Oct. 4, 1966 J. MARSHALL ETAL 3,277,425

TERMINAL CONNECTOR

Original Filed May 29, 1962 2 Sheets-Sheet 1

FIG. 1

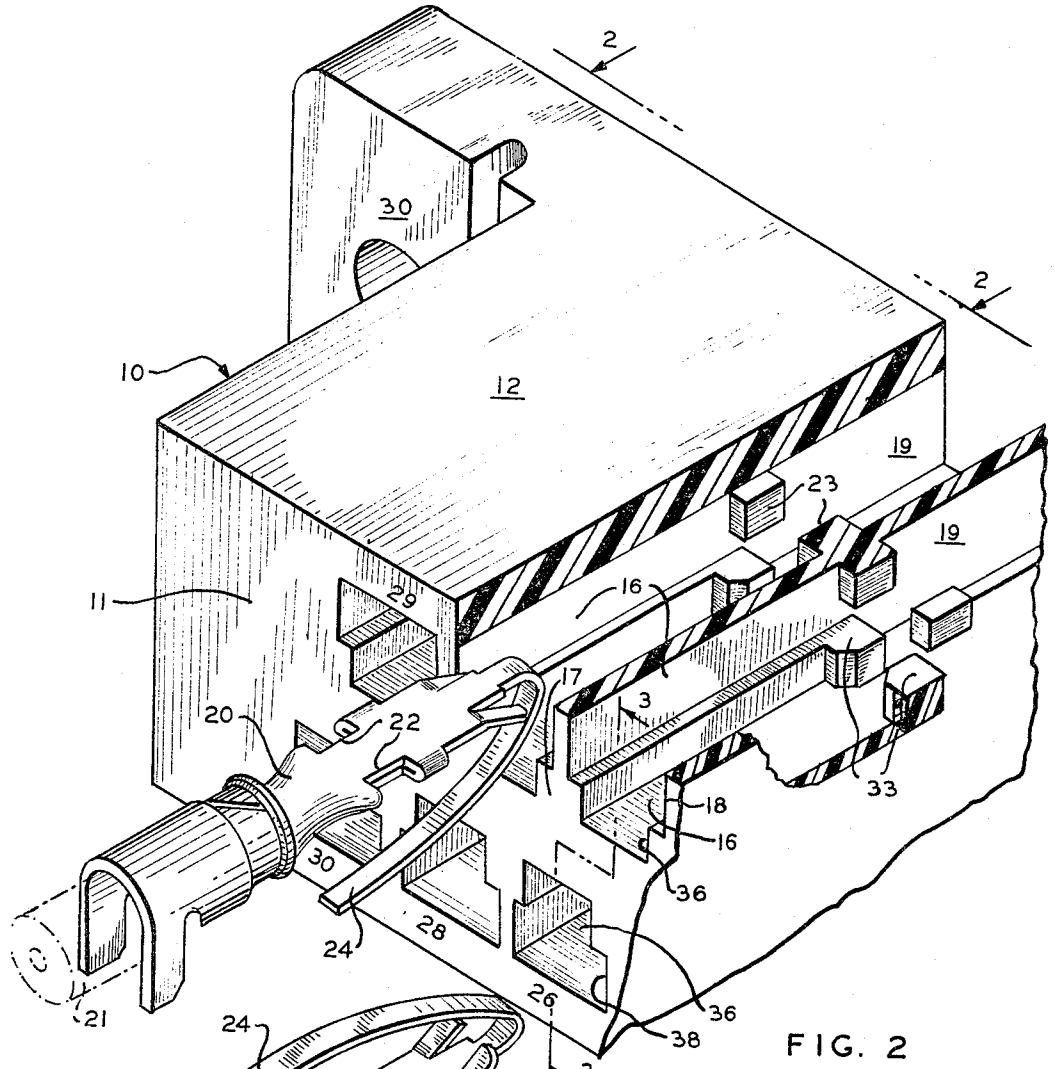
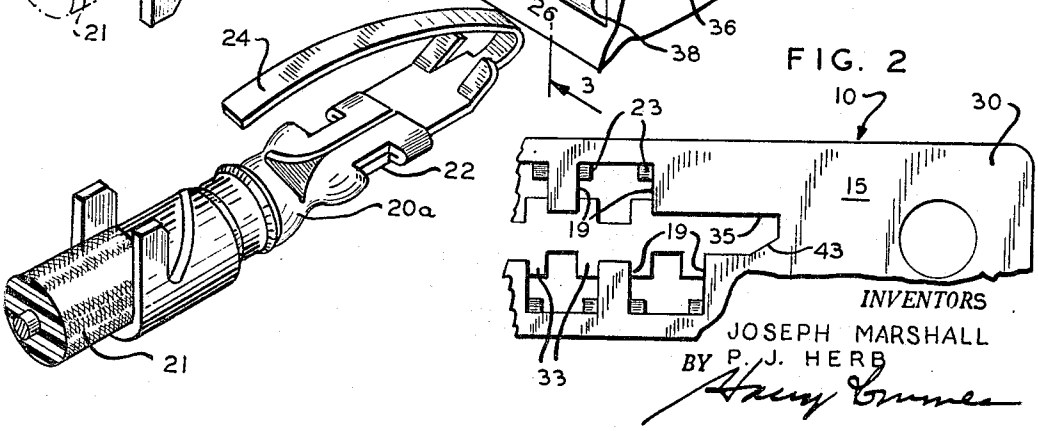


FIG. 2



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FIG. 3

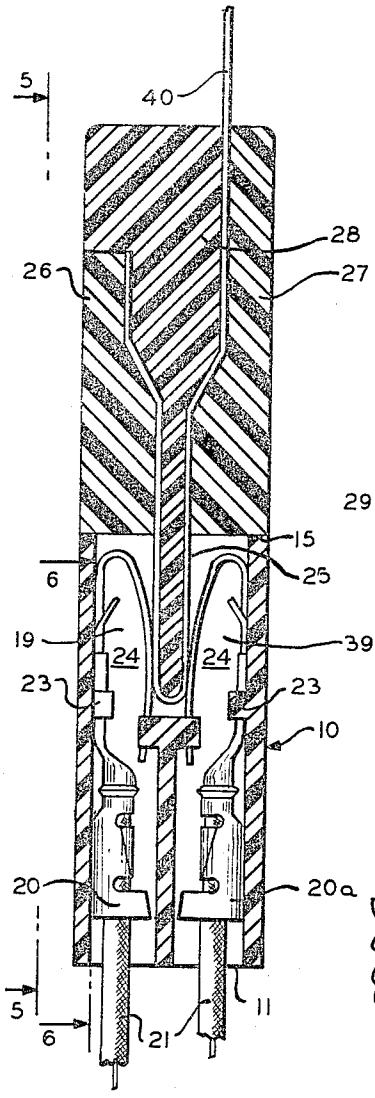


FIG. 4

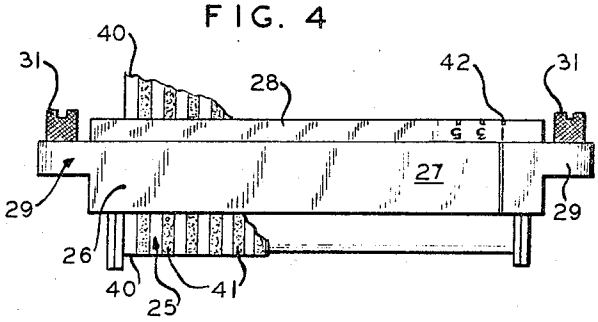


FIG. 5

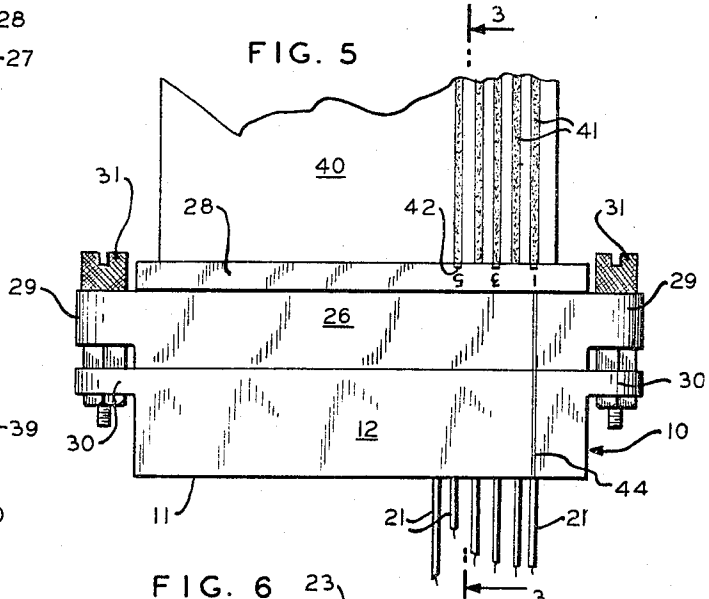


FIG. 6

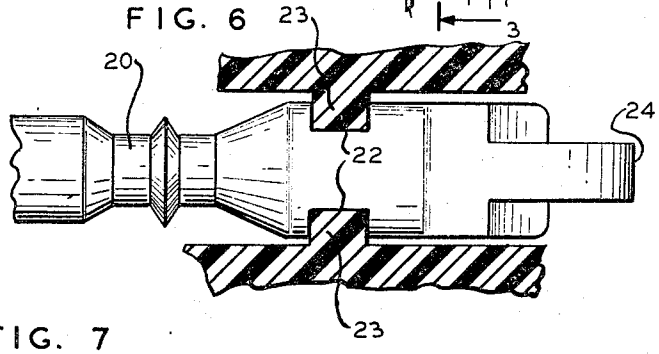
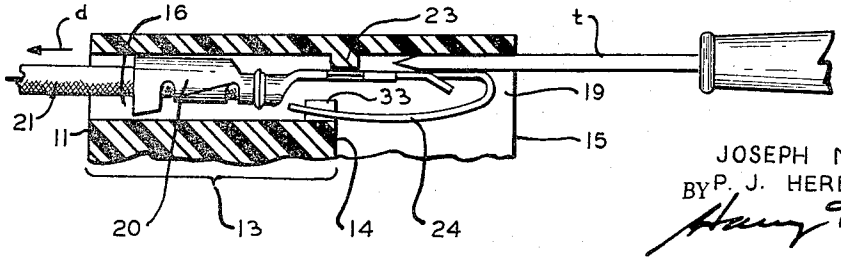


FIG. 7



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TERMINAL CONNECTOR

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Continuation of application Ser. No. 198,645, May 29, 1962. This application Sept. 13, 1965, Ser. No. 492,974

9 Claims. (Cl. 339—176)

This application is a continuation of U.S. application Serial No. 198,645, filed May 29, 1962 and now abandoned.

This invention is concerned with connection of cables, wires, and other conductors to flat conductors such as printed circuit boards, flexible tape conductors, and other flat surfaces provided with conductors or other electrical components.

In making connections to flat conductors such as those of flexible tape cable, it has been standard practice to either individually connect each conductor by soldering and the like to terminals or to engage each conductor on one side of the cable by a resilient contact. In either case, the connections to each of the conductors of the flat cable must be disposed close to one another and can result in a definite close space limitation which can present the possibility of a short circuit or crosstalk between adjacent conductors. Thus, even though the conductors can be closely spaced in the flat cable, a limitation arises as to how close the connections to the cable can be made in a connector.

It is therefore one of the objects of the invention to provide an electrical connector for cable of the flexible tape type in which adequate spacing can be provided between the connection of a terminal member to each of the conductors of the cable.

It is another object of the invention to provide an electrical connector for cable of the flexible tape type in which all of the connections to the conductors of the cable can be disposed adjacent to one region of the cable and yet are adequately spaced from one another.

It is another object of the invention to provide an electrical connector for cable of the flexible tape type in which connections can be made to the conductors of the cable when it is folded.

In an embodiment of the invention the connector for cable of the flexible tape type comprises a body of insulating material having a slot extending inwardly from one face thereof. The connector further includes a support member about which the cable is adapted to be folded with the plurality of conductors of the cable exposed. The slot of the body member is adapted to receive the support member with the cable folded around it. In addition the body is provided with two parallel spaced apart rows of apertures which extend inwardly and intersect the slot. The apertures of each of the rows are spaced apart from one another with each row being disposed adjacent to a different one of the opposite sides of the slot. In addition, the apertures in one row are staggered with respect to the apertures in the other row. The connector also includes terminals disposed in the apertures which extend adjacent to the portion of the aperture which intersects the slot. With this arrangement the terminals of the rows can connect to the different alternate conductors of the cable when it is folded and inserted into the slot.

The invention comprises a self contained terminal connector having novel means for positioning a plurality of conductor terminals therein from one end face in predetermined relation and securely held therein for connection with flat conductors inserted into the connector from the other end face thereof.

The invention is provided with novel means for latching the conductor terminals therein in registered alignment, as above set forth, at the same time enabling the ready disengagement of said conductor terminals therefrom whenever desired. The connector is adapted to be readily secured to and removed from flat conductors or components, providing positive and simple registry and electrical connection of the parts on assembly and enabling rapid and simple disassembly to be had when desired.

The drawings, illustrating procedures and devices useful in carrying out the invention, and the description below, are exemplary only of the invention, which shall be deemed to cover all other devices and procedures coming within the scope and purview of the appended claims.

In the drawings, wherein similar reference characters indicate like parts:

FIG. 1. is a perspective, partly fragmentary view of a terminal connector embodying the invention, terminals being shown about to be inserted thereinto from one marginal edge thereof,

FIG. 2 is a fragmentary, elevational view, taken from the other marginal edge thereof, at line **2—2** of FIG. 1,

FIG. 3 is an enlarged vertical sectional view of the connector assembly, taken at line **3—3** of FIG. 5 and **3—3** of FIG. 1, with the flat conductor element **25** shown positioned therein and electrically connected with the conductor terminals therein,

FIG. 4 is a fragmentary elevational view of a tape conductor member shown secured to a holder which may be inserted into a connector of this invention,

FIG. 5 is a similar view, showing said holder inserted into the connector and removably connected thereto by latching means, taken at line **5—5** of FIG. 3,

FIG. 6 is an enlarged, partly sectional view of a conductor terminal **20** shown inserted and latched to the connector, taken at line **6—6** of FIG. 3, and

FIG. 7 is a partly fragmentary, longitudinal sectional view of the connector with the terminal therein shown about to be disengaged therefrom by a tool *t*.

As shown in the drawings, the terminal connector **10** of this invention comprises a member or body preferably made of dielectric material such as, for example, of plastic molded or otherwise formed to define a plate **12** having an end face **11**. A section **13** of said plate (FIG. 7) from said end face **11** to a point **14** substantially short of the other end face **15** thereof, is provided with a series of parallel apertures **16**, a wall **17** (FIG. 1) terminating in said one end face **11** of the plate, having the ends **18** of the series of apertures **16** extending therethrough. Walls **19** extend (FIG. 7) from the end **14** of the apertured section **13** to the said other end face **15** of plate **12**.

Terminals **20** secured to cables, wires, or other conductors **21** (FIG. 1) are inserted through the apertures **18** of wall **17**, said terminals have slotted or notched portions **22** or the like adapted to snap into latching engagement with the registering lock means such as bosses **23** of plate **12** aligned with the apertures **16** therein for latching the terminals **20** therein. The walls **19** terminate short of each other to define a space **35** therebetween (FIG. 2) to receive the conductor element **25**. Terminals **20** preferably have flexible nosings **24** extending (when the terminals are so inserted into plate **12**) along space **35** (FIG. 3) so that, upon insertion of the flat conductor element or cable of the flattened tape type (such as **25**, FIGS. 5 and 3) to be connected to said terminals into

said space **35** from the end face **15** thereof (FIG. 3) effective electrical connection will be made while the connected parts are fully enclosed and shielded.

The flat conductor element **25** may be carried by a holder **26** of any desired or convenient form, and may be made of two or more parts, for example, part **27** and support member **28** (FIGS. 3, 4) which may have interfitting or latching engagement; said flat conductor element **25** might be a printed circuit board or the like. The holder **26** may be provided with assembly means such as terminal flanges **29** (FIG. 4) for alignment with terminal flanges such as **30** of the plate **12** (FIGS. 1 and 5) and means such as bolts **31** (FIG. 5) may secure the holder **26** and plate **12** together. The plate **12** may be provided with further registry and guiding means for the flexible nosings **24**, such as for example, spaced bosses **33** intermediate which the nosings **24** register on insertion of the terminals **20** in plate **12** as above mentioned.

Apertures **16** have narrow portions **33** (FIG. 1) in which the nosings **24** slide on insertion of the terminals **20** in plate **12** (FIG. 1). Plate **12** is provided, from the end face **11** thereof with a second series of apertures **38** having narrow portions **36** corresponding with but inverted with relation to apertures **16** (FIGS. 1, 2, and 3) and apertures **38** are provided with bosses corresponding with the spaced bosses **23** and **33** of apertures **16** (FIG. 3) for registry of the second series of terminals **20***a* (FIG. 1) therewith. To remove a terminal from the plate **12**,it is merely necessary to insert a tool *t* (FIG. 7) through the end face **15** and above the terminal **20** and lift, whereupon said terminal **20** may be withdrawn in the direction indicated by the arrow *d* (FIG. 7) out of plate **12**.

As will be apparent to those in this art, from the disclosure herein, the invention may be used in connection with a holder **26** (FIG. 4) of my desired configuration, it being desirable for use thereof in connection with the connector **10** of this invention, only that a flat conductor element **25** be presented for insertion into opening or slot **35** (FIG. 2) of the body of insulating material or plate **12** for connection, thus with conductors **20** and **20***a*. Where, as shown in FIGS. 4 and 5, the holder **26** is used to hold flat conductor element **25** such as a flexible tape **40** or conductor ribbons **41** by scraping or baring the ends of said tape **40**, the ribbons **41** (or selectively such of said ribbons as desired) may be exposed for connection with the conductors **20**, **20***a*. The latter are (FIG. 1 and 2) held in plate **12** in staggered, spaced parallel relation. Thus, on assembly of the parts (FIG. 3) said conductors **20**, **20***a* will be aligned with alternate conductors **41** of the flexible tape **40** so that connection may be made in this fashion with the predetermined desired conductor ribbons **41** therein. To this end the holder **26** may be provided with suitable markings **42** schematically illustrated in FIGS. 4 and 5 to facilitate identification of such of the conductors **21** as it is desired to connect with the conductor **40**, which as above noted may engage alternate conductors **41**.

The slot **35** may be polarized as noted at **43** (FIG. 2) so that a keying arrangement will be provided for insertion of the conductor element **25** into opening **43** only in the correct position.

We claim:

1. An electrical connector adapted to form a connection to a folded portion of a cable of the flexible tape type having a plurality of parallel conductors spaced apart from one another at a predetermined interval, the conductors at one side of the folded portion facing away from the conductors at the other side of the folded portion, said connector comprising a body of insulating material having a slot extending inwardly from one face thereof with said slot having a pair of opposite sides spaced apart from one another and a bottom disposed therebetween, said slot being adapted to receive a folded portion of the cable extending to adjacent said bottom with the conductors of the cable adjacent to said opposite sides of said slot, said body having two spaced apart rows of apertures extending inwardly from another face thereof disposed opposite to said one face with the apertures of each row being spaced apart from one another at an interval which is substantially twice the predetermined interval of the conductors, said apertures of one row being staggered with respect to the apertures of the other of said rows by a distance corresponding to substantially one-half of said interval between apertures, each of said rows being parallel to a different one of said opposite sides of said slot, said apertures of each of said rows intersecting a different one of said pair of opposite sides of said slot, each of said apertures of each of said rows having a surface disposed adjacent to the central portion of said body and parallel to a different one of said opposite sides of said slot, said surface of each of said apertures terminating at said bottom of said slot, and terminal members disposed in said apertures, each of said terminal members having a base element and a contact element overlying a portion of said base element, said contact element being connected at one end portion thereof to an end portion of said base element and being in a facing relationship with said slot, the other end portion of said contact element disposed opposite to said one end portion thereof engaging said surface of said aperture adjacent said bottom of said slot to position said base element adjacent another surface of said aperture disposed opposite said surface thereof, whereby said terminal members of each of said rows are adapted to form a connection to different alternate conductors at each of the sides of the folded portion of the cable when the folded portion is received in said slot.

2. An electrical connector in accordance with claim **1** and further comprising means disposed in each of said apertures and in engagement with said loose element of said terminal member therein for releasably locking said terminal member in said aperture.

3. An electrical connector in accordance with claim **1** in which said contact element comprises a resilient nosing extending substantially parallel to the length of said aperture, whereby the resiliency of said contact element insures the forming of a connection to the conductor of the cable adjacent thereto.

4. An electrical connector adapted to form a connection to a folded portion of a cable of the flexible tape type having a plurality of parallel conductors spaced apart from one another at a predetermined interval, the conductors at one side of the folded portion facing away from the conductors at the other side of the folded portion, said connector comprising a body of insulating material having a slot extending inwardly from one face thereof with said slot having a pair of opposite sides spaced apart from one another and a bottom disposed therebetween, a support member having oppositely disposed surfaces adapted to engage the sides of the folded portion of a cable when the folded portion is disposed around said stepped support member, said slot being adapted to receive said support member and the portion of the cable folded therearound with the folded portion of the cable extending to adjacent said bottom with the conductors of the cable adjacent to said opposite sides of said slot, said body having two spaced apart rows of apertures extending inwardly from another face thereof disposed opposite to said one face with the apertures of each row being spaced apart from one another at an interval which is substantially twice the predetermined interval of the conductors, said apertures of one row being staggered with respect to the apertures of the other of said rows by a distance corresponding to substantially one-half of said interval between apertures, each of said rows being parallel to a different one of said opposite sides of said slot, said apertures of each

of said rows intersecting a different one of said pair of opposite sides of said slot, each of said apertures of each of said rows having a surface disposed adjacent to the central portion of said body and parallel to a different one of said opposite sides of said slot, said surface of each of said apertures terminating at said bottom of said slot and terminal members disposed in said apertures, each of said terminal members having a base element and a contact element overlying a portion of said base element, said contact element being resiliently connected at one end portion thereof to an end portion of said base element and being in a facing relationship with said slot, the other end portion of said contact element disposed opposite to said one end portion thereof engaging said surface of said aperture adjacent said bottom of said slot to position said base element adjacent another surface of said aperture disposed opposite said surface thereof, whereby said terminal members of each of said rows are adapted to form a connection to different alternate conductors at each of the sides of the folded portion of the cable when the folded portion is received in said slot.

5. An electrical connector in accordance with claim 4 and further comprising a socket for receiving the portion of the cable when folded back upon itself around said support member, and means for securing said socket to said body when the portion of the cable and said support member are disposed in said slot, whereby the conductors of the cable are retained in connection with said terminals.

6. An electrical connector in accordance with claim 4 in which said contact element of said terminal member comprises a resilient nosing extending substantially parallel to the length of said aperture, whereby the resiliency of said contact element insures the forming of a connection to the conductor of the cable thereto.

7. An electrical connector adapted to form a connection to a folded portion of a cable of the flexible tape type having a plurality of parallel conductors spaced apart from one another at a predetermined interval, the conductors at one side of the folded portion facing away from the conductors at the other side of the folded portion, said connector comprising a body of insulating material having a slot stepped inwardly from one face thereof, the inner portion of said stepped slot having a pair of inner opposite sides spaced apart from one another at a predetermined distance with a bottom disposed therebetween, the outer portion of said stepped slot having a pair of outer opposite sides spaced apart from one another at a distance greater than said predetermined distance, a stepped support member having oppositely disposed surfaces adapted to engage the sides of the folded portion of a cable when the folded portion is disposed around said stepped support member, said stepped support member being formed to mate within said stepped slot when the portion of the cable is folded therearound with the conductors of the cable adjacent to the inner and outer opposite sides of said stepped slot, said stepped slot being adapted to receive the folded portion of the cable and said support member with the folded portion of the cable extending to adjacent said bottom with the conductors of the cable adjacent to said inner opposite sides of said stepped slot, said body having two spaced apart rows of apertures extending inwardly from another face thereof disposed opposite to said one face with the apertures of each row being spaced apart from one another at an interval which is substantially twice the predetermined interval of the conductors, said apertures of one row being staggered with respect to the apertures of the other of said rows by a distance corresponding to substantially one-half of said interval between apertures, each of said rows being parallel to a different one of said inner opposite sides of said stepped slot, said apertures of each of said rows

intersecting a different one of said pair of inner opposite sides of said stepped slot, each of said apertures of each of said rows having a surface disposed adjacent to the central portion of said body and parallel to a different one of said inner opposite sides of said stepped slot, said surface of each of said apertures terminating at said bottom of said inner portion of said stepped slot and terminal members disposed in said apertures, each of said terminal members having a base element and a contact element overlying a portion of said base element, said contact element being resiliently connected at one end portion thereof to an end portion of said base element and being in a facing relationship with said inner portion of said stepped slot, the other end portion of said contact element disposed opposite to said one end portion thereof engaging said surface of said aperture adjacent said botom of said inner portion of said stepped slot to position said base element adjacent another surface of said aperture disposed opposite said surface thereof, whereby said terminal members of each of said rows are adapted to form a connection to different alternate conductors at each of the sides of the folded portion of the cable when the folded portion is received in said stepped slot.

8. An electrical connector in accordance with claim 7 in which said contact element of each of said terminals comprises a resilient nosing extending along the length of said aperture and positioned adjacent said slot, said resilient nosings of the terminals of each of said rows being adapted to connect to the conductors of the folded cable when the cable is disposed in said stepped slot.

9. An electrical connection in a cable of the flexible tape type having a plurality of parallel conductors spaced apart from one another at a predetermined interval comprising a folded portion of said cable, the conductors at one side of said folded portion facing away from said conductors at the other side of the folded portion, a body of insulating material having a slot extending inwardly from one face thereof with said slot having a pair of opposite sides spaced apart from one another and a bottom disposed therebetween, said slot engaging a folded portion of the cable extending to adjacent said bottom with said conductors of said cable adjacent to said opposite sides of said slot, said body having two spaced apart rows of apertures extending inwardly from another face thereof disposed opposite to said one face with the apertures of each row being spaced apart from one another at an interval which is substantially twice the predetermined interval of said conductors, said apertures of one row being staggered with respect to the apertures of the other of said rows by a distance corresponding to substantially one-half of said interval between apertures, each of said rows being parallel to a different one of said opposite sides of said slot, said apertures of each of said rows intersecting a different one of said pair of opposite sides of said slot, each of said apertures of each of said rows having a surface disposed adjacent to the central portion of said body and parallel to a different one of said opposite sides of said slot, said surface of each of said apertures terminating at said bottom of said slot, and terminal members disposed in said apertures, each of said terminal members having a base element and a contact element overlying a portion of said base element, said contact element being connected at one end portion thereof to an end portion of said base element and being in a facing relationship with said slot, the other end portion of said contact element disposed opposite to said one end portion thereof engaging said surface of said aperture adjacent said bottom of said slot to position said base element adjacent another surface of said aperture disposed opposite said surface thereof, whereby said terminal members of each of said rows connect to

different alternate conductors at each of the sides of said folded portion of said cable.

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