Jan. 3, 1967 M. YARMOVSKY 3,296,487

PLURAL VOLTAGE REGULATOR DISCHARGE DEVICES IN A UNITARY STRUCTURE

Filed Feb. 4, 1964

Fig. 1.

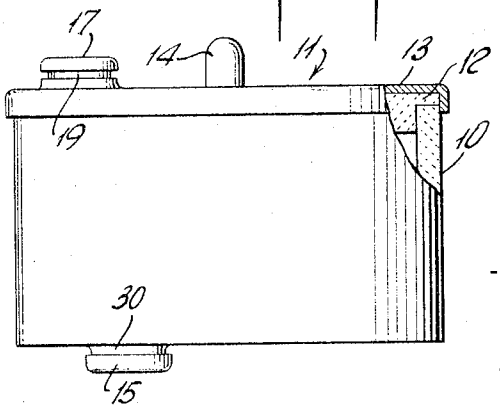


Fig. 2.

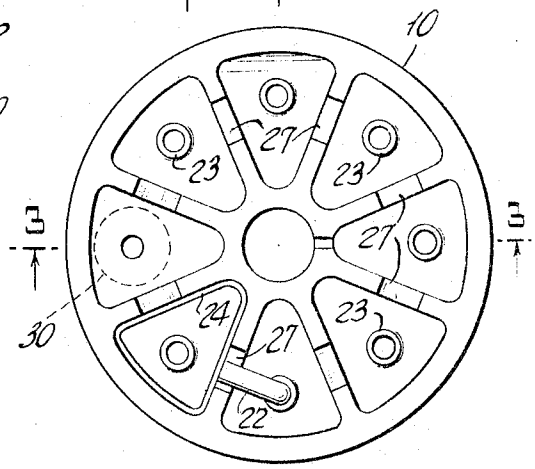


Fig. 3.

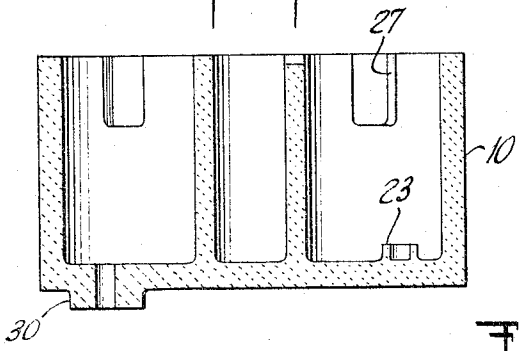


Fig. 4.

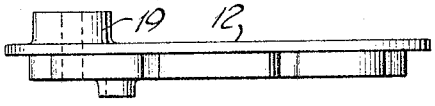


Fig. 5.

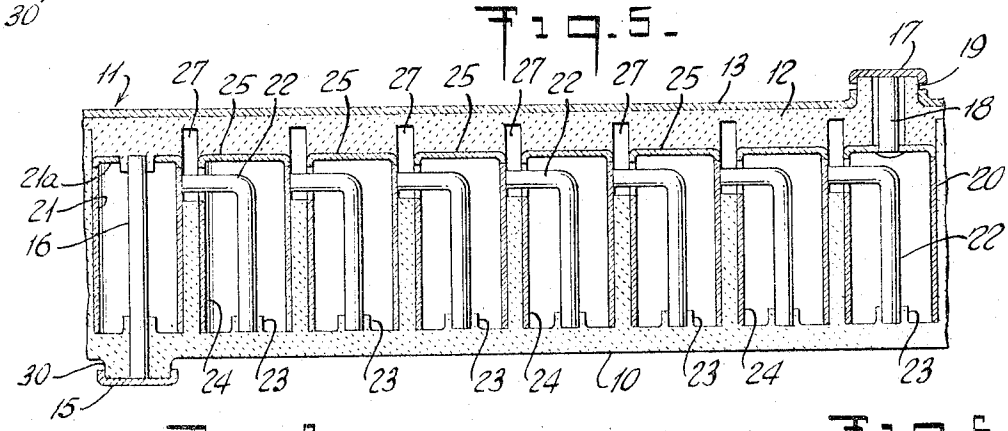


Fig. 7.

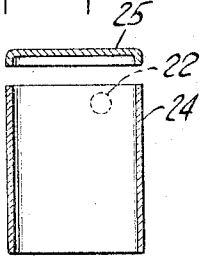
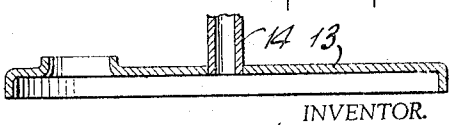


Fig. 6.



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3,296,487

Patented Jan. 3, 1967

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PLURAL VOLTAGE REGULATOR DISCHARGE DEVICES IN A UNITARY STRUCTURE

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Filed Feb. 4, 1964, Ser. No. 342,364

8 Claims. (Cl. 315—36)

This invention relates to a voltage regulator discharge device for providing a stabilized voltage across its terminals. The invention has particular reference to a novel envelope shape which permits a plurality of devices to be arranged within a small and compact space.

Voltage regulator devices are old in the art and have been used for some time in regulator circuits to provide a stabilized output voltage when either the supply voltage is varied or the load impedance is changed. Prior discharge tubes have generally been constructed with glass envelopes and glass re-entrant stems. When higher voltages are required, a plurality of separate regulator tubes are necessary, each having its own base fitting. The present invention provides a convenient means for grouping as many as 16 discharge devices in a single compact unit which saves space and eliminates considerable wiring.

One of the objects of this invention is to provide an improved voltage regulator discharge device which avoids one or more of the disadvantages and limitations of prior art regulators.

Another object of the invention is to provide a compact structure for a plurality of discharge units.

Another object of the invention is to arrange a plurality of discharge devices in a single compact arrangement so that all the devices may be exhausted, processed, and sealed in a single operation.

The invention comprises an envelope in the form of a wheel having a plurality of cavities arranged around the central axis and connected to each other by means of an L-shaped electrode. A single external terminal is provided for a rod-shaped anode at one end of the series and a single external terminal is provided for a triangular-shaped cathode at the other end of the series. One feature of the invention comprises an intermediate electrode combination which includes a triangular-shaped cathode connected to a rod anode extending into the next adjoining cavity. An exhaust connection is made to the central portion of the device so that all the cavities can be exhausted and filled at the same time.

For a better understanding of the present invention, together with other and further objects thereof, reference is made to the following description taken in connection with the accompanying drawings.

FIG. 1 is a side view of the discharge device with a small portion shown in section.

FIG. 2 is a top view of the discharge device with the cover removed and showing only one cathode-anode electrode combination.

FIG. 3 is a cross sectional view of that portion of the discharge device shown in FIG. 2 and is taken along line 3—3 of that figure.

FIG. 4 is a side view of the top portion of the device with the metal cover removed.

FIG. 5 is a cross sectional development of the discharge devices arranged in a straight line to show the operation and the series connection provided by the electrodes.

FIG. 6 is a cross sectional view of the metal cover which fits on top of the component shown in FIG. 4. This view indicates the manner in which the discharge tubulation is connected.

FIG. 7 is a cross sectional view of one of the cathode electrodes showing a cover which is fitted on the top portion.

Referring now to the drawings, the discharge device shown in FIG. 1 includes a cylindrical body **10** having a cover arrangement **11**. The cover **11** includes a disk **12** which is preferably made of ceramic and a metallic cover **13** which fits over the ceramic member **12** and is brazed to a metallic coating on the top portion of the main body **10**.

In order to exhaust and fill all the discharge elements with gas at a suitable reduced pressure, a small tube **14** is connected to the center of the metallic cover **13** for connection to a vacuum pump.

The anode terminal comprises a cap **15** which is connected to an anode rod **16** (see FIG. 5). The cathode terminal comprises a metal cap **17** which is electrically isolated from the metal covering **13** by the extension **19** of the ceramic that is metalized and brazed to the cap. The cathode cap **17** is connected by means of a short rod **18** to a triangular cathode element **20** in the last discharge space.

Referring now to the development diagram shown in FIG. 5, the anode **16** is positioned in the first discharge space adjacent to the cathode **21** in the first discharge space. This cathode is a triangular sleeve of nickel which just fits into the discharge space and supports a cover **21***a* which has an opening therethrough for the passage of the anode **16** and an extension of the ceramic cap **12** which supports the anode **16** and insulates it from the cover **21***a*. This triangular sleeve **21** is brazed or welded to a first L-shaped electrode **22** which passes through an opening **27** in the ceramic wall and is anchored in a receptacle **23** in the next adjoining discharge space. Though the electrode **22** is connected to the cathode **21**, in the adjoining discharge space it functions as an anode.

In the adjoining discharge space the cathode **24** has the same shape as cathode **21** and supports a cover **25**. Each succeeding cathode is the same as cathode **24** and each succeeding anode is the same as anode **22**.

When this discharge device is constructed the terminal anode **16** is inserted into the bottom portion **10** and the terminal cap **15** is brazed to a metallic coating burned onto an extension **30** which forms an integral part of the bottom portion **10**. Next, all the cathode triangular electrodes are placed in their respective cavities and the covers **25** applied to all the intermediate devices. Finally the ceramic disk **12** together with the metallic cover **13** and the terminal cap **17** are positioned on top of the main body and the metallic cover and cap **17** are brazed in place. This completes the assembly of the device and now tube **14** may be connected to a pump and the discharge devices processed and filled with the desired gas.

The operation of this device is the same as the operation of other voltage regulator discharge devices which have been described in the literature and which are well known.

Discharge devices of this type may be made to regulate the voltage across each anode and cathode within the range of 70 volts to 150 volts by varying the type of gas within the envelope, its pressure, and the cathode work function. With a voltage regulator having 8 cavities and 8 discharge devices in series connection, the regulated voltage will be 8 times the terminal voltage of each individual device. When the device has 16 cavities and 16 discharge devices in series connection, the regulated voltage will be 16 times the terminal voltage.

The preferred type of voltage regulator has been shown with a metallic cover plate **13** but it is obvious that this cover plate may be omitted and the disk **12** brazed to the bottom portion **10**. It has been found helpful in making tubes of this alternate design to position a band of metal around the edge of disk **12** and in overlapping position on the base portion **10**. The band is then brazed to both portions and a good reliable seal is produced.

The foregoing disclosure and drawings are merely illus-

trative of the principles of this invention and are not to be interpreted in a limiting sense. The only limitations are to be determined from the appended claims.

I claim:

1. A gaseous voltage regulator discharge device comprising, a sealed envelope of electrical insulating material formed with spaced internal walls thereby defining a plurality of cavities, a hollow cathode electrode positioned in each cavity, an anode electrode also positioned in each cavity within a cathode thereby forming a plurality of diode discharge units, connecting means between each cathode and the next adjoining anode, an anode terminal external of the envelope connected to one of said anodes, and a cathode terminal also external of the envelope connected to one of said cathodes.

2. A gaseous voltage regulator discharge device comprising, a sealed envelope of electrical insulating material formed with spaced internal walls thereby defining a plurality of cavities, said envelope containing a gas at reduced pressure, a hollow cathode electrode positioned in each cavity, a rod anode electrode also positioned in each cavity within the hollow portion of the cathode thereby forming a plurality of diode discharge units, an anode terminal external of the envelope connected to one of said anodes, a cathode terminal also external of the envelope connected to one of said cathodes, the other anodes being connected to the outside surface of the adjoining cathodes to form intermediate discharge devices connected in series.

3. A voltage regulator discharge device as claimed in claim 2 wherein an exhaust tube is connected to the envelope thereby permitting the exhausting and filling of all discharge units at one operation.

4. A voltage regulator discharge device as claimed in claim 2 wherein the spaced internal walls are radial about a central axis thereby defining a plurality of cavities arranged around the axis.

5. A voltage regulator discharge device as claimed in claim 2 wherein the envelope is made of ceramic material.

6. A voltage regulator discharge device as claimed in claim 2 wherein each rod anode has one end brazed to a metal surface and the other end is held in a cup formed in the envelope material.

7. A voltage regulator discharge device as claimed in claim 2 wherein the anodes connected to the outside surface of the adjoining cathodes traverse a cut-out portion in said internal walls.

8. A voltage regulator discharge device as claimed in claim 3 wherein said exhaust tube is centrally positioned on a circular cover plate and wherein an axial hole is formed in the envelope material adjoining the exhaust tube.

No references cited.

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