

Feb. 13, 1962

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3,021,500

CONNECTOR ASSEMBLY

Filed Sept. 22, 1959

4 Sheets-Sheet 1

FIG. 1

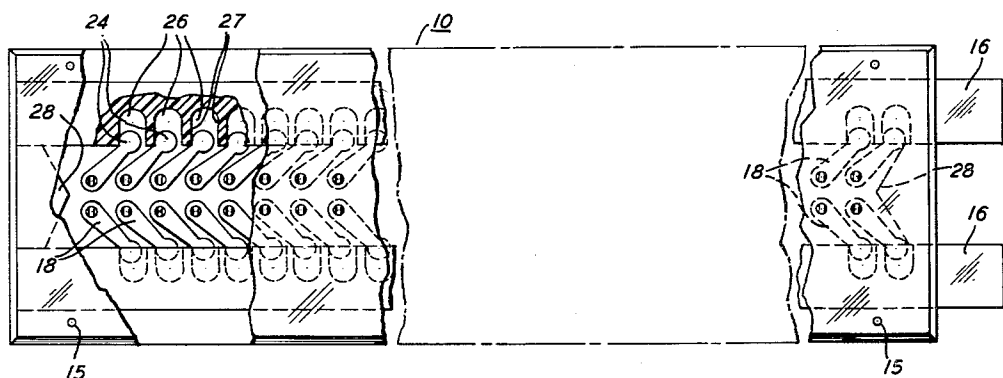


FIG. 2

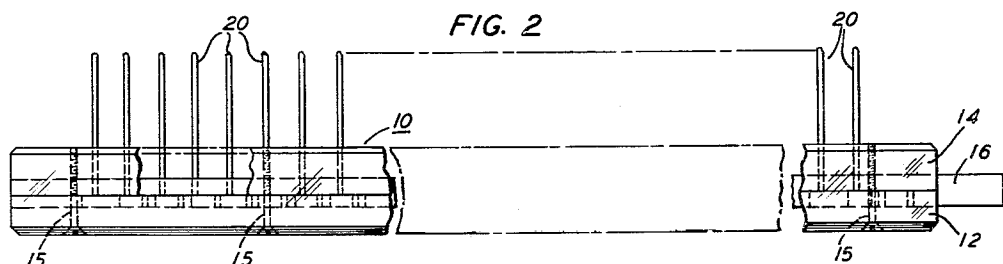
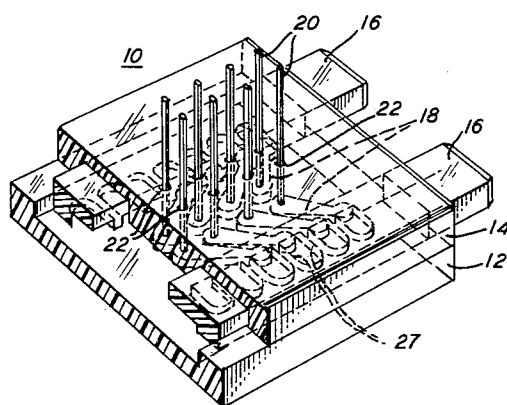


FIG. 3



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4 Sheets-Sheet 2

FIG. 4

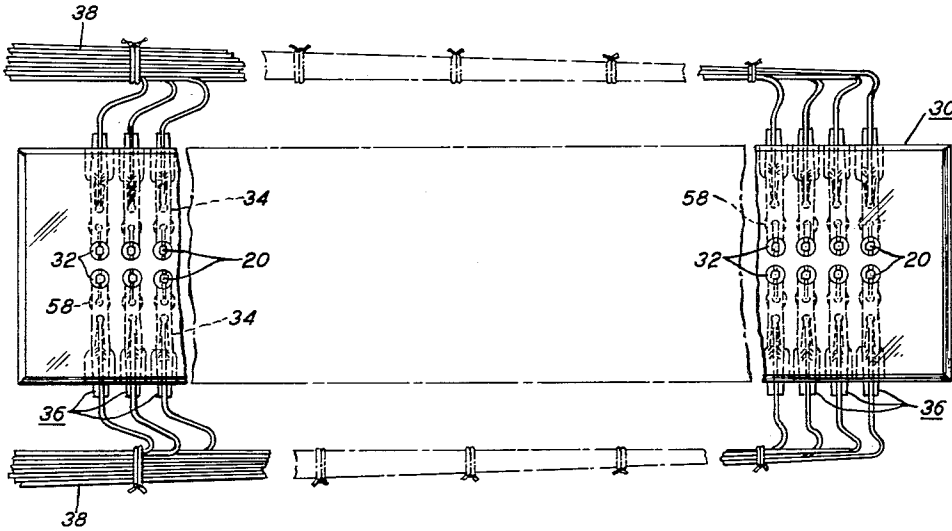


FIG. 5

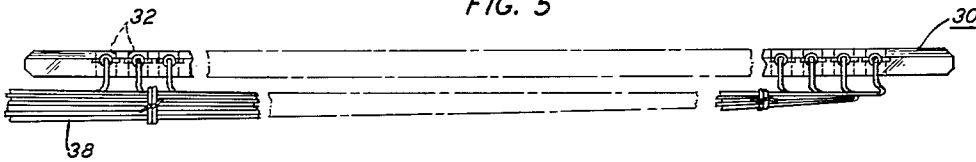
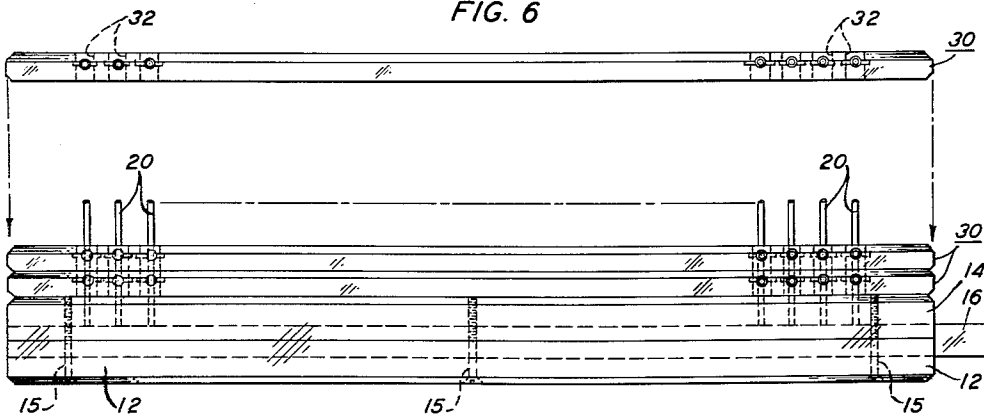


FIG. 6



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CONNECTOR ASSEMBLY

Filed Sept. 22, 1959

4 Sheets-Sheet 3

FIG. 7

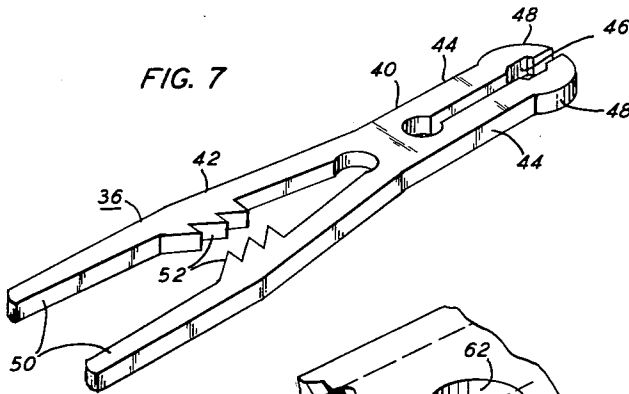
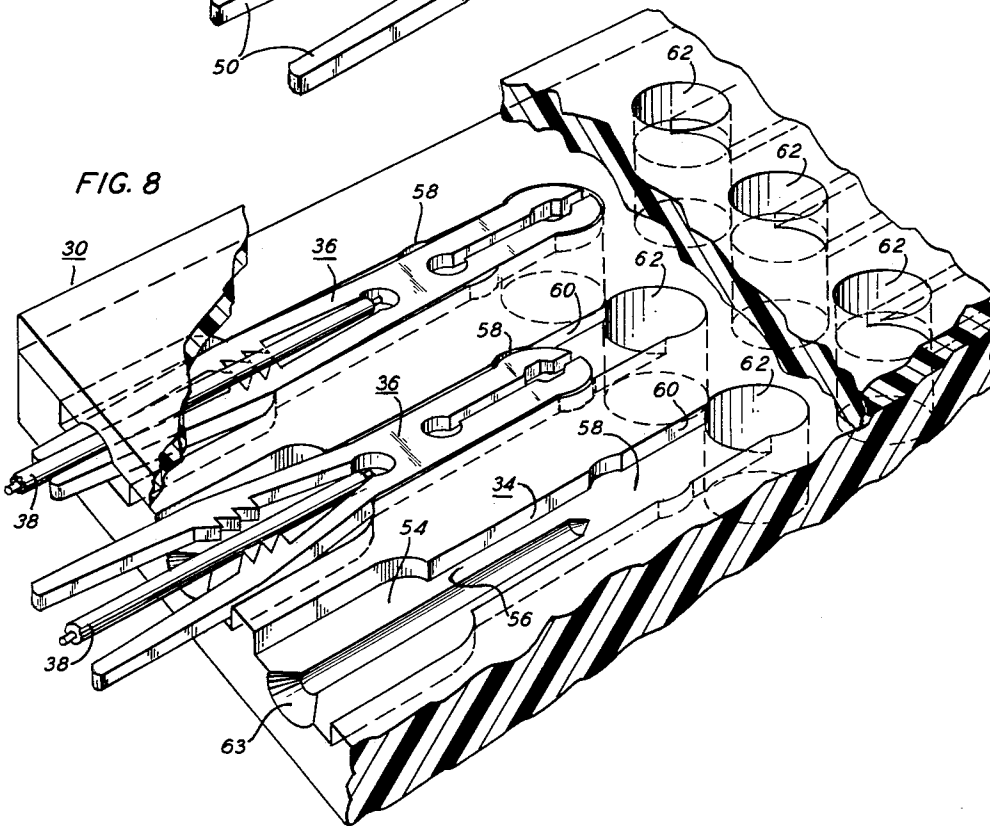


FIG. 8



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3,021,500

CONNECTOR ASSEMBLY

Filed Sept. 22, 1959

4 Sheets-Sheet 4

FIG. 9

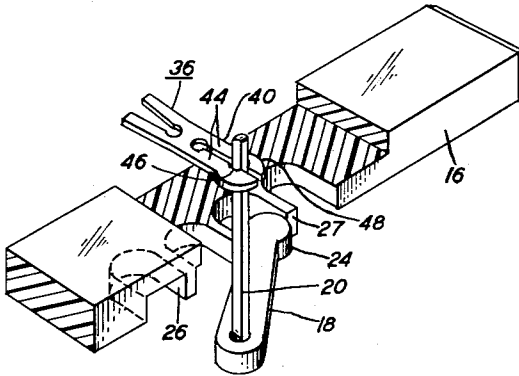


FIG. 10

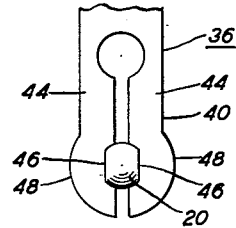


FIG. 11

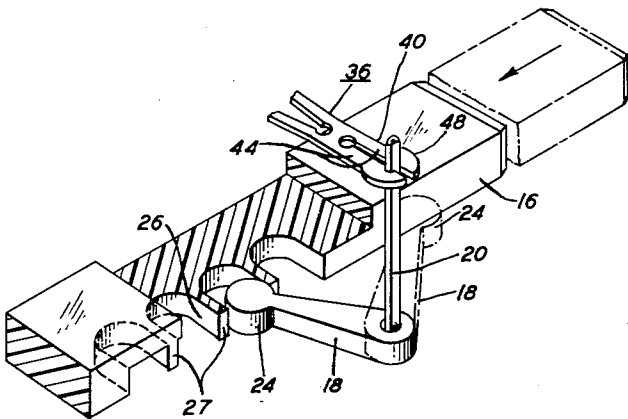
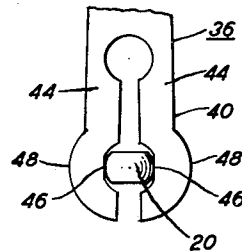


FIG. 12



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1

3,021,500

CONNECTOR ASSEMBLY

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14 Claims. (Cl. 339-75)

This invention relates to electrical connectors for interconnecting two or more groups of conductors and more particularly to a connector assembly of the type that permits the contacting elements thereof to be coupled and separated under slight pressure, full contact pressure being applied when the contacting elements are properly coupled.

In electrical connectors, it is desirable to have the best possible electrical contact between the contacting elements and also the greatest possible ease in coupling and separating the contacting elements. Electrical contact is, in many connectors, obtained by pressure between the contacting elements. The greater the pressure, the better is the electrical contact. However, the greater the pressure, the greater is the difficulty in coupling and separating the contacting elements.

An object of this invention is to provide a connector assembly for interconnecting two or more groups of conductors wherein the pressure between the contacting elements is controllable so that when the contacting elements are being coupled or separated, there is only a light pressure, and the engagement may be done easily; but when the contacting elements are properly engaged, the pressure is increased to insure good electrical contact between the contacting elements.

This and other objects of the present invention are realized in an illustrative embodiment thereof wherein the connector assembly comprises a plurality of terminals respectively secured to the ends of the plurality of conductors forming the groups of conductors to be interconnected. Each terminating member has an eccentric aperture extending therethrough, the edge about the aperture providing the terminating member with a contacting surface.

The terminating members are placed within individual slots in dielectric wafer members, each wafer holding the terminating members secured to a single group of conductors in a spaced array. The wafers have apertures extending therethrough transversely to the slots, the apertures being located so that when a terminating member is properly positioned within a slot, an aperture in the wafer is coaxial with the aperture in the terminating member.

Cooperating with the wafers is a dielectric base member having a plurality of conducting pin members mounted therein in a spaced array and having means for axially rotating the pins between a first and a second position. Each pin has an eccentric cross-sectional configuration, and when the pins are in the first position, they are oriented so that a plurality of wafers are easily placed thereover, the pins extending through the apertures in the wafers and loosely engaging the contacting surfaces of the terminating members. Once the wafers are so placed, the pins are axially rotated to the second position. In this position the pins exert substantial pressure upon the contacting surfaces of the terminating members, good electrical contact is made between the pins and the terminating members, and all terminating members engaging a single pin are interconnected.

Thus a feature of the invention resides in a structure in which a plurality of pin members are mounted in a dielectric base member, means are provided to axially rotate the pin members between a first and second position, and the pin members are eccentrically shaped so

2

that when the pin members are in the first position, a plurality of terminating members held by a plurality of dielectric wafer members are easily placed into engagement therewith, and when the pin members are in the second position, they tightly engage the contacting surfaces of the terminating members and achieve good electrical contact with the terminating members.

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 one embodiment of the invention is 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 top view, partly in section, of the base member of the connector assembly of this invention;

FIG. 2 is a side view, partly in section, of the base member;

FIG. 3 is a perspective view, partly in section, of a portion of the base member;

FIG. 4 is a top view of terminating members secured to conductors and positioned within the wafer member of the connector assembly;

FIG. 5 is a side view of the terminating members in the wafer member;

FIG. 6 is a side view depicting the placing of a plurality of wafer members upon the base member, the pin members extending through the apertures in the wafer members;

FIG. 7 is a perspective view of an insulation piercing type of terminating member that may be used with the connector assembly;

FIG. 8 is a perspective view, partly in section, of a portion of the wafer member showing the interaction between the wafer member and the insulation piercing type of terminating member;

FIG. 9 is a perspective view, partly in section, showing the interaction between the slide bar, crank member, pin member, and terminating member when the slide bar is in the first of two positions;

FIG. 10 is a top view of the pin member and terminating member in FIG. 9;

FIG. 11 is a perspective view, partly in section, showing the interaction between the slide bar, crank member, pin member, and terminating member when the slide bar is in the second of two positions; and

FIG. 12 is a top view of the pin member and terminating member in FIG. 11.

Referring to FIGS. 1, 2, and 3, the connector assembly of this invention comprises a dielectric base member 10 consisting of a lower plate 12 and an upper plate 14, the upper and lower plates being secured together by any well-known means such as screws 15. Housed between the upper and lower plates are dielectric slider bars 16 and dielectric crank members 18.

One end of each crank member 18 has an electrically conducting pin member 20 respectively secured thereto and extending perpendicularly therefrom. The pins extend through spaced apertures 22 in the upper plate 14, and the apertures are of such a size as to allow the pins to rotate freely therein but at the same time prevent any undue relative movement between pins. The other end of each crank is provided with a cam portion 24. The cam portions are respectively received by spaced recesses 26 in the slider bars 16, ribs 27 formed by the spaced recesses maintaining the cam portions in a spaced and separated arrangement. Lateral movement of the slider bars, through the interaction of the ribs and the cam portions of the cranks, cause the cranks to rotate

and axially rotate the pins. Stop portions 28 formed in both ends of the lower plate 12 restrict the motion of the cranks so that lateral movement of the slider bars from one extreme position to the other axially rotates the pins 90°.

Turning now to FIGS. 4, 5, and 6, a plurality of dielectric wafer members 30 are removably positionable over the pin members 20. Each wafer member has two rows of apertures 32 extending therethrough in an identical spaced arrangement to the spacing of the pins in the base member 10. The apertures are larger than the cross section of the pins so that the pins can pass freely therethrough. Each wafer further has a plurality of shaped slots 34 extending partially therethrough transversely to the apertures 32. A plurality of electrically conducting terminating members 36 are removably positionable within the slots, the terminating members being secured to a plurality of conductors 38.

Referring to FIG. 7, each terminating member 36 has a contacting end 40 for conductively engaging one of the pin members 20 and a securing end 42 for conductively engaging one of the conductors 38. The contacting end is bifurcated, the arms 44 formed thereby having lateral spring movement. The contacting end is also apertured, the edge about the aperture providing a contacting surface 46. The contacting end is further shaped so as to provide the arms 44 with shoulders 48. The securing end of each terminating member is provided with diverging legs 50 having teeth 52 formed in the facing edges thereof.

As shown in FIG. 8, each shaped slot 34 in the wafer members 30 has a receiving portion 54, a first constricted portion 56, a first enlarged portion 58, a second constricted portion 60, and a second enlarged portion 62. When a terminating member 36 is inserted into a slot and the contacting end 40 thereof enters the first constricted portion 56 of the slot, the shoulders 48 cam the arms 44 together. Further insertion of the terminating member moves the shoulders into the first enlarged portion 58 of the slot and the arms move laterally apart, locating the terminating member in the first of two positions. In this position the legs 50 of the securing end 42 of the terminating member are just entering the receiving portion 54 of the slot. The legs are still in a diverging condition and a conductor is easily placed between the legs, the conductor being guided between the legs by a cylindrical passage 63 formed in each slot. Further insertion of the terminating member into the slot moves the shoulders 48 into the second constricted portion 60, camming the arms together, and starts to move the legs 50 into the first constricted portion 56, commencing to cam the legs together. Upon complete insertion of the terminating member into the slot, the shoulders move into the second enlarged portion 62, and the arms move laterally apart, substantially filling the second enlarged portion and locating the terminating member in the second of two positions. At the same time, a major portion of the legs moves into the first constricted portion, and the legs are cammed tightly together, the teeth thereon piercing through the insulation on and imbedding themselves in the conductor inserted between the legs. In this fully inserted position the aperture in the terminating member is coaxial with the aperture in the wafer.

Thus, in using the terminating members 36, a plurality of the terminating members are individually inserted within slots 34 in a plurality of wafer members 30, the terminating members being placed in the first of the two positions described above. Individual conductors 38 are then inserted into the slot between the legs 50 of each terminating member and the terminating member moved to the second of the two positions, each terminating member thereby being electrically joined to a conductor. Advantageously, each individual group of conductors of the plurality of groups of conductors to be

interconnected may be secured to the terminating members held by a single wafer. The individual conductors within each group of conductors are distributed among the terminating members so that the conductors in each group that are to be interconnected occupy the same slot position in the wafers.

Referring to FIGS. 9, 10, 11, and 12 each pin member 20 has a generally elliptical cross-sectional configuration and the pins are secured to the crank members 18 so, that when the slider bars 16 are in one extreme position, the major axes of all the pins extend perpendicularly to the longitudinal axis of the base members; and when the slider bars are in the other extreme position, the major axes of all the pins extend parallel to the longitudinal axis of the base member. Apertures in the contacting end 40 of each terminating member 36 also have generally elliptical configuration, the major axis of which extends parallel to the longitudinal axis of the terminating member, and when the major axis of an aperture is aligned with the major axis of a pin's cross section the aperture is larger than the cross section of the pin.

When, as shown in FIGS. 9 and 10, the slider bars 16 are moved so that the major axes of the pin members 20 extend perpendicularly to the longitudinal axis of the base member 10, the major axes of the pins are aligned with the major axes of the apertures in the terminating members as held by the wafer members. Because the apertures in the terminating members are larger than the cross section of the pins, a plurality of wafers holding the terminating members may be easily positioned upon the base so that the pins extend through the apertures in the wafers and the terminating members, little or no pressure being exerted by the pin members upon the contacting surfaces 46 of the terminating members.

With the wafer members 30 assembled upon the base member 10, the slider bars 16 are moved, as shown in FIGS. 11 and 12, so that the major axes of the pin members 20 extend parallel to the longitudinal axis of the base. In this position the major axes of the pins are transverse to the major axes of the apertures in the terminating members, and the arms 44 of the terminating members are spread apart by the pins, bringing them to bear against the surrounding wall of the wafer member. The pins tend to spread the arms to a greater degree than permitted by the surrounding wall, and a substantial pressure is thus exerted by the pins upon the contacting surfaces 46 of the terminating members. This pressure, combined with a wiping of the contacting surfaces by the pins as the pins are axially rotated, assures a good electrical contact between the terminating members and the pins. Since the terminating members mounted in the same slot position in each wafer contact the same pin, the conductors secured to the terminating members occupying the same slot position are interconnected.

It is apparent that the length of the pin members 20 can be varied to accommodate as many wafer members 30 and thereby as many groups of conductors 38 as is desired. It is also apparent that the size and shape of the wafers and the size and shape of the base member 10 can be varied to accommodate as many terminating members 36 and pins and thereby as many conductors in each group as is desired. Furthermore, although the terminating members described are of the insulation piercing type, the terminating members may be secured to the conductors in any desirable manner. 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 for interconnecting a plurality of conductors comprising in combination a plurality of terminating means having apertures respectively

5

formed therein, said apertures having an eccentric configuration, the surface about each aperture providing a contacting surface, a first dielectric means holding a plurality of said terminating means in a spaced array, a second dielectric means having a plurality of pin means mounted therein in a spaced array, each of said pin means having an eccentric cross-sectional configuration, the maximum breadth of said eccentric cross-sectional configuration being greater than the minimum breadth of and smaller than the maximum breadth of said aperture in each of said terminating means, said first dielectric means being positioned on said second dielectric means so that said pin means enter said apertures in said terminating means, means for axially rotating said pin means between a first and a second position, said pin means in said first position being oriented so that they loosely engage said contacting surfaces of said terminating means, and said pin means in said second position being oriented so that they tightly engage and make electrical contact with said contacting surfaces of said terminating means.

2. An electrical connector for interconnecting a plurality of conductors comprising in combination a plurality of terminating members having one end adapted to be respectively secured to said plurality of conductors, the other end of each of said terminating members having an aperture formed therein, said apertures having an eccentric configuration, the surface about each aperture providing a contacting surface, a plurality of first dielectric members individually holding a plurality of said terminating members in a spaced array, a second dielectric member having a plurality of pin members mounted therein in a spaced array, each of said pin members having an eccentric cross-sectional configuration, the maximum breadth of said eccentric cross-sectional configuration being greater than the minimum breadth of and smaller than the maximum breadth of said aperture in each of said terminating members, said cross-sectional configuration being enclosable within said aperture, said plurality of first dielectric members being positioned on said second dielectric member so that said pin members extend through said apertures in said terminating members, means for axially rotating said pin members between a first and a second position, said pin members in said first position being oriented so that they loosely engage said contacting surfaces of said terminating members and said first dielectric means are therefore easily positioned on or moved from their position on said second dielectric member, and said pin members in said second position being oriented so that they tightly engage said contacting surfaces of said terminating members and good electrical contact is therefore made therebetween and all terminating members engaging a single pin member are interconnected.

3. An electrical connector as in claim 2 in which each of said first dielectric members has a spaced array of apertures extending therethrough, each of said apertures being of greater size than the aperture in each of the terminating members, and each of said terminating members is held so that the aperture therein is coaxial with an aperture in one of said first dielectric members.

4. An electrical connector as in claim 3 in which each of said first dielectric members has a plurality of slots extending partially therethrough transversely to the apertures therein, and each terminating member is placed within an individual slot so that the aperture in the terminating member is coaxial with an aperture in the first dielectric member.

5. An electrical connector as in claim 4 in which the slots in the first dielectric members are shaped to provide a constricted portion and an enlarged portion, the other end of each of said terminating members is bifurcated and said bifurcations have shoulders, so that when a terminating member is initially inserted into a slot, said shoulders engage said constricted portion of said slot,

6

camming said bifurcations together, and when said terminating member is inserted to the full depth of said slot, said shoulders move into said enlarged portion of said slot, and said bifurcations move apart, properly locating said terminating member within said slot.

6. An electrical connector as in claim 5 in which the end of each terminating member adapted to be secured to a conductor comprises a pair of diverging legs, the facing surfaces of said legs having teeth formed therein, and when a conductor is placed between the legs and the terminating member is placed in a slot in the first dielectric means and inserted to the full depth of said slot, said legs of said terminating member are cammed together and said teeth pierce through the insulation on and imbed themselves in said conductor.

7. An electrical connector as in claim 5 in which the facing surfaces of the bifurcations of each terminating member describe the aperture therein, and the pin members in the second position spread said bifurcations apart against the wall around the enlarged portion of the slot, creating a substantial contacting pressure between said pin member and the contacting surface of said terminating members.

8. An electrical connector as in claim 2 in which the means for axially rotating the pin members comprises a plurality of crank members respectively secured to said pin members and extending perpendicularly therefrom, and means for rotating said crank members.

9. An electrical connector as in claim 8 in which the means for rotating the crank members comprises a slider bar having spaced recesses formed therein, and the unsecured ends of said crank members are positioned within said spaced recesses.

10. An electrical connector as in claim 9 in which the slider bar and the crank members are housed within the second dielectric member.

11. An electrical connector as in claim 2 in which the aperture in each of the terminating members has a generally elliptical configuration and the pin members have a generally elliptical cross-sectional configuration.

12. An electrical connector assembly for interconnecting a plurality of conductors comprising a plurality of terminating members respectively secured to the conductors, each terminating member having an aperture of an eccentric configuration therein, the surface about said aperture providing an electrical contacting surface a plurality of dielectric members each of which holds a group of said terminating members in a spaced array and insulates each terminating member from each other terminating member held thereby, said dielectric members being positioned one above the other with the terminating members in one in registration with the terminating members in the other, a plurality of pin members each of which has an eccentric cross-sectional configuration accommodable by said aperture in said terminating means, said pin members being axially rotatable between a first and a second position, said pin members in said first position being inserted through the apertures in a plurality of superimposed terminating members and in said second position engaging the contacting surfaces of the terminating members and electrically interconnecting them.

13. An electrical connector comprising a terminating member having a pair of arms and a pair of diverging legs for securing a conductor therebetween, said arms having lateral projections, a receptacle having an aperture therein for receiving said terminating member, said aperture including an enlarged portion, the positioning of said terminating member within said aperture in said receptacle moving and holding said legs together in a conductor securing relationship, means positionable between said arms of said terminating member for spreading said arms apart to move said lateral projections into said enlarged portion, said means spreading said arms apart when said terminating member is positioned within

3,021,500

7

said aperture in said receptacle, said arms when spread apart holding said terminating member in said receptacle, and thereby holding said legs in a conductor securing relationship.

14. An electrical connector as defined in claim 13 5 wherein said enlarged portion is arcuate in shape and said projections are arcuate in shape.

8

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