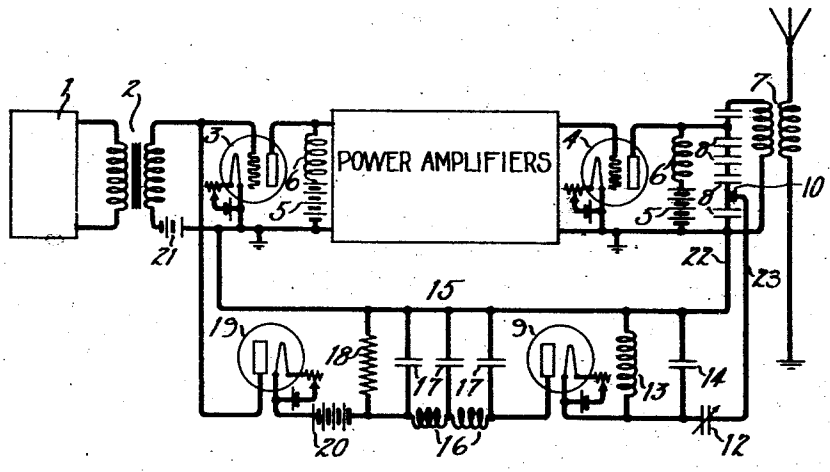
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REGULATING DEVICE FOR HIGH FREQUENCY POWER AMPLIFIERS

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REGULATING DEVICE FOR HIGH FREQUENCY POWER AMPLIFIERS

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This invention relates to amplifying systems and more particularly to devices for limiting the output voltage of such systems.

One object of this invention is to prevent the production of an excessive potential in the output circuit of an amplifying system.

Another object is to control the energy supplied to the input circuit of a power amplifier by voltage changes in its output circuit whereby the potential developed in its output circuit is maintained within a desired safe value.

A feature of this invention is a voltage limiting device so connected between the output and input circuits of a power amplifier, that an excessive voltage in the output circuit reduces the power supplied to the amplifier input circuit.

Novel features which are believed to be characteristic of this invention are pointed out with particularity in the claims appended hereto. The invention itself, however, both as to the details of its organization and its mode of operation, will be better understood by reference to the following description taken in connection with the accompanying drawing in which the single figure is a diagrammatic representation of a radio signaling circuit embodying this invention.

Referring to the drawing, there is shown a modulating system having its output circuit connected by a transformer 2 to the input circuit of a power amplifier. The first and last stages of the power amplifier are represented, by way of example, as space discharge devices 3 and 4 respectively. The modulating system 1 may be of any well known type adapted to produce a carrier wave modulated in accordance with signals. Space current is applied to the discharge devices 3 and 4 by sources 5 through inductances 6 which may be either air core inductances or iron core choke coils. These inductances are used to prevent short circuiting the amplified alternating current through the sources 5. Source 21 is adapted to maintain the grid of repeater 3 at the desired negative potential relative to its cathode. The alternating current anode circuit of repeater 4 includes the primary winding of transformer 7, the secondary of which is connected in the radiating or transmission circuit. Capacity 8 comprising a plurality of units is connected across the primary winding of the transformer 7 and cooperates therewith to constitute a circuit tuned to the frequency of the transmitted wave.

The voltage limiting device includes the rectifier 9, filter15 and rectifier 19. Rectifier 9 is connected across a portion of the tuning capacity. One connection 10 is made variable and may be adjusted to connect one or more of condensers 8 to the rectifier 9 so as to obtain the proper ratio between the voltage produced in the primary winding of transformer 7 and that supplied to the rectifier 9. Variable condenser 12 is inserted in lead 23 from connection 10 for the purpose of adjusting the coupling between the power amplifier output circuit and the voltage limiting device. In connection with condenser 14 it controls the ratio of voltage applied by condenser 8 to that supplied to coil 13. Inductance 13 acts as a by-pass for direct curent, in the circuit including rectifier 9, around condenser 14. Although rectifier 9 has been shown as a two-element space discharge device having a hot cathode and cold anode, any type of device possessing the property of unilateral conductivity can be used.

The alternating current component of the rectified current flowing through the circuit of rectifier 9 is prevented from passing through resistance 18 connected in series with rectifier 9 by means of a filter 15. This filter is shown as comprising series inductances 16 and shunt condensers 17. Inductances 16 will offer high impedance to the alternating current which will be shunted through condensers 17, while direct current will flow in the circuit including rectifier 9 and inductance 13, inductances 16 and resistance 18. The cathode of rectifier 19 is connected through battery 20 and resistance 18 to the cathode of the device 3 while its anode is connected to the grid of device 3 of the power amplifier. Direct current will flow through resistance 18 in such a direction that the terminal of this resistance connected to the cathode of rectifier 19 will tend to have a nega-

tive potential. Rectifier 19, battery 20 and resistance 18 constitute a circuit connected across the grid-cathode circuit of the first power amplifier tube 3 in shunt to the secondary of transformer 2. When the impedance of rectifier 19 is lowered by its cathode becoming negative with respect to its anode, current will flow therethrough so that the potential applied to the grid of device 3 cannot build up beyond a predetermined value.

In the operation of this system the voltage limiting device will be isolated from the input circuit of the first power amplifier tube when the cathode of rectifier 19 is positive with respect to its anode due to the unilateral impedance introduced thereby. When a voltage in excess of a predetermined value is impressed upon the condensers 8 in the output circuit of the power amplifier, current will flow through the rectifier 9 and resistance 18. When the current flowing through the resistance 18 reaches such value that the cathode of rectifier 19 is made negative with respect to its anode the impedance of the rectifying device 19 will be reduced, thereby causing the device to act as a load in shunt to the input or cathode-grid circuit of the first stage 3 of the power amplifier. A certain amount of the input energy supplied by the transformer 2 will be diverted through this shunt path and hence the control potential impressed upon the grid of the device 3 is prevented from building up. The voltage of battery 20 should be adjusted to a value such that the potential applied to the rectifier 19 due to the voltage drop across the resistance 18 will be sufficient to cause the cathode to become negative with respect to its anode when the voltage in the output circuit of the amplifier across the capacity connected to the rectifier 9 reaches the predetermined value. By adjusting tap 10 the limiting or protective device may be set to exercise its control at various voltage levels of the amplifier output.

Although this invention has been shown and described as embodied in a particular circuit, it is understood that it is of general application, and hence is not to be limited to the specific details herein disclosed.

What is claimed is:

1. A space discharge amplifying system including an input circuit for said system and an output circuit therefor, a circuit interconnecting said input and output circuits including a non-conductive impedance comprising means for establishing a conductive path through said impedance for a portion of the input energy when the output voltage of the system exceeds a predetermined value.

2. An electrical system comprising an amplifier having wave input and output circuits, a regulating circuit interconnecting said input and output circuits, a space discharge rectifier connected in shunt to said input circuit and included in said regulating circuit, and means for controlling the impedance of said rectifier in accordance with the wave voltage in said output circuit whereby the input energy of the waves impressed upon the amplifier is controlled.

3. In an electrical system, an amplifier, an input circuit for said amplifier and an output circuit for said amplifier, a voltage limiting circuit connecting said input and output circuits and including a rectifier connected to said input circuit and a rectifier connected to said output circuit, the rectifier connected to said input circuit being of normally high impedance, and means whereby said rectifier is rendered of low impedance by the application of a potential exceeding a certain predetermined value upon the rectifier connected to said output circuit.

4. In an electrical system, an amplifier comprising space discharge repeaters having input and output circuits, a voltage limiting device comprising a plurality of rectifiers, means for impressing a voltage derived from said amplifier upon one of said rectifiers, a filter comprising inductance and capacity for preventing alternating currents from passing to said second rectifier, means for applying a voltage to said second rectifier varying in proportion to the voltage impressed upon said first mentioned rectifier, means for causing said second rectifier to act as a load on said amplifier when the output potential of said amplifier exceeds a certain predetermined value.

5. A system comprising an electron discharge device amplifier having an input circuit and an output circuit, an auxiliary space discharge device associated with said input circuit, and means cooperatively associated with the output circuit whereby excessive potential differences across an element of said output circuit reduce the input energy applied to said amplifier by acting upon the input circuit to establish a conductive path in shunt thereto.

6. In an electrical system, an amplifier comprising space discharge devices, an input circuit and an output circuit for said amplifier and a circuit interconnecting said input circuit and said output circuit, said interconnecting circuit including rectifiers and a resistance for preventing the output energy level of said amplifier exceeding a predetermined value.

7. A space discharge amplifying system provided with an input circuit and an output circuit, a normally open circuit for connecting said input circuit with said output circuit including a variable impedance, and means, responsive to energy in said output circuit, for closing said connecting circuit and inserting said variable impedance in shunt to said input circuit.

8. In an electrical system, a space discharge amplifier, an input circuit and an output cir-

cuit for said amplifier, a variable impedance and means controlled by the output energy of the amplifier to insert said impedance in shunt to said input circuit to control the ratio of the energy supplied to the input circuit with respect to the energy applied to the amplifier.

9. In an electrical system, a space discharge amplifier, an input circuit and an output circuit for said amplifier, and a circuit interconnecting said input and output circuits including two rectifiers and a resistance which cooperate to control the amplifier.

10. An amplifier having an output circuit and an input circuit, means connected to said output circuit to regulate the energy applied to said input circuit in such manner as to prevent excessive currents in said output circuit and means for rendering said regulating means ineffective to regulate said input energy so long as said output current is less than a predetermined magnitude.

11. An amplifier having an input circuit and an output circuit and means associated with said output circuit for diverting energy from said input circuit when the magnitude of said output circuit current exceeds a preassigned value, said means remaining ineffective so as to permit said amplifier to operate unaffected by it throughout any range of magnitude of output currents less than said preassigned value.

12. A system comprising a space discharge amplifier having an input circuit, an output circuit, a conductive path of variable impedance in shunt to said input circuit and means associated with said output circuit and responsive to potential differences across an element thereof to vary the impedance of said conductive path in accordance with said potential differences without, however, in any way affecting said impedance while the output circuit currents lie within any range less than a preassigned limiting magnitude.

13. In combination, an amplifier, an input circuit connected thereto, an output circuit connected thereto, a path connected in shunt across said input circuit having a normal impedance which is substantially infinite and means operated in response to excess currents in said output circuit to vary the magnitude of said impedance so as to cause it to variably divert energy from said input circuit.

In witness whereof, I hereunto subscribe my name this 3rd day of November A. D., 1924.

JOHN C. SCHELLENG.