United States Patent

Albert

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[54] MULTI-POINT PROGRAM PLUG AND RECEPTACLE CONNECTOR ARRANGEMENT HAVING POSITIVE ALIGNMENT PRIOR TO POSITIVE MATING

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[21] Appl. No.: **62,434**

[52] **U.S. Cl.** .....**339/18 B**, 339/65, 339/75 M

[51] **Int. Cl.**.....**H01r 25/00**, H01r 13/54

[58] **Field of Search** .....339/4, 17 M, 18 R, 18 B, 45 R, 339/45 M, 61, 65, 66, 75 R, 75 M, 91 R, 198 H, 198 K, 198 P; 317/101 C, 101 B, 101 D, 101 DH, 101 F

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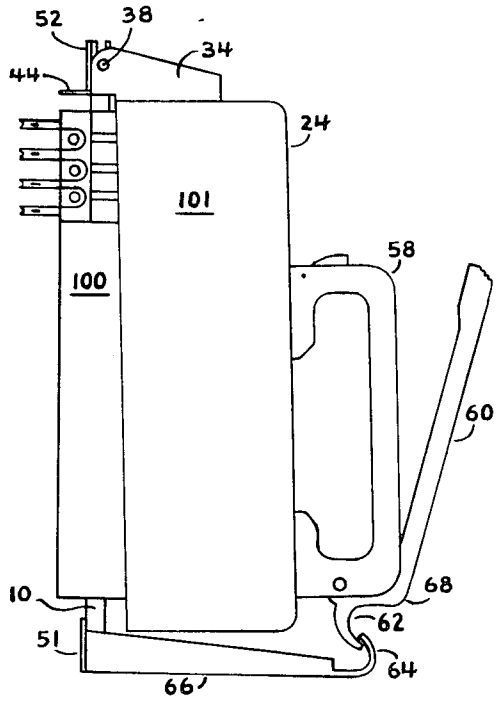
[57] **ABSTRACT**

A multi-point connector arrangement including separable plug and receptacle members each having a frame portion with a selected profile camber to insure full positive engagement of the contact elements during coupling, and having cooperable interengaging portions adapted to effect proper alignment during mating of the plug and receptacle members.

8 Claims, 10 Drawing Figures



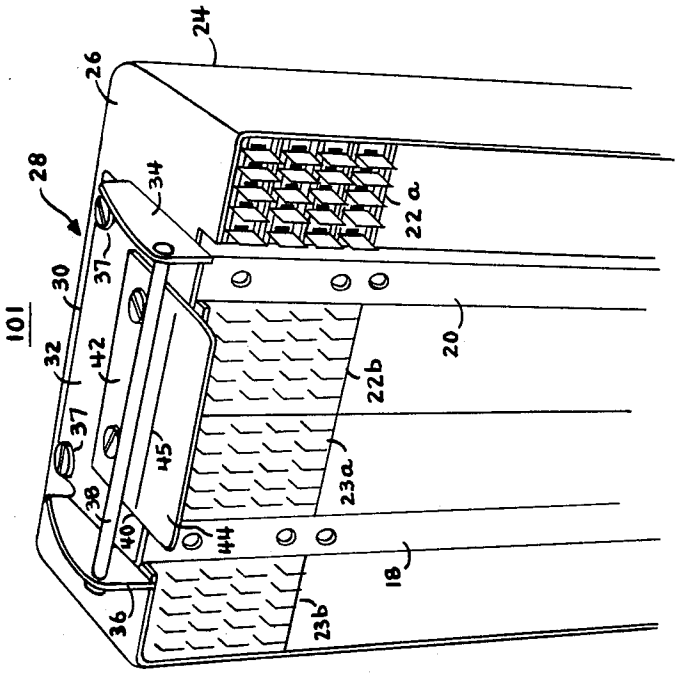


FIG. 1b

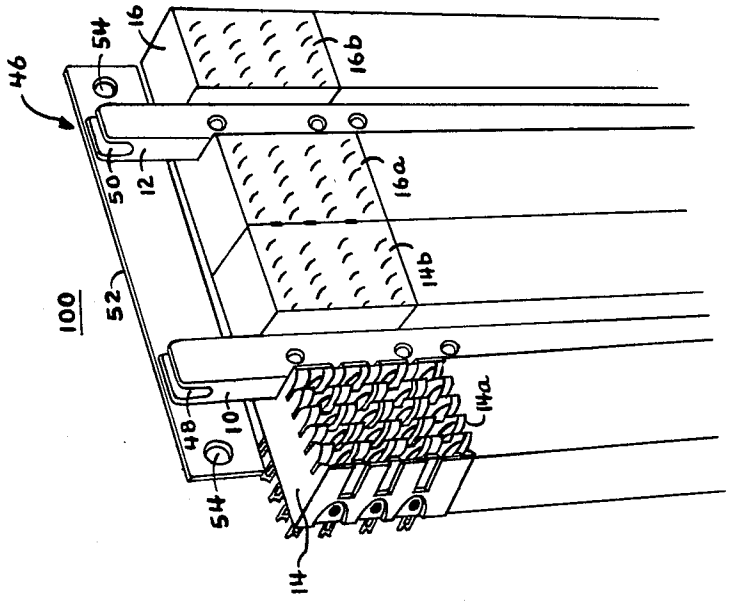


FIG. 1a

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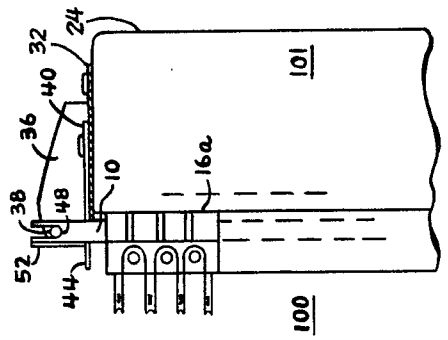

FIG. 2c

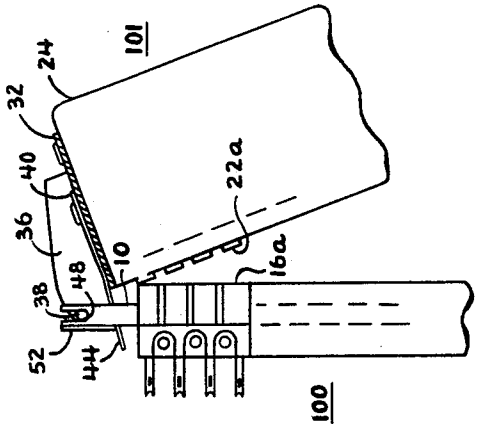

FIG. 2b

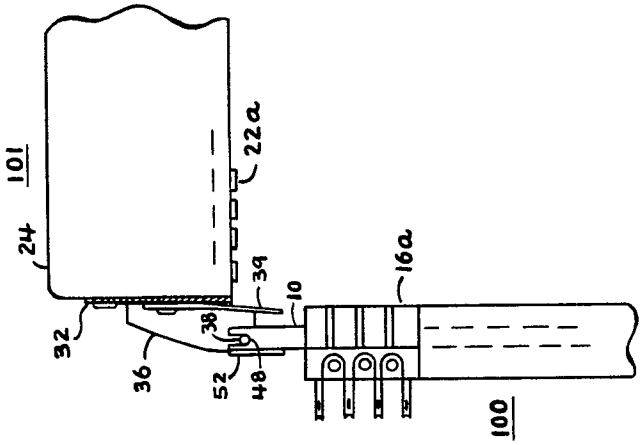

FIG. 2a

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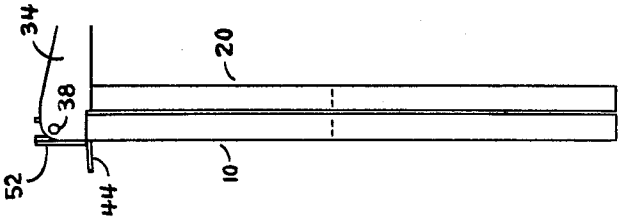

FIG. 3c

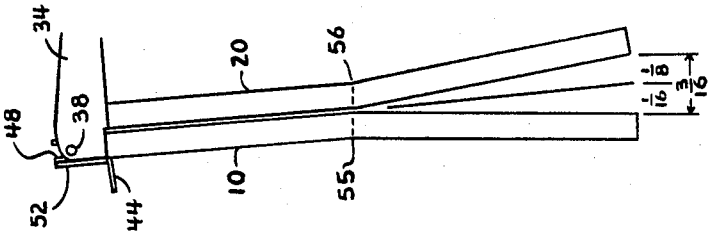

FIG. 3b

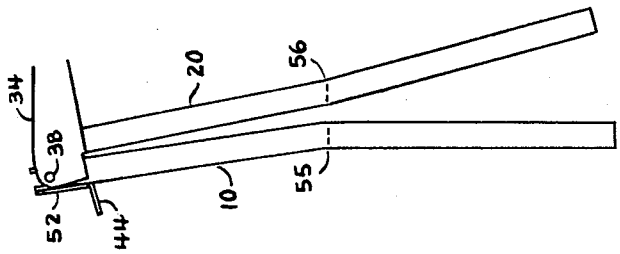

FIG. 3a

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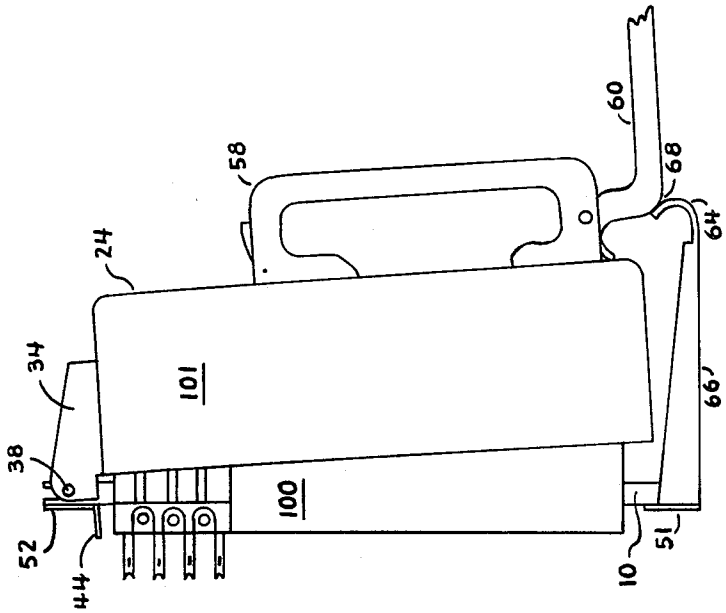

FIG. 4b

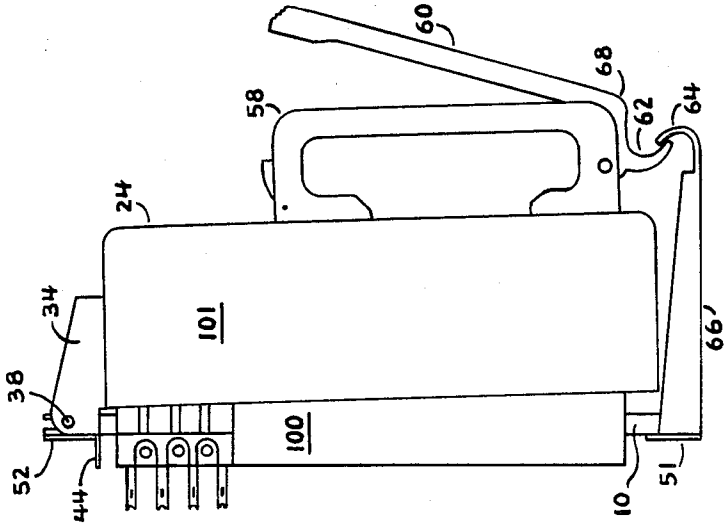

FIG. 4a

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MULTI-POINT PROGRAM PLUG AND RECEPTACLE CONNECTOR ARRANGEMENT HAVING POSITIVE ALIGNMENT PRIOR TO POSITIVE MATING

BACKGROUND OF THE INVENTION

1. Field of Invention

The present invention relates generally to a multi-point connector arrangement, and more particularly to such an arrangement for effecting positive mating relation between a plug having a plurality of connector projections thereon and a receptacle adapted to selectively receive each of the connector projections.

2. Description of Prior Art

It has been a problem when mating conventional male and female elements of a pin type connector to ensure proper alignment of the respective housing portions prior to actual mating of the male and female pin connectors. It can readily be understood that if the respective housing portions supporting the male pins and female receptacles are not aligned, proper contact of the pins cannot be assured; and of equal importance, the force used in attempting mating of the non-aligned elements may damage them.

It has also been a problem in multi-point connectors to ensure positive contact of all of the male pins with their corresponding female receptacles. Conventional multi-point connectors employ separable housing members which are secured at mating edge portions such that the force required to mate the pins and receptacles is usually applied at the edges of the housings and not in their centers. Accordingly, the pins along the edges of the housing members are ensured of positive contact, while those pins centrally located may not be properly received in positive contact with the corresponding receptacles.

SUMMARY OF THE INVENTION

The present invention seeks to overcome the problems associated with the prior art multi-point connectors by providing on one of a pair of housing members supporting male pins and female receptacles to be positively mated, a pair of laterally spaced locating member means adapted to hingedly engage a pivot rod supported by the other of the housing members. An alignment tongue is secured to the housing member supporting the pivot rod and serves to engage a cross plate fixed to the locating member means to urge the pivot rod into firm engagement with the locating member means to ensure proper alignment of the male and female elements of the connector prior to effecting actual contact therebetween. The housing members include frame bars which are cambered, when considered in side profile, to effect a biased engagement of the centrally disposed connector pins with their associated receptacles when the housing members are brought into positive interconnection.

Accordingly, one of the primary objects of the present invention is to provide a multi-point pin type connector which includes novel means insuring proper alignment of the pins with their corresponding receptacles before mating is effected.

Another object of the present invention is to provide a multi-point connector including novel means to ensure positive contact between all the male pin elements and their corresponding female receptacles of the connector, both those along the edge of the housing members and those disposed centrally thereof.

Another object of the present invention is to provide a multi-point connector as described wherein the means for insuring proper alignment of the connector pins and associated receptacles includes locating members adapted to engage a pivot rod, and an alignment tongue adapted to engage a cross plate in order to urge the pivot rod into positive engagement with the locating member.

According to one feature of the invention the novel connector device of the present disclosure finds useful application in effecting the connection of programs to the control circuitry

of associated machinery to which the female receptacle of the connector may be fixedly attached. In one embodiment, a different male plug is provided for each different program to be used, and in reprogramming the associated machinery, it is only necessary to use the particular one of the male connectors which has the desired program.

Further objects and advantages of the present invention, together with the organization and manner of operation thereof, may best be understood by reference to the following description of a preferred embodiment of the invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1***a* and **1***b* illustrate a female receptacle and male plug, respectively, each having mounting frame bars and associated alignment mechanism in accordance with the present invention;

FIGS. **2***a*, **2***b*, and **2***c* show three successive stages of operation of the alignment mechanism during coupling of the female receptacle and male plug, portions being broken away for clarification;

FIGS. **3***a*, **3***b*, and **3***c* show the operation of the mounting frame bars in ensuring positive contact of all of the pin and receptacle elements; and

FIGS. **4***a* and **4***b* show the handle mechanism used in closing and opening the connected connector members.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, and in particular to FIGS. **1***a* and **1***b*, there is illustrated a female receptacle connector member, indicated generally at **100**, and a plug or male connector member indicated generally at **101**. The female connector member **100** includes a housing structure comprising a pair of parallel laterally spaced frame bars **10** and **12**. Secured along the rearward surface of each frame bar **10** and **12** are individual forty pin female receptacles **14**, **16**, each receptacle having two 20 pin sections **14***a*, **14***b*; **16***a*, **16***b*, each pin section extending outwardly on opposite sides of the frame bars **10** and **12**. A number of such receptacle sections may be secured longitudinally along the frame bars **10** and **12** depending upon the number of pin connections desired between the female and male connector members **100** and **101**.

The male connector member **101** is of the same general size as the female connector member **100** and similarly includes a housing structure comprising parallel laterally spaced frame bars **18** and **20**. The frame bars **18** and **20** support a plurality of male plugs, each plug having two pin sections **22***a*, *b*; **23***a*, *b*, in similar fashion to the mounting of the female receptacles **14** and **16** on the frame bars **10** and **12**. The housing structure of the male connector member **101** includes a casing **24** which serves to enclose a wired electrical program, or electrical cable, associated with the male plugs. The casing **24** has an upper end plate **26** which is generally coplanar with the upper ends of the spaced frame bars **18** and **20**. As will become more apparent hereinbelow, the male pins on the male plug sections **22***a* and *b*, **23***a* and *b* of the male connector member **101** are adapted to be received and connectively coupled to the female receptacle sections **14***a* and *b*, **16***a* and *b* of the female connector member **100**. The present invention insures proper registration of the male plugs and female receptacles and insures positive contact therebetween during coupling or connection of the male and female connector members.

The male connector member **101** includes alignment mechanism means, indicated generally at **28**, secured to the upper end plate **26** of the casing **24**. The alignment mechanism means **28** serves both as a means by which the female connector member **100** can be hingedly connected to the male connector **101**, and a means cooperative with the female connector member to insure proper alignment of the male plugs and female receptacles during coupling. The alignment means **28** comprises a bracket **30** having a planar base portion **32** and parallel upstanding end flanges **34** and **36**. The

base portion **32** is secured to the upper end plate **26** of casing **24** by screws **37**. The end flanges **34** and **36** support a pivot pin or rod **38** disposed perpendicular to the longitudinal axes of the upper ends of the frame bars **18** and **20** lying in a plane parallel to and spaced outwardly from the forward surfaces of the frame bars **18** and **20** as shown in FIG. **2***c*.

The alignment mechanism means **28** includes an alignment tongue **40** having a rearward portion **42**, suitably secured to the base portion **32** of bracket **30** by screws **43**, and a forward portion **44** lying in a plane inclined upwardly relative to the rearward portion **42**. The upward inclination of portion **44** is from a bend line **45** disposed rearwardly of the alignment rod **38** as will become more apparent hereinbelow.

The female receptacle connector member **100** includes locating means, indicated generally at **46**, adapted for cooperation with the pivot rod **38** to effect a hinge connection between the female connector member and the male connector member **101**. The locating means **46** includes a pair of laterally spaced locating members which preferably comprise upper end portions of the frame bars **10** and **12** extending above the female receptacles **14**, **16** as shown in FIG. **1***a*. The spaced locating members have aligned transverse slots or grooves **48** and **50** therein which are adapted to receive the alignment rod **38** therein.

The upper ends of the spaced frame bars **10** and **12** comprising the locating members of locating means **46** have a cross plate **52** suitably secured to the rearward surfaces thereof in transverse relation to the longitudinal axes of the upper ends of the frame bars **10** and **12**. The cross plate **52** has a vertical dimension extending from the upper ends of the frame bars **10** and **12** downwardly such that its lower edge is spaced vertically above the upper end of the female receptacles **14**, **16**. The cross plate **52** preferably extends laterally outwardly from the frame bars **10** and **12** with its outer ends being provided with holes **54** for securing the female connector member **100** to a suitable support frame before the male connector **101** and the female connector **100** are connected together as described below. A similar cross plate **51** is attached to the other end of mounting bars **10** and **12** for use in attaching the female connector **100** to the same support frame.

The lateral dimension of the forward portion **44** of the alignment tongue **40** is such that the forward upwardly inclined portion of the alignment tongue may be received between the laterally spaced frame bars **10** and **12** of the female connector member **100** and between the lower edge of the cross bar **52** and the upper edge of the female receptacles **14**, **16**.

Noting FIGS. **2***a–c*, wherein end flange **34** of bracket **30** is broken away for clarification, positioning of the male plug connector member **101** approximately perpendicular to the plane of the female connector member **100**, FIG. **2***a*, allows the pivot rod **38** to be readily received within the aligned grooves **48** and **50** of the locating means **46**. With the male connector member **101** positioned with its pivot rod **38** received within the aligned grooves **48** and **50**, the male connector member may be rotated downwardly with the alignment tongue **40** being received between the cross plate **52** and female receptacles **14**, **16**, FIG. **2***b*. As noted, the forward portion **44** of the alignment tongue **40** is inclined upwardly relative to the upper end **26** of casing **24**. The angle of upward inclination is established to cause the upper surface of the forward portion of the alignment tongue **40** to engage the lower edge surface of the cross plate **52** and urge the male connector member **101** downwardly such that the pivot rod **38** of the male connector member **101** is firmly seated in the bottoms of the aligned grooves **48** and **50**. The pivot rod **38** is disposed forwardly of the associated frame bars **18** and **20** (FIG. **1***b*) and cooperates with the aligned grooves **48** and **50** (FIG. **1***a*) in the frame bars **10** and **12** to assist in the alignment of the male projecting elements on the male plug sections **22***a* and *b*, **23***a* and *b* with the corresponding female receptacle sections **14***a* and *b*, **16***a* and *b* of the female connector member **100** when the male and female connector members are brought into mating relation.

FIGS. **3***a–c* illustrate schematically the side profile configurations of the frame bars **10** and **12** of the female connector member **100** and the frame bars **18** and **20** of the male connector member **101**. The side profile configurations of the pairs of frame bars are adapted to effect a biased engagement of the centrally disposed connector pins of the male plug sections **22***a* and *b*, **23***a* and *b* with the corresponding female receptacle sections **14***a* and *b*, **16***a* and *b* when the male and female connector members are brought into positive interconnection. In the showing of FIG. **3***a* the male connector **101** has been properly engaged with the female connector **100** in the manner shown in FIG. **2***b*, and has been moved in the direction of the female connector **100** so that the upper pins of the two connectors are in mating relation. Noting FIG. **3***b*, the lower one-half length of each of the frame bars **10** and **12** of the female connector member **100** is cambered rearwardly from a bend line **55** disposed approximately intermediate its length. Similarly, the frame bars **18** and **20** of the male connector member **101** are cambered rearwardly from bend lines **56** disposed generally intermediate their lengths. With the frame bars **10**, **12**, **18** and **20** having their lower half lengths cambered rearwardly as shown in FIG. **3***b*, bringing the respective frame bars of the male and female connector members **100** and **101** together such that they are in substantially full contacting engagement along their mating surfaces as shown in FIG. **3***c* will effect the desired positive contact of the male pin elements and female receptacle elements throughout the full length of the multipoint connector arrangement. It has been found that with the respective female and male connector members **100** and **101** having longitudinal lengths of approximately about 8.5 inches, providing a rearward camber of one-sixteenth inch for the lower half lengths of the frame bars **10** and **12**, and a rearward camber of approximately about one-eighth inch for the lower half lengths of the frame bars **18** and **20** will provide the desired biased engagement of the intermediate length portions of the frame bars.

Noting FIG. **4**, the multi-point connector arrangement including the female connector member **100** and male connector member **101** includes means for maintaining the respective separable male and female connector members in locked coupled relation. To this end, the casing **24** of the male connector member **101** has a latch handle **58** secured to the rearward surface thereof, the latch handle being of a known type commercially available from the Camloc Fastener Corporation of Paramus, New Jersey. The latch handle **58** pivotally supports a locking lever **60** having a lower hooked end portion **62**. The hooked end **62** of the locking lever **60**, FIG. **4***a*, is adapted to matingly interconnect with a hook end **64** provided on the forward end of a catch bracket **66** which is affixed in generally normal relation to the lower ends of the depending frame bars **10** and **12** of the female connector member **100**. It can be seen that when the male connector member **101** is brought into mating engagement with the female connector member **100**, with the locking lever **60** in a generally vertical position as considered in FIG. **4***a*, further pivotal movement of the locking lever toward the vertical position will cause the hooked portions **62** and **64** of the locking lever **60** and catch bracket **66**, respectively to apply a force which urges the pins of male connector **101** into positive engagement with the receptacle pins of female connector **100**. The locking lever **60** has a shoulder portion **68** which serves to abut the outer surface of the hook portion **64** of the catch bracket **66** and assist in separating the male and female connector members **101** and **100** when disconnecting them, as shown in FIG. **4***b*.

Having thus described the elements comprising a preferred embodiment of a multi-point arrangement in accordance with the present invention, it can be seen that the alignment mechanism means **28** insures an exact alignment of the male pin elements of the plug sections with the associated female receptacle sections **14**, **16** of the female connector member when effecting coupling therebetween. Additionally, the rearward camber provided on the lower half length portions of the frame bars **10**, **12**, **18** and **20** of the female and male connector members assures that the male plug elements intermediate

the length of the male connector member **101** will be properly and completely coupled to the associated female receptacle sections intermediate the length of the female connector member **100** during interengagement and coupling of the male and female connector members as described.

While a preferred embodiment of the present invention has been shown and described, it will be understood to those skilled in the art that changes and modifications may be made therein without departing from the invention in its broader aspects. For example a single frame bar could be used on each connector, the vertical median of the cross plate on the female connector being coincident with the vertical median of the frame bar, the tongue on the male connector having two forward portions, each engaging the cross plate on either side of the single frame bar.

I claim:

1. A multi-point connector arrangement comprising interconnectable plug means and mating receptacle means, said plug means including first frame bar means, first connector means supported by said first frame bar means, said receptacle means including second frame bar means, second connector means supported by said second frame bar means, said first and second connector means being adapted for mating relationship upon interconnecting of said plug and receptacle means, and alignment means operatively associated with said plug and receptacle means for effecting proper alignment of said first and second connector means during interconnecting of said plug and receptacle means; said alignment means including pivot rod and locating member means cooperable to establish selective relative positioning of said first and second connector means whereby to effect said proper alignment thereof, and alignment tongue means associated with said pivot rod to engage said locating member means in a manner to continually urge said pivot rod in a direction to positively and firmly engage said locating member means during interconnecting of said plug and receptacle means.

2. A multi-point connector arrangement as defined in claim **1** wherein said locating member means includes at least one locating member having a locating slot therein adapted to receive said pivot rod, and including plate means supported by said locating member and cooperable with said alignment tongue means to urge said pivot rod into the full depth of said locating slot.

3. A multi-point connector arrangement comprising interconnectable plug means and mating receptacle means, said plug means including first frame bar means, first connector means supported by said first frame bar means, said receptacle means including second frame bar means, second connector means supported by said second frame bar means, said first and second connector means being adapted for mating relationship upon interconnecting of said plug and receptacle means, and alignment means operatively associated with said plug and receptacle means for effecting proper alignment of said first and second connector means during interconnecting of said plug and receptacle means, said alignment means including pivot rod and locating member means cooperable to establish selective relative positioning of said first and second connector means whereby to effect said proper alignment thereof, said first and second frame bar means being adapted for substantially full length engagement during interconnecting of said plug and receptacle means, said first and second frame bar means having diverse relative camber therebetween when in relaxed positions such that full length engagement of said first and second frame bar means effects a biased engagement of the intermediate length portions thereof to effect positive connection of said first and second connector means during said mating relationship.

4. The multi-point connector arrangement of claim **3** wherein each of said first and second frame bar means has a lower length portion cambered rearwardly relative to the upper length portion thereof.

5. The multi-point connector arrangement of claim **4** wherein said first and second frame bar means have their lower one-half length portions cambered rearwardly relative to their respective upper one-half length portions.

6. A multi-point connector arrangement as defined in claim **3** including alignment tongue means associated with said pivot rod and adapted for cooperation with said locating member means to effect said selected relative positioning of said first and second connector means during interconnection of said plug and mating receptacle means.

7. A multi-point connector arrangement as defined in claim **6** including latch means adapted to releasably connect said plug and mating receptacle means such that full length engagement of said first and second frame bar means is effected upon interconnection of said plug and receptacle means.

8. A multi-point connector arrangement comprising interconnectable plug means and mating receptacle means, said plug means including a first pair of laterally spaced frame bars, first connector means supported by said first pair of frame bars, said receptacle means including a second pair of laterally spaced frame bars, second connector means supported by said second pair of frame bars, said first and second connector means being adapted for mating relationship upon interconnecting of said plug and receptacle means, and alignment means operatively associated with said plug and receptacle means for effecting proper alignment of said first and second connector means during interconnecting of said plug and receptacle means, said alignment means including pivot rod and locating member means cooperable to establish selective relative positioning of said first and second connector means to effect said proper alignment thereof, said pivot rod being supported by one of said pairs of frame bars in transverse relation to the longitudinal axes thereof, said locating member means being defined by the upper end portions of the other of said pairs of frame bars which have aligned locating slots therein to receive said pivot rod therein, alignment tongue means including an alignment tongue supported by said one of said pairs of frame members, and a cross-plate secured to said upper end portions of said other of said pairs of frame bars in generally transverse relation thereto, said cross-plate being engageable with said alignment tongue to urge said pivot rod to the full depths of said locating slots upon interconnecting of said plug and receptacle means.

* * * * *