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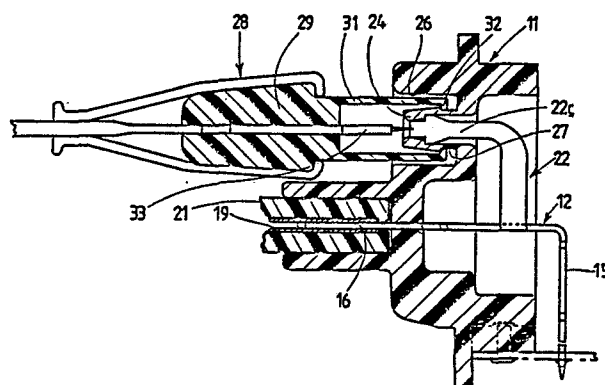
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54 **Electrical connector.**

57 An electrical connector comprising an electrically insulating body (11), and an electrically conductive terminal member (12) supported by the body (11), said terminal member (12) having a first portion (15) for connection to the electrical circuit (14) in respect of which the terminal member (12) is to constitute a terminal. The terminal member (12) includes a second portion (16) which is accessible at one face of the body (11) for engagement in use by a mating electrical terminal (19) of a mating external connector (21). The terminal member (12) further includes an integral test portion (22) which is exposed by way of an aperture (25) in the body for engagement by a conductive test probe (33) of a mating test probe assembly (28). The body (11), adjacent the aperture (25), is shaped positively to latch with the mating test probe assembly (28) so as to hold the conductive probe (33) of the test probe assembly in contact with the integral test portion (22) of said terminal member (12).



ELECTRICAL CONNECTOR

This invention relates to electrical connectors primarily, but not exclusively, intended for use as terminal blocks for electrical and electronic devices, the connectors being of the kind which comprise a terminal member supported by a body of electrically insulating material, the terminal member being accessible at one face of the body for engagement by a mating external terminal of an external connector, and the terminal member having a portion for connection to the electrical circuit in respect of which the member is to constitute a terminal.

There has been a demand for such connectors to afford the ability for making a test connection to the circuit in respect of which the terminal member is to constitute the terminal, without the need to disconnect the external connector. Such testing is usually known as "non-disruptive testing".

Certain known electrical connectors provide the facility for non-disruptive testing by having an aperture in the electrically insulating connector body through which the terminal member is exposed for contact by a testing probe. While such arrangements are suitable for simple manual testing, where an operator simply touches the exposed terminal with a test probe and notes whether the circuit is live or not, such arrangements are not suitable for more complex testing for example automatic testing of a connector forming part of a multiplexing system. In such a system it may be necessary to effect a more long term test probe connection which is maintained without

- 2 -

the assistance of the operator while a more complex test routine is conducted.

It is an object of the present invention to provide an electrical connector wherein the above mentioned
5 disadvantage of the known connectors is minimised.

In accordance with the present invention there is provided an electrical connector comprising an electrically insulating body, and an electrically conductive terminal member supported by the body, said
10 terminal member having a first portion for connection to the electrical circuit in respect of which the terminal member is to constitute a terminal, and a second portion which is accessible at one face of the body for engagement in use by a mating electrical
15 terminal of a mating external connector, the terminal member further including an integral test portion which is exposed by way of an aperture in the body for engagement by a conductive test probe of a mating test probe assembly, said body, adjacent said aperture,,
20 being shaped positively to latch with said mating test probe assembly so as to hold said conductive probe of said test probe assembly in contact with said integral test portion of said terminal member.

Preferably said test portion is an end region of a test
25 limb integral with, and projecting from, said terminal member.

Desirably said body includes an integral shroud member within which said end region of said test limb extends, said aperture being at one end of said shroud member, and the exterior surface of said shroud member being
30 shaped to be received within a corresponding portion of the mating test probe assembly, and to effect positive latching therewith.

Preferably said first portion of said terminal member is arranged to be connected to a track of a printed circuit board, and said body is arranged physically to be secured to the printed circuit board.

5 Alternatively said first portion of said terminal member is arranged to be electrically connected to a conductive lead.

Conveniently said body supports one or more further, identical terminal members and has an appropriate
10 number of apertures exposing the test portions of said one or more further terminal members.

Desirably said apertures are arranged in a predetermined array.

One example of the invention is illustrated in the
15 accompanying drawings wherein:-

Figure 1 is a side elevational view partly in section of an electrical connector forming a terminal block of a printed circuit board,
Figure 2 is a view in the direction of arrow A of the
20 terminal member of Figure 1,
Figure 3 is a view in the direction of arrow B in Figure 2, and
Figure 4 is a view similar to Figure 1 but illustrating a mating test probe in position.

25 Referring to the drawings, the electrical connector comprises a moulded synthetic resin body 11 and a metal, and therefore electrically conductive, terminal member 12. The body 11 is arranged at 13 to be rivetted to a printed circuit board 14 of an electrical
30 or electronic device, and has a flange 11a which may

- 4 -

abut the exterior surface of a casing (not shown) of the electrical or electronic device. It will be understood that the exact shaping of the body 11 and terminal member 12 will be determined by the application which they are to perform, and whereas the connector illustrated in Figure 1 is intended for use as a terminal block of an electrical or electronic device, it is to be understood that the connector could be one part of a two part connector unit for effecting an electrical connection between two or more electrical leads in, for example, a wiring harness. Furthermore, the connector could be the termination of one or more leads of a wiring harness and could be designed for attachment to a conventional terminal block.

It can be seen that the terminal 12 of Figure 1 is formed by stamping and bending flat metal strip, and includes a first portion 15 connected by soldering at one end to an appropriate track of the printed circuit board 14. Integral with and extending at right angles to the portion 15 is a second portion 16 of the terminal member 12, the portion 16 extending as a tight fit through a slot 17 in a wall of the body 11, and protruding into a recess 18 in the outer face of the body 11. The region of the portion 16 within the recess 18 is accessible for connection by a mating terminal 19 (Figure 4) of a mating external connector 21. The body of the connector 21 is received within the recess 18 and either the body 21 and the body 11 or the terminal 19 and the portion 16, or both, are provided with latching means for retaining the connector 21 in engagement with the connector 11, 12.

The terminal member 12 is formed with an integral test limb 22. The test limb 22 protrudes from the portion 16 at right angles thereto, and includes an initial

portion 22a which is coplanar with the portion 16. At the end of the portion 22a the limb 22 is formed with a right angled bend and thereafter a portion 22b extends at right angles to the portion 22a and perpendicular to the plane of the portions 16 and 22a. Finally the limb 22 includes a portion 22c which is coplanar with the portion 22b but extends at right angles thereto so as to extend parallel to the extent of the portion 16 of the terminal member 12, while having its plane perpendicular to the plane of the portion 16. The free end region of the portion 22c of the limb 22 extends within a passage 23 of the body 11. The passage 23 extends through the wall of the body 11, and extends within an integral shroud member 24 of the body 11, the shroud member 24 being circular in transverse cross-section. The shroud member 24 extends parallel to the recess 18 and has an aperture at its free end through which the end surface of the portion 22c of the limb 22 is exposed.

The shroud member 24 extends within a recess 26 in the face of the body 11 and throughout the majority of its length the shroud member 24 is externally of frusto-conical form. The frusto-conical region of the shroud member 24 is of smallest diameter adjacent the aperture 25, and increases in diameter to a maximum adjacent the root of the shroud member 24. However, at its root the shroud member 24 is formed with a circumferentially extending recess 27 so as to define a neck of reduced cross-section at the root of the shroud member 24.

As can be seen with reference to Figure 4, the test probe assembly 28 intended for use with the connector 11, 12 includes a moulded synthetic resin body 29 terminating at one end in an integral sleeve 31 having

a radially inwardly extending peripheral flange 32 at its free end. Within the sleeve 31 is an electrically conductive probe 33 which is spring urged axially of the probe assembly 28 towards the free end of the sleeve 31. The central aperture of the flange 32 has a diameter substantially equal to that of the neck of the shroud 24 defined by the circumferential recess 27. Thus the probe assembly 28 can be engaged with the connector 11, 12 while a mating connector 21 is engaged with the connector 11, 12, by introducing the sleeve 31 of the probe assembly into the recess 26 so that the free end of the shroud member 24 enters the aperture in the flange 32 of the sleeve 31 and the probe 33 passes through the aperture 25 of the shroud member and touches the end surface of the portion 22c of the test limb 22. The sleeve 31 is inserted into the recess 26 until the whole of the frusto-conical portion of the shroud 24 lies within the sleeve 31. During this inter-engagement of the sleeve and the shroud member the sleeve is deformed outwardly, as permitted by its inherent resilience, and restores towards an original configuration when the flange 32 aligns with the circumferential recess 27 adjacent the root of the shroud member 24. During the axial movement of the probe assembly 28 relative to the body 11, the probe 33 is in engagement with the end surface of the portion 22c of the limb 22 and thus the spring urging the probe 33 axially of the sleeve 31 is compressed. The spring compression provides a good contact pressure at the point of engagement of the probe 33 with the portion 22c.

It will be recognised that the engagement of the flange 32 in the recess 27 of the shroud member 24 achieves a positive latching action between the probe assembly 28 and the body 11 which holds the probe assembly firmly

in position against vibration, and against the spring force of the probe 33. Thus it is not necessary for an operator to hold the probe assembly 28 in position during testing, and an electrical connection can be made to the circuit of which the terminal member 12 is the termination without the need to disconnect the terminal 19 from the terminal portion 16. In addition to testing the circuit of which member 12 is a termination it is possible to test the circuit connected to the terminal 19 and in so doing to test the integrity of the electrical connection between terminals 16 and 19.

In order to release the probe assembly 28 from the body 11 the operator applies a sufficient withdrawal force to cause the flange 32 to "snap-over" the edge of the recess 27.

While the connector is described above as having only a single terminal member 12 it is to be understood that a single body 11 may support a plurality of terminal members 12 aligned with one another in a linear array, or alternatively positioned relative to one another in some other predetermined array. In each instance the terminal member 12 will have a test limb 22 which will be exposed for the making of a test connection in the manner described above. Where appropriate therefore a single test probe assembly may contain an appropriate plurality of probes 33 arranged in an array equivalent to the array of the test portions 22c.

Using the arrangement illustrated in Figure 4, it is to be understood that in a multi-terminal connector, where the terminals are arranged as a linear array, that is to say having their portions 16 coplanar, the shrouds 24 of the portions 22c of the terminals will merge into one another to define an elongate rib having the

passages 23 therein. In such an arrangement the sleeve 31 of the test probe assembly 28 will be correspondingly shaped and will house an appropriate plurality of probes 33. However, it will be recognised that in such an arrangement it is not essential to have the recess 27 extending completely around the rib defining the shrouds 24, and localised recesses and corresponding localised flange parts 32 on the sleeve 31 will be adequate to maintain the test probe assembly 28 engaged with the body 11 against vibration and the action of the springs which load the probes 33 against the ends of the limbs 22c.

It will further be recognised that while in the arrangement described above it is desirable to achieve positive latching by an appropriate shaping of the exterior of the shroud or shrouds 24, it is equally possibly to achieve positive latching by appropriate shaping of the body 11 in regions other than the shrouds 24. Corresponding changes will of course be made in the body 29 of the probe assembly 28.

The particular form of terminal 12 described above is convenient but not essential. For example, it may be that it is desirable for the probe assembly 28 to be engaged with the body 11 in a direction at right angles to the engagement of the connector 21. In such circumstances it may be possible to dispense with the test limb 22 and simply to provide apertures in the material of the body 11 through which appropriate test probes can engage the portions 16 of the respective terminals 12. Using such an arrangement it is unlikely that shrouds 24 will be provided around the apertures through which the test probes extend, and thus it is more likely that the positive latching will be provided by corresponding shaping of the body 11, perhaps in the wall of a recess similar to the recess 26 and the

sleeve 31 of the test probe assembly body 29. In such an arrangement of course it would be necessary to provide positive latching around the whole of the periphery of the sleeve 31 and the equivalent of the recess 26, and localised shaping to achieve positive latching may be all that is necessary.

CLAIMS.

1. An electrical connector comprising an electically insulating body (11), and an electrically conductive terminal member (12) supported by the body (11), said terminal member (12) having a first portion (15) for connection to the electrical circuit (14) in respect of which the terminal member (12) is to constitute a terminal, and a second portion (16) which is accessible at one face of the body (11) for engagement in use by a mating electrical terminal (19) of a mating external connector (21), the terminal member (12) further including an integral test portion (22) which is exposed by way of an aperture (25) in the body for engagement by a conductive test probe (33) of a mating test probe assembly (28), the connector being characterized in that said body (11) adjacent said aperture (25), is shaped positively to latch with said mating test probe assembly (28) so as to hold said conductive probe (33) of said test probe assembly in contact with said integral test portion (22) of said terminal member (12).
2. A connector as claimed in claim 1 characterized in that said test portion is an end region (22c) of a test limb (22) integral with, and projecting from, said terminal member (12).
3. A connector as claimed in claim 1 or claim 2 characterized in that said body (11) includes an integral shroud member (24) within which said end region (22c) of said test limb (22) extends, said aperture (25) being at one end of said shroud member (24), and the exterior surface of said shroud member (24) being shaped to be received within a corresponding portion of the mating test probe assembly (28), and to effect positive latching therewith.

4. A connector as claimed in anyone of claims 1 to 3 characterized in that said first portion (15) of said terminal member (12) is arranged to be connected to a track of a printed circuit board (14) and said body
5 (11) is arranged physically to be secured to the printed circuit board (14).

5. A connector as claimed in anyone of claim 1 to 3 characterized in that said first portion (15) of said terminal member (12) is arranged to be electrically
10 connected to a conductive lead.

6. A connector as claimed in anyone of claims 1 to 5 characterized in that said body (11) supports one or more further, identical terminal members (12) and has an appropriate number of apertures (25) exposing the
15 test portions (22) of said one or more further terminal members (12).

7. A connector as claimed in claim 6 characterized in that said apertures are arranged in a predetermined array.

