United States Patent [19]

Dumas

[11] **3,777,249**

[45] **Dec. 4, 1973**

[54] **MULTIPLIER ASSEMBLY**

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[22] Filed: **Mar. 14, 1973**

[21] Appl. No.: **340,968**

Related U.S. Application Data

[63] Continuation of Ser. No. 229,905, Feb. 28, 1972, abandoned.

[52] **U.S. Cl.** **321/8,** 321/15
[51] **Int. Cl.** **H02m 7/00**
[58] **Field of Search** 321/8, 15

[56] **References Cited**

UNITED STATES PATENTS

3,614,539	10/1971	Hallenbeck	317/101 R X
2,985,812	5/1961	Peterson	321/15
2,823,347	2/1958	Procter	321/15
3,349,310	10/1967	Ladoniczki	321/8 R X
3,566,192	2/1971	Stump, Jr.	321/15
2,880,385	3/1959	Callender	321/2

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Attorney—Leo J. Aubel

[57] **ABSTRACT**

A voltage multiplier assembly for high voltage application which provides a unique mechanical and dielectric construction to improve the dielectric breakdown characteristics and inhibit corona discharge in the components of the assembly.

3 Claims, 3 Drawing Figures

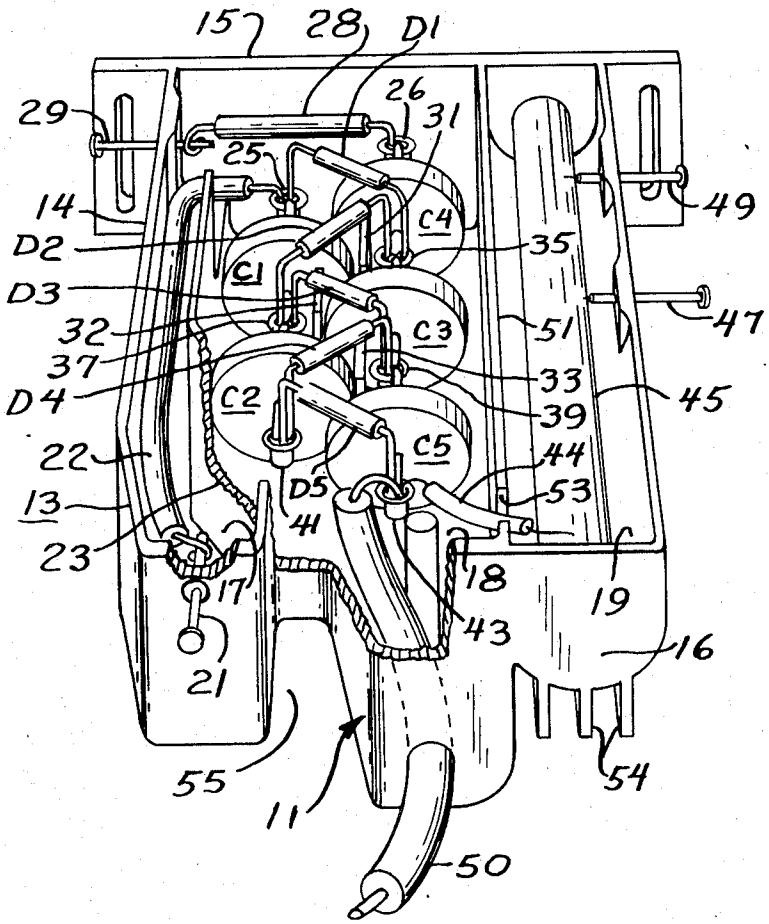
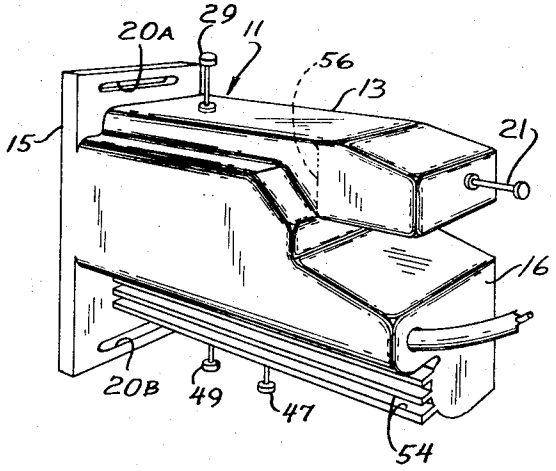


Fig. 1



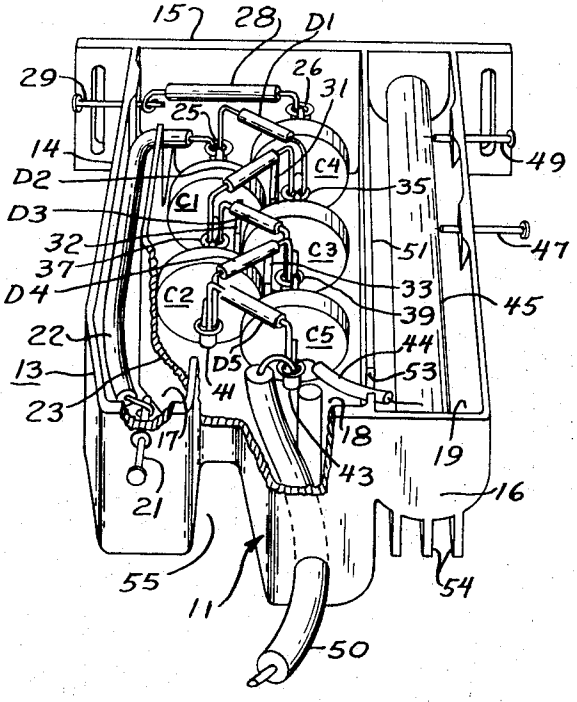
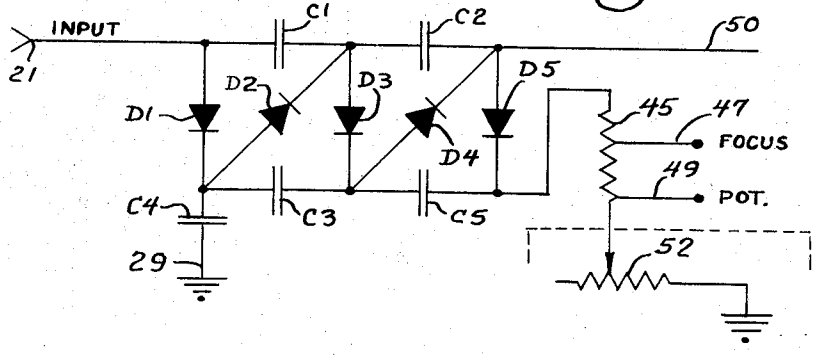


Fig. 2

Fig. 3



MULTIPLIER ASSEMBLY

This is a continuation, of application ser. No. 229,905, filed Feb. 28, 1972 and now abandoned.

BACKGROUND OF THE INVENTIOn:

One of the problems in using high voltage components packaged in small assemblies is that of avoiding or preventing discharge of high voltage from the components to a point of lower potential by way of corona discharge. The corona discharge may be initiated between the components themselves or between the components and ground potential. In high voltage devices used in color television picture tube chassis, corona discharge can cause damage to the components, and can adversely affect the performance of the assembly and the quality of the picture.

Accordingly, it is a principal object of the present invention to provide a high voltage assembly construction which has improved dielectric separation between the regions of voltage differential in the assembly to thereby inhibit corona discharge.

It is another object of the invention to provide a high voltage multiplier assembly construction which is small and compact and yet provides improved dielectric separation and, hence, improved corona inhibiting characteristics.

It is another object of the present invention to provide electrical connectors which inhibit, or minimize the possibility of corona.

The foregoing and other features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment, as illustrated in the accompanying drawings wherein:

FIG. 1 is an isometric view of the high voltage multiplier assembly in accordance with the invention;

FIG. 2 is an isometric view as seen from the back of the assembly of FIG. 1; and,

FIG. 3 is a schematic diagram of the circuitry of the invention.

DESCRIPTION OF THE INVENTION:

Referring to FIGS. 1 and 2, the housing 11 of a high voltage tripler assembly 13, in accordance with the invention, may be formed of a polypropylene material. Note that while a voltage tripler assembly is shown, the invention is applicable generally to multi-lattice networks including voltage doublers, triplers, etc. Housing 11 includes a U-shaped case 14 having a closed end 16 and a mounting base 15 closing the other end of the case. Mounting base 15 includes unting slots 20A and 20B. The back side of the housing 11 is open and after assembly of the components in the case, the case 14 is filled or potted with a suitable encapsulation compound.

As best seen in FIG. 1, the case 14 is formed to have three separate side-by-side compartments, 17, 18 and 19 which extend the length of the casing and which house respective components as will be explained.

An input terminal pin 21 couples an input voltage through input lead 22, mounted in compartment 17 to the electronic circuitry of the assembly. Compartment 17 is an elongated compartment which is separated from the adjacent compartment 18 by a dielectric barrier 23 extending substantially the full length of the case or casing 14.

The barrier 23 is open at a point adjcent the mounting base 15 to permit the input lead 22 to be passed therethrough to couple to an electrical terminal post 25 in compartment 18. Compartment 18 is the center compartment and contains capacitors C1-C5 and diodes D1-D5 which comprise a voltage tripler and which are electrically connected as shown in FIG. 3. The electrical components and the circuit connections of FIG. 3 are known in the art, and per se, do not comprise a part of this invention, hence, they will be explained only briefly. The reference numerals are placed in FIG. 3 to show the points on the electrical circuitry corresponding to the physical construction of FIG. 2.

The capacitors C1 and C2 function as AC coupling capacitors and also serve to store a DC voltage component, as is known in the art. Capacitors C3, C4 and C5 function as the DC voltage adding capacitors. One terminal of capacitor C4 is connected to terminal post 26, and, hence, through electrical lead 28 to ground terminal pin 20.

Mounting or positioning plates 31, 32 and 33 provide means for positioning the capacitors C1-C5 in interleaved and staggered relation. Terminal posts 35, 37, 39, 41 and 43 are positioned at the ends of, and intermediate, capacitors C1-C5 to facilitate the electrical connections between the capacitors and the diodes D1-D5 which are positioned in superposed, angled and juxtapositioned relation to capacitors C1-C5.

A focusing resistor 45 is mounted in compartment 19 and extends substantially the full length of the compartment. An electrical connection is made from post 43 through lead 44 to one end terminal of resistor 45. Post 43 also connects to the high voltage lead 50. The focusing output resistor 45 may be a potentiometer or a multi-tap resistor as shown in FIG. 1 wherein the resistor 45 provides a focus voltage output from tap 47 and a potentiometer output from terminal 47. The other end terminal of resistor 45 is connected to a trimmer or focus control resistor 52, which is mounted externally of housing 11, as indicated by the dotted line adjacent resistor 52 in FIG. 3. Focusing resistor 45 may be of any suitable shape, such as a flat plate, rectangular rod, etc., and in this embodiment comprises an elongated circular rod or tube.

Note that the barriers 23 and 51 can be molded or formed as an integral part of the case 14, or the barriers can be separate members positioned in the case during assembly such as by posts, notches or other suitable means.

As mentioned above, the input lead 22 in compartment 17 is separated from the capacitors C1-C5 and diodes D1-D5 in compartment 18 by dielectric barrier 23. Likewise, the capacitors C1-C5 and diodes D1-D5 are separated from the focusing resistor 45 by dielectric barrier 51.

In one application, compartment 17 was foreshortened at a point indicated by the dotted lines 56 in FIG. 2 and the terminal pin 21 relocated accordingly. The function and operation of the assembly 13 remained the same.

After the components are positioned in the housing, as shown in FIG. 2 with the electrical connections properly made, case 14 is filled with a encapsulation compound such that the components are encapsulated or embedded in casing 14 in the position indicated. It is important to note that the material used as the encapsulation compound is different from the material of the

dielectric barrier. A basic concept of the invention is that the dielectric barriers **23** and **51** are of a material which is different from the encapsulating compound, and thus, provide different dielectric impedances to corona breakdown, and accordingly provide improved corona voltage dissipation characteristics to thereby inhibit the initiation and continuation of corona discharge.

The voltage input to the assembly **13** is generally a low impedance, high voltage pulse which makes the components highly susceptible to the initiation of a corona discharge if the dielectric separation and spacing is not proper. Therefore, barrier **23** is provided to separate the input lead **22** from the rest of the components. As mentioned above, the barriers **23** and **51** are of material different from the encapsulating compound and have a different dielectric constant then the compound, and hence exhibit different corona breakdown characteristics, thus enhancing the corona inhibiting characteristics.

Capacitors **C1** and **C2**, which are AC coupling capacitors, also store energy during the dwell periods between the input pulses. If sufficient dielectric impedance such as provided by barrier **23** or the combination of barrier **23** and the encapsulating compounds is not present, a corona discharge will result.

Note that barrier **51** extends the full length of compartment **19** and, thus completely separates the focusing resistor **45** from the capacitors and diode in compartment **18** and in addition, resistor **45** is embedded in the encapsulation compound. The basic shape and thickness of the barrier **51** may vary depending upon the dielectric insulation parameters required between the diode capacitor matrix and the focusing resistor.

In addition to barrier **51**, the focusing resistor **45** is positioned in spaced relation to he capacitors **C1-C5** and diodes **D1-D5** to thereby compensate for any corona start voltage which may tend to be initiated by a dielectric failure of barrier **51**.

Referring to FIG. **3** as well as FIG. **1**, capacitor **C1** is positioned such that it connects directly to the input lead on one side of the capacitor and the other side of the capacitor is mounted adjacent the barrier **23** to prevent corona breakdown. Normally, the voltage gradients between the individual components in the **C1-C5** and diode **D1-D5** matrix is not equal. That is, in a usual assembly, each component may be at different voltage potential and there is therefore a high probability of corona discharge.

By the barrier construction of the invention, an attempt is made to hold the voltage gradient between the various components parts substantially the same to improve corona breakdown characteristics as well as to provide improved voltage regulation.

The capacitor **C4**, which is the "ground leg capacitor" is positioned adjacent the mounting base **15** to provide enhanced capacity. The foregoing adds to the overall capacity storage and ladder effect of capacitor **C3**, and also provides improved regulation and improved high voltage protection.

In addition to the dielectric separation, the spacing between the components and the barriers **23** and **51** provide thermal separation and insulation between the various components in the case **14**. Note that the focusing resistor **45**, which may have a power dissipation of about five watts maximum, is positioned to be physically spaced from other components of the assembly and, in addition, barrier **51** is positioned between the resistor and the other components.

The back of the the case **14** is open, and hence, the ambient temperature assists in providing a stable thermal enviroment. Similarly, as discussed above with relation to the dielectric isolation provided by the barriers, the barrier **51** has a thermal conductivity efficient which is different from that of the encapsulation compound and, thus will tend to prevent the heat from the focusing resistor to affect the diodes and capacitors. The heat from the focusing resistor will thus proceed outwardly through the encapsulating compound and the open bak of the case **14.**

While fins **54** are shown only adjacent the compartment **19**, which houses the focusing resistor **45** to provide a chimney effect and cooling function to that portion of the case **14**, it will be understood that fins can be provided all along the case as desired to provide a cooling effect to the other portions of the case.

The focusing resistor **45** functions as a quiescent load which tends to stabilize the output voltage of the multiplier system when current demands go from mininum to maximum. Further, the focusing resistor also changes the frequency-corona current load characteristics, and thereby minimizes any picture flutter which may be caused by variations in the beam currents. In other words, the focusing resistor **45** acts as a dampening resistor to this corona discharge and thereby minimizes the corona on the output line between the multiplier assembly and the picture tube or other portions of high voltage exterior to the multiplier assembly.

For certain applicators, a focusing resistor can be connected in parallel with capacitor **C4**, and resistor **54** can be an untapped high voltage bleeder; however, the construction of the assembly of FIGS. **1** and **2** remains essentially the same.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

I claim:

1. A high voltage multiplier assembly comprising a matrix of electronic components including capacitors, diodes and resistor means connectable to a source of voltage, a casing for said components, dielectric barrier means for dividing said casing into substantially fully separate compartments, a dielectric encapsulation compound in said compartments, said components being mounted within said encapsulation compound in said compartments, said encapsulation compound having a different dielectric constant than said barrier means and exhibiting different corona breakdown characteristics than said barrier means, said components mounted on said compartments being at different voltage levels, and said components being positioned and spaced in said compartments to enable the voltages developed in said components to provide voltage gradients between the various components which are substantially the same throughout the casing to thereby inhibit the initiation and continuation of corona discharge.

2. A multiplier assembly as in claim **1** wherein the electronic components include an input lead, and wherein the dielectric barriers separate the casing into a first part for moutning the input lead, a second part for mounting the matrix, and a third part for mounting the resistor means.

3. A multiplier assembly as in claim **1** wherein the dielectric barriers and the encapsulation compound have different thermal characteristics to thereby provide improved thermal dissipation.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,777,249 Dated December 4, 1973

Inventor(s) Christ J. Dumas

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

column 1, line 52, "unting" should read -- mounting --.

column 2, line 1, "adjcent" should read -- adjacent --.

column 2, line 20, "20" should read -- 29 --.

column 3, line 36, "he" should read -- the --.

column 4, line 12, "bak" should read -- back --.

column 4, line 29, "applicators" should read -- applications --.

column 4, line 30, "54" should read -- 45 --.

column 4, line 51, "on" should read -- in --.

column 4, line 61, "moutning" should read -- mounting --.

Signed and sealed this 10th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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Disclaimer

3,777,249.—*Christ J. Dumas*, Forest View, Ill. MULTIPLIER ASSEMBLY. Patent dated Dec. 4, 1973. Disclaimer filed Apr. 29, 1974, by the assignee, *American Plasticraft Company*.

Hereby disclaims the term of the patent subsequent to Nov. 6, 1990.

[*Official Gazette July 1, 1975.*]