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BLADE CONNECTOR

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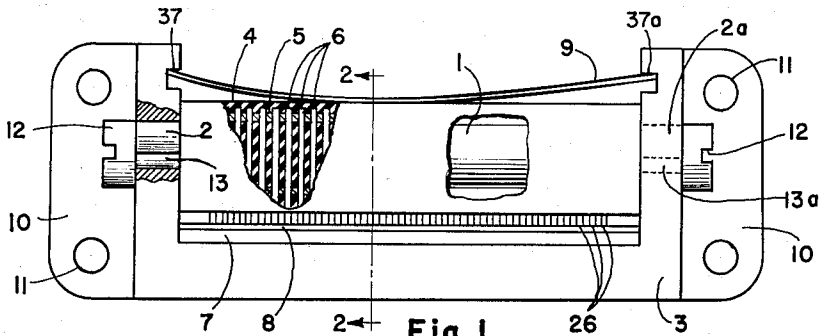


Fig. 1

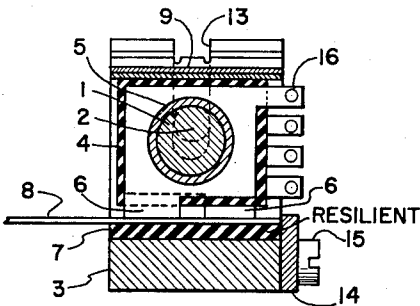


Fig. 2

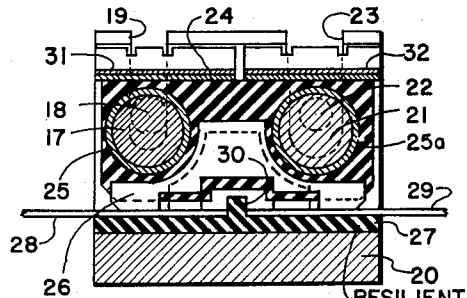


Fig. 5

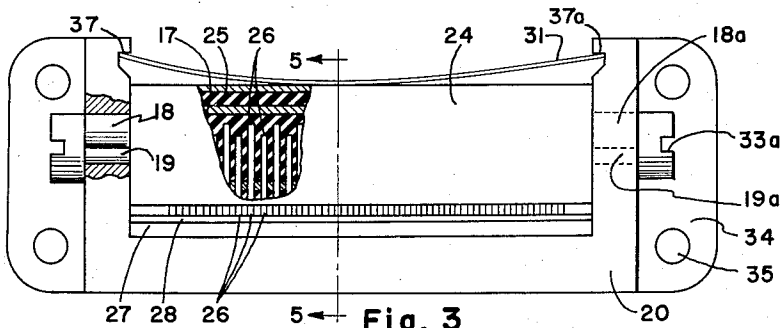


Fig. 3

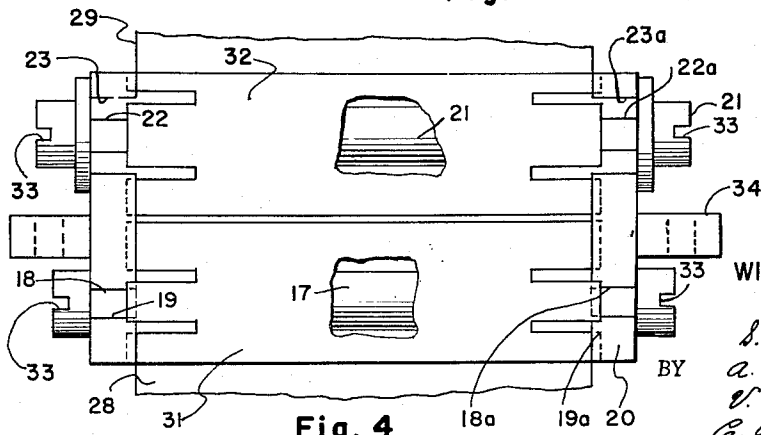


Fig. 4

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BLADE CONNECTOR

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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 holding or connecting to flat cable and particularly for making electrical connections at the ends of flat electrical cables or transmission lines, printed circuits, etc., which, for the purpose of saving weight and space are in the form of a thin, flat sheet, ribbon, tape, or strips of non-conductive 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 as an integral part of the base material for the purpose of conducting electrical energy.

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. However, in all cases it may not be entirely feasible to eliminate the need for separately connected wire connections from one end of my connector due to controlling features of adjacent, allied, or related wire bundles, components, or equipment, in which case the use of soldered or other connections may be resorted to.

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 the connector, but the connector may also be used with cables or printed circuitry which may have been specifically designed for use with my 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 surfaces, to assure maximum reliability of electrical connection thus made.

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 from the existing cable.

A further object of this invention is to provide a con-

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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 with suitably spaced blades when connected.

To accomplish the foregoing general objects, and other more specific objects which will hereinafter appear, my invention resides in the method and apparatus elements, and their relation one to another, as are more particularly described in the following specification. The specification is accompanied by drawings, in which:

Fig. 1 is an elevation view of a connector for use in connecting one flat cable to separately connected wire conductors, looking in the direction in which the flat cable is inserted in the connector;

Fig. 2 is a vertical cross section of the connector on the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is an elevation view of a connector for use in connecting the ends of two flat cables, looking in the direction in which one of the cables is inserted, this approach of the connector being hereinafter conveniently referred to as the front of the connector, the rear of the connector being the opposite approach, and having an appearance similar to the front;

Fig. 4 is a plan view of the connector shown in Fig. 3 and

Fig. 5 is a vertical cross section of the connector on the line 5—5 of Fig. 3, looking in the direction of the arrows.

In the embodiment of the invention shown in Figs. 1 and 2, a connector for use in connecting one flat cable to separately connected wire conductors, a shaft 1, comprising an integral eccentric center portion supported by shaft ends 2 and 2a, operates in elongated slots 13 and 13a vertically inclined at or near each end of a horizontal surface on mounting base 3. Loosely mounted on shaft 1 is contact body 4 consisting of insulating material, and embedded in said contact body 4 is mounting tube 5 for the purpose of providing a bearing for shaft 1, and embedded also in contact body 4 is a series of thin contact blades 6, said contact blades consisting of electrically conductive material, each said blade performing a similar conductive function, but each having a slightly different shape to permit use of a staggered arrangement to increase the electrical leakage path and also to provide sufficient space or clearance for making external connections thereto.

A lug 16, clearly shown in Fig. 2, is provided integral with each contact blade 6 for the purpose of soldering, or otherwise attaching, a wire or other conductor.

The lower portion of mounting base 3 houses pressure pad 7, consisting of a resilient material upon which the cable 8, when connected, rests in contact with the series of contact blades 6.

Operating in grooves 37 and 37a in the upper side portions of mounting base 3 and exerting pressure on contact body 4 is spring 9 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 the said spring. The center portion of shaft 1 which is eccentric with respect to ends 2 and 2a does not apply a downward pressure on contact body 4 inasmuch as elongated slots 13 and 13a do not restrain vertical travel of shaft ends 2 and 2a. The eccentric portion functions to lift contact body 4 against spring 9 when shaft 1 is rotated to bottom shaft ends 2 and 2a. This serves to raise contact body 4 allowing cable 8 to be inserted or withdrawn.

Slots 12 in end of shaft 1 enable rotation of said shaft by means of screw driver or other appropriate tool. In

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some applications of the connector it may be desirable to rotate the shaft by means of a pin inserted in a hole in the end of the shaft in lieu of using a screw driver and slot, or a lever may be attached to the end of the shaft for the purpose of obtaining proper rotation. However, rotation may be obtained by any appropriate method and is not limited to any of the methods described.

Mounting lugs 10 are located on mounting base 3 and may be arranged on the connector to permit mounting vertically, horizontally, or at any required angle or position.

Holes 11 in mounting lugs are conveniently placed for mounting purposes but may be omitted if other means of mounting are appropriate.

In Fig. 2, cable end stop 14 is fastened to the mounting base 3 by means of screw 15, but may be attached by any other appropriate method, or may be made integral with mounting base 3, or may be made a part of pressure pad 7.

In the operation of the connector shown in Figs. 1 and 2, the contact body 4, in which the series of contact blades 6 are embedded, is lifted from the pressure pad 7 by rotating shaft 1, the lifting being effected by the operation of the eccentric portion of shaft 1 supported by shaft ends 2 and 2a in slots 13 and 13a, the top of the contact body 4 being in contact with and exerting pressure against spring 9.

With the contact body 4 in the lifted position a clearance exists between the contact surfaces of the embedded contact blades 6 and the pressure pad 7 sufficiently large to permit entry of cable 8 which is so inserted with the conductive lines or elements facing the contact blades. The cable 8 is inserted into the connector to the point where the end of said cable comes to rest against cable end stop 14 at the rear of mounting base 3. Shaft 1 is then rotated, choosing the direction which will, as the contact body 4 descends under the exerted pressure of spring 9, cause the contact blades 6 to move with respect to spring 9 and mounting base 3 toward the rear of mounting base 3 as the blades come in contact with cable 8, thus imparting a slight push to the cable 8 causing the position of the cable to be maintained against the cable end stop 14. This combination of rotating and pushing motion of the contact blades 6 produced by the eccentric center portion of shaft 1 as it is rotated by shaft ends 2 and 2a which are laterally restrained in the slots 13 and 13a, produces a wiping effect at the point of contact of the contact blades 6 and the conductive lines or elements of cable 8, said wiping effect serving to clean the contacting surfaces and assuring proper contact being made. The pressure pad 7, between the underside of the cable 8 and the mounting base 3 serves the purpose of assuring proper contact being made and maintained with all the blades 6, and the appropriate conductive lines or elements of the cable 8, and also to permit full use of all of the available exerted pressure of spring 9 against contact body 4 to maintain contact and to prevent accidental or forcible removal of cable 8 without first relieving the pressure by rotating shaft 1.

In disconnecting or removing the cable 8 from the connector, the shaft 1 is rotated, bringing the contact body 4 to the lifted position. The cable can then be removed from the connector.

In the embodiment of the invention shown in Figs. 3, 4 and 5, a connector for connecting two flat cables, a shaft 17 comprising an integral eccentric center portion supported by shaft ends 18 and 18a operates in slots 19 and 19a at or near each end of mounting base 20, and a shaft 21 also comprising an integral eccentric center portion supported by a shaft ends 22 and 22a operates in slots 23 and 23a at or near each end of mounting base 20. Loosely mounted on shafts 17 and 21 is a single contact body 24 consisting of insulating material, and embedded in said contact body 24 is mounting tube

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25 for shaft 17 and mounting tube 25a for shaft 21, for the purpose of providing bearings for shafts 17 and 21. Embedded also in the contact body 24 is a series of thin contact blades 26, to transfer current from the cable inserted in the front of the connector to the cable inserted in the rear of the connector, said contact blades consisting of electrically conductive material, each said blades performing a similar conducting function, but each alternate blade having a different shape to permit use of a staggered arrangement to increase the electrical leakage path.

The lower portion of the mounting base 20 houses pressure pad 27, consisting of resilient material, upon which the cable 28 connected to the front of the connector rests in contact with the series of contact blades 26, and cable 29 in the rear of the connector rests in contact with the rear ends of the series of blades 26. Pressure pad 27 has a raised portion 30 which acts as a stop against which cables 28 and 29 come to rest as each said cable is inserted into the respective openings of the connector.

Operating in grooves in the upper side portions of the mounting base 20 and exerting pressure on contact body 24 is spring 31 operating over the end of contact body 24 through which shaft 17 extends, and spring 32 operating over the end of contact body 24 through which shaft 21 extends. Springs 31 and 32 consist of one or more pieces depending on the extent of pressure desired or required, said springs 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 springs.

Slots 33 in the ends of shafts 17 and 21 enable rotation of said shafts by means of a screw driver or other appropriate tool.

Mounting lugs 34 are located on mounting base 20 and may be arranged on the connector to permit mounting vertically, horizontally, or at any required angle or position.

Holes 35 in mounting lugs 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. 3, 4 and 5, the contact body 24, in which the series of contact blades 26 are embedded, is lifted from pressure pad 27 by first rotating shaft 17, operating in narrow slots 19 and 19a, and then rotating shaft 21 operating in wide slots 23 and 23a, the lifting being effected by the operation of the center eccentric portions of shafts 17 and 21 the top of the contact body 24 being in contact with and exerting pressure against springs 31 and 32. The purpose of the different size slots is discussed below.

With the contact body 24 in the lifted position a clearance exists between the contact surfaces of the embedded contact blades 26 and the pressure pad 27 sufficiently large to permit entry of cable 28 into the front opening of the connector and cable 29 into the rear opening of the connector.

Cable 28 is first inserted in the front of the connector, or that end in which the narrow slots 19 exist, with the conductive lines or elements facing the contact blades, to the point where the end of said cable 28 comes to rest against the raised portion 30 of pressure pad 27. Shaft 17 is then rotated, choosing the direction which will, as the contact body 24 descends under the exerted pressure of spring 31, cause the contact blades 26a and 26b to move toward the center of the connector as the said contact blades come in contact with cable 28, thus imparting a slight push to the cable 28 causing the position of said cable 28 to be maintained against the raised portion 30 of pressure pad 27. This combination of rotating and pushing motion of the series of contact blades 26 as the shaft 17 is rotated by the eccentrics 18 in the slots 19 produces a wiping effect at the point of contact of the blades 26 and the conductive lines or elements of

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cable 28, said wiping effect serving to clean the contacting surfaces and assuring proper contact being made.

With cable 28 firmly gripped in the front of the connector, cable 29 is inserted in the rear of the connector with the conductive lines or elements facing the contact blades 26 to the point where the end of said cable 29 comes to rest against the raised portion 30 of the pressure pad 27. Shaft 21 is then rotated, choosing the direction which will, as the contact body 24 descends under the exerted pressure of spring 32, cause the contact blades 26 to move toward the center of the connector as the said contact blades come in contact with cable 29, thus imparting a slight push to the cable 29 causing the position of the said cable 29 to be maintained against the raised portion 30 of pressure pad 27. This combination of rotating and pushing motion of the contact blades 26 effected by the eccentric center portion of shaft 21 as it is rotated in slots 23 and 23a produces a wiping effect at the point of contact of the contact blades 26 and the conductive lines or elements of the cable 29, said wiping effect serving to clean the contacting surfaces and assuring proper contact being made. The pushing motion is necessarily less than in the case of that caused by shaft 17 since the ends of shaft 19 are only slightly restrained by slots 23 and 23a which are larger than slots 19 and 19a which restrain shaft 17. If this were not the case a substantial lateral movement inward on cable 29, after cable 28 is engaged, would push outward on cable 28 and perhaps release cable 28.

The pressure pad 27, between the underside of cables 28 and 29 and the mounting base 20 serves the purpose of permitting proper contact being made and maintained with all the contact blades 26 and the appropriate conductive lines or elements of the cables 28 and 29, and also to permit full use of all of the available exerted pressure of springs 31 and 32 against contact body 24 in order to maintain contact and to prevent accidental or forcible removal of cables 28 and 29 without first relieving the pressure by rotating shafts 17 and 21.

The purpose of the wide slots 23 and 23a is to provide adequate clearance for shaft ends 22 and 22a during rotation; contact body 24 pivoting on shaft 17 without releasing the contact of contact blades 26 and cable 28.

In disconnecting or removing the cables from the connector, cable 29 should preferably be removed first; the shaft 21 is rotated, bringing the rear end of contact body 24 to the lifted position. Cable 29 can then be easily removed from the connector while a firm grip is maintained on cable 28. Cable 28 may subsequently be removed by rotating shaft 17 thereby lifting the remainder of contact body 24 permitting removal of cable 28.

It is not absolutely necessary that cable 29 be removed first. If cable 28 is removed first sufficient clearance exists in slots 23 and 23a to permit shifting of shaft 21 in slots 23 and 23a, the pivoting of contact body 24 then being accompanied by a slight sidewise shifting of shaft 21 in slots 23 and 23a without loss of contact between contact blades 26 and cable 29.

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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.

A change in the direction of rotation of any of the shafts with integral eccentrics in any of the above described connectors 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.

While I have shown and described several embodiments of my invention it will be understood that these have been chosen for the purpose of illustration only and that I 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.

While the foregoing is a description of the preferred embodiment, the following claims are intended to include those modifications and variations that are within the spirit and scope of my invention.

I claim:

1. In a connector for interconnecting two multiconductor flat cables, a mounting base, a contact body having interconnecting contact blades with a first contact region adapted to make contact with the conductive lines of a first flat cable and a second contact region adapted to make contact with a second flat cable having a matching set of conductive lines, said cables being inserted at opposite ends of the connector, first and second shafts positioned in slots in said mounting base, said first shaft comprising an eccentric link to said first contact region and said second shaft comprising an eccentric link to said second contact region, means to rotate said shafts, a resilient pressure pad connected to said mounting base for supporting said cables, first and second springs supported by said mounting base and respectively exerting a clamping force against said first and second contact regions for clamping said cables between said pressure pad and said contact blades, said clamping force being relieved when said shafts are rotated to a release position.

2. The connector set forth in claim 1 further comprising a projection above said pressure pad intermediate between said opposite ends to limit the travel of each of said cables.

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