Feb. 8, 1927. 1,616,914

A. MAVROGENIS

ELECTRON DISCHARGE DEVICE

Filed Jan. 15, 1926

Fig. 1

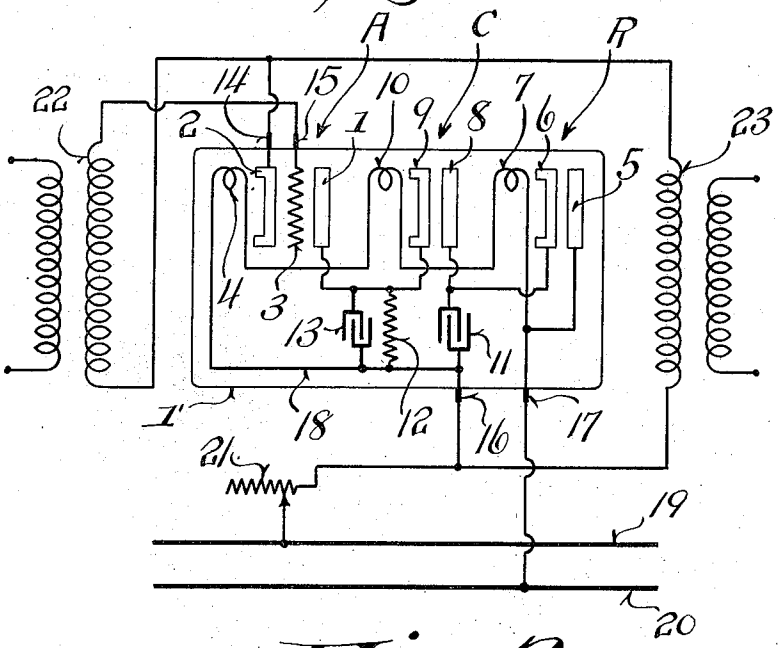
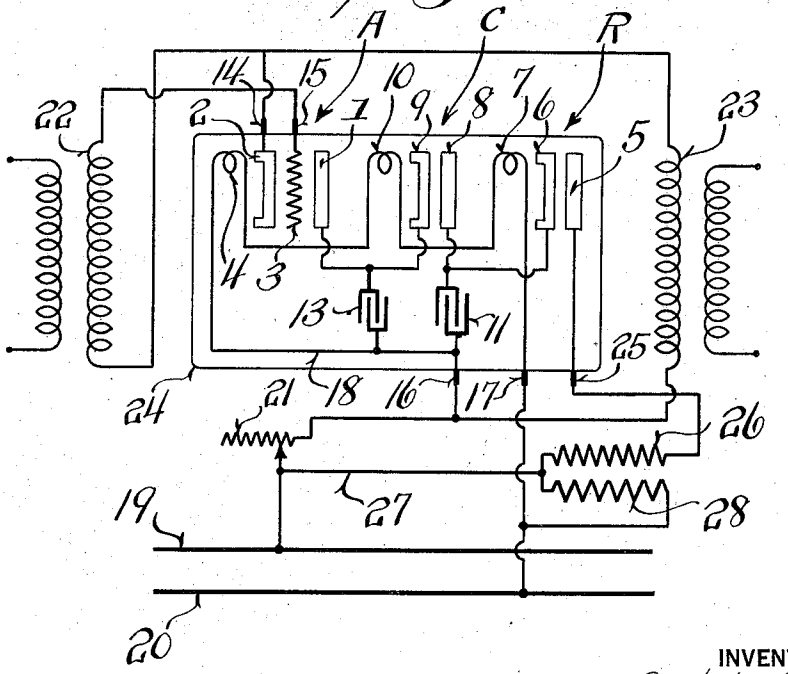


Fig. 2



INVENTOR
Aristote Mavrogenis
BY
ATTORNEYS

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UNITED STATES PATENT OFFICE.

ARISTOTE MAVROGENIS, OF MILWAUKEE, WISCONSIN.

ELECTRON-DISCHARGE DEVICE.

Application filed January 15, 1926. Serial No. 81,393.

This invention relates to electron discharge devices.

This invention is an improvement over that disclosed in my copending application for electron discharge devices, Serial Number 78,876, filed January 2, 1926, and has in general the same objects as those disclosed in such application.

As stated in my copending application the electron discharge device is designed to be energized by alternating current, both as to its plate and filament circuits, and is adapted to rectify the alternating current directly from alternating current supply mains or from transformers and to smooth out pulsations and remove the hum, thus fitting the device eminently for the reception of wireless waves.

The primary object of this invention is to provide an electron discharge device having the above characteristics which also has an even larger constant of amplification than that attained by the device disclosed in my above noted application.

A further object of this invention is to further reduce the cost of operation of the apparatus.

More specifically, this invention has for its object the provision of a unitary electron discharge device directly energized from alternating current as to all of its parts and adapted for the reception of wireless waves in which means are bridged around the audion portion of the apparatus and its translating circuit which temporarily stores up energy when the current flow through the audion is either reduced or stopped and which delivers this energy when the audion flow is again established.

Embodiments of the invention are shown in the accompanying drawings, in which:—

Figure 1 is a diagrammatic view showing one form of the invention.

Figure 2 is a corresponding view showing a further form of the invention.

Referring to Figure 1, it will be seen that the device is a unitary structure having a highly evacuated vessel 1′ within which are positioned an audion portion, a rectifying portion, and a current limiting portion represented respectively by the reference characters A, R and C.

The audion is provided with a plate 1 cooperating with an equipotential cathode 2 and having a grid 3 interposed between the plate and cathode. The cathode is heated by means of a filament 4.

The rectifying apparatus consists of a plate 5 and equipotential cathode 6 and a filament 7 for heating such cathode.

The current limiting device consists of a plate 8, an equipotential cathode 9 and a filament 10 for heating such cathode. This current limiting device has its plate and cathode closely spaced so that it attains its saturation point at a minimum voltage.

Further, as described in greater detail in my copending application noted above, each of the plates and equipotential cathodes are of extensive surface to thus reduce the voltage drop across the elements when the devices are functioning.

The evacuated vessel 1 carries a relatively large condenser 11, a high resistance 12 and a small capacity condenser 13.

This device is provided with four prongs which are diagrammatically indicated at 14, 15, 16 and 17 and may have the mechanical construction such as disclosed in my above noted application.

The elements of the apparatus are connected as follows:—The prong 17 is connected to the filament 7, such filament being connected to the filament 10. The filament 10 is connected to the filament 4 and the return conductor 18 is connected to the prong 16.

The plate 5 of the rectifier is connected to the prong 17. The cathode 6 of the rectifier is connected to the plate 8 of the current limiting device and also to one side of the large condenser 11,—the other side of such condenser being connected to the conductor 18 and from thence to the prong 16. The cathode 9 of the current limiting device is connected to the plate 1 of the audion and is also connected to one side of the high resistance 12 and the small capacity condenser 13, the other side of the condenser and resistance 13 and 12 being connected to the return conductor 18 and to the prong 16. The cathode of the audion is connected to the prong 14. The grid is connected directly to the prong 15.

The external wiring of this apparatus connects the prongs 16 and 17 with the alternating current supply means 19 and 20′ through a variable resistance 21. The prongs 14 and 15 are connected to opposite sides of the secondary 22 of an input trans-

former or to any corresponding points in the input circuit. The prong 14 leading from the cathode 2 of the audion is also connected through the primary 23 of a transformer to the main 19 through the variable resistance 21.

The operation of this apparatus is as follows:—

Alternating current is supplied to the apparatus from the mains 19 and 20. The current is rectified by the rectifier R. This current is pulsating although unidirectional. It is smoothed out by the large condenser 11 to a certain degree and is fed to the current limiting device. This current limiting device works along the straight line portion of its characteristic curve, that is to say, is saturated at all values of the curve passed therethrough in the normal operation of the apparatus. Consequently, it holds this current to a fixed value irrespective of any voltage pulsations. The fixed value current is supplied to the plate 1 of the audion and returns from the cathode 2 through the translating circuit which may include the primary 23 of the transformer.

It is to be noted that a variation of the resistance 21 varies both the temperature of the filaments and the voltage supplied to the plate circuits of the apparatus, thus securing a unitary control.

A small portion of the current from the current limiting device C is bypassed by the resistance 12 which is bridged around the audion and its translating circuit. However, any variation in the amount of current used by the audion during radio reception is temporarily compensated for the small capacity condenser 13 and consequently the voltage at the plate of the audion is maintained absolutely constant although the audion may be at its lowest or highest operating portion of its plate characteristic.

It is apparent, therefore, that the leak resistance 12 may be of very high value and may thus waste a minimum of current.

As a practical illustration of one form which the device may take, it has been found that the condenser 11 may be not more than 1 m. f., the condenser 13 may be .0002 m. f., and the resistance 12 may be from 50,000 to 100,000 ohms. These dimensions, of course, may be departed from for other sizes or types of the apparatus, but as a practical illustration they are given.

It will be seen, therefore, that the resistance 12 wastes a minute amount of current. However, the condenser 13, although of small capacity, is sufficient to take up the extremely rapid variations caused by the varying amount of plate current flowing through the audion. This maintains the voltage at the audion absolutely constant although the audion may be functioning, and thus there is no voltage rise at the audion even when the audion is at either its lowest or highest operating portion of its characteristic.

It is apparent, therefore, that there is no increase in voltage when the audion suppresses the plate current flow and consequently the voltage constantly supplied to the plate of the audion during the minimum flow of plate current. This markedly increases the constant of amplification of the apparatus as it does not cause the audion to operate at one voltage during current passage, and at a higher voltage during current suppression. Further, it is to be particularly noted that this result is attained with a minimum of waste of bypassed current due to the high resistance 12.

Substantially the same form of the invention is illustrated in Figure 2 with the exception, however, that the resistance 12 is omitted and the tube is a five-prong tube.

Referring to Figure 2, it will be seen that a unitary apparatus is also provided with a highly evacuated vessel 24 within which the audion A, rectifier R, and current limiting device C are positioned. The same reference numerals are employed in indicating the elements of this device as those used in connection with the form shown in Figure 1, and it is not thought necessary to repeat the description for the identically similar elements. However, it is to be noted, as stated, that the condenser 13 alone is bridged around the audion and its translating circuit. Further, it is to be noted that a fifth prong 25 is provided for the plate 5 of the rectifier. This prong is connected to one end of the secondary 26 of a stepup transformer. The other end of this secondary is connected by means of the conductor 27 through the adjustable resistance 21 to the other side of the translating circuit including the primary 23 of the transformer. The primary 28 of the stepup transformer is connected across the mains, as illustrated. The operation of this apparatus is identically the same as that described with reference to Figure 1, except that no leak resistance 12 is provided, and also a higher voltage may be impressed upon the plate 5 of the rectifier by the use of the stepup transformer.

It will thus be seen that a unitary electron discharge device has been provided for the reception of wireless waves in which all of the parts including the heating members and the plate circuits are energized directly from commercial alternating current mains, and in which the hum is wholly suppressed and the device operates absolutely noiselessly so far as the supply mains are concerned.

Further, it may be seen that the device may be very cheaply operated as there is a minimum demand for current made by the

device. It may thus be operated very much more cheaply than any battery energized apparatus heretofore known.

It is to be noted further that the apparatus is designed to give a constant current irrespective of fluctuations in voltage of the supply mains. For example, the current limiting device is adapted to become saturated before the minimum voltage of the mains is reached. Thus, although lights and motors may be thrown on or off the mains, no variation in the reception will be occasioned with this device.

Although specific types of current limiting devices, rectifiers and audions have been shown, it is understood that other devices of this nature may be employed in place of the specific device described in detail in this application.

Further, it is to be noted that a very high constant of amplification is secured by this apparatus.

Although the invention has been described in considerable detail, such description is intended as illustrative rather than limiting as the invention may be variously embodied and as the scope of such invention is to be determined as claimed.

I claim:

1. A unitary electron discharge device including an evacuated vessel, an audion having an equipotential cathode, a plate cooperating with said cathode, and a grid interposed between said cathode and plate, a rectifier for supplying said plate, a current limiting device controlling the current supplied said plate, a condenser cooperating with said rectifier and current limiting device, and a second condenser bridged around said audion.

2. A unitary electron discharge device including an evacuated vessel, an equipotential cathode, a plate cooperating with said cathode, a grid interposed between said cathode and plate, said cathode, plate and grid constituting an audion, a rectifier for supplying said plate, a current limiting device controlling the current supplied said plate, a condenser cooperating with said rectifier and current limiting device, a second condenser and a resistance bridged around said audion for bypassing a portion of the current supplied to the plate of said audion.

In testimony that I claim the foregoing I have hereunto set my hand at Milwaukee, in the county of Milwaukee and State of Wisconsin.

ARISTOTE MAVROGENIS.