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ELECTRICAL CONNECTOR

3,076,951

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2 Sheets-Sheet 1

FIG. 1

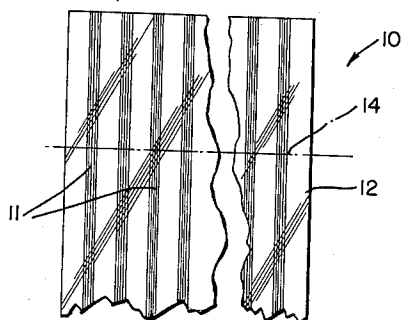


FIG. 2

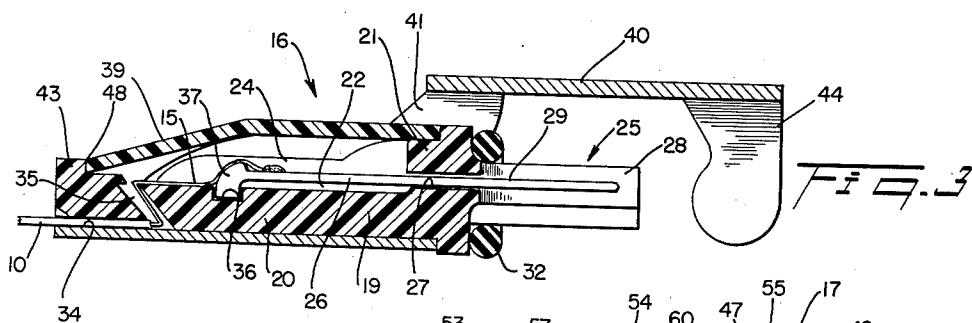
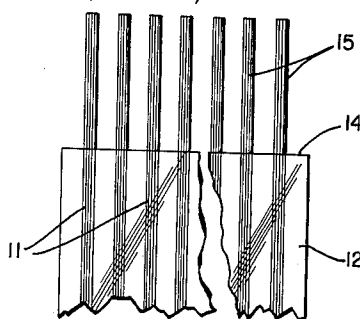
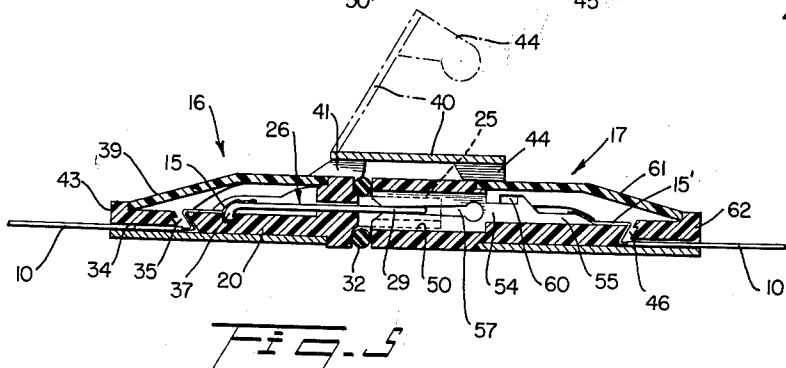
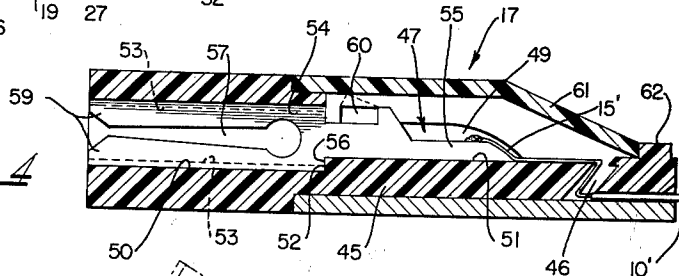


FIG. 4



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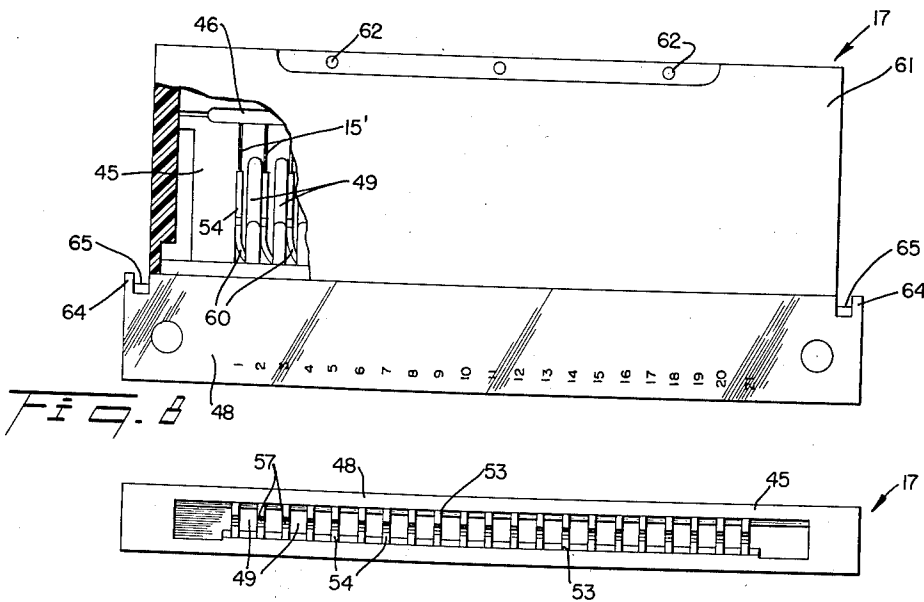
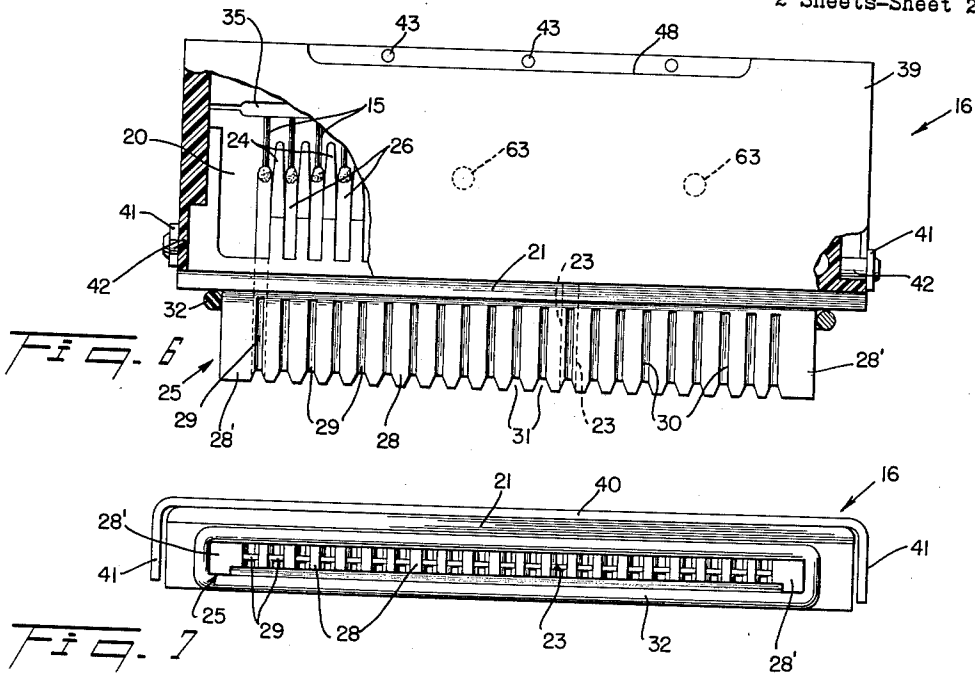
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## ELECTRICAL CONNECTOR

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9 Claims. (Cl. 339-91)

This invention relates to a separable connector, and in the embodiment thereof illustrated herein, particularly relates to a separable connector for cables in flattened, tape form.

The invention has among its objects the provision of a novel separable connector for multiple conductor cables. A further object of the invention is the provision of an improved separable electrical connector which may be used to advantage with multiple conductors of the flat or tape type.

Yet another object of the invention lies in the provision of a separable connector for tape cables, such connector being particularly characterized by the ease with which the conductors are electrically connected to the respective pin and socket contacts of the connector parts, by the fact that there is an effective insulating barrier between each pair of adjacent conductors within the connector parts, and the fact that when the connector parts are operatively engaged there is an effective insulating barrier between each set of engaging pin and socket contacts.

Still a further object of the invention lies in the provision of a separable electrical connector of the type indicated which is rugged and compact, and which adds but comparatively little to the weight of an assembly in which it is used.

The above and further objects and novel features of the invention will more fully appear from the following description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended as a definition of the limits of the invention.

In the drawings, wherein like references refer to like parts throughout the several views,

FIG. 1 is a fragmentary view in plan of a multi-conductor tape cable, such as that shown connected by the illustrative embodiment of electrical connector;

FIG. 2 is a fragmentary view in plan showing the end of the tape cable of FIG. 1 after the insulation has been removed from a zone at the end thereof;

FIG. 3 is a view in longitudinal vertical section through a first or pin-bearing connector part made in accordance with the invention;

FIG. 4 is a view in longitudinal vertical section through a second or socket contact-bearing connector part of an illustrative connector made in accordance with the invention;

FIG. 5 is a view in longitudinal vertical section through the first and second connector parts in fully engaged, operative relationship;

FIG. 6 is a view in plan of the first illustrative connector part, a fragment of the protecting insulating shell being broken away therefrom;

FIG. 7 is a view in end elevation of the first connector part, the view being taken in an upward direction in FIG. 6;

FIG. 8 is a view in plan of the second illustrative connector part, a portion of the protective electrically insulating shell thereof being broken away; and

FIG. 9 is a view in end elevation of such second connector part, the view being taken in an upward direction in FIG. 8.

As will be apparent from the above, there is illustrated herein one embodiment of a separable electrical connector made in accordance with the invention. FIGS. 3, 6, and

7 show a first or pin-bearing portion of the connector; FIGS. 4, 8, and 9 show a second, socket contact-bearing portion of the connector, and FIG. 5 shows the two connector parts in assembled operative relationship. The illustrative connector is shown used with a multiple connector cable of the flattened or tape type. Whereas the connector of the invention displays perhaps its maximum advantages when used with such type of cable, it is to be understood that the connector of the invention may also be used advantageously with cables of other types.

In FIG. 1 there is shown a portion of a flattened or ribbon type cable with which the connector of the invention is shown as being used. Such cable, generally designated 10, has a plurality of thin, ribbon-like conductor strips 11 which are sealed in spaced parallel relationship between upper and lower electrically insulating layers 12. In the illustrative cable, which may, for example, be one manufactured by the Tape Cable Company, Rochester, New York, the conductors 11 are made of thin copper strips, and the layers 12 are made of clear, transparent, thermoplastic material such as a polyester resin. In FIG. 2 the end of the tape cable is shown as having been stripped of insulating layers 12 back to a line 14, whereby to present bared conductor leads 15.

The first or contact pin-bearing connector parts, shown in FIG. 3, is generally designated by the reference character 16. Connector part 16 is adapted matingly to interfit with a socket contact-bearing connector part 17, shown in FIG. 4 and to be described hereinafter. Connector part 16 has an electrically insulating body 19 which may be made, for example, of tough, relatively inflexible plastic material. Body 19 has a relatively flat laterally extended base portion 20, there being a vertical laterally extending forward end wall 21 integrally fixed to base portion 20. Base portion 21 is provided with a plurality of narrow upstanding parallel longitudinally directed partitions 24 integral therewith, whereby to provide a plurality of conductor-receiving compartments in the body 19 which are substantially separated from each other.

Projecting forwardly from body 19, and, in the embodiment shown, integral therewith is a comb-like guard portion 25 which is located intermediate the top and bottom of body 19. Guard portion 25 is made up of a plurality of spaced parallel longitudinally extending fingers, the side fingers 28' being somewhat wider than the plurality of similar intermediate fingers 28. The confronting vertical faces of adjacent fingers 28, 28' are provided intermediate their heights with confronting oppositely directed longitudinal grooves 23 (FIGS. 6 and 7) which receive and accurately position the forward pin portions 29 of pin contacts 26. As a result of such construction, successive pin contact portions 29 are separated from each other, both when the first contactor part is disconnected, as shown in FIG. 3, and when it is connected to the second connector part, as shown in FIG. 5, by an electrically insulating member 28 of substantial section. In the embodiment shown the forward ends of contact pins 29 lie somewhat inwardly of the forward ends of insulating fingers 28, whereby the contact ends are protected from becoming short-circuited. The forward ends of the slots 30 between successive fingers 28 are preferably flared as shown whereby to facilitate entry of portion 25 into the socket contact-bearing portion of the second connector part 17.

The pin connector 26 has a main blade-like body, such body extending through a passage 27 through the end wall 21 of body 19 at the forward end of each compartment 22. Such engagement between the contact pin and the end wall 21 further aids in locating the contact pin accurately relative to body 19. Connector part 16 is further provided with means for securing an end of tape

3

cable 10 thereto. At the rear bottom edge of body 20 there is provided a shallow groove 34 having a depth which is little if any in excess of the thickness of tape cable 10. The forward end of groove 34 communicates with the lower forward end of a laterally extending and rearwardly and upwardly directed groove 35. It will be apparent that when the end of the tape cable is disposed in grooves 34 and 35 as shown in FIG. 3, with the bared or skinned ends 15 of the conductors extending forwardly, the tape cable is securely snubbed against being pulled rearwardly outwardly from connector part 16.

The pin connectors 26 are retained from endwise movement by means including a shallow recess or hole 36 in the upper surface of body 20 toward the rear end and centrally of each of compartments 22. The rear end of each of pin contacts 26 is provided with a portion 37 of thickened section and having a lower end of such shape as snugly to fit within recess 36.

The structure thus far described is assembled as follows: The contacts 26 are mounted on body 19 by having their forward ends 29 telescoped through openings 27, the contacts being slid forwardly until portion 37 thereon overlies recess 36. Portion 37 of the contact is now thrust firmly downwardly into recess 36. The resilience of body 19 results in making firm mechanical connection between the portion 37 of the contact pin and body 19 of connector part 16. The end of the tape cable 10 may have previously been introduced into grooves 34 and 35, or this operation may be carried out at this time. Each of the bared leads 15 is now disposed above the rear end of the respective contacts 26, and is joined thereto as by being soldered thereto, as indicated in FIG. 3.

Connector part 16 is completed by a sheath 39 of strong electrically insulating material which snugly underlies the bottom surface of base 20, snugly contacts tape cable 10 in groove 34, and closely overlies the tops of the partitions 24 on base 20. Sheath member 39 may advantageously, although not necessarily, be made of nylon. As shown, the forward upper and lower edges of sheath 39 contact shoulders on end wall 21 of body 19. The sheath is mounted upon body 19 by being telescoped thereover in a direction from left to right in FIG. 3. The sheath is retained in assembled position by being snapped over resiliently deformable projections or buttons 43, which, in the fully assembled position, contact the rear edge of the cutout portion 48 of the sheath. Preferably the portion of the connector part 16 within sheath 39 is further protected from displacement, moisture, etc., by filling the space within the sheath with a suitable potting compound through one or more holes in the sheath such as those shown at 63 in FIG. 6. Among the many suitable potting compounds for this purpose are epoxy resins and the like.

To retain connector part 16 securely in operative relationship with connector part 17, the former is provided with selectively releasable latching means. Such means here takes the form of a bail-like structure having a laterally extending body 40 from which there depend a pair of rear parallel ears 41 and a pair of forward parallel latching ears 44. The lower ends of ears 41, as shown most clearly in FIG. 6, are pivotally secured to the forward side edges of sheath 39 by pivot pins 42. The latching means on connector part 16 coacts with means to be described on connector part 17, when the parts are together, as shown in FIG. 5.

The second connector part 17 has a main body 45 which is also formed of relatively rigid plastic electrically insulating material, preferably molded to shape. The rear end of body 45 is provided with slot means, generally designated 46, similar to slots 34 and 35 in bodies 19, whereby the tape cable, here designated 10', is secured and snubbed to the body 45. Body 45 is provided with a plurality of transversely aligned longitudinally extending relatively narrow compartments 47 formed be-

4

tween a plurality of similar parallel partitions 49 which are integrally attached to the upper surface of the rear portion of body 45. The forward edge portion of body 45 has a laterally extended opening or socket 50 which is of such size and configuration as accurately to receive therewithin the forward guard portion 25 of connector part 16. Within socket 50 there are accurately secured and located a plurality of vertical, horizontally divided, blade-like socket contacts 54, as shown in FIG. 9, retained in spaced parallel position therein by upper and lower grooves 53 in the body 45. The configuration of socket contacts 54 will be more readily appreciated upon consideration of FIG. 4. As there shown, the socket contact has an elongated rear or tail member 55 which overlies and extends forwardly along the upper surface 51 of body 45. Socket contact 54 has a shoulder 56 which engages a shoulder 52 at the bottom rear edge of socket 50, whereby accurately to locate socket contact 54 and to prevent its inward travel when a pin contact is thrust thereinto. Contact 54 is divided into upper and lower fingers 59 by a slot 57, the slot being of such configuration that the fingers converge in a direction toward the outer open end of connector part 17 when in relaxed condition as shown in FIG. 4 and the outer ends of the fingers have flared or bevelled confronting zones. To prevent any appreciable escape of socket contacts 54 from body 45 upon withdrawal of the pin contacts therefrom, each contact 54 is provided with a forwardly and laterally bent tang 60 which forcibly engages the confronting side surface of the respective partition 49. It will be evident that such tang allows socket contact 54 to be thrust into socket 50 in a direction from left to right (FIG. 4) but that it strongly resists movement of the socket contact relative to body 45 in the opposite direction.

The structure thus far described is assembled as follows: The socket contacts 54 are thrust into socket 50 to lie within the upper and lower grooves 53 therein, travel of the socket contact being continued until shoulder 56 contacts shoulder 52. The end of the tape cable 10' may previously have been introduced through slot 46, or such operation may be carried out at this time. Each of the bared leads 15' is now disposed above the rear end of the respective contacts 54, and is joined thereto as by being soldered thereto, as indicated in FIG. 4. Connector part 17 is completed by an electrically insulating sheath 61 which may be generally similar to sheath 39 of connector part 16. In the embodiment shown sheath 61 is also retained by edge engagement between a rear contact portion of the sheath and resilient upstanding pins on body 45, here designated 62. The portion of the connector part within sheath 61 is preferably embedded in potting compound, in the same manner as connector part 16.

When connector parts 16 and 17 are in operative engaging position, as shown in FIG. 5, it is preferred that the body portions of the parts be sealed to each other. In the embodiment shown, such seal is provided by an O-ring 32 which extends about the base of guard portion 25. Positioned on the opposite ends of the socket portion of body 45 (FIG. 8) are rearwardly directed flanges 64 which provide seats 65 between them and the sides of body 45. The latching means 40, 44 is of such size and configuration and is so located relative to seats 65 that when portions 44 of the latching means are snapped downwardly into seats 65, in the position generally indicated in full lines in FIG. 5, the O-ring 32 is subjected to marked compression between the connector parts, and the latching means is stably held against accidental release.

Although only a single embodiment of the electrical connector of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be especially understood that various changes, such as in the relative dimensions of the arts,

5

materials used, and the like, as well as the suggested manner of use of a connector of the invention, may be made therein without departing from the spirit and scope of the invention as will now be apparent to those skilled in the art.

What is claimed is:

1. A separable electrical connector comprising a connector part having a laterally extended electrically insulating body, a comb-like guard projecting forwardly from the forward part of said body, said guard having a plurality of similar flat straight parallel finger members having free outer forward ends, the finger members being aligned with the flat surfaces of successive finger members confronting each other, a plurality of straight blade-like contact members supported on the body and having forward flat portions projecting therefrom and between successive finger members, said flat portions extending generally transversely to the broad extents of the finger members, the contact members terminating at their outer ends inwardly of the outer, forward end of the guard, and means for retaining the flat portions of the contact members intermediate the upper and lower edges of the finger members.

2. A connector as defined in claim 1 wherein the means for retaining the flat portions of the contact members intermediate the upper and lower edges of the finger members comprises aligned slots in the confronting faces of adjacent finger members, said slots accurately receiving the opposite edges of the portions of the flat portions of the contact members projecting between successive finger members.

3. A connector as defined in claim 2, comprising means on the insulating body and on each of the contact members for retaining said contact members from longitudinal motion relative to the body.

4. A separable electrical connector as defined in claim 3, wherein the means for retaining the contact members from longitudinal motion relative to the body comprises a recess in the body and a projection on each of the contact members adjacent the rear end thereof, said projection being disposed at a marked angle to the length of the contact member and being adapted for reception within said recess.

5. A separable electrical connector as defined in claim 4, wherein the said connector part is adapted to be connected to a flattened multi-conductor cable with an electrical connection between the conductors of the cable and the respective contact members, and comprising means for securing the cable to the body of the said connector part adjacent the rear end of such body.

6. A separable electrical connector comprising a first connector part having a laterally extended electrically insulating body, a comb-like guard projecting from the forward part of said body, said guard having a plurality of similar flat straight parallel finger members having free outer forward ends, the finger members being aligned with the flat surfaces of successive finger members confronting each other, a plurality of straight blade-like first contact members supported on the body and having forward flat portions projecting therefrom and between successive finger members, said flat portions extending

6

generally transversely to the broad extents of the finger members, the first contact members terminating at their outer ends inwardly of the outer, forward end of the guard, and means for retaining the flat portions of the first contact members intermediate the upper and lower edges of the finger members, and a second connector part receiving the first connector part, said second connector part having a laterally extended electrically insulating body, said body having an elongated opening thereinto from its forward face, said opening accurately receiving the guard on the first connector part, a plurality of laterally spaced parallel second contact members mounted within said opening in the body of the second connector part and making electrical connection with the respective first contact members of the first connector part, means to retain said second contact members in position within the opening in the body of the second connector part.

7. A separable electrical connector as defined in claim 6, wherein the second contact members are generally flat, are laterally aligned, and the flat surfaces of successive contacts confront each other, and wherein the said second contact members are generally centrally longitudinally divided by a slot for a substantial portion of their lengths from the forward ends thereof, whereby the first contact members are received within the slot in the respective second contact members and lie generally at right angles to the broad extents of the second contact members.

8. A separable electrical connector as defined in claim 7, wherein the means for retaining the flat portions of the first contact members intermediate the upper and lower edges of the finger members of the guard on the first connector part comprises aligned substantially centrally located slots in the confronting faces of adjacent finger members, said slots accurately receiving the opposite edges of the flat portions of the first contact members which project between successive finger members.

9. A separable electrical connector as defined in claim 6, comprising releasable means to retain the two connector parts in mating, operative engagement.

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