Dec. 1, 1925. 1,564,070

H. K. HUPPERT

RADIO VACUUM TUBE

Filed Jan. 19, 1923

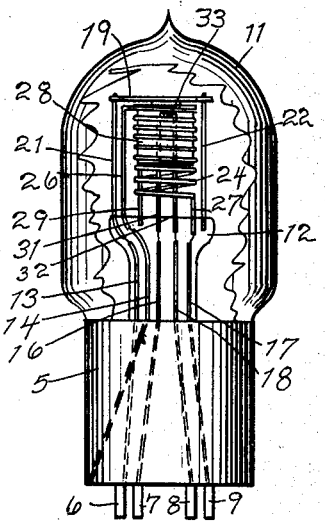

Fig. I.

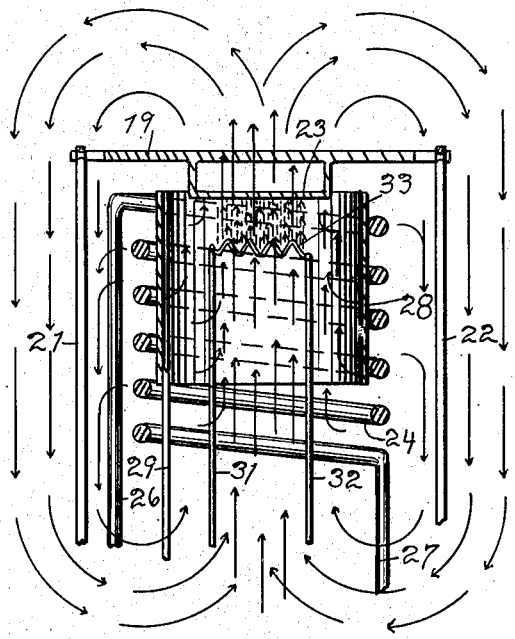

Fig. II.

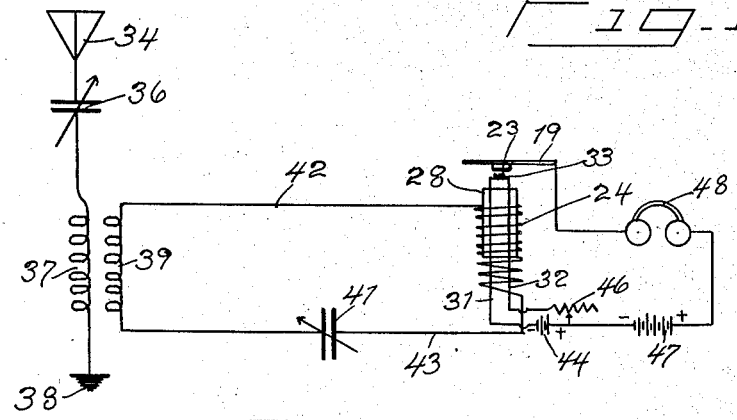

Fig. III.

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RADIO VACUUM TUBE.

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To all whom it may concern:

Be it known that I, HENRY K. HUPPERT, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented new and useful Improvements in Radio Vacuum Tubes, of which the following is a specification.

This invention relates to improvements in radio vacuum tubes, and has particular reference to a tube adapted to be used in the reception of weak radio currents for the purpose of detecting, rectifying and amplifying the same so that they may become audible and intelligible.

The principal object is to provide a tube which does not employ a grid thereby eliminating the super-imposed static which at times is very annoying when using a tube having a grid.

A still further object is to provide a tube which is exceedingly quiet.

A still further object is to provide a tube which may be employed with radio receiving sets as now upon the market with but a slight alteration.

A still further object is to provide means for shielding against the escape of any of the electrons from a given path.

Other objects and advantages will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevation of a vacuum tube constructed in accordance with my invention, and partly broken away for the purpose of better illustration,

Figure 2 is an enlarged detail cross section partly in elevation showing the arrangement of parts within the tube and further showing, through the medium of arrows the electronic and magnetic action of the tube, and

Figure 3 is a diagrammatic view showing the manner of employing the tube in a radio receiving circuit.

Up to the present time the most efficient tubes have employed a filament, a plate and a grid. The action of tubes of this kind may be summarized as follows:—

After the filament has been lighted an electronic emission takes place which escapes toward a positively charged plate. A grid is interposed between the filament and the plate which grid is attached to the input or receiving circuit in such a manner that the radio oscillations are impressed upon this grid with the result that the same is constantly changing its value in accordance with the radio oscillations, with the result that the same assists or repels the electrons in their travel toward the plate.

It will readily be seen that static superimposed upon this grid would also affect the electronic emission toward the plate, which results in a very noisy tube.

I have sought to overcome the objections to a tube of this type by employing a plate, a filament, a solenoid and a shield, which shield is placed between the solenoid and the filament thereby preventing any electronic action between the filament and the solenoid. This solenoid I connect at both ends to the input or receiving circuit thereby securing a direct flow of current therethrough with the result that the static which may be super-imposed upon the incoming oscillations cannot affect the tube in the above described manner.

In the accompanying drawings wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 5 designates a base having contact pins 6, 7, 8 and 9 mounted therein. The construction of this base and pins is well known and common in all radio tubes, therefore further discussion of the same will be avoided.

At 11 I have shown a glass bulb which forms a chamber within which the elements of the tube are enclosed and also serves as a medium for maintaining a proper condition of vacuum about the elements.

At 12 is shown a stem of glass fused to the tube 11 and forming a support for the elements of the tube, as well as a means for sealing thereinto leads as shown at 13, 14, 16, 17 and 18. The manner of connecting these leads to the various elements will be omitted, as it is well known and merely consists of a fine piece of platinum wire fused into the glass support.

At 19 I have shown a plate which is substantially rectangular and is supported by rods 21 and 22. The rod 21 is connected to the lead 13, while the rod 22 is merely secured in the glass stem 12.

By referring to Figure 2, it will be noted that this plate 19 is provided with a down-

ward extension 23, for the purpose of forming an abutment for the bombardment of the electronic emission. It is of course understood that this extension may be omitted without altering the operation of my tube.

At 24 I have shown a coil or solenoid, one end of which is bent downwardly so as to form a support 26, while the opposite end of this coil is bent downwardly so as to form a support 27. The support 26 is connected to the lead 14 which lead is in turn secured to the base 5 as shown in dotted lines in Figure 1. The support 27 is connected to the lead 17 which lead is in turn connected to the pin 9 thus forming a complete circuit through the solenoid from the exterior of the tube.

At 28 I have shown a vertically mounted cylindrical shield, which shield may be constructed of any impervious material, such as glass, mica, fiber, aluminum or other similar metals. It is of course understood that in using a metal shield, the wire forming the solenoid must be insulated therefrom by being covered with enamel or similar insulating material. It is also understood that if I employ more than one layer of convolutions in my solenoid, the wire must also be insulated. This shield 28 is supported by a rod 29 having its lower extremity sealed in the glass stem 12.

Parallel spaced conductors 31 and 32 serve to carry current to a filament 33, which conductors are connected to the leads 16 and 18, which leads are in turn connected to the pins 7 and 8 respectively.

By now referring to Figure 3, the numeral 34 refers to an aerial, 36 to a condenser, 37 to the primary of an inductance, 38 the ground, 39 the secondary of the inductance, 41 a condenser connected to one side of the secondary and the numeral 42 a wire leading from the opposite side of the secondary.

It will now be noted that the wire 42 is connected to the upper end of the coil or solenoid 24, while the wire 43, leading from the condenser 41 is connected to the lower end of the solenoid 24, thus completing the circuit.

It will also be noted that the conductor 31 is connected to the negative side of an A battery 44, while the conductor 32 is connected through a rheostat 46 to the opposite side of the A battery, as well as the negative side of a B battery 47. The opposite side of this B battery is connected through the telephones 48 to the plate 19, thus completing a second circuit.

It is to be here noted that the shield 28 completely surrounds the filament 33 so that it is impossible for any of the electrons to contact the convolutions of the coil 24 thereby entirely preventing any possibility of the solenoid acting as a grid, it being a well established fact that the electrons will not readily pass through any solid matter, while it is also well known that magnetic lines of force cannot be insulated.

The operation of my tube is as follows:—

Assuming that the current has been turned on so as to heat the filament 33, an electronic emission will commence as indicated by the small dotted arrows in Figure 2, between the filament and the plate. Assuming that conditions are at a point of rest the electronic action will be undisturbed and therefore a definite rate of flow will exist.

We will assume now that radio oscillations are received upon the antenna, which oscillations are transferred as shown in Figure 3, from the primary to the secondary and thence into the solenoid circuit, the result being that an oscillating current will be caused to pass through the solenoid 24. This current passing through this solenoid will immediately set up a magnetic flux which will flow as shown by the long arrows in Figure 2, when the current is moving in one direction. This direction of movement of the magnetic flux will reverse when the current oscillates in the opposite direction, the result being that this flux being densest in the center of the solenoid will assist the electronic emission and cause a more rapid bombardment during the period that the flux is moving in a direction corresponding with these arrows.

As the magnetic flux reverses its direction of movement, the result will be that they will oppose the flow of electrons in an exact proportion to the density of the magnetic flux.

It will thus be seen that I have provided a tube which through magnetic action assists or retards the electronic flow from the filament to the plate in exact proportion to the magnitude of the oscillations impressed upon the aerial or input circuit.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:—

1. In a device of the character described, a stem, a plate supported above said stem at a point remote therefrom, conductors rising from said stem, a filament arranged between said conductors at their upper ends thereof, an extension depending from the plate and arranged in the path of the electronic emissions from the filament, a vertically mounted cylindrical electronic shield surrounding said filament, a solenoid surrounding said shield, said shield being adapted to prevent electronic action between the filament and

solenoid, and a bulb secured to said stem and surrounding the above mentioned elements for the purpose of providing a vacuum chamber therefor.

2. A radio vacuum tube of the character described comprising a base, a stem rising therefrom, vertically disposed parallel arranged rods having their lower ends embedded in the stem, a plate bridging the upper ends of the rods and being supported thereby, conductors rising from the stem between the rods, a filament secured to the upper ends of the conductors, a cylindrical shield vertically supported to surround the filament, a downward extension formed on the plate and arranged to overlie the filament, a solenoid surrounding the cylindrical shield and being adapted to set up a magnetic flux to flow in a given path and said shield being adapted to prevent electronic action between the filament and solenoid.

In testimony whereof I affix my signature.

HENRY K. HUPPERT.