

Jan. 9, 1962

E. H. BORCHARD
CONNECTOR ASSEMBLY

3,016,512

Filed Sept. 22, 1959

3 Sheets-Sheet 1

FIG. 1

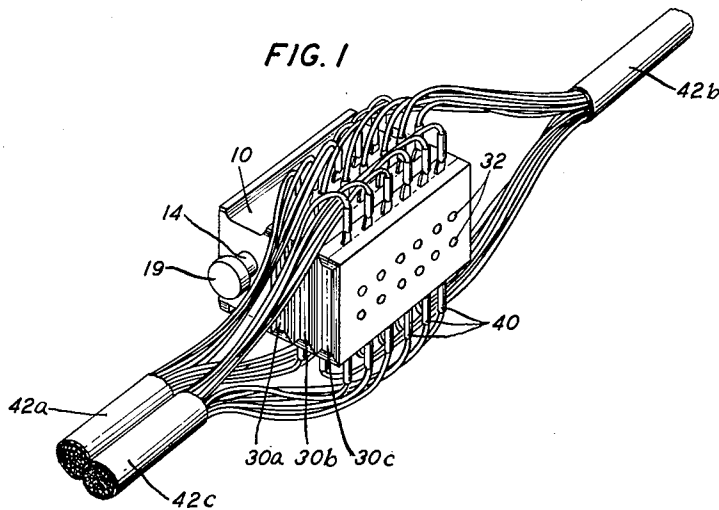
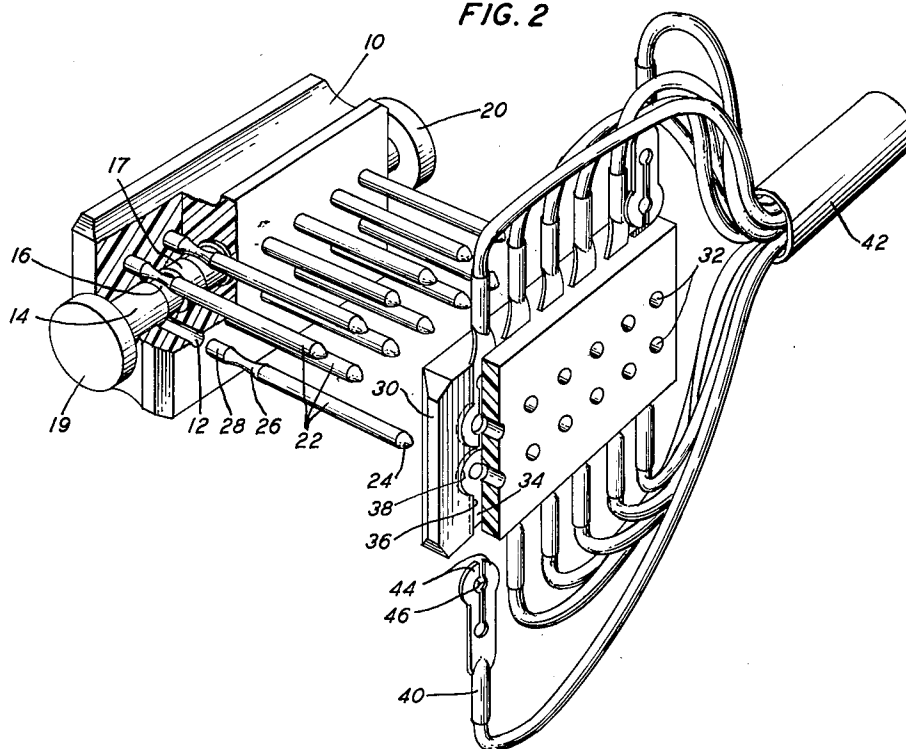


FIG. 2



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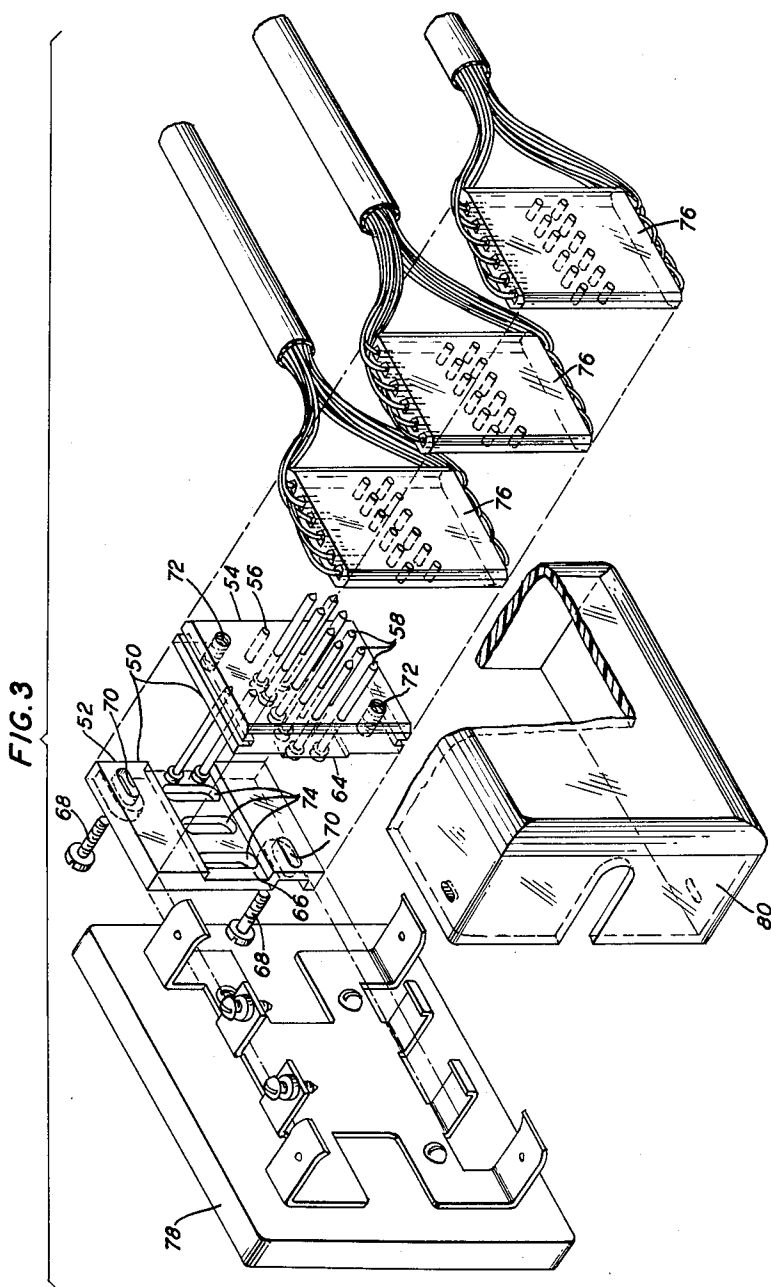
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FIG. 4

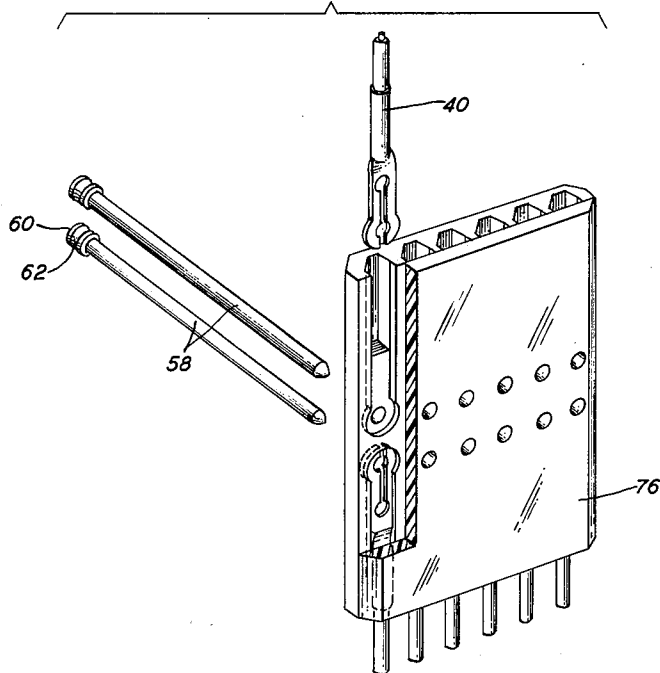


FIG. 6

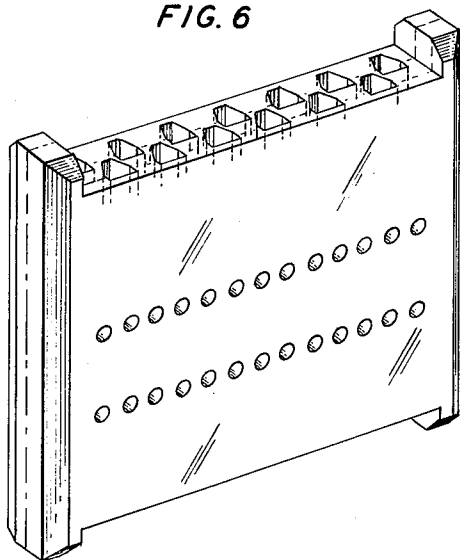
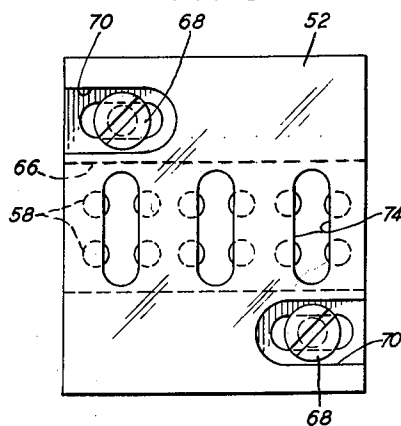


FIG. 5



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CONNECTOR ASSEMBLY

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2 Claims. (Cl. 339-217)

This pertains to electrical connectors and more particularly to a connector assembly for interconnecting two or more groups of conductors.

While many connector devices have been developed for connecting a first group of conductors to a second group of conductors, few connector devices are able to interconnect three or more groups of conductors. Probably the means most commonly utilized to perform this task is a terminal board having a plurality of terminal posts mounted thereon, each terminal post comprising a threaded stud upon which is screwed a plurality of nuts. In using the terminal board to interconnect the plurality of groups of conductors, the insulation is skinned from the ends of the conductors; the bared end of each conductor in the first group of conductors is individually wrapped around a stud, and the lowermost nut on each stud is tightened down upon each of these conductors; the bared end of each of the conductors in the second group of conductors is individually wrapped around the stud having the conductor to which it is to be connected, and the next nut on each stud is tightened down upon each of these conductors; the bared end of each of the conductors in the third group of conductors is individually wrapped around the stud having the conductors to which it is to be connected, and the next nut on each stud is tightened down upon each of these conductors; and so on.

It is apparent that interconnecting several groups of conductors in this manner is a tedious and time consuming task. Furthermore, if it is necessary to replace one group of conductors with another group of conductors, it may entail the disassembly and reassembly of all of the conductors.

An object of this invention is to provide a connector assembly that will permit quick and easy interconnection of two or more groups of conductors.

A further object of this invention is to provide a connector assembly that will permit quick and easy changes in connection.

Another object of this invention is to provide a connector assembly that will interconnect two, three, four, or more groups of conductors with equal facility.

These and other objects of the invention are realized in an illustrative embodiment thereof wherein the connector assembly comprises a plurality of terminating members respectively secured to the ends of the plurality of conductors forming the groups of conductors to be interconnected. Each terminating member is apertured, the edge about the aperture providing a contacting surface. Each terminating member is also bifurcated, the bifurcations having lateral spring movement.

The terminating members are placed within individual slots in dielectric wafer members, each wafer member holding in a spaced array the terminating members secured to a single group of conductors. The slots in the wafer members are shaped so that when the terminating members are properly positioned therein, the lateral spring movement of the bifurcations act as a detent to hold the terminating members in place. In addition, when the terminating members are properly positioned within the slots, apertures formed in the wafer are coaxial with the apertures in the terminating members.

Cooperating with the wafer members is a dielectric base member having a plurality of conducting pin mem-

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bers mounted therein in a spaced array. Each pin member has a cross sectional configuration which is similar to the configuration of the aperture in each terminating member. By placing the wafer members upon the base member so that the pin members extend through the apertures in the terminating members held by each wafer member, the pin members engage the contacting surfaces of the terminating members and all terminating members engaging a single pin member are interconnected.

Thus a feature of the invention resides in a structure in which a plurality of terminating members are respectively secured to the ends of a plurality of groups of conductors, and the terminating members of each group of conductors are held in a spaced array by a dielectric wafer member.

Another feature of the invention resides in a structure in which each terminating member is bifurcated and the slots in the dielectric wafer members that receive the terminating members are shaped so that when the terminating members are properly positioned therein, the lateral spring movement of the bifurcations hold the terminating members in place.

A further feature of the invention resides in a structure in which an aperture of a certain configuration is formed in each terminating member, and the edge about the aperture provides a contacting surface that cooperates with a conducting pin member having a similar cross sectional configuration.

A still further feature of the invention resides in a structure in which a plurality of the pin members are mounted in a dielectric base member, a plurality of wafer members are positioned upon the base member so that the pin members engage the contacting surfaces of the terminating members carried by the wafer members, and each pin member interconnects all terminating members engaged by it.

A complete understanding of the invention and of these and other features and advantages thereof may be gained from consideration of the following detailed description taken in conjunction with the accompanying drawing wherein several embodiments of the invention are illustrated. It is to be expressly understood however that the drawing is for the purposes of illustration and description and is not to be construed as defining the limits of the invention.

In the drawing:

FIG. 1 is a perspective view of one embodiment of the connector assembly of this invention;

FIG. 2 is an exploded perspective partly in section showing portions of FIG. 1 in greater detail;

FIG. 3 is an exploded perspective of a second embodiment of the invention;

FIG. 4 is an exploded perspective partly in section showing portions of FIG. 3 in greater detail;

FIG. 5 is a rear view of the second embodiment of this invention; and

FIG. 6 is a perspective view of a modification of the wafer member.

Referring to FIGS. 1 and 2, one embodiment of the connector assembly of this invention comprises a dielectric base member 10 having two rows of spaced apertures 12 extending partially therethrough. A generally cylindrical, dielectric locking bar 14 extends through the base member between and transversely to the two rows of apertures. The locking bar has circumferential grooves 16 and circumferential lands 17 spaced along its length, the spacing of the circumferential grooves corresponding to the spacing between adjacent apertures in a single row of apertures. The locking bar is axially movable and has knobs 19 and 20 at the respective ends thereof to locate it in one of two positions. When the knob 19 is moved against the side of the base member adjacent thereto, the circumferential grooves in the locking

bar are aligned with the apertures in the base member. When the knob 20 is moved against the side of the base member adjacent thereto, the circumferential lands in the locking bar are aligned with the apertures in the base member.

With the circumferential grooves 16 in the locking bar 14 aligned with the apertures 12, a plurality of electrically conducting pin members 22 are removably positionable within the apertures. The pin members may have any convenient cross sectional configuration. Each pin member is advantageously tapered at one end 24 thereof and has a circumferential groove 26 adjacent the other end 28 thereof. The ends 28 of the pin members are inserted into the apertures 12, and when the pin members are inserted to the full depth of the apertures, the circumferential grooves 26 in the pin members are positioned adjacent the locking bar. The circumferential grooves are of such a shape that when the knob 20 of the locking bar is moved against the side of the base member adjacent thereto, the lands 17 in the locking bar register with the circumferential grooves and the pin members are locked in place.

With the pin members 22 mounted in a spaced array as when held in the base member 10, a plurality of dielectric wafer members 30 are removably positionable over the pin members. Each wafer member has two rows of apertures 32 extending therethrough in an identical spaced arrangement to the spacing of the apertures 12 in the base member. Each wafer member further has a plurality of shaped slots 34 extending partially therethrough transversely to the apertures 32, each slot having a constricted portion 36 and an enlarged portion 38.

Prior to the positioning of the wafer members 30 over the pin members 22, a plurality of electrically conducting terminating members 40 are positioned within the shaped slots 34, the terminating members being respectively secured to the ends of a plurality of conductors 42. The unsecured end of each terminating member is bifurcated, the arms 44 formed thereby having lateral spring movement. The unsecured end of each terminating member is also apertured, the edge about the aperture providing a contacting surface 46. Each terminating member is further shaped so as to cooperate with the shaped slots in the wafer members. When a terminating member is inserted into a slot, the arms 44 are cammed together by the constricted portion 36 of the slot, and when the terminating member is inserted to the full depth of the slot, the arms move laterally apart and substantially fill the enlarged portion 38 of the slot. In this latter position, the aperture in the terminating member is coaxial with an aperture 32 in the wafer member.

The above-described cooperation between the terminating members 40 and the shaped slots 34 of the wafer members 30 performs several functions. First, it assures proper positioning of the terminating members to the full depth of the slots. When a terminating member is inserted into a slot, the movement of the arms of the terminating member from the constricted portion 36 into the enlarged portion 38 can be readily felt. Second, it serves to hold the terminating members in place once they are properly positioned within a slot. If a terminating member is to be moved from a fully inserted position, the arms of a terminating member must be cammed together to pass into the constricted portion of the slot. Thus a reasonable amount of pull must be exerted on the terminating member to move it from a fully inserted position, and accidental dislodgement of a terminating member is prevented. Third, when the wafer members are mounted on the base member so that the pin members extend through the apertures in the terminating members, the terminating members are locked in place. The pin members prevent the arms of the terminating members from moving together, and therefore the terminating

members cannot move into the constricted portion of the slots.

As shown in FIG. 1, the terminating members 40 respectively secured to a single group of conductors 42 may be advantageously positioned within a single wafer member 30. Thus the terminating members secured to the group of conductors 42a are held by the wafer member 30a, the terminating members secured to the group of conductors 42b are held by the wafer member 30b, and the group of terminating members secured to the group of conductors 42c are held by the wafer member 30c. The terminating members are distributed in the wafer members so that the terminating members secured to the respective conductors in each group that are to be interconnected occupy the same slot positions in the wafer members.

The groups of conductors 42 are interconnected by placing the wafer members 30 upon the base member 10 so that the pin members 22 held by the base member extend through the apertures in the terminating members 40 held by the wafer members. The cross sectional configuration of the pin members and the configuration of the apertures in the terminating members are generally similar, the apertures in the terminating members being slightly smaller than the cross section of the pin members. Thus, as the pin members move into the apertures in the terminating members, there is a spreading of the arms 44 of the terminating members which provides the arms with an inward bias or clamping force against the pin members. This clamping force combined with a wiping of the contacting surface 46 of the terminating members and the surfaces of the pin members as the terminating members are moved down over the pin members assures a good electrical contact therebetween. Since the terminating member mounted in the same slot position, in each wafer member contacts the same pin member, the conductors secured to the terminating members occupying the same slot position are interconnected.

It is apparent that the length of the pin member 22 can be varied to accommodate as many wafer members 30 and thereby as many groups of conductors 42 as is desired. It is also apparent that the size and shape of the wafer members and the size and shape of the base member 10 can be varied to accommodate as many terminating members and pin members and thereby as many conductors in each group as is desired. It has been found however, that because of the clamping force of the arms 44 of the terminating members against the pin members, including more than about 25 terminating members in a single wafer member, makes removal of the wafer member difficult. It is therefore advisable to divide the conductors among two or more wafers when there are more than 25 conductors in each group.

Should it be necessary to make a change in the connection between several of the conductors 42, the locking bar 14 is moved so that the knob 19 is against the side of the base member 10 adjacent thereto; and the wafer members 30 are pulled from the base member. Because of the clamping force of the arms 44 of the terminating members 40 against the pin members 22, the removal of the wafer members will remove the pin members from the base member, the pin members maintaining their position in the wafer members. Only the pin members interconnecting the conductors to be changed need then be pulled from the wafer members, allowing a change in the position of the terminating members of these conductors without disturbing those conductors whose connection is not being changed. When the change is completed, the removed pin members are re-inserted into the wafer members, the wafer members reassembled on the base member, and the locking bar moved to the locked position.

Turning now to FIGS. 3 and 4, a second embodiment of the connector assembly of this invention comprises a

dielectric base member 50 including a cover 52 and a pin holder 54. The pin holder has two rows of spaced apertures 56 extending therethrough in which a plurality of pin members 58 are removably mounted. The pin members, shown most clearly in FIG. 4, have a head 60 with a circumferential groove 62 therein at one end thereof and are tapered at the other end thereof. The pin members are inserted into the apertures 56 from the rear of the pin holder, the apertures in the pin holder being of such a size as to allow the body of the pins to move therethrough but to prevent the heads of the pins from passing therethrough.

The pin holder 54 has a boss portion 64 which is received by a notch portion 66 in the cover 52, the two members being secured together by means of fasteners 68 extending through elongated apertures 70 in the panel and threaded apertures 72 in the pin holder. The cover is also provided with elongated apertures 74 which are spaced so that, as shown in FIG. 5, when the cover is directly behind the pin holder, the apertures are not aligned directly behind any of the pin members. Thus, when a plurality of wafer members 76 having a plurality of terminating members respectively mounted therein are placed over the pin members, the solid portions of the cover between the apertures 74 will prevent the wiping action of the terminating members from pushing the pin members out from the pin holder.

The elongated apertures 70 in the cover 52, however, allow the cover to be moved laterally in either direction so that the apertures 74 may be placed directly behind any of the pin members 58 to provide access to the heads 60. Thus to make a change in the interconnection between several conductors, the cover is moved to expose the pins engaging the terminating members of these conductors. The blade of a screwdriver or similar object is placed into the circumferential groove 62 of these pins, and the pins pulled out. The terminating members may then be removed from the wafers and placed in their new positions. The pins are inserted back through the pin holder 54, and the cover returned to a position directly behind the pin holder.

As shown in FIG. 3, the base member of the connector assembly may be mounted on a bracket 78. Such a bracket may hold several connector assemblies side by side, back to back, or in any other arrangement. In addition, a dust cover 80 may be mounted to the bracket to enclose the connector assembly. As shown in FIG. 4, the wafer members may be widened to include a skirt that encloses the entire terminating member, leaving no metal exposed and preventing the possibility of short circuiting between terminating members. Furthermore, as shown in FIG. 6, the wafer members may be formed so that a large number of terminating members can be accommodated within a fairly small wafer.

Although the pin members and the terminating members disclosed have been removable, in some applications it may be more desirable to have them fixed, and they could be part of an electrical component or package of components. In addition, although the pin members disclosed have extended in only one direction from the base member, in some applications it may be more desirable to have them extend in both directions. Finally, although the pin members disclosed have been mounted in a base member, in some applications it may be more desirable to simply stack a plurality of wafer members together and individually insert the pin members through the apertures in the terminating members carried by the wafer members. These and other changes may be made in the design and arrangement of the various elements of the connector assembly without departing from the spirit and

scope of the invention as the same will now be understood by those skilled in the art.

What is claimed is:

1. An electrical connector assembly for interconnecting a plurality of conductors comprising a plurality of terminating means respectively secured to the plurality of conductors, each of the terminating means having an aperture extending therethrough and the surface about the aperture providing a contacting surface, a plurality of first dielectric means each of which holds a group of terminating means in a spaced array and insulates each terminating means from each other terminating means held thereby, a second dielectric means having a plurality of apertures therein, a plurality of pin means removably mounted in the apertures, each pin means having a circumferential groove adjacent one end thereof, and means for locking the pin means in place comprising a generally cylindrical member extending through the second dielectric means transversely to and between the apertures therein, the cylindrical member having circumferential grooves and lands spaced along the length thereof, the cylindrical member further being axially movable between a first and a second position, the cylindrical member when in the first position having the circumferential grooves therein aligned with the aperture in the second dielectric means and the pin means being readily inserted or removed from the apertures, and the cylindrical member when in the second position having the circumferential lands therein aligned with the apertures in the second dielectric means and in register with the circumferential grooves in the pin means, locking the pin means in place.

2. An electrical connector assembly for interconnecting a plurality of conductors comprising a plurality of substantially planar terminals, each of which is secured to an individual conductor, each terminal being bifurcated and having an aperture extending therethrough perpendicular to the plane thereof, the surface about the aperture providing a contacting surface, a plurality of substantially planar dielectric members, each of which holds a group of the terminals in a spaced array with the plane of the terminals extending approximately parallel to the plane thereof and each of which insulates each terminal from all other terminals held thereby, the plurality of dielectric members being stacked with the array of terminals of each in registration, and a plurality of pin members, each pin member having a cross sectional configuration generally similar to the configuration of the aperture in each terminal, the apertures in the terminals being slightly smaller than the cross section of the pin members, and each pin member extending through the apertures in and engaging the contacting surfaces of a plurality of stacked terminals, thereby moving the bifurcations apart, creating a clamping force against the pin members, and interconnecting the terminals.

References Cited in the file of this patent

UNITED STATES PATENTS

840,537	Weir	Jan. 8, 1907
1,561,495	Thompson	Nov. 17, 1925
1,605,904	Van Brunt	Nov. 2, 1926
2,283,040	Brinkmann et al.	May 12, 1942
2,383,909	Buchanan	Aug. 28, 1945
2,594,069	Poehlmann	Apr. 22, 1952
2,618,183	Cooke	Nov. 18, 1952
2,728,060	Doeg	Dec. 20, 1955
2,766,435	French	Oct. 9, 1956

FOREIGN PATENTS

617,539	Great Britain	Feb. 8, 1949
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