

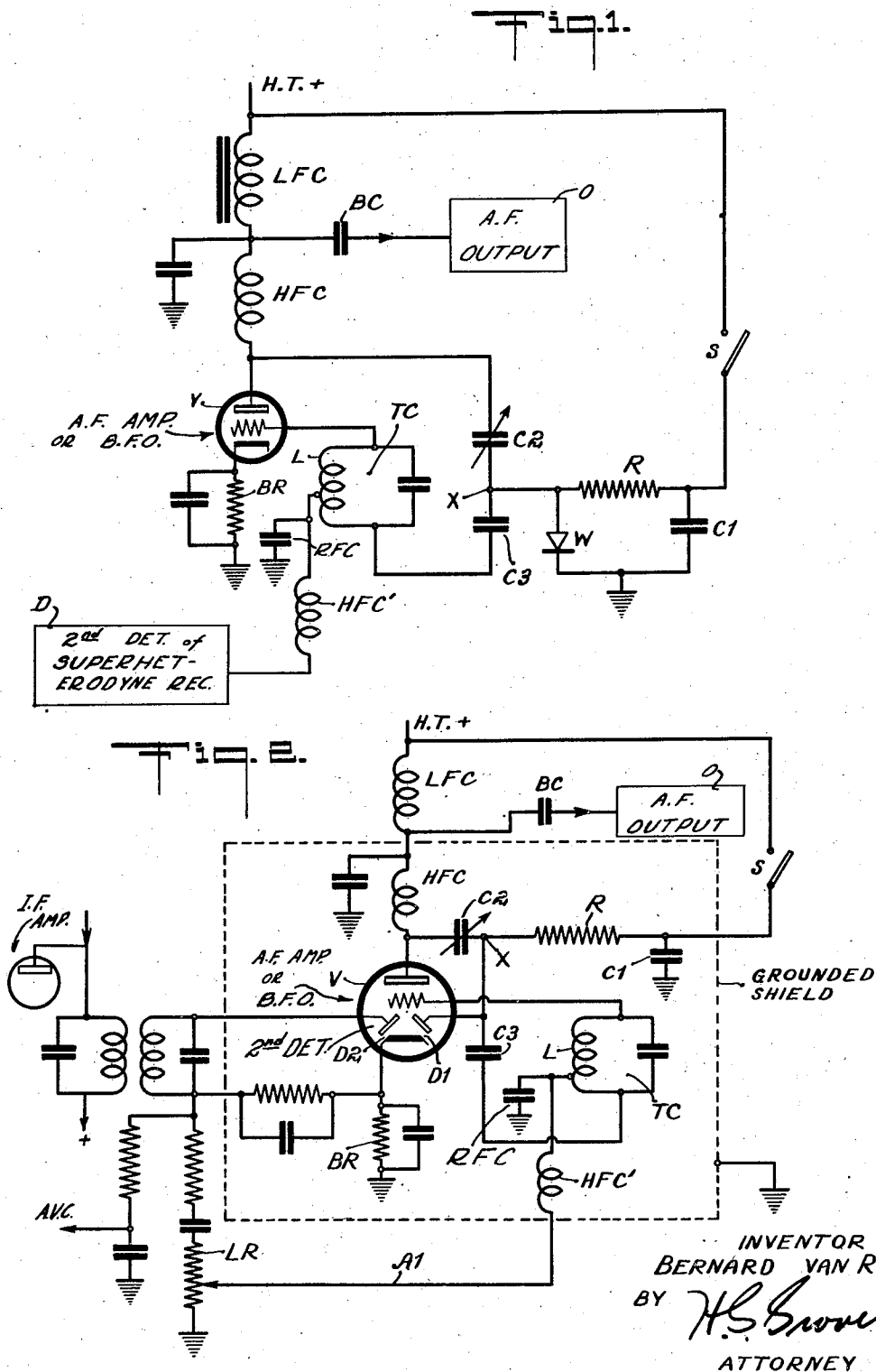
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B. VAN RYN

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SWITCH FOR HIGH FREQUENCY CIRCUITS

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SWITCH FOR HIGH-FREQUENCY CIRCUITS

Bernard van Ryn, Chelmsford, England, assignor to Radio Corporation of America, a corporation of Delaware

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The present invention relates to switching arrangements for electric circuits carrying radio-frequency energy and particularly for radio-frequency oscillators.

It is frequently required that a circuit carrying radio-frequency energy, such as an oscillator valve having a radio-frequency output, shall be screened so that it shall not cause interference with other apparatus, and yet that access shall be available to the circuit for the purpose of switching it out of operation.

As a case in point, mention may be made of a superheterodyne radio receiver designed for both telephone and continuous wave (C. W.) telegraph reception in which it is important that as few valves shall be used as conveniently possible and in which, to this end, the first audio-frequency amplifier stage and the beat frequency oscillator share in common a single valve. It is to be understood that a case of this nature is to be regarded merely as exemplary and not as limiting the invention to such a case.

In a case such as that outlined above, in order to prevent any of the harmonics of the beat frequency from reaching, by external coupling, earlier stages of the receiver, it is usual to mount the valve serving the two purposes mentioned in a separate screening box.

For the reception of modulated waves (telephone reception), however, it is required to switch off the beat frequency oscillator without, in any way, interfering with the performance of the valve insofar as its audio-frequency amplifying functions are concerned. Such a switching operation would present no problem were it possible or permissible, as frequently it is not, to mount the necessary switching apparatus within the box which contains the valve and the immediately associated complementary instrumentalities and elements. The difficulty presented, when such mounting within the box is not possible or permissible, could of course be overcome by mounting the switch outside the box and bringing a lead from the inside of the box to the switch. Since, however, such a lead would be carrying radio-frequency energy, it and the switch to which it is to be connected would have to be screened, a condition which, under certain circumstances, as when the switch is required to perform other functions, presents its own problems.

According to the invention, a switching arrangement for a circuit, or circuit element, carrying radio-frequency energy includes, connected across the circuit or circuit element, a rectifier which in its normal condition presents a high

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impedance to radio-frequency energy, a source of direct current energy, and a switch for connecting said source to the anode (or element serving as anode) of said rectifier in such sense as to cause said rectifier to become conducting so as to present a low impedance to radio-frequency energy.

If desired, there may be connected between said anode and said switch, a radio-frequency filter comprising a series-connected resistor or inductor and a shunt-connected condenser.

Fig. 1 of the accompanying drawing illustrates a particular exemplary circuit arrangement for a superheterodyne receiver in which a beat frequency oscillator is employed for continuous wave (telegraph) reception; and

Fig. 2 shows a circuit diagram of an alternative embodiment.

Referring to Fig. 1, a common valve V is used to function as the first audio-frequency amplifier (A. F. amp.) and as the beat-frequency oscillation generator (B. F. O.) of the receiver. The valve, which may be a triode, has its cathode connected to ground through a condenser-shunted bias resistor BR and its anode connected to the control grid through a variable condenser C2, in series with a further condenser C3, which may or may not be variable, and a parallel-tuned circuit TC. The anode of the valve is also connected, through a radio-frequency choke HFC in series with an audio-frequency choke LFC to the positive terminal HT+ of the usual source of high potential energy (not shown), the negative terminal of which is, as is usual, grounded or otherwise connected to the cathode of the valve.

Audio frequency input is applied from the output of the second detector, represented by block D, to some convenient point on the inductor L of the parallel-tuned circuit TC through a radio frequency choke HFC' between the grid end of which and ground there is connected a radio frequency bypass condenser RFC. Audio frequency output may be taken from a point between the two chokes HFC and LFC and fed through a blocking condenser BC to the final audio stage, represented by block O.

The switching device according to the invention is connected to a point X between the series-connected variable condenser C2 and the condenser C3, and comprises a rectifier W connected between this point and ground, a resistor R connected between this same point (that is, effectively, between one terminal of the rectifier) and one terminal of a make-break switch S, the other terminal of which is connected to the positive ter-

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minial HT+ of a source of energy, and a decoupling condenser C1 connected between the said one terminal of the switch and ground.

The rectifier W is so connected that when the switch is closed to condition the tube as the beat frequency oscillator for C. W. reception the positive terminal HT+ of the source of energy, which source may be the same as that connected to the anode of the valve V, is connected to that terminal of the rectifier which is connected to the junction point X of the series connected condensers. The rectifier therefore will be conductive and will provide a path of low impedance between the said point and ground.

By way of further explanation of the operation of the system disclosed in Fig. 1, tube V operates, for the reception of radio telephony (voice), only as an audio frequency amplifier, and for the reception of radio telegraphy (code) it operates as a combined audio frequency amplifier and beat frequency oscillator. In the latter instance, switch S will be closed and tube V will function as a Hartley oscillator by reason of the connection of the grid to one side of the frequency determining circuit TC, the connection of the anode through closed switch S, resistance R and condenser C3 to the other side of circuit TC, and the connection of the cathode through condenser RFC to an intermediate point on the coil L of circuit TC.

Audio frequency signals from the second detector D are also applied to the grid of tube V by way of the tapped connection on circuit TC which for audio frequency is connected to ground through condenser C3 and the rectifier W which it will be remembered provides a path of low impedance in the closed position of switch S. The heterodyne beat resulting from the interaction in tube V of the audio frequency signals and the locally produced oscillations will appear in the output of the tube and be amplified and indicated in the usual manner. As heretofore explained the radio frequency filter constituted by R and C1 prevents the oscillations of the beat frequency oscillator from being transmitted to earlier stages of the receiver through the switch S and its connections.

For the reception of radio telephony, the opening of switch S removes the voltage from across rectifier W which therefore acts as a high impedance device, and being shunted effectively across the space discharge path of the tube prevents the tube from oscillating. The tube and associated circuit elements (TC, BR, LFC and BC) will however function as an audio frequency amplifier.

The rectifier may be a dry-plate rectifier, as illustrated in Fig. 1, or a diode, or a triode acting as such, or it may be the diode-portion of a diode-triode, or, as illustrated in Fig. 2 of the accompanying drawing, one of the diode-portions of a double-diode-triode, the other diode-portion in this circuit serving for detection and for the production of an automatic volume-control bias.

Referring to Fig. 2, the triode part of the valve V serves as a beat-frequency oscillator and audio-frequency amplifier. The cathode of the valve is connected to earth through a condenser-shunted bias resistor BR and the anode is connected to the control grid of the valve through a variable condenser C2, in series with a further condenser C3, which may or may not be variable, and a parallel-tuned circuit TC. The anode of the valve is also connected, through a radio-frequency choke HFC in series with an audio-frequency choke

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LFC, to the positive terminal HT+ of the usual source of high-tension energy (not shown), the negative terminal of which is, as is usual, grounded or otherwise connected to the cathode of the valve.

Audio-frequency input is derived from a point on the low-frequency volume control resistor LR and applied over lead AI to some convenient point on the inductor L of the parallel-tuned circuit TC, and audio-frequency output may be taken from a point between the two chokes HFC and LFC and fed through a blocking condenser BC to the final audio stage, represented by block O.

The switching device according to the invention is connected to a point X between the series-connected variable condenser C2 and further condenser C3, and comprises diode portion D1 of the double-diode-triode valve V connected between this point and ground, a resistor R connected between this same point (that is, effectively, between one terminal of the rectifier) and one terminal of a make-break switch S, the other terminal of which is connected to the positive terminal HT+ of a source of energy, and a decoupling condenser C1 connected between the said one terminal of the switch and ground.

The diode portion D1 is so connected, that when the switch S is closed, the positive terminal HT+ of the source of energy, which source may be the same as that connected to the anode of the valve V, is connected to the anode of the diode, the diode is conductive and provides a path of low impedance between the point X and ground. The other diode D2 serves as a detector and also supplies an AVC bias voltage to the lead AVC.

The resistive value of the resistor R may be quite high (for example 2 megohms) and it and the decoupling condenser C1 then constitute a satisfactory radio-frequency filter so that the lead beyond this filter, and the switch, will be at substantially zero radio-frequency potential.

I claim:

1. A circuit arrangement comprising a tube provided at least with a cathode, control grid and anode, two condensers and a tuned circuit connected in series and in the order named between said anode and control grid, the cathode being connected to ground, means for coupling a source of audio frequencies to said tuned circuit, a rectifier so connected between the junction point of said condensers and ground as to present a high impedance to radio frequency energy and to thereby condition the tube to function as an audio frequency amplifier, and a switch for connecting a potential across said rectifier to reduce the impedance of said rectifier for radio frequency and to thereby condition the tube to function as an oscillation generator.

2. A circuit arrangement as claimed in claim 1 wherein there is connected across said rectifier a resistor and condenser in series, said switch being connected on one side to the junction of said resistor and condenser and on the other side to the positive terminal of a source of current, said resistor and condenser constituting a radio frequency filter to prevent radio frequency being transmitted to said switch and its connections.

3. A circuit arrangement as claimed in claim 1 wherein said rectifier is a diode.

4. A circuit arrangement as claimed in claim 1 wherein said tube is a diode-triode and the rectifier constitutes the diode portion of the tube.

BERNARD VAN RYN.