# United States Patent [19]

**Olsson**

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[54] **CLUSTER BLOCK HOUSING AND PIN RECEPTACLE**


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[73] Assignee: **AMP Incorporated,** Harrisburg, Pa.



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[52] **U.S. Cl.**..... **339/217 S,** 339/192 RL, 339/258 P

[51] **Int. Cl.**..... **H01r 9/08**

[58] **Field of Search**.... 339/217 RS, 192 RL, 256 R, 339/258



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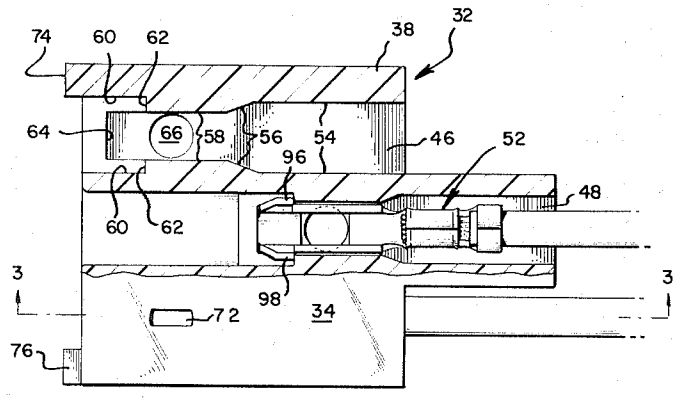
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[57] **ABSTRACT**

A cluster block housing and pin connectors to be received therein in a free floating manner are disclosed for making reliable electrical and mechanical connection with hermetric cluster pins. Each connector includes a channel shaped receptacle portion the spaced side walls of which are resiliently integral with an apertured central web. A non-flexible locking lance is formed on a portion of the free edge of each side wall. All flexation in the connector takes place between the web and side walls as the connectors are positioned in passageways in the housing and pins are inserted therein. The locking lances engage shoulders in the housing to prevent unintended withdrawal of the connectors while abutments prevent the connectors from passing completely through the passageway.


**4 Claims, 8 Drawing Figures**



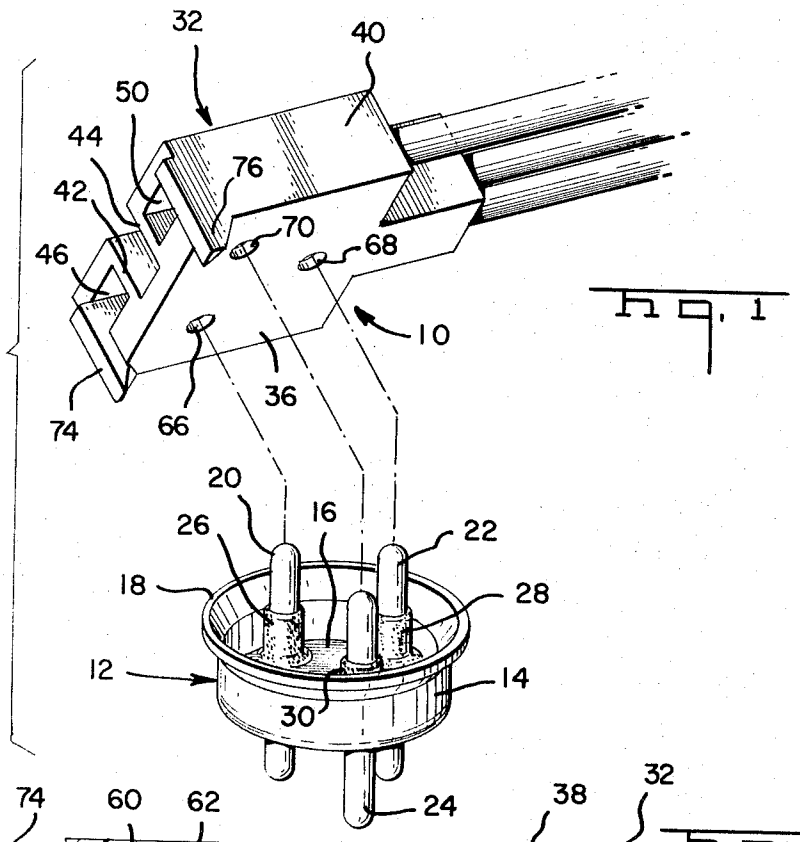



Fig. 1

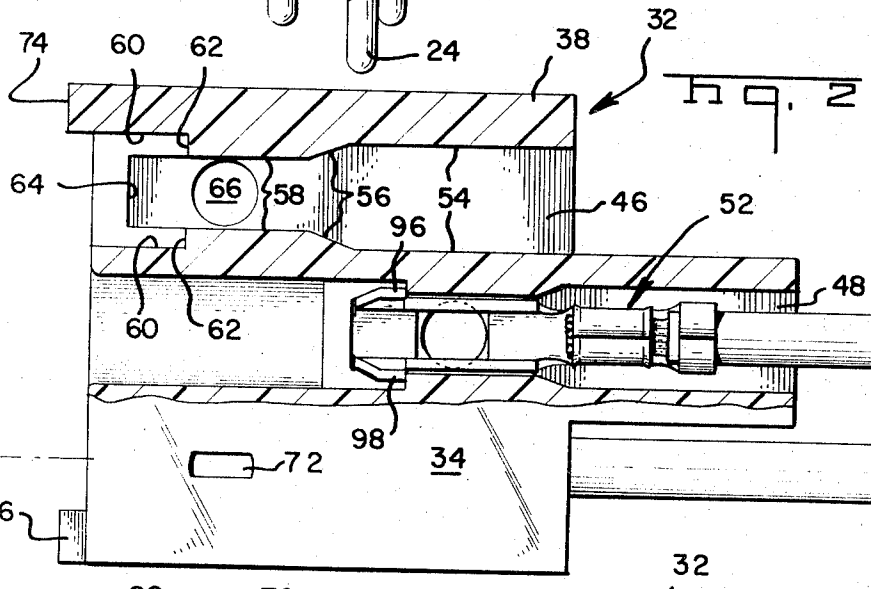



Fig. 2

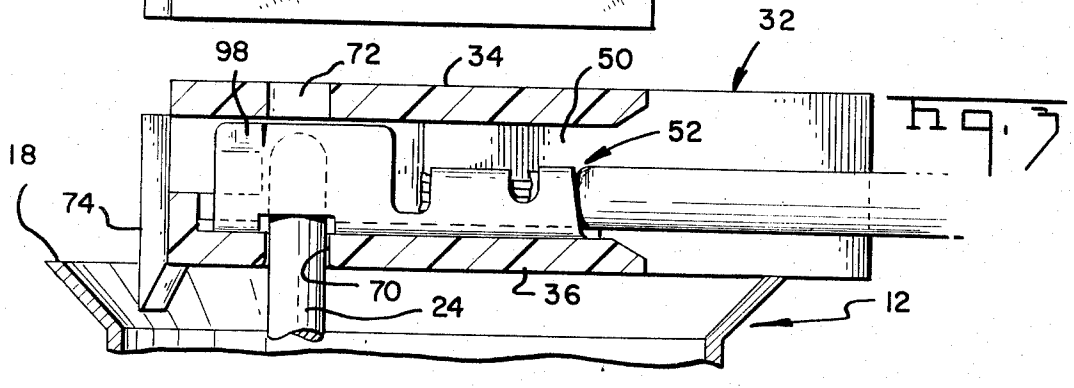



Fig. 3

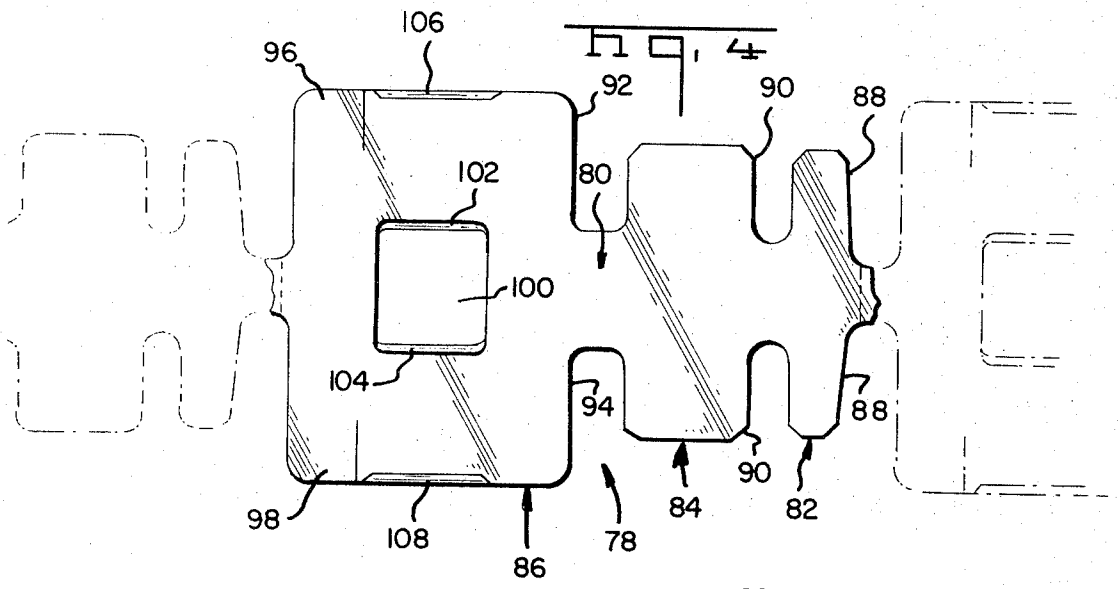



Fig. 4

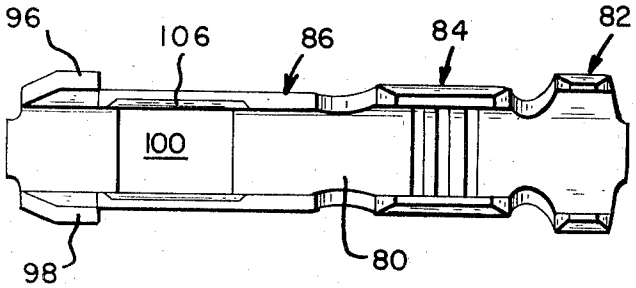



Fig. 5

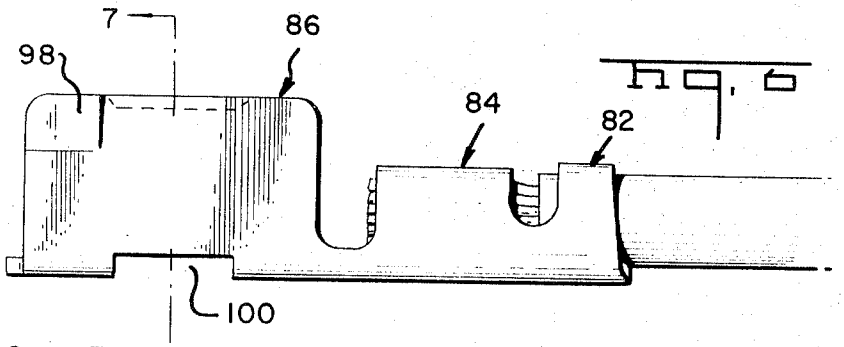



Fig. 6

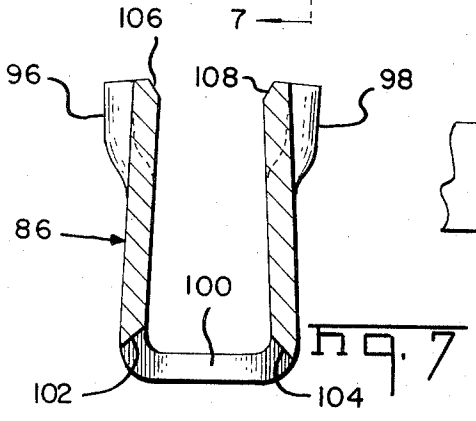



Fig. 7

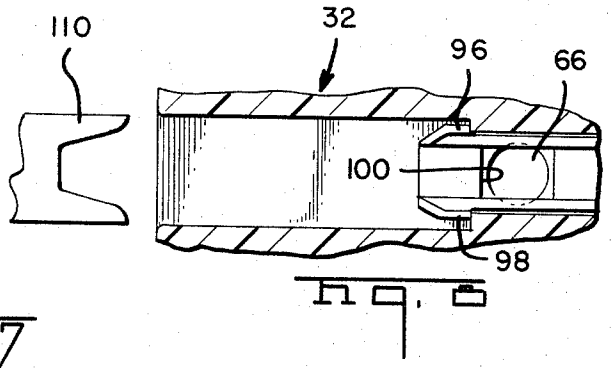



Fig. 8

# CLUSTER BLOCK HOUSING AND PIN RECEPTACLE

## BACKGROUND OF THE PRESENT INVENTION

1. The Field of the Invention

The present invention relates to electrical connectors and housings therefor and more particularly to electrical connectors to be mounted in an insulating housing for use with hermetric cluster pin terminals.

2. The Prior Art

There are many instances when it is desirable to terminate wire leads from an apparatus at a group of pins or posts which are adapted to be frictionally engaged in a female receptacle connected by suitable leads to the rest of the circuit. This type of terminal is usually referred to as a cluster pin terminal or assembly and is typically found in the refrigerating and air conditioning fields where portions of the equipment are located within hermetically sealed containers or housings. Electrical connection to this sealed equipment is effected by a series of insulated pins extending through the shell of the hermetically sealed container. The pins are normally clustered together to reduce the required number of seals. Examples of such terminals are found in U.S. Pat. Nos. 2,728,060; 3,202,959; 3,336,567; and 3,605,076.

Some connector receptacles previously developed have attempted to avoid loosening of the electrical contact between the connector and pin by arranging the connector in the form of a closed loop or U-shape, the free ends of which are locked against excessive or unintended spreading. Examples of this type of connector are found in U.S. Pat. Nos. 3,120,990; 3,231,849 and 3,271,729. While these closed loop connectors form a tight contact, they have the disadvantage of being somewhat expensive and complicated to form and install.

Some problems encountered in the field cluster pin terminals and connectors include assuring that a good mechanical and electrical contact will be maintained with each pin despite the severe operating conditions normally encountered. These conditions include high temperatures and humidity as well as extensive and prolonged vibration.

The connectors installed inside the housing are substantially inaccessable once the housing is sealed. Therefor it is a principal consideration to form the connectors in such a manner that they will not come off the pins easily and will not lose their electrical contact efficiency, since failure of the internal contacts to maintain their grip on the pins is tantamount to a complete failure of the entire unit with little possibility of effecting economic repair.

Another consideration in making connectors of the present type is the fact that millions of such connectors are made yearly so that economy of production and assembly, as well as reliability, must be considered.

Space requirements for cluster pin assemblies also dictate that the receptacle housing and the connectors use as small an amount of space as possible. Thus when several connectors are to be used in combination, they must be capable of being placed closely together with accurate positioning. Of course the housing must provide complete electrical isolation between the individual connectors to avoid possible arcing between adjacent connectors with consequent short circuits and damage to the attendant units.



## SUMMARY OF THE INVENTION

The subject housing and pin connectors include an insulated receptacle housing and at least one electrical connector adapted to be mounted in the housing. The housing is formed of a rigid electrically insulating material and has at least one passageway extending longitudinally therethrough with at least one pin aperture communicating with each passageway. Each passageway includes, in sequence, an entrance portion formed by parallel side walls, a transition portion formed by converging side walls, a restricted neck or throat portion formed by closely spaced parallel side walls, a retainer portion formed by transverse shoulders, and an abutment formed by a transverse wall. Each connector is channel shaped and includes, in sequence from back to front, a first ferrule portion adapted to be crimped to the insulation of a lead, a second ferrule portion adapted to be crimped to the conductor of a lead, and a channel shaped receptacle portion adapted to receive a pin therein. The spaced opposing side walls of the receptacle portion are resiliently integral with the central web and each has a non-flexible locking lance extending from the free upper end thereof. An aperture is formed in the center web of the connector between the side walls of the receptacle portion. When the connector is properly positioned in a passageway, the aperture in the web is substantially aligned with the pin aperture in the housing and the side walls of the receptacle portion are spaced apart a distance less than the diameter of the associated pin to form an interference fit therewith.

It is an object of the invention to teach a connector which may be readily inserted into a housing in such alignment that will assure proper electrical and mechanical connection with an associated pin and which cannot be unintentionally displaced from such alignment.

It is another object of the invention to teach a connector and housing combination in which any connector can be readily inserted into the housing in one direction and removed in the opposite direction for repair or replacement.

It is another object of the invention to teach a receptacle housing which can receive one or more connectors in closely spaced positioning while providing adequate electrical insulation between adjacent connectors.

It is another object of the invention to teach a tool suitable for removing connectors positioned within an associated housing.

Other objects and advantages of the present invention will become apparent to those skilled in the art upon reading the following detailed description taken in conjunction with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the subject electrical connector housing aligned above, but not connected with, an associated hermetically sealed cluster pin terminal;

FIG. 2 is a top plan view, partially in section, of the subject housing with one pin connector in place;

FIG. 3 is a vertical section taken along line 3—3 of FIG. 2 showing the housing assembled with the cluster pin terminal;

FIG. 4 is a plan view of a preferred form of sheet metal blank from which electrical connectors are formed in accordance with the present invention;

FIG. 5 is a top plan view of a connector according to the present invention prior to being crimped onto a lead;

FIG. 6 is a side elevation of a connector according to the present invention after being crimped onto a lead;

FIG. 7 is a vertical section taken along line 7—7 of FIG. 6; and

FIG. 8 is a fragmentary view of the housing and a tool for removing a connector from the housing.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, the present electrical connector, generally designated by reference numeral **10**, is used to provide electrical connection with a cluster pin terminal **12**. The cluster pin terminal is of a well known type (see U.S. Pat. No. 3,605,076, for example) that is usually fixedly mounted on a wall of a compressor, motor or other sealed machinery (not shown). The cluster pin terminal includes a cylindrical metallic casing **14** having one end closed by integral plate **16** and a flared annular flange **18** on the other end. Three pins **20, 22** and **24** are fixedly mounted in a spaced triangular configuration in the plate **16** by glass-to-metal seals **26, 28,** and **30,** respectively, with the seals also serving to electrically insulate the pins from the casing.

The housing **32** is preferably molded as a unitary block of rigid, electrically insulating material having parallel spaced top and bottom walls **34** and **36,** respectively, connected by spaced parallel side walls **38, 40** and internal divider walls **42, 44.** The side and divider walls define therebetween three parallel, longitudinal passageways **46, 48** and **50,** each of which is adapted to receive a connector **52** therein. Each passageway, from right to left as shown in FIG. **2,** has an entrance portion, defined by a pair of spaced parallel wall portions **54**; a transition portion, defined by a pair of converging walls **56**; a throat or restricted portion defined by a pair of parallel wall portions **58** spaced closer together than the walls forming the entrance portion; a receptacle portion defined by a pair of wall portions **60** spaced apart further than the throat portion and joined thereto by a pair of transversely extending shoulders **62**; and a stop block or detent **64** extending transversely across the passageway. The bottom wall **36** is provided with three triangularly spaced pin apertures **66, 68** and **70** each opening into one of the passageways. Similar apertures or slots **72** may be provided in the top wall **34** of the housing in alignment with the apertures in the bottom wall. Legs **74** and **76** extend forwardly and downwardly from the housing and serve to support the block on the cluster pin terminal as shown in FIG. **3.**

Each connector **52,** see FIGS. **4** to **7,** is formed from a continuous metal strip blank **78.** The connector includes a longitudinally extending web **80** having, from right to left or back to front, first ferrule forming portion **82,** second ferrule forming portion **84** and receptacle portion **86.** First and second pairs of ears **88** and **90,** respectively, integrally extend from web **80** to form the first and second ferrule forming portions. The receptacle portion **86** includes two substantially rectangular sidewalls **92** and **94** integrally extending from either side of the web **80.** Locking lances **96** and **98** extend from an upper portion of side walls **92** and **94,** respectively. The locking lances shown are bent outwardly and adjustable amount with respect to the sidewalls. An aperture **100** is formed in the web between the side walls and includes bevelled lead-in surfaces **102** and **104** on the respective side walls. Similar lead-in surfaces **106** and **108** are provided on the free edges of the side walls.

The connector is formed from the blank in the usual fashion by first forming a channel shaped configuration, as shown in FIG. **5.** The side walls of the channel shape preferably are not parallel but converge at their upper free ends at an angle in the range of 1° to 3°. A lead is positioned in the first and second ferrules which are subsequently crimped to engage the insulation and conductor portions of the lead, respectively, firmly securing it in the connector.

The completed connectors, with the leads crimped therein, are inserted into the entrance end of the passageways in housing **32.** The connector passes through the entrance portion **54** with clearance. As the connector encounters the transition portion **56,** the locking lances **96** and **98** engage the converging walls and cause a resilient flexing inwardly of at least the upper forward end of the connector side walls with respect to the web. The connector is prevented from passing completely through the passageway by its forward end striking against stop block **64.** The locking lances clear the neck portion before the stop block is engaged and allow the side walls to flex outwardly to the normal position shown in FIG. **7.** In this position the locking lances will prevent withdrawal of the connector by engaging the shoulders **62.**

Each connector has a limited amount of free floating room in its respective passageway so that the apertures **100** will be in substantial alignment with an opening **66, 68** or **70** in the bottom wall of the housing **32.** Since the individual pins of any cluster pin assembly usually are not accurately positioned, there is some need to provide for a limited amount of movement of each connector. The side walls are so inclined towards each other that there will be a force fit engagement between each connector and its respective pin **20, 22** and **24.** The locking lances can easily be adjusted separately from the formation and bending of the sidewalls to have adequate extension for engaging with the locking shoulders of each passageway. The above mentioned bevelled lead-in surfaces are provided on the side walls to assist in the insertion of a pin into the receptacle portion of the connector. Thus the receptacle connector will be firmly mounted on the cluster pin terminal and will be able to withstand a substantial amount of vibration without becoming loosened.

As mentioned above, the housing may be positioned on a terminal as shown in FIGS. **1** and **3** to provide a fairly tight assembly. However, if it is desired to have a somewhat lower assembly force and vibration is less of a factor, then the pin apertures and slots housing can be molded into the housing reversed from the position shown. In such an embodiment the pins can be inserted from the opposite side of the housing to be received in the open side channel shaped receptacle portion of the connectors. The primary purpose of the slots **72** is for molding convenience, however, they are also useful for visually aligning the housing with respect to a cluster pin terminal. It is also preferable that pin apertures not

be provided on both sides of the housing in order for either the top or bottom wall of the housing to serve as a stop for the pins inserted from the opposite side of the housing.

While the connectors are held in the housing against further forward movement by abuttment 64 and against withdrawal movement by engagement of the locking lances 96 and 98 with shoulders 62, it is possible to remove any individual connector from the housing by inserting a dove tail shaped tool 110 into the passageway from the open end. The dove tail end of the tool engages and compresses the side walls, against the resiliency of the side walls with respect to the central web, until the locking lances clear the shoulders and allow withdrawal movement of the connector through the narrow neck portion of the passageway. Of course this can be accomplished only when the housing is dismounted from the cluster pin terminal.

It should be understood that while the present invention has been described relative to a three pin embodiment, the scope of the invention is not so limited. The principal features of the invention are equally applicable to a combination of a housing and connectors of a fewer or greater number and in different geometric configurations so that many modifications and changes may be made without departing from the spirit or essential characteristics of the present invention.

What is claimed is:

1. A disengagable electrical connector for use with a plurality of closely spaced parallel contact pins disposed in a cup-like mounting member, said connector comprising:

a unitary block of insulating material having a plurality of parallel cavities extending therethrough, each of said cavities being open at both ends and having a throat portion defined by a pair of side walls converging towards one another to merge with a pair of parallel walls which terminate in sharp shoulders extending transversely outwardly of the cavity, an abutment extending transversely across said cavity spaced from said shoulders, and a pin aperture formed in one wall of each cavity,

a terminal connector received in each said cavity, each said connector having, from back to front, first and second ferrule portions adapted to be crimped onto electrical cable and a channel shaped receptacle portion including two spaced side walls resiliently integrally connected by one edge to a central web, an aperture in said central web, and a locking lance rigidly projecting from an upper portion of each side wall, each said lance projecting out of the plane of its corresponsing side wall and away from the other said side wall, said side walls of said connector located between said parallel walls of said housing as said locking lances abut said shoulders, retaining said connector in said housing, said pins adapted to engage with interference fit in opposing sides of said connector aperture and between the side walls of said receptacle portion.

2. A disengagable electrical connector according to claim 1 wherein said sharp shoulders and said abutment lie on opposite sides of said pin aperture.

3. A disengagable electrical connector according to claim 1 wherein each said locking lance is formed at the front end of the associated side wall.

4. A disengagable electrical connector according to claim 1 wherein the side walls of each said terminal connector converge towards their free ends.

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