Nov. 9, 1965 E. J. DIEBOLD 3,217,210

HIGH VOLTAGE RECTIFIER STRUCTURE

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FIG. 1.

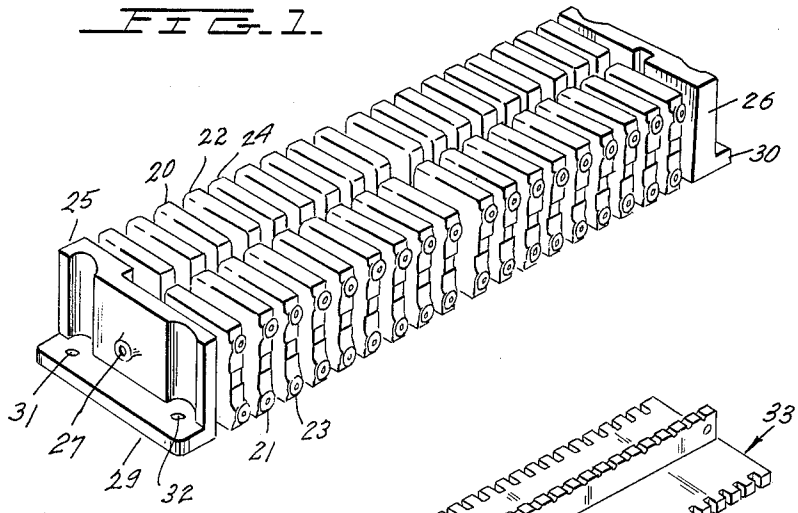

FIG. 2.

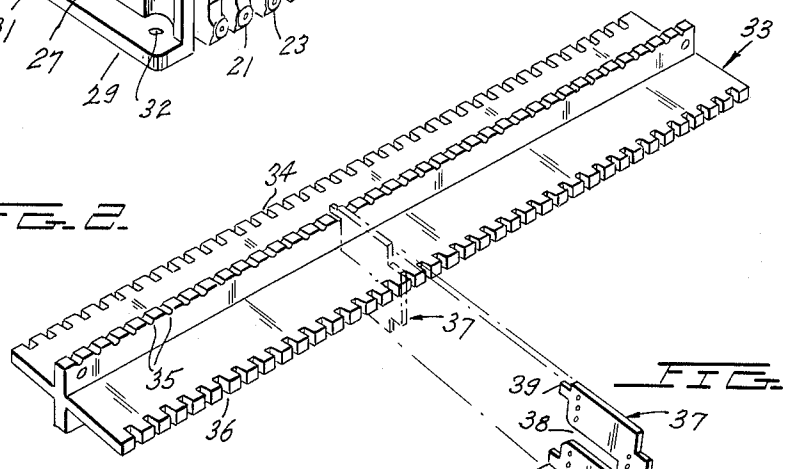

FIG. 2A.

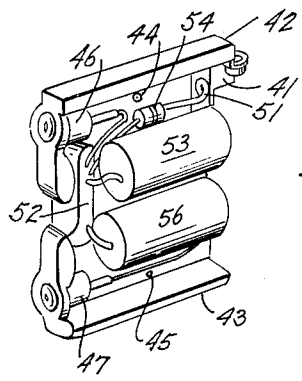

FIG. 3.

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FIG. 6.

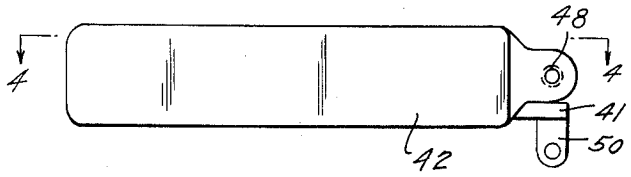


FIG. 4.

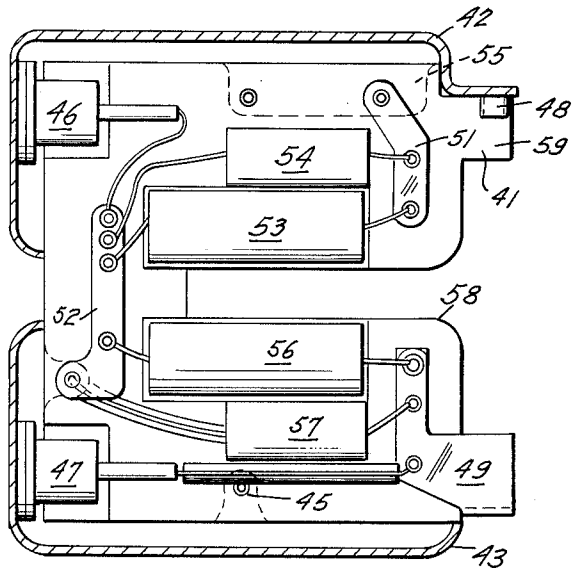
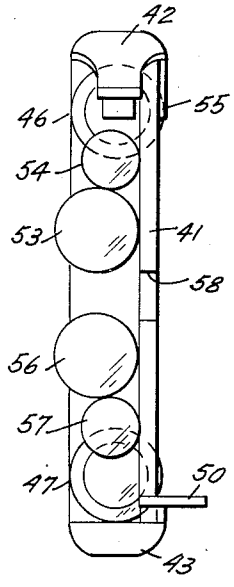


FIG. 5.



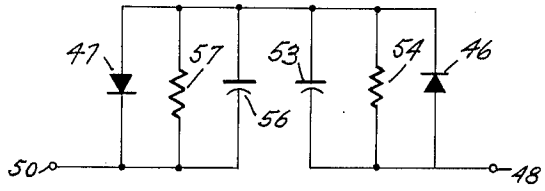


FIG. 4A.

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FIG. 7

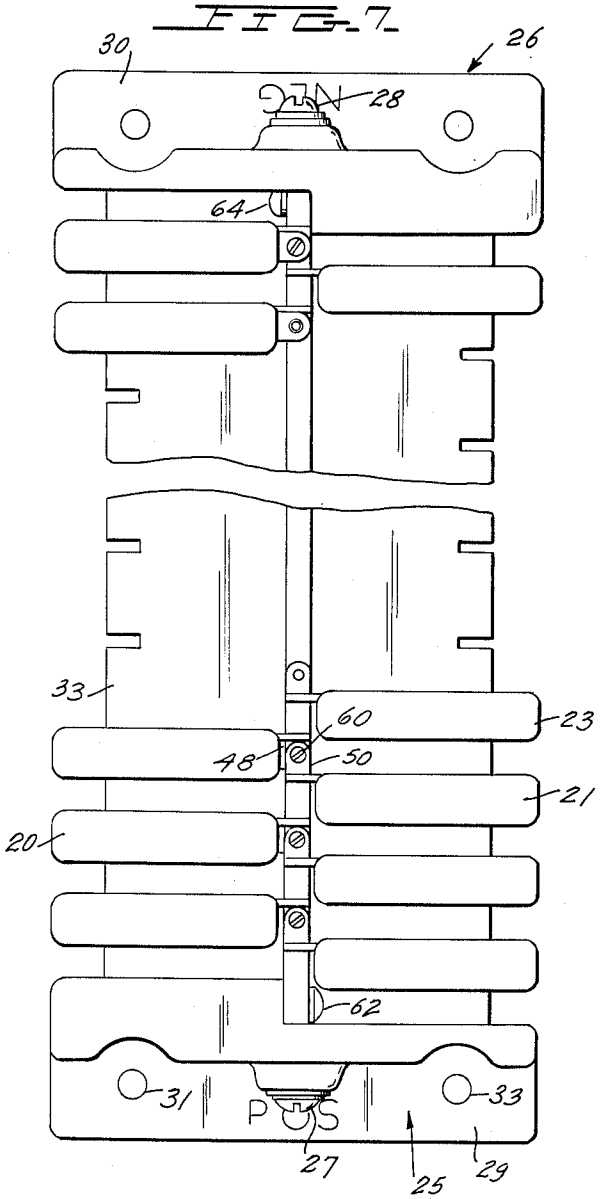
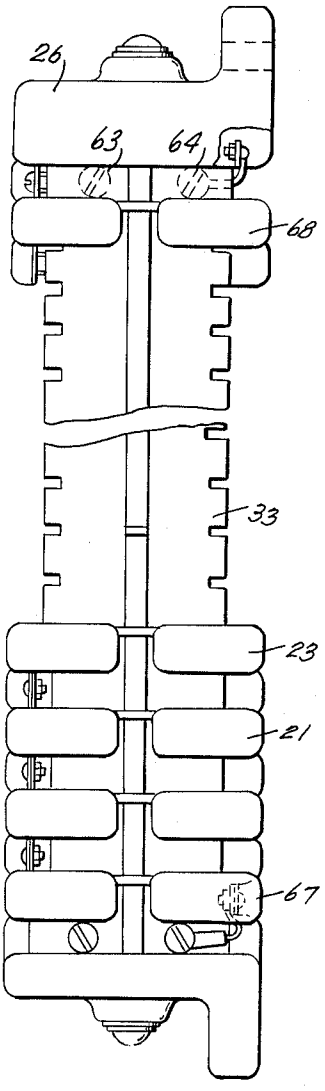


FIG. 8



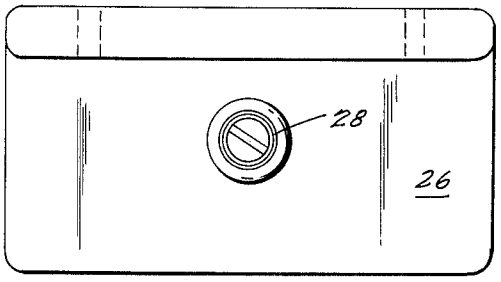


FIG. 9

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FIG. 10.

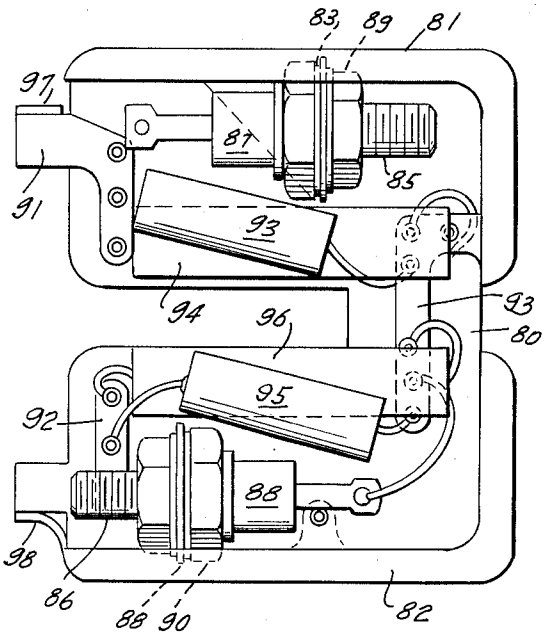
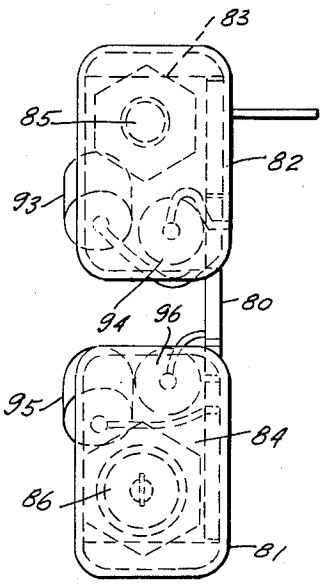


FIG. 12.



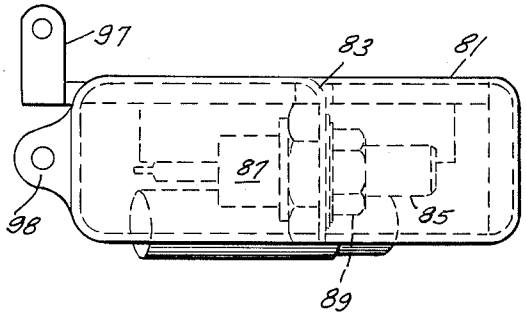


FIG. 11.

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Nov. 9, 1965 E. J. DIEBOLD 3,217,210

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FIG. 13

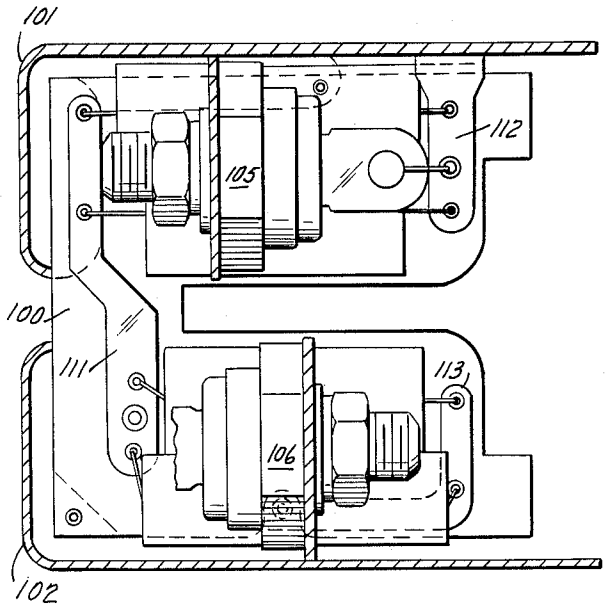
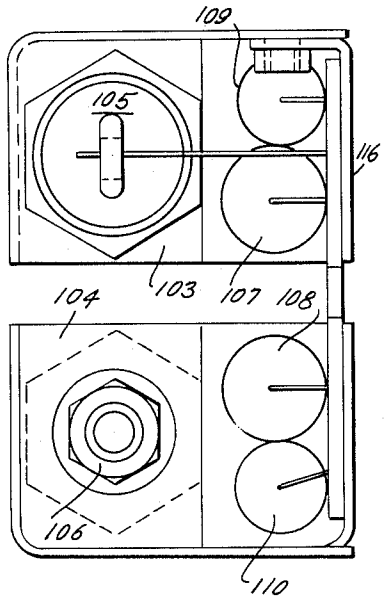


FIG. 15



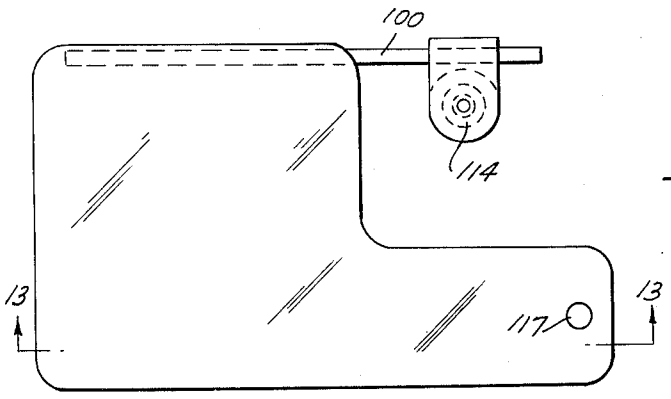


FIG. 14

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HIGH VOLTAGE RECTIFIER STRUCTURE

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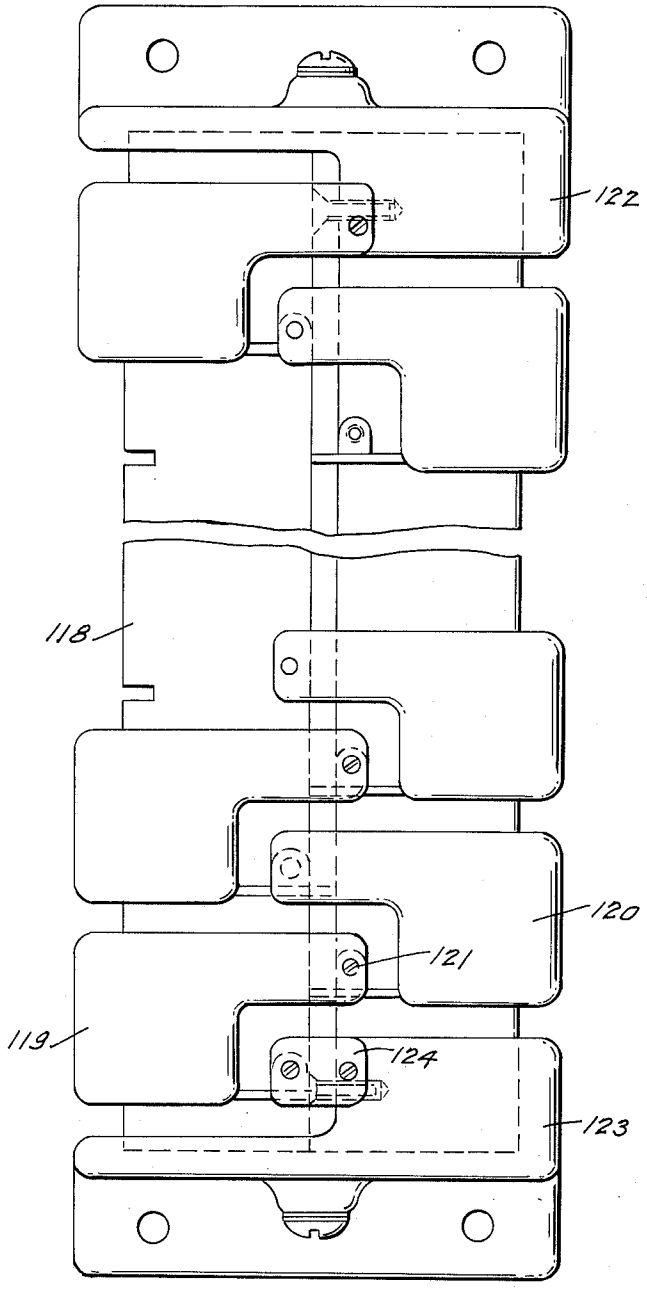

FIG. 16.

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United States Patent Office

3,217,210
Patented Nov. 9, 1965

3,217,210

HIGH VOLTAGE RECTIFIER STRUCTURE

Edward J. Diebold, Palos Verdes Estates, Calif., assignor to International Rectifier Corporation, El Segundo, Calif., a corporation of California

Filed Apr. 26, 1961, Ser. No. 105,729
12 Claims. (Cl. 317—101)

This invention relates to a high voltage, high power rectifier assembly, and more specifically relates to a novel rectifier assembly wherein individual modules identical to one another contain rectifier elements along with their respective voltage balancing resistors and capacitors, and the modules are mounted in pancake arrangement on an insulating support beam in a novel and simplified manner.

High voltage, high power rectifier devices may be used for the power supply for various types of high power tubes used, for example, in long range radar, long range television, communication transmitters, particle accelerators, induction heating devices, pulse modulation devices and others too numerous to be listed here.

A rectifier assembly which uses semiconductor rectifier elements is highly advantageous for such power supplies since there is no need for a filament power supply, is less expensive and is less space consuming. Where, however, the system requirements are of the order of 10,000 to 100,000 volts D.-C. at current capacities which range from 1 to 50 amperes, it is necessary to provide a large plurality of individual rectifier cells connected in series with one another to form the power supply. Arrangements of this type are shown, for example, in my copending application Serial No. 34,191 filed June 6,1960, entitled "High Voltage Rectifier Stack" and assigned to the assignee of the present invention. Moreover, a large plurality of individual cells connected in series can thereafter be connected in various types of circuits, such as the voltage doubler circuit of the type described in my copending application Serial No. 56,900 filed September 19, 1960, now Patent No. 3,121,835 entitled "High Voltage, High Power Rectifier System," and assigned to the assignee of the present invention.

In such arrangements, it is necessary that the plurality of rectifier cells which form the high voltage rectifier system be mounted in as economical a manner as is possible consistent with highly reliable operation, particularly in applications where they can be subjected to fast rising transient voltages under fault conditions.

In accordance with the present invention, each of the individual rectifier elements are mounted in an individual module which includes an insulator base for carrying the rectifier, a voltage balancing resistor and capacitor for the rectifier, a conductive shield and conductive terminal members for connecting the rectifier, resistor and capacitor in parallel with one another. The shield, as will be later seen, serves as part of a unitary shield for the complete rectifier stack, so that the complete device appears as though it were a single electrode, and additionally serves as a heat sink for the rectifier elements with which it is associated.

Each of the individual modules are then connectable to a main insulating support beam having high mechanical strength which could, for example, have an X-shaped cross-section. The modules are mounted on this support beam with alternate adjacent modules being mounted from

opposite sides of the beam. The modules adjacent one another are then electrically connected to one another so that their respective rectifiers are series connected, the connection further serving to mechanically secure the adjacent modules to one another and to the insulating support board. Moreover, the insulating support board may be appropriately notched for receiving each of the individual modules so that they are inherently spaced during simplified assembly procedures.

Accordingly, a primary object of this invention is to provide a novel high voltage, high power rectifier assembly.

Another object of this invention is to provide a novel high power, high voltage rectifier assembly comprised of individual module boards containing rectifiers, resistors and capacitors, which boards are mounted in pancake arrangement on a central support beam.

A further object of this invention is to provide a novel high voltage, high power rectifier assembly which lends itself to simplified manufacturing techniques.

A further object of this invention is to provide a novel high voltage, high power rectifier assembly comprised of a plurality of individual rectifier cells mounted on respective modules having respective conductive shields so that the modules form a homogeneous string which appears as a single electrode to areas external of the assembly.

Yet a further object of this invention is to provide a novel high voltage, high power rectifier for delivering output voltages of the order of 10,000 to 100,000 volts at current capacities of between 1 to 50 amperes.

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 perspective view of a rectifier assembly constructed in accordance with the present invention.

FIGURE 2 shows the central support beam of the rectifier assembly of FIGURE 1 with a single module board connected thereto.

FIGURE 2*a* is a perspective view of the module board of FIGURE 2.

FIGURE 3 shows the module board of FIGURE 2*a* with its various components mounted thereon in perspective view.

FIGURE 4 is a front view of the module board of FIGURE 3.

FIGURE 4*a* is an electrical schematic diagram of the module board of FIGURES 3 and 4.

FIGURE 5 is a side view of the module board of FIGURE 4 as seen from the right-hand side of FIGURE 4.

FIGURE 6 is a top view of the module board of FIGURE 4.

FIGURE 7 is a top view of the rectifier assembly of FIGURE 1.

FIGURE 8 is a side view of FIGURE 7.

FIGURE 9 is a front view of the rectifier assembly of FIGURES 1 and 7.

FIGURE 10 is a front view of a module board formed in accordance with a second embodiment of the invention for rectifiers having a different rating than that of the rectifiers of FIGURE 4.

FIGURE 11 is a top view of the module of FIGURE 10.

FIGURE 12 is a side view of the module of FIGURE 10 as seen from the right-hand side of FIGURE 10.

FIGURE 13 shows a front view of a further module board construction for rectifier elements of a different rating than those of FIGURES 4 and 10.

FIGURE 14 shows a top view of the module of FIGURE 13.

FIGURE 15 shows a side view of the module board of FIGURE 13 as seen from the right-hand side of FIGURE 13.

FIGURE 16 shows a top view of an assembly of module boards of the type shown in FIGURES 13, 14 and 15.

Referring first to the embodiment shown in FIGURES 1 through 9, and more specifically to FIGURE 1, a complete rectifier assembly is formed of a plurality of modules which each contain rectifier elements and voltage balancing structures for the rectifier elements. The modules such as modules **20**, **21**, **22**, **23** and **24** are stacked in adjacent relationship with respect to one another with alternate modules being on opposite sides of a center. Thus, modules **20**, **22** and **24** are on one side, while modules **21** and **23** are on the other side of a center through the assembly. The adjacent modules, however, are so arranged that their internal rectifier elements are connected in series to define a long string of individual rectifier elements connected in series between a first end shield **25** and a second end shield **26**, which end shields are of conductive material and have centrally located terminals **27** and **28** respectively (FIGURES 7 and 8) which serve as terminals for the rectifier assembly.

The end shields **25** and **26** are provided with extending mounting pads **29** and **30** respectively which have openings therein such as openings **31** and **32** in mounting pad **29** to serve as means for mounting the rectifier assembly.

The main support member for the rectifier assembly of FIGURE 1 is shown in perspective view in FIGURE 2 as being comprised of a central beam **33** which has an X-shaped cross-section and can, for example, be made of a polyester fiberglass.

The outer edges of the beam are notched with a plurality of notches such as notches **34**, **35** and **36**, which notches will serve, as will be seen more fully hereinafter, to receive the insulating mounting boards of the various modules to be assembled on beam **33**. Thus, in FIGURE 2 I have shown a module board **37** as mounted on beam **33**. Module board **37** is further shown in FIGURE 2*a* as having a centrally located slot **38** to cause the module board to have a U-shape. The upper ends of the legs of the U-shaped module board are then provided with extending tongue sections **39** and **40**.

In assembling the board on beam **33**, it will be clear that the extending length of beam **33** receives slot **38**. The extending tongue members **39** and **40** are then received into appropriate notches at either end of the vertical portion of beam **33** with the bottom of slot **38** falling into the notch at one end of the horizontal portion of beam **33**. Thus, the panel **37** is automatically located in a predetermined position on beam **33** so as to simplify the assembly of the device, as will be described more fully hereinafter.

Each of the individual modules of the device such as modules **21** through **24** of FIGURE 1 are constructed in an identical manner, each of the modules having an insulating support of the type shown in FIGURE 2*a*.

The module construction of one of the typical module devices is best shown in FIGURES 3, 4, 4*a*, 5 and 6. Referring to these figures, I show the module as having a support base **41** which is identical to base **37**. Base **41** is the main supporting member of the module, and may be a polyester glass board which receives all of the component parts of the module. Thus, the board first has an upper shield **42** and lower shield **43** secured thereto as by rivets **44** and **45** respectively which extend from the insulating board **41** to the shields **42** and **43**. The shield **42** has a rectifier cell **46** connected thereto at one of its electrodes as by soldering or any other desired fastening means, while, in a like manner, shield **43** has rectifier cell **47** secured thereto at one end of its electrodes. The upper shield **42** has a conductive eyelet **48** extending therefrom to serve as one terminal for the module, while the other terminal of the module is formed of an L-shaped conductive strip **49** which is riveted to board **41** and has a leg **50** extending therefrom. It will be noted that conductive strip **49** is insulated from shield **43**.

The board **41** has further terminal members **51** and **52** secured thereto as by rivet means. A first capacitor **53** and first resistor **54** are then provided for rectifier cell **46**, and are connected in parallel with rectifier **46**, capacitor **53** and resistor **54**. The capacitor **53** and resistor **54** are supported by their leads. Thus, the left-hand lead of resistor **54**, the left-hand lead of capacitor **53**, and the conductive lead leading from the second terminal of rectifier cell **46** are all connected to conductive strip **52**. The right-hand leads of resistor **54** and capacitor **53** are then connected to conductive strip **51** which is, in turn, electrically connected to a downwardly projecting portion **55** of shield **42**.

In a similar manner, a capacitor **56** and resistor **57** are provided for rectifier cell **47** with their left-hand leads being connected to conductive strip **52** and their right-hand leads being connected to conductive strip **49**. The second electrode of rectifier cell **47** is also connected to conductive strip **49**.

Accordingly, the electrical circuit defined by the module of FIGURES 3 through 6 will be as shown in FIGURE 4*a* where, beginning at terminal **48**, the rectifier cell **46** has capacitor **53** and resistor **54** in parallel therewith, this parallel connected group of components being connected in series with a similar parallel connected group of components **47**, **56** and **57** which terminate at terminal **50**.

The board **51** then has the slot **58** therein for receiving an extending section of beam **33**, while its extending tongue portions such as tongue portion **59** are received in grooves in the beam to automatically physically locate the module on the beam.

The individual modules are then assembled on beam **33**, as illustrated in FIGURES 7 and 8, where those modules such as modules **21** and **23** to the right of the beam are merely slid into their appropriately predetermined positions as determined by the notches in the beam, while the modules such as module **20** are rotated by 180° with respect to modules **21** and **23**, and are similarly inserted on the beam **33**. That is to say, the module boards are so arranged on alternate sides of the beam so that the extending terminal **50** of a module such as module **21** will be adjacent an eyelet such as eyelet **48** of module **20** (FIGURE 8).

By now appropriately securing the respective eyelets **48** and extending terminals **50** of the adjacent modules as by a screw means such as screw **60** or other appropriate connecting means, the modules such as modules **20** and **21** are inherently connected in series with one another and are secured to the beam **33**. In a similar manner, each of the remaining modules are electrically connected to one another and mechanically secured to the board **33** along its complete length.

In the embodiment of FIGURES 7 and 8, a total of 50 modules, for example, are used so that a total of 100 rectifier cells are connected in series with one another to define an exceedingly high voltage assembly, the current capacity of which is determined by the current capacity of any of the individual cells.

The end shields **25** and **26** previously described are then secured to the ends of beam **33** as by screws **61–62** and **63–64** respectively where the screws pass through the beam **33** and terminate in electrically conductive relationship with respect to the conductive shields. The last module can, therefore, be electrically connected to its adjacent shield by an electrical jumper such as jumpers **65** and **66** where jumper **64** connects end shield **25** to the first module **67** of the stack of FIGURE 8, while jumper **66** connects the other end of module **68** to end shield **26**.

With the construction as described above, the rectifier elements form a string of series connected rectifier cells where each of the cells is shunted by a respective resistor and a capacitor. Moreover, all of the metallic parts of the rectifier column are placed at a very specific potential within the column, which potential changes gradually by equal steps from end shield **25** along the stack to end shield **26**.

An unusual feature of the novel construction is that the reliability of the overall assembly is greater than the reliability of the individual components. In the event that a single cell within the stack fails, the resistor and capacitor voltage divider associated with the cell will permit its reverse voltage to collapse without upsetting the voltage division of the other cells. This collapse of reverse voltage prevents the flow of excessive reverse current through the cell which fails. Thus, a failed cell is not completely destroyed and mechanically opened, but rather remains a conductor which permits the current to continue flowing through the string. Where a sufficient number of identical cells are used, it will be apparent that the failure of a single cell will not affect the performance of the column of cells which remain. Therefore, the reliability of the entire column is greater than the reliability of its parts.

The shunting resistor of each of the groups of cells provides voltage division between the cells under normal voltage conditions in the usual manner. The shunting capacitors are provided for each of the cells to provide voltage division under transient voltage conditions in the usual manner.

With regard to other high voltage effects, it will be seen that each of the modules is provided with individual conductive shields which serve as a heat sink for their respective rectifier, but also serve as a part of a continuous shield for the complete device. The two end shields of the device are then matched to the individual cell shields to give the column its unified appearance and unified performance as a single electrode device. Each of the shields are held at intermediate potentials by the voltage dividing network, and do not have sharp corners or discontinuities, thus eliminating corona and other gas discharge effects.

In a preferred embodiment of the invention, the highest gradient in open space will be held below 10 volts per mil. Moreover, creepage distances along the insulating material will be held below 2,000 volts per inch for normal operation, and below 4,000 volts per inch under transient conditions.

The complete rectifier system of FIGURE 1 may then be mounted in any desired manner, and could, for example, be contained within an ambient insulation such as air, compressed gas, or oil, as is well known to the art. The single electrode appearance of the device simplifies the insulator mountings for mounting the device within a container.

An alternate embodiment of the invention is shown in FIGURES 10, 11 and 12 where rectifier cells of the bolted type are to be used. The module under these conditions are provided with insulation board support **80**, in the usual manner, which has an upper and lower shield **81** and **82** respectively. Each of shields **81** and **82** have extending conductive bracket portions **83** and **84** respectively extending therefrom which pass through appropriately positioned slots in board **80**. Each of bracket portions **83** and **84** have centrally located openings therein for receiving the extending bolt-type terminal **85** and **86** respectively of rectifier cells **87** and **88** respectively.

The rectifier cells **87** and **88** are secured to brackets **83** and **84** respectively as by nut means **89** and **90** respectively with appropriate washer means being used. Thus, the rectifier cells **87** and **88** may be secured to shields **81** and **82** respectively, and thus to board **80**.

Appropriate conductive strips **91**, **92** and **93** are then secured to board **80** so that capacitor **93** and resistor **94** may be connected in parallel with rectifier cell **87** as shown, and so that capacitor **95** and resistor **96** may be connected in parallel with rectifier cell **88** as shown with the rectifiers **87** and **88** being connected in series.

The electrical terminals of the module are then defined by an extending ear **97** of conductive strip **91**, and an extending eyelet **98** defined by lower shield **82**. A plurality of modules may then by mounted on a beam such as beam **33** of FIGURE 2 having appropriate notches for prepositioning the modules in the manner described above in FIGURES 8 and 9.

As a further modification of the invention, the size of the rectifier cell may require a modification of the shield shape and mounting arrangement. Thus, in FIGURES 13, 14 and 15 I show a module which has an L-shape when seen from the top. More specifically, in FIGURES 13, 14 and 15, the usual insulating panel such as panel **100** carries upper and lower shields **101** and **102** respectively which have extending bracket portions **103** and **104** respectively which have openings therein for receiving extending bolt-type rectifier cells **105** and **106** respectively.

Integral with the module assembly are capacitors **107** and **108** which are connected in shunt with cells **105** and **106** respectively and resistors **109** and **110** which are to be connected in parallel with rectifier cells **105** and **106** respectively. Appropriate conductive strips **111**, **112** and **113** are provided for receiving the leads of the various rectifier cells, resistors and capacitors for achieving these circuit connections.

The size of the rectifier cells, however, and their shunt resistors and capacitors require that the module be relatively thick, as illustrated in FIGURE 14, and there is a slight modification of the electrical connection of cells **105** and **106**. More specifically, the first terminal for the device is formed of an eyelet **114** which is secured, as shown in FIGURE 15, to a conductive strip **116** mounted on board **100**. Conductive strip **116** is then electrically connected to conductive strip **112** by an electrical connection taken through the board and which could, for example, be rivets which secure each of strips **112** and **116** to the board **100**. One terminal of capacitor **107**, resistor **109** and rectifier cell **105** are then electrically connected to conductor **112**, while their opposite terminals are connected to conductive strip **111**.

An appropriate terminal of rectifier cell **106** and one side of each of capacitor **108** and resistor **110** are then similarly electrically connected to strip **111**, while the opposite leads of these elements are connected to conductive strip **103** which is, in turn, electrically connected to shield **102**. The shield **102** has an opening **117** therein to serve as the second terminal of the module. The plurality of modules are then mounted on a beam such as beam **118** which may be similar to beam **33** of FIGURE 2, wherein, as shown in FIGURE 16, an opening **117** of one module will always be adjacent eyelet **114** of an adjacent module. Thus, in FIGURE 16, the opening such as opening **117** in FIGURE 14 of module **119** will be positioned adjacent an eyelet such as eyelet **114** of FIGURE 14 of module **120**. In this manner, each of the adjacent modules are electrically connected to one another and mechanically secured to beam **118** by provision, for example, of a screw means such as screw means **121** which connects the upper ends of modules **119** and **120**.

Upper and lower end shields **122** and **123** complete the assembly of FIGURE 16 in the usual manner as by providing a jumper **125** from the eyelet-type terminal of module **119** to an appropriate terminal of conductive end shield **123**, and by a direct connection from module **125** to an eyelet-type terminal of end shield **122**. In this manner, end shields **122** and **123** are identical in construction, each having eyelet-type terminals for connection to the adjacent module.

Although this invention has been described with respect to its preferred embodiments it should be understood that many variations and modifications will now be obvious to those skilled in the art, and it is preferred,

therefore, that the scope of this invention be limited not by the specific disclosure herein but only by the appended claims.

What is claimed it:

1. A rectifier mounting structure comprising an elongated support beam of insulating material having an outwardly extending side and an insulating board having a slot extending therein; said insulating board having a rectifier cell mounted thereon; said slot in said insulating board receiving said outwardly extending side to mount said insulating board and said rectifier to said support beam; said insulating board lying in a plane perpendicular to the axis of said elongated support beam; said insulating board further having a conductive shield, a resistor, and a capacitor secured thereto; said resistor and said capacitor being connected in parallel with respect to said rectifier cell; said conductive shield having a smooth surface facing outwardly of said support beam; said rectifier having one of its terminals connected to said shield.

2. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having an outwardly extending side and a plurality of insulating boards; each of said insulating boards having a rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of each of said insulating boards receiving said outwardly extending side to mount said insulating boards and their said rectifier cells on said support beam; each of said insulating boards further having a respective conductive shield, respective resistors, and respective capacitors; each of said resistors and capacitors being connected in parallel with said respective rectifier cell of their respective insulating board; each of said conductive shields having a smooth surface facing outwardly of said support beam; each of said rectifier cells having one of their terminals connected to their respective conductive shields.

3. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having an outwardly extending side and a plurality of insulating boards; each of said insulating boards having a first and second rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of each of said insulating boards receiving said outwardly extending side to mount said insulating boards and their said rectifier cells on said support beam; each of said insulating boards having a first and second conductive shield insulated from one another; each of said first and second shields of each of said insulating boards facing outwardly of said support beam; the anode of each of said first rectifiers of each of said insulating boards being connected to the said first conductive shield of their said respective insulating board; the cathode of said second rectifiers of each of said insulating boards being connected to the said second conductive shield of their said respective insulating boards; the cathode of said first rectifier cells being connected to the anodes of their respective second rectifier cells.

4. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having an outwardly extending side and a plurality of insulating boards; each of said insulating boards having a first and second rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of each of said insulating boards receiving said outwardly extending side to mount said insulating boards and their said rectifier cells on said support beam; each of said insulating boards having a first and second conductive shield insulated from one another; each of said first and second shields of each of said insulating boards facing outwardly of said support beam; the anode of each of said first rectifiers of each of said insulating boards being connected to the said first conductive shield of their said respective insulating board; the cathode of said second rectifiers of each of said insulating boards being connected to the said second conductive shield of their said respective insulating boards; the cathodes of said first rectifier cells being connected to the anodes of their respective second rectifier cells; each of said insulating boards further having first and second resistors and first and second capacitors; said first resistor and first capacitor of each of said insulating boards being connected in parallel with said first rectifier of their respective insulating board; said second resistor and second capacitor of each of said insulating boards being connected in parallel with said second rectifier of their respective insulating board.

5. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having an outwardly extending side and a plurality of insulating boards; each of said insulating boards having a first and second rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of each of said insulating boards receiving said outwardly extending side to mount said insulating boards and their said rectifier cells on said support beam; each of said insulating boards lying in planes parallel to one another and being axially spaced from one another along the axis of said support beam; said planes of said insulating boards being perpendicular to the axis of said beam; the outer end of said outwardly extending side having notches spaced therealong; said notches receiving the bottom of respective slots of said insulating boards to axially position said insulating boards from one another; each of said insulating boards having a first and second conductive shield insulated from one another; each of said first and second shields of each of said insulating boards facing outwardly of said support beam; the anode of each of said first rectifiers of each of said insulating boards being connected to the said first conductive shield of their said respective insulating board; the cathode of said second rectifiers of each of said insulating boards being connected to the said second conductive shield of their said respective insulating boards; the cathodes of said first rectifier cells being connected to the anodes of their respective second rectifier cells.

6. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having four outwardly radiating sides and a plurality of insulating boards; each of the adjacent outwardly radiating sides being perpendicular to one another; each of said insulating boards having a rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of said insulating boards receiving selected outwardly extending sides of said support beam to mount said boards along the axis of said support beam; alternate insulating boards being mounted on a first pair of opposing sides of said four outwardly radiating sides of said support beam and abutting against the other pair of opposing sides of said four outwardly radiating sides of said support beam.

7. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having four outwardly radiating sides and a plurality of insulating boards; each of the adjacent outwardly radiating sides being perpendicular to one another; each of said insulating boards having a rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of said insulating boards receiving selected outwardly extending sides of said support beam to mount said boards along the axis of said support beam; alternate insulating boards being mounted on a first pair of opposing sides of said four outwardly radiating sides of said support beam and abutting against the other pair of opposing sides of said four outwardly radiating sides of said support beam; each of said insulating boards lying in planes parallel to one another and being axially spaced from one another along the axis of said support beam;

said planes of said insulating boards being perpendicular to the axis of said beam.

8. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having four outwardly radiating sides and a plurality of insulating boards; each of the adjacent outwardly radiating sides being perpendicular to one another; each of said insulating boards having a rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of said insulating boards receiving selected outwardly extending sides of said support beam to mount said boards along the axis of said support beam; alternate insulating boards being mounted on a first pair of opposing sides of said four outwardly radiating sides of said support beam and abutting against the other pair of opposing sides of said four outwardly radiating sides of said support beam; each of said insulating boards lying in planes parallel to one another and being axially spaced from one another along the axis of said support beam; said planes of said insulating boards being perpendicular to the axis of said beam; the outer ends of said first pair of opposing sides having notches spaced therealong; said notches receiving the bottom of respective slots of said insulating boards to axially position said insulating boards from one another.

9. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having four outwardly radiating sides and a plurality of insulating boards; each of the adjacent outwardly radiating sides being perpendicular to one another; each of said insulating boards having a rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of said insulating boards receiving selected outwardly extending sides of said support beam to mount said boards along the axis of said support beam; alternate insulating boards being mounted on a first pair of opposing sides of said four outwardly radiating sides of said support beam and abutting against the other pair of opposing sides of said four outwardly radiating sides of said support beam; each of said insulating boards lying in planes parallel to one another and being axially spaced from one another along the axis of said support beam; said planes of said insulating boards being perpendicular to the axis of said beam; the outer ends of each of said sides having notches spaced therealong; the ends of each of said insulating boards at which said slot enters having first and second protruding tongue portions on either side of said slot; said notches in said first pair of opposing sides receiving the bottom of respective slots of said insulating boards; said notches in said second pair of opposing sides receiving respective tongue portions of said insulating boards.

10. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having four outwardly radiating sides and a plurality of insulating boards; each of the adjacent outwardly radiating sides being perpendicular to one another; each of said insulating boards having a rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of said insulating boards receiving selected outwardly extending sides of said support beam to mount said boards along the axis of said support beam; alternate insulating boards being mounted on a first pair of opposing sides of said four outwardly radiating sides of said support beam and abutting against the other pair of opposing sides of said four outwardly radiating sides of said support beam; each of said insulating boards lying in planes parallel to one another and being axially spaced from one another along the axis of said support beam; said planes of said insulating boards being perpendicular to the axis of said beam; the outer ends of each of said sides having notches spaced therealong; the ends of each of said insulating boards at which said slot enters having first and second protruding tongue portions on either side of said slot; said notches in said first pair of opposing sides receiving the bottom of respective slots of said insulating boards; said notches in said second pair of opposing sides receiving respective tongue portions of said insulating boards; each of said insulating boards further having a respective conductive shield, respective resistors, and respective capacitors; each of said resistors and capacitors being connected in parallel with said respective rectifier cell of their respective insulating board; each of said conductive shields having a smooth surface facing outwardly of said support beam; each of said rectifier cells having one of their terminals connected to their respective conductive shields.

11. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having four outwardly radiating sides and a plurality of insulating boards; each of the adjacent outwardly radiating sides being perpendicular to one another; each of said insulating boards having a rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of said insulating boards receiving selected outwardly extending sides of said support beam to mount said boards along the axis of said support beam; alternate insulating boards being mounted on a first pair of opposing sides of said four outwardly radiating sides of said support beam and abutting against the other pair of opposing sides of said four outwardly radiating sides of said support beam; each of said insulating boards lying in planes parallel to one another and being axially spaced from one another along the axis of said support beam; said planes of said insulating boards being perpendicular to the axis of said beam; the outer ends of each of said sides having notches spaced therealong; the ends of each of said insulating boards at which said slot enters having first and second protruding tongue portions on either side of said slot; said notches in said first pair of opposing sides receiving the bottom of respective slots of said insulating boards; said notches in said second pair of opposing sides receiving respective tongue portions of said insulating boards; and electrical connecting means; the said rectifier cells of adjacent insulating boards being connected in series with one another by said electrical connecting means; said electrical connecting means further securing said insulating boards to said support beam.

12. A rectifier mounting structure for a plurality of rectifier cells comprising an elongated support beam of insulating material having four outwardly radiating sides and a plurality of insulating boards; each of the adjacent outwardly radiating sides being perpendicular to one another; each of said insulating boards having a rectifier cell mounted thereon; each of said insulating boards having a respective slot extending therein; each of said slots of said insulating boards receiving selected outwardly extending sides of said support beam to mount said boards along the axis of said support beam; alternate insulating boards being mounted on a first pair of opposing sides of said four outwardly radiating sides of said support beam and abutting against the other pair of opposing sides of said four outwardly radiating sides of said support beam; each of said insulating boards lying in planes parallel to one another and being axially spaced from one another along the axis of said support beam; said planes of said insulating boards being perpendicular to the axis of said beam; the outer ends of each of said sides having notches spaced therealong; the ends of each of said insulating boards at which said slot enters having first and second protruding tongue portions on either side of said slot; said notches in said first pair of opposing sides receiving the bottom of respective slots of said insulating boards; said notches in said second pair of opposing sides receiving respective tongue portions of said insulating boards; each of said insulating boards further having a respective conductive shield, respective resistors, and respective capacitors; each of said resistors and capacitors

being connected in parallel wtih said respective rectifier cell of their respective insulating board; each of said conductive shields having a smooth surface facing outwardly of said support beam; each of said rectifier cells having one of their terminals connected to their respective conductive shields; and electrical connecting means; the said rectifier cells of adjacent insulating boards being connected in series with one another by said electrical connecting means; said electrical connecting means further securing said insulating boards to said support beam.

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