June 20, 1933. L. TONKS 1,915,076

SUPERREGENERATIVE RECEIVER

Filed Jan. 16, 1932

Fig. 1.

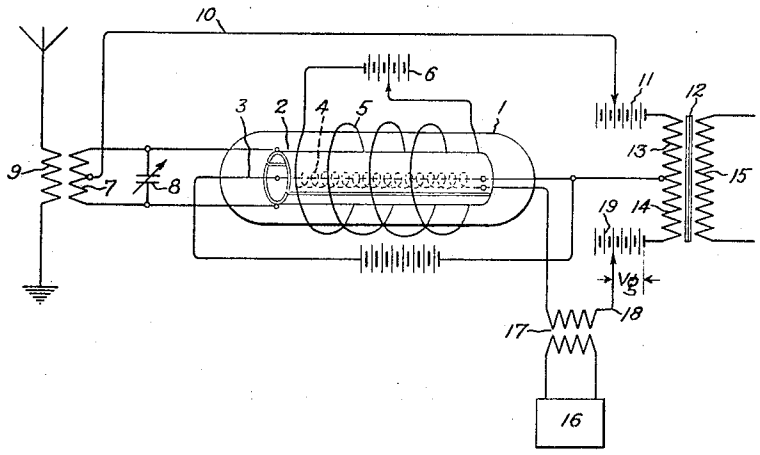
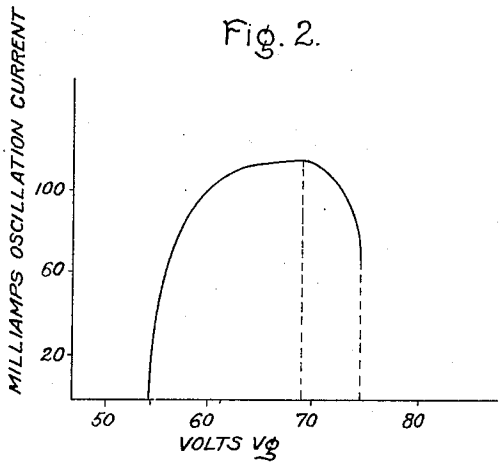


Fig. 2.



Inventor:
Lewi Tonks,
by Charles V. Mullen
His Attorney.

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UNITED STATES PATENT OFFICE

LEWI TONKS, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

SUPERREGENERATIVE RECEIVER

Application filed January 16, 1932. Serial No. 586,999.

My invention relates to high frequency signal receiving means employing an electron discharge device of the divided anode type, having a grid element, and in which a magnetic field is maintained between the anode members.

One of the objects of my invention is to provide a signal receiving apparatus of the super-regenerative type which is particularly adapted for operation at short wave lengths.

Another object of my invention is to provide a super-regenerative receiver employing an electron discharge device of the split anode magnetically controlled type.

Still a further object of my invention is an improved circuit arrangement whereby an electron discharge device of the split anode magnetically controlled type may be utilized for the reception of high frequency signals.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing in which Fig. 1 represents a preferred embodiment of my invention; and Fig. 2 represents a characteristic thereof.

Referring to the drawing, I have illustrated in Fig. 1 an electron discharge device 1 which comprises an evacuated envelope having disposed therein a plurality of anodes 2. These anodes are preferably curvilinear and are arranged in cylindrical formation. Extending along the axis of the cylinder formed by anodes 2 is a heated cathode 3, and interposed between the cathode and anodes is a grid element 4. The electron discharge device is surrounded with a direct current field coil 5 which is energized from a suitable direct current source 6. This field coil produces a unidirectional magnetic flux within the electric discharge device and between the anodes thereof, the magnetic lines of which extend parallel to the inner surfaces of the anodes.

Connected to the anodes is an oscillatory circuit comprising inductance 7 and capacity 8. In some instances the inherent capacity of the inductance and the connections may be sufficient so that capacity 8 may be said to indicate this capacity effect. The oscillatory circuit is coupled to a source of signal energy 9 which may be an antenna circuit. Each of the anodes is supplied with a direct current potential by means of a connection 10 extending from an intermediate point on inductance 7 to the positive terminal of source of potential 11. The negative terminal of the source of potential 11 is connected to the cathode 3 through a portion of the output device 12. The grid element 4 is supplied with a direct current potential by means of a connection 18 to the positive terminal of a source of potential 19, the negative terminal of which is connected to the cathode 3 through a portion of the output device 12. The output device 12 is provided with primary and secondary windings, of which the primary winding is tapped at an intermediate point which divides it into two portions 13 and 14. This arrangement has the advantage of producing a greater effect in the secondary winding 15 than would be the case if the primary winding were only in the anode-cathode circuit. This is due to the fact that the grid current decreases as the anode current increases with signal variations and hence there is produced a cumulative effect in the secondary winding 15 which results in a greater signal output.

The curve in Fig. 2 illustrates the manner in which the voltage Vg supplied by the source of potential 19 and impressed upon the grid element 4, influences the production of oscillations in the circuit 7, 8. The intensity of the oscillations in milliamperes in this circuit is plotted as ordinates. It will be seen that as the voltage impressed upon the grid element 4 increases, the relative oscillation current in the circuit 7, 8 increases up to a certain maximum, which in one instance was at 69 volts. A further increase in voltage resulted in a rapid decrease in oscillatory current.

In adjusting the circuit shown in Fig. 1 for proper operation, the voltage obtained from the source of potential 6 is adjusted to produce the correct amount of magnetic field

between the anodes 2. The voltage Vg is adjusted to a point where oscillations in the circuit 7, 8 are just impending, which in the instance illustrated in Fig. 2, would be about 55 volts. Oscillations from an oscillator 16 are then impressed upon the grid element 4 by means of the coupling device 17. The oscillations impressed upon the grid element 4 will cause oscillations to appear periodically in the oscillatory circuit 7, 8, which will have a frequency equal to the resonant frequency of that circuit. These periodic oscillations in the circuit 7, 8 provide a form of super-regeneration which produces sensitive and efficient operation of the detector. In operation it has been found that the best super-regenerative action has been obtained when the frequency of the oscillator 16 was less than 10% of the frequency to be received.

One of the advantages of my invention resides in the fact that the output circuit receives the combined effect of signal variations in both the anode and grid element circuits, thereby providing an increased effective output.

While I have shown particular embodiments of my invention, it will of course be understood that I do not wish to be limited thereto since many modifications, both in the circuit arrangement and in the instrumentalities employed, may be made without departing from the spirit and scope of my invention as set forth in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, an electrical discharge detector comprising a plurality of oppositely disposed anode members, a cathode extending between said members, a grid element disposed symmetrically between said cathode and anode members, means for producing a magnetic field between said anode members, an input circuit connected to said anodes, means for receiving and impressing signal oscillations on said input circuit, an output circuit connected between said input circuit and said cathode, an oscillation generator, and means for impressing oscillations from said generator upon said grid element whereby a super-regenerative action is obtained.

2. In a high frequency radio receiving system, the combination of an electric discharge detector comprising a pair of oppositely disposed anodes, a cathode extending between said anodes, a grid element disposed between said cathode and anodes, means for producing a magnetic field between said anodes, an input circuit connected to said anodes, an output circuit connected to an intermediate point on said input circuit and to said grid element, said cathode being connected to an intermediate point of said output circuit, means for biasing said grid element to a point where oscillations are impending in said input circuit, an oscillation generator, and means for impressing oscillations on said grid element thereby to cause oscillations to occur periodically in the input circuit of said electric discharge detector.

3. In a signal receiving system, the combination of an electric discharge detector circuit capable of oscillating, said circuit including an electron discharge device having a cathode, a plurality of oppositely disposed anodes, and means for producing a magnetic field between said anodes, a grid element, a source of oscillations, means for impressing oscillations from said source upon said grid element whereby said detector circuit is periodically caused to oscillate, and means arranged between said anodes and said cathode to receive the output currents from said detector.

4. The combination, in a high frequency receiver, of an electron discharge device having a cathode, a grid element, and a plurality of anodes, said anodes being arranged oppositely and disposed in cylindrical formation around said cathode, means for producing a magnetic field between said anodes, an oscillatory circuit connected between said anodes, said oscillatory circuit being coupled to an antenna, an output circuit connected to said grid element, said cathode and an intermediate point on said oscillatory circuit, means for producing oscillations, and means for impressing said oscillations on said grid element periodically to cause oscillations in said oscillatory circuit, whereby detector action of said electron discharge device is obtained.

5. In combination, an electron discharge device having a cathode, a grid element, and a plurality of anodes, said anodes being arranged oppositely in cylindrical formation around said cathode, means for producing a magnetic field between said anodes, an oscillatory input circuit connected between said anodes, means for producing oscillations, means for impressing said oscillations on said grid element to produce a super-regenerative action, and output means connected in the anode-cathode circuit and in the grid element-cathode circuit, whereby a cumulative effect of the variations in said circuits is obtained in said output means.

In witness whereof, I have hereunto set my hand.

LEWI TONKS.