



PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

Improvements relating to Amplifying Devices for use in Wireless Telegraphy and Telephony.

I, JOHN BRUCE BOLITHO, of 13, West Park, Eltham, in the County of Kent, Captain in the King's Army, do hereby declare the nature of this invention to be as follows:—

This invention relates to amplifying arrangements used in wireless telegraphy and telephony. Such amplifying arrangements are also applicable for use as relays.

The principle on which the invention is based is as follows:—Let us assume that the plate of a three-electrode valve is connected in a tuned circuit, the plate being connected through a high voltage battery (+ to the plate) to the filament while the grid is connected through a reactance (coupled in the normal way with the plate circuit) and a suitable number of cells to the filament. These cells in the grid circuit are used to control the potential of the grid relatively to the filament. If these cells were removed the circuit would start oscillating and would maintain oscillations on its own account, but if the negative potential on the grid were increased it would be found that there was a point at which the circuit would not sustain and amplify very small oscillations. This point is a critical one. By the present invention, the voltage is arranged so that the valve and its accompanying circuits are unable to build up and sustain any very small oscillations.

Now let us suppose that the potential of the grid is arranged to be say 0.1 volt less than the critical point referred to above, at which the valve may be said to be unable to initiate oscillations. Then, if incoming signals are applied to the grid circuit so that the potential of the grid of the valve is caused to oscillate, when the

oscillations cause the grid to be raised to a potential of the critical value or greater, oscillations will build up rapidly in the anode and grid circuits, and will be sustained until quenched by some external agency. As soon as the valve starts to oscillate, the anode current becomes very much greater than before. The use of this principle combined with a method of rapid quenching is the basis of the present invention. The method of quenching the oscillations according to this invention is an electrical one. A second valve circuit is provided with its filament in parallel with that of the first, while the grids of the two valves are joined with or without arrangements to apply a different potential to the second as compared with the first. The plate of the second is joined to the filament through a reactance and a source of alternating current of a frequency which will generally be much less than that of the incoming signal. The reactance in this plate circuit, which we may term the "quenching circuit", is coupled to the grid of the amplifying circuit, but with its reactance reversed. Now it will be seen that when the potential of the plate of the quenching circuit becomes sufficiently positive, the reactances of the two plate circuits will balance out and the valve will quench. Again, if the plate of the quenching circuit is brought to a higher positive potential, the resultant of the two reactances will be reversed reactance and the valve will quench more rapidly. When the potential of the plate of the quenching circuit is negative, the quenching circuit becomes inoperative and the amplifying circuit is able to be

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“triggered” (set in oscillation) and the oscillations will persist with much increased anode current until the resultant reactance again becomes small enough or strongly enough reversed to damp out the oscillations.

It will be seen that the reactance of the amplifying circuit is varied according to

the modulations which are imposed for quenching purposes.

Dated this 6th day of October, 1919.

For the Applicant:

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COMPLETE SPECIFICATION.

Improvements relating to Amplifying Devices for use in Wireless Telegraphy and Telephony.

I, JOHN BRUCE BOLITHO, of 13, West Park, Eltham, in the County of Kent, a subject of the King of Great Britain, and a Captain in the King's Army, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to amplifying arrangements used in wireless telegraphy and telephony. Such amplifying arrangements are also applicable for use as relays. The principle on which the invention is based will be understood from the accompanying diagram.

Let us assume that the plate 1 of a three-electrode valve is connected in a circuit containing reactance 4, a high voltage battery 6, an indicating or recording device or relay 7, and say a milliammeter 8 to the filament 3; 6, 7 and 8 are shunted by a capacity 5 of suitable size in order to provide a low resistance path for oscillating currents. The grid 2 is connected through a tuned reactance 9 (coupled in the normal way with reactance 4 in the plate circuit), a suitable number of cells 10 and a potentiometer 11 to the filament 3. These cells 10 and the potentiometer 11 are used to control the potential of the grid 2 relatively to the filament 3. If these cells were removed the circuit would start oscillating and would maintain oscillations on its own account, but if the negative potential on the grid 2 were increased it would be found that there was a point at which the circuit would not sustain and amplify very small oscillations. This point is a critical one. According to the present invention, the voltage is arranged so that the valve and its accompanying circuits are unable to build up and sustain any very small oscillations.

Now let us suppose that the potential of the grid is arranged to be say 0.1 volt less than the critical point referred to above, at which the valve may be said to be unable to initiate oscillations. Then, if incoming signals are applied to the grid circuit so that the potential of the grid of the valve is caused to oscillate, when the oscillations cause the grid to be raised to a potential of the critical value or greater, oscillations will build up rapidly in the anode and grid circuits, and will be sustained until quenched by some external agency. As soon as the valve starts to “oscillate”, due to impulse received for instance from coil 33 in a signal circuit inductively coupled with coil 9, the anode current between 3 and 1 becomes very much greater than before, thus giving the required amplification. It is a novel method of quenching these oscillations rapidly which forms the basis of the present invention.

The method of quenching the oscillations according to this invention is an electrical one. A second valve is provided with its filament 14 connected in parallel through leads 16, 17, to the terminals of battery 15 and filament 3 of the first valve, while the grids of the two valves are joined with or without arrangements to apply a different potential to the second as compared with the first. In the arrangement shown, grid 2 of the first valve is connected to grid 13 of the quenching valve through lead 18, and a variable battery 19 in parallel with a shunt capacity 20. The plate 12 of the second valve is joined to its filament 14 through lead 21, a reactance 22 and a source of alternating current 23 of a frequency which will generally be much less than that of the incoming signal. The reactance coil 22 in this plate circuit, which we may term the “quenching

circuit", is coupled to the coil 9 connected to the grid 2 of the amplifying circuit, but with its reactance reversed. Other details indicated in the diagram of connexions of the two valves are a tuning condenser 34 in parallel with coil 9, a shunt capacity 35 in parallel with battery 10, a volt-meter 36 between battery 10 and the filament 3, and a milli-ammeter 37 in the circuit of the high tension supply 23 leading to filament 14.

Now it will be seen that when the potential of the plate 12 of the quenching circuit becomes sufficiently positive, the reactances of the two plate circuits will balance out as the reactance of coil 22 is reversed, *i.e.* tending to damp out oscillations, so that the oscillations in circuit 9, 34, will be quenched. Again, if the plate 12 of the quenching circuit is brought to a higher positive potential, the resultant of the two reactances will be a reversed reactance, and the oscillations will be quenched even more rapidly. When the potential of the plate 12 of the quenching circuit is negative, the quenching circuit becomes inoperative and the amplifying circuit is able to be "triggered" (set in oscillation) and the oscillations will persist with much increased anode current until the resultant reactance again becomes small enough or strongly enough reversed to damp out the oscillations. It will be seen that the reactance of the amplifying circuit is varied according to the modulations which are imposed for quenching purposes. The action really amounts to varying intermittently the oscillation resistance by electrical means, with the use of a valve, which serves to damp out periodically the oscillations produced by a "triggered" valve.

The source of high tension A.C. supply 23, is shown as consisting of a coil 24 connected across the terminals of a capacity 25 between coil 22, and filament 14 in the quenching circuit, while coil 24 is coupled inductively with coils 26, 27, in a valve circuit for generating oscillations. Of the coils, 26 is connected between the grid 30 and anode 31 of the valve, whose plate 29 is connected to the positive terminal of a high voltage supply 32, while coil 27 is connected in parallel with capacity 28 between filament 31 and the negative terminal of the high voltage supply 32. In place of the arrangement last above described, any source of electrical oscillations or impulses may be used

which will make the plate 12 intermittently and sufficiently positive to bring the reversed reactance between the coils 9 and 22 into operation, so as to produce a quenching action.

The signals may be applied to the valve circuit in any suitable manner, so that when signals are received the valve will be "triggered" owing to the slight changes in voltage on the grid 2. For example, the signals might be brought into the grid circuit at any point where a transformer could be inserted coupled with a receiving circuit, as it is not essential that the oscillation circuit 9, 34, should be tuned to the signals, although for many purposes this is highly advantageous.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. An amplifying arrangement for use in wireless telegraphy or telephony, wherein automatic electrical means are employed for damping out periodically the oscillations produced in a circuit by a "triggered" amplifying valve, such automatic electrical means of damping comprising a valve varying intermittently the oscillation resistance of the circuit of the "triggered" amplifying valve, substantially as described.

2. An amplifying arrangement for use in wireless telegraphy or telephony, wherein a reversed reactance coil in the circuit of a quenching valve, which is supplied with high tension current generally of relatively low frequency, reacts with a coil in the oscillation circuit of the "triggered" amplifying valve, and quenches the oscillations as rapidly as is required according to the frequency of the oscillations applied to the quenching valve terminals, substantially as described.

3. Amplifying arrangements for use in wireless telegraphy and telephony, wherein the oscillations set up in the circuit of a "triggered" valve are quenched electrically in the manner hereinbefore set forth with reference for example to the accompanying diagram.

Dated this 6th day of July, 1920.

For the Applicant:

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[This Drawing is a reproduction of the Original on a reduced scale.]

