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(54) Connector.

(57) An electrical connector for connecting a flat cable to one or more contacts (100) comprises a housing (10) of generally rectangular cross section. The housing (10) has a first pair of generally parallel spaced long sides connected by a second pair of generally parallel spaced short sides and an actuator (20) movable in the housing (10). The housing (10) defines a cavity to receive a cable backing member (50) which forms part of the actuator (20) and the flat cable (40). The housing (10) has a locking element (150) which cooperates with a recess (60) in the actuator for locking the actuator in an inserted position in the housing, the locking element (150) being located intermediate the short sides.

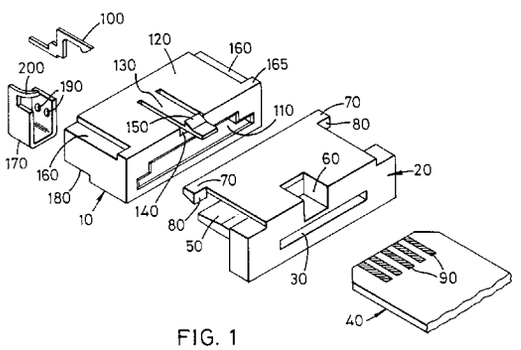

FIG. 1

EP 0 597 710 A2

This invention relates to a connector. In particular, it relates to a zero insertion force, or ZIF, connector for engaging conductors on a flat flexible cable with an electrical contact or contacts.

Connectors of this type are known in which a reciprocating actuator having a protruding portion moves the cable conductors into engagement with contacts within a housing cavity. Generally, the actuator has a slot for receipt of the cable and the protruding portion or cable backer enters the housing cavity with the cable and holds the cable conductors against the contacts. Once in this position, the actuator is locked to the housing by a latching structure.

Latching structures for these connectors are typically provided on two short sides of the connector, on the exterior of the housing. This arrangement inevitably leads to a substantial increase in the size of the connector. Further problems arise in releasing the latching structures in order to unlock the actuator and remove the cable from the connector. Generally, it is necessary to release both latching structures at once, for example by lifting locking levers on both sides using a screwdriver or similar implement, and whilst the latching structures are released the actuator is pulled manually out of the housing. Not only does this operation require a certain amount of dexterity but there is also the danger that the latching structures and/or the connector itself will be damaged during the operation, particularly if too much uneven force is used.

In an alternative known connector, the cable is inserted into the housing and the actuator is then rotated down and pushed in until the actuator presses the cable down onto the contacts. A top contact serves as a retention device to ensure that the actuator is gripped although there is no locking mechanism per se and retention force is low. The actuator is pulled out and rotated up so as to release the cable. This design thus requires a great deal of space, i.e. it has a high connector "volume".

This invention seeks to provide a connector which overcomes these problems of connector volume and latching/release of the actuator.

According to the present invention, there is provided an electrical connector for connecting a flat cable to one or more contacts and comprising a housing being generally rectangular in cross section and having a first pair of generally parallel spaced long sides connected by a second pair of generally parallel spaced short sides, and an actuator movable in the housing, the housing defining a cavity to receive a cable backing member, which forms part of the actuator, and the flat cable, wherein the housing includes first locking means which co-operates with second locking means on the actuator for locking the actuator in an inserted position in the housing, the first locking means being located intermediate the short sides.

Not only does this design provide a smaller connector volume than that of known connectors, but the location of the first and second locking means intermediate the short sides allows the actuator to be removed more easily from the housing.

Preferably, the actuator further includes one or more protruding members and the housing includes one or more channels for co-operating with the protruding members, whereby the actuator is held on the housing by locating the protruding member or members in the channel or channels. There are preferably two protruding members and two channels, one at each edge of one of the long sides, either side of the locking means.

Each channel preferably includes a stop at one end whereby the actuator is prevented from complete removal from the housing when the cable is released. Each protruding member may thus move along its respective channel when the locking means are released until the protruding member engages the stop.

The connector may further include biasing means for urging the actuator in a direction out of the housing when the locking means are released.

The biasing means may include a cantilever element on the or each contact arranged to act against the actuator when the actuator is in the inserted position in the housing.

The biasing means may further include means for urging each protruding member along its channel, which means are preferably mounted on the housing and include retention means to hold the urging means on the housing. The retention means may comprise, for example, raised portions which engage with depressions in the housing, or vice versa.

The urging means typically includes a spring lever which may be deflected by the protruding member as it moves along the channel. Usually the spring lever is fully deflected when the actuator is locked. When the locking means are released, the spring lever releases its energy, thereby pushing the protruding member back along the channel to a released position.

The first locking means may comprise a lever and the second locking means may comprise a recess. The lever preferably includes a tooth which engages with the recess to lock the actuator to the housing. Alternatively, the second locking means may be a lever and the first locking means a recess.

The housing preferably receives the cable and cable backing member through a slot which may be stepped. A wider part of the slot preferably receives the cable backing member and a narrower part receives the cable.

The contact(s) may be substantially L-shaped or inverted L-shaped with a portion extending out of the housing. The actuator will preferably be configured in a complementary manner so that the cable backing member forces the cable against the contact(s). The contact(s) may also include a point which extends towards the cable for creating improved contact pres-

sure when the actuator is locked in position.

One embodiment of a connector according to the invention will now be described, by way of example only, with reference to the drawings, in which:

Figure 1 is an exploded perspective view of a connector;

Figure 2 is a plan view of a housing and actuator;

Figure 3 is a sectional view of the housing and actuator along lines III-III in figure 2, with an actuator in a released position.

Figure 4 is a sectional view of the housing and actuator along the lines IV-IV in figure 2, with the actuator in a partly engaged position in the housing;

Figure 5 is the sectional view, also along the lines IV-IV in figure 2 but with the actuator in locked position in the housing.;

Figure 1 shows a housing 10 and actuator 20 prior to assembly. The actuator 20 includes a slot 30 for receipt of a cable 40 and a cable backing member or cable backer 50. An upper portion of the actuator 20 includes a central recess 60 and two protruding members 70. Each protruding member 70 extends both outwardly from the upper portion and down into a tooth 80.

The cable 40 includes conductors 90 on its upper surface which are to be engaged with contacts 100 (only one shown) in the assembled connector.

Housing 10 defies a cavity with a stepped slot 110 at one end for receipt of the cable backing member 50 and the cable 40. An upper long side 120 of the housing includes a central locking lever 130. A slot 140 beneath the lever enables the lever 130 to be depressed. The lever 130 includes a tooth 150 at its free end for locking the actuator and housing together. Opposing sides of the upper long side 120 have channels 160 with stops 165 at the end nearest slot 140.

Two U-shaped biasing components 170 fit around cut-aways 180 (one only shown) and each biasing component includes two bumps 190 for engaging with recesses in the housing. Each component 170 also includes a spring lever 200 at its upper end which rotates in the direction of the arrows when loaded.

Figure 2 shows a plan view of the housing 10, from which a sample five contacts 100 extend and with biasing components 170 in position, and the actuator 20 partly engaged in the housing through the slot 30 (not shown in figure 2). The protruding members 70 carrying the teeth 80 lie in the channels 160 of the housing 10. It can be appreciated from figure 2 that as the actuator is pushed into the housing, the protruding members 70 will be forced against the spring levers 200 of the biasing components 170. The spring levers 200 exert a force on the protruding members 70 to urge the actuator 20 in a direction out of the housing 10 when the actuator is released from a loaded position in the housing 10.

The sectional views of figures 3 to 5 illustrate how the housing 10, actuator 20 and the cable are assembled.

As can be seen in Figure 3, the actuator 20 is retained in the housing by the teeth 80 of the protruding members 70 which can slide in the channels 160 in the housing 10.

In order to lock the actuator 30 and the cable 40 to the housing the cable 40 is first inserted through the slot 30 in the actuator and into the housing cavity. Cable backing member 50 is tapered so that as the actuator moves towards its locked position, the cable 40 is forced against the contact(s) 100. Each contact 100 includes a body portion 101 from which extends an arm 102 carrying a contact point 105 which is embedded in the cable as the cable is pushed against it by the cable backing member 50. Each contact 100 has a limb 210 for use in making a connection by, for example, soldering or crimping. In this manner, improved contact between the cable conductors 90 and contacts 100 is achieved. Each contact body portion 101 has a slit 103 defining a finger 104, which acts against the free end of the cable backing member 50 as will be described later.

Figure 4 shows an intermediate position in which the cable 40 has reached a fully inserted position, and the actuator 20 is partly inserted into the housing 10. Upon further movement of the actuator 20 into the housing 10, the tapered cable backing member 50 engages the finger 104 of each contact 100 (figure 5). This causes the arm 102 and contact point 105 to be urged towards the cable 40, but the cable 40 offers resistance to such movement of the contact point 105. Similarly, the finger 104 of each contact resists bending. This combination of forces results in a force exerted on the cable backing member 50 to urge the actuator out of the housing 10. Furthermore, the contact point 105 acts on the cable 40 and then to the cable backing member 50, the taper of which causes the force exerted by the contact point 105 to have a component in a direction to urge the actuator 20 out of the housing 10.

When the actuator has reached a fully engaged position (figure 4) the reaction forces as just described are held by a latching arrangement in which the tooth 150 of the lever 130 latches against the edge of the recess 60, having previously been forced towards the contacts 100 as the actuator 20 moves through the housing 10. Upon release of the latch, the reaction forces described above arising from the contact 100 urge the actuator 20 out of the housing, these forces being supplemented by forces exerted by the spring levers 200 acting on the protruding members 70 of the actuator 20, the spring levers 200 being bent back when the actuator is fully inserted into the housing 10.

It will be appreciated that alternative constructions are contemplated where the cable backing

member is arranged on the other side of the cable. Both forms of contact 100 include an additional limb 210 which extends from the housing and to which further connections may be made, for example by soldering or crimping.

It can be seen that the location of lever 130 provides easy access and single point of locking/release, thus allowing easy outward removal of the actuator. Furthermore, the spring lever provides active assistance in the removal process once the lever is depressed. The whole connector is compact and lacks the cumbersome locking devices of the prior art.

It will be appreciated that the invention has been described above by way of example only and that changes may be made without departing from the scope of the invention.

Claims

1. Electrical connector for connecting a flat cable to one or more contacts and comprising a housing being generally rectangular in cross section and having a first pair of generally parallel spaced long sides connected by a second pair of generally parallel spaced short sides, and an actuator movable in the housing, the housing defining a cavity to receive a cable backing member, which forms part of the actuator, and the flat cable, wherein the housing includes first locking means which cooperates with second locking means on the actuator for locking the actuator in an inserted position in the housing, the first locking means being located intermediate the short sides.

2. An electrical connector according to claim 1, in which the actuator further includes one or more protruding members and the housing includes one or more channels for cooperating with the protruding members, whereby the actuator is held on the housing by locating the protruding member or members in the channel or channels.

3. An electrical connector according to claim 2, in which there are two protruding members and two channels, one at each edge of one of the long sides, either side of the locking means.

4. An electrical connector according to claim 2, or claim 3 in which each channel includes a stop at one end, whereby the actuator is prevented from complete removal from the housing when the cable is released.

5. An electrical connector according to any one of claims 2 to 4, further including biasing means for urging the actuator in a direction out of the housing when the locking means are released.

6. An electrical connector according to claim 5, in which the biasing means include a cantilever element on the or each contact arranged to act against the actuator when the actuator is in the inserted position.

7. An electrical connector according to claim 5 or claim 6 wherein the biasing means include means for urging each protruding member along its channel.

8. An electrical connector as claimed in claim 7 wherein the urging means includes retention means to hold the urging means on the housing.

9. An electrical connector according to claim 8, in which the retention means comprises raised portions which engage with depressions in the housing, or vice versa.

10. An electrical connector according to any one of claims 7 to 9, in which the biasing means includes a spring lever, which is deflected by the protruding member as it moves along its channel.

11. An electrical connector according to claim 10 in which the spring lever is fully deflected when the actuator is locked.

12. An electrical connector according to any one of claims 1 to 11, in which the first locking means comprises a lever and the second locking means comprises a recess.

13. An electrical connector according to any one of claims 1 to 12, in which the first locking means comprises a recess and the second locking means comprises a lever.

14. An electrical connector according to claim 12 or claim 13, in which the lever includes a tooth which engages with the recess to lock the actuator to the housing.

15. An electrical connector according to any one of claims 1 to 14, in which the housing receives the cable and cable backing member through a stepped slot.

16. An electrical connector according to any one of claims 1 to 15 in which the contact(s) is substantially L-shaped or inverted L-shaped with a portion extending out of the housing.

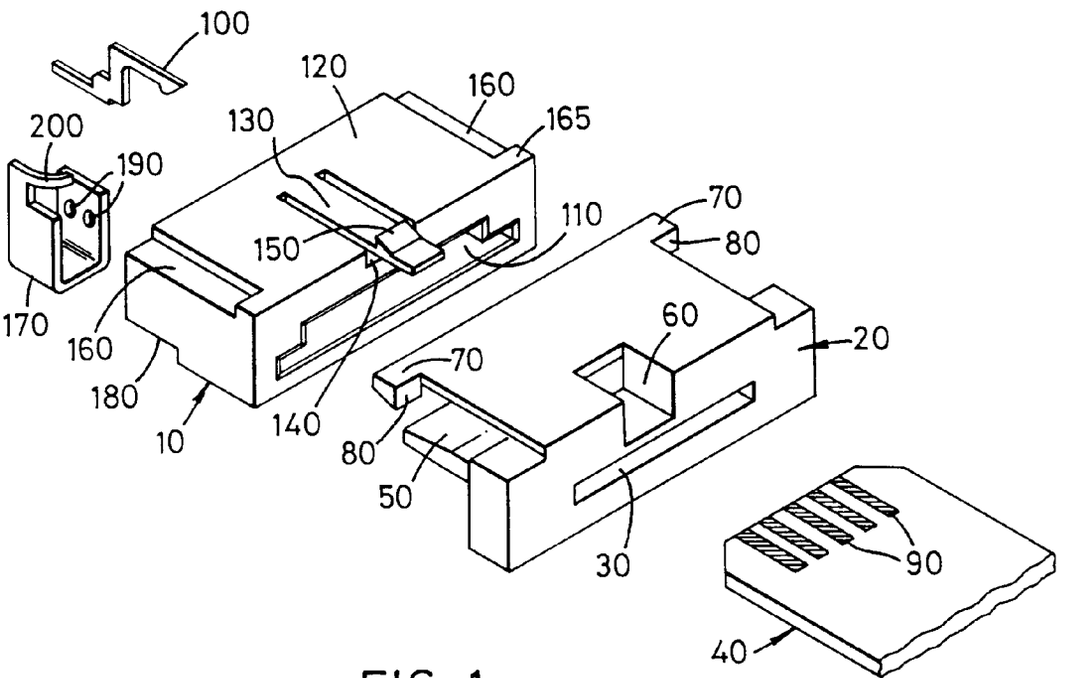
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FIG. 1

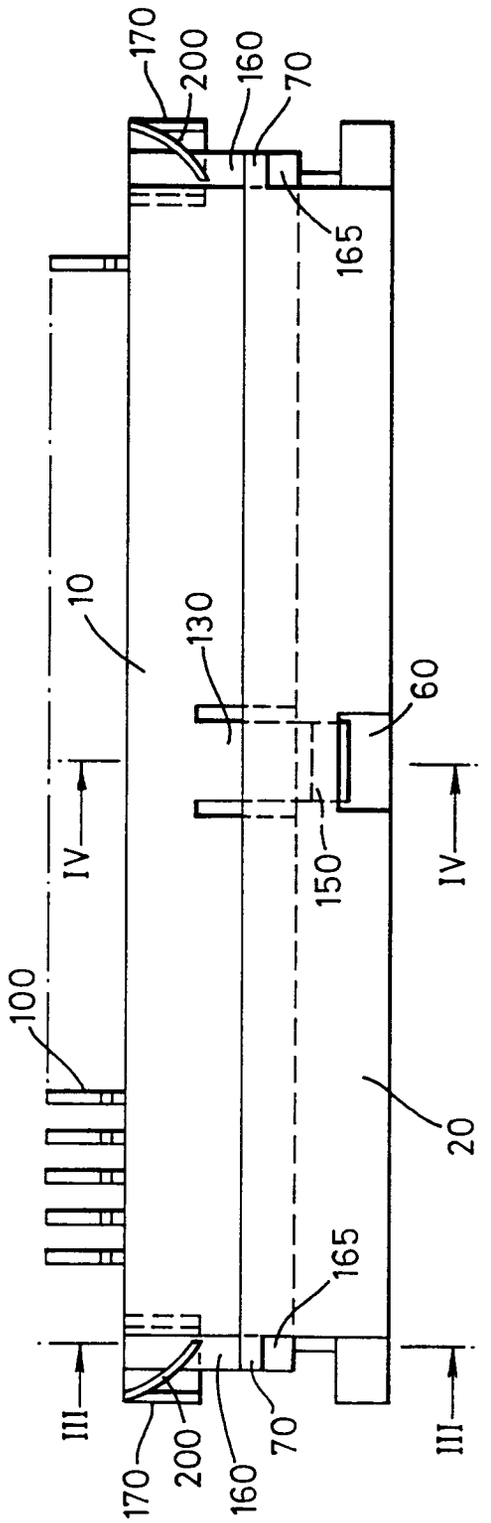
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FIG. 2

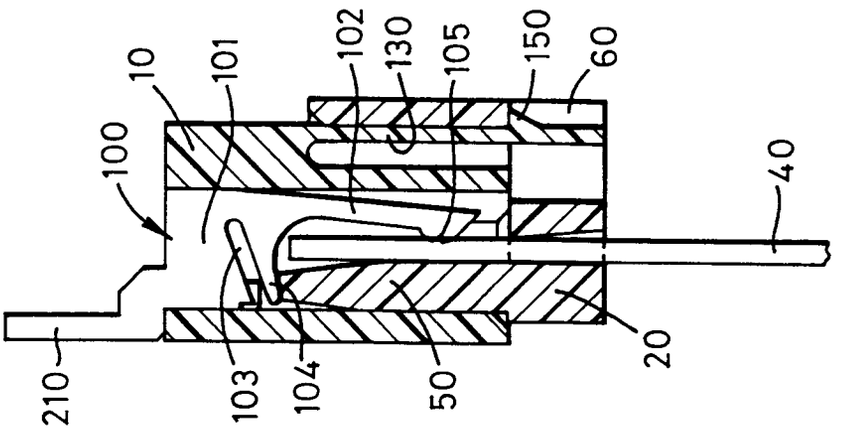

FIG. 5

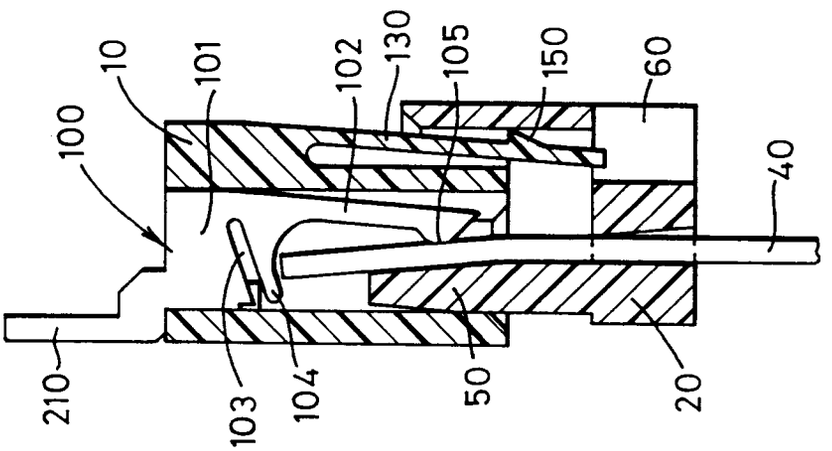

FIG. 4

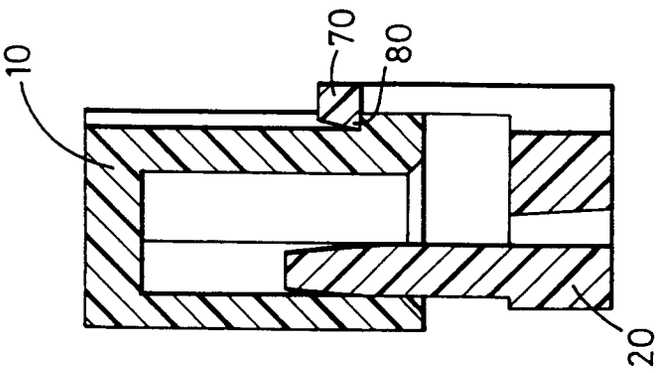

FIG. 3