Nov. 4, 1930. B. G. BLACKMAN 1,780,698

VACUUM TUBE

Filed Sept. 16, 1925

Fig.1.

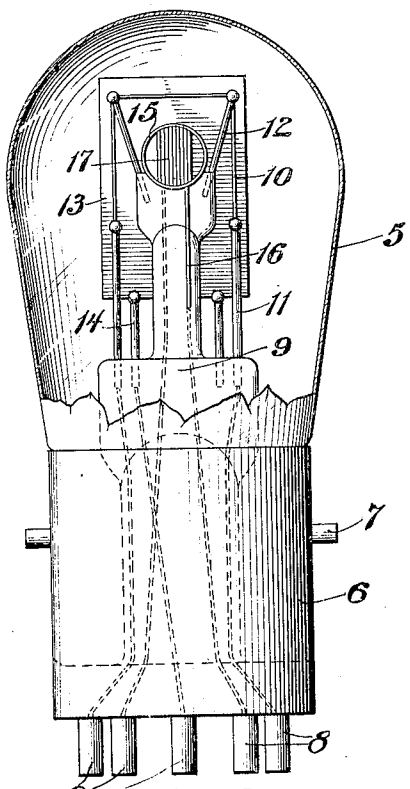


Fig.2.

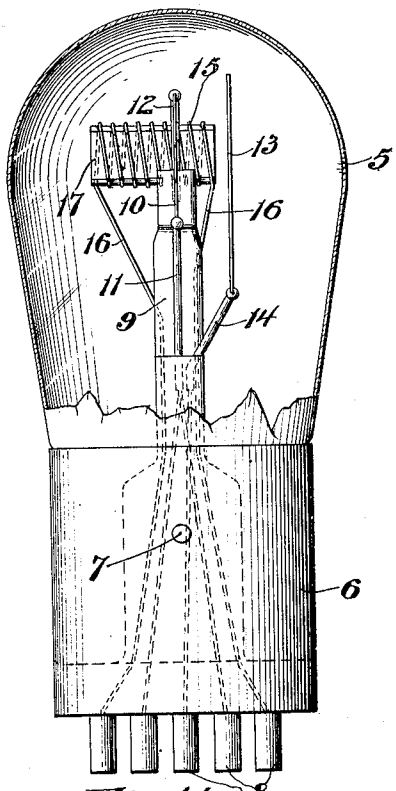


Fig.3.

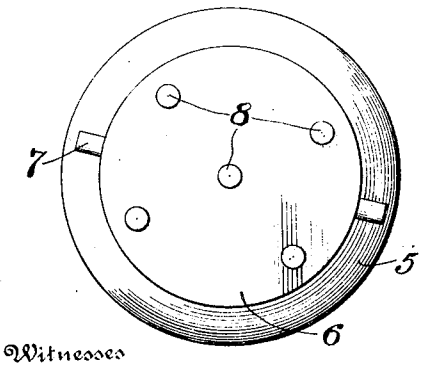
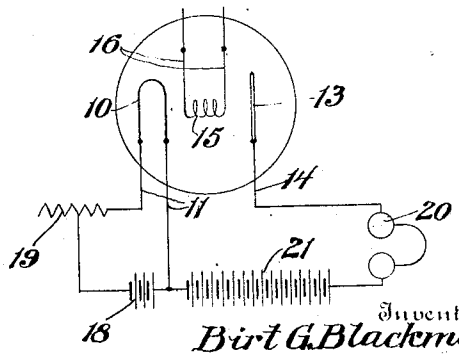


Fig.4.



Witnesses

Chas. L. McDonald.

E. N. Lovewell

Inventor

Birt G. Blackman

By E. G. Siggers

Attorney

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UNITED STATES PATENT OFFICE

BIRT GRIFFIN BLACKMAN, OF OGDEN, UTAH, ASSIGNOR OF ONE-THIRD TO CLEVELAND REDFIELD, OF OGDEN, UTAH

VACUUM TUBE

Application filed September 16, 1925. Serial No. 56,677.

This invention relates to an improvement in vacuum tubes, such as are adapted to be used in oscillatory electrical circuits to generate, maintain, amplify, or rectify electrical oscillations.

The general object of the invention is to provide a tube containing an electron emitting member, a vibratory plate of ferro-magnetic material constituting the electron receiving member, and a member adapted to receive the input and capable of creating a magnetic flux, which varies with the oscillations in the input to actuate the electron receiving member as hereinafter explained.

The specific construction of the invention, its objects and advantages, and the principles of its operation will be more fully explained in connection with the accompanying drawing, which illustrates one embodiment thereof.

In the drawing:

Figure 1 is an elevation of the tube partly broken away.

Figure 2 is a similar view taken at right angles to Figure 1.

Figure 3 is a bottom plan view.

Figure 4 is a diagram of one circuit in which the invention may be used.

The characteristic features of the invention are contained within a bulb 5, which is secured in a base 6, having projecting lugs 7 adapted to engage a bayonet slot in the socket, and having five terminals 8. The various elements within the tube are mounted on a central support 9. A filament 10, constituting the electron emitting element, is connected with lead-in wires 11, and is held quite rigidly by supporting wires 12. A plate 13 of ferro-magnetic material is connected at its lower end with support wires 14 which are flexible, one of which is connected with a lead-in wire. The plate 13 is normally disposed in a plane parallel to the plane of the filament 10, but may be thin and flexible and capable of vibration toward and from the filament. I prefer that the flexibility should be in the support rather than in the plate. A coil 15 is supported by the central support 9. The wires 16 act as lead-ins and anchors for the coil, the axis of the coil being at right angles to the normal position of the plate 13. For the best results, a magnetic core 17 is supported within the coil 15, although the device is operative without the core.

In the hook-up shown in Figure 4, the wires 11, leading to the filament 10, are connected to an A battery 18 with a variable resistance 19 in the circuit. The wire 14, which constitutes the lead-in wire for the plate 13, is connected through a head set 20 to one terminal of a B battery 21, the other terminal of the B battery being connected to the positive terminal of the A battery 18.

In the operation of the tube, the filament 10 is electrically heated to a point of electronic emission. The plate 13 is charged positively from the B battery 21, and the coil 15 receives the oscillations from the input line 16. The coil, whether self-excited or externally excited, creates a magnetic flux which, either with or without the core 17, causes the plate 13 to vibrate in harmony with the oscillations in the circuit. The plate will be drawn toward the coil when the latter is energized in one direction, which will cause a certain degree of polarization in the plate, so that upon reversal of the direction of flow of current within the coil, reversing the polarity of the coil, the coil and plate will have like poles opposed to each other, due to the temporary holding of polarity of the plate, or residual magnetism.

These like poles will naturally repel each other, causing the plate to move away from the coil, and consequently away from the filament. The plate may, if deemed advisable, be composed of a substance of low permeability, and polarized.

The operation of the tube will cause great variations in current in the plate circuit, by reason of the variations in distance between the plate and filament; first, by change of the internal plate resistance of the tube offered by the electron path between the filament and the plate, which will vary in direct proportion to the distance between the plate and the filament; second, by increase and decrease in the strength of the electron path by reason of the varying distance between the filament and plate changing the

static attraction of the positive charge upon the plate for the electrons emitted by the filament, which attraction is inversely proportional to the square of the distance between the two members; and third, by the controlling or valve action of the coil upon the electronic movement from the filament to the plate, due to the inphase relation of the magnetic flux of the coil with the electronic movement.

While I have shown and described one specific embodiment of the invention, and have illustrated one hook-up in which it may be used, it will be apparent to those skilled in the art that various modifications may be made in the same without altering its general characteristics, or the principles of its operation. It is, therefore, my purpose to include all such modifications within the scope of the appended claims.

What is claimed is:

1. In an electron discharge device, an evacuated envelope, an electron emitting filament therein, a flexibly mounted plate of magnetic material located within the envelope, a core, and a control member formed as a coil about said core, the coil being adapted to have passed therethrough the current to be amplified whereby variations in the magnetic field about the coil will influence the plate.

2. In an electron discharge device, an evacuated envelope, an electron emitting filament therein, a flexibly supported plate of magnetic material mounted in a plane substantially parallel with that of the electron emitting element, a core within the envelope located within the confines of the filament, and a control coil carried by the core and having its axis at right angles to the planes of the electron emitting element and plate, the coil being adapted to have a current passed therethrough whereby variations in the magnetic field will result in corresponding movement of the plate for correspondingly varying the length of the path to be traveled by the electronic stream.

3. In an electron discharge device, an evacuated tube; an electron emitting filament therein; a flexibly supported plate of magnetic material mounted in a plane substantially parallel with that of the filament; and an electromagnetic coil within the tube having its axis at right angles to the planes of the filament and plate; the coil being adapted to be connected to a current to be amplified whereby variations in the magnetic field will result in corresponding movement of the plate for correspondingly varying the length of the path to be traveled by the electronic stream.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature.

BIRT GRIFFIN BLACKMAN.