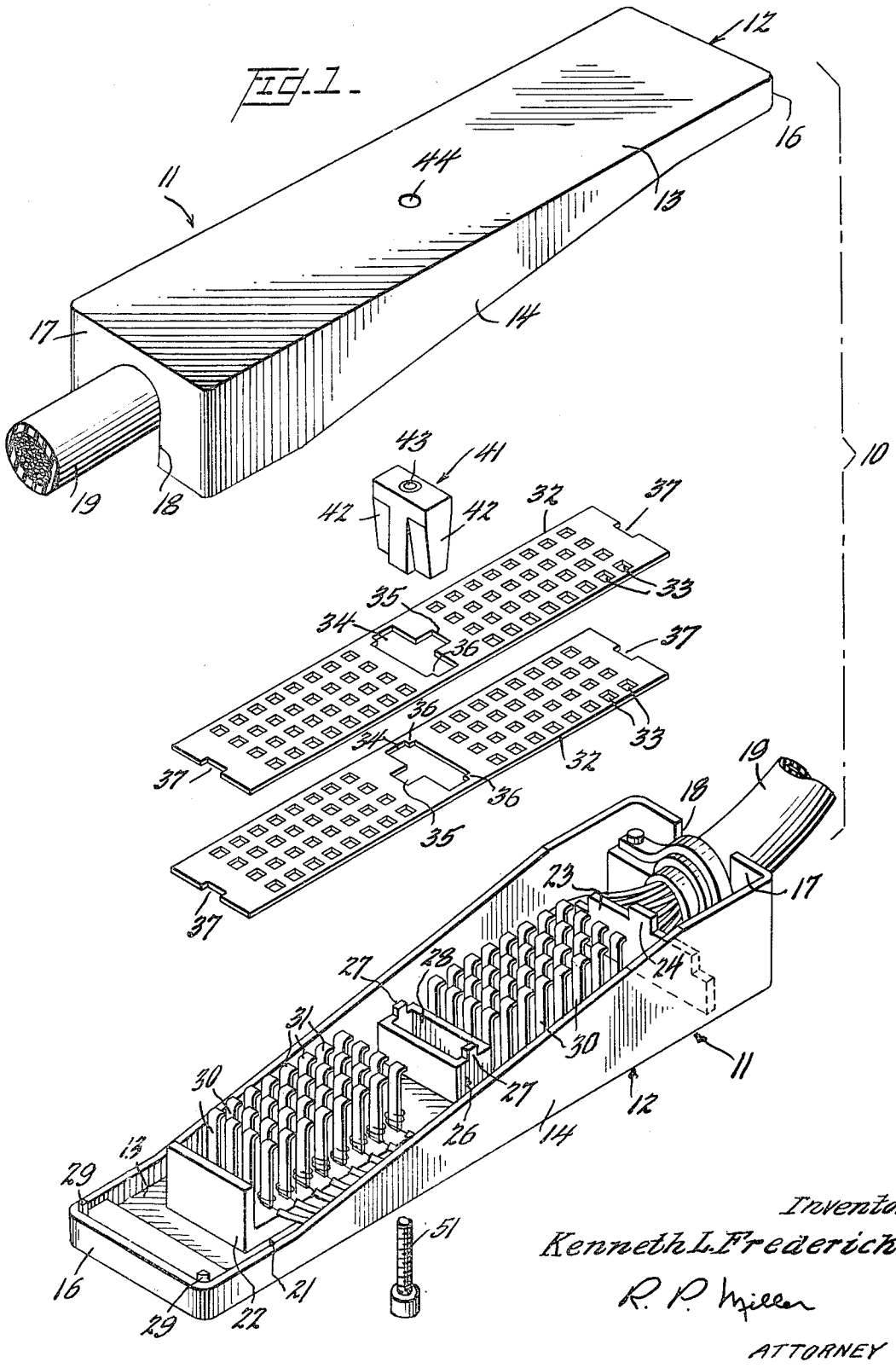
Jan. 13, 1970 K. L. FREDERICK 3,489,986

ELECTRICAL CONNECTOR

Filed Jan. 9, 1967 3 Sheets-Sheet 1

FIG. 1



Inventor

Kenneth L. Frederick

R. P. Miller

ATTORNEY

Jan. 13, 1970 K. L. FREDERICK 3,489,986

ELECTRICAL CONNECTOR

Filed Jan. 9, 1967 3 Sheets-Sheet 2

FIG. 2

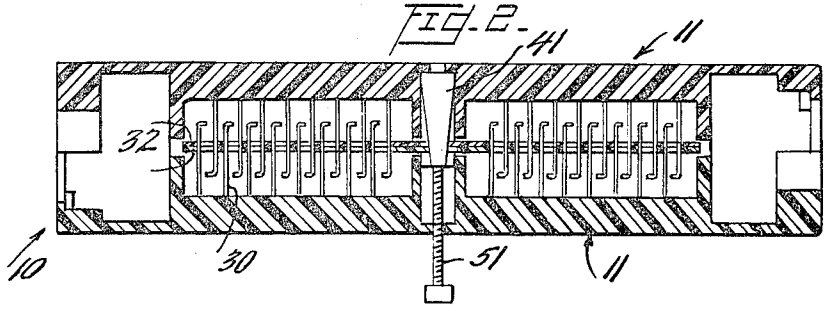


FIG. 3

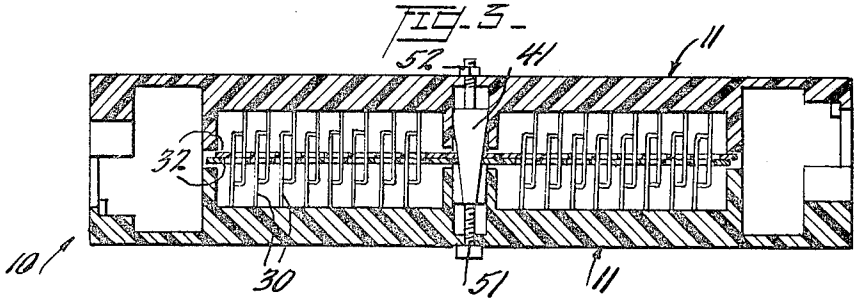


FIG. 4

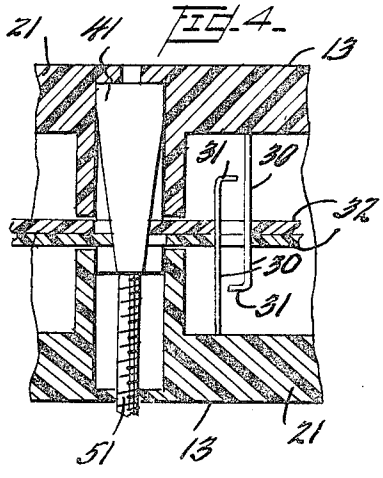
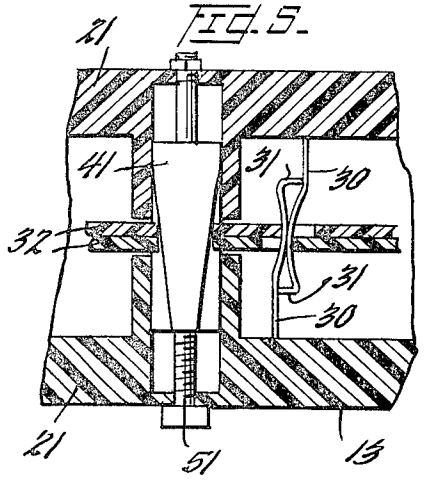


FIG. 5



Jan. 13, 1970 K. L. FREDERICK 3,489,986

ELECTRICAL CONNECTOR

Filed Jan. 9, 1967 3 Sheets-Sheet 3

FIG. 6.

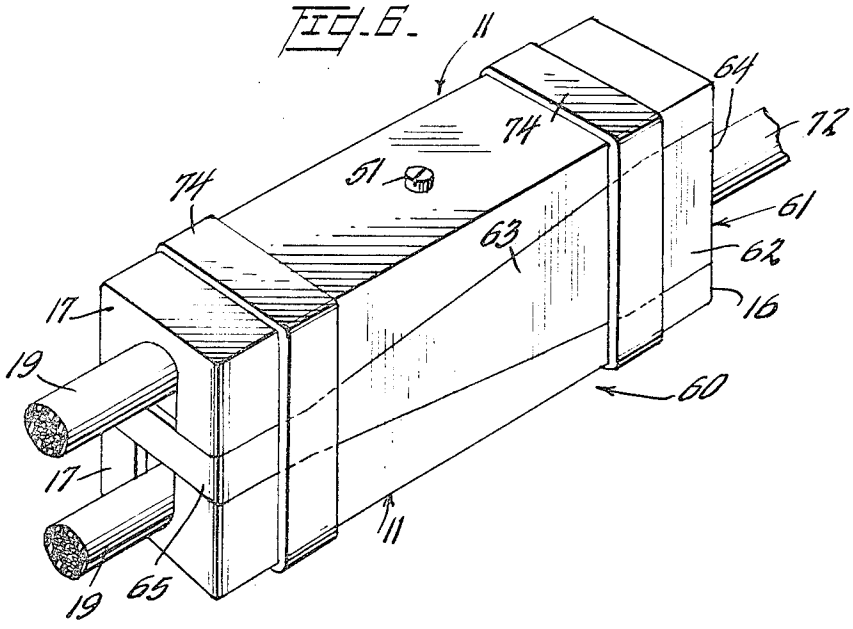
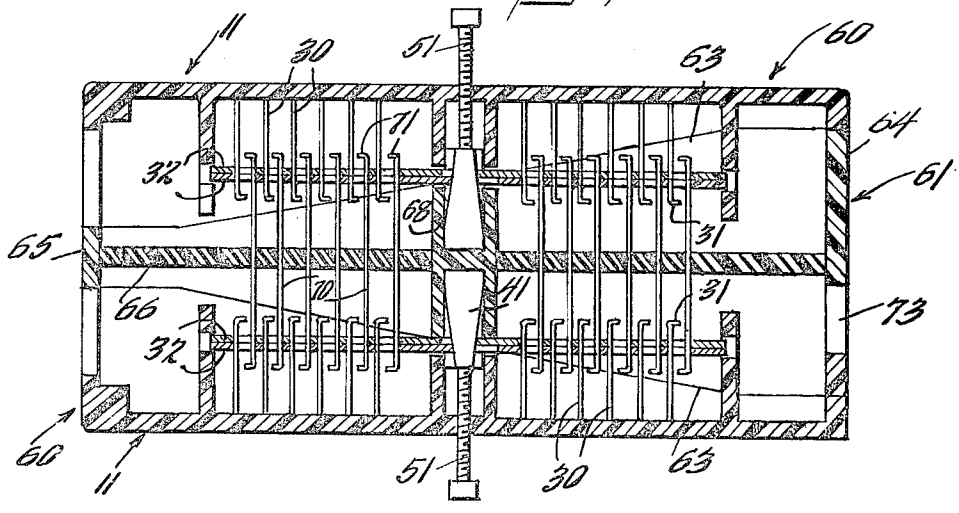


FIG. 7.



United States Patent Office

3,489,986
Patented Jan. 13, 1970

3,489,986

ELECTRICAL CONNECTOR

Kenneth L. Frederick, Columbus, Ohio, assignor to Western Electric Company, Incorporated, New York, N.Y., a corporation of New York

Filed Jan. 9, 1967, Ser. No. 608,170
Int. Cl. H01r 25/00
U.S. Cl. 339—49 12 Claims

ABSTRACT OF THE DISCLOSURE

An improved electrical connector includes a pair of identical mating connector halves each having a group of electrical contacts which are rendered effective by simultaneously deflecting free ends of the contacts of each group of contacts into electrical engagement with an intermediate portion of the mating contact of the other group of contacts.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to an electrical connector, and, more particularly, to an electrical connector having plural mating connector halves with overlapping spaced contacts which are moved relative to, and into engagement with, each other to establish electrical connection therebetween.

Description of the prior art

The joining of a plurality of electrical conductors in one cable electrically with the conductors of another cable, which may require frequent disconnections, is generally effected by a plug and socket type connector. Connectors of this type are extensively used in the telephone industry and are included with cables connected to frames in the shop and merely plugged together at a telephone switching installation. The use of disconnectable connectors permits access to the circuitry and allows the performance of certain tests. However, in many disconnectable plug-socket devices, a faulty connection may occur if the contact pressure is not properly controlled. There is still a need for an electrical connector that may be disassembled as conveniently as a plug and socket connection, and, in which, a positive pressure may be exerted to maintain opposing contacts in engagement with one another.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a new and improved electrical connector for interconnecting a plurality of wires or cables.

It is another object of this invention to assemble a multicontact connector half, the contacts of which are joined to electrical conductors at an end of a cable, with an identical mating connector half which is joined similarly to an end of another cable with the opposing contacts in the connector halves deflected into contact with each other to make detachable electrical connections between the conductors of the cables.

It is a further object of this invention to provide an electrical connector having a plurality of relatively movable apertured members through each of the apertures of which, a contact of each of the connector halves projects from opposite directions in spaced parallel relationship, and means for causing relative longitudinal movement between the apertured members to deflect free overlapping ends of the contacts into firm, electrical contact with intermediate portions of the mating contacts.

Still another object of this invention is to provide a connector half having a plurality of projecting contacts which is placed against an identical mating connector half with opposing contacts of the connector halves overlapping and spaced laterally from each other within aligned apertures of overlying cards interposed between the connector halves, so that when the two connector halves are secured together, the cards are shifted with respect to each other to deflect the opposing contacts into engagement with each other.

An additional object of this invention is to provide a new and improved multiple conductor connector having a pair of opposed mating connector halves which support a plurality of overlapping, laterally spaced contacts and which are secured together by drawing a bolt against a wedge-shaped block to shift a pair of apertured cards interposed between the connector halves in opposite directions and deflect each pair of contacts protruding through each aperture, toward and into contact with one another.

With these and other objects in mind, the present invention contemplates a connector for cables including a pair of identical mating connector halves each having a plurality of contacts joined to a plurality of cable conductors. When the connector halves are mated, contacts of the connector halves oppose and overlap each other in laterally spaced relationship, and are deflected toward and into contact with one another when the connector halves are secured together.

More particularly, the connector includes a pair of identical open-faced connector halves with each of the connector halves having arrays of contacts supported from a bottom thereof and projecting therefrom toward the open faces of the connector halves. A conductor of a cable is attached to each contact in each of the connector halves. A wedge-shaped actutaor block is then inserted into a receptacle formed in one of the connector halves. An apertured card is placed over the contacts on each connector half with each contact extending through one of the apertures. One of the connector halves is placed in mating engagement with the other connector half so that associated pairs of apertures of the cards are aligned and mating contacts of the connector halves both project through the associated pairs of aligned apertures. The contacts of each pair of opposed contacts within each pair of the aligned apertures overlap, but are spaced laterally from each other.

A threaded bolt is then inserted through the connectors and as the bolt is tightened, the wedge block is drawn through nonaligned actuator openings in the cards and cams against the edges of the openings. The overlying cards are shifted laterally with respect to each other to misalign the aligned apertures through which the mating contacts project and deflect the mating contacts in opposite directions into contact with each other.

Other objects and advantages of the present invention will be apparent from the following detailed description when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an exploded, perspective view showing a cable connector which includes two multicontact connector halves having two apertured card-like members interposed therebetween with a wedge-shaped actuating block for effectuating engagement between contacts of the connector halves in accordance with certain principles of the invention;

FIG. 2 is a sectional view of the connector of FIG. 1 with the connector halves in an initially assembled condition with card-like members interposed between a wedge-shaped block in an unoperated position and a threaded bolt and nut loosely assembled in the connector in anticipation of establishing engagement between the mating contacts of the connector;

FIG. 3 is a sectional view of the connector shown in FIG. 2 with the wedge block in an operated position to move the cards relative to each other and deflect the mating contacts of the connector halves into engagement with each other;

FIG. 4 is an enlarged view of one pair of contacts of the connector of FIG. 2 in an initially assembled condition;

FIG. 5 is an enlarged view of the pair of contacts of FIG. 4 with the wedge block in an operated position, the cards shifted relative to each other, and the mating pair of contacts deflected into engagement with each other;

FIG. 6 is a perspective view of a connector embodying certain principles of the invention which may be utilized for connecting together three cables and which includes, in addition to the two connector halves of the connector shown in FIG. 1, an intermediate connector element; and

FIG. 7 is a sectional view of the connector of FIG. 6 taken along line 7—7 thereof and illustrating the cooperative relationship of the contacts of the two connector halves and the contacts of the intermediate connector element placed between the two outer connector halves.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. 1, there is shown a connector, designated generally by the numeral **10**, which includes two identical connector halves or members, designated generally by the numerals **11—11**. Each of the connector halves **11—11** has an outer open-faced plastic shell or housing, designated generally by the numeral **12**. The housing **12** has a base **13** and two sloping sides **14—14**. The sides **14—14** of the shell **12** extend from a front low end **16** to a high end **17** and a notch **18** is provided in the high end of the shell for receiving an end portion of a cable **19**.

As shown in FIG. 1, a U-shaped bracket, designated generally by the numeral **21**, of an electrically insulating material is formed integrally with the shell **12** on the base **13** thereof. A plate-like abutment **22** is formed integrally with and extending upward from the base **13** near the low end **16** of the shell. A stepped, plate-like abutment **23** is formed integrally with the base **13** and is located at the opposite end of the bracket **21** and terminates in a lug **24**.

Also formed integrally with the bracket **21**, near the center thereof and extending transversely thereacross, is a rectangular box-like shaped support well or receptacle **26**. The well **26** is provided with two small projections **27—27** extending therefrom and a cavity **28**. Two small aligning pins **29—29** are mounted in the corner of the shell **12** adjacent to the end **16** thereof in order to properly position the connector halves with respect to each other when the connector **10** is being assembled. An array of metallic contacts **30—30** is molded integrally with the bracket **21** and extends upwardly from the bracket **21** on opposite sides of the support well **26**. Each of the contacts **30—30** has a tranversely extending free end **31**. Each of the conductors of the cable **19** may be connected to one of the contacts **30—30** as shown in FIG. 1.

Alternatively, the U-shaped bracket **21** can be formed separate and apart from the shell **12** with the bracket molded integrally with the arrays of contacts **30—30** so that the contacts extend from the bottom thereof. The bracket **21** would be modified to have a recessed bottom portion so that the bracket may be supported on the base **13** of the shell **12** without the contacts **30—30** which extend from the bottom of the bracket touching the base of the shell. Then the conductors of the cable **19** may be connected to those portions of the contacts **30—30** extending from the bottom of the bracket **21** with a wire wrapping tool. The bracket **21** is then secured to the base **13** on the inside of the shell **12**. It should be apparent that the bracket **21** could also be formed with a plurality of apertures through which the contacts **30—30** could then be inserted rather than molding the bracket about the contacts.

The abutments **22** and **23** and the support well **26** cooperate to support a flat insulating plate or card **32** which has a plurality of apertures **33—33** formed therein (see FIG. 1). The insulating card **32** may be molded or stamped, for example, from a plastic material. A relatively large, substantially T-shaped actuator opening **34** is located at approximately the center of the card **32**. The actuator opening **34** has a stem **35** and small shoulders **36—36**. The ends of the card **32** has aligning notches **37—37** formed therein.

When one of the cards **32—32** is placed within the shell **12** of the associated connector half **11**, the associated lug **24** on the abument **23** projects through one of the slots **37—37** of the associated card. The other end of the card **32** rests on the abutment **22** and the center of the card is supported over the well **26** with portions of the opening **34** aligned with the cavity **28** in the well **26**. Each of the contacts **30—30** projects through an aperture **33** in the card **32**.

In the assembly of the connector **10**, an actuator block, designated generally by the numeral **41**, having wedge-shaped portions **42—42** and a threaded central bore **43** formed therethrough is inserted into one of the support wells **26—26** of the shells **12—12** so that the bore **43** is aligned with an aperture **44** formed through the base **13** of the cooperating shell **12** and the bracket **21**. When the block **41** is seated in the associated shell **12** against the base **13** thereof, the block extends slightly through the central opening **34** in the associated card **32** (FIG. 2).

One of the connector halves **11—11** thus assembled with the block **41** and card **32** is inverted and abutted against the other identical connector half **11** so that the end **17** of each of the connector halves **11** is guided by the pins **29—29** of the mating connector half into position over the end **16** on the opposite connector half **11**.

In order to secure the connectors together and to effect the engagement between the mating contacts **30—30** of the connector **10**, a threaded bolt **51** is inserted into the aperture **44** in the connector **10** and turned into the threaded bore **43** in the block **41**. At this point in the assembly process, the block **41** is resting against the base **13** of the associated shell **12** (see FIG. 2) and projects through the openings **34—34** in cards **32—32**.

Also, the cards **32—32** overlie one another with two opposing contacts **30—30** projecting through each of the aligned apertures **33—33** (see FIG. 4). The free end **31** of each one of the contacts within each of the apertures **33—33** is displaced laterally with respect to the free end of the mating contact. The central openings **34—34** overlap each other with the stems **35—35** of the T-shaped openings being positioned on opposite sides of the wedge block **41**, as shown in FIG. 1. The wedge-shaped surfaces **42—42** engage the shoulders **36—36** on the cards **32—32**.

As the bolt **51** is turned, and the head of the bolt engages the base **13** of the associated shell **12**, further rotation will cause the block **41** to be moved in the well **26** and portions of the block to pass through the cards **32—32** toward and into the associated well **26** so that the sloped surfaces **42—42** of the block cam against the shoulders

36—36 to displace the cards 32—32 longitudinally with respect to each other (see FIG. 3).

When the cards 32—32 are shifted longitudinally in opposite directions, the free ends 31—31 of the contacts 30—30 in each pair of associated apertures 33—33 are deflected toward and into engagement with the mating contact by walls of the apertures in the moving cards. Continued relative movement of the cards 32—32 causes an intermediate portion of each of the contacts 30—30 to bow sufficiently so that at least a predetermined contact pressure is maintained between the mating contacts 30—30 by the resiliency of the contacts (see FIG. 5). In this way, electrical contact is positively established between mating contacts 30—30 (FIGS. 3 and 5). Furthermore, the contact pressure between the contacts 30—30 may be adequate to hold the two connector halves together. However, if a firmer locking is desired and to alleviate unduly high stresses on the contacts the bolt 51 can be lengthened to extend through both connector halves 11—11. A nut 52 may then be used on the end of the bolt 51 to secure the connector halves together more positively (FIG. 3).

It should be readily apparent that one of the advantages of the principle of the present invention is that one of the connector halves 11 can be connected to either end of a cable. There is no requirement that one end of the cable be connected to a particular half. The connector halves 11—11 are identical and may be mated together only when properly oriented with respect to each other. In this way, the connectors may be assembled to the ends of a plurality of cables with no thought required in selecting a different connector half for each end of the cable.

The principle of the present invention may be used for connecting together multiple cables, for example, three cables in a common connecting device. Referring now to FIG. 6, there is shown a connector, designated generally by the numeral 60, which includes an intermediate connector member designated generally by the numeral 61 having an open top and open bottom and interposed between a pair of connector members 11—11 identical to the connector halves shown in FIGS. 1, 2 and 3.

The intermediate connector member 61, includes a plastic housing or shell 62, having double tapered sides 63—63 which extend from a high end 64 to a low end 65. The housing 62 has an intermediate wall 66 with a receptacle 68 formed integrally therewith. The receptacle 68 is equivalent in cross section to the support wells 26 and projects from opposite sides of the intermediate wall 66. The wall 66 may be molded about a plurality of contacts 70—70 which extend through the wall in opposite directions and are approximately aligned with, but laterally spaced from, opposing contacts 30—30 in the associated connector halves 11—11 (FIG. 7). Each of the contacts 70—70 has transversely extending free ends 71—71. A cable 72 is placed in the intermediate connector member 61 through an opening 73 formed in the high end 64 of the housing 62 and has the individual conductors appropriately attached to the contacts 70—70 in the connector member 61.

In order to assemble the connector 60, two wedge-shaped actuator blocks 41—41 are positioned within the receptacle 68 in the connector member 61 on opposite sides of the intermediate wall 66. A pair of cards 32—32 are placed on the support well 26 and over the contacts 30—30 of one of the identical connector members 11. Then the connector member 11 is placed on one side of the intermediate connector member 61 with the shallow end 16 of the member 11 over the high end 64 of the member 61. The pins 29 are of assistance in the positioning of the member 11 on the member 61. At this time, the first pair of cards 32—32 are between the support well 26 and the receptacle 68.

Next, a second pair of cards 32—32 are placed on the support well 26 and over the contacts 30—30 of the other connector member 11. The other connector member 11 is then positioned over the member 61 with the shallow end 16 of the member 11 over the high end 64 of the member 61 and with the high end 17 over the shallow end 65 (see FIG. 7). The second pair of cards 32—32 are held between the receptacle 68 in the member 61 and the support well 26 in the member 11. Each pair of cards 32—32 as initially positioned between the support well 26 and the receptacle 68 have aligned apertures 33—33, but have the actuator stems of the openings 34—34 in opposite orientation as shown in FIG. 1. In this way, as is seen in FIG. 4, the stems 35—35 in each pair of cards will be offset initially from one another.

The connector members 11—11 and 61 are secured together by a pair of resilient C or U-shaped clamps 74—74, one at either end (see FIG. 6) of the connector 60. Alternatively, a bolt, extending through the three connector members and secured by a nut (not shown), may be used at each end of the connector 60 instead of the C or U-shaped clamps.

It should be noted that, as shown in FIG. 7, when the connector members 11—11 are assembled to connector member 61 with the high ends 17—17 aligned, the contacts 30—30 in the parts 11—11 are aligned and colinear with each other, but offset from the contacts 70—70 in the connector 61. However, the connector members 11—11 are constructed so that when they are utilized as a two cable connector the opposed contacts 30—30 will be laterally offset from each other (compare FIGS. 2 and 7).

A threaded bolt 51 is inserted into the aperture 44 in the connector 11, through one of the pairs of cards 32—32, and into one of the wedge blocks 41 in the receptacle 68. Similarly, another bolt 51 is inserted into the aperture 44 of the other connector part 11 and turned into the other wedge block 41 in the receptacle 68. As the bolts 51 are turned further, each of the wedge blocks 41—41 is moved in the receptacle 68 into camming engagement with one pair of cards 32—32. The wedge surfaces 42—42 cam against the shoulders 36—36 of the misaligned actuator openings 34—34 to displace longitudinally in opposite directions both cards 32—32 of each pair. As the cards are shifted, the free ends 31—31 and 71—71 of each of the contacts 30—30 and 70—70, respectively, projecting through apertures 33—33 in the cards 32—32 are deflected into contact with each other to establish an electrical connection between the contacts 30—30 and 70—70 and thus connecting the cables 19—19 electrically to the cable 72.

It is to be understood that the above-described arrangements are simply illustrative of the invention. Other arrangements may be devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

I claim:

1. In an electrical connector,

a first connector member having at least one contact projecting therefrom,

a first connector member designed to be mated with the first connector member, said second connector member having at least one contact projecting therefrom toward the contact of said first connector member to form at least one spaced pair of overlapping contacts,

movable means interposed between said connector members and having an opening formed therethrough and having at least one aperture for receiving said spaced pair of overlapping contacts, and

actuating means drawn through said opening for camming against the walls of said opening to move said first mentioned means and move said contact of said first connector member into engagement with the contact of said second connector member.

2. In an electrical connector as set forth in claim 1, wherein,

said actuating means comprises a wedge-shaped block for engaging said movable means.

3. In an electrical connector as set forth in claim 2, wherein,

said projecting contacts are flexible and are deflected into engagement with each other when said wedge-shaped block is drawn through said opening to move said first mentioned means.

4. In an electrical connector which comprises:

a first connector member having a first array of resilient contacts projecting from a surface thereof;

a second connector member mating with said first connector member and having a second array of resilient contacts projecting from a surface thereof;

the contacts arranged so the free ends of the respective contacts of one connector member are in spaced overlapping relationship with the associated ones of the contacts of the other connector member;

a contact operating member mounted slidably for movement in a first direction between said mating contact connector members and having a plurality of apertures arranged so that the walls of the apertures engage one array of contacts, said operating member also having an actuator opening formed therethrough; and

means drawn through said actuator opening for moving slidably said operating member to bend the contacts of the one array into engagement with the other array of contacts.

5. In an electrical connector comprising:

a pair of identical mating connector halves having opposed overlapping arrays of deflectable contacts, said opposing arrays being laterally offset with respect to each other to provide spaces between the contacts in one array and the contacts in the other array;

a pair of nonconductive members each having a plurality of apertures and an actuator opening formed therein;

means for mounting said members between said connector halves to align said apertures and to offset said actuator openings from each other with a pair of opposed laterally spaced contacts positioned through each of said apertures; and

means received in said actuator openings for aligning said actuator openings and for shifting said members with respect to each other to misalign said apertures and simultaneously deflect said contacts protruding therethrough into engagement with each other.

6. In a device for connecting the ends of two multiwire cables,

a pair of open-face housings having openings to receive the ends of said cables,

a plurality of contacts mounted in each housing to project toward said open face and connected to the wires of the cable received in the associated housing,

a pair of cards having a plurality of aligned first openings and a pair of non-aligned second openings, said cards mounted slidably in one of said housings to shift across said open faces,

means for securing the housings together with the contacts in each housing projecting through the first openings and into lateral spaced relationship with the contacts in the other housing to form a plurality of pairs of contacts projecting through said first openings, and

means received in said non-aligned second openings for aligning said second openings and for shifting said cards in opposite directions to move the contacts in each pair toward and into engagement with each other.

7. An electrical connector comprising:

a first connector half having an array of deflectable contacts which extend toward an open face of said connector, each of said contacts connected to an electrical conductor of a cable extending into said first connector half;

supporting means formed in said first connector half;

a pair of juxtaposed insulative cards having a plurality of aligned apertures and a pair of unsymmetrical nonalligned actuator openings, said cards positioned on said supporting means and over said contacts with the contacts projecting through the apertures;

a second connector half identical to and mated against said first connector half to form pairs of overlapping laterally spaced contacts within each of said pairs of aligned apertures;

actuator means positioned within said supporting means and extending through said actuator openings for movement from said first connector half to said second connector half to shift said cards in opposite directions with respect to each other; and

means extending through said actuator means for moving said actuator means to shift said cards and deflect the pair of contacts within each aperture into engagement with each other and for securing the connectors together.

8. In a connector as set forth in claim 7, wherein,

each of said contacts is formed with a shank normal to and attached to the bottom of said connector half and a free bent end portion contiguous with said shank whereupon deflection of contacts by the cards moves the bent portion of each contact into engagement with the shank of the other contact in the pair to establish electrical contact therebetween.

9. An electrical connector as defined in claim 7, wherein,

said actuator means comprises a wedge-shaped block.

10. An electrical connector as defined in claim 9, wherein:

said moving and securing means comprises a bolt extending through said block for drawing said block from said first connector half into said second connector half whereupon the block aligns the actuator openings in the cards and laterally shifts the cards relative to one another in opposite directions to deflect the contacts into engagement with each other.

11. In an electrical connector,

a pair of spaced identical connector members, each of said members having contacts projecting toward said other member,

a third connector members intermediate said pair of identical members and having contacts projecting toward said contacts of each of said identical members to form spaced pairs of overlapping contacts,

means interposed between each of said identical connector members and said third connector member and mounted for movement in a first direction for urging said contacts of each of said pairs into engagement with each other, and

means positioned in said third connector member and moved transverse to said first direction for camming against each of said urging means to move said urging means and engage said contacts with each other.

12. In a device for electrically connecting together three cables each having a plurality of electrical conductors,

a first and second pair of spaced identical connector members each having a plurality of deflectable contacts upstanding therein, said contacts of said connectors colinear with each other,

a third connector member interposed between and mating with said pair of identical connector members, said third connector member having a plurality of contacts which overlap said plurality of contacts in each of said pair of connector members to form two sets of pairs of laterally spaced contacts,

a pair of insulative cards positioned between said third connector member and each one of said pair of connector members, each of said pairs of cards having

apertures to receive a set of pairs of overlapping contacts extending through each of said apertures, means for securing said members together, and means responsive to said securing means for shifting each pair of said cards to deflect each pair of overlapping contacts into engagement with one another.

References Cited

UNITED STATES PATENTS

1,917,009	7/1933	Betts et al.	339—91
2,076,612	4/1937	Beall.	
2,124,182	7/1938	Braun	339—91
2,417,369	3/1947	Luhn.	
2,945,201	7/1960	Waninger	339—49
2,982,883	5/1961	Gordy.	

FOREIGN PATENTS

625,388	6/1949	Great Britain.
1,145,245	5/1957	France.

RICHARD E. MOORE, Primary Examiner

P. A. CLIFFORD, Assistant Examiner

U.S. Cl. X.R.

339—75, 270