

[54] **CONNECTOR HOUSINGS AND LOCKING STRUCTURES THEREFOR**

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[22] Filed: **Jan. 12, 1973**

[21] Appl. No.: **322,913**

[52] U.S. Cl. **339/91 R, 339/198 H**

[51] Int. Cl. **H01r 13/54**

[58] Field of Search **339/91, 198**

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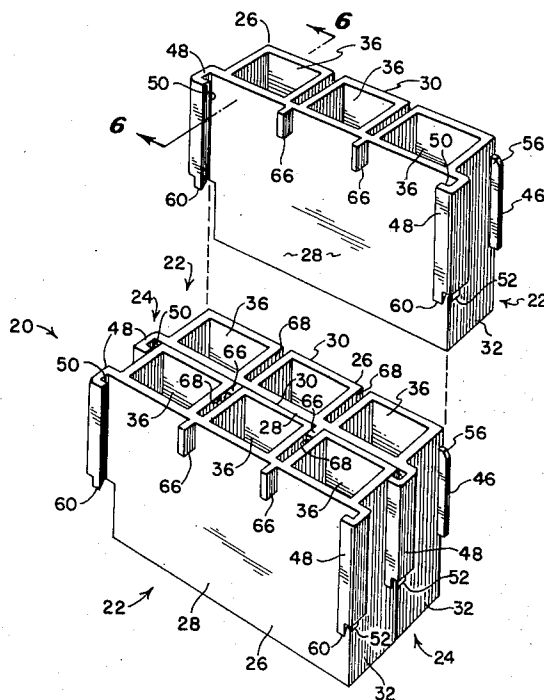
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Primary Examiner—Joseph H. McGlynn
Attorney, Agent, or Firm—Mason, Kolehmainen, Rathburn & Wyss

[57] **ABSTRACT**

A connector housing includes discrete plastic housing parts held in assembled position by a locking structure including rib members on one housing part slidably received in slots formed by channel members on the other housing part. A locking tab connected by an integral hinge to the entrance end of each channel member is engaged by the rib entering the slot and is moved aside to permit entry of the rib. When the housing parts are fully assembled, the locking tab returns to its original position in order to retain the rib in the slot.

12 Claims, 10 Drawing Figures



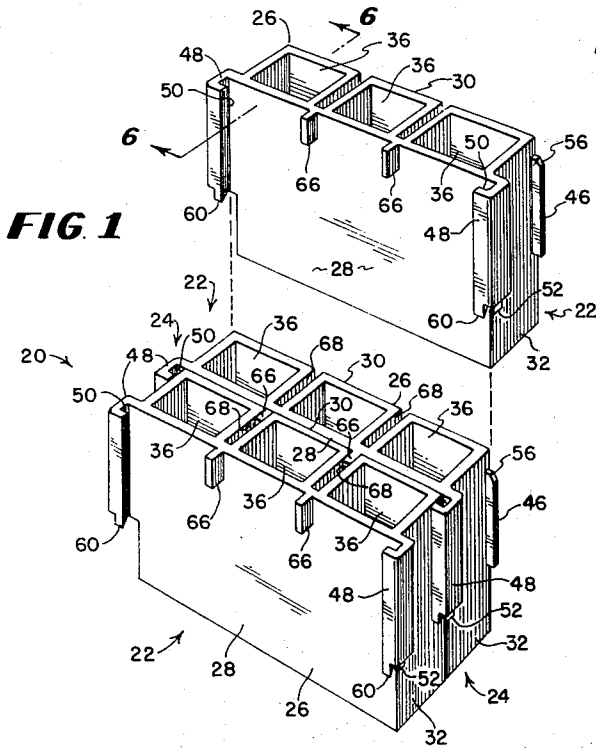


FIG 2

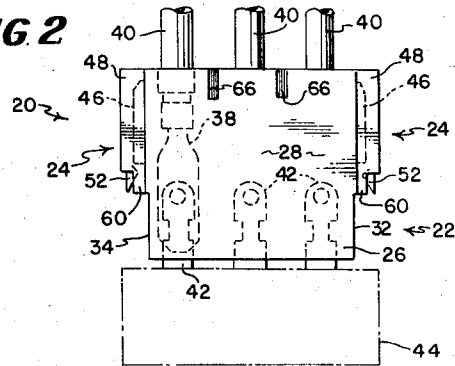


FIG 4

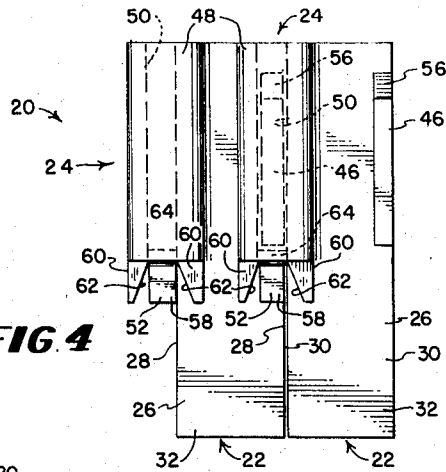


FIG 3

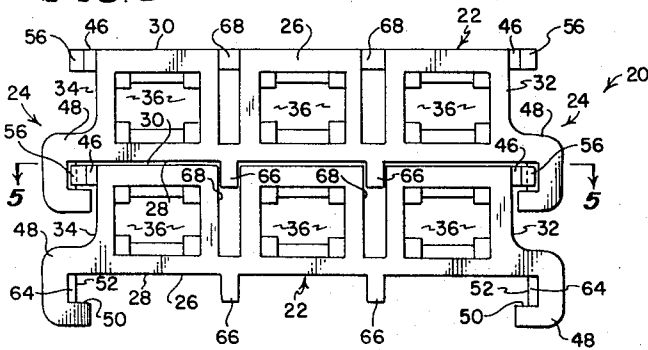


FIG 5

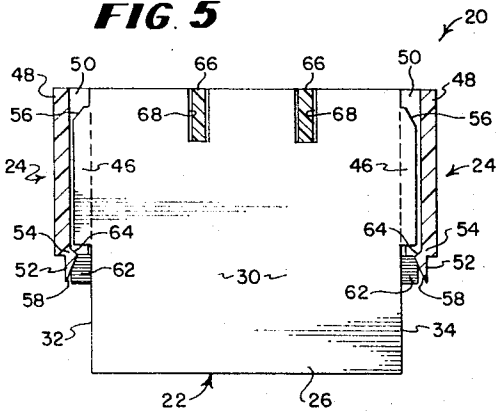


FIG 6

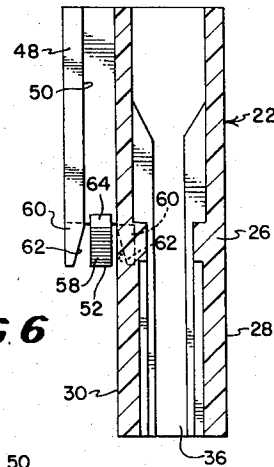
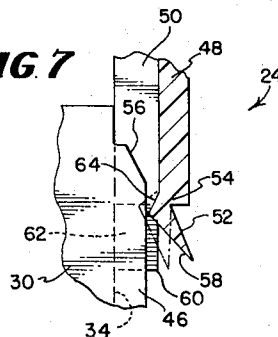
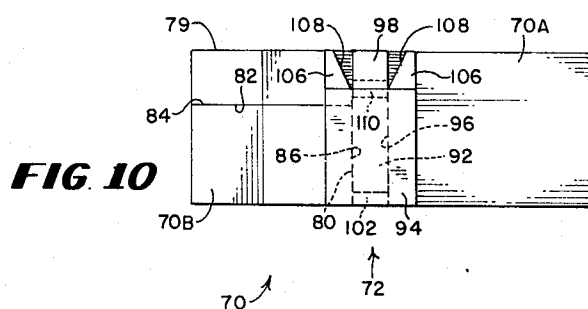
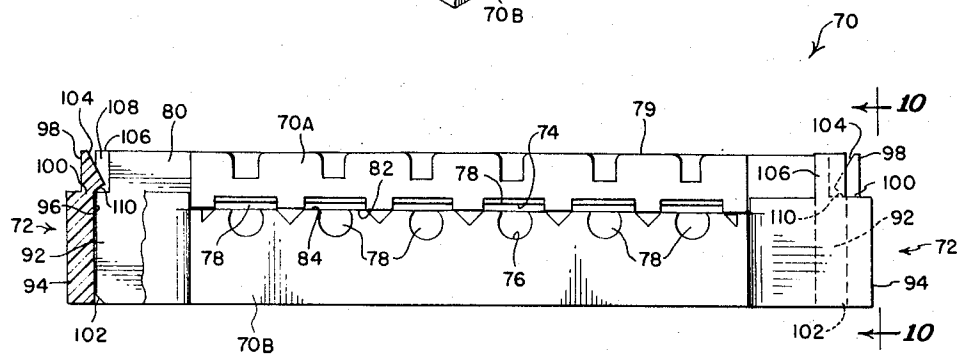
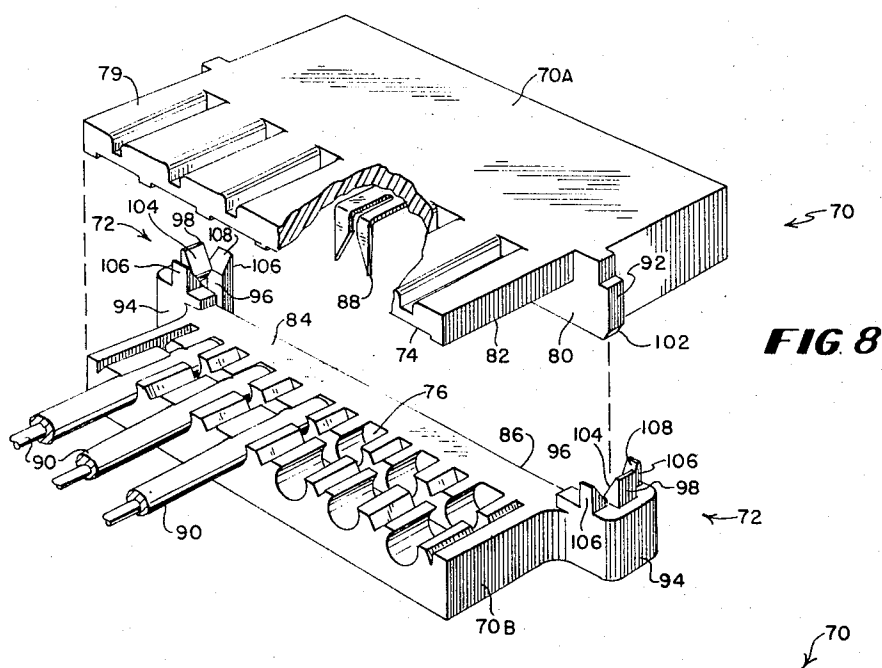


FIG 7





CONNECTOR HOUSINGS AND LOCKING STRUCTURES THEREFOR

The present invention relates to electrical connectors and more particularly to connector housings including discrete parts held together by a locking structure.

Electrical connectors including molded plastic housings having terminal receiving cavities are well known. In some instances it is desirable to form connector housings of two or more discrete parts which are joined together in the assembly of a complete housing. For example, a discrete housing module or part having a small number of terminal receiving cavities may be ganged with other similar modules to form a composite modular housing of desired size having a larger number of terminal receiving cavities. As another example, two housing parts each defining a portion of a terminal receiving cavity may be joined together to form a complete housing having a complete terminal receiving cavity.

In these and other instances where two or more discrete parts are assembled into a complete connector housing, it is desirable to hold the housing parts together in assembled relation. Important objects of the present invention are to provide an improved locking structure for holding together the parts of a connector housing; to provide improved connector housings having discrete parts held together by locking structure; and to provide a locking structure which is small in size and reliable in use, which is sturdy enough to hold firmly yet permits convenient assembly, which is capable of multiple use and reuse, and which is adaptable to situations wherein it is desirable to hold parts together relatively rigidly or relatively loosely.

In brief, the above and other objects and advantages of the present invention are achieved through the provision of a connector housing including discrete plastic housing parts having exterior surfaces adapted to be moved together relative to one another to an assembled position. One of the housing parts includes rib means, and the adjacent housing part includes channel means defining slot means. As the housing parts are moved together, the rib means is slidably received in the channel means. A lock means disposed at the entrance end of the slot means is displaced from its normal position by entry of the rib means into the slot means, and upon complete assembly returns to its initial position to hold the rib means in the channel means, and thereby to hold the two housing parts in assembled relation.

The invention together with the above and other objects and advantages may best be understood from the following detailed description of the embodiments of the invention illustrated in the drawings, wherein:

FIG. 1 is a perspective view of a partly assembled connector housing constructed in accordance with the principles of the present invention;

FIG. 2 is a side view of the connector housing of FIG. 1 illustrated in connection with an electrical device;

FIG. 3 is an end view of a portion of the connector housing of FIG. 1;

FIG. 4 is a side view of the structure illustrated in FIG. 3;

FIG. 5 is a sectional view on a reduced scale taken along the line 5—5 of FIG. 3;

FIG. 6 is an enlarged sectional view of a portion of the connector housing of FIG. 1 taken along the line 6—6 of FIG. 1;

FIG. 7 is a greatly enlarged fragmentary view of a portion of the structure illustrated in FIG. 5 showing the position of certain structure at an intermediate point during assembly;

FIG. 8 is a perspective, partly sectional view of a connector housing comprising an alternative embodiment of the present invention;

FIG. 9 is an enlarged end view of the connector housing of FIG. 8; and

FIG. 10 is a side view of the connector housing of FIG. 8 taken from the line 10—10 of FIG. 9.

Having reference now to the drawings, in FIGS. 1—7 there is illustrated a connector housing designated generally as 20 and constructed in accordance with the principles of the present invention. The connector housing 20 is of modular construction and is made up of two or more discrete housing parts or modules of identical construction and each designated as a whole by the reference numeral 22. In accordance with an important feature of the present invention the housing parts 22 are held in assembled relation with one another by means of a number of locking assemblies generally designated as 24.

Each module or part 22 includes a body 26 preferably formed of molded plastic having suitable dielectric properties and having a slight degree of resiliency. Each body 26 is generally rectangular in section and includes opposed side walls 28 and 30 and opposed edge walls 32 and 34. Extending between the opposite ends of the body 26 are a series of terminal receiving cavities 36. Cavities 36 are of suitable configuration for the reception of terminal members of any desired type, depending upon use to which the connector housing 20 is to be put.

One use of the connector housing 20 is illustrated in FIG. 2 wherein cavities 36 receive suitable snap in female terminal members, such as the terminal 38, crimped to wire conductors such as the wires 40. After crimping of the terminals 38 to the wires 40 and insertion of the terminals 38 into the cavities 36, the connector housing 20 is engaged with projecting male terminals 42 of an electrical device such as the device designated as 44 and shown in block form in FIG. 2. The device 44 may be one of a series of push button switches which are arranged in side by side relation as by mounting the switches on a common mounting bracket or the like. In this case, the number of housing parts or modules 22 is equal to the number of devices 44 and the composite connector housing 20 is used in a convenient fashion to provide the necessary electrical connections simultaneously to all of the devices 44.

Having reference now more specifically to the locking assemblies 24 of the present invention, each of the parts 22 includes a pair of ribs 46 located at the corners of the side wall 30 and the edge walls 32 and 34 formed substantially as extensions of the side walls 30. In addition, each part 22 includes a pair of channel members 48 located at the corners of the side wall 28 and the edge walls 32 and 34.

In accordance with the invention and as can best be seen in FIGS. 3 and 5, the ribs 46 and channels 48 are located and dimensioned to the end that the ribs 46 of one module 22 may be slidably received within slots 50 defined by the channels 48 of another module 22 in order to mount one module 22 to its next adjacent counterpart. More specifically, and as indicated by broken direction lines in FIG. 1, the surface 28 of one

housing part 22 is slidingly engaged with the surface 30 of an adjacent housing part 22 so that the leading edges of ribs 46 enter the entrance ends of the slots 50 and so that upon full assembly of the two adjacent housing parts 22, the ribs 46 are disposed within the channels 48.

In order to retain two housing parts or modules 22 in assembled relationship after they are joined together, each locking assembly 24 includes a locking device in the form of a locking tab 52 formed integrally with the corresponding channel 48. As appears best in FIGS. 5 and 7, each locking tab 52 partially obstructs the entrance end of the corresponding channel 48. In order to permit the locking tabs 52 to be deflected upon entrance of ribs 46 into channels 48, the locking tabs 52 are interconnected with the channels 48 by means of reduced thickness neck portions 54 (FIG. 7). Because the bodies 26 are formed of a plastic material having some resilience, the neck portions 52 function as integral resilient hinges permitting the locking tabs 52 to pivot between their normal locking position illustrated in FIG. 5 and their alternate position illustrated in FIG. 7 wherein the ribs 46 may move into the slots 50 of the channels 48.

In order to facilitate the displacement of each locking tab 52 by a rib 46, the leading end of each rib 46 is provided with an inclined ramp surface 56. Similarly, each locking tab 52 is provided with an inclined surface 58 directed outwardly of the slot 50. Thus, when the rib 46 is moved toward and into the slot 50, the ramp surface 56 engages the inclined surface 58 and the resulting lever action rotates the locking tab 52 to the position illustrated in FIG. 7. The ramp surface 56 and inclined surface 58 also cooperate in guiding the ribs 46 into the slots 50 of the channels 48.

Proper assembly of two adjacent modules 22 is also facilitated by guide fingers 60 disposed at the entrance end of the channels 48 to each side of the locking tab 52 and having inclined guide surfaces 62. The guide surfaces 62 cooperate with the inclined surfaces 58 of the locking tabs 50 to provide a converging mouth structure at the entrance end of each channel 48.

After entry of the ribs 46 into the slots 50 of the channels 48, and as best shown in FIG. 7, the locking tabs 52 ride along the outermost edges of the ribs 46 and provide only inconsequential resistance to full entry of the ribs 46 into the channels 48. When the fully assembled position is reached as illustrated in FIG. 5, the locking tabs 52 return to their initial locking position due to the inherent resiliency of the plastic material from which the neck portions 54 are formed. Each locking tab 52 is provided with a retaining surface 64 directed inwardly relative to the slot 50 and serving to retain the ribs 46 within the slots 50 because the retaining surfaces 64 obstruct the entrance end of the channels 48.

In the embodiment of the invention illustrated in FIGS. 1-7, the capability of disassembly is desired. For this reason, the retaining surfaces 64 are inclined outwardly so that the trailing ends of the ribs 46 can engage the retaining surfaces 64 and force the locking tabs 52 to their alternate position shown in FIG. 7 so that the ribs 46 may be withdrawn from the slots 50. Alternatively, if it is desired to prevent disassembly, the retaining surfaces 64 could be provided with no incline or with a reverse incline cooperating with a similar configuration of the trailing edge of the rib 46.

Movement of two adjacent modules 22 beyond the fully assembled position is prevented by means of stop tabs 66 projecting from the side surfaces 28. As the adjacent parts 22 are assembled, the tabs 66 enter slots 68 in the side surface 30. As shown in FIG. 5, in the assembled position the tabs 66 engage the inner ends of the slots 68 to prevent further relative movement of the adjacent modules 22. This arrangement of stop tabs 66 and slots 68 also provides a keying function because insertion of the ribs 46 into the slots 50 of the channels 48 from the end opposite the locking tabs 52 is prevented.

In the arrangement of FIGS. 1-7 wherein the connector housing 20 is used with a series of electrical devices such as the device 44, it is desirable to obtain a relatively loose fit between adjacent modules 22 so that limited movement of the modules with respect to one another is permitted. Typically, the terminals 42 of push button switches or other devices 44 are not located in accordance with precise tolerances. Moreover, the common bracket or other device used to mount the switches often permits some variation between the positions of terminals 42 of adjacent devices 44. If the modules 22 were joined together rigidly in such a way that relative motion were prevented, difficulty might be encountered in interconnecting the completed connector with a group of the devices 44.

In order to permit some relative movement of adjacent assembled modules 22, the slots 50 are somewhat larger in size than the ribs 46. This provides a slight clearance best illustrated in FIG. 3 permitting the desired relative movement. Despite the clearance, however, the ribs 46 are securely and firmly retained within the slots 50.

Having reference now to FIGS. 8-10, there is illustrated a connector housing designated as a whole by the reference numeral 70 and comprising an alternative embodiment of the present invention. The housing 70 is composed of two discrete housing parts 70A and 70B which are assembled together to form the complete connector housing 70. The parts 70A and 70B are held in assembled relation by means of a pair of locking assemblies generally designated as 72.

Unlike the connector housing illustrated in FIGS. 1-7, the connector housing 70 is not of modular construction —i.e., it is not made up of identical interchangeable housing parts or modules any number of which may be ganged together. Rather, the parts 70A and 70B of the connector 70 include arrays of recesses respectively designated by the reference numerals 74 and 76 cooperating upon assembly to define a series of terminal containing cavities 78 (FIG. 9).

Housing parts 70A and 70B are preferably formed of a plastic material having suitable electrical insulating qualities and having a degree of resilience. Part 70A includes a shelf-like extension 79 extending from a wall 80 and having a lower wall 82. The walls 80 and 82 of part 70A form an L-shaped depression or recess into which the housing part 70B fits upon assembly. The part 70B includes an upper wall 84 interfacing with the wall 82 and a rear edge wall 86 interfacing with the wall 80 upon assembly of the parts 70A and 70B.

Although many different types of terminal arrangements may be used with a two part connector housing such as the housing 70, in the illustrated arrangement the housing part 70A supports a series of insulation piercing terminals such as the terminal 88 a portion of

which is shown in FIG. 8. The housing part 70B is adapted to support a series of wires 90 aligned with the terminals 88. When the parts 70A and 70B are joined by moving the surface 84 toward the surface 82, the terminals 88 make contact with the conductors of the wires 90.

With reference more specifically to the locking assemblies 72, these assemblies are similar in structure and in function to the assemblies 24 associated with the connector housing 20 illustrated in FIGS. 1-7. The part 70A is provided with a pair of ribs 92 located at opposite sides of and formed essentially as extensions of the wall 80. The housing part 70B is provided with a pair of channels 94 located in alignment with the ribs 92 and including slots 96 sized to receive the ribs 92.

Each channel 94 is provided with a locking tab 98 which in its locking position partially obstructs the entrance end of the channel 94. In order to permit movement of the locking tabs 98 between their locking positions and their alternate positions, reduced thickness neck portions 100 (FIG. 9) are provided. As is the case with the locking assemblies 24 described above, the ribs 92 are provided with ramp surfaces 102 and the tabs 98 are provided with inclined surfaces 104 to facilitate displacement of the locking tab between positions and to guide entry of the ribs 92 into the channels 94. The channel 94 is provided with guide fingers 106 including inclined guide surfaces 108 cooperating with surfaces 104 to provide converging mouth openings for the slots 96. After full entry of the ribs 92 into the slots 96, the connector housing 70 is maintained in assembled relation by engagement of retaining surfaces 110 of the locking tabs 98 with the trailing ends of the ribs 92.

In the case of the connector housing 70, the full assembled position is reached when the surfaces 84 and 82 are abutting. In view of the mating housing configurations, there is need for no other stop or keying structure.

Relative movement between the housing parts 70A and 70B after assembly is not desirable in connection with the connector housing 70 since it is desired to hold the terminals 88 firmly in position. A rigid interconnection of the housing parts 70A and 70B is accomplished by dimensioning the ribs 92 and the slots 96 of the channels 94 so that a relatively tight fit with minimal clearance is obtained.

Although the invention has been described with reference to details of the illustrated embodiments, it should be understood that other modifications and alterations may be devised by those skilled in the art. Such details should not be understood to limit the invention as defined in the following claims.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. A locking structure for holding a pair of connector housing parts in assembled relation, said locking structure comprising a pair of interfacing rigid channel members each defining a slot and a pair of complementary rib members slidably receivable in said slots, a pair of resilient lock means for releasably retaining said rib members, in said channel members, each said lock means comprising a lock member normally obstructing the entrance end of one said slot, an integral resilient hinge interconnecting each said lock member and one said channel member for permitting said lock member to be moved relative to said rigid channel member in

response to engagement by the corresponding rib member to a position wherein said rib member may enter said slot.

2. The structure of claim 1 said integral resilient hinge interconnecting said lock member and said channel member.

3. The structure of claim 2, said lock member having an inclined surface directed outwardly of said slot to facilitate entrance of said rib member into said slot.

4. The structure of claim 3, said lock member having an additional inclined surface directed inwardly of said slot to permit withdrawal of said rib member from said slot.

5. The structure of claim 3, said rib having an inclined ramp surface at its leading end engageable with said inclined outwardly directed surface of said lock member upon entry of said rib member in said slot.

6. The structure of claim 5, further comprising additional inclined guiding surfaces formed at the entrance end of said channel member for guiding said rib member into said slot.

7. Locking structure for first and second discrete molded plastic housing parts adapted to be joined together to form a connector housing, said locking structure comprising:

a channel member formed integrally and relatively rigidly on said first housing part;

a rib member formed integrally and relatively rigidly on said second housing part and having a front and rear end;

a slot defined in said channel member having an entrance end for receiving the front end of said rib member upon joining of said housing part;

a lock member;

an integral hinge of small cross sectional area relative to said lock member, said hinge interconnecting said lock member and said channel member at said entrance end of said slot;

said lock member normally being positioned to obstruct the entrance end of said slot;

first surface means on said lock member and on the first portion of said rib member that enters said channel member for causing said lock member to pivot about said integral hinge and to permit movement of said rib member into said slot; and

second surface means on said lock member and on the rear end of said rib member for resisting withdrawal of said rib member from said slot after movement of said rear end of said rib member past said lock member.

8. The housing of claim 7, said rib members and channel members being sized for a tight fit to hold said housing parts firmly together.

9. The housing of claim 7, said rib members and channel members being sized for a loose fit to permit limited movement of the interlocked housing parts relative to one another.

10. The housing of claim 7, further comprising tab and slot means for preventing over-insertion of said rib members into said channel members.

11. The housing of claim 7, said housing parts being substantially identical and each including both rib members and channel members and being interlockable with other similar housing parts.

12. The housing of claim 11, each said housing part including at least one terminal receiving cavity.

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