

PATENT SPECIFICATION

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(19)



(54) ELECTRICAL CONNECTOR

(71) We, AMP INCORPORATED, a corporation organised and existing under the laws of the State of New Jersey, United States of America, of Eisenhower Boulevard, Harrisburg, Pennsylvania, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to electrical connectors.

An electrical connector according to the invention comprises male and female contact housings each moulded in one piece from plastics material and having contacts at their mating faces, a cam shaft rotatably mounted in one housing by releasably resiliently flexible means integral with the one housing, the arrangement being such that the housings are movable to a first position of mating in which the contacts in one housing overlap and are spaced from the contacts in the other housing, and rotation of the cam shaft in the first position causes the shaft to engage the other housing directly and shift the other housing laterally to bring the spaced contacts into engagement.

According to another aspect of the invention, an electrical connector comprises matable male and female housings each moulded in one piece from plastics material and having contact receiving passageways extending between mating and rear faces, the contacts in one housing projecting beyond its mating face and the other contacts being located in cavities formed in the mating face of the other housing; an annular hood projecting from the mating face of the female housing to receive and guide the male housing into a first mating position in which the projecting contacts are received in respective cavities in overlap-

ping spaced relation to the other contacts, and a cam shaft rotatably mounted in a passageway in one housing by a releasable, resiliently flexible projection integral with the one housing engaging a circumferential groove formed in the shaft, the cam shaft being provided with a latching head projecting from the mating face and being rotatable in the first mating position of the housings directly to engage and shift the other housing laterally into a second mating position in which the contacts are in engagement and in which the latching head is in latching engagement with the other housing to secure the housings together.

Advantageously, the groove progressively increases from substantially zero depth as it extends around the shaft.

A specific example of a connector according to the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a side view, partly in cross-section, showing the connector parts aligned for mating;

Figure 2 is a cross-sectional view of a portion of the connector in a first stage of mating;

Figure 3 is a cross-sectional view of a portion of the connector in a second stage of mating;

Figure 4 is a cross-sectional view along line 4-4 of Figure 2 of a portion of the connector;

Figure 5 is a cross-sectional view along line 5-5 of Figure 3;

Figure 6 is a perspective view of a latching cam member; and,

Figure 7 is a perspective view, of a resilient contact of the connector.

The connector includes matable male and female connectors 10 and 12, respectively housing contacts 38 and 58. The male housing is integrally moulded of plastics material to form a rectangular mounting

portion 14 surrounding a contact carrying body portion 16. The mounting portion 14 has outwardly directed mounting flanges 18 at opposite ends formed with bolt receiving openings 20.

At one end of the contact carrying portion 16 there is an arcuate cam follower surface 28 defined on a projection 22 between a first bore 24 and a semi conical counter bore 26. The projection 22 also defines a rearwardly facing shoulder 30. At the opposite end of the mounting portion 14 there is a transverse latching flange 32. A plurality of contact receiving bores 34 extend between rear and mating faces of the body and counter bores 36 define cavities opening into the mating face. A rigid contact pin 38 (the passive contact) is fixed in each of the contact bores 34 with its forward end extending into the counter bore 36 but not projecting beyond the mating face 40 of the male connector block. The other end of the pin is connected to an electrical lead (not shown) by any conventional means.

The female connector 12 includes a housing body 42 also integrally moulded of plastics material and having an integral, outwardly directed, annular flange 44 received in a recess 48 of a shroud 46 to join the body to the shroud. The shroud is bipartite and screws 50 secure the parts together and clamp between them a cable 52 providing strain relief. The body 42 includes an annular hood 54 which extends beyond a mating face to define a preferably polarised, opening into which the body portion 16 can be inserted. A plurality of bores 56 extend between opposite faces of body 42 and receive, respectively, resilient contacts 58 (the active contacts). The resilient contact includes a resilient blade portion 60 which extends beyond the mating face 62 of the contact block from wire connecting portion 64 adapted to be connected to a lead 66 of cable 52 by any conventional means such as crimping. A beaded or dished portion 68 is formed on the free end of blade portion 60.

A first bore 70 extends between opposite faces of the body 42 and communicates at one end of the contact block 42 with a counter bore 72. At least one resilient latching member 74 extends from an edge of the first bore 70 into the counter bore 72. The latching member 74 has a latch head 76 on its free end protruding radially into bore 70.

A cam member 78 is mounted in the first bore 70 and includes a first cylindrical portion 80 having a second cylindrical portion 82 of smaller diameter integral with one end to define at their junction an annular shoulder 84. The second cylindrical portion 82 is formed with an eccentric cam groove

88 defining a pair of spaced shoulders 90, 92, the shoulder 90 normally being engaged with the projection 76 of latching means 74. The free end of the second cylindrical member is formed with a nose 94 providing a cam surface 96 and a latching projection 98. A first cam stop 100 is integrally formed with housing 46 at a position where it will be engaged by lever 86. A second cam stop 102 is integrally formed within counter bore 72. The first and second cam stops are preferably spaced apart by a distance equalling one quarter turn of the cam member.

A transverse latching shoulder 104 is formed by a flange 106 or by a recess (not shown) within the hood 54 at the opposite end of the contact block 42 from the cam member 78.

A transverse lever 86 is provided on the other end of the first cylindrical portion 80.

To assemble the connector the male housing 10 is inserted into the hood 54, as shown in Figures 2 and 4. The relative location of the cam member 78 and shoulder 104 in the female connector and the cam follower surface 28 and flange 32 on the male connector provide a polarising feature preventing mismatching and the hood aids location of the two housings prior to latching. It should be noted that in this initial mating position the rigid contact pins 38 are not engaged by the blade portion 60 of the resilient contacts 58. Therefore, the only force required to insert the male housing into the female housing is the force required to overcome the sliding friction between the mating peripheral surfaces of the male and female housings.

When the male and female housings have been mated to the initial position shown in Figures 2 to 5, the lever 86 of cam member 78 is rotated to rotate the cam and latching nose 94 from the position shown in Figures 2 and 4 to the position shown in Figures 3 and 5. During this rotational movement, the cam surface 96 engages the arcuate surface 28 causing a relative transverse movement of the housings which mates the active contacts 60 with the passive contacts 38. The projection 98 also rotates into position behind the shoulder 30 while the transverse flange 32 engages the shoulder 104 to lock the opposite ends of the connectors together. Thus, rapid mating and latching are obtained.

The engagement of flange 32 and shoulder 104 also prevents over-travel by limiting the relative transverse movement of the housings during the final stage of mating. Thus, the blades 60 cannot be damaged by over stressing.

The nose 94 of the cam member 78 bars entry of the male connector 10 into the hood 54, if the cam member is in the posi-

tion shown in Figures 3 and 5, preventing contact damage by mismating.

The cam groove 88 flexes the latching member 74 outwardly when the cam member 78 is rotated to the latching position (See Figures 2 and 3). This permits assembly and removal of the cam member 78 from the contact block 42 if desired when the housings are unmated.

- 10 Advantages of the above described connector are that it is of extremely simple and compact construction requiring in essence only three parts which can each be moulded in one piece of plastics material
- 15 whilst providing zero insertion force characteristics and positive locking of the housings when fully mated. There is little or no wear on the contacts during mating but the relative movement of the resilient contact
- 20 produces an advantageous wiping action and the housing construction facilitates the use of long contacts having low spring rates thus minimising force variations resulting from dimensional tolerances. Furthermore,
- 25 only a very short length of contact need extend beyond the mating face further minimising risk of contact damage in use. As the latching member is located on one side of the housing, a continuous contact pattern
- 30 can be maintained and assembly of contacts into the housing is facilitated.

WHAT WE CLAIM IS:—

- 35 1. An electrical connector comprising male and female contact housings each moulded in one piece from plastics material and having contacts at their mating faces, a cam shaft rotatably mounted in one housing by releasable resiliently flexible means
- 40 integral with the one housing, the arrangement being such that the housings are movable to a first position of mating in which the contacts in one housing overlap and are spaced from the contacts in the other hous-

ing, and rotation of the cam shaft in the first position causes the shaft to engage the other housing directly and shift the other housing laterally to bring the spaced contacts into engagement.

2. An electrical connector comprising 50 matable male and female housings each moulded in one piece from plastics material and having contact receiving passageways extending between mating and rear faces, the contacts in one housing projecting 55 beyond its mating face and the other contacts being located in cavities formed in the mating face of the other housing; an annular hood projecting from the mating face of the female housing to receive and guide 60 the male housing into a first mating position in which the projecting contacts are received in respective cavities in overlapping spaced relation to the other contacts, and a cam shaft rotatably mounted in a passage- 65 way in one housing by a releasable, resiliently flexible projection integral with the one housing engaging a circumferential groove formed in the shaft, the cam shaft being provided with a latching head pro- 70 jecting from the mating face and being rotatable in the first mating position of the housings directly to engage and shift the other housing laterally into a second mating 75 position in which the contacts are in engagement and in which the latching head is in latching engagement with the other housing to secure the housings together.

3. An electrical connector according to claim 2 in which the groove progressively 80 increases from substantially zero depth as it extends around the shaft.

4. An electrical connector substantially 85 as described with reference to the accompanying drawings.

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Advantages of the above described connector are that it is of extremely simple and compact construction requiring in essence only three parts which can each be moulded in one piece of plastics material whilst providing zero insertion force characteristics and positive locking of the housings when fully mated. There is little or no wear on the contacts during mating but the relative movement of the resilient contact produces an advantageous wiping action and the housing construction facilitates the use of long contacts having low spring rates thus minimising force variations resulting from dimensional tolerances. Furthermore, only a very short length of contact need extend beyond the mating face further minimising risk of contact damage in use. As the latching member is located on one side of the housing, a continuous contact pattern can be maintained and assembly of contacts into the housing is facilitated.

WHAT WE CLAIM IS:—

1. An electrical connector comprising male and female contact housings each moulded in one piece from plastics material and having contacts at their mating faces, a cam shaft rotatably mounted in one housing by releasable resiliently flexible means integral with the one housing, the arrangement being such that the housings are movable to a first position of mating in which the contacts in one housing overlap and are spaced from the contacts in the other hous-

ing, and rotation of the cam shaft in the first position causes the shaft to engage the other housing directly and shift the other housing laterally to bring the spaced contacts into engagement.

2. An electrical connector comprising matable male and female housings each moulded in one piece from plastics material and having contact receiving passageways extending between mating and rear faces, the contacts in one housing projecting beyond its mating face and the other contacts being located in cavities formed in the mating face of the other housing; an annular hood projecting from the mating face of the female housing to receive and guide the male housing into a first mating position in which the projecting contacts are received in respective cavities in overlapping spaced relation to the other contacts, and a cam shaft rotatably mounted in a passageway in one housing by a releasable, resiliently flexible projection integral with the one housing engaging a circumferential groove formed in the shaft, the cam shaft being provided with a latching head projecting from the mating face and being rotatable in the first mating position of the housings directly to engage and shift the other housing laterally into a second mating position in which the contacts are in engagement and in which the latching head is in latching engagement with the other housing to secure the housings together.

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