Aug. 23, 1966 E. E. ORTNER 3,268,774

ENCAPSULATED DIODE ASSEMBLY

Filed May 29, 1964

FIG. 1.

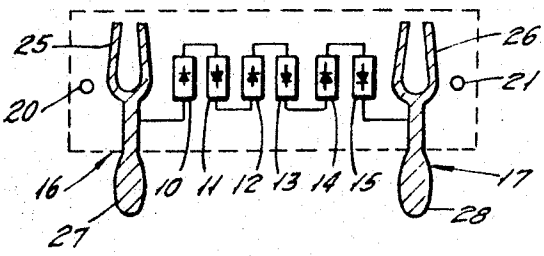


FIG. 2.

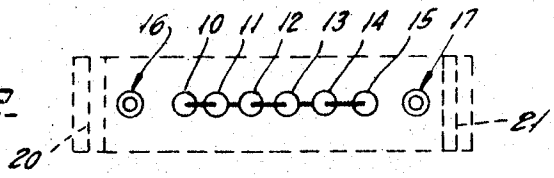


FIG. 3.

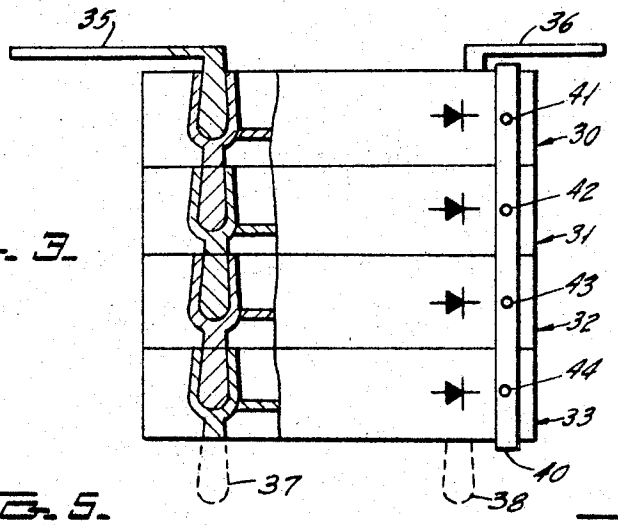


FIG. 5.

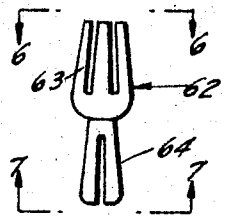


FIG. 8.

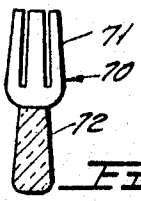


FIG. 6.



FIG. 7.

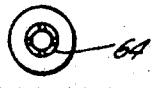
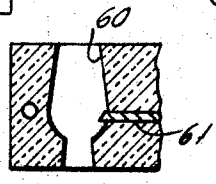


FIG. 4.



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ENCAPSULATED DIODE ASSEMBLY

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4 Claims. (Cl. 317—101)

This invention relates to a novel diode assembly structure, and more specifically relates to a diode assembly structure wherein diodes are encapsulated in a support body having extending plug connectors and sockets which may be easily stacked and connected to one another to form diode assemblages containing a large number of diodes.

A primary object of this invention is to provide a novel encapsulated diode assembly which can be easily connected to other similar assemblies to form various rectifier configurations.

Another object of this invention is to provide a novel plug-in rectifier module.

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

FIGURE 1 shows a side cross-sectional view of a single module manufactured in accordance with the present invention.

FIGURE 2 shows a top view of FIGURE 1.

FIGURE 3 illustrates the connection of a plurality of modules of the type shown in FIGURES 1 and 2.

FIGURE 4 shows a partial cross-sectional view of the encapsulation medium for one of the modules wherein plug connectors can be connected to the module in a simplified manner.

FIGURE 5 illustrates a plan view of a typical connector that can be used with the device of FIGURE 4.

FIGURE 6 is a top view of the connector of FIGURE 5.

FIGURE 7 is a bottom view of the connector of FIGURE 5.

FIGURE 8 is a partial cross-sectional view of a connector similar to that of FIGURE 5, but which has an insulated projecting section.

Referring now to FIGURES 1 and 2, I have illustrated therein a typical module constructed in accordance with the invention which is formed of a series connection of diode elements **10** through **15**. Each of diodes **10** through **15** may be of the type disclosed in copending application Serial No. 261,109 filed February 26, 1963 entitled Semiconductor Device Housing and assigned to the assignee of the present invention. These diodes **10** through **15** are each connected in series with one another, and terminate on plug-type connectors **16** and **17**, respectively.

The complete assembly is then encapsulated in a suitable insulation medium, as schematically illustrated by the dotted lines in FIGURE 1, where the encapsulation medium preferably has openings such as openings **20** and **21** therein which can serve to receive mounting means which supports the module in a suitable support frame.

The connectors **16** and **17** are seen to comprise two sections. The upper sections are female-type sections **25** and **26**, respectively, while the lower sections are male-type sections **27** and **28**, respectively. Note that the male sections **27** and **28** project through the encapsulation surface for a length corresponding to the depth of female sections **25** and **26**. Moreover, the cross-sectional shape of sections **27** and **28** conform to the shapes of sections **25** and **26**, with means being provided for permitting the snap-type entrance of sections **27** and **28** into the equivalent sections **25** and **26** of an adjacent module.

In operation, modules of the type shown in FIGURES 1 and 2 may be stacked in the manner shown in FIGURE 3 for the stacking of modules **30**, **31**, **32** and **33**. Clearly, this stacking is easily done and will define an electrical circuit having the parallel connection of twenty-four diodes.

Suitable electrical terminal conductors may be formed in the manner illustrated by terminal conductors **35** and **36** which are received by the female conductor portions of the upper module **30**. The projecting sections **37** and **38** of lower module **33** may then be capped by a suitable insulation cap or can be clipped off to prevent their accidental short circuiting.

The complete assembly is then held in position, for example, by a frame member such as frame member **40** which has suitable securing means such as screws **41**, **42**, **43** and **44** passing therethrough and through corresponding openings such as opening **21** of FIGURES 1 and 2 of modules **30** through **33**. A similar securement means will be received by the openings in the left-hand side of modules **30** through **33**, but is not shown in FIGURE 3.

While FIGURE 3 shows the modules connected in parallel circuit relation, it will be apparent to those skilled in the art that this arrangement could be modified whereby the modules are connected in series with one another or can be connected in various series-parallel arrangements. For a direct series connection, the modules **31** and **33** would be reversed; the projecting male sections of the connectors at the left-hand side of modules **30** and **32** and at the right-hand side of module **31** would be removed or insulated from its adjacent module, and terminal **36** would be connected to the left-hand end of module **33**.

The module structure shown in the figures may, of course, be modified in many ways. By way of example, the module structure may be formed to leave an opening **60** in the module of the shape shown in FIGURE 4 with lead conductor **61** extending into opening **60** with the encapsulating medium being flexible enough to permit connection of suitable connectors. For example, opening **60** may cooperate with a removable connector section such as the snap-type connector **62** of FIGURE 5 which could be snapped into opening **60**.

The connector **62** of FIGURE 5 has an upper female-type section **63** which is formed of slit sections in the usual manner to permit spreading of section **63** when making snap connection to a suitable male connector.

In a similar manner, the lower male-type section **64** of FIGURES 5 and 7 is also formed of a plurality of slit sections. Clearly, when the connector of FIGURE 5 is inserted into opening **60** in FIGURE 4, there will also be engagement between lead **61** and the conductive connector body.

As indicated above, it is frequently desirable to have the lower male-type section of the connector (or alternatively, the female section of a connector) electrically insulated from the adjacent connector of the next module. This would be necessary, for example, when arranging the modules in series relation.

FIGURE 8 illustrates a connector **70** which can be snapped into opening **60** of FIGURE 4, and includes the conductive upper section **71** with a lower insulation body **72**. The insulation body **72** can, if desired, be slit in the manner illustrated in FIGURES 5 and 7 for conductive sections **64**. The insulation section **72** is provided solely for mechanical purposes. It can, of course, be eliminated if desired with all mechanical connection between adjacent modules being accomplished by the cooperating conductive sections and clamps such as the clamp **40**.

Although this invention has been described with respect to its preferred embodiments, it should be under-

stood that many variations and modifications will now be obvious to those skilled in the art, and it is preferred therefore that the scope of the invention be limited not by the specific disclosure herein but only by the appended claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. A diode module comprising a plurality of series connected diodes arranged in a predetermined manner, first and second connectors connected to the respective ends of said series connection of diodes and an encapsulation medium for encapsulating said first and second connectors and said plurality of series connected diodes; said encapsulation medium having a first and second smooth opposing surfaces; said first and second connectors being elongated in a direction perpendicular to said first and second smooth surfaces; said first and second connectors having respective female sections extending from said first surface; said first connectors having a male section extending from the end of said female section; said male section extending through said second surface for a distance substantially equal to the depth of said female section.

2. The device substantially as set forth in claim **1** wherein said second connector has an extending male section identical to said male section of said first connector.

3. The device substantially as set forth in claim **1** wherein said male section has dimensions for electrical connection with said female section of said first and second connector.

4. The device substantially as set forth in claim **1** wherein said encapsulation medium has third and fourth smooth opposing surfaces perpendicular to said first and second surfaces; and a mounting opening extending through said encapsulation medium from said third surface to said fourth surface.

References Cited by the Examiner

UNITED STATES PATENTS

2,938,068	5/1960	Silverschotz	339—17 X
3,196,318	7/1965	Richardson	317—101

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