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W. SCHAFFER
ARRANGEMENT FOR FREQUENCY TRANSFORMATION PARTICULARLY
FOR OPERATING RELAY STATIONS
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Fig. 1

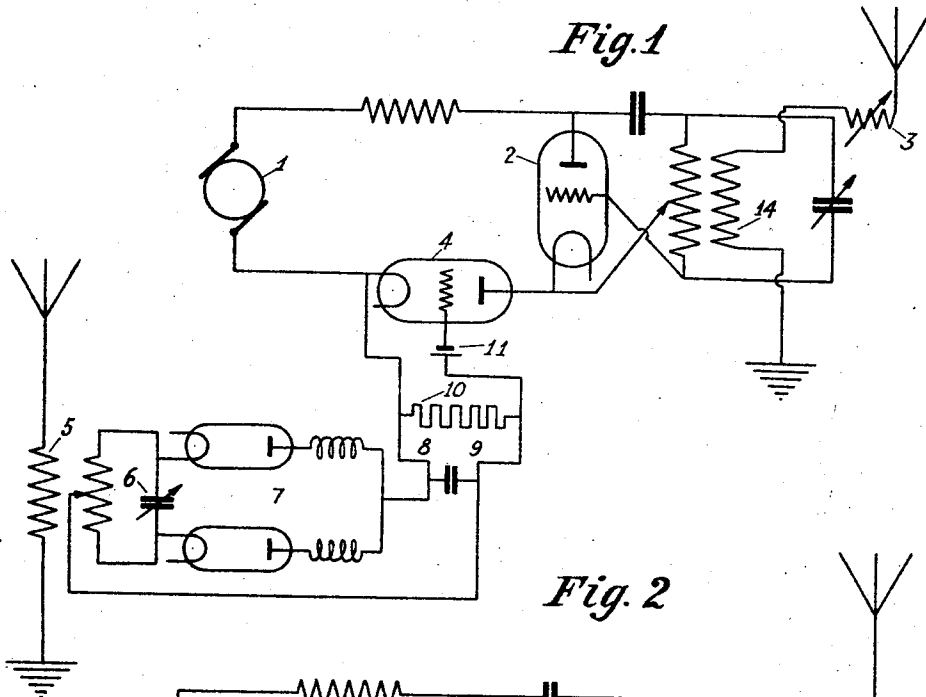
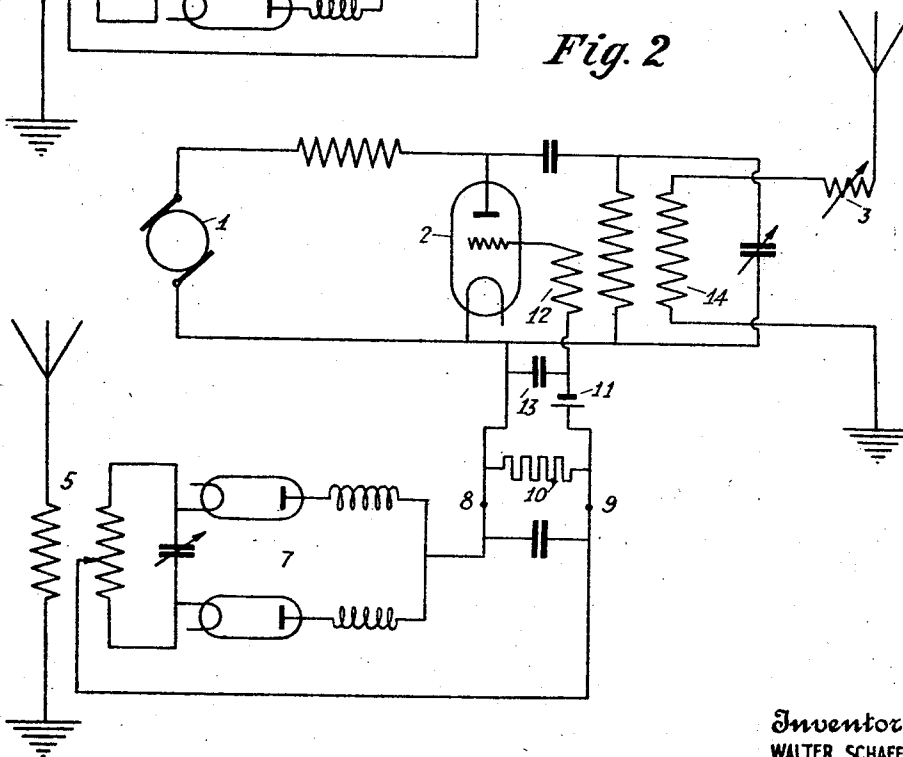


Fig. 2



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ARRANGEMENT FOR FREQUENCY TRANSFORMATION PARTICULARLY FOR OPERATING RELAY STATIONS.

Application filed August 18, 1922. Serial No. 582,612.

To all whom it may concern:

Be it known that I, WALTER SCHAFFER, a citizen of the Republic of Germany, and a resident of Berlin, Germany, have invented certain new and useful Improvements in Arrangement for Frequency Transformation Particularly for Operating Relay Stations (for which application has been filed in Germany No. 54,321 July 13, 1921), of which the following is a specification accompanied by drawings.

Under certain circumstances it is advisable to use the incoming received energy for the purpose of controlling a locally provided sender which radiates a frequency different from the received frequency. This happens both in telephony and telegraphy. This is the case particularly in operating so called relay stations. The invention relates to an arrangement that makes possible a frequency transformation particularly adapted for this purpose.

In the drawings in which like reference numerals designate like parts in the various views;

Fig. 1 is a diagrammatic representation of a circuit arrangement embodying the invention, and

Fig. 2 is a diagrammatic representation of a modified circuit arrangement.

In the exemplification of the invention shown in Fig. 1, the reference numeral 1 designates the operating direct current source, 2 the generator tube of the sender and 3 the antenna of the relay sender which as shown is coupled with the tubes through an intermediate circuit 14 or directly. 4 is a tube provided in the current supply circuit of tube 2 and is operated as a resistance of varying value depending on the grid potential supplied thereto and thus controls the energy supplied to the tube 2. The receiving energy in the receiving antenna 5 is induced into the circuit 6 and is rectified by means of any suitable rectifying arrangement as, for instance, the double rectifier 7. The direct current potential difference between points 8 and 9 is always in proportion to the received energy. This direct current potential difference is transmitted in any suitable manner to the grid of the tube 4 and controls, therefore, in the above de-

scribed manner the generator tube 2. The arrangement is so provided that the grid of the tube 4 is connected in parallel with a resistance or grid leak 10 through which the grid discharge may take place. If it is desired to reduce the energy supplied to the generator tube 2 to zero when the receiving current is zero, then the grid of the tube 4 must be supplied with an auxiliary negative potential which is obtained from the auxiliary battery 11. In the normal condition, that is to say, when no signal is being received the tube 2 does not produce oscillations because its current supply circuit is interrupted by the infinitely large resistance of the tube 4. When the receiving starts them, in proportion with the strength of the receiving current, the resistance of tube 4 is reduced, thereby causing oscillations to be produced by the tube 2, the oscillations being controlled by the resistance of the tube 4. It will be seen therefore that independently of the incoming receiving frequency, it is possible to tune the intermediate circuit 14, which is energized by tube 2, to any desired wave length.

The arrangement consists in this that the incoming high frequency energy is transformed into a direct current energy and the latter is used for the purpose of controlling a tube sender of any desired different frequency. Instead of the resistance 10 we may use the transformer in the case of speech or telephone reception.

The same result may be obtained from the second circuit arrangement shown in Fig. 2. In this figure, 1 again denotes the operating direct current source for the relay sender, 2 the generator tube and 3 the relay sender antenna. The grid of the generator tube 2 is inductively back coupled at 12 with the intermediate circuit 14. A condenser 13 is inserted in the connection between the grid coupling coil 12 and the cathode. The received energy in the receiving antenna 5 is, as explained in Fig. 1, induced in the circuit 6 and rectified by means of any desired rectifying arrangement 7. The direct current potential difference existing between points 8 and 9 is transmitted by any suitable means to the condenser 13 and controls therefore in the well known

manner the generator tube 2. The arrangement is so provided that the condenser 13 is connected in parallel with a resistance or grid leak 10 through which the grid discharge may take place. In order to prevent the generation of oscillations by the generator tube 2 when the receiving current is equal to zero, as is the case with the grid of the tube 4 in the above described case, a negative auxiliary potential, which is obtained from the auxiliary battery 11 is supplied to the condenser 13. In the normal condition, i. e. when no signal is being received the tube 2 does not generate oscillations because the negative grid potential is too high. When the receiving starts, depending on the strength of the received energy, the grid of the generator tube 2 is supplied with a more or less high grid potential whereby oscillations are produced by the tube 2 and are controlled.

As compared with Fig. 1, the arrangement of Fig. 2 has the advantage that the control of the generator tube 2 is accomplished through its own back coupled grid thus enabling the tube sender to be controlled by less received energy than is required with the arrangement shown in Fig. 1. On the other hand, the circuit arrangement shown in Fig. 1 is more certain in its operation than that shown in Fig. 2 because the controlling occurs in the direct current supply rather than in the high frequency oscillation generator.

Having described my invention what I claim is:

1. An arrangement for frequency transformation adapted for use in operating relay stations comprising a cathode tube having a grid, a tube sender controlled by said cathode tube, a receiving circuit connected to the grid, a rectifier in the receiving circuit for causing direct current potential in proportion to the received energy to be impressed on the grid, and means for applying an auxiliary potential to the grid to prevent the generation of oscillations in the tube sender when no energy is being received.

2. In combination, means for receiving

electric waves, a generator, means for transmitting the carrier wave of said generator, a rectifier coupled to said receiving means, means including a three element thermionic valve for controlling the generator to control the amplitude of the carrier wave, means for impressing the rectified received waves on the grid circuit of said valve, a source of direct current interposed in said grid circuit so that when the amplitude of the rectified waves is zero the amplitude of the transmitted carrier wave is also zero.

3. In combination, receiving means, a thermionic tube oscillator circuit, means for transmitting the carrier wave of said oscillator, a double rectifier coupled to said receiving means, a three element thermionic valve having its plate circuit in series with the plate current supply circuit of said oscillator for controlling the amplitude of the carrier wave generated, means for impressing the rectified received waves on the grid circuit of said valve, a source of direct current interposed in said grid circuit to keep the amplitude of the oscillator waves substantially zero when no energy is received.

4. A relay station comprising a transmitter, a thermionic tube oscillator circuit coupled to said transmitter, a thermionic control tube in the power supply circuit of said oscillator circuit, a receiver, an oscillatory circuit comprising an inductance and condenser coupled to said receiver, one-way valves each having a similar electrode connected to an end of said inductance, a grid condenser, the opposite electrodes each being connected to one side of said grid condenser, the mid-point of said inductance being connected to the other side of said grid condenser, a grid leak connected in parallel to said grid condenser, said grid condenser being in the grid circuit of said control tube, and a supply of electric energy located between said grid and said grid condenser to bias said grid sufficiently to prevent the generation of oscillations by said transmitter when none are received by said receiver.

WALTER SCHAFFER.