

May 15, 1956

L. GILBERT

2,746,022

SEPARABLE CONNECTOR ASSEMBLY WITH ALIGNING AND SECURING MEANS

Filed Feb. 10, 1953

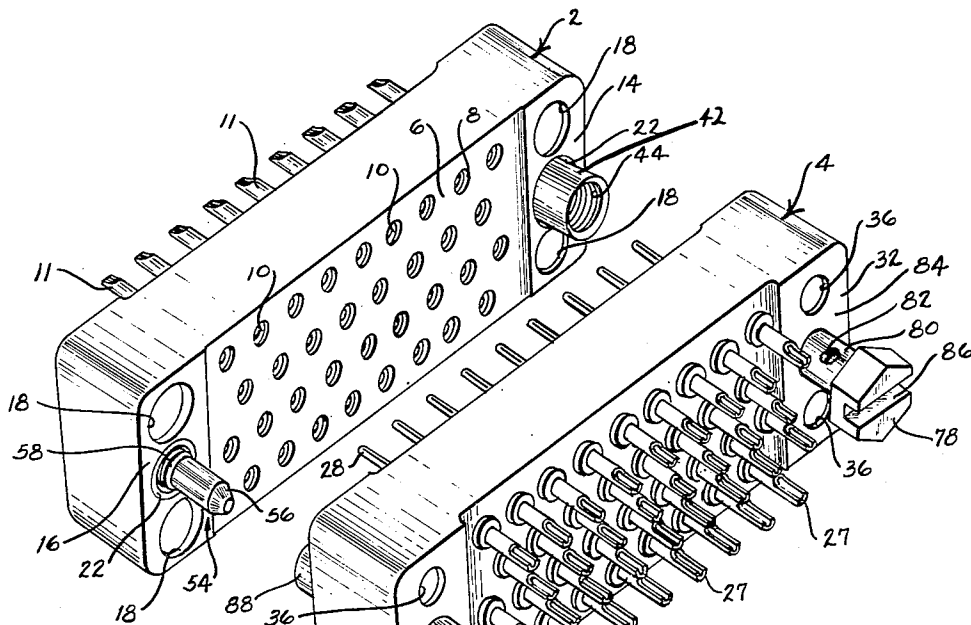


FIG. 1

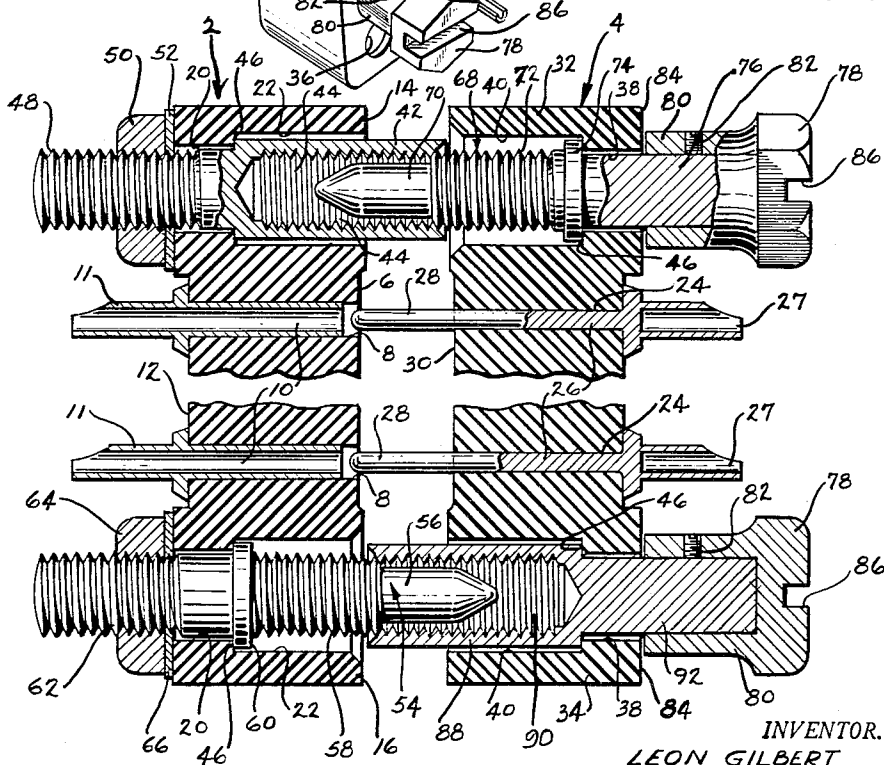


FIG. 2

INVENTOR.
LEON GILBERT
BY *James and Franklin*
ATTORNEY

1

2,746,022

SEPARABLE CONNECTOR ASSEMBLY WITH ALIGNING AND SECURING MEANS

Leon Gilbert, Stamford, Conn., assignor to Continental Connector Corporation, Long Island City, N. Y., a corporation of New York

Application February 10, 1953, Serial No. 336,049

13 Claims. (Cl. 339-92)

The present invention relates to a separable connector assembly particularly adapted for multiple miniature electrical connectors, the connector assembly being so constructed as to ensure proper orientation thereof during the connecting operation and facilitate both the connection and separation operations.

Separable electrical connectors comprising a plurality of male and female members engageable to provide for electrical connection therebetween and disengageable so as to sever that electrical connection are well known. They are particularly well adapted for use in electronic installations, where they provide an effective means for connecting different electronic sub-assemblies each of which include a large number of separate circuits or contact points. Replacement of one sub-assembly with another or isolating or testing a given sub-assembly is facilitated when all of the electrical connections between that sub-assembly and the remainder of the installation can be effectively and efficiently made or broken through a single operation, and without requiring extensive soldering steps.

Coincident with the development and extension of use of multiple separable connectors of the type described has been the tendency toward miniaturization thereof, this tendency being particularly marked in the case of equipment to be used where space or weight is a factor, as in aircraft or the like.

Miniaturization necessarily results in a lessening of the reliability of the connections made, the interengaging contacts being much more fragile and susceptible to disengagement when subjected to vibration than when the units are of larger and more substantial construction. The inherent structural strength of the units is an important factor because when a large number of male and female connectors are to be simultaneously disengaged considerable force must be applied to separate the supports which carry those connectors. This force is often applied either by rocking one support with respect to the other or by inserting some element between them and prying them apart. The strength of the grip between the male and female connector elements is made as strong as possible in order to minimize the dislocative tendency of vibration, and further in order to ensure adequate electrical connection, particularly in high frequency circuits, and this strong inter-element grip necessitates the exertion of considerable force in separating the two relatively movable assembly supports.

Thus conflicting factors influence the design of connectors of the type under discussion. A large number of sets of connector elements should be incorporated into a single assembly, but this increases the force which is required to separate or connect the assembly parts. The structure must be made as small and light as possible, but this increases the tendency to breakage unless great care is exerted in the act of separating the assembly parts. Also, miniaturization of the connector elements makes it necessary to ensure that those elements are properly and accurately aligned before any attempt is made toward

2

mutual engagement. Means must also be provided, particularly when a large number of sets of connector elements are involved, for ensuring that the two separable connector parts are properly oriented before the connector elements engage, thus preventing electrical connection between inappropriate connector elements. To connect the wrong connector elements even momentarily might often result in the application of a high potential to a sensitive portion of a given circuit, leading to damage to the equipment.

The present invention provides, in an extremely simplified manner, for the solution of the problems set forth above. It ensures proper orientation of the separable connector parts before the connector elements are engaged. It positively holds those elements in engagement against all effects of vibration or shock. It permits the uniform application of engaging force so as to move the connector elements into engaged position. It further provides for the uniform application of separative force, so that even very small connector parts can be separated without undue strain or danger of breakage. In addition, the device is so arranged that proper orientation even of a large number of separable connector elements is ensured before any electrical connection between those elements is permitted.

According to the present invention, the relatively movable supports which carry the engageable electrical connector elements are provided with securing and aligning members consisting of a plurality of pairs of sleeves and pins receivable within the sleeves, one member of each pair being mounted on one support and the other member being mounted on the other support so as to register with the first member when the electrical connector elements are properly aligned. The sleeves are internally threaded and the pins are externally threaded. Threaded engagement between the pins and sleeves starts when the supports are spaced sufficiently far apart so that the electrical connector elements are not appreciably engaged, and preferably so that they are not engaged at all. Thus alignment is ensured before any electrical connection is made. In order to positively prevent accidental connection of the wrong connector elements, each support carries a pin and a sleeve spaced from one another so that they can engage their respective sleeve and pin on the other support only when the supports are oriented or polarized in the desired manner. One member of each of the sleeve-pin pairs is non-rotatable with respect to the support on which it is mounted, and the other member of that pair is manually rotatable on its support. Hence once threaded engagement between the two members of each pair is effected, rotation of the rotatable member of that pair will cause the two supports to move toward one another, being pulled in that direction by means of the pin-sleeve threaded interengagement, until the electrical connector elements are positively and firmly engaged, and this even against the most rigorous frictional engagement or grip between the connector elements. Since a plurality of such pin-sleeve pairs are employed, preferably positioned adjacent opposite ends of the supports, simultaneous rotation of the rotatable members of said pairs will cause the supports to move toward one another in a uniform and non-canted manner. When the rotatable members are turned in the other direction the supports will be correspondingly separated, again even against the most rigorous grip between the electrical connector elements, thus eliminating any prying or rocking operation which might tend to destroy, bend or break the connector elements themselves. The arrangement of the pin-sleeve pairs is such that the supports will be moved thereby quite close to one another, and even into abutting relationship. Moreover, according to a preferred embodiment, the sleeves and pins, whether rotatable or non-rotatable, may be respectively formed

from identical blanks, thus reducing the cost of manufacture to a minimum.

To the accomplishment of the above, and to such other objects as may hereinafter appear, the present invention relates to a separable connector assembly, as defined in the appended claims and as described in this specification, taken together with the accompanying drawings in which:

Fig. 1 is a three-quarter perspective view of the assembly showing the two separable parts thereof spaced from one another; and

Fig. 2 is a cross sectional view showing the separable parts in the position which they assume when threaded engagement between the pins and sleeves is about to be initiated.

The invention, in the preferred embodiment here illustrated, comprises a pair of supports 2 and 4 formed of some preferably molded insulating material. The central portion of the inwardly facing surface 6 of the support 2 is provided with a plurality of apertures 8 in which female electrical connectors 10 are received, portions 11 of those connectors projecting out beyond the outwardly facing surface 12 of the support 2 so that leads may be connected thereto. As here disclosed thirty-four individual female connector elements 10 are employed, although that number may be varied over wide ranges according to the desired installation. The end portions 14 and 16 of the support 2 have inwardly facing surfaces which may be slightly raised above the surface 6, and those end portions may be provided with apertures 18 for receiving screws by means of which the support 2 may be mounted on any appropriate panel support or the like. The end portions 14 and 16 are further provided with holes 20 having countersunk portions 22 extending outwardly from the inwardly facing ends thereof for an appreciable distance, for a purpose to be described hereinafter.

The support 4 is similar to the support 2, and its central portion is provided with a plurality of apertures 24, of equal number as and positioned so as to register with the apertures 8 in the support 2, male electrical connector elements 26 being mounted in the apertures 24, having outwardly extending portions 27 to which leads may be connected, and having prongs 28 extending forwardly from the inwardly facing surface 30 of the central portion of the support 4. The end portions 32 and 34 of the support 4 are provided with apertures 36 through which mounting screws are adapted to pass, the apertures 36 registering with the apertures 18 in the support 2, and are further provided with holes 38 having countersunk portions 40 extending outwardly for an appreciable distance from the inner end thereof, the holes 38 and countersunk hole portions 40 being positioned opposite and in registration with the holes 20 and countersunk hole portions 22 of the support 2.

In the form here specifically disclosed, a sleeve 42 internally threaded at 44 is received within the upper countersunk hole portion 22 of the support 2, the sleeve 42 being larger than the hole 20 and resting on the ledge 46 formed between the countersunk hole portion 22 and the hole 20. Extending outwardly from the sleeve 42 is a part 48 which passes through the hole 22 and projects out beyond the outwardly facing surface 12 of the support 2, the part 48 being externally threaded and a nut 50 being received thereover and screwed down thereon so as to clamp the sleeve 42 in position, holding it against axial movement or rotation. If desired, a washer 52 may be interposed between the nut 50 and the support 2.

A pin generally designated 54 and preferably having an outwardly projecting unthreaded tip portion 56 and a rearwardly positioned externally threaded portion 58 is received within the lower countersunk hole portion 22 on the support 2. The pin 54 is provided, rearwardly of its threaded portion 58, with a part 60 of diameter smaller than the countersunk hole portion 22 but larger than the hole 20, the part 60 being adapted to rest on the

ledge 46 between the countersunk hole portion 22 and the hole 20. Extending rearwardly from the part 60 is a part 62 which passes through the hole 22 and projects outwardly beyond the outwardly facing surface of the support 2, the part 62 preferably being externally threaded and having a nut 64 received thereover and screwed down so as to clamp the pin 54 against axial movement and rotational movement relative to the support 2. If desired, a washer 66 may be interposed between the nut 64 and the support 2.

The upper hole 38 and countersunk hole portion 40 on the support 4 is adapted to receive a pin generally designated 68 which is substantially identical with the pin 54, having an unthreaded outwardly projecting tip 70, an externally threaded portion 72, a wide diameter part 74 and a rearwardly extending part 76 all corresponding to the parts 56, 58, 60 and 62 of the pin 54, except that the outwardly projecting pin part 76 need not be, although it may be, externally threaded. A knob 78 having a sleeve 80 is received over the outwardly projecting part 76 of the pin 68, and is secured to that part for rotation therewith by any appropriate means, such as the set screw 82. The sleeve 80 has a slight clearance with respect to the outwardly facing surface 84 of the support 4 when the pin part 74 is against the ledge 46 between the hole 38 and the countersunk hole portion 40, thus limiting the axial movement of the pin 68 relative to the support 4 but permitting rotation thereof. The knob 78 may have a hexagonal outline to facilitate rotation thereof by a wrench, and may also be provided with a slot 86 so that it may be rotated by a screw driver.

The lower hole 38 and countersunk hole portion 40 in the support 4 is adapted to receive a sleeve 88 substantially identical with the sleeve 42, the interior of that sleeve being threaded at 90, the sleeve resting on the ledge 46 between the hole 38 and the countersunk hole portion 40, and the sleeve having a rearwardly extending part 92 which projects out beyond the outwardly facing surface 84 of the support 4. The only difference between the sleeve 88 and the sleeve 42 is that the outwardly projecting part 92 of the sleeve 88 need not be externally threaded, although it may be.

A knob 78 is secured to the outwardly projecting sleeve part 92 in a manner similar to that described with respect to the pin 68, and for the same purpose, to wit, limiting the degree of axial movement of the sleeve 88 relative to the support 4 but permitting manual rotation thereof.

When it is desired to electrically connect the electrical connector elements by causing the prongs 28 of the male connector elements 26 to telescope within the female connector elements 10, the supports 4 and 2 are moved toward one another. It will be assumed for the purposes of this discussion that support 2 is fixed in position, the support 4 being moved theretoward. Since the sleeves 42 and 88 and the pins 54 and 68 all project out beyond the inwardly facing surfaces 6 and 30 of the supports 2 and 4, the unthreaded tips 56 and 70 of the pins 54 and 68 respectively will enter the sleeves 88 and 42 respectively long before the prongs 28 are near the female connector elements 10. If the support 2 is not properly polarized or oriented with respect to the support 2, this telescoping action will not take place, the sleeve 88 abutting against the sleeve 42 and the pin 68 abutting against the pin 54 and thus immediately apprising the operator that the support 4 should be turned around. Thus positive protection against improper electrical connection is afforded.

When the supports are properly oriented or polarized, the unthreaded pin tips 56 and 70 will slide within their respective sleeves 88 and 42 until the threaded pin portions 58 and 72 come into contact with the threaded sleeve portions 90 and 44. As may be seen in Fig. 2, this initial contact between the threaded portions preferably takes place before the prongs 28 of the male connector

5

elements 26 have actually engaged the female connector elements 10. Further movement of the support 4 toward the support 2, which is necessary to produce electrical connection, is effected by rotating the knobs 78 either manually or by means of an appropriate tool, this causing the threaded pin portions 72 and 58 to screw into the sleeves 42 and 88 respectively. As the support 4 is thus pulled down toward the support 2, the prongs 28 of the male connector elements 26 telescope within the female connector elements 10, thus making electrical connection therebetween. This telescoping action will continue until the support 4 has been moved all the way toward the support 2, the sleeves 42 and 88 sliding into the countersunk hole portions 40 and 22 of their respective cooperating pins 68 and 54. The inwardly facing ends of these countersunk hole portions 40 and 22 may be slightly flared in order to facilitate entry of the sleeves thereinto. Because of the screw action, the support 4 is moved toward the support 2 firmly and uniformly even when a very strong grip is exerted by the female connector elements 10 on the prongs 28.

When it is desired to separate the supports 2 and 4 so as to break electrical connection, it is merely necessary to rotate the knobs 78 in an unscrewing direction. This will positively force the support 4 away from the support 2 against even the strongest grip exerted on the prongs 28 by the female connector elements 10. Thus the two supports can be separated in a steady and uniform manner without canting, rocking or prying. The length and position of the interengaging shell and pin threaded portions is such that, as shown in Fig. 2, once the threaded portions have been completely unscrewed, the prongs 28 preferably will have been fully released from the female connector elements 10, so that the support 4 may be lifted from the support 2 without having to apply any appreciable amount of force thereto.

Since each of the pins 54 and 68 is identical or substantially so, and since each of the sleeves 42 and 88 is identical or substantially so, and at any rate each pin or sleeve is formed from the same screw-machine-produced blank, it will be apparent that the aligning and securing mechanism here disclosed may be very inexpensively produced and may be assembled on the supports 2 and 4 in an extremely simple and facile manner.

While but one embodiment of the instant invention has been here disclosed, it will be apparent that many variations may be made therein as to specific design or shape, arrangement of parts and the like, all within the spirit of the invention as defined in the following claims.

I claim:

1. A separable connector assembly comprising supports having a plurality of cooperable connector elements adapted to operatively engage when said supports are moved toward one another, one of said supports having a sleeve opening toward said other support and a pin projecting toward said other support, said sleeve and pin being spaced from one another an appreciable distance, said other support having a sleeve opening toward said one support and positioned so as to receive said first named pin therein when said connector elements are aligned, and also having a pin projecting toward said one support and positioned so as to enter said first named sleeve when said connector elements are aligned, one of each cooperating sleeve-pin pair being fixed to its support and the other being rotatable on its support but substantially immovable axially thereof and including means for manually rotating it, said sleeve having internally threaded portions and said pins having externally threaded portions cooperable therewith.

2. The separable connector assembly of claim 1, in which the cooperable threaded portions on said sleeves and pins are so positioned with respect to said connector elements that when said threaded portions are just engaged but not screwed together said connector elements are not engaged to any appreciable degree, said threaded

6

portions having a length such that screwing the sleeves and pins together moves said supports toward one another so that said connector elements operatively engage.

3. The separable connector assembly of claim 2, in which said pins comprise tip portions freely passable into the respective sleeves without engaging the sleeve threads, thereby ensuring proper orientation of said assembly before said pins and sleeves are threadedly engaged.

4. The separable connector assembly of claim 1, in which said pins comprise tip portions freely passable into the respective sleeves without engaging the sleeve threads, thereby ensuring proper orientation of said assembly before said pins and sleeves are threadedly engaged.

5. A separable connector assembly comprising a pair of supports and a plurality of cooperable connector elements adapted to operatively engage when said supports are moved toward one another, each of said supports having a pair of holes therethrough which register with holes in the other support when said connector elements are aligned, and aligning and securing means comprising a pair of pins and a pair of sleeves into which said pins are respectively receivable, each of said pins and sleeves having a rearwardly projecting part passing through one of said holes and extending out beyond the outwardly facing surface of its respective support, a pin and a sleeve being opposite one another on opposing supports, means engaging the rearwardly projecting parts of one member of each cooperating sleeve-pin pair and limiting axial movement and preventing rotatable movement thereof relative to their respective supports, and means engaging the rearwardly projecting parts of the other elements of said cooperating sleeve-pin pairs and limiting axial movement and providing for manual rotation thereof relative to their respective supports, said sleeves having internally threaded portions and said pins having externally threaded portions cooperable therewith, said sleeves and pins being so distributed and relatively sized that said pins are receivable within the respective oppositely positioned sleeves only when said supports are oriented in a predetermined manner.

6. The separable connector assembly of claim 5, in which the cooperable threaded portions on said sleeves and pins are so positioned with respect to said connector elements that when said threaded portions are just engaged but not screwed together said connector elements are not engaged to any appreciable degree, said threaded portions having a length such that screwing the sleeves and pins together moves said supports toward one another so that said connector elements operatively engage.

7. The separable connector assembly of claim 6, in which said pins comprise tip portions freely passable into the respective sleeves without engaging the sleeve threads, thereby ensuring proper orientation of said assembly before said pins and sleeves are threadedly engaged.

8. The separable connector assembly of claim 5, in which said pins comprise tip portions freely passable into the respective sleeves without engaging the sleeve threads, thereby ensuring proper orientation of said assembly before said pins and sleeves are threadedly engaged.

9. The separable connector assembly of claim 5, in which a sleeve and a pin are on the same support and are rotatable relative thereto, the sleeve and the pin on the other support being non-rotatable relative thereto.

10. A separable connector assembly comprising supports having a plurality of cooperable connector elements adapted to operatively engage when said supports are moved toward one another, a pair of pins and a pair of sleeves into which said pins are respectively receivable, said sleeves and pins being mounted on said supports in opposed sleeve-pin pairs with said sleeves opening toward the support other than that on which they are mounted and with said pins projecting toward the sleeves with which they cooperate, said pairs being separated from one another an appreciable distance, said sleeves and pins being so distributed and relatively sized that said pins

7

are receivable inside the respective oppositely positioned sleeves only when said supports are oriented in a predetermined manner, one of each cooperating sleeve-pin pair being fixed to its support and the other being rotatable on its support but substantially immovable axially thereof and including means for manually rotating it, said sleeve having internally threaded portions and said pins having externally threaded portions cooperable therewith.

11. The separable connector assembly of claim 10, in which the cooperable threaded portions on said sleeves and pins are so positioned with respect to said connector elements that when said threaded portions are just engaged but not screwed together said connector elements are not engaged to any appreciable degree, said threaded portions having a length such that screwing the sleeves and pins together moves said supports toward one another so that said connector elements operatively engage.

8

12. The separable connector assembly of claim 11, in which said pins comprise tip portions freely passable into the respective sleeves without engaging the sleeve threads, thereby ensuring proper orientation of said assembly before said pins and sleeves are threadedly engaged.

13. The separable connector assembly of claim 10, in which said pins comprise tip portions freely passable into the respective sleeves without engaging the sleeve threads, thereby ensuring proper orientation of said assembly before said pins and sleeves are threadedly engaged.

References Cited in the file of this patent

UNITED STATES PATENTS

15	2,068,399	Dash et al.	Jan. 19, 1937
	2,610,222	Burt et al.	Sept. 9, 1952
	2,647,244	Dewey et al.	July 28, 1953