64** until the cam surfaces **74** bear against the flanges **78**. Further, rotation of the handle **70** brings the progressively increasing radius portions of the cam surface **74** into contact with the bearing surfaces of the flanges **78** to cause the connected banks **10** and **12** to flex with respect to each other (see FIG. **14**) and to disconnect the connectors **14** sequentially starting with the connectors nearest the disconnect mechanism **60** and progressing to those remote therefrom. Obviously the maximum or fully open radius **74''** of the cam surfaces **74** will depend on the overall length of connector banks to be disengaged to insure that the throw of the cam surface **74** is sufficient to accomplish complete disconnection.

The force which must be applied to the handle **70** is kept to a minimum when the invention is employed in this manner because the connector banks are flexed to reduce the separation resistance of each connector junction. Moreover, by "peeling" the connector banks away from each other, the lever member **62** at any particular time must overcome only a portion of the total separation resistance of the banks **10**, **12** while the separation is somewhat aided by the "spring away" effect of previously disengaged connectors. Of course, the lever member **62** also has an inherent mechanical advantage corresponding to the ratio of the distances between the handle **70** and the pivot **64** and the cam radius **74** acting at any particular time. All of these features combine to afford facile and rapid disconnection of the banks **10** and **12**.

Although the preferred use of the disconnect assembly **60** is to "peel" the connector banks with a minimum of exertion, the invention may also be advantageously employed in applications where it is desired to break all circuits simultaneously by mounting disconnect assemblies **60** at both ends of the connector banks and operating the assemblies in unison.

It is my intention to cover all modifications and equivalents of my invention which do not depart from the spirit and scope of the appended claims.

What I claim is:

1. An apparatus for mounting in transverse aligned relationship a plurality of uniform sized electrical connectors of the type comprising an insulating, longitudinally extending housing open at each end and having a terminal member mounted therein, means adapting said connector for longitudinal electrical engagement with similar connectors, said housing being provided on opposite said thereof with tongues and grooves, respectively, adapted for mating engagement with the tongues and grooves of like connectors to produce a side-by-side assembly of connectors adapted for electrical engagement with the connectors of a second and similar assembly, said apparatus comprising in combination: means defining at least one transverse locking recess in each of said connector housings; and an elongated mounting rail, said mounting rail being formed to define an elongated opening to receive by transverse insertion a plurality of said connectors in tongue and groove mating side-by-side relationship, and having at least one locking member shaped to cooperate with said locking recess to prevent longitudinal displacement of said inserted connectors.

2. An apparatus for mounting in transverse aligned relationship a plurality of uniform sized electrical connectors of the type having housings adapted for longitudinal engagement with similar connectors, said apparatus comprising in combination: means defining two locking recesses formed transverse to and on opposite sides of said connector housings, and a mounting rail comprising an elongated C-shaped channel member having an upper wall, a lower wall and a rear wall, the forward portion of said C-shaped channel member being open to present the connecting ends of said connectors in transverse aligned relationship for longitudinal engagement with

similarly disposed connectors, depending lips formed on the inner surfaces of said upper and lower walls and shaped to cooperate with said locking recesses to prevent longitudinal displacement of said inserted connectors, and said rear wall having a plurality of transversely spaced cable receiving apertures formed therein to allow for longitudinal insertion and retraction of electrical terminals into and from said mounted connectors.

3. The apparatus of claim 1 wherein said mounting wall further includes tightening means for urging said locking members into said locking recesses to prevent transverse movement of said connectors with respect to said retaining rail.

4. The apparatus as claim 2 wherein said mounting rail is further characterized by said upper and lower walls extending forward of said locking members and having outwardly extending mounting flanges depending from the forward end of said upper and lower walls at a point substantially flush with the connecting ends of said inserted connectors.

* * * * *