Jan. 9, 1968 H. J. REDD ET AL 3,363,220

ELECTRICAL CONNECTOR

Filed Jan. 12, 1966

Fig. 1

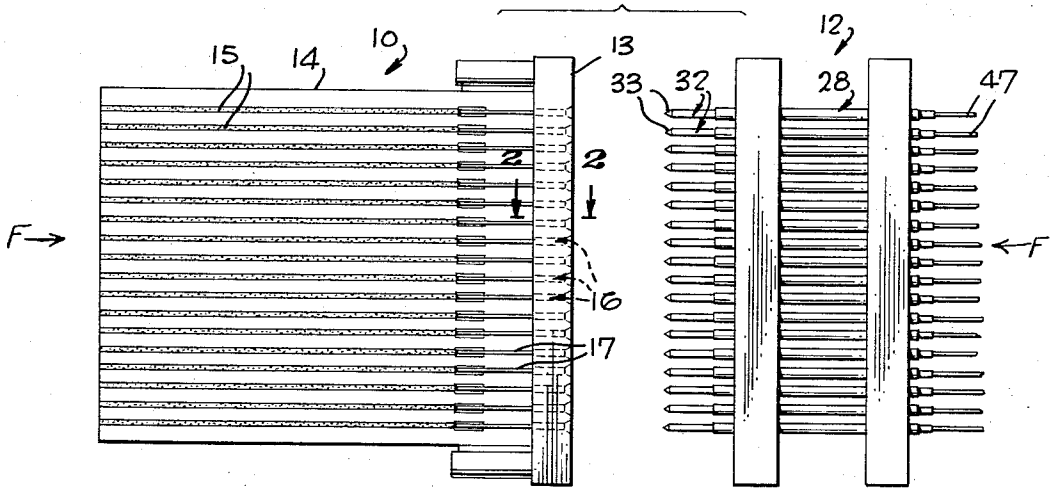


Fig. 2

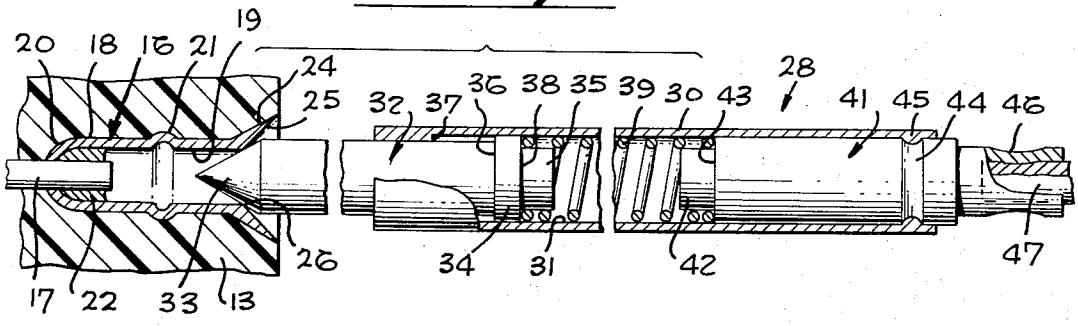
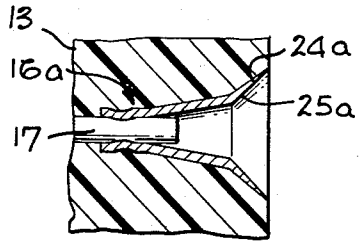


Fig. 3



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ELECTRICAL CONNECTOR

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ABSTRACT OF THE DISCLOSURE

A connector having male and female electrical electrodes each contoured to contact each other along substantially a line contact, said connector having particular application for a positive, low current connection.

This invention pertains to an electrical connector, and more particularly to such a connector which is adapted for use in test equipment, and the like.

In the use of automatic test equipment, and the like, it frequently is necessary to bring out many test points to a position where they can be sampled by a computer-controlled piece of test equipment.

It is customary to connect a plurality of male electrodes to plurality of female electrodes by a cam which is adapted to supply sufficient force to force them into engagement and force them loose upon disengagement of the plugs.

The electrode combination of this invention uses a conically shaped male and a conically shaped female electrode with the male electrode contacting the female electrode in substantially a line contact. To this end, the apex angle of the conically shaped female electrode is greater than the apex angle of the male electrode. The female electrode is then relieved to prevent surface contact between the male and female electrodes except along the line of intersection of the two cones.

In a preferred embodiment, each of the male electrodes is spring-biased into engagement with the female electrode. Typically, the bearing stress on the line of contact between the male and female electrodes may be of the order of 17 to 18 pounds per square inch or higher.

It is therefore an object of this invention to provide a male-female electrode combination which has a positive contact, and which is easily engaged and disengaged.

More particularly, it is an object of this invention to provide such a male-female electrode pair that is adapted to be used in sets and multiple sets.

It is a more specific object of this invention to provide a male-female electrode pair which is adapted for use in connecting test equipment to equipment to be tested.

Other objects will become apparent from the following description, taken in connection with the accompanying drawing in which:

FIGURE 1 shows a multiple electrode male and female plug using the male-female electrode pairs of this invention;

FIGURE 2 is a view, partly in section, taken at 2—2 in FIGURE 1; and

FIGURE 3 is a view, partly in section, of a modified female electrode.

Referring to FIGURE 1, a circuit board **10** may be connected to a female plug body **13**. A male plug **12** in which the individual male connectors **32** are aligned with the female connectors **16** is shown in FIGURE 1.

The individual male and female members of each plug is shown more particularly in FIGURE 2. In FIGURE 2, the male plug **32** is shown with a conical end **33** having a predetermined apex angle. The female plugs **16** are shown with a conical surface **25** having a predetermined apex angle which is greater than the first mentioned apex angle of the line contact at **26** which is substantially circular. The female conical contact **25** is truncated at the line of contact **26** to prevent contact between the male point **33** and the female member **16** in the region **19**. The female plug member **16** of FIGURE 2 is shown with the clearance portion **19** substantially cylindrical.

The male plug **32** is biased toward the female plug **16** by a spring **39** which engages between a fixed shoulder **43** and a shoulder **38** attached to the male plug member **32**.

Electrical wires **17** may be attached to the female plug, for example by solder **22**. Electrical connections may be attached by a coupling member **47** to the male plug.

Preferably the members **16, 32, 30,** and **41** are made, for example, of metallic conducting material.

An alternative embodiment of the female plug is shown in FIGURE 3. In FIGURE 3, the relieved portion is shown as a conical portion which has an apex angle that is smaller than the apex angle of the conical member **33**.

It is evident that the region of the conical point **33** in the vicinity of the apex of the cone may be truncated or rounded at the convenience of the manufacturer and, in fact, may be spherical instead of conical.

Although the male member is shown with the point **32** sliding in a sleeve **30**, other configurations of that portion of the male plug may be used.

In operation, a plurality of test points are attached, for example, to the female member, and a plurality of computer-controlled test equipment may be connected to the male plugs. Alternatively, the male and female connections may be reversed.

Force to the connecting of the male and female plugs is shown by the arrows designated by the symbol F.

Although the structure of the plug of this invention has been described above, it is not intended that the invention should be limited by that description, but only in accordance with the spirit and scope of the appended claims.

We claim:

1. A miniature connector having low force engagement and disengagement of its members along a circular line contact for low resistance and low current applications comprising: a hollow rigid female contact member provided with an inwardly converging inner surface extending from an outer end to a contact position defining a small circular opening disposed in advance of its inner end, a rigid male contact member provided with a conically shaped end portion having a smaller angle of convergence than the female contact member but extending along its length to a base portion that is larger than the circular opening in the female contactor whereby the coaxial abutment of said male and female members occurs along a substantially circular line contact at that contact position of the female contact member defining the small circular opening and at a position on the conical surface of said male member, a forward portion of the conical surface of said male member projecting into said circular opening in the female member and a rearward portion of the conical surface of the male contact member disposed outside of said opening, and spring biasing means for maintaining the contacts in abutment.

2. A plural electrode connector as in claim **1**, comprising a plurality of said rigid female contact members spaced apart from one another and disposed in a supporting member, and a like plurality of said male contact members spaced apart and disposed in a second supporting member in substantial coaxial alignment with said female contact members.

3. A plural electrode connector as in claim **1**, having a

plurality of said female contact members being supported inside an insulating block member provided with a planar outer surface and with a plurality of said male contact members being supported by and projecting from a second insulating block member, and with each of said male contact members in substantial coaxial alignment with a corresponding one of the female contact members.

References Cited

UNITED STATES PATENTS

2,728,062	12/1955	Klostermann	339—255
2,742,626	4/1956	Collins et al.	339—255 X
3,002,173	9/1961	Allen	339—95
3,070,770	12/1962	Mercier	339—255 X
3,204,284	9/1965	Merriman	339—103

FOREIGN PATENTS

945,667	11/1948	France.
942,609	4/1956	Germany.

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