July 21, 1964 J. G. JOHNSON 3,141,720

CONNECTOR FOR PRINTED OR ETCHED FLAT CONDUCTOR CABLES

Filed Sept. 22, 1961 2 Sheets-Sheet 1

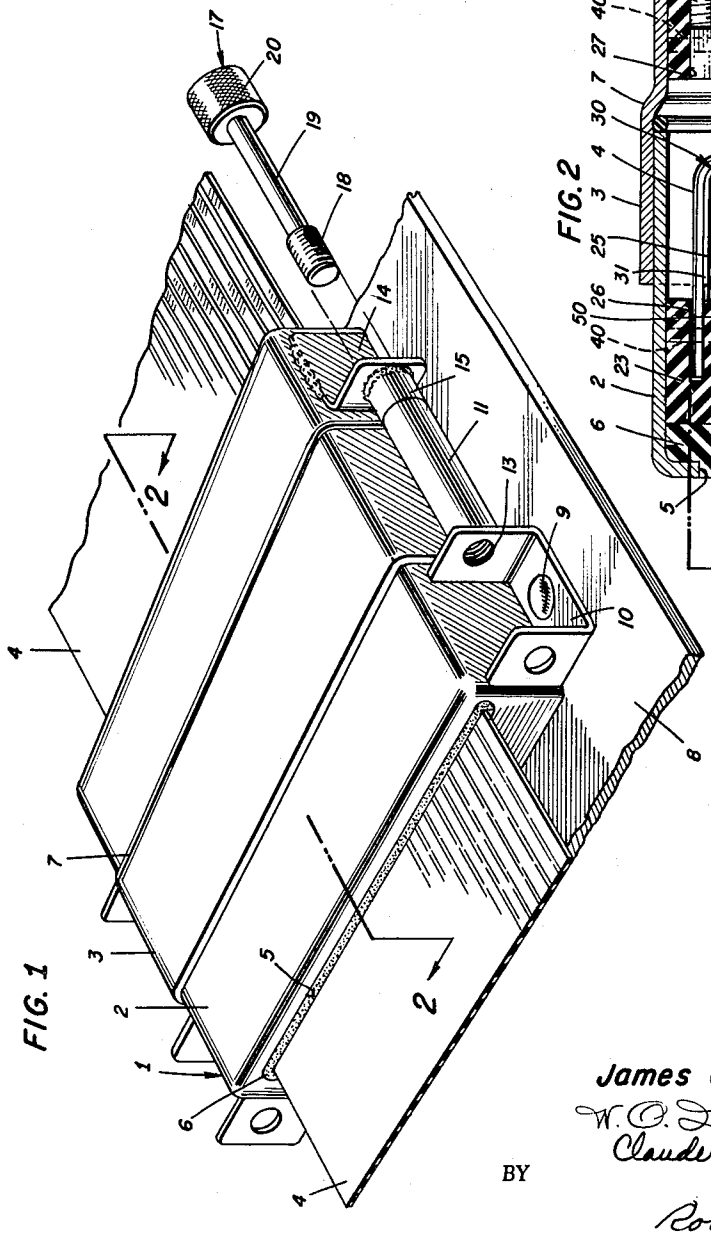


FIG. 1

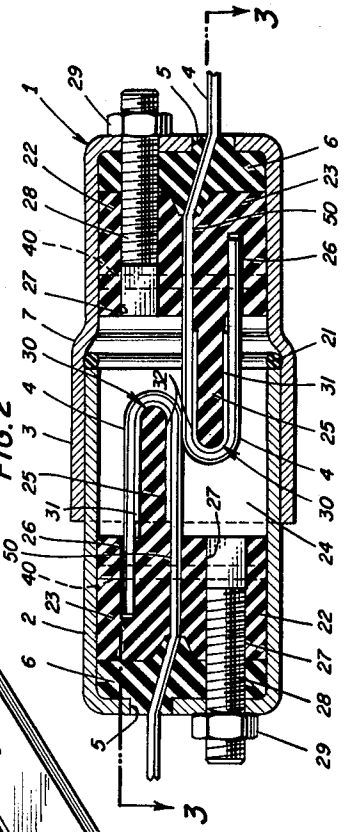


FIG. 2

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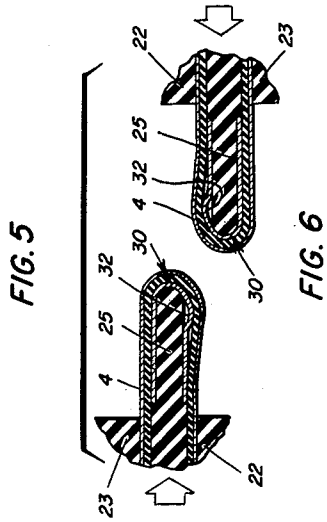


FIG. 5

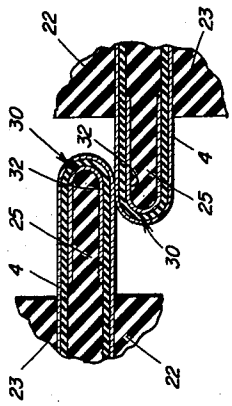


FIG. 6

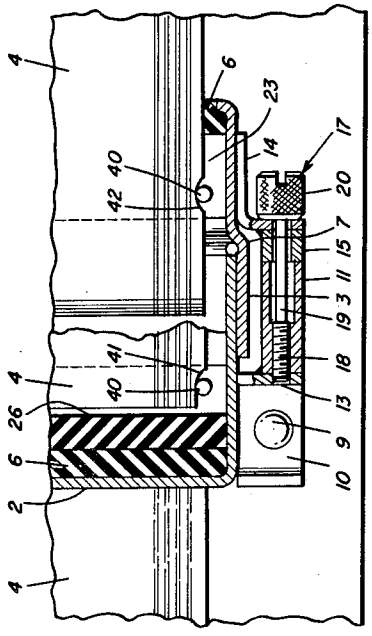


FIG. 3

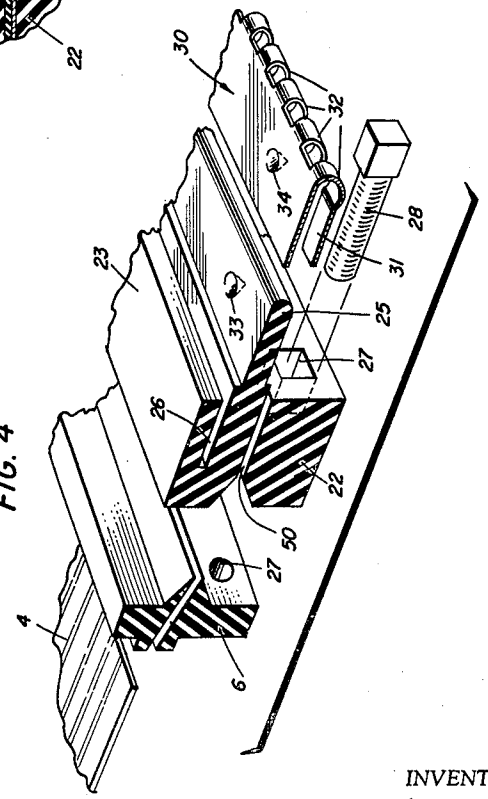


FIG. 4

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CONNECTOR FOR PRINTED OR ETCHED FLAT CONDUCTOR CABLES

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3 Claims. (Cl. 339—176)

This invention is related to electrical connectors; more particularly this invention is related to electrical connectors for printed or etched flat conductor cables. In electrical connectors and more particularly in electrical connectors that have a large number of connecting prongs it has been customary to provide quick disconnect type electrical connectors with a keying means for guiding and proper orientation of the two connecting parts, namely the male and female part. It has been customary to use round connectors where electrical wires or lead lines are designed to be the connected article. But since printed or etched conductor cables tend to be flat and elongated, the use of round type connectors are undesirable; for this reason a rectangular or elongated connector is used.

There are certain advantages in using the connector of the invention rather than some of the prior art devices. Since flat conductor cables are made out of a soft material they may be easily damaged when knocked against a sharp surface or subjected to other abuses. For this reason the invention forms a protective shield around the contacting part of the flat conductor cable. This protective shield also prevents short circuiting when the flat conductor cable comes into contact with a conducting surface if the related surface is energized. Since a damaged contact area or a short circuiting of the contact area could cause unreliable operation or irreparable damage to the related circuits, an added degree of safety and reliability is inherent in this invention.

Connectors used with flat conductor cables in prior art devices have been sealed with a potting means. This potting means provided a water proof seal and a reliable bonding for the flat conductor cable. But when the printed circuit or the connector was damaged both the flat conductor cable and the connector had to be replaced since they were bonded together as a single unit. In the present invention only the damaged part need be replaced. Therefore, if the flat conductor cable is damaged the related connector need only be dismantled, the flat conductor cable removed, a new flat conductor cable inserted in its place and the connector reassembled. If the connector alone is damaged the connector may be disassembled and the damaged part replaced or repaired and then the same flat conductor cable can be reinserted. This leads to a great saving in time and maintenance cost and reduces the need for a spare supply of replacement connectors that would normally be destroyed during repair.

This connector has the added advantage of a reference key as an integral part of the connector. This key forms a dual function of ensuring that the flat conductor cable is not rotatably inserted in the connector and it also secures the flat conductor cable to the connector. The combination of features provide a safe, reliable, rugged, and easily maintained connector for flat conductor cables.

An object of this invention is to provide an improved electrical connector.

Another object of this invention is to provide an improved reliable electrical connector.

Another object of this invention is to provide an electrical connector that protects the contact ends of a flat conductor cable from damage when disconnected.

Another object of this invention is to provide an electrical connector for flat conductor cables that protects the exposed ends of the flat conductor cable when the male and female parts are disassembled.

Another object of this invention is to provide a flat conductor cable connector that is easily dismantled.

Another object of this invention is to provide a flat conductor cable connector that has an orientation means to ensure non rotatability of the inserted flat conductor cable.

Another object of this invention is to provide a simple electrical connector that has a small number of parts.

Another object of this invention is to provide a simple reliable flat conductor cable connector with a shielding means.

Various other objects and advantages will appear from the following description of one embodiment of the invention, and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

FIG. 1 shows an isometric view of the connector when assembled;

FIG. 2 illustrates a sectional side view of FIG. 1 along the lines 2—2;

FIG. 3 illustrates a sectional top view of FIG. 2 along the lines 3—3;

FIG. 4 illustrates an exploded view of the connecting parts within the outer housing;

FIG. 5 illustrates an enlarged sectional view of the contact prongs of the flat conductor cable connector;

FIG. 6 shows an enlarged sectional view of the contact prongs of the flat conductor connector in contact relationship.

In the illustrated embodiment FIG. 1, the complete connector 1 would comprise a male section 2 which is inserted in the female section 3. Both the male and female sections of the connectors have a flat conductor cable 4 inserted in a slot at the end 5 and through a soft seal 6, made of material such as neoprene or soft rubber. The female section has an enlarged cross section starting at the ridge 7 and is sized to receive the male section 2.

One section 2 of the connector is rigidly secured to a wall or surface 8 by a rivet 9 on a clamping means 10. Rigidly secured to this clamping means 10 is a tubular portion 11 which has a threaded hole in the axial direction. Rigidly secured to the female section 3 by a weld or other means is a clamp 14 which holds a related or matched tubular section 15 which is aligned with the tubular section 11. Tubular section 15 also has an axial threaded hole within it. A threaded retainer 17, which can be in the form of a partially threaded screw 18 and shank 19, is inserted in the hole 13. Also associated with the retainer 17 is a knurled head 20 which can be hand turned securing means for insuring that the retainer will not be separated due to vibrations or inadvertent tension on the cables. Also by tightening down the clamp there is an assurance of good solid connection between the association contact prongs of the connector.

The sectional view of FIG. 2 shows the internal relationship of the associated parts when the male and female parts of the plug are connected together. The enlarged portion of female section 3 receives the smaller male section 2. A seal 21 follows the inner contour of the enlarged portion of the female connector 3. This seal prevents the entrance of moisture and dirt which would tent to destroy the contact relationship or cause a current leakage across the surface of the flat conductor cables 4. Both the male 2 and female 3 sections of the connector have similar and complementary parts for retaining the flat conductor cable and forming the connection prong 25. The flat conductor cable 4 is adapted to fit through the slot 5 in the end of the casings and through a soft rubber or other insulating material which forms a seal 6. This seal also serves as a clamping means for holding

the flat conductor cable in place when subjected to a tension type pulling force. Immediately adjacent the soft seal are two elements 22 and 23 which are made of material such as hard rubber or other insulating material. These two elements 22 and 23 are adjacent each other and form a slot or path for the flat conductor cable to continue into an inner chamber 24. The element 23 has an extension which forms a prong 25 and projects into the chamber 24. The flat conductor cable 4 extends around this prong 25 and is returned into a slot 26 in the element 23. The element 22 has a hole 27 in it which receives a square headed bolt 28. This bolt 28 extends through the hard rubber element 22, the rubber seal 6 and the housing of the male connector 2 at the slot 5; a nut 29 is then used to securely fasten this bolt in the hole 27. The internal elements of the female section 3 are similar and complementary, therefore no added clarity could be gained from describing these parts.

FIG. 4 shows the exploded view of the above related parts without the casing. As can be seen in this fig. the flat conductor cable 4 is inserted into the rubber seal 6. The two hard insulating material elements 22 and 23 are then aligned and form a slot or path 50. The prong 25 is positioned relative to the slot to receive the flat conductor cable 4 which is to be wrapped around the prong and inserted into the slot 26. Before the flat conductor cable 4 is wrapped around the prong 25, a metallic element 30 which has spring type arms 31 with detents 32 for aiding the contact of the flat conductor cable by pushing it out from the body in the form of a slight hill and dale. The prong 25 has a small cup shape detent 33 in it which receives another detent 34 of the metallic element 30 for securing the metallic element 30 to the prong 25. The flat conductor cable 4 is wrapped around the prong 25 and metallic element 30 and can be bonded to this metallic element 30 if such an arrangement is desired but such bonding is not necessary in the present invention. The lack of the need for a bonding will be clearly set out in the following description. As set out above the square headed hole 27 in the element 22 is adapted to receive the square headed screw 28. All the elements are closed upon each other in mating relationship, the keying pin 40 is inserted and then all the elements inserted into the outer casing of the respective connector sections 2 or 3. This mating holds the elements in rigid relationship to one another and prevents a scrambling of the pieces when they are inserted into the outer shell of the section 2 or 3.

FIG. 3, which illustrates the top sectional view along the lines 3—3 of FIG. 2, shows the male and female sections 2 and 3 connected together. As can be seen from this view, when the flat conductor cable 4 is inserted through the seal 6 and wrapped around the prong 25 the keying pin 40 receives a groove 41 in the flat conductor 11 in slot 26. This pin and groove allows for easy alignment of the flat conductor cable to prevent any shift in a sideways direction. A second indexing groove 42 is formed in the flat conductor cable and receives the extended portion of the keying pin 40 in the slot 50, the second groove being located between the prong 25 and the rubber seal 6. These keying pins 40 and grooves 41 and 42 also serve the additional functions such as providing an indexing means to prevent inverted insertion of the flat conductor cable in the connecting elements and also providing a retaining means thereby preventing the flat conductor cable 4 from being removed from the sections 2 or 3 by tension shifting its position.

FIGS. 5 and 6 show in an enlarged detailed cross sectional view of the prongs prior to connection or engagement and after engagement. As can be seen by this drawing, the flat conductor cable 4 is wrapped around the prong 25 of the element 23 which can be a molded Bakelite, hard rubber or other non conducting material. The metallic element 30 is secured to the prong 25, the flat conductor cable 4 being wrapped around it. The

two prongs are moved toward each other in lateral relationship as shown by the two arrows when the male 2 and female 3 sections are coupled. When the prongs come in relationship with one another the detents 32 flatten out and tend to ride over one another, and when passed, the high points tend to form an interlocking detent means as shown in FIG. 6. This additional detent means also serves as a safe guard to prevent inadvertent and accidental disconnection when the screw type clamping means is not being used. They also serve to inform the person connecting the male and female sections that the prongs are in connection by offering a certain amount of mechanical resistance. This mechanical resistance is apparent when the prongs are moved toward each other or when they are pulled away.

Going back to FIG. 4 it can be seen how easily a damaged element can be replaced. Any of the elements 6, 22, 23, 30 or the bolt 28 can be completely separated from the other and a new or replacement part be used in its place. This saving in parts and case in maintenance and removal of parts makes for a very adaptable connector. In this manner different sized or shaped elements 22, and 23 can be used which would accept a thicker or thinner flat conductor cable without changing the whole connecting element.

It will be understood, that various changes in the details, materials, steps and arrangement of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art, within the principle and scope of the invention, as expressed in the appended claims.

What is claimed is:

1. In an electrical connector the combination comprising;

a male portion, and a female portion, said male portion and said female portion having cup shaped outer housings, said outer housing of said female portion having an enlarged opening to receive one end of said male portion outer housing, said outer housings each having a mating end and a partially enclosed conductor-receiving end, said partially enclosed conductor-receiving end having an opening therein for receiving a printed, etched or flat conductor cable, soft resilient sealing means within the partially enclosed ends, respectively, of each of said male and said female portions, one end thereof extending through and substantially filling the conductor-receiving openings therein, said sealing means each comprising two mating portions between which a printed, etched or flat conductor cable extending through the conductor-receiving openings in said male and female portions of said connector is received, said sealing means forming a seal with the conductor and with the conductor-receiving opening, said sealing means end located in the conductor-receiving opening being rectangular in cross section, and an opposite end being wedge-shaped, a rigid projection means within each of said male and said female portions engaging said sealing means and projecting toward the mating end of its respective housing, said projection means each having two mating sections adapted to form a channel therebetween, a first end of each of said projection means having a V-shaped groove therein when the sections are mated to engage the wedge-shaped end of said sealing means and to guide a conductor from the respective conductor receiving openings in each of said sealing means to the respective channels in each of said projection means, one section of each of said projection means having an elongated extension thereon adjacent the channel between the two mating sections extending toward the mating end of its respective housing, U-shaped resilient detent means adapted to engage each of said elongated extensions, and slots within the section of said projection means

having the elongated extension thereon whereby printed, etched or flat conductor cables may be extended through the channels in said sealing and projection means, wrapped around the U-shaped resilient detent means on each of said elongated extensions, and secured within the slots, so that the portions of the conductors on said elongated extensions within the male portion of said housing will engage the conductors on the elongated extensions in the female portions and form an electrical connection therewith due to the force of said resilient detents when said male and female portions are mated and key means projecting through each of said projection means normal to the plane of the channel therein to maintain each of the conductors in alignment with its matching conductor on the mating portion.

2. In an electrical connector having two complementary sections, each section having a protective housing open at its mating end and having an opening in the conductor receiving end, and having no permanent or semipermanent connections to the conductor, the improvement which comprises a sealing means in the conductor receiving end comprising two adjacent soft, resilient members substantially filling the end, the two members having an interface aligned with the opening and providing a seal for the opening, whereby a cable may be inserted in the opening while maintaining the seal, and means in the mating end of each section to removably support an electrical cable, whereby conductive contact with a cable in the other section is maintained when the sections are mated, each supporting means being adjacent the sealing means and comprising a rigid insulating means having two portions, the interface between which is aligned with the interface in the sealing means, one of the portions being elongated and extending toward the mating end, and further including means to removably secure to the elongated portion a conductor passing through the opening in the conductor receiving end between the two aligned interfaces and around the elongated portion.

3. The electrical connector of claim 2 wherein one end of each sealing means extends into and substantially fills the opening in the conductor receiving end, wherein the other end of each sealing means is wedge-shaped and wherein the end of the supporting means adjacent the sealing means is V-shaped to engage the wedge-shaped portion of the sealing means.

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