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ELECTRICAL CONNECTOR FOR FLAT CABLES

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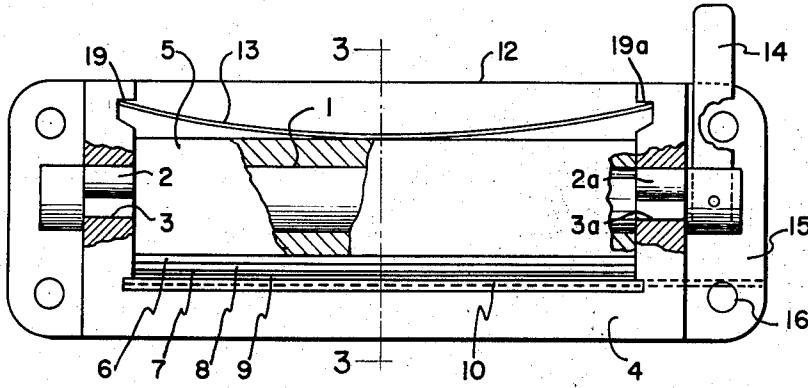


Fig. 1

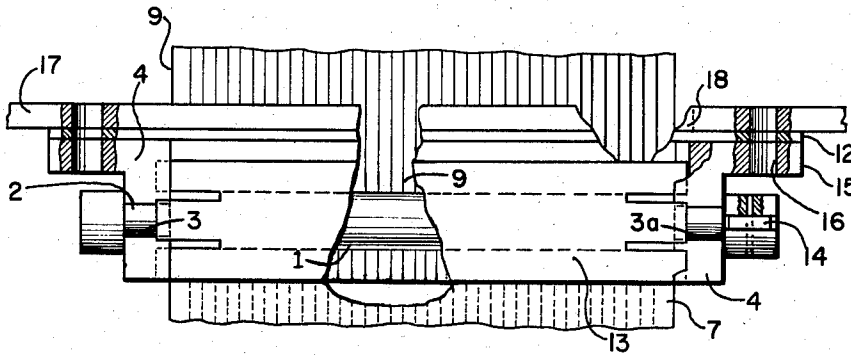


Fig. 2

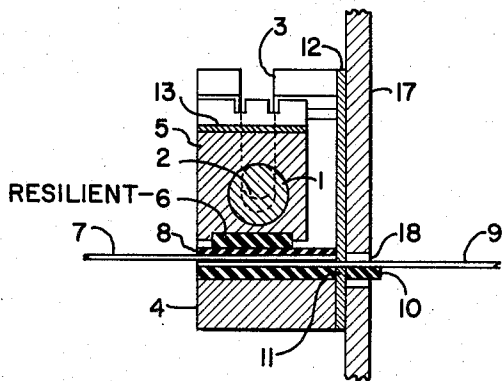


Fig. 3

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ELECTRICAL CONNECTOR FOR FLAT CABLES

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2 Claims. (Cl. 339—75)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

This invention relates to a connector or connecting device especially adapted for making electrical connections at the ends of cables or connecting two or more cables, or printed circuits which for the purpose of saving weight and space are in the form of a thin, flat sheet, ribbon, tape, or strip of nonconductive base material on the surface of which a series of conductive lines or elements of metal or other conductive material has been attached, bonded, or made an integral part of the base material for the purpose of conducting electrical energy. The invention, however, is not limited to the use of electrically conductive cables, strips, or ribbons, as it may be used for connecting, or holding, any type of flat material.

It is to be understood that the terms cable, flat cable, whether stated or not to comprise conductive lines, are used interchangeably with any form of printed circuitry suitably constructed to fit the herein described connectors.

Connecting flat conductive cables has heretofore been a very troublesome thing to do due to the need for separately soldering or otherwise connecting an individual wire to each of the conductive lines of the cable, thus forming a wire bundle from the several wires individually connected, said wire bundle then being connected to a bulky pin-type or other connector, from which a second wire bundle proceeds to the adjacent flat cable where the need exists for again separately soldering or otherwise connecting each individual wire of the bundle to the proper conductive line of the flat cable. The use of such means of connecting flat cables is not only time-consuming but defeats the very purpose of weight and space saving inherent in the flat cable.

An object of this invention is to provide a connector or connecting device which is so constructed that no expanding ends or other deviation from the normal design or pattern of said cable is required, it being only necessary to cut a specified or random length of said cable from a stock length or roll prior to inserting into my connector, but the connector may also be used with cables or printed circuitry which may have been specifically designed for use with the connector.

Another object of this invention is to provide a connector so constructed that the cables connected will be firmly held in the connector to maintain reliable electrical continuity of all conductive lines or elements of the cables connected to the connector.

Another object of this invention is to provide a connector so constructed that the operation of the connector will impart a wiping effect on the contacting surfaces, said wiping effect serving to clean said contacting

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surfaces, to assure maximum reliability of electrical connection thus made.

A further object of this invention is to provide a connector so constructed that electrical energy may be conducted from the inside to the outside, or from one location to another, inside, or on or adjacent to the outside, of a box, chassis, component, or other device or equipment, in connection with which printed circuitry is used, said printed circuitry being of such suitable nature and design to fit the connector.

In addition thereto, certain modifications may be incorporated into the design and manufacture of the connector to permit change of direction in the normal outlet or inlet of the connector, up or down, right or left, or any angle of direction which may be required.

A further object of this invention is to provide a connector so constructed to permit its use in making connection to an existing cable when it is required to make connection at some intermediate location along the cable without cutting the cable for the purpose of making said connection; said connection forming a branch of the existing cable.

A further object of this invention is to provide a connector so constructed to permit interchanging cables, the conductive lines on said cables varying in width, thickness, spacing, and number, and capable of conducting various values of voltage and current, providing said conductive lines are in mating contact when connected.

Further objects, features and advantages will become apparent from the following description and claims when read in view of the drawings, in which:

In the accompanying drawings,

Fig. 1 is an elevation view (less mounting panel 17 shown in Figure 2) of a connector for use in connecting two flat cables which are inserted in the connector face to face with the conductive lines or elements of the cable in contact with each other, this approach of the connector being hereinafter conveniently referred to as the front of the connector, the opposite approach being the rear of the connector;

Fig. 2 is a plan view of the same embodiment of the invention; and

Fig. 3 is a vertical cross section of the connector on the line 3—3 of Fig. 1, looking in the direction of the arrows.

The embodiment of the invention shown in Figs. 1, 2 and 3 illustrates a connector for connecting two flat cables face to face with the conductive lines or elements of the cables in contact with each other. Shaft 1, comprising an integral eccentric center portion supported by shaft ends 2 and 2a, in vertically elongated slots 3 and 3a in raised portions at or near each end of mounting base 4 between which portions is a substantially horizontal surface. By virtue of the shaft having this eccentric portion and shaft ends in elongated slots 3 and 3a, the block is lifted when the shaft ends bottom, but no downward pressure is exerted on the block by the eccentric portion of shaft 1 when the shaft ends are rotated to a raised position. Loosely mounted on shaft 1 is a pressure block 5 and fixed in a groove in the underside of said pressure block is a pressure pad 6 consisting of resilient material. On cable 7 a reinforcement 8 consisting of an insulating material is bonded on the side opposite the conductive lines or elements of said cable. A reinforcement 10, also consisting of insulating material is bonded to cable 9 on the side opposite the conductive lines or elements of said cable, and in said reinforcement 10 is a groove 11 for engaging back plate 12 and thereby locking cable 9,

with its reinforcement 10, in place. However, either or both reinforcements 8 and 10 may possess the characteristic of being resilient as well as insulating.

Operating in grooves 19 and 19a in the upper side portions of mounting base 4 and exerting pressure on pressure block 5 is spring 13 consisting of one or more pieces depending on the extent of pressure desired or required, said spring being the controlling factor in the amount of pressure applied, the clamping action of the connector being prefixed or predetermined by the physical characteristics of said spring. The eccentric shaft 1 does not provide a downward pressure on the pressure block 5 as the shaft ends are not restrained by elongated slots 3 and 3a from upward motion.

Lever 14 is on the end of the shaft 1 for rotating said shaft. However, any method of rotating said shaft may be used, such as screw driver and slots, or pins; the method of rotation is not limited to any of the methods described.

Mounting lugs 15 are located on mounting base 4 and may be arranged on the connector to permit mounting vertically, horizontally, or at any required angle or position. Holes 16 in mounting lugs 15 are conveniently placed for mounting purposes but may be omitted if other means of mounting are appropriate.

In the operation of the connector shown in Figs. 1, 2 and 3, the pressure block 5 together with the inserted pressure pad 6 is lifted in the mounting base 4 by rotating shaft 1, the lifting of said pressure block being effected by the operation of the eccentric center portion of shaft 1 supported by shaft ends 2 and 2a resting on the bottom of slots 3 and 3a, the top pressure block 5 being in contact with and exerting pressure against spring 13.

With the pressure block 5 in the lifted position a clearance exists between the pressure pad 6 and the lower portion of mounting base 4 sufficiently large to permit entry of cable 9 together with its bonded reinforcement 10 and cable 7 together with its bonded reinforcement 8.

The mounting holes in back plate 12, mounting lugs 15, and wall, partition, or other suitable mounting surface, indicated by numeral 17, coincide and are used for rigidly mounting the connector, said wall also having a suitable opening 18 cut out to permit entry of cable 9. Cable 9 together with its bonded reinforcement 10 is first inserted through the opening 18 in said wall, the conductive lines of said cable 9 facing upward. Said cable 9 is then inserted into the rear of the mounting base 4, and the slot in back plate 12, clearly shown at numeral 11 in Fig. 3, is engaged in the groove of reinforcement 10, said slot in back plate being open at one end to permit said engagement. The connector is then bolted or otherwise fastened to wall 17.

Cable 7, together with its bonded reinforcement 8 is inserted into the front of the connector, the conductive lines on said cable facing downward and in contact with the conductive lines of the cable 9, cable 7 being inserted to the position where the end of the cable 7 comes to rest against the front of the back plate 12.

Shaft 1 is rotated, choosing the direction which will, as the pressure block 5 together with pressure pad 6 descends under the exerted pressure of the spring 13, cause the cable 7 to move toward the back plate 12, the action of the eccentric integral with the shaft 1 moving with respect to spring 13 which remains substantially stationary imparts a wiping motion of the conductive lines on cable 7 against the conductive lines of the cable 9, the said wiping effect serving to clean the conductive lines of cables 7 and 9 and assuring proper contact of the said conductive lines being made. The eccentric center portion of shaft 1 produces the lateral motion toward the back of plate 12 inasmuch as the shaft ends 2 and 2a are laterally restrained by slots 3 and 3a as shown in Figures 2 and 3.

Pressure pad 6, fixed to the underside of the pressure block 5, serves the purpose of assuring proper contact of the conductive lines on the cables being made and

maintained and also permits full use of all the available exerted pressure of the spring 13 against the pressure block 5 to maintain contact and to prevent accidental or forceable removal of the cables without first relieving the pressure by rotating shaft 1.

In disconnecting or removing cable 7 from the connector, shaft 1 is rotated, bringing pressure block 5 to the lifted position. Cable 7 can then be removed from the connector, cable 9 remaining locked by engagement of back plate 12. Cable 9 is then removed by removing the mounting bolts of the connector and sliding back plate 12 out of groove 11 in reinforcement 10. Cable 9 is then removed through opening 18 in wall 17.

In the normal use of the connector, cable 9 may be considered a permanent part of the installation of the connector, but not necessarily so in all cases; said cable may further be considered a part of the internal wiring or conducting system inside of wall 17, the connector being mounted on the outside of said wall. However, the connector may be used to connect cables under conditions where neither cable is a part of an internal wiring system, such as where no wall may exist; in such case back plate 12 is bolted to mounting lugs 15, the connector being modified for other mounting means.

The embodiment and operation of other types of the connectors, such as when the two cables are to be inserted in the same end of the connector, or when it is required to insert more than two pairs of cables, is similar to that described above, the necessary modifications being made in the design of the connector to suit required conditions.

A change in the direction of rotation of the shaft with integral eccentrics in the above described connector will produce the desirable result that a pull on the connected cable tends to further rotate said shaft and eccentrics in a direction that will increase the clamping action on said cable without eliminating the desirable feature of utilizing the wiping effect previously described.

In some cases the base material of the cables connected may be of such thickness and/or strength to make it unnecessary to apply the bonded reinforcements 8 and 10 to said cables.

The operation of other types of connectors such as when connecting two cables at right angles to each other is similar to that described above, the connector being modified to suit required conditions.

While we have shown and described several embodiments of the invention it will be understood that these have been chosen for the purpose of illustration only and that we do not desire to be limited to the details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

We claim:

1. In an electrical system the combination comprising first and second flat cables, each having a plurality of matching electrical conductive lines, a connector comprising a mounting base including a substantially flat cable supporting horizontal surface between two raised vertical portions, a shaft rotatably supported at each end in vertically elongated slots in said raised portions and said shaft having an eccentric portion between said ends, a pressure block rotatably mounted on said eccentric portion and including a resilient pressure pad, a spring supported by said raised portions and in contact with said pressure block for clamping said cables in an overlapping position face to face against said flat surface, said slots being positioned with respect to said horizontal surface whereby said shaft ends are vertically unrestrained by said slots when said ends are rotated to a raised position and restrained by said slots when the shaft ends are rotated to a lower position whereupon said eccentric exerts a force on said pressure block to remove said clamping effect.

2. The combination set forth in claim 1 wherein one of said cables includes a reinforcing material on the non-conducting side corresponding to the overlapped cable

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area, and means attached to said base for limiting the distance of cable insertion into said connector.

2,703,854
2,857,577

References Cited in the file of this patent

UNITED STATES PATENTS

2,286,812 Keefe ----- June 16, 1942

5 625,388
629,734

6

Eisler ----- Mar. 8, 1955
Vanderpool ----- Oct. 21, 1958

FOREIGN PATENTS

Great Britain ----- June 27, 1949
Great Britain ----- Sept. 27, 1949