United States Patent [19]

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Campbell et al.

[11] **3,912,354**

[45] **Oct. 14, 1975**

[54] **GROUND CONNECTOR FOR SHIELDED CABLE**

[75] Inventors: **Donald S. Campbell; Edward A. Stephan,** both of St. Paul, Minn.

[73] Assignee: **Minnesota Mining and Manufacturing Company,** St. Paul, Minn.

[22] Filed: **Mar. 4, 1974**

[21] Appl. No.: **447,768**

[52] **U.S. Cl.**..... **339/99 R;** 339/143 R; 339/DIG. 3

[51] **Int. Cl.**[2]..... **H01R 13/38**

[58] **Field of Search**..... 339/14, 17, 18, 19, 95, 339/97–99, 143, 222, DIG. 3; 174/36, 88 R

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Primary Examiner—Joseph H. McGlynn

Attorney, Agent, or Firm—Alexander, Sell, Steldt & DeLaHunt

[57] **ABSTRACT**

A connector for use in making permanent electrical contact between selected wire-conductors of a shielded flat cable and the conductive shield comprises a series of insulationpiercing bifurcate spring compression reserve contact elements held under conductive spring tension in a conductive support which is retained in conductive contact with said shield by a surrounding frame.

4 Claims, 10 Drawing Figures

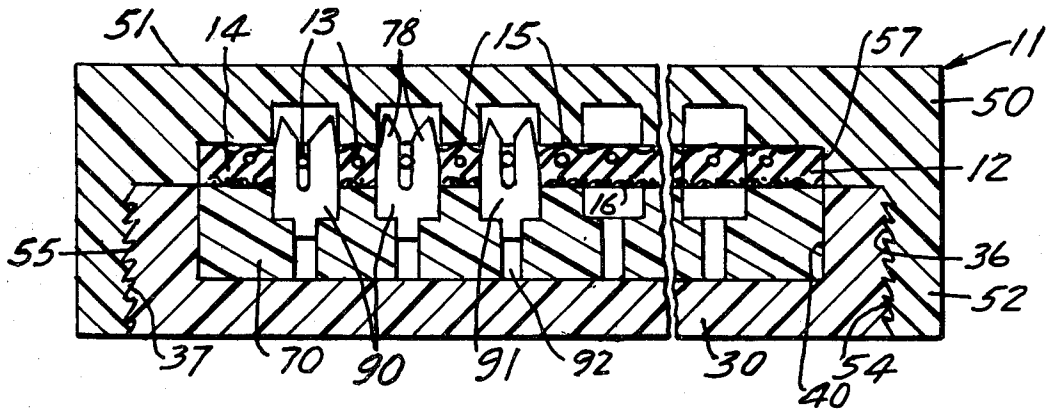


FIG. 1

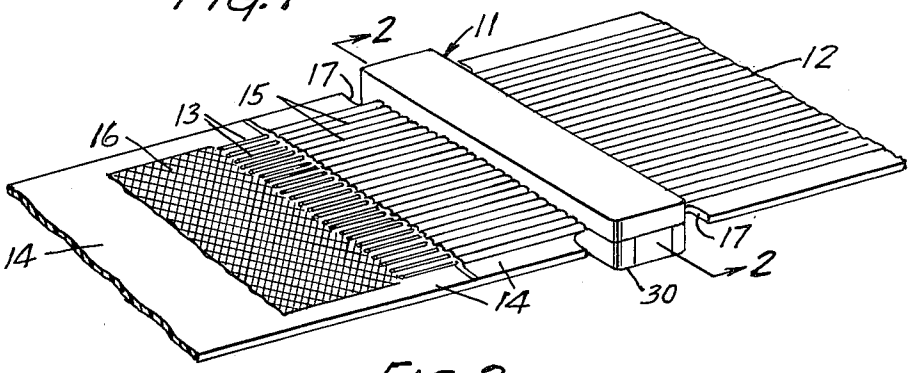


FIG. 2

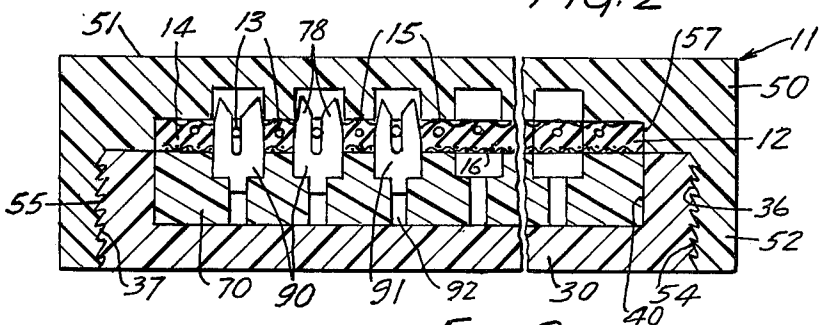


FIG. 3

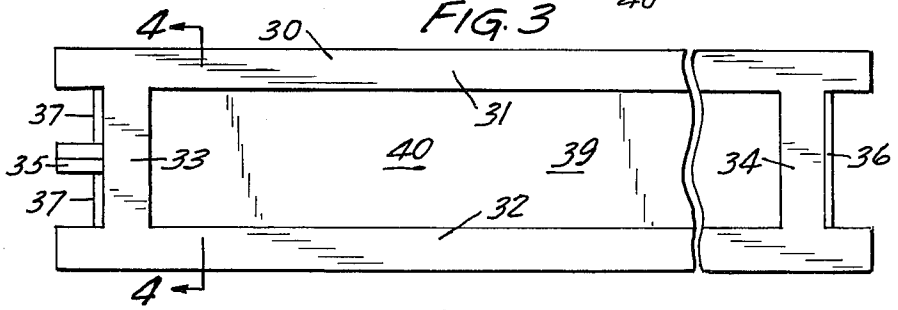


FIG. 4

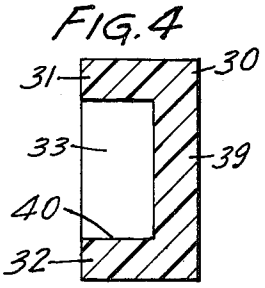


FIG. 5

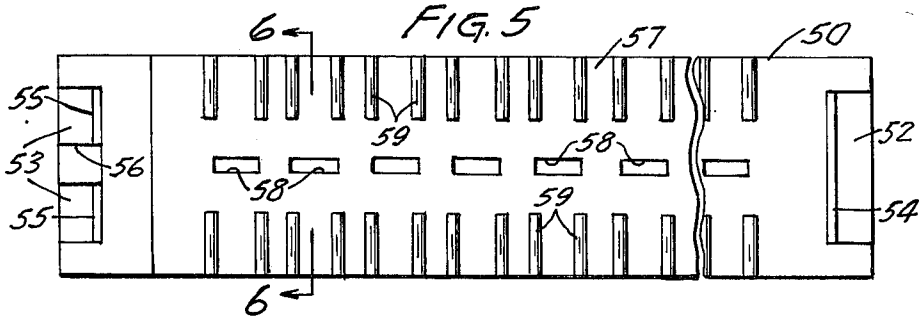


FIG. 6

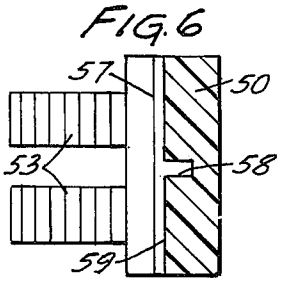


FIG. 7

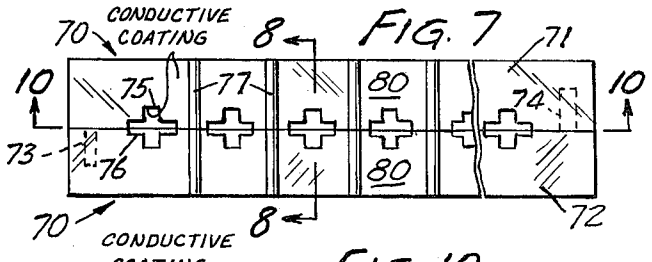


FIG. 8

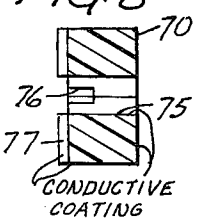


FIG. 9

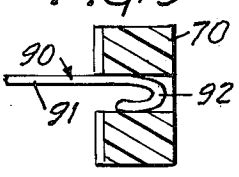
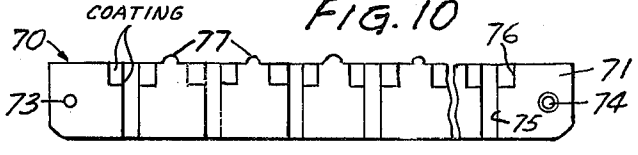


FIG. 10



GROUND CONNECTOR FOR SHIELDED CABLE

This invention relates to electrical connectors and has particular reference to connectors useful in providing contact between the shield and one or more of the wire-conductors of a multi-conductor shielded flat cable.

Flat cables are much used in the wiring of printed circuit and other complicated electrical and electronic systems. Such cables may contain a large number, upwards of fifty or more, small wire-conductors of circular cross-section per inch of width. In order to minimize cross-talk and other forms of interference, it is found advantageous to include in the cable structure a conductive shielding layer and to ground selected wires thereto. In some instances one wire of each pair of wires may be thus connected. Connection by stripping and soldering has been practiced but is a delicate and time-consuming operation.

The present invention provides a connector with which any desired number of the wire-conductors of a shielded flat cable may be effectively and permanently connected with the shield in a single simple operation involving only the exposing of the shield and the pressure assembly of a three-part connector about the exposed section. Removal of the outer insulating layer covering the shield is easily accomplished by careful hand cutting and stripping, or more conveniently by controlled mechanical abrasion. Assembly of the connector involves merely positioning the three parts against the surfaces of the cable and then forcing them together with a suitable hand- or power-operated press. Low resistance contact between wires and shield is obtained immediately and is thereafter maintained under all normal conditions of use.

In the drawing,

FIG. 1 is a view in perspective showing a connector of the invention mounted on a section of shielded flat cable,

FIG. 2 is a partial view in cross-section and on an enlarged scale taken approximately at line 2—2 of FIG. 1,

FIG. 3 is a top plan view, and FIG. 4 a section taken approximately at line 4—4 thereof, of the body member of the connector,

FIG. 5 is a bottom plan view, and FIG. 6 a section taken approximately at line 6—6 thereof, of the cover member,

FIG. 7 is a top plan view, FIG. 8 a section taken approximately at line 8—8 thereof, and FIG. 9 a similar section with a contact element inserted, of the assembled contact carrier member, and

FIG. 10 is an elevation taken approximately at line 10—10 of FIG. 7 showing an inner face of one segment of the two-part contact carrier member.

The connector 11 of FIGS. 1 and 2, shown applied to a cable 12, is composed of three major components, namely a recessed body 30, a ribbed and grooved cover 50, and a contact carrier 70 containing one or more bifurcate contact elements 90.

The cable 12 contains a plurality of parallel small wires 13 within a strip of insulating material 14 which is ridged at the upper surface above each wire, forming ridges 15. A flat expanded copper shield or ground plane 16 is embedded in the lower portion of the insulation and parallel to the wires 13. The insulation is first removed from the lower surface of the ground plane along a transverse strip equal to or slightly wider than the width of the connector, and the edges are notched adjacent to the outermost wires as shown at notches 17 in FIG. 1 to provide a close fit within the connector assembly.

The body 30 is of one piece construction and comprises extended sides 31, 32, inset ends 33, 34 and bottom 39, defining a recess 40, and a central end projection 35. The outer faces of the ends are serrated to provide teeth 36, 37 for meshing with cooperating teeth on the cover. The projection 35 has a wedge-shaped upper end 38 for ease of insertion into a corresponding groove in the cover.

The cover 50 has a flat upper surface 51, and depending ends 52, 53 having serrated inner faces 54, 55. The two ends 53 are spaced apart to provide an opening 56 for receiving the projection 35, thus assuring proper endwise alignment during assembly. The inner surface of the cover is recessed to provide a shallow recess 57 and a series of deeper recesses or grooves 58, and the surface forming the bottom of the recess 57 is provided with parallel transverse ridges 59 at each side of each groove thereby defining wire-aligning channels across the inner surface of the cover.

The contact carrier 70 is assembled of two identical halves 71, 72 fitted and held together by cooperating pegs 73 and apertures 74 at the contacting surface. Each piece is channeled to provide a deep channel 75 and a shallow channel 76 corresponding to the position of each of the deep grooves 58 of cover 50. Each piece also carries a transverse ridge 77 between each two adjacent shallow channels. The entire surface of each piece is plated with a very thin conductive metal coating.

The spring compression reserve contact elements 90 have a widened bifurcate portion 91 and a narrow J-shaped stem portion 92. The latter fits tightly within the pocket formed by the channels 75; the base of the bifurcate portion fits within the pocket formed by the channels 76. The wire-contacting tines 78 extend outwardly above the surface of the carrier 70.

Contact elements may be inserted in the desired pockets prior to assembly of the connector, or may be inserted uniformly in all positions during manufacture, with selective elements then being withdrawn prior to assembly if desired. The J-shaped stem makes effective electrical contact with the plated surface of the carrier 70 within the channels 75.

The carrier, with contact elements in the desired locations, is placed within the frame 30 and the whole is placed beneath the cable 12 at the uncovered and notched area. The cover is then pressed over and against the assembly, thereby forcing the contact elements through the ground plane and insulation and into spring compression reserve contact with the corresponding wires. The serrated edges of the cover mesh with those of the body and hold the entire assembly firmly together, the resiliency of the components being sufficient to permit the required deflection under the forces applied in applying the connector.

The contact element 90 makes excellent electrical contact with the wire-conductor but its contact with the ground plane 16 is uncertain and is subject to deterioration with subsequent movement of the cable or connector. However, the plated upper surface of the contact carrier 70 is held in fully effective contact with the ground plane and also makes full contact with the

stem of the contact element, so that a fully satisfactory grounding of the selected wires is achieved.

A typical connector of the invention, for use in conjunction with a flat cable containing **34** wires of **28** or **30** gauge and an expanded copper shield in pvc insulation, is two inches in length, one-half inch wide, and one-fourth inch thick in external dimensions. The body, cover, and contact carrier are molded of glass filled polyester injection molding polymer. The two halves of the contact carrier are plated prior to assembly using a bright tin plate over a copper flask. The contact elements are of ten mil beryllium copper, heat treated to spring temper and plated with gold over nickel.

I claim:

1. A ground plane connector for making permanent conductive electrical contact between the ground plane and selected wire-conductors of a longitudinally ribbed shielded flat cable, comprising: a contact carrier having electrically conductive contact element supporting pockets communicating physically and conductively with an electrically conductive surface; at least one resilient bifurcate electrically conductive flat plate contact element fitting within and making conductive contact with a said contact element supporting pocket and extending from the contact element supporting pocket beyond said conductive surface in position for making connection with a corresponding wire-conductor,; a cover fitting over said electrically conductive surface of said carrier, grooved to receive the said contact elements and having transverse ridges extending from adjacent the grooves for assuring alignment of said ribbed cable; and means for aligning said cover on said contact carrier and for maintaining the two in forceful contact with a cable section placed therebetween.

2. Connector of claim **1** wherein said contact carrier is an assembly of two substantially identical plastic bodies with adjacent faces channeled to provide said element-supporting pockets and with all surfaces having a conductive metal surface coating.

3. Connector of claim **2** wherein said contact elements include a generally J-shaped stem fitting within said element-supporting pocket and making spring contact with said metal coating.

4. Connector of claim **1** including a recessed body member for supporting said contact carrier and having serrated outer end surfaces, and wherein said cover is provided with depending ends having cooperatively serrated inner surfaces.

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