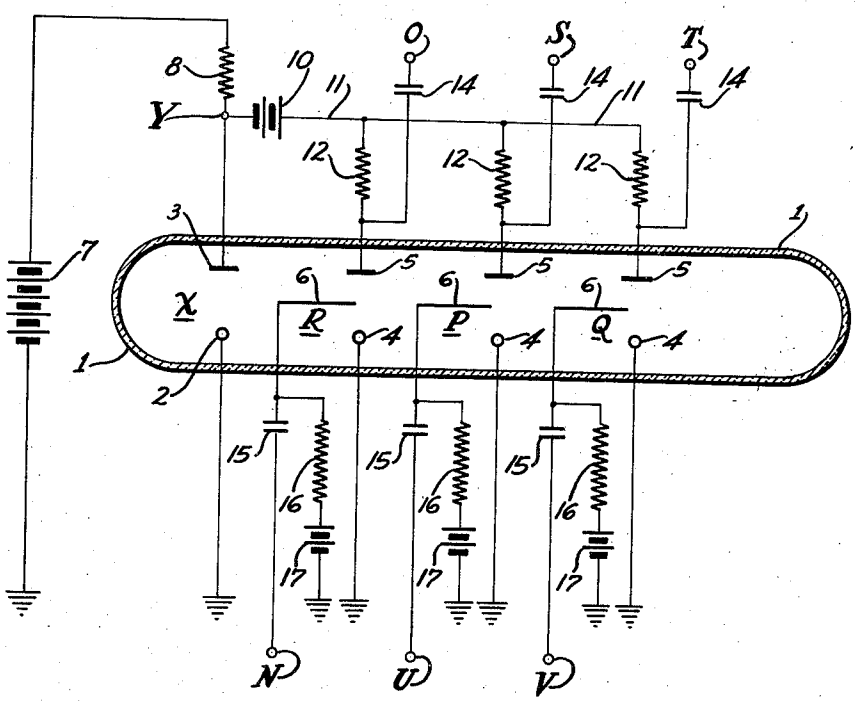
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VOLTAGE REGULATED MULTIPLE AMPLIFIER FOR PULSES

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VOLTAGE REGULATED MULTIPLE AMPLIFIER FOR PULSES

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My invention relates to pulse amplifiers, and more particularly to a gaseous pulse amplifier tube having a plurality of pulse amplifying units therein.

In electronic computers for example, particularly those wherein a minimum of weight is required, it is advantageous to utilize a gaseous conduction tube for pulse amplification, thereby reducing power demand below that which is required if hot cathode devices are used.

However, the gas pressure in small glow discharge tubes can vary due to many factors such as, for example, changes in internal and external temperature, and changes caused by instantaneous amounts of gas adsorption on electrodes and envelope surfaces. Such changes in pressure have a determining effect on the operating voltage characteristics of the glow, and may cause computation errors due to non-uniform response of a plurality of separate gaseous discharge pulse amplifiers in a computing circuit.

I have found that by placing a plurality of independent pulse amplifying electrode units in a single envelope, the variations in voltage characteristics due to pressure changes are common to all units.

It is therefore an object of the invention to provide a plurality of independently operating pulse amplifying units, all operating under the same gas pressure conditions.

It is still another object of the present invention to provide a means and method of maintaining uniform operating conditions for a plurality of pulse amplifying units.

However, even with the inclusion of a plurality of pulse amplifying units in one envelope, it is also advantageous to control the anode voltage of all the units in accordance with an anode voltage established by a separate glow discharge operating in the same gas as that surrounding the amplifying units.

It is also an object of the present invention to provide means for regulating the anode voltage of a plurality of gaseous discharge pulse amplifying units in the same envelope, in accordance with gas conditions in that envelope.

It is a still further object of the invention to provide a novel pulse amplifier and circuit.

Briefly, the present invention comprises an envelope containing a gas at glow discharge pressure. Means are provided to establish a continuous glow discharge in the envelope, and to utilize this discharge to establish operating voltages for a plurality of pulse amplifying units each comprising a cold cathode, an anode, and

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an input electrode. Each of the pulse amplifying units has its own pulse input and output, and also has means for automatically extinguishing a discharge once started, thereby giving rise to an output in the form of a pulse. The pulse amplifying units are entirely independent, but are uniform in action due to their inclusion in a common gas, and to their voltage operating control by the continuous glow discharge. Constant output and sensitivity are thus obtained.

The drawing shows, in schematic diagram form, one preferred tube and circuit for a plurality of pulse amplifying units.

In the drawing, an envelope 1 is preferably elongated to contain a plurality of electrode assemblies, in this specific instance, four, as follows: X, R, P, and Q.

Electrode assembly X is preferably positioned at one end of the envelope 1 and comprises a glow discharge cathode 2 and a glow discharge anode 3. The three electrode assemblies R, P, and Q are identical and each comprises an amplifier cathode 4, an amplifier anode 5, and an amplifier input electrode 6. As the amplifying electrode assemblies are small, 50 or 100 or more of them may be placed along the same envelope, as may be desired for the computer in which the pulse amplifiers are to be utilized.

In assembly X, the cathode 2 is connected directly to ground, and the anode 3 is connected to the positive path of a main power source 7 through a supply resistor 8, and the negative side of the power source 7 is grounded. The source potential is such that a continuous glow discharge is maintained between electrodes 2 and 3 of assembly X.

At a point Y, between resistor 8 and anode 3 of assembly X, the negative pole of a booster battery 10 or similar source is connected, and the opposite, positive pole of this latter battery 10 is extended as an anode line 11. The anodes 5 of electrode assemblies R, P and Q, are connected to anode line 11 through separate anode resistors 12.

Output lines O, S and T are connected to the respective anodes of electrode assemblies R, P, and Q through blocking condensers 14.

The respective input electrodes 6 of assemblies R, P, and Q are connected to input lines, N, U and V, through separate input capacities 15, and each input electrode is connected to ground through a resistor 16 and a small input glow battery 17. Glow batteries 17 have voltages just below the striking voltages between input electrodes 6 and cathodes 4.

Thus each of the assemblies R, P and Q have their own input and output lines.

The anode voltage, however, of each of the electrode assemblies R, P and Q is the anode voltage of electrode assembly X plus the voltage of booster battery 10.

In operation of a specific circuit as shown, for example, source 7 may provide 500 v. potential for the continuous glow discharge in electrode assembly X. The current supplying this glow flows through supply resistor 8, thereby causing point Y to be at a somewhat less potential than that of source 7. Thus point Y is at the operating potential of the anode 3 of electrode assembly X.

Booster battery 10, in this case 100 v., tends to make up the difference between the operating potential at point Y, and the striking potential necessary to operate assemblies R, P and Q. However, the potential of battery 10 is not quite sufficient to cause a glow discharge to strike between the cathodes and anodes of units R, P or Q.

Thus initially, the voltages at the anodes of assemblies R, P and Q are approximately, but not quite, sufficient to cause a glow discharge to strike.

When, however, a small positive pulse of say 5 v., is applied to one of the input electrodes 6 through input line N, for example, this pulse will start a small but significant glow discharge between the input electrode 6 and the adjacent cathode 4 under the voltage from input glow battery 17 which, in the specific circuit being described, may be 100 v. This small glow discharge is sufficient to start a main glow discharge between the anode 5 and cathode 4 of the assembly R. The input glow, however, is immediately extinguished due to the voltage drop in resistor 16. Similarly, the current from the main glow discharge, flowing through output resistor 12, causes a sufficient voltage drop at anode 5 to quickly extinguish the main glow discharge. Thus the voltage at the output O will decrease from a normal value and then quickly rise again to this value to form a sharp negative output pulse of an amplitude equal to the voltage of battery 10, i. e., a 100 v. negative pulse.

As the small glow discharge between the input electrode 6 and the cathode 4 of any one unit is only sufficient to start a main glow discharge between the associated anode and a cathode, and the main glow of one assembly will not fire any other, each electrode assembly is independently operable.

In the specific 500 v. circuit just described, other data are as follows:

Resistance 8=1000 ohms
Resistances 12 and 16=5000 ohms
Capacities 14 and 15=.005 microfarad
Gas=helium
Gas pressure=100 m.m. Hg

The effect of any change in pressure of the gaseous medium and hence a change in the operating voltages of the various electrode assemblies R, P and Q will be immediately detected by assembly X and there will be a corresponding change in the potential of point Y. The voltage of booster battery 10 is constant, hence the potential of the anodes of assemblies R, P and Q, will be held just below the striking point irrespective of the change in gas pressure. Thus the assembly X adjusts the voltage supply of the other assemblies in such a manner as to compensate for variations in the voltage requirements of assemblies R, P and Q due to the change in gas pressure which is common to all assemblies. Constant sensitivity and uniformity of output is insured.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute, the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise a preferred form of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

What is claimed is:

1. A pulse amplifier comprising an envelope containing a gas at glow discharge pressure, a plurality of electrode assemblies in said envelope, each of said assemblies including a cold cathode, anode and input electrode, an input source of potential connected between the cathode and input electrode of each assembly through an input resistor, an output source of potential connected between each cathode and anode of each assembly through an output resistor, said electrodes being spaced to provide a higher starting voltage between the anode and said cathode of each assembly than between said input electrode and said cathode, said input and output sources of potential being of a value holding said input electrodes and said anodes at potentials just below their respective striking potentials, means for applying an input pulse to each of said input electrodes to create an input glow discharge between said pulsed input electrode and related cathode and thereby to initiate a main glow discharge between the related anode and cathode, the drops in potential due to the current flow of said discharges through said respective input and output resistors of a pulsed assembly being sufficient to extinguish said glow discharges after said input pulse has ceased, an output pulse connection to each of said anodes, a separate adjacent glow anode and cold cathode discharge electrodes in said same envelope, a separate source of potential connected across said separate glow discharge electrodes through a separate anode resistor, said separate source having a potential value sufficient to maintain a continuous glow discharge between said separate glow discharge electrodes, a booster source of fixed potential value connected between said separate glow discharge anode and each of the anodes of said plurality of electrode assemblies, the potentials across said continuous glow discharge and said booster source being additive and forming said output source of potential for each of said electrode assemblies.

2. A regulated glow discharge system comprising an envelope containing a gas at glow discharge pressure, a plurality of similar intermittently and independently operated glow discharge devices in said envelope, each having at least an anode and a cold cathode, a regulating anode and cold cathode assembly in said same envelope, a source of potential connected for

creating a continuous glow discharge between said regulating anode and cold cathode, the potential across said continuous glow discharge being connected to the anodes of said intermittently operated glow discharge devices to form a major portion of the potential required to energize said latter glow discharge devices, and a potential source of fixed value connected in series with said continuous glow discharge to form the remainder of the potential required to operate said intermittent glow discharge devices.

3. A glow discharge system comprising an envelope containing an ionizable gas at glow discharge pressure, a plurality of cold cathode glow discharge electrode assemblies positioned in said envelope, a separate adjacent anode and a separate glow discharge cathode in said same envelope, a source of potential connected across said separate glow discharge electrodes through an anode resistor, said source having a potential value sufficient to maintain a continuous glow discharge between said separate glow discharge electrodes, a booster source of fixed potential value connected between said separate glow discharge anode and each of the anodes of said plurality of electrode assemblies, the potentials across said continuous glow discharge and said booster source being additive and forming the source of anode potential for each of the electrode assemblies in said plurality.

4. The method of regulating the operation conditions of a plurality of similar intermittently and independently operable glow tube cold cathode electrode assemblies, which comprises immersing all of said assemblies in the same body of ionizable gas at glow discharge pressure, applying a potential across a portion of said body of gas to create a continuous glow discharge in

said gas, and including the voltage drop across said continuous glow discharge as a substantial portion of the potential used to create a glow discharge in any of said electrode assemblies whereby the operating conditions of all of said assemblies will change uniformly in accordance with gas pressure conditions affecting said continuous glow discharge.

5. A glow discharge system comprising a single envelope containing a gas at cathode glow discharge pressure, a plurality of substantially identical glow discharge electrode assemblies in said envelope and immersed in said gas, each of said assemblies having at least a cold cathode electrode and an anode electrode, a common source of operating potential, a separate regulating resistance for each of said assemblies and connected to one of the electrodes in said assemblies in series with said common potential source, said resistances being substantially identical in value, input means for intermittently and independently energizing said assemblies to cause said cathodes to glow, and a separate output circuit connected to each of said anodes whereby the energization response of all of said assemblies will uniformly change in accordance with any change in gas conditions in said single envelope.

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