

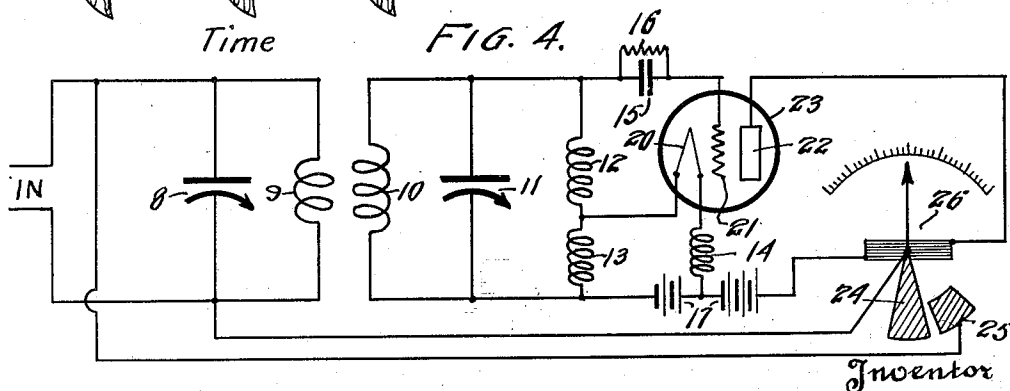
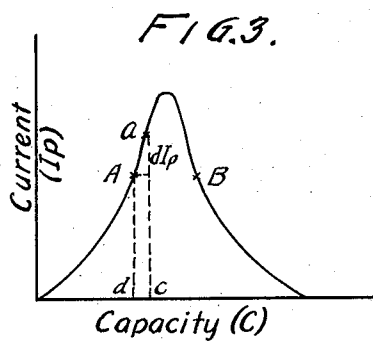
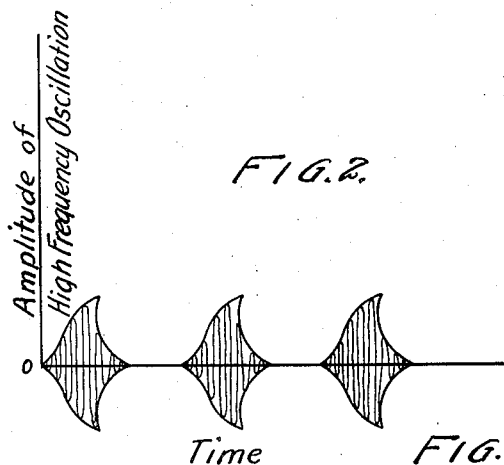
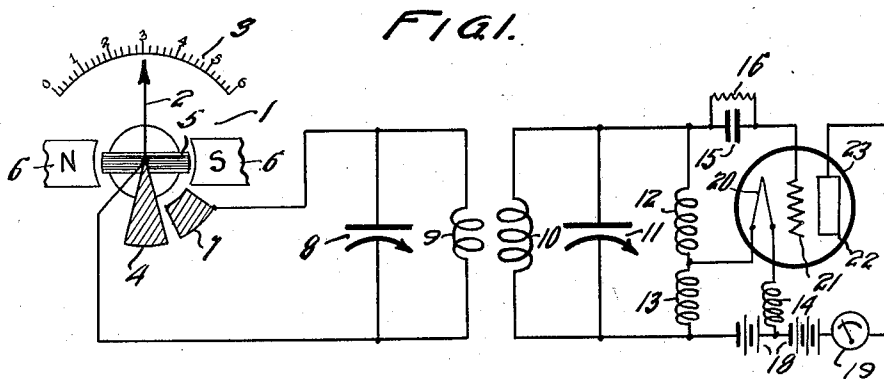
July 11, 1933.

C. D. BARBULESCO ET AL

1,917,237

CAPACITY CONTROLLED AMPLIFIER

Filed May 14, 1929



Inventor

C. D. BARBULESCO

Paul S. Edwards

By Semmes & Semmes

Attorneys

UNITED STATES PATENT OFFICE

CONSTANTIN D. BARBULESCO AND PAUL S. EDWARDS, OF DAYTON, OHIO

CAPACITY CONTROLLED AMPLIFIER

Application filed May 14, 1929. Serial No. 363,019.

(GRANTED UNDER THE ACT OF MARCH 3, 1883, AS AMENDED APRIL 30, 1928; 370 O. G. 757)

The invention described herein, if patented, may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This invention relates to capacity controlled amplifiers and has reference more particularly to amplifiers of the electronic tube type using one or more self-modulating oscillators such as described in our copending application, Serial No. 305,753, filed September 13, 1928, patented August 30, 1932, No. 1,874,222.

Prior to this time the difficulty which has existed with amplifiers of the ordinary type is that they have little amplification per stage and it has therefore been necessary, in order to secure proper amplification, to employ several stages all of which increases cost, complication and frequent servicing.

Another difficulty which has heretofore existed in ordinary amplifiers is that they are unstable, require close attention in operation, and frequent adjustment.

An object of this invention is to provide an amplifier of enormous amplification and great stability.

Another object of this invention is to devise an amplifier which operates only in one direction and will not feed back the energy amplified in consecutive stages if this effect is not desired.

Still another object of this invention is to provide a capacity controlled amplifier of the electronic tube type that is simple in construction, positive in action and requires little attention or adjustment in operation.

With these and other objects in view which may be incident to our improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising our invention may be varied in construction, proportion and arrangement, without departing from the spirit and scope of the appended claims.

In order to make our invention more clearly understood we have shown in the accompanying drawings means for carrying the

same into practical effect, without limiting the improvements in their useful application to the particular constructions, which, for the purpose of explanation, have been made the subject of illustration.

In the drawing:

Fig. 1 is a diagram of one form of our improved amplifier showing the several circuits and elements involved.

Fig. 2 is a graph showing the shape or pattern of the group of high frequency oscillations generated by our improved device.

Fig. 3 is a graph showing the points of operation of our device on the resonance curve.

Fig. 4 is a diagram of a modified form of circuit adapted for regulation.

Referring by numerals to the drawing, wherein the same elements are designated by like symbols, and more particularly to Fig. 1, there is shown a measuring instrument 1, provided with an indicating needle 2, playing over a graduated scale 3. Needle 1 and a magnetic segment of small capacity 4 are attached to a moving element 5 pivoted for rotation in a magnetic field 6. A stationary insulated metallic plate 7 of small capacity is mounted to coact with metallic segment 4.

The instrument 1 is of the most sensitive type; it can detect minute currents of any kind and by the displacement of the needle it produces a variation in the capacity between the metallic plates 4 and 7. The small capacity 4 and 7 is connected in parallel with the oscillating circuit 8 and 9, which is tuned close to resonance with respect to the tank circuit 10 and 11 associated with a self-modulated oscillator. The oscillator comprises an electronic tube having a filament 20, a grid 21 and a plate 22 contained in a vacuum container 23. Numerals 12, 13 and 14 indicate the choke coils producing the driving electromotive force necessary to maintain high frequency oscillations in the tank circuit 10 and 11. Numeral 15 indicates a blocking condenser, and 16 a resistance of large value. The condenser 15 is charged by high frequency oscillations and discharges periodically in the resistance 16. The nu-

merals 17 and 18 indicate batteries or other sources of direct current and 19 indicates a meter in circuit with tube plate 22.

Fig. 2 shows the shape of the group of high frequency oscillations generated and Fig. 3 shows the two possible points of operation, A and B, on the resonance curve. These points are selected at the two points of inflection of the curve in order to have the greatest variation, ΔI_p , in plate current for the minimum variation, ΔC in capacity produced by the displacement of the metallic plate 4.

It may be readily appreciated that meter 19 can be provided with a system of plates similar to 2 and 4 (as shown in Fig. 4) and another stage added in cascade; the number of additional stages being limited only by the amount of power to be disposed of in the plate of the last tube.

It is also evident that a relay can be used instead of the meter 19 and still greater amount of power controlled by a slight displacement of the metallic plate 4.

The great advantage of this scheme of amplification is the impossibility of any kind of feed back unless this effect is desired. If regeneration is desired it can be easily produced by the simple arrangement shown in Fig. 4, in which the meter 19 is provided with a pair of plates 24 and 25 similar to 4 and 7. The extra capacity due to these plates is put in parallel with the input circuit 8 and 9.

If an increase in the capacity of 8 produces a decrease of the plate current it is evident from the movement of the needle 26 that the capacity between 24 and 25 increases and adds to the increase in capacity produced by the external cause. A still further decrease in plate current is produced and the effect is still further amplified.

If the fixed plates 7 and 25 are placed at the left of the moving plates 4 and 24, the reversed effect will take place, which means that a deflection to the right of the needle 2 will add more capacity to 8 and if the operating point is A an increase in the plate current will occur and the needle 26 will move to the right, adding by the approach of the plates a still greater increase in the capacity 8 and consequently a further increase in the plate current.

While we have shown and described the preferred embodiment of our invention, we wish it to be understood that we do not confine ourselves to the precise details of arrangement herein set forth by way of illustration, as it is apparent that many changes and variations may be made therein by those skilled in the art without departing from the spirit of the invention, or exceeding the scope of the appended claims.

We claim:

1. In a system of amplification, a self-modulating high frequency oscillator, an ex-

ternal oscillating circuit coupled to said oscillator, a variable condenser associated with said external oscillating circuit to vary its natural frequency and an auxiliary variable condenser associated with said external oscillating circuit to slightly vary its frequency and hence to vary the amount of current flowing in the plate circuit of the oscillator.

2. In a system of amplification, a self-modulating high frequency oscillator, an indicating instrument, a variable condenser associated with said instrument to be varied thereby, and an external oscillating circuit coupling said condenser to said oscillator, whereby a deviation of the indicating instrument will cause a variation in current in the plate circuit of the oscillator.

3. In a system of amplification, a self-modulating high frequency oscillator, an indicating instrument in the plate circuit of said oscillator, and a variable condenser associated with said instrument to indicate variations in the plate current of the oscillator by variations in the capacity of the variable condenser.

4. In a system of amplification, a self-modulating high frequency oscillator, an input oscillating circuit tuned close to resonance with and coupled to said oscillator, an indicating instrument in the plate circuit of said oscillator, a variable condenser associated with said instrument to be varied thereby, said variable condenser being connected to said input oscillating circuit, whereby variations in the plate current of the oscillator will be reflected in variations in the natural frequency of the input oscillator circuit.

5. A system of cascade amplification comprising, a self-modulating high frequency oscillator, an input oscillating circuit coupled to said oscillator and tuned close to resonance therewith, an indicating instrument for measuring the controlling current for the amplifier, and a variable condenser connected with said instrument to be operated thereby, said condenser forming a part of the input oscillating circuit, whereby slight variations in the controlling current will cause large variations in the plate current of the oscillator through the intermediary of the variable condenser and the input oscillating circuit.

6. In an amplifier, in combination, a self-modulating high frequency oscillator, an external oscillating circuit coupled with and tuned close to resonance with said oscillator, means for varying the capacity of said external oscillating circuit to produce variation of the plate current of the oscillator, and means for varying the plate current of the oscillator to vary the capacity of the external oscillating circuit to produce further variation of the plate current.

7. In an amplifier, in combination, a self-

modulating high frequency oscillator, an external oscillating circuit coupled with and tuned close to resonance with said oscillator, means for varying the capacity of the external oscillating circuit and to produce variation of the plate circuit of the oscillator, a variable condenser forming part of the said external oscillating circuit, and means operated by variations in the plate current of the oscillator for varying the capacity of said variable condenser.

In testimony whereof we affix our signatures.

CONSTANTIN D. BARBULESCO.
PAUL S. EDWARDS.

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