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H. J. ROUND

WIRELESS TELEGRAPH AND TELEPHONE TRANSMISSION

Filed March 31, 1920

*Fig. 1.*

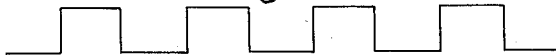


*Fig. 2.*

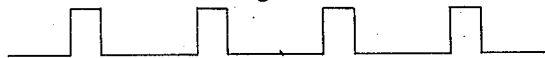


*Fig. 3.*

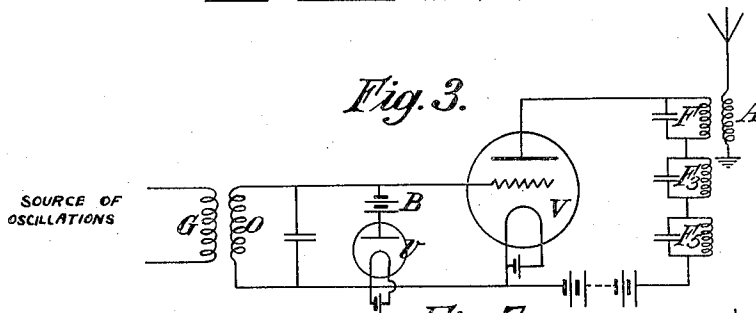


*Fig. 7.*

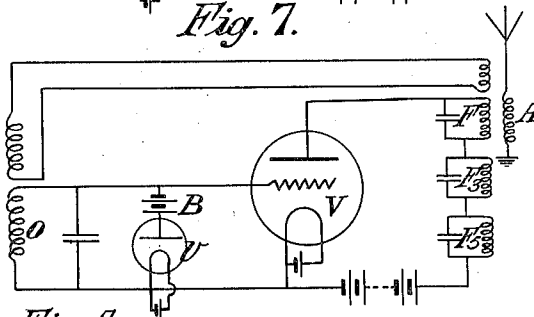


*Fig. 4.*

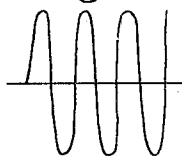


*Fig. 5.*

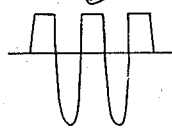


*Fig. 6.*



*Fig. 8.*

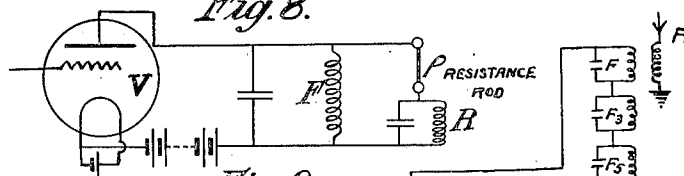
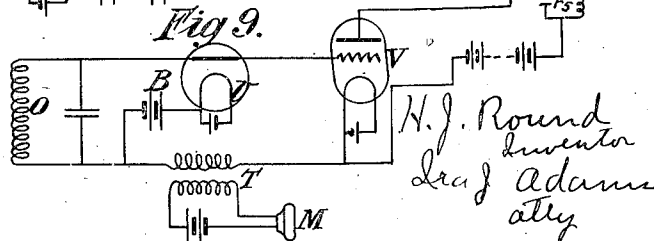


*Fig. 9.*



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## UNITED STATES PATENT OFFICE.

HENRY JOSEPH ROUND, OF LONDON, ENGLAND, ASSIGNOR TO THE RADIO CORPORATION OF AMERICA, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

## WIRELESS TELEGRAPH AND TELEPHONE TRANSMISSION.

Application filed March 31, 1920. Serial No. 370,174.

*To all whom it may concern:*

Be it known that I, HENRY JOSEPH ROUND, a subject of the King of Great Britain, residing at 9 Woodberry Crescent, Muswell Hill, London, England, have invented new and useful Improvements in Wireless Telegraph and Telephone Transmission, of which the following is a specification.

This invention relates to improvements in or relating to valve and other interrupting devices used in wireless telegraph and telephone transmission and its object is to reduce the internal heating that occurs in such devices during use.

The invention is illustrated by the accompanying drawing of which Figs. 1 and 2 illustrate the nature of currents, Fig. 3 shows a wireless transmitter, Figs. 4 and 5 illustrate voltages. Fig. 6 illustrates a current: Figs. 7 and 8 show alternative arrangements of transmitter and Fig. 9 shows a telephone transmitter.

It is found that if it can be so arranged that the current issuing from the device is of an intermittent nature somewhat of the form shown in Figure 1 of the accompanying drawing, and the amplitude is suitably chosen then nearly the whole of the energy supplied by a direct current source can by the aid of arrangements described below be expended externally to the device.

When no current is flowing there is no loss in the device and when maximum current is flowing the loss is small because the voltage drop across the device is very small. By producing a "square" form current i. e. a current somewhat of the nature shown in Figure 1, it is possible to pass rapidly from one state of minimum loss to the other state of minimum loss.

According to this invention a control voltage of a "square" form is applied to a valve or other interrupting device and arrangements are made for the absorption or taking up of the energy developed in the higher harmonics.

In the case of a valve, for instance, the first of these conditions may be effectively produced by shunting the grid coil by a low resistance valve of the Fleming type with suitable E. M. F. adjustment and the second by inserting in the anode circuit one or more suitably damped oscillatory circuits tuned to the first harmonic or to the first

and other harmonics and usually in series with the main or fundamental circuit.

Alternatively it is possible to replace the absorbing action of the combination of harmonic circuits by a resistance in series with a rejector tuned to the fundamental.

Also it is possible to obtain the effect in certain cases by means of absorption harmonic circuits in series and a fundamental circuit in parallel or vice versa.

In actual practice both the above conditions may be produced to some extent automatically, the first by taking advantage of the rectifying properties of the main valve grid and the second by the distributed impedance of the anode circuit such as when that circuit is partly formed of an aerial system. The effect is, however, much more pronounced and the resulting reduction in internal heating so much the greater when special arrangements are made as in the manner detailed above.

The invention may be illustrated by comparison with a simple make and break commutator with equal spaces and bars; the valve being represented by a commutator in series with oscillatory circuits and a direct current source. With a proper series of circuits a commutator so arranged will be sparkless, in other words there will be no loss in the commutator.

When it is desired to vary the amplitude of the fundamental, say, by means of the voice, then the form of the grid voltage is varied so that the maximum amplitude remains constant while the duration of maximum E. M. F. in each period varies, that is to say, the form varies from that shown in Figure 1 to that shown in Figure 2, and the loss in the valve remains a minimum.

One of the methods by which this type of variation is provided by the voice is to apply to the subsidiary low resistance valve mentioned above in addition to the sine form alternating E. M. F. a voltage controlled by a microphone.

Consider the effect of the summation of the low frequency voltage due to the microphone and the high frequency E. M. F. applied to the grid circuit from an independent generator. If the low frequency voltage is very negative, then the high frequency positive pulses to the grid of the main valve are reduced both in amplitude

and in width, while if the high frequency voltage is very positive, the positive pulses are increased both in amplitude and in width. If, however, in addition a limiting voltage  
 5 device, such as a low resistance Fleming valve, be applied across the high frequency E. M. F., the result will be that the high frequency positive pulses applied to the grid of the main valve will not vary in amplitude  
 10 but only in width. The amplitude should be so chosen that the valve, as before, is taken very rapidly from one state of minimum loss to the other. It will readily be understood that although the amplitude of the ap-  
 15 plied voltage is constant the variations produced by the voice in the width of the positive pulses will cause variations in the amplitude of the fundamental wave produced in the anode circuit.

20 In Figure 3 of the drawing is shown a generating or amplifying valve V having its grid connected to an oscillatory circuit O in which high frequency oscillations are generated by an independent generating circuit  
 25 G. Across the grid and filament of valve V is arranged a low resistance Fleming valve *v* with an adjusting battery B so that if the voltage applied to circuit O from circuit G is of the form shown in Figure 4 the voltage  
 30 across grid and filament of valve V will have the form shown in Figure 5, but as the lower portions of this last curve are inoperative, the form of the anode current will be as shown in Figure 6. In the anode circuit be-  
 35 sides the oscillatory circuit F tuned to the fundamental frequency and coupled to an aerial A are two other circuits  $F_3$ ,  $F_5$  tuned to the third and fifth harmonics.

40 In place of employing an independent generating circuit an interaction may be arranged between the circuits F and O as shown in Figure 7.

45 Figure 8, shows in place of the circuits  $F_3$ ,  $F_5$  of Figure 3 a resistance rod  $\rho$  in series with a rejector circuit R tuned to the fundamental frequency.

50 Figure 9 shows one method of adapting the invention to telephony: here the circuits are the same as in Figure 3 but a microphone circuit M is connected through a transformer T to the grid filament circuit of the valve V.

What I claim is:

55 1. The method of wireless transmission which consists in applying to a thermionic valve a rapidly fluctuating voltage of square wave form and absorbing outside the device the energy developed in harmonics of the fundamental frequency.

2. In a wireless transmitter, the combination of an interrupting device, means for impressing upon it a rapidly fluctuating voltage of square wave form and means for absorbing the energy developed in harmonics of the fundamental frequency. 60

3. In a wireless transmitter the combination of a three-electrode valve, means for impressing upon it a square wave form voltage and means for absorbing the energy developed in harmonics of the fundamental 65 frequency. 70

4. In a wireless transmitter, the combination with a three-electrode valve having separate input and output electrodes of an oscillatory circuit connected to the anode of 75 the valve and tuned to the fundamental frequency of the current supplied by the valve and a circuit tuned to a harmonic of that frequency and connected to the anode of the valve. 80

5. In a wireless transmitter, the combination with a three-electrode valve having separate input and output electrodes of means for impressing upon it a fluctuating voltage of square wave form, an oscillatory circuit 85 connected to the anode of the valve and tuned to the fundamental frequency of the current supplied by the valve and a circuit tuned to a harmonic of that frequency and connected to the anode of the valve. 90

6. A wireless transmission system including a three-electrode valve and means associated with said valve for producing a flat top wave form therein said means consisting of a two-electrode valve in series with the 95 grid and filament of the first valve.

7. In a wireless transmitter, the combination of a three-electrode valve, an oscillatory circuit connected to the grid and filament of the valve, a two-electrode valve connected 100 to the grid and filament in parallel with the oscillatory circuit, a second oscillatory circuit connected to the plate and filament of the first valve and a third oscillatory circuit connected in series with the second circuit and tuned to a harmonic of the frequency to which the second circuit is tuned. 105

8. In a wireless transmitter the combination of a three-electrode valve, an oscillatory circuit connected to the grid and filament, a two-electrode valve connected to the grid and filament in parallel with the oscillatory circuit, a transformer having its secondary winding connected between the two valves and a battery and microphone 110 connected in series with the primary winding of the transformer. 115

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