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3,307,139

FLAT CABLE CONNECTOR

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2 Sheets-Sheet 1

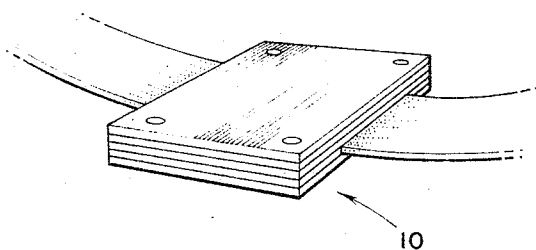


FIG. 1

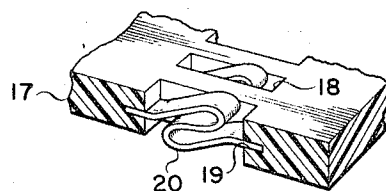


FIG. 4

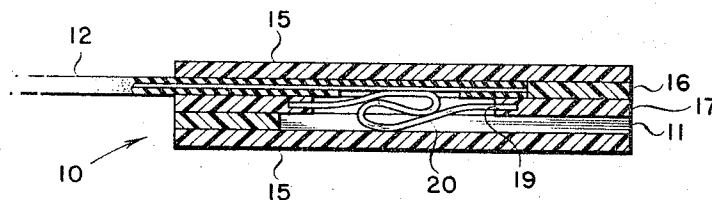


FIG. 3

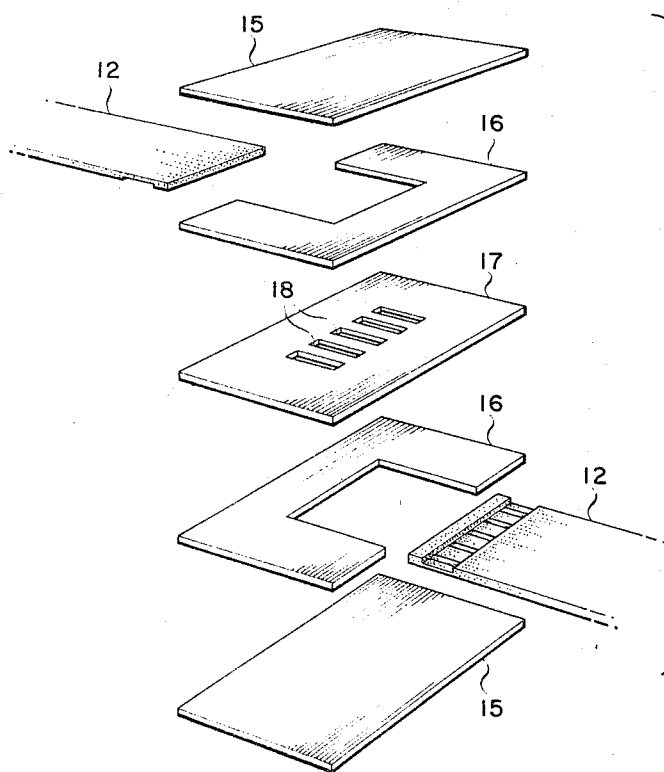


FIG. 2

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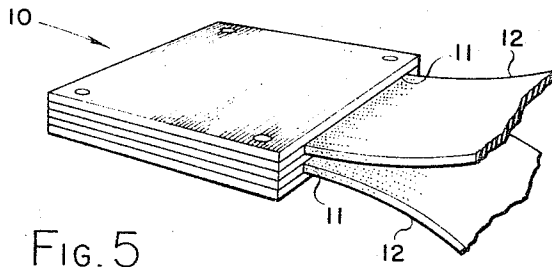
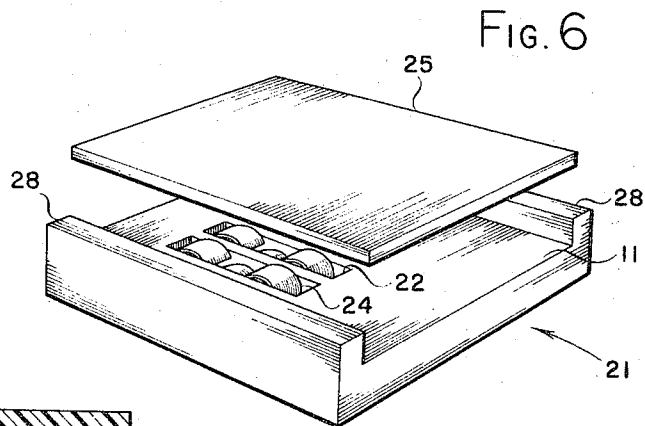
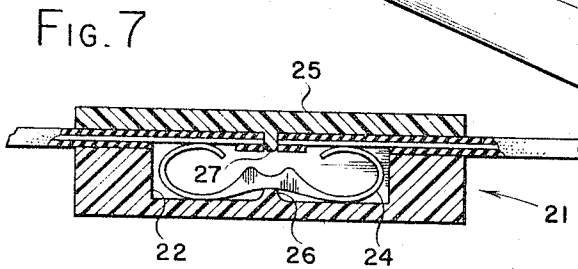
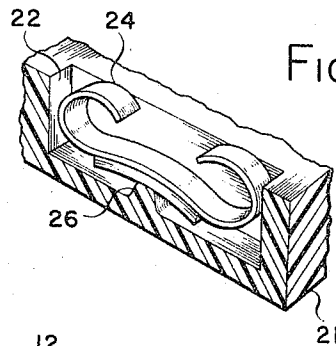
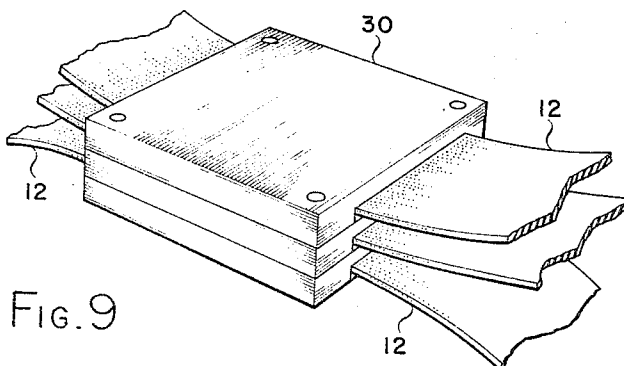
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2 Sheets-Sheet 2



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FLAT CABLE CONNECTOR

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The present invention relates in general to an electrical connector of the multiple circuit type, and in particular to a connector adaptable for flat, multi-conductor cables.

The use of flat multi-conductor cable, made of a plurality of thin flat parallel metallic conductors encapsulated between layers of thin flexible insulating material, has been available for the past decade. Its advantage over conventional cable made of round wire is significant and its particular advantage includes cost saving, light weight, small volume, great mechanical flexibility, high tensile strength, and air-free insulation. In spite of the fact of the known advantages of flat cable as an interconnect concept, flat conductor cable has made little inroad into the electrical and electronic wire harness applications. One reason for the lack of widespread use of flat conductor cable is in part due to the lack of suitable termination means.

It is the object of the present invention to provide a unique, inexpensive, flat cable interconnect suitable for use in general applications where cost and ease of handling are a great factor.

Another object of the present invention is to provide a flat, multi-conductor cable connector which may be assembled cheaply and easily in single and multi-layer configurations for plain and shielded flat conductor cable.

Another object of the present invention is to provide a flat, multi-conductor connector which includes inherent simplicity in design along with foolproof insulation characteristics which is also adaptable to various environmental conditions.

These objects and other features and advantages of the present invention will become apparent to a skilled practitioner in the art of connectors after a perusal of the following specification and drawings of which:

FIGURE 1 is a perspective view of one embodiment of the flat multi-conductor cable connector according to the present invention;

FIGURE 2 is an exploded view of the connector shown in FIGURE 1, showing the separate components thereof;

FIGURE 3 is a cross-section view of the connector according to the present invention as embodied in FIGURE 1;

FIGURE 4 is a fragmentary view of the connector showing the installation of the interconnect means;

FIGURE 5 is a perspective view showing an alternate configuration of the connector embodied in FIGURE 1;

FIGURE 6 is an exploded perspective view showing another embodiment of the present invention;

FIGURE 7 shows a cross-section view of the embodiment depicted in FIGURE 6;

FIGURE 8 is a fragmentary view of an alternate interconnect media of that shown in FIGURE 6; and

FIGURE 9 is a perspective view showing a stacked array of flat conductor connectors in accordance with the present invention.

Referring to FIGURES 1 through 4 of the drawings, a connector 10 having a pair of spaced insert receptacles 11 which are adapted to receive a length of flat cable 12 therein. Flat cable 12 comprises a multiplicity of conductors consisting of thin flat parallel metallic ribbons embedded in and extending longitudinally of a thin flexible sheath of insulating material is depicted. Connector 10 comprises a pair of flat, semi-rigid cover boards 15,

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a pair of flat, C-shaped semi-rigid boards 16, and a flat, interconnected centerboard 17 all made from an insulating material and secured together to form a unit member. Centerboard 17 is provided with a plurality of rectangular cavities 18 cut through the surface thereof, one each for the metal conductor traces of multi-conductor cable 12 which are to be interconnected.

The members 15-18 are stacked together with the open portion of each C-shaped board 16 pointing in a different direction. The openings which define the C provide the insert receptacle 11 to receive flat cable 12 therein. It is anticipated that the C-shaped boards 16 could be positioned having the C openings pointed in the same direction if so desired for a cable interconnect embodiment shown in FIGURE 5.

Metal conductor interconnects are secured within cavities 18 by having their ends secured in slots 19 which are cut in opposing walls of cavities 18 of centerboard 17. The center portion of interconnects 20 protrude above and below the surface of the centerboard to make electrical and mechanical contact with the exposed metallic traces of flat cable 12. FIGURE 4 best depicts this feature, however, it is understood to be well within the scope of this invention that other suitable interconnect means such as a circular spring could be also utilized.

The flat cable conductor 12 is inserted in the insert receptacles 11. It is necessary that the insulation material of cable 12 be removed on one side to provide surface contact for the interconnects 20 with the spring bias of the interconnects providing a friction lock. One method of providing improved locking or securing means is to leave a portion of the flat conductor 12 on the extreme terminal end of the cable and remove a strip of insulation a short distance in from the end. In this way the upward force of spring 20 making positive mechanical contact with the cable 12 would provide a lock to aid in retaining the circuit cable in its proper position yet still allow removal and re-insertion of flat cable.

An alternate embodiment of the present invention is shown in FIGURES 6 through 8. A connector body 21 has a grooved recess formed in its upper surface. A plurality of housing cavities 22 are formed in the surface of the grooved recess to provide a plurality of housing means for metal interconnect member 24. A cover board member 25 having a raised lip 27 mates with the raised shoulders 28 on either side of the grooved recess on the upper surface of connector 21. Raised lip 27 serves as the inner stop for the receptacle defined by the upper surface of body 21, the side walls of the shoulders 28 and lip 27. A raised center portion 26 in the bottom of each cavity 22 to serve as a fulcrum to force interconnect means 24 on the opposite side in an upward direction. The free ends of interconnects 22 may be made of a thinner and softer spring material which makes electrical contact with the metal traces of the flat cable. It is noted that many variations of spring interconnects may be used, depending upon the environment, cost, and quality control desired.

FIGURE 9 shows a stack array of the connectors 30 as shown in the present invention. It is noted that any or all of the various embodiments of connectors 10 or 21 could be used either separately or mixed together to provide a stacked array of connectors if so desired.

The connector as shown is also adaptable to round wire configurations for connecting flat to round circuitry. The round wires would be terminated in a ferrule member which has its outer end inherently joined with a flat tongue member which would be inserted into receptacle opening 11.

What has been shown above is a plurality of flat multi-conductor cable connectors which have many distinct ad-

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vantages over those presently available. It is believed to be well within the skill of any practitioner in the connector art to make many modifications and changes in the connectors as shown without departing from the scope and intent of the invention which is defined in the following claims.

I claim:

1. A multi-contact electrical connector for connecting flat cable, said flat cable having a multiplicity of conductors consisting of thin flat parallel metallic ribbons embedded in and extending longitudinally of a thin, flexible sheath of insulating material, having a portion of the insulating material adjacent the terminal removed exposing the metallic ribbons; said multi-contact electrical connector comprising a relatively flat, thin main body member, said body member having at least two receptacles for receiving the terminal ends of said flat cable, an inner portion of each of said receptacles disposed in a spaced, overlapping relationship; a plurality of housing cavities formed within said body member and positioned adjacent a single exposed metallic ribbon of each flat cable, an electrical interconnect secured within each housing cavity, each of said electrical interconnects being formed of a compressible resilient metal member adapted to be in electrical and mechanical contact with a single metallic ribbon of each of said flat cables inserted into said receptacles, whereby the electrical contact will form an electrical interconnection between pairs of said flat cable, and the mechanical contact acting under force from the compressible resilient metal will serve as a friction lock to secure each flat cable within the connector receptacles.

2. The multi-contact electrical connector according to claim 1 wherein said electrical interconnect secured within each housing cavity formed of a compressible resilient metal member is shaped within each housing cavity in a generally serpentine form.

3. A multi-contact electrical connector for connecting flat cable, said flat cable having a multiplicity of conductors consisting of thin flat parallel metallic ribbons imbedded in and extending longitudinally of a thin, flexible sheath of insulating material, having a portion of the insulating material adjacent to terminal removed exposing the metallic ribbons; said multi-contact electrical connector comprising a relatively flat, thin main body member, said body member having at least two receptacles for receiving the terminal ends of said flat cable; a plurality of housing cavities formed within said body member and positioned adjacent a single exposed metallic ribbon of each flat cable, an electrical interconnect secured within each housing cavity, each of said electrical interconnects being formed of a compressible resilient metal member adapted to be in electrical contact and mechanical contact with a single metallic ribbon of each of said flat cables inserted into said receptacles; said body member being comprised of an interconnect centerboard disposed between a pair of C-shaped insulating board members, said centerboard and C-shaped board members disposed between a pair of cover members, said intercon-

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nects in the board having a plurality of spaced, parallel slots cut therein defining said housing cavities, and means for bonding said centerboard, C-shaped insulating boards, and said cover members into a single body unit member, whereby the electrical contact will form an electrical interconnection between the pairs of said flat cable, and the mechanical contact acting under force from the compressible resilient metal will serve as a friction lock to secure each flat cable within the connector receptacles.

4. A multi-contact electrical connector for connecting flat cable, said flat cable having a multiplicity of conductors consisting of thin flat parallel metallic ribbons imbedded in and extending longitudinally of a thin, flexible sheath of insulating material, having a portion of the insulating material adjacent the terminal removed exposing the metallic ribbons; said multi-contact electrical connector comprising a relatively flat, thin main body member, said body member having at least two receptacles for receiving the terminal ends of said flat cable; a plurality of housing cavities formed within said body member and positioned adjacent to a single exposed metallic ribbon of each flat cable, an electrical interconnect secured within each housing cavity, each of said electrical interconnects being formed of a compressible resilient metal member adapted to be in electrical and mechanical contact with a single metallic ribbon of each of said flat cables inserted into said receptacles; said body member comprising a first body portion and a second body portion, said first body portion comprising a substantially rectangular member having a wide recess area in its upper surface defined by a pair of raised parallel shoulder regions along two sides of said first body portion, a plurality of parallel, slotted, longitudinally directed cavities along the upper surface of said first body and formed therein, said slotted cavities defining said housing cavities, a second body portion comprising a flat cover insulating board disposed upon the shoulder region of said first body portion, the lower surface of said second body portion having a raised lip portion directed transverse with respect to said shoulder portions and substantially fitted therebetween, the upper surface of said first body portion, the inner walls of said raised shoulder regions, the lower surface of said cover board and the sides of said raised lip portion defining the receptacles for receiving a flat cable end therein; whereby the electrical contact will form an electrical interconnection between pairs of said flat cable, and the mechanical contact acting under force from the compressible resilient metal will serve as a friction lock to secure each flat cable within the connector receptacles.

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