June 18, 1968 C. R. CURTIS 3,389,369

MODULAR ELECTRICAL CONNECTOR

Filed March 29, 1966 3 Sheets-Sheet 1

Fig. 1

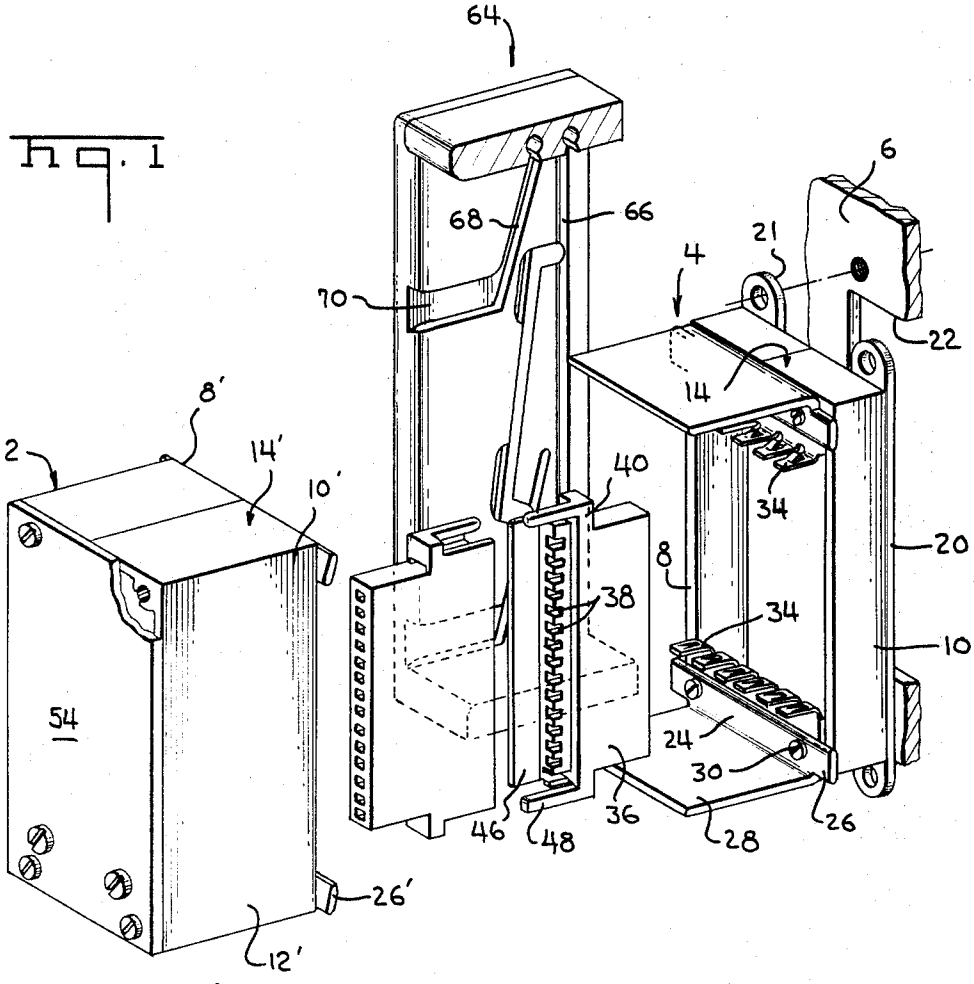
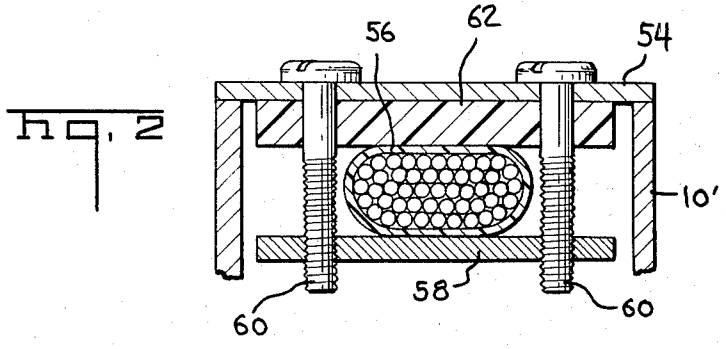


Fig. 2



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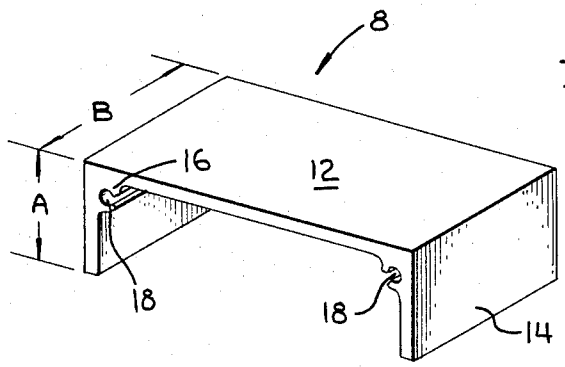


Fig. 3

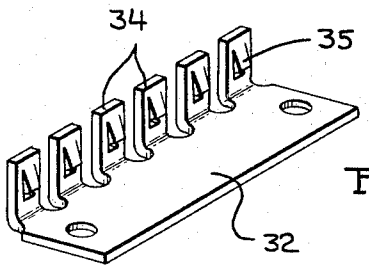


Fig. 5

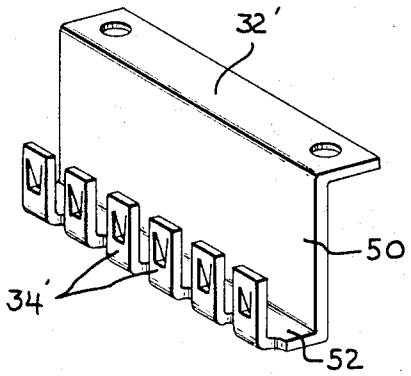
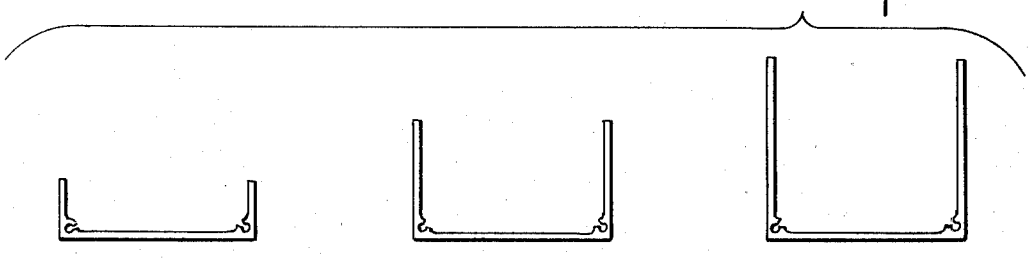


Fig. 6

Fig. 7



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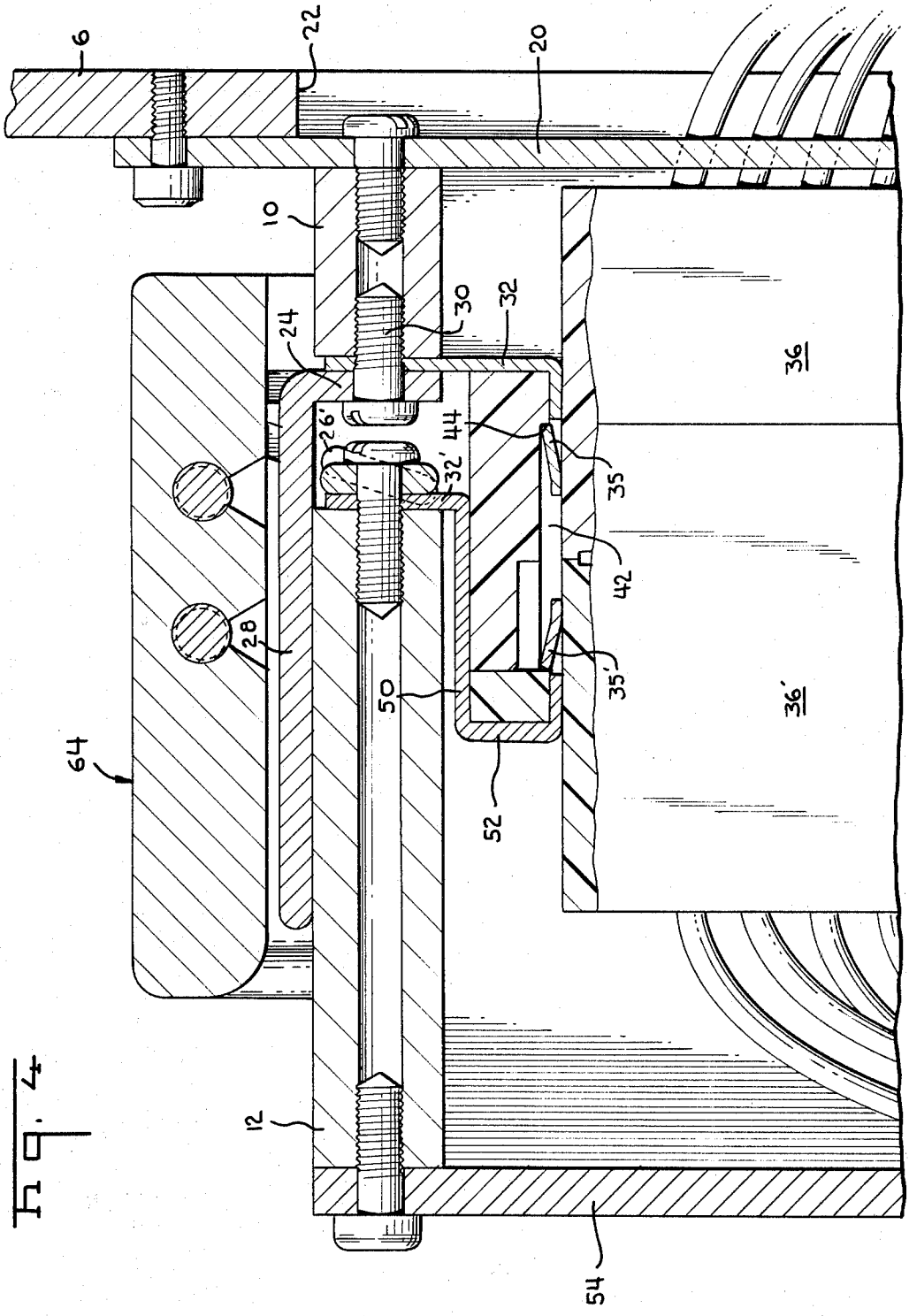


Fig. 4

United States Patent Office 3,389,369
Patented June 18, 1968

3,389,369

MODULAR ELECTRICAL CONNECTOR

Charles Robert Curtis, Camp Hill, Pa., assignor to AMP Incorporated, Harrisburg, Pa.

Filed Mar. 29, 1966, Ser. No. 538,285
3 Claims. (Cl. 339—121)

This invention relates to a modular-type multi-contact electrical connector.

Electrical connectors are usually manufactured in different sizes to accommodate different types and varying numbers of contact terminals. The designer, when he specifies an electrical connector for a given piece of equipment, is usually thus required to consult catalogues or other supply sources and select a particular connector which will satisfy his requirements with regard to the number and size of electrical contacts which must be accommodated. Since the number of contacts and the types of contacts required in a given instance might vary, it is sometimes difficult to find a connector which provides the required number of types of contacts. Many of these inconveniences are avoided by modular-type electrical connectors which can be assembled from standard parts and made in any desired size.

It is an object of the invention to provide an improved modular-type electrical connector. It is a further object to provide a modular-type connector which can be made in a wide range of sizes with a minimum number of parts. A further object is to provide a connector which can be manufactured in a wide range of sizes with a minimum amount of tooling. A further object is to provide a connector which will accommodate varying numbers of modules having a standard set of dimensions and which can be provided with cavities adapted to receive any of the commonly available types of electrical contacts.

These and other objects of the invention are achieved in a preferred embodiment comprising a connector consisting of two matable connector parts each of which comprises a shell and insert means in the shell. The shell of each connector part comprises a pair of extruded channel members having the edge portions of their flanges in abutting relationship and secured together by means of connecting bars secured to the two channels. A pair of module retainers are secured to, and extend parallel to, two of the opposite sides of the shell, each retainer having a plurality of spaced-apart retaining fingers extending therefrom parallel to the connector axis. A plurality of insert modules are mounted in the shell and extend between the module retainers with the fingers of these retainers extending into suitable cavities in the insert modules. Suitable latching means are provided on the fingers and in the cavities to retain the modules in the shell.

In the drawing:

FIGURE 1 is a perspective and partially exploded view of a preferred form of connector assembly in accordance with the invention;

FIGURE 2 is a sectional view taken along the lines 2—2 of FIGURE 1;

FIGURE 3 is a perspective view of a channel section of a type used to form the shells of the connector assembly of FIGURE 1;

FIGURE 4 is a fragmentary sectional side view showing the upper portion of the connector assembly of FIGURE 1 with the two connector parts engaged with each other;

FIGURE 5 is a perspective view of one of the module retainers forming part of the connector assembly of FIGURE 1;

FIGURE 6 is a perspective view of another module retainer used in the connector assembly of FIGURE 1; and

FIGURE 7 is an end view of three sizes of channel members which can be used for shells of connectors in accordance with the invention.

In the description which follows, the complete assembly (comprising the two matable parts 2, 4 and the camming frame 64) is referred to as the connector assembly while the individual matable parts 2, 4 are referred to as connectors or connector parts.

Referring first to FIGURE 1, the invention is herein disclosed in an embodiment comprising a pair of matable connector parts 2, 4, the part 4 being adapted to be mounted on a panel 6 which may form a housing of a computer or other electronic apparatus. The two connector parts 2,4 are similar to each other in many respects and only the part 4 will, therefore, be described in complete detail.

The connector part 4 comprises a shell which is made up from two identical channel sections 8, 10, FIGURE 3, each of which has a web 12 and flanges 14. The internal corners have relatively heavy fillets 16 with key-hole type slots 18 extending axially therethrough. The channels 8, 10 are advantageously of aluminum and are manufactured by a continuous extrusion process so that they can be made in any desired length. The use of extruded parts contributes materially to the achievement of relatively low tooling costs for a wide range of connector sizes as will be discussed below.

The two channel sections are disposed in facing relationship with the edges of their flanges 14 abutting each other and are held together by means of bars 24 extending parallel to the sides formed by the flanges 14. These bars are secured to the shell by fasteners 30 which extend through openings in the bars and into the circular portions of the key-hole slots 18. Advantageously, self-tapping screws are used since the need of any machining operations is thereby avoided. The bars 24 have laterally extending end portions 26 which cooperate with a latching frame 64, described below, and have forwardly extending hood flanges 28 which function to align the part 4 with the part 2 during mating. In the disclosed embodiment, mounting bars 20 are secured to the rearward side of the shell by means of fasteners which extend into the openings 18 and have projecting end portions 21 which are secured to the panel 6 by means of screws. The wires from the contacts contained in the connector part 4 will extend through the opening 22 in this panel to the components contained behind the panel.

The individual modules are mounted on the mating face of the connector part 4 (i.e., the face which is opposed to the connector part 2) by means of module retainer strips 32 clamped between the bars 24, FIGURE 5, and the edge portions of the shell by means of previously identified fasteners 30. These retainer strips have a plurality of spaced-apart forwardly extending fingers 34 extending therefrom, opposed pairs of these fingers on the two strips being in alignment with each other.

The individual modules 36 are of any suitable firm insulating material and have a plurality of contact-receiving cavities 38 extending therethrough, the disclosed form of module being particularly adapted to receive a hermaphrodite type of contact shown in U.S. Patent 3,178,669. Ears 40 extend from the opposite ends of the individual modules and cavities 42 are provided in these ears for the reception of the retaining fingers 34. The fingers are each provided with a struck-up lance 35 which bears against the oppositely directed shoulders 44 in the cavity 42 as shown in FIGURE 4. The individual modules are thus prevented from moving rightwardly as viewed in FIGURE 4 by virtue of the fact that the ears 40 engage the portions 32 of the module retainers and are prevented from moving leftwardly by the inner engagement of the lances 35 with the shoulders 44. The individual modules can, of course, be removed by merely

inserting a relatively narrow tool into the cavities **42** and depressing the lances **44**.

The modules shown have hoods **46** extending along one side thereof and have spaced-apart fingers **48** extending from the ears **40** on the other side. The arrangement is such that two identical modules will mate with each other so that only one type of module need be used for a complete electrical connector assembly.

The parts of the connector part **2** are identified with the same reference numerals, differentiated by prime marks, as those used to describe the corresponding parts of the connector part **4**. The two connector parts, while similar in many respects, are different in respects specifically discussed below.

The shell portion of connector part **2** is composed of a pair of opposed channel sections **8'**, **10'** which are held in assembled relationship by bars **24'** having projecting end portions **26'**. The module retaining strip **32'** differs from the strip **32** in that the strip **32'** has rearwardly and downwardly extending sections **50**, **52** as viewed in FIGURE 4 with the fingers **34'** extending from the end of the section **54**. The individual modules mounted in the connector part **2** are thus recessed from the mating face of the module although the mounting arrangement is otherwise the same for both modules. It will also be noted that the channel sections **14'** are somewhat deeper (have a larger B dimension as indicated in FIGURE 3).

A cover plate **54** is secured to the rearward side of the shell of the part **2** by means of fasteners extending into the openings **18'** of the channel sections and a suitable cable clamp is provided as shown in FIGURE 2 comprising screws which extend through the back plate **54** and into a clamping plate **58**. This clamping plate functions to clamp the cable **56** against a suitable resilient pressure pad **62**.

The two parts of the connector **2**, **4** are moved into and out of engagement with each other by means of a rectangular camming frame **64** havings slots **66**, **68** on its opposite sides which receive the projecting ends **26**, **26'** of the bars **24**, **24'**. This arrangement for mating and unmating connector parts is described in detail in the co-pending application of John Carl Asick, Ser. No. 525,253, filed Feb. 4, 1966.

There are several features of the disclosed embodiment of the invention which contribute to the fact that the complete connector assembly can be manufactured from a small number of types of parts. The principal parts required for the connector assembly (not including the camming frame **64**) is limited to the channels **8**, **8'**, the clamping bars **24**, **24'**, the retainers **32**, **32'** and the cover plate **54**. The channels **8**, **8'** can be manufactured in the form of a continuous extrusion and cut to the desired length (the B dimension of FIGURE 3). Thus, while the channel part **8'** differs from the channel part **8** in the respect of this B dimension, the two parts can nonetheless be produced by the same extrusion die. Furthermore, by making channels in two or more sizes having different A dimensions (flange heights) but a common web width, it is possible to get a wide variation of connector sizes. This feature of the invention will be apparent from FIGURE 7 which shows three possible channel sections having different A dimensions. Any one of these sections can be used with an identical section or with any of the other two sections to produce a connector shell and the three sizes of channels shown can thus be used to produce six different shell sizes. As previously noted, the B dimension is determined by merely cutting the extruded channels to the appropriate length so that only three extrusion dies are required for the six shell sizes referred to above.

Only one type of module **36** is required for a given contact so that only one mold is required for this part regardless of the sizes of the shell being assembled. Finally, the module retainer strips shown in FIGURES 5 and 6 can be produced as a continuous strip by stamping and forming and cut to the desired sizes for a particular connector being assembled.

A connector in accordance with the invention can be used with any suitable means for holding the two parts in assembled relationship. Thus, the cam frame **64** could be replaced by conventional jack screws if desired.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.

I claim:

1. A multi-contact electrical connector comprising, a shell in the form of an open rectangular frame, a pair of module retainers secured to said frame on one face thereof and extending transversely thereacross on opposite sides thereof, said retainers each comprising a strip secured at its ends to said frame and having a plurality of spaced-apart fingers extending therefrom in a direction away from said frame and parallel to the axis of the opening in said connector, opposite ones of said fingers being aligned with each other, a plurality of connector modules disposed in side-by-side relationship in said frame, said modules extending between said opposite sides of said frame, said modules each having a width substantially equal to the center-to-center distance between adjacent fingers of said retainers, said modules each having ears on their ends extending laterally beyond said retainers on said one face, cavities in said ears, said fingers extending into said cavities, and shoulder and lance means in said cavities and on said fingers, said ears preventing movement of said modules in one axial direction relative to said frame and said shoulders and lances preventing movement of said module in the other axial direction relative to said frame, whereby said modules are retained in said frame.

2. An electrical connector part comprising a shell member, insert module retaining means securd to, and extending across, opposite sides of said shell member, said insert module retaining means each comprising a plurality of spaced-apart fingers extending parallel to the axis of said shell member, corresponding fingers on said opposite sides of said shell member being aligned with each other, and individual modules mounted on each pair of said fingers, extending into cavities on the end of said module, each module and pair of fingers having interengaging means for retaining said module in said shell member.

3. A connector as set forth in claim **2** including clamping bar means extending across, and secured to said opposite sides of said shell member, said clamping bar means clamping said module retaining means to said shell member, and hood means integral with said clamping bar means, said hood means extending from said opposite sides of said shell member.

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