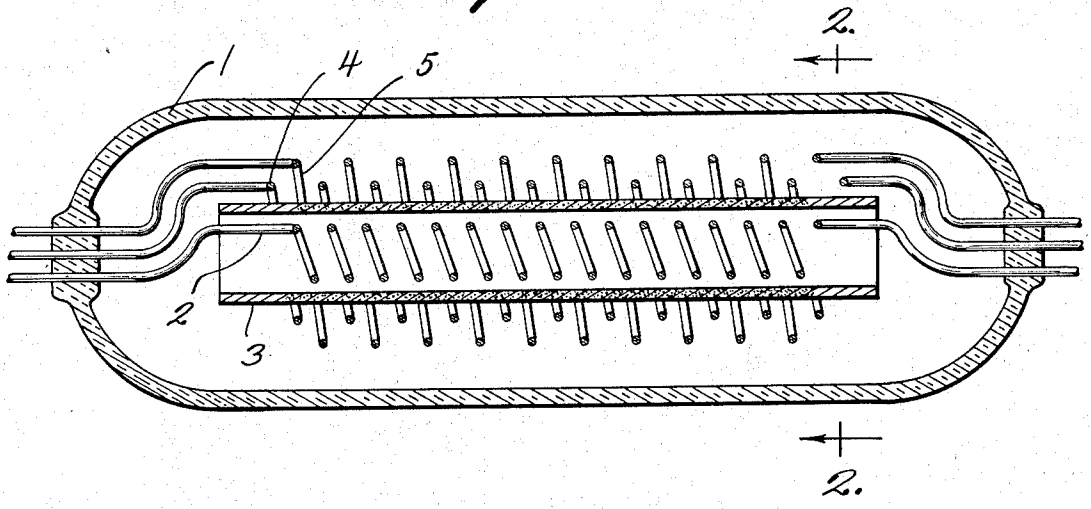
June 9, 1936. H. P. PRATT 2,043,517

RADIO APPARATUS

Original Filed March 31, 1923

Fig. 1.



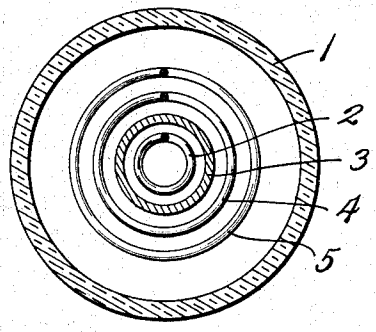


Fig. 2.

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UNITED STATES PATENT OFFICE

2,043,517

RADIO APPARATUS

Harry Preston Pratt, Chicago, Ill., assignor, by mesne assignments, to Harry Preston Pratt, William Frederick Grower, Henry Asa Allen, Howard Thompson Ballard, and George Squires Herrington, trustees acting as Pratt Radio Trust

Original application March 31, 1923, Serial No. 628,962. Divided and this application June 29, 1935, Serial No. 29,083

11 Claims. (Cl. 250—27.5)

My invention has for its object the method of and apparatus for increasing the strength, activity and intensity of the electrical oscillations in radio, power, metal or wireless circuits, and consists primarily of the introduction into said circuit of a vacuum tube with sealed-in terminals or electrodes. By electrical, magnetic, luminous, caloric, energy radiant, electro-chemical and mechanical means, my method and apparatus as hereafter explained will establish, maintain and stabilize an electrical circuit between the terminals within said vacuum tube, through the conducting medium and polar action of the material particles that remain in said tube, or are added to said tube after partial exhaustion has taken place. By such means I am able to utilize and increase the potential energy stored up in the atomic structure or subdivisions of matter within the vacuum tube. By means as herein described I am able to increase, decrease, concentrate and control and directionalize the movements of said material particles, electrons, atoms and molecules in said tube, and to ionize and electrolize and to split up and combine electro-chemically said material particles and gases. As herein used, material particles and electrons refer to all elements as metals, gases, etc.

A further object of my invention is to increase or decrease the number of electro-magnetic and electro-static lines of force within the vacuum tube and to use said lines of force with their potential energies to control the velocity, the direction, and the velocity and direction of the atoms, molecules, ions, moving particles and gases, so that the force of impact of these moving entities when substantially impressed upon the electrodes in partial vacuo will serve to increase and regulate the activities of the moving entities and change the number of lines of force and the "potentials" between terminals in the tube, thus varying the strength of the signals or impulses. The speed and impact of the atoms, moving particles, etc. which is part of my discovery depend wholly upon the potential energy released and the free path in the tube.

A further object of my invention and discovery consists in receiving the initial signals or impulses which are delivered to or transmitted from the antenna of a radio apparatus, passing them through what is commonly known as a primary wire, coil, spiral or solenoid or an equivalent electrical conducting medium which may be attached to, or in circuit with a tuning device.

In one of my constructions hereinafter explained, a vacuum tube is surrounded with a coil, spiral or solenoid which causes said tube to act in the capacity of a core, placing the tube's contents in an electrostatic and electromagnetic field, any oscillatory or pulsatory impulses or other signals, passing through the coil, spiral or vacuum tube, or both, directly or indirectly serve to augment and increase the activity of the material particles in said tube which necessarily responds to the oscillatory tuned impulses and when the initial signal passes to the point of transformation, amplification and detection, the signals or impulses become considerably strengthened and aligned.

When a signal passes into or out of a vacuum tube of my construction, the material particles within the tube are influenced according to their polarities and respond to the directive energy, that is to say in one direction or another, depending on the direction in which the signals are passing. If oscillatory or alternating, a forward and back spiral or direct movement is produced. If pulsatory, the movement created, passes in one direction.

In my discovery and construction, the service of the filament-plate circuit acts as a conducting medium only, for the purpose of receiving, transmitting or transferring the superimposed impulses along the directional line of force as discussed by me, in the circuit to the receiving instrument, and to more securely establish the electrical connection between the filament and plate electrodes completing the circuit through the medium of the said material particles in the tube.

In the case of the present highly exhausted filament-heated-tube, the negative electrons serve to make it a one-way or uni-directional current. The other two currents, the filament-plate and oscillatory from the grid, are not miscible. The superimposed current follows the direction and movements of the lines of force in the circuit.

Consequently, the filament-plate circuit maintains a constant voltage. The superimposed impulses with their varied potentials and oscillations should produce practically no effect whatsoever on the filament plate circuit potential, which always maintains its integrity. Any variations that may take place in the filament-plate circuit, if any, are due to imperfect control of the tube action from other sources, than that of superimposed impulses.

Difficulty has been experienced with the present three-element tube by depending upon the movements of the electrons without taking into con-

sideration the atomic gas value contents and control of same within the tube. The stream of negative electrons when leaving the filament are thrown off in all directions after attacking the plate and are shifted through repellant forces from the plate to the grid and then the negative stream of electrons through repulsions are split up, moving in every direction, completely filling the unoccupied portion of the tube, until every particle is repelling every other particle without following any definite direction. Consequently, all of the negative electrons exist in a disordered or non-directionalized state. This permits the tube to respond readily to all disturbing influences superimposed or not, brought in with the incoming oscillatory tuned-in signals, of all sorts and kinds resulting in the production of the whistling sound as well as any other inductive or so-called static disturbances so annoying to the listener.

These undesirable inductive and static disturbances, are frequently produced within the local circuit, and are strong enough to cause a kick-back, or convert the oscillations of an incoming signal, into the oscillations of an outgoing or transmitting signal, with the result that the squealing and whistling noises, are set up in the neighboring receiving sets.

My invention overcomes these difficulties by the release of the energy stored up in the atomic structure, and utilizing this energy within the tube, to control and direct the incoming and outgoing signals. This application is a division of my application Serial No. 628,962, filed March 31, 1923.

In the accompanying drawing, I have illustrated what I now consider the preferred embodiment of my invention.

The drawing, Fig. 1 shows a sectional elevation of a radio tube embodying my invention.

Fig. 2 is a cross section thereof taken along the line 2—2 of Fig. 1, looking in the direction of the arrows.

Referring now to the drawing, the reference character 1 designates an evacuated envelope of any suitable material within which is mounted an elongated helical heating coil 2. A tubular insulating member 3 surrounds the coil 2 and is suitably supported therein. The insulating member 3 is a composite member and may be constructed of mica, glass or any other suitable dielectric material, and may be prepared with a chemical or any of the active elements, metals or salts, which, when heated give off material particles or gases. The insulating member 3 may be supported suitably in position within the envelope and may be provided with perforations over its surface, if desired. A second helical coil 4 surrounds the tubular insulating member 3 and is mounted inductively with respect to the coil 2. The tubular coil 4 may be supported by the insulating tubular element 3 which may separate the coils or electrodes 2, 4 and 5 and prevent such electrodes from buckling. Such insulating member may act as a support or framework for the electrodes. Another helical coil 5 surrounds the insulating member 3. The helical coils 2, 4 and 5 are inductively related one with the other, and may constitute the usual filament, grid and plate of a thermionic vacuum tube. This same form of construction may be employed advantageously for coupling between various circuits in a manner similar to any usual type of transformer or induction coil.

In operation, when the inner coil 2 is heated by passing an electric current therethrough, material particles are given off therefrom as well as from the active metals within the tubular dielectric tube, and the coil 4 can be connected and function in the manner of the usual grid while the coil 5 functions as an anode as in a usual thermionic tube. The various elements of the device can be connected in an electric circuit in any suitable manner, well known to those skilled in the art. The tube may operate in some instances as a cold tube.

The material particles or gases emitted from the insulating composite tubular member 3 may cause the envelope 1 to become higher or lower in vacuum according to the amount of energy supplied the coil 2 to control its heat.

I claim:

1. A vacuum tube, a spiral electrode therein, a dielectric element surrounding said electrode, a spiral grid surrounding said electrode and dielectric element, and a spiral electrode surrounding all of the aforesaid elements within the tube.

2. A vacuum tube envelope housing a coil electrode and a tubular insulating element surrounding said coil electrode and containing material for emitting material particles when heated and a cooperating coil electrode surrounding said element.

3. A vacuum tube envelope housing an elongated coil electrode, other coil electrodes surrounding said first coil electrode and a tubular insulating element interposed between said first electrode and said other electrodes containing material for emitting material particles when heated.

4. A vacuum tube envelope housing an elongated heating coil, a tubular mica element surrounding said coil and containing salts for emitting material particles when heated and a cooperating electrode in said tube.

5. A vacuum tube envelope housing a coil electrode, a tubular insulating element surrounding said coil electrode and a second coil electrode surrounding said tubular element and supported thereby.

6. A vacuum tube envelope housing an elongated coil electrode, other coil electrodes surrounding said first coil electrode and a mica insulating member supporting one of said electrodes.

7. A vacuum tube housing a heating coil, electrodes surrounding said heating coil and a mica element for supporting one of said electrodes.

8. A vacuum tube housing a filament, a grid and a plate, a nonconducting dielectric element surrounding said filament, said dielectric element containing salts for emitting material particles when heated, said material particles acting as a conducting medium connecting the filament, the grid and plate electrically.

9. A vacuum tube housing an elongated heating element, a plurality of coil electrodes surrounding said element, and an insulating tube interposed between said element and one of said coil electrodes.

10. A vacuum tube housing an elongated heating element, a plurality of coil electrodes surrounding said element, and an insulating tube interposed between said element and one of said coil electrodes and containing material which when heated gives off material particles.

11. A vacuum tube housing an elongated heating coil and a plurality of coil electrodes surrounding said first coil and concentric therewith.

HARRY P. PRATT.