

PATENT SPECIFICATION

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(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:—

This invention relates to an electrical connector for connecting a coaxial electrical cable to a printed circuit board.

In British Patent Specification No. 994,255 there is described such an electrical connector comprising a tubular outer conductive member stamped and formed from sheet metal and having legs for reception in holes in a printed circuit board, the outer member containing a di-electric material insert which serves to separate and electrically insulate an inner conductive member in the form of a pin also contained within the outer member, from the outer member, the inner pin member having a portion extending from the outer member and parallel to the legs thereof, for reception in a hole in the printed circuit board.

Use of this known electrical connector requires a coaxial cable to be connected thereto to be terminated with a mating connector provided with an outer conductive member connected to the shielding of the cable, for reception in the tubular outer member of the known connector and an inner socket member connected to the centre conductor of the cable, for receiving the inner pin member of the known connector, the outer conductive member and the inner socket member being electrically insulated from each other.

Thus, this known electrical connector requires a coaxial cable to be mated therewith, to be terminated by a relatively complex connector which is, therefore, relatively expensive to manufacture and assemble to the cable.

In U.S. Patent Specification No. 3,828,298

there is described a relatively simple electrical terminal for connection to the shielding of a coaxial cable, which terminal is relatively cheap to manufacture and assemble to a cable. When this known electrical terminal is used the centre conductor of the cable is bared for direct connection as by soldering to a further circuit component as required.

According to this invention there is provided an electrical connector for connecting a coaxial electrical cable to a printed circuit board and comprising an outer conductive member stamped and formed from sheet metal and having legs for reception in holes in a printed circuit board, the outer member containing a dielectric material insert which serves to separate and electrically insulate an inner conductive member also contained within the outer member, from the outer member, the inner member having a leg portion extending outside the outer member and parallel to the legs thereof, for reception in a hole in the printed circuit board, in which the outer member comprises a first portion containing the dielectric material insert and a second portion formed with a pair of inwardly directed spring arms adapted to engage an electrical terminal connected to the shielding of a coaxial cable, when inserted in the second portion, and urge the electrical terminal into contact with a base of the second portion, and in which the inner conductive member is stamped and formed from sheet metal to provide a socket for receiving and making electrical connection to a bared end portion of the centre conductor of a coaxial electrical cable inserted therein.

The electrical connector of this invention has the advantages that the two conductive members thereof are easily and cheaply formed from sheet metal by stamping and forming operations, and that a coaxial electrical cable for mating therewith requires a minimum of preparation and termination, i.e., baring of an end portion of the centre conductor, and connection of a terminal, for

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example as described in U.S. Patent Specification No. 3,828,298, to the shielding.

5 Preferably the first portion of the outer member is rectangular in cross-section, this facilitating the stamping and forming operations required for manufacture thereof since only right-angle bends are required.

10 The second portion of the outer member is preferably substantially U-shaped in cross-section with free end portions of the arms thereof bent over to be directed towards the base thereof to provide the spring arms.

15 Preferably the arms of the second portion of the outer member are coplanar with individual sides of the first portion thereof, and the bases of the first and second portions are coplanar, since this facilitates manufacture of the outer member.

20 With such an outer member the first and second portions are preferably joined by only edge parts of their bases and short portions of each adjacent side wall-arm pair, that is the arms of the second portions are substantially free from the first portion whereby the arms are displaceable laterally of the outer member.

25 Preferably the legs of the outer member are struck from the bases of the first and second portions thereof, each leg being formed with outwardly directed shoulders which will serve to ensure a predetermined depth of insertion of the leg into a hole in a printed circuit board.

30 The dielectric material insert can be formed on its base with a pair of parallel ribs which are received in an aperture in the base of the first portion of the outer member, for example the aperture produced in striking out of the leg therefrom, to locate and insert in its correct position laterally and rearwardly of the first portion.

35 Preferably the dielectric material insert has a flared mouth facing towards the second portion of the outer member, through which mouth the bared end portion of the centre conductor of a coaxial electrical cable can enter the insert to mate with the inner socket member contained therein.

40 The inner socket member is preferably rectangular in cross-section since, as for the outer member, this facilitates manufacture thereof, and can be formed with an inwardly bowed base providing a beam spring, an inserted bared end portion of the centre conductor of a coaxial cable being gripped between this beam spring and the roof of the inner socket member.

45 The leg portion of the inner socket member preferably extends from the forward end thereof and is bent to engage the forward end of a base of the dielectric material insert to help in locating the insert in its correct position forwardly of the first portion of the outer member.

50 One embodiment of an electrical connec-

tor according to this invention will now be described by way of example with reference to the drawings in which:—

Figure 1 is an exploded perspective view of the connector prior to assembly of the parts thereof; 70

Figure 2 is a partly cross-sectional view of the assembled connector and a terminated coaxial electrical cable to be mated therewith; and 75

Figure 3 is a horizontal section through the outer conductive member of the connector.

Referring to the drawings, the connector consists of three parts, namely an outer conductive member 1, a dielectric material insert 2, and an inner conductive member 3. 80

The outer member 1 is stamped and formed from sheet metal, and has a first, rectangular cross-section portion 4 which contains the insert 2, and a second portion 5 of substantially U-shaped cross-section. Free end portions of the arms of the second portion 5 are bent over to form a pair of inwardly directed spring arms 6. As shown in Figure 1 the outer ends 7 of the spring arms 6 are rounded off to facilitate insertion of a coaxial electrical cable as will be described later. 85

The first and second portions 4 and 5 of the outer member 1 are joined at only edge parts of their bases 8 and 9 (Figure 3) and a short part of their side walls 10 and arms 11 extending from their bases 8 and 9, whereby the arms 11 of the second portion 5 can act as cantilever springs. 90

Legs 12 are struck from the bases 8 and 9 of the first and second portions 4 and 5 of the outer member 1, each leg 12 being formed with outwardly directed shoulders 13 (Figure 1) which serve to ensure a predetermined depth of insertion of the leg 12 into a hole 14 in a printed circuit board 15 on which the connector is mounted as shown in Figure 2. 95

The dielectric material insert 2 is formed with a pair of parallel ribs 16 which are received in the aperture 17 in the base 8 of the first portion 4 of the outer member 1, produced on striking out the legs 12 therefrom, to locate the insert 2 in the first portion 4. 100

The dielectric material insert 2 has a flared mouth 18 to facilitate insertion of the centre conductor of a coaxial cable thereinto as will be described later. 105

The free end of first portion 4 of the outer member 1 is closed by an end wall 19, and the insert 2 is retained in the first portion 4 after insertion with the outer member 1 as shown in Figure 1, by bending over of free end portions of the sides 10 of the first portion 1 to form a roof 20 as shown in Figure 2. 110

The inner socket member 3 is also stamped and formed from sheet metal and has a 120

rectangular cross-section socket portion 21 having a leg portion 22 extending from the forward end thereof. During assembly the leg portion 22 is bent from its position shown in Figure 1 to its position shown in Figure 2 in which it extends outside the outer member 1 parallel to the legs 12 thereof, and engages the forward end of the base 23 of the insert 2 to help in locating the insert 2 in the first portion 4 of the outer member 1.

The base of the inner socket member 3 is bowed inwardly to form a beam spring 24 which serves to grip the centre conductor of a coaxial electrical cable as will be described later.

Figure 2 shows the assembled connector positioned on the printed circuit board 15 with the legs 12 of the outer member 1 received in holes 14 in the board 15, and the leg portion 22 of the inner socket member 3 received in a hole 25 in the board 15. For use the connector will be soldered to the board 15 in this position with the legs 12 connected to an earth conductor and the leg portion 22 connected to a signal conductor. Figure 2 also shows a coaxial electrical cable 26 having a centre conductor 27, a dielectric material layer 28, a braided outer shielding layer 29 and an outer protective insulating layer 30. An electrical terminal 31 (as described in U.S. Patent Specification No. 3,828,298) is crimped about the cable 26 with a first part 32 connected to the shielding 29 and a second part 33 gripping the outer layer 30. A bared end portion of the centre conductor 27 of the cable 26 extends beyond the terminal 31.

When the shown terminated end portion of the cable 26 is inserted into the connector the bared end portion of the centre conductor 27 is guided into the insert 2 by the flared mouth 18 thereof and mates with the inner socket member 3, being gripped between the bowed floor beam spring 24 and the roof of the inner socket portion 3. Simultaneously the terminal 31 is received in the second portion 5 of the outer member 1 and is gripped between the spring arms 6 and the base 9 thereof. The centre conductor 27 of the cable 26 is thus connected to the signal conductor on the board 15, and the shielding 29 of the cable 26 is connected to the earth conductor on the board 15. The cable 26 can be simply disconnected from the connector by withdrawal in the direction opposite to the insertion direction.

WHAT WE CLAIM IS:—

1. An electrical connector for connecting a coaxial electrical cable to a printed circuit board and comprising an outer conductive member stamped and formed from sheet metal and having legs for reception in holes in a printed circuit board, the outer member containing a dielectric material insert which serves to separate and electrically insulate

an inner conductive member also contained within the outer member, from the outer member, the inner member having a leg portion extending outside the outer member and parallel to the legs thereof, for reception in a hole in the printed circuit board, in which the outer member comprises a first portion containing the dielectric material insert and a second portion formed with a pair of inwardly directed spring arms adapted to engage an electrical terminal connected to the shielding of a coaxial electrical cable, when inserted in the second portion, and urge the electrical terminal into contact with a base of the second portion, and in which the inner conductive member is stamped and formed from sheet metal to provide a socket for receiving and making electrical connection to a bared end portion of the centre conductor of a coaxial electrical cable inserted therein.

2. A connector as claimed in Claim 1, in which the first portion of the outer member is rectangular in cross-section.

3. A connector as claimed in Claim 1 or 2, in which the second portion of the outer member is substantially U-shaped in cross-section with free end portions of the arms thereof bent over to be directed towards the base thereof to provide the spring arms.

4. A connector as claimed in Claim 3, in which the arms of the second portion of the outer member are coplanar with individual sides of the first portion thereof, and the bases of the first and second portions are coplanar.

5. A connector as claimed in Claim 4, in which the first and second portions of the outer member are joined by only edge parts of their bases and short portions of each adjacent side wall-arm pair.

6. A connector as claimed in any preceding claim, in which the legs of the outer member are struck from bases of the first and second portions thereof, each leg being formed with outwardly directed shoulders.

7. A connector as claimed in any preceding claim, in which the dielectric material insert is formed on its base with a pair of parallel ribs which are received in an aperture in a base of the first portion of the outer member to locate the insert in its correct position in the first portion.

8. A connector as claimed in any preceding claim, in which the dielectric material insert has a flared mouth facing towards the second portion of the outer member.

9. A connector as claimed in any preceding claim, in which the inner socket member is rectangular in cross-section.

10. A connector as claimed in Claim 9, in which the inner socket member is formed with an inwardly bowed base providing a beam spring.

11. A connector as claimed in any pre-

rectangular cross-section socket portion 21 having a leg portion 22 extending from the forward end thereof. During assembly, the leg portion 22 is bent from its position shown in Figure 1 to its position shown in Figure 2 in which it extends outside the outer member 1 parallel to the legs 12 thereof, and engages the forward end of the base 23 of the insert 2 to help in locating the insert 2 in the first portion 4 of the outer member 1.

The base of the inner socket member 3 is bowed inwardly to form a beam spring 24 which serves to grip the centre conductor of a coaxial electrical cable as will be described later.

Figure 2 shows the assembled connector positioned on the printed circuit board 15 with the legs 12 of the outer member 1 received in holes 14 in the board 15, and the leg portion 22 of the inner socket member 3 received in a hole 25 in the board 15. For use the connector will be soldered to the board 15 in this position with the legs 12 connected to an earth conductor and the leg portion 22 connected to a signal conductor. Figure 2 also shows a coaxial electrical cable 26 having a centre conductor 27, a dielectric material layer 28, a braided outer shielding layer 29 and an outer protective insulating layer 30. An electrical terminal 31 (as described in U.S. Patent Specification No. 3,828,298) is crimped about the cable 26 with a first part 32 connected to the shielding 29 and a second part 33 gripping the outer layer 30. A bared end portion of the centre conductor 27 of the cable 26 extends beyond the terminal 31.

When the shown terminated end portion of the cable 26 is inserted into the connector the bared end portion of the centre conductor 27 is guided into the insert 2 by the flared mouth 18 thereof and mates with the inner socket member 3, being gripped between the bowed floor beam spring 24 and the roof of the inner socket portion 3. Simultaneously the terminal 31 is received in the second portion 5 of the outer member 1 and is gripped between the spring arms 6 and the base 9 thereof. The centre conductor 27 of the cable 26 is thus connected to the signal conductor on the board 15, and the shielding 29 of the cable 26 is connected to the earth conductor on the board 15. The cable 26 can be simply disconnected from the connector by withdrawal in the direction opposite to the insertion direction.

WHAT WE CLAIM IS:—

1. An electrical connector for connecting a coaxial electrical cable to a printed circuit board and comprising an outer conductive member stamped and formed from sheet metal and having legs for reception in holes in a printed circuit board, the outer member containing a dielectric material insert which serves to separate and electrically insulate

an inner conductive member also contained within the outer member, from the outer member, the inner member having a leg portion extending outside the outer member and parallel to the legs thereof, for reception in a hole in the printed circuit board, in which the outer member comprises a first portion containing the dielectric material insert and a second portion formed with a pair of inwardly directed spring arms adapted to engage an electrical terminal connected to the shielding of a coaxial electrical cable, when inserted in the second portion, and urge the electrical terminal into contact with a base of the second portion, and in which the inner conductive member is stamped and formed from sheet metal to provide a socket for receiving and making electrical connection to a bared end portion of the centre conductor of a coaxial electrical cable inserted therein.

2. A connector as claimed in Claim 1, in which the first portion of the outer member is rectangular in cross-section.

3. A connector as claimed in Claim 1 or 2, in which the second portion of the outer member is substantially U-shaped in cross-section with free end portions of the arms thereof bent over to be directed towards the base thereof to provide the spring arms.

4. A connector as claimed in Claim 3, in which the arms of the second portion of the outer member are coplanar with individual sides of the first portion thereof, and the bases of the first and second portions are coplanar.

5. A connector as claimed in Claim 4, in which the first and second portions of the outer member are joined by only edge parts of their bases and short portions of each adjacent side wall-arm pair.

6. A connector as claimed in any preceding claim, in which the legs of the outer member are struck from bases of the first and second portions thereof, each leg being formed with outwardly directed shoulders.

7. A connector as claimed in any preceding claim, in which the dielectric material insert is formed on its base with a pair of parallel ribs which are received in an aperture in a base of the first portion of the outer member to locate the insert in its correct position in the first portion.

8. A connector as claimed in any preceding claim, in which the dielectric material insert has a flared mouth facing towards the second portion of the outer member.

9. A connector as claimed in any preceding claim, in which the inner socket member is rectangular in cross-section.

10. A connector as claimed in Claim 9, in which the inner socket member is formed with an inwardly bowed base providing a beam spring.

11. A connector as claimed in any pre-



ceding claim, in which the leg portion of the inner socket member extends from the forward end thereof and is bent to engage the forward end of a base of the dielectric material insert to help in locating the insert in its correct position in the first portion of the outer member.

12. An electrical connector substantially as hereinbefore described with reference to the drawings.

For the Applicants,
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