

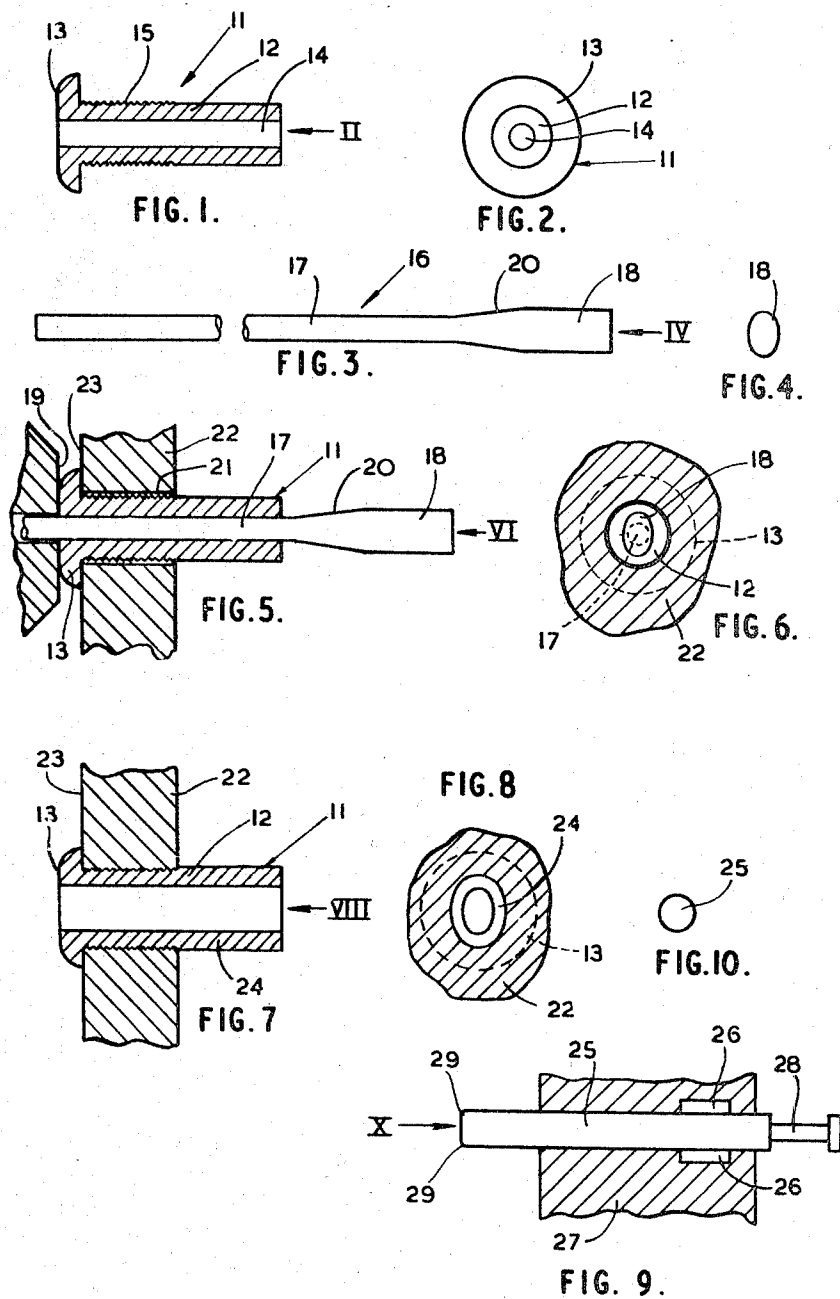
Jan. 19, 1971

F. A. SUMMERLIN

3,555,673

ELECTRICAL CONNECTOR SOCKET

Original Filed Dec. 11, 1967



INVENTOR
FREDERICK A. SUMMERLIN
Kenyon, Kalmus & Costello
ATTORNEYS

1

3,555,673

ELECTRICAL CONNECTOR SOCKET

Frederick Arthur Summerlin, Harpenden, England, assignor, by mesne assignments, to Aerpat A.G., Zug, Switzerland, a Swiss company

Original application Dec. 11, 1967, Ser. No. 689,582.

Divided and this application Mar. 18, 1969, Ser. No. 817,227

Claims priority, application Great Britain, Dec. 16, 1966, 56,541

Int. Cl. H02g 15/00

U.S. Cl. 29—629

3 Claims

ABSTRACT OF THE DISCLOSURE

An electrical connector socket, for mating with a pin of circular cross-section, comprises a tubular member of substantially elliptical internal cross-section, such that the diameter of the pin is intermediate the internal major and minor diameters of the socket. The socket may be manufactured and installed by drawing a die or former (such as the mandrel of a blind-riveting tool), having a substantially elliptical cross-section, through a tubular member.

This application is a division of Ser. No. 689,582, filed Dec. 11, 1967, now abandoned.

The invention relates to electrical connector sockets, and also to methods and apparatus for manufacturing and installing them.

It is an object of the invention to provide an improved electrical connector socket which can be repeatedly mated with a plugpin and still grip the latter consistently.

It is another object of the invention to facilitate the manufacture and repetitive installation of such sockets.

These and further objects of the invention will become apparent to those skilled in the art from the following description of how the invention may be put into practice.

Some embodiments of the invention will now be described by way of example (but not by way of limitation of the invention) and with reference to the accompanying drawings, in which:

FIG. 1 is a longitudinal axial section through a headed tubular member before completion of manufacture and installation as a socket;

FIG. 2 is an elevation taken in the direction of the arrow II in FIG. 1;

FIG. 3 is an elevation of a mandrel according to the invention;

FIG. 4 is an end elevation taken in the direction of the arrow IV in FIG. 3;

FIG. 5 is a sectional view through the tubular member of FIG. 1 threaded on the mandrel of a riveting gun (the mandrel being shown not in section) inserted in an aperture in a printed circuit board in which it is to be installed;

FIG. 6 is an elevation taken in the direction of the arrow VI in FIG. 5;

FIG. 7 is a section similar to FIG. 5 showing the installed connector;

FIG. 8 is an elevation in the direction of the arrow VIII in FIG. 7;

FIG. 9 is a partial section through a plug showing a pin suitable for insertion in the installed socket; and

FIG. 10 is a view of the pin in the direction of the arrow X in FIG. 9.

The tubular member 11 shown in FIGS. 1 and 2 is made of tinned or cadmium-plated brass and has a cylindrical body 12 formed with an integral head 13 in the form of an outwardly radially extending flange at one end. A cylindrical bore 14 extends throughout the member. The portion 15 of the exterior of the body adjacent the head is diamond knurled or otherwise roughened.

2

The mandrel 16 shown in FIGS. 3 and 4 is of steel and has an elongated cylindrical shank 17 and an enlarged head 18 which is of elliptical cross-section. The diameter of the shank 16 is such that when the tubular member 11 is threaded thereon it is an easy sliding fit (the term "threaded" is here used in the sense of "beads threaded on a string" and not "screw threaded"). The minor diameter of the elliptical mandrel head 18 is slightly larger than the internal diameter of the bore 14, and the major diameter of the head is less than the external diameter of the tubular body. The head merges into the shaft by means of a smooth taper 20.

The mandrel is used in conjunction with a tool which provides for relative axial movement between the mandrel and an annular anvil (indicated at 19 in FIG. 5) through which the mandrel protrudes. Preferably the anvil is split and is provided by movable jaws which can open to allow the passage of a tubular member (threaded on the mandrel shank) therethrough and can then close to provide an abutment for the head of the tubular member whilst the mandrel head is pulled through the latter to expand it. Thus a plurality of tubular members can be pre-threaded upon the shank of a mandrel (each with its tail end towards the mandrel head), allowing the installation in rapid succession of a number of sockets in the manner to be described.

FIGS. 5 to 8 illustrate the installation of the tubular member 11 in an aperture 21 in a printed circuit board 22 which has its printed circuit on one side 23. The circular aperture 21 is of such a diameter that the knurled part 15 of the tubular member is an easy fit in the aperture, and the thickness of the board 22 is approximately equal to the length of that knurled part.

As illustrated in FIG. 5, the tubular member 11, threaded on the shank 17 of the mandrel, with its head 13 adjacent the anvil 19 and its tail end adjacent the narrow end of the taper 20, is inserted into the aperture 21. The operator presses the tool so that the anvil presses the head 13 of the tubular member into contact with the surface 23 of the board 22. The tool is then operated to move the mandrel axially into the anvil of the tool, thus drawing the mandrel head completely through the tubular member. This has the effect of radially enlarging the tubular member, and the result is illustrated in FIGS. 7 and 8. The part of the tubular body within the aperture 21 is expanded so that the knurled surface 15 bites into the board and securely holds the connector against both axial and rotational movement relative to the board. The tail part of the tubular connector which projects clear of the board is expanded so that its cross-section is elliptical and moreover is of predetermined cross-sectional dimensions (since the dimensions of the mandrel head, and the initial dimensions of the tubular body and its mechanical properties, are predetermined). Thus the action of expanding the tubular member by passing the mandrel head through it both completes its manufacture (by making its projecting tail part elliptical) and installs it in position in the printed circuit board (by causing the knurled part to grip the board).

The projecting tail part 24 of the connector provides a socket, electrically connected to the part of the printed circuit on the board surface 23 under the head 13, which is deformable and can mate with a suitable pin. One example of such a pin is shown in FIGS. 9 and 10. This pin comprises a solid cylindrical body 25 of a diameter intermediate the minor and major internal diameters of the tail part 24 of the socket 11. In this example the pin forms part of a multi-pin plug and has lugs 26 by which it is held in an electrically insulating body 27, and also a suitable head 28 for soldered connection of a wire. The pin has its leading end slightly chamfered or bevelled at 29, to facilitate insertion of the pin into the socket. Since it is desirable

3

that the socket grips the pin adequately, even after repeated insertion and removal, it is preferable that the minor internal diameter of the part 24 of the installed socket is smaller, rather than larger, than is strictly necessary. Hence on the initial insertion of the pin into the socket, the part 24 of the socket suffers so much deformation that, when the pin is withdrawn, the internal diameter does not return to its original dimension but is slightly larger. In other words, some permanent set remains. However, on subsequent insertions and removal of the pin (or a pin of the same diameter) the socket will not be deformed to any greater extent than on the initial insertion, and it will always return to substantially the same dimensions on removal of the pin. Thus any pin (provided it is of the same diameter) will always be gripped by the socket with substantially the same force, thus ensuring consistent mechanical retention and electrical contact. In these ways, the tubular socket of elliptical (or substantially elliptical) cross-section of this example is advantageous.

The specific form of socket of this example, and the methods of manufacturing and installing it, are also advantageous. A multiplicity of sockets can be installed quickly and easily using any convenient manually, pneumatically, or hydro-pneumatically, actuated tool. Fixing of the socket to the support is automatic, as is the formation of the predetermined internal cross-sectional shape of the socket, by use of a mandrel with an elliptical head.

The invention is not restricted to the details of the foregoing examples. For instance, sockets of elliptical cross-section could be manufactured in other ways. The tubular member need not be circular in cross-section initially; it could, for example, be elliptical. The internal cross-section of the socket need not be absolutely elliptical, provided that it functions satisfactorily in use. The minor diameter of the mandrel head need not necessarily be greater than the initial diameter of the bore of the tubular member, although this would produce less secure fixing of the socket in its support. A socket may be installed in supports other than a printed circuit board; electrical connections may be made to it e.g. by soldering.

In practice, a multi-pin plug and socket assembly must be provided with some lateral float of the pins and/or sockets, to allow for misalignment. When, as in the example described above, the sockets are securely mounted in a substantially rigid printed circuit board, it would be necessary to provide the float in the pins of the plug.

Alternatively, the or each pin may have a wire connected to it by, for example, crimping or soldering, and be used as a wander plug (to provide a flying lead), instead of in a multi-pin plug.

4

Although one specific way of putting the invention into practice has been described, it will be appreciated that the invention may be put into practice otherwise than described whilst remaining within the scope of the appended claims.

What is claimed is:

1. A method of assembling at least one connector pin member of circular cross section to an apertured support, comprising the steps of:

inserting a headed tubular member of annular cross section into an aperture in said support with the head engaging one side of the support and with a part of the member projecting clear of the opposite side of the support, the internal shape of the tubular member substantially complementing that of the pin; plastically deforming both the internal and external peripheries of said tubular member and simultaneously securing said tubular member to the aperture wall of the support by passing a mandrel through the bore of said tubular member, said mandrel being substantially elliptical in cross section having a major diameter greater than the diameter of said pin and a minor diameter less than the diameter of said pin; and

frictionally inserting the pin into the deformed and secured tubular member.

2. A method as defined in claim 1 in which said mandrel is the operating mandrel of a blind riveting gun.

3. A method as defined in claim 2 in which a plurality of tubular members are loaded on said mandrel to enable a fast sequence of placing of said members in apertured workpieces.

References Cited

UNITED STATES PATENTS

608,178	8/1898	Cock	29—523X
2,150,361	3/1939	Chobert	29—282X
2,146,461	2/1939	Beltington.	
2,465,144	3/1949	Wyatt.	
2,507,979	5/1950	Kelar.	
2,545,527	3/1951	Maxwell.	
2,815,255	12/1957	Phillips et al.	
1,116,507	11/1914	Smith	227—60

JOHN F. CAMPBELL, Primary Examiner

R. W. CHURCH, Assistant Examiner

U.S. Cl. X.R.

29—281, 282, 523, 630; 85—37, 73, 74, 87; 227—60, 61, 62; 339—220, 256