

March 17, 1970

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3,501,736

MULTIPLE TERMINAL ELECTRICAL CONNECTOR

Filed Dec. 7, 1967

2 Sheets-Sheet 1

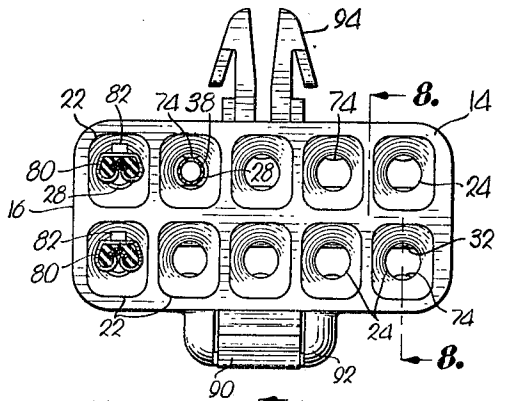


Fig. 3.

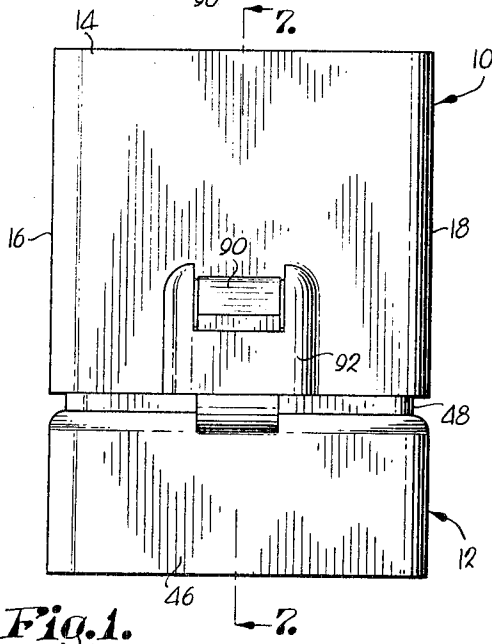


Fig. 1.

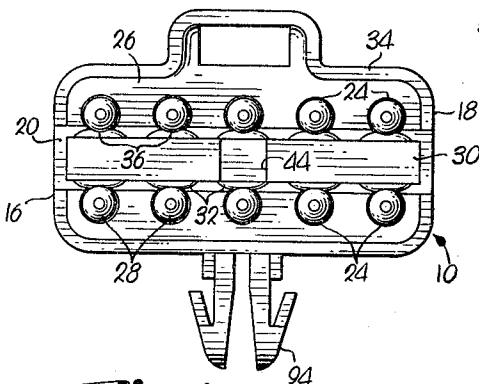


Fig. 4.

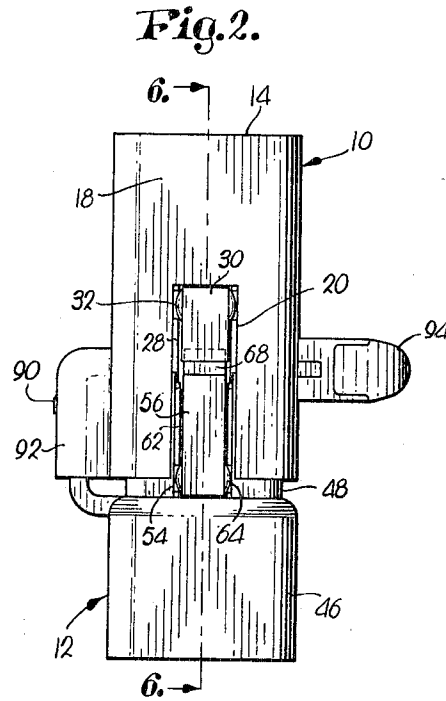


Fig. 2.

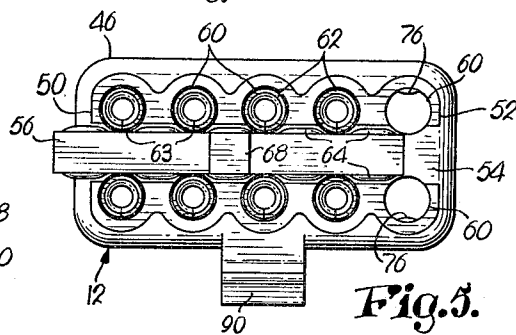


Fig. 5.

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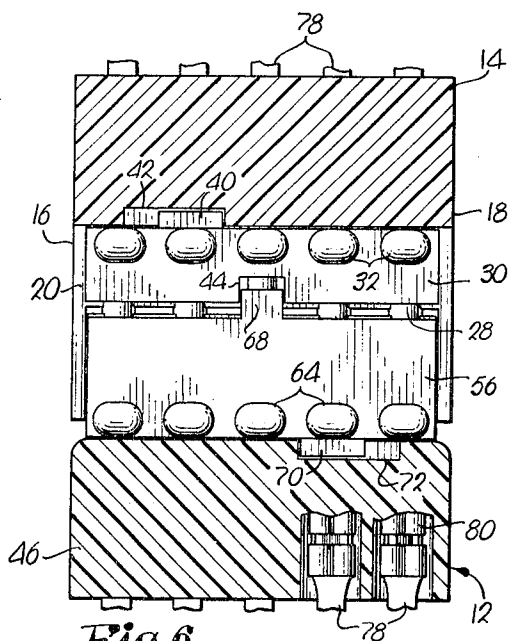


Fig. 6.

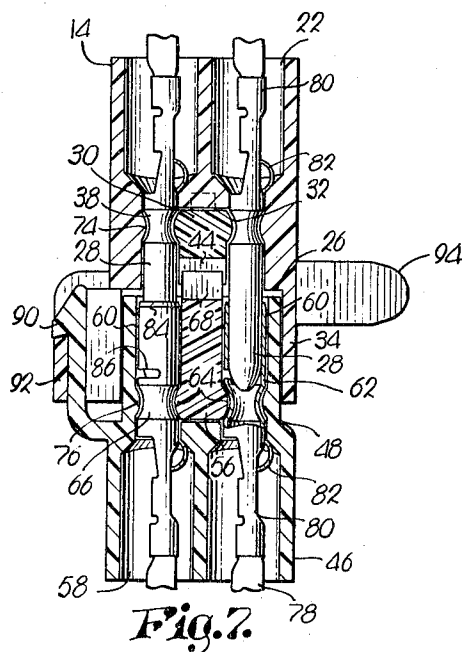


Fig. 7.

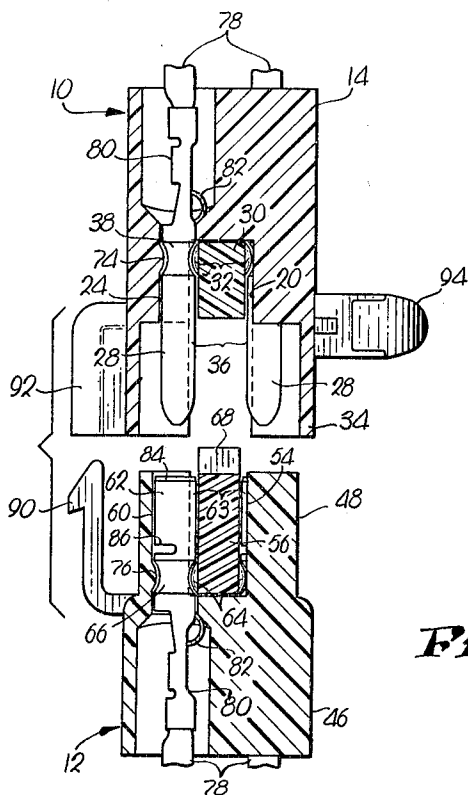


Fig. 8.

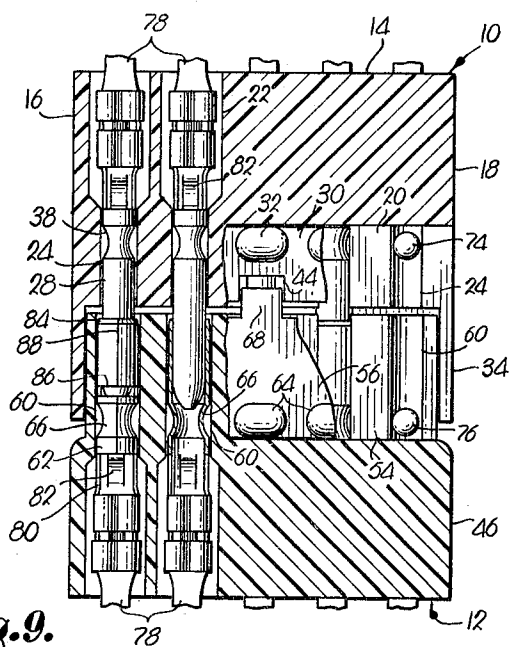


Fig. 9.

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3,501,736 MULTIPLE TERMINAL ELECTRICAL CONNECTOR

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U.S. Cl. 339—91

15 Claims

ABSTRACT OF THE DISCLOSURE

A connector has an insulator body provided with a shiftable locking bar which simultaneously captures a plurality of male or female terminals inserted within the body. The locking bar has a released or unlocked position utilized during loading of the insulator body with the terminals. As each terminal is inserted into the body, it is temporarily held against withdrawal therefrom by a restriction formed in the terminal-receiving opening. After all of the terminals are inserted into the body, the locking bar is shifted to its locked position to securely retain the terminals in place.

Two such connectors are employed to form a composite coupling, uniting of the two connectors being possible only if the locking bars thereof are both in their locked positions. Once united, the locking bars are interlocked by a detent to preclude movement thereof to terminal-releasing positions as long as the connectors are joined together.

In the automotive industry as well as other fields where electrical cables and connectors are employed, the trend at the present time is toward smaller electrical components and this is reflected in the cable and connector art as well as in packaged equipment. Thus, a need has arisen for a miniaturized coupling for electrical cables capable of use in production line operations to interconnect multilead cables. As an example, in the automotive industry a coupling is required at the fire wall of a vehicle to accommodate the emplacing of wiring harnesses in various sections of the vehicle at different times in the production line assembly.

Several problems, however, are presented when miniaturization is undertaken. The smaller the terminals in the cable connectors the more difficult it is to maintain working tolerances. Furthermore, for rapid assembly of the cables and connectors and minimization of possible damage to the miniaturized terminals, it is necessary that only relatively small insertion forces be required to load the terminals (on the ends of the cable leads) into the connector. Once in place, then means must be provided to rapidly and securely lock the terminals to the body of the connector. Finally, connectors of this type must be adapted for weatherproofing to protect the terminals from corrosion and provide a long useful life.

It is, therefore, an important object of the instant invention to provide a miniaturized connector for multilead cables which overcomes the problems and satisfies the requirements mentioned above.

Specifically, it is an important object of the instant invention to provide a cable connector having an insulator body for receiving and supporting terminals of the male or female type, wherein loading of the terminals into the body during assembly may be accomplished by the application of relatively small insertion forces and withdrawal of the terminals from the body, once inserted therein, is inhibited.

Furthermore, it is an important aim of this invention to provide a connector as aforesaid having a locking member therein which may be operated to selectively release

or lock the terminals in place within the body of the connector, whereby the assembly of the connector body and the terminals may be rapidly accomplished with assurance that the terminals will be properly positioned therewithin, yet providing a connector in which the terminals may be released for repair or other purposes if necessary.

Another important object of this invention is to provide such a connector in which the maintenance of close tolerances is not required in order to adapt the connector for use as a miniaturized coupling.

Still another important object to provide connectors as aforesaid which may be employed in pairs having mating male and female terminals, and which cannot be brought together for mating of such terminals unless the locking members of both connectors are in their locked positions.

Yet another important object is to provide a pair of connectors as set forth in the previous object wherein both locking members are automatically locked against movement to their unlocked positions when the two connectors are brought together to mate the terminals thereof and establish electrical continuity in multiple electrical circuits.

In the drawings:

FIGURE 1 is a side elevational view of the coupling showing the male and the female connectors thereof locked together, the leads extending from the coupling being deleted from the illustration;

FIG. 2 is an end elevational view of the coupling shown in FIG. 1;

FIG. 3 is a top plan view of the coupling shown in FIG. 1 illustrating three of the terminals in place in the female connector;

FIG. 4 is a bottom view of the female connector showing all terminals in place and the locking bar in its locked position;

FIG. 5 is a top plan view of the male connector showing 8 of the 10 terminals in place therein and the locking bar thereof in its unlocked position;

FIG. 6 is a vertical sectional view taken along line 6—6 of FIG. 2, the locking bars being shown in elevation for clarity;

FIG. 7 is a vertical sectional view taken along line 7—7 of FIG. 1;

FIG. 8 is an exploded, cross-sectional view taken substantially along line 8—8 of FIG. 3 and showing the terminals locked in place in both connector bodies; and

FIG. 9 is a view similar to FIG. 6 with parts being broken away to reveal the internal details of the coupling.

The coupling comprises a ten-way female connector 10 and a ten-way male connector 12 illustrated in the drawings as the upper and lower connectors, respectively, of the assembly. The connector 10 has an insulator body 14 of generally rectangular configuration, presenting opposed end walls 16 and 18 intercommunicated by an elongated, centrally disposed, longitudinally extending channel 20 in body 14.

Two rows of five generally rectangular insertion holes 22 are formed in the top of insulator body 14 and extend downwardly thereinto, each hole 22 communicating at its lower end with a cylindrical opening 24 coaxially aligned therewith. The lower end of each cylindrical opening 24 communicates with the bottom face 26 of body 14; therefore, ten continuous passages through body 14 are formed extending from top to bottom.

As is particularly clear in FIG. 4, the channel 20 extends alongside the two rows of openings 24 and is disposed therebetween in parallelism with the two rows, each opening 24 receiving a male bullet terminal 28 which projects downwardly from bottom face 26. A terminal locking member in the form of an elongated, rectangular bar 30 is received within channel 20 and is longitudinally shiftable therealong, the bar 30 being provided with five

spaced locking projections 32 along each side thereof. The bottom of body 14 is provided with a depending skirt 34 which enshrouds the male terminals 28 except at the ends of the channel 20.

A circumferential segment of each of the cylindrical openings 24 is open and communicates with channel 20, thereby exposing a portion 36 of each of the male terminals 28. These exposed portions 36 project into channel 20 as is clear from a comparison of FIGS. 4 and 8. Each of the male terminals 28 has an annular, arcuate depression 38 forming a part of the exposed portion 36 thereof, the adjacent locking projection 32 being received within the exposed part of depression 38 when the locking bar 30 is in its locked position illustrated in FIGS. 2, 4 and 6-9. Each of the locking projections 32 is in the form of an integral hump on member 32 having a convex outer surface as clearly revealed in FIGS. 2, 7 and 8.

The upper, longitudinal edge of locking bar 30 is provided with an upwardly projecting key 40 which is received within a keyway 42 in body 14. The ends of keyway 42 define the limits of longitudinal movement of bar 30 in channel 20, the opposite limits corresponding to the unlocked and locked positions of bar 30. It should also be noted that the lower, longitudinal edge of bar 30 is centrally slotted at 44 for a purpose to be subsequently discussed.

The male connector 12 includes an insulator body 46 of generally rectangular configuration, the body 46 having a reduced section 48 which telescopes into the skirt 34 of body 14. The reduced section 48 has opposed end walls 50 and 52 between which an elongated, centrally disposed channel 54 extends, the latter receiving a locking member in the form of an elongated, rectangular bar 56.

In a fashion analogous to female connector 10 described above, the body 46 has two rows of five, generally rectangular insertion holes 58 extending upwardly thereinto from the bottom thereof. Each of the holes 58 communicates at its upper end with a cylindrical opening 60, the latter depending vertically through the reduced section 48 to provide a continuous passage through body 46. A tubular, female terminal 62 is coaxially disposed in each opening 60, the latter having a circumferential segment thereof communicating with channel 54 to expose a portion 63 of the female terminal 62. The locking bar 56 is provided with five spaced locking projections 64 along each side thereof adjacent the lower longitudinal edge of bar 56, the projections 64 being of the same configuration as the projections 32 of locking bar 30.

Each of the female terminals 62 is provided with an arcuate, annular depression 66 forming a part of the exposed portion 63 thereof, each locking projection 64 being received within the exposed part of the depression 66 of a corresponding female terminal 62 when locking bar 56 is in its locked position illustrated in FIGS. 2 and 6-9. The upper longitudinal edge of bar 56 is provided with an integral, upstanding stud 68 which presents a detent receivable within slot 44 of locking bar 30 when the connectors 10 and 12 are brought together with both locking bars in the locked positions thereof. Additionally, the lower, longitudinal edge of bar 56 is provided with a depending key 70 which is received within a keyway 72 in body 46, the limits of keyway 72 defining the locked and unlocked positions of bar 56.

It should be understood that the drawings are oversize illustrations of a coupling of the type suitable for use with the cables of automotive wiring harnesses. The insulator bodies 14 and 46 are preferably of injection molded plastic material such as a modified polyphenylene oxide material (G.E. Noryl or equivalent). The locking bars 30 and 56 are also molded from the same material. Thus, except for the terminals, each of the connectors is composed of only two parts, each capable of being formed as an integral unit by injection molding.

Both the male and female terminals are formed from a flexible, metallic sheet material such as copper alloy.

A flat blank is first stamped from the sheet, and a subsequent forming operation imparts the desired shape to the finished terminal. It should be noted that the diameters of the terminal-receiving openings 24 and 60 are somewhat greater than the diameters of the terminals there-within, but that a restriction is formed in each opening 24 by a protuberance 74 which is received within the annular depression 38 of male terminal 28. Similarly, a protuberance 76 in each opening 60 is received within the annular depression 66 of the female terminal 62 there-within, thereby also forming a restriction in each of the openings 60. The various restrictions in openings 24 and 60 define zones of reduced diameter therewithin, requiring that the terminals be forced past the restrictions upon insertion into corresponding openings until the protuberances 74 or 76 become aligned with the corresponding depressions 38 or 66.

Each of the terminals 28 or 62 is secured to a corresponding electrical lead 78 by an integral lug 80 which is crimped to the exposed tip of lead 78 and also crimped thereon at the end of the insulated covering of lead 78. Thus, each of the terminals is both mechanically and electrically attached to the corresponding lead 78, a portion of the lug 80 being bent outwardly to present a stop 82 which seats against the shoulder formed at the inner end of the terminal receiving opening 24 or 60.

The male terminals 28 have closed, tapered noses for good alignment pickup, and the female terminals 62 have an external chamfer 84 at their outer ends to aid in the insertion thereof into openings 60. Additionally, each of the female terminals 62 has a transversely extending relief slot 86 therein adjacent depression 66 for insertion flexing of the two semicylindrical halves thereof formed during shape of the female terminal and which define proximal longitudinal edges seen at 88 in FIG. 9.

An external latch is integrally formed with the two insulator bodies 14 and 46 and comprises mating latch parts on both of the bodies in the form of a latch dog 90 extending from body 46 and a catch 92 formed on body 14. Additionally, for the purpose of attaching the coupling to an apertured panel such as the fire wall of a motor vehicle, for example, a body clip type latch 94 is integrally formed with insulator body 14. The clip 94 may be omitted if the coupling is to be employed as an in-line connector.

Either of the connectors 10 or 12 are loaded with respective terminals in the same fashion. Using the female connector 10 as an example, the locking bar 30 thereof is initially disposed in its released or unlocked position which, as viewed in FIG. 6, is with the left end of bar 30 protruding from the end wall 16 of body 14. The release position is defined by the left-hand limit of keyway 42. When bar 30 is released, its locking projections 32 are disposed between the various terminal-receiving openings 24 and thus do not interfere with the insertion of the male terminals 28 into body 14.

High insertion forces (greater than two to four pounds) are to be avoided and, to this end, the restrictions in openings 24 provided by protuberances 74 reduce the diameters of openings 24 at the zones of restriction to approximately the outside diameters of the male bullet terminals 28. Thus, each of the male terminals 28 is readily forced past the restricting protuberance 74 until the fully inserted position thereof is reached where the protuberance 74 is received by the annular depression 38 in the terminal 28. Thus, it may be appreciated that loading of the ten terminals 28 into insulator body 14 may be rapidly accomplished even though the sizes of the components to be handled are small. It should be noted that the flexibility of the terminals 28 permits the same to be pushed past protuberances 74 without maintaining close tolerances, the stops 82 formed on the lugs 80 of the terminals assuring that the same will not be inadvertently pushed through openings 24 past the fully inserted positions thereof illustrated.

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During loading of insulator body 14, the various protuberances 74 assure that each terminal 28 will not be inadvertently withdrawn after insertion since the protuberances 74 inhibit such withdrawal by virtue of the interference provided by the cooperation of each protuberance 74 and the depression 38 in which it is received. Therefore, once all of the terminals 28 are in place, the assembler merely pulses against the protruding end of locking bar 30 to shift the same to the locked position thereof illustrated to cause the locking projections 32 to simultaneously capture all of the terminals 28 and secure the same in place within body 14.

The same procedure is followed for the insulator body 46 of the male connector 12. When it is desired to unite the two connectors 10 and 12, it may be appreciated that a safeguard is provided in that both locking bars 30 and 56 must be in their locked positions in order for the two connectors 10 and 12 to fit together. This feature is provided by the detent 68 extending from bar 56 and the corresponding slot 44 in bar 30, alignment thereof being required before the male connector 12 can be fully seated within the skirt 34 of the female connector 10.

Additionally, the use of the oppositely extending keyways 42 and 72 is of importance in that it precludes shifting of the interlocked bars 30 and 56 to their released positions after the connectors 10 and 12 are united. As may be seen from viewing FIG. 6, the released or unlocked position of the locking bar 56 of the male connector 12 is to the right from the locked position shown, i.e. with the right end of bar 56 projecting from the right end of body 46. Thus, neither of the locking bars 30 or 56 can be moved once detent 68 seats in slot 44.

As the two connectors 10 and 12 are brought together to mate their terminals, the latch dog 90 slips behind the catch 92 and snaps into place in locking interengagement therewith when the male connector 12 is fully seated within the female connector 10. In applications where weatherproofing of the coupling is required, a pair of sealing boots (not shown) may be slipped over the ends of the composite coupling from which the leads 78 extend, and are telescoped one within the other at the central portion of the coupling.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A multiple circuit electrical connector comprising:
 - a plurality of elongated electrical terminals;
 - an insulator body having a plurality of spaced openings therein receiving respective terminals upon longitudinal insertion of the latter into corresponding openings, whereby to support the terminals in predetermined spaced interrelationship,
 - said body having means therein engageable with each of said terminals for inhibiting withdrawal of each terminal from the body after insertion thereof into the corresponding opening; and
 - a shiftable locking member in said body provided with a plurality of spaced projections and movable between an unlocked position, where said projections clear the terminals, and a locked position where each projection is engageable with a corresponding terminal to capture the latter and thereby lock all of the terminals in place within said body.
2. A connector as set forth in claim 1,
 - each of said openings being elongated and larger in transverse dimension than the terminal therewithin,
 - said inhibiting means comprising a restriction in each of said openings respectively presenting a zone within the opening of reduced transverse dimension,
 - said terminals being of flexible material to permit insertion thereof past respective restrictions without application of excessive insertion forces thereto,
 - each of said terminals having means receiving the restriction of the corresponding opening when the terminal is fully inserted therinto.

3. A connector as set forth in claim 1, said openings being disposed in a row, said locking member being elongated and longitudinally shiftable between said positions thereof along a path of travel extending substantially parallel to said row, said projections being spaced longitudinally of said locking member and extending toward corresponding openings when the member is in its locked position.

4. A connector as set forth in claim 3, said locking member being provided with a key projecting transversely therefrom, said body having a keyway therein receiving said key to limit the travel of the locking member, and establishing said positions of the member at the limits of said travel thereof.

5. A connector as set forth in claim 3, said body having a channel therein extending alongside said row of openings, receiving the locking member and defining said path of travel thereof, said openings communicating with said channel to expose a portion of each of said terminals, each of said projections being engageable with said portion of the corresponding terminal when the locking member is in its locked position.

6. A connector as set forth in claim 5, the axes of said openings and the longitudinal axis of said channel extending at substantially right angles to one another, each of said terminals being of generally cylindrical configuration, substantially coaxially disposed within the respective opening, and having an annular depression therein comprising a part of the exposed portion thereof,

said projections being received within the depressions of the corresponding terminals when the locking member is in its locked position.

7. A connector as set forth in claim 6, said inhibiting means including a protuberance in each opening respectively extending therinto and received by the depression of the terminal therewithin.

8. A connector as set forth in claim 7, each of said projections and the protuberance of the corresponding opening, when the locking member is in its locked position, being disposed in diametrically opposed relationship to each other.

9. An electrical coupling comprising: a pair of multiple circuit electrical connectors, each of said connectors including a plurality of elongated electrical terminals of generally cylindrical configuration, an insulator body having a row of spaced, cylindrical openings therein substantially coaxially receiving respective terminals upon longitudinal insertion of the latter into corresponding openings whereby to support the terminals in predetermined spaced interrelationship, said body further having means therein engageable with each of said terminals for inhibiting withdrawal of each terminal from a predetermined, fully inserted, relative longitudinal disposition within the corresponding opening after insertion therinto, and an elongated, longitudinally shiftable locking member in said body movable along a path of travel extending substantially parallel to said row of openings between an unlocked position clearing said terminals and a locked position engaging said terminals to capture the latter and thereby lock the terminals in place within said body, the latter having a channel therein extending alongside said row of openings, receiving the locking member and defining said path of travel thereof,

the terminals of one of said connectors being of the male type and projecting from the body thereof, and the terminals of the other of said connectors being of the female type and mating with corresponding

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male terminals with said locking members disposed in parallelism with each other,

said locking members being provided with interengageable structure permitting relative telescoping of the male and female terminals only when both of the locking members are in their locked positions.

10. A coupling as set forth in claim 9, there being latch means for joining the bodies of the connectors upon said relative telescoping of the male and female terminals,

said latch means having latch parts on the outside of said bodies operable to interlock with one another as the connectors are brought together with their terminals in mating interengagement.

11. A coupling as set forth in claim 9, one of said locking members being provided with an outer longitudinal edge having a slot therein,

the other of said locking members having an outer longitudinal edge provided with an outwardly projecting detent receivable in said slot, the latter and the detent presenting said structure.

12. A coupling as set forth in claim 11, said locking members being shiftable to the locked positions thereof in opposite directions, whereby engagement of the detent with said one member within said slot prevents movement of either member to its unlocked position.

13. A multiple circuit electrical connector comprising: a plurality of elongated electrical terminals; an insulator body having a plurality of spaced openings therein receiving respective terminals upon longitudinal insertion of the latter into corresponding openings, whereby to support the terminals in predetermined spaced interrelationship; and

a shiftable locking member in said body provided with a plurality of spaced projections and movable be-

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tween an unlocked position, where said projections clear the terminals, and a locked position where each projection is engageable with a corresponding terminal to capture the latter and thereby lock all of the terminals in place within said body.

14. A connector as set forth in claim 13, said openings being disposed in a row, said locking member being elongated and longitudinally shiftable between said positions thereof along a path of travel extending substantially parallel to said row, said projections being spaced longitudinally of said locking member and extending toward corresponding openings when the member is in its locked position.

15. A connector as set forth in claim 14, said body having a channel therein extending alongside said row of openings, receiving the locking member and defining said path of travel thereof, said openings communicating with said channel to expose a portion of each of said terminals, each of said projections being engageable with said portion of the corresponding terminal when the locking member is in its locked position.

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U.S. Cl. X.R.

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