March 6, 1962 E. L. VAN DEUSEN 3,024,437

CONDUCTOR CONNECTING MEANS

Filed Sept. 2, 1959

FIG. 1.

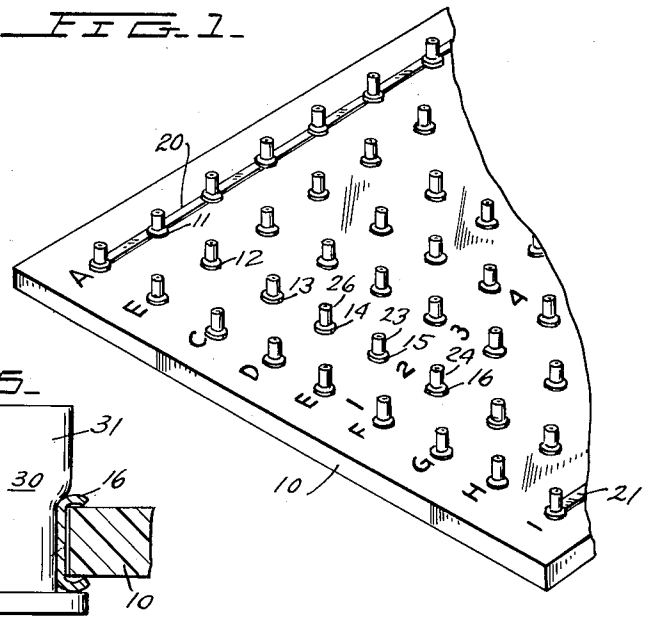


FIG. 6.

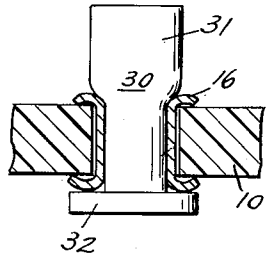


FIG. 2.

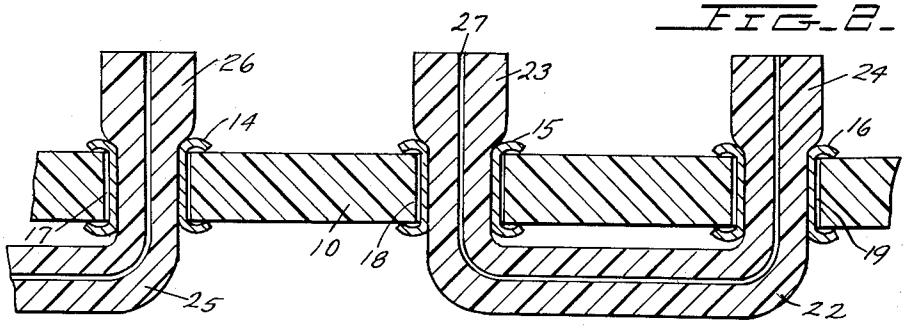


FIG. 3.

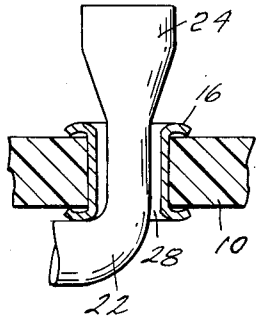


FIG. 4.

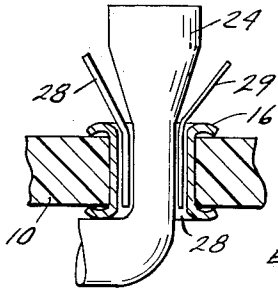
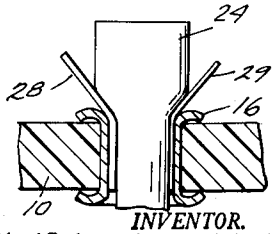


FIG. 5.



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CONDUCTOR CONNECTING MEANS

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8 Claims. (Cl. 339—18)

This invention relates to an electrical connecting device having particular application to permitting easy assembly of an electrical test circuit as by being disposed in what is commonly known as a "breadboard."

The connector of the invention permits the easy connection and disconnection of a plurality of electrical conductors to one another regardless of the relative configuration or diameter of the conductors. In a preferred embodiment of the invention, I form a conductive eyelet having a compressible member extending therethrough which may be, for example, natural rubber. The extensible insert is relatively fixed at one side of the eyelet whereby, if the other end of the extensible insert is pulled, the sides of the insert will contract to provide a space between the side of the insert and the eyelet. A plurality of conductors may then be inserted in this space, and the extensible insert can be released and permitted to expand so that the conductors, regardless of their configuration, will be pressed into engagement with the common conductive eyelet and thus be electrically connected.

In order to release this electrical connection, one merely extends the insert to release the contact pressure, and the conductors may be withdrawn from the space between the extended insert and the eyelet sides.

Accordingly, a primary object of this invention is to provide a novel electrical connector for permitting rapid connection and disconnection of a plurality of electrical conductors.

Another object of this invention is to provide a novel electrical connecting means which permits rapid connection and disconnection of a plurality of conductors having dissimilar configurations.

A still further object of this invention is to provide an electrical connector for a breadboard wherein the connector is easily formed by mass production techniques to permit rapid connection and disconnection of electrical connectors.

A still further object of this invention is to provide a novel electrical connector comprised of an eyelet having an extensible insert therein wherein extension of the insert causes it to contract to provide a space for insertion of electrical conductors whereby releasing the extensible insert causes it to expand and drive the connectors into high pressure engagement with respect to the eyelet.

A further object of this invention is to provide an extensible member which normally engages a conductive member whereby a strain applied to the extensible member distorts it away from the conductor to provide a space between the extensible member and conductive member for receiving at least two conductors which are to be connected together.

These and other objects of my invention will become apparent from the following description when taken in connection with the drawings, in which:

FIGURE 1 shows a fragmentary perspective view of a novel breadboard equipped with the connectors of the present invention.

FIGURE 2 shows a cross-sectional view through three of the eyelets of the breadboard of FIGURE 1.

FIGURE 3 shows a cross-sectional view of one of the eyelets of FIGURE 2 when the extensible insert is distorted by a strain.

FIGURE 4 is similar to FIGURE 3, and shows the insertion of two electrical conductors in the space formed between the extended extensible insert and the eyelet.

FIGURE 5 is similar to FIGURE 4, and shows the manner in which the extensible insert expands when it is released to force the electrical conductors into high pressure contact engagement with respect to the eyelet.

FIGURE 6 shows a cross-sectional view through one of the eyelets of FIGURE 1 wherein a different type of extensible insert is used.

Referring now to FIGURE 1, I have generally shown a breadboard body **10** which is a square or rectangular-shaped board and is formed, for example, of a cellulose-filled phenolic. The board **10** has a plurality of holes drilled therein which receive eyelets such as eyelets **11**, **12**, **13**, **14**, **15** and **16**, which are arranged in any desired mesh configuration to provide a plurality of connecting points for connecting some particular circuit array. The eyelets are preferably of a high conductivity material, such as gold-plated brass.

As best seen in FIGURE 2 which shows a cross-sectional view through eyelets **14**, **15** and **16**, the eyelets extend through cooperating apertures **17**, **18** and **19** in board **10**, and are then flanged outwardly by an appropriate tool to be secured within their respective board openings. The end eyelets, such as eyelet **11**, have a common bus **20**, as shown in FIGURE 1, which electrically connects all of the eyelets of row A so as to provide a ground connection where a great number of conductors must be connected to ground; and in a like manner a conductor **21** connects all of the eyelets of the bottom row I. Conductors **20** and **21** are of any desired conductive material, such as a copper-foil having a thickness of 0.005 inch .

A U-shaped extensible insert **22** which may be of natural rubber forms an extensible insert for each of eyelets **15** and **16**, and protrudes through the top of the board **10** with upper extensions **23** and **24** respectively. In a like manner, a U-shaped extensible member **25** will cooperate with eyelets **13** and **14** with extension **26** extending beyond the top of eyelet **14**.

In order to retain U-shaped members, such as members **25** and **22** to the board, the extending portions **23**, **24** and **26** will have an enlarged diameter as shown in the figure. To insert the extensible inserts in their respective apertures, it is clear that the enlarged diameter will be reduced as by stretching when the material at this portion is extended so that it can fit through the smaller diameter eyelets. In order to permit easy extension of extensible members, such as members **22** and **25**, a central opening, such as opening **27**, is provided in the inserts.

In operation, when it is desired to connect a plurality of conductors to one another where the conductors could be the "pigtail leads" of a resistor, capacitor or transistor, or the like, they can be connected, for example, through eyelet **16** of FIGURE 2. Thus, as is shown in FIGURE 3, the extension **24** is distorted or pulled upwardly, as illustrated, whereby the portion of the insert extending through eyelet **16** will contract to produce an annular-shaped opening **28***a* between the outer diameter of member **22** extending through eyelet **16** and the inner diameter of eyelet **16**.

The conductors, such as conductors **28** and **29** of FIGURE 4, which are to be connected to one another (and may have different diameters or configurations) are then inserted in the annular-shaped opening **28***a*. The extension **24** is then released, as shown in FIGURE 5, whereby the material extending through the eyelet expands and firmly presses conductors **28** and **29** into engagement with eyelet **16**.

In order to disconnect these members it is only necessary to again grasp manually operable extension **24** and pull it outwardly to form the annular opening **28***a*, whereby the conductors **28** and **29** may be easily removed from the annular opening.

It will be apparent that this type of electrical connection is extremely rapid whereby a complete circuit can be connected together as for experimental purposes. Furthermore, since the connector provides a high pressure contact, soldering is not necessary whereby elements such as transistors, diodes and other semi-conductor components which are particularly sensitive to heat will not be damaged during the experimental stages associated with the use of the breadboard of FIGURE 1.

While the embodiment of FIGURES 2 through 5 illustrate the extensible insert for each of the eyelets as being formed of a single U-shaped extensible member which serves adjacent pairs of eyelets, it will be apparent that each eyelet may have a respective extensible insert. For example, in FIGURE 6, I have illustrated eyelet **16** of board **10** as being equipped with an extensible insert **30** of natural rubber wherein the extensible insert is formed with the enlarged extension **31** which is substantially identical to extensions **23**, **24** and **26** of FIGURE 2. However, the insert is retained with respect to eyelet **16** by providing an extended flange **32**.

Clearly, however, it is only necessary that one end of the extensible insert associated with each eyelet be retained in any manner desired in order to practice the present invention. Note also that the embodiments of FIGURES 2 and 6 have the additional advantage of providing an inherently insulated base for the complete breadboard unit.

Although I have described preferred embodiments of my novel invention, many variations and modifications will now be obvious to those skilled in the art, and I prefer therefore to be limited not by the specific disclosure herein but only by the appended claims.

I claim:

1. An electrical connector for connecting a first and second conductor; said electrical connector comprising a conductive member and an extensible member; at least a portion of said extensible member having a normally engaging position with respect to at least a portion of said conductive member; said extensible member having an exposed manually operable portion; said portion of said extensible member being distorted away from said normally engaging position with respect to said portion of said conductive member when strain is applied to said exposed manually operable portion of said extensible member and providing a space for insertion of said first and second conductors adjacent said conductive member; release of strain on said exposed manually operable portion of said extensible member causing said extensible member to rigidly drive said first and second conductors into engagement with respect to said conductive member.

2. An electrical connector for connecting a first and second conductor; said electrical connector comprising a conductive member and an extensible member; at least a portion of said extensible member having a normally engaging position with respect to at least a portion of said conductive member; said extensible member having an exposed manually operable portion; said portion of said extensible member being distorted away from said normally engaging position with respect to said portion of said conductive member when strain is applied to said exposed manually operable portion of said extensible member and providing a space for insertion of said first and second conductors adjacent said conductive member; release of strain on said exposed manually operable portion of said extensible member causing said extensible member to rigidly drive said first and second conductors into engagement with respect to said conductive member; said conductive member comprising an eyelet.

3. An electrical connector for connecting a first and second conductor; said electrical connector comprising a conductive member and an extensible member; at least a portion of said extensible member having a normally engaging position with respect to at least a portion of said conductive member; said extensible member having an exposed manually operable portion; said portion of said extensible member being distorted away from said normally engaging position with respect to said portion of said conductive member when strain is applied to said exposed manually operable portion of said extensible member and providing a space for insertion of said first and second conductors adjacent said conductive member; release of strain on said exposed manually operable portion of said extensible member causing said extensible member to rigidly drive said first and second conductors into engagement with respect to said conductive member; said conductive member comprising an eyelet; said extensible member comprising a plug of elastic insulating material extending through said eyelet.

4. An electrical connector; said electrical connector comprising an eyelet of conductive material and an insert of elastic insulating material in said eyelet; said insert of elastic insulating material being extensible within said eyelet to contract the sides of said insert of elastic insulating material in said eyelet to permit insertion of electrical conductors between said insert and said eyelet.

5. An electrical connector for an electrical breadboard; said electrical connector comprising an eyelet of conductive material and an insert of elastic insulating material in said eyelet; said insert of elastic insulating material being extensible to contract the sides of said insert of elastic insulating material in said eyelet to permit insertion of electrical conductors between said insert and said eyelet.

6. An electrical connector; said electrical connector being comprised of a hollow conductive member having an insert of extensible material therein; one end of said extensible material being substantially fixed with respect to said hollow member of conductive material; the other end of said extensible member being relatively free to move with respect to said hollow conductive member; said rubber insert being extensible within said hollow electrical conductor extension of said relatively movable end of said extensible member causing contraction of portions of said extensible member within said hollow conductive member to form a space between said extensible member and said hollow conductive member; said space being adapted to receive at least a first and second electrical conductor to be connected to one another; said first and second electrical conductors being driven into high pressure contact engagement with said conductive member when said relatively movable end of said extensible member is released and said extensible member expands within said hollow conductive member.

7. An electrical connector for an electrical breadboard; said electrical connector comprising an eyelet of conductive material and an insert of elastic insulating material in said eyelet; said insert of elastic insulating material being extensible within said insert to contract the sides of said insert of elastic insulating material in said eyelet to permit insertion of electrical conductors between said insert and said eyelet; said breadbroad having an upper surface and a lower surface; a portion of said insert of elastic insulating material extending below said lower surface of said breadboard to form an insulating support for said breadboard.

8. An electrical connector comprising a hollow electric conductor having an insert of elastic insulating material extending therethrough; a first portion of said insert of elastic insulating material being substantially fixed with respect to said hollow conductor; a second portion of said insert of elastic insulating material extending beyond one end of said hollow conductor; said insert of elastic insulating material being extensible within said hollow electrical conductor to contract the walls of said

insert from the inner walls of said hollow conductor to provide a conductor receiving area.

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