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RECEIVER SUBAUDIBLE MODULATION CONTROL CIRCUIT

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Fig. 1

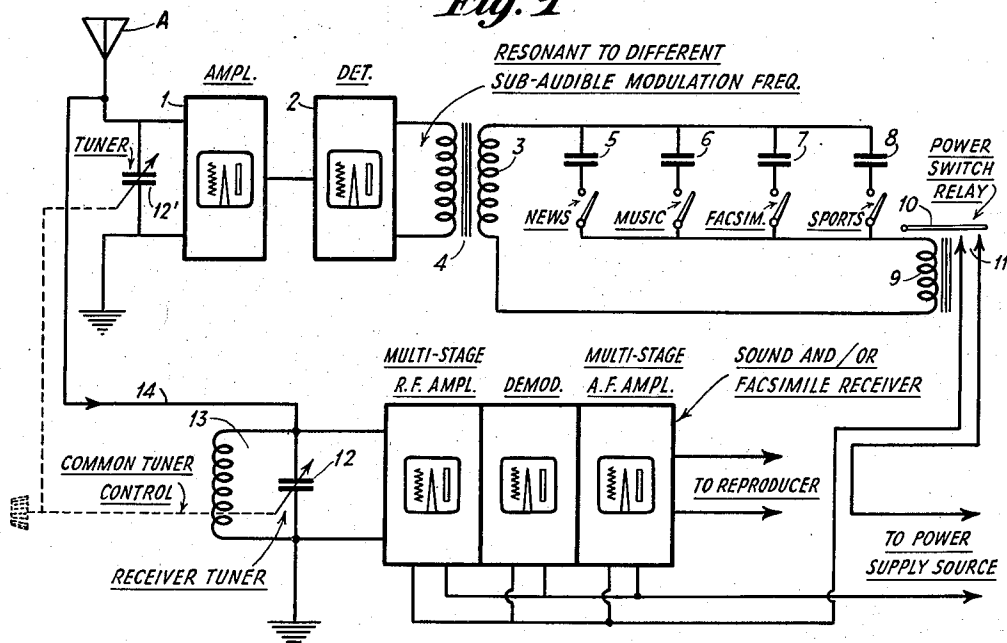
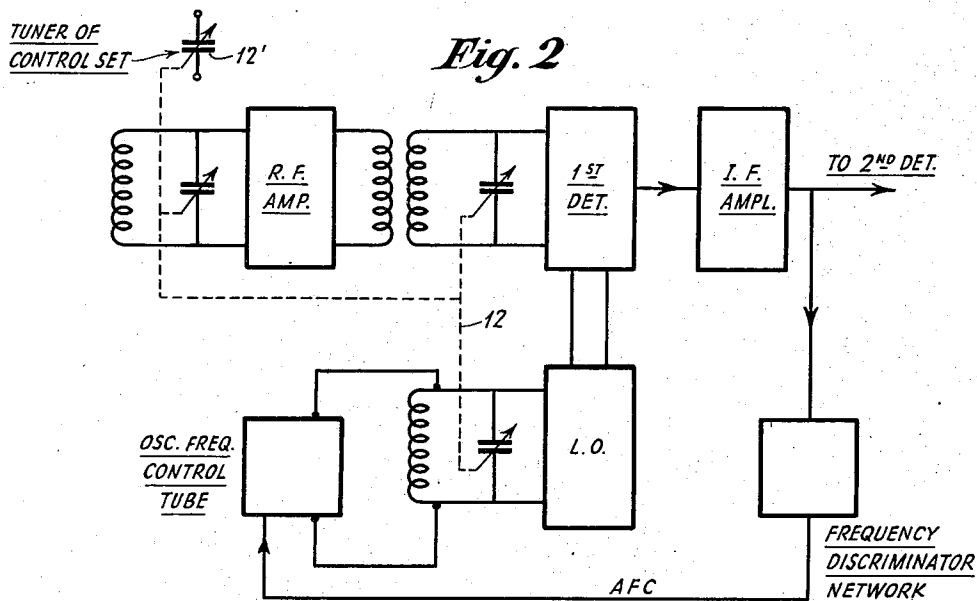


Fig. 2



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RECEIVER SUBAUDIBLE MODULATION CONTROL CIRCUIT

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5 Claims. (Cl. 250—20)

My present invention relates generally to energization of radio receivers, and more particularly the invention relates to circuits for controlling the energization of radio receivers, and which control circuits function upon reception of a sub-audible modulation frequency.

There are many situations in the art of radio reception wherein it is desired to have automatic signal reception upon collection of modulated carrier waves radiated from a transmitter. It is obviously uneconomical to keep a radio receiver energized throughout a twenty-four hour period so that signals will be automatically reproduced upon reception; the electron discharge tubes in such case would require replacement, and the consequent expense would be far greater than the benefits derived. Signal-actuated automatic reception is especially desirable for facsimile, or other similarly intermittent broadcast reception. Such types of receivers often employ many electron discharge tubes, and, therefore, it is highly uneconomical to energize them over long periods.

Accordingly, it may be stated that it is one of the main objects of my present invention to provide a method of, and means for, energizing a radio receiver which includes many tubes and is of a type generally employed for sound or facsimile operation, and the energization being accomplished automatically upon reception of a special signal from a transmitter; the signal being sub-audible and being imposed on the transmitter carrier as a modulation frequency.

Another important object of this invention is to provide in combination with a usual broadcast receiver, an auxiliary control receiver which includes relatively few tubes and is sensitive and sharply selective to a desired carrier frequency, but does not have any fidelity of reproduction characteristic comparable to that of the broadcast receiver, and which auxiliary receiver includes in the detector output circuit a plurality of circuits resonant to different sub-audible modulation frequencies, and any of which latter circuits, upon being rendered operative, function to render operative the energizing circuit of the broadcast receiver.

The novel features which I believe to be characteristic of my invention are set forth in particularity in the appended claims; the invention itself, however, as to both its organization and method of operation will best be understood by reference to the following description taken in connection with the drawing in which I have indicated diagrammatically several circuit organi-

zations whereby my invention may be carried into effect.

In the drawing:

Fig. 1 schematically shows a reception system embodying the invention.

Fig. 2 schematically shows a modified form of the invention.

Referring now to the accompanying drawing, wherein like reference characters in the two figures designate similar circuit elements, there is shown in Fig. 1 a reception system which comprises a main receiver, and an auxiliary reception network which functions to control the energization of the main receiver.

Since the operation of the present invention, and the understanding thereof, is not dependent upon the details of the various networks of the control and main receivers, these networks are schematically represented. The usual signal collector A may be employed to collect the radiated carrier waves, and this collector may be a grounded antenna; a radio frequency transmission line; a loop antenna; or any other type of signal collecting device. The carrier waves may be in the radio broadcast range; in the short wave ranges; or in the frequency ranges usually employed for facsimile operation. In any case the signals collected by the collector A are impressed upon the control circuit which comprises relatively few tubes; for example, the control receiver may be a two tube receiver wherein the first tube 1 is used in a tunable radio frequency amplifier stage and the following tube 2 functions as a tunable detector. The usual variable tuning condensers of the input circuits of tubes 1 and 2 are conventionally represented by the designation "Tuner", and it will be understood that the tuning device of the control receiver may take any form well known to those skilled in the art.

It is to be understood that the circuits of tubes 1 and 2 are electrically connected to a source of energizing voltage, which source is not shown to preserve simplicity of disclosure. In contradistinction to the main receiver and its power supply source, the tubes 1 and 2 are to be understood as being continuously connected to the power supply source thereof. The output circuit of the detector tube 2 is coupled to a network which comprises a coil 3, and the latter may be the secondary winding of the transformer 4 whose primary winding is disposed in the detector plate circuit. The audio network of the control circuit is constructed so that the closing of a predetermined switch device results in the connection across coil 3 of a predetermined condenser.

Thus, condensers 5, 6, 7 and 8 are provided, and each of these condensers has a switch associated therewith. Furthermore, a power switch relay is provided, and the coil 9 of this relay is arranged to be connected in series between the coil 3 and any of the condensers 5, 6, 7 and 8, upon closing of an appropriate switch. Each of the condensers in the audio network corresponds to a different sub-audible modulation frequency of a received carrier, and they are, of course, of different sizes so as to tune their respective circuits to the different sub-audible frequencies. For example, closing of the switch associated with condenser 5 results in the operative association with the detector output circuit of an audio circuit resonant to twenty cycles. The condenser 6 may resonate the coil 3 to twenty-three cycles; condenser 7 may resonate coil 3 to twenty-six cycles; and condenser 8 could resonate the coil 3 to twenty-nine cycles.

Obviously the sub-audible modulation frequency values may be varied at will depending upon the desires of the designer. It will be clear, however, that each sub-audible modulation frequency can be made to correspond to a different type of program desired to be reproduced by the main receiver. By way of example, there is shown in Fig. 1 that closure of the switch associated with condenser 5 results in reception of news; the succeeding switches result respectively in reception of music, facsimile and sports. The relation between the sub-audible modulation frequency and the nature of the program is entirely dependent upon the desires of the user of the system. Upon adjustment of the tuning device of the auxiliary receiver to a desired carrier frequency, there will be produced in the output of the detector tube 2 current of the desired sub-audible modulation frequency, assuming that the appropriate switch has been closed. Such current flowing through coil 9 attracts the pivoted armature 10 to close the circuit between the contacts 11 of the power supply circuit to the main receiver.

Whereas in Fig. 1 the relay coil 9 is shown in series with sub-audible resonant circuits, it is to be clearly understood that in practice various well known types of relays may be employed instead. For example, the coil 9 could be a secondary circuit, and be energized by a rectifier included in a sub-audible resonant circuit.

The main receiver may be of any desired type. In Fig. 1 the receiver is shown in highly generalized form as comprising a multi-stage radio frequency amplifier followed by a demodulator, and the latter being succeeded by a multi-stage audio frequency amplifier. The output of the audio amplifier is impressed upon any desired type of reproducer. As stated heretofore, the main receiver may be a receiver for sound reproduction, or it may be of a type used in connection with facsimile reproduction, such as exemplified in U. S. Patent 1,770,493 of R. H. Ranger. Regardless of the type of receiver employed as the main receiver the contacts 11 will be connected to the power supply circuit of the receiver as shown in Fig. 1. In other words, unless the armature 10 is attracted to close the circuit through contacts 11, the power supply circuit through the main receiver is open. In this way the energization of the various tubes of the main receiver is wholly dependent upon the control receiver. The power supply source supplying the main receiver with energizing voltage may be of any type well known in the art at the present

time, and may be the filtered output of a rectified alternating current supply circuit, or it may be a commercial direct current supply circuit.

The tuning mechanism of the main receiver has been conventionally represented, and it is to be clearly understood that the reference numeral 12 denotes the usual uni-control tuning device for a multi-tube radio receiver. For example, the numeral 12 designates the various variable air condensers used in the different tunable stages of a radio receiver, and whose rotors are operated by a common shaft. Such a construction is so well known in the art that it is believed sufficient to conventionally represent it.

Of course it is necessary to simultaneously adjust the adjustable elements of the tuning devices 12 and 12', and for this reason a common tuner control is shown in dotted lines as mechanically coupling the adjustable elements, or rotors, of the tuning devices 12 and 12' of the main and auxiliary receivers respectively.

It will now be appreciated that when a desired carrier frequency is to be received the common tuning control is adjusted to the carrier frequency, and at that setting of the tuner the desired carrier waves are not only impressed upon the auxiliary receiver, but are also impressed upon the input circuit 13 of the main receiver by virtue of the signal path 14 connected between the collector A and the high alternating potential side of the input circuit 13. However, there will be no reproduction in the output of the main receiver until the power supply circuit thereof is closed. This is accomplished by the closing of the circuit through contacts 11. As explained above, it is necessary to close an appropriate condenser switch to energize relay coil 9 in order to close the circuit through contact 11. Assuming that the intelligence radiated from the desired transmitter is music, the second switch will have been closed, thus resonating the output circuit of the detector 2 to the sub-audible modulation frequency included in the modulation on the desired carrier; it being understood, of course, that it has been pre-arranged that a given sub-audible modulation frequency denotes a program of music.

Obviously as many condensers as desired may be included in the output circuit of detector tube 2. These condensers may correspond to different sub-audible modulation frequencies to be included in the modulation on any one carrier wave at different periods of a day, or they may correspond to sub-audible modulation frequencies included in the modulations on different carriers from different transmitters. All that is necessary to have the main receiver energized is to adjust the tuning devices of the auxiliary and main receivers to a desired carrier, and to have the proper sub-audible modulation frequency switch at the auxiliary receiver closed.

The auxiliary receiver is constructed to be sufficiently selective to receive the radiated carrier, but does not possess sufficient fidelity to reproduce the program on the carrier. For this reason it is possible to construct the auxiliary receiver with a maximum of two tubes. Of course, by employing a single tube of the pentagrid converter type, 2A7, a single tube can be used as the energization control tube. While it is true that the control tube must be energized at all times, it will be realized that this is a highly economical measure relative to the alternative of keeping all the tubes of the main receiver energized at all times. An arrangement of the type

shown in Fig. 1 is especially valuable for facsimile operation, or other similarly intermittent types of broadcasting. In other words, by employing the present system, it is economical and practical to employ for the main receiver a set having as many as six to twelve tubes, and which is to be automatically operative upon collection of intermittently radiated waves. It is to be clearly understood, however, that the main receiver may include as many as twenty tubes; in general the main receiver is to be considered as incorporating as many tubes as is desired for the functions it is to perform.

It is to be understood that in using this system shown in Fig. 1, the tuning devices 12 and 12' may be pre-set, and kept adjusted to a desired carrier for a long period of time. Similarly, a particular condenser switch may be kept closed for the same period of time, and in that case the main receiver will be energized only upon collection of waves from a desired transmitter and which transmitter is radiating carrier waves including the predetermined sub-audible modulation frequency. Again, the auxiliary and main receivers may be constructed as one apparatus; that is to say, all the circuits may be embodied within a single cabinet.

In Fig. 2 there is shown a modification of the invention wherein the main receiver is shown to be specifically of the superheterodyne type. Such type of receiver is substantially universally used today because of its highly selective characteristics. The circuits of the superheterodyne receiver have been conventionally represented, but it will be observed that the tuning device 12' of the control set, and the tuning device 12 of the superheterodyne receiver are to be simultaneously adjusted. It will be realized that due to the difference in selectivity of the control and main sets, and the fact that the tuning devices 12 and 12' are simultaneously adjusted, the main set may not be accurately tuned to the desired carrier. This may result in poor reproduction. Fig. 2 shows the inclusion of an automatic frequency control circuit in the main set (designated as AFC) to automatically adjust the tuning of the local oscillator of the superheterodyne receiver to a value such as to produce substantially the operating intermediate frequency, upon adjustment of the tuning device 12 to a setting approximately close to a predetermined oscillator frequency value. Such an AFC circuit has been fully disclosed and claimed in application Serial No. 4,793, filed February 4, 1935 by C. Travis. The AFC system disclosed and claimed by S. Seeley in application Serial No. 45,413, filed October 17, 1935 may also be used.

For example, the circuit shown in Fig. 1 of said Travis application may be utilized in connection with the superheterodyne receiver conventionally represented in Fig. 2 of this case. It is believed sufficient to point out that such an AFC circuit comprises a frequency discriminator network which usually embodies a pair of resonant rectifier circuits mistuned an equal frequency amount from the operating intermediate frequency, and the differential output of the rectifiers being employed to vary the gain of an oscillator frequency control tube in a predetermined sense. The control tube is connected to the oscillator tank circuit so as to reflect across the tank circuit a reactance of a predetermined sign, and the variation of the gain of the control tube, by the differential output of the pair of rectifiers, will be in a direction to adjust the

tuning of the oscillator tank circuit sufficiently to produce in the first detector output circuit a frequency substantially close to that of the operating intermediate frequency.

By the inclusion of such an AFC circuit in the main set, it will be seen that the necessarily rough tuning of the main set by tuning device 12 will be compensated for by the automatic frequency control circuit operation. Upon impression of the received carrier waves on the main set, the AFC circuit will immediately function to accurately tune the main set. This action will occur conjointly with the receiver energizing operation which depends upon the closing of the power switch relay 10-11 by the currents of the desired sub-audible modulation frequency.

While I have indicated and described several systems for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular organizations shown and described, but that many modifications may be made without departing from the scope of my invention, as set forth in the appended claims.

What I claim is:

1. A radio receiving system comprising a main carrier wave receiver network, an energizing source for the various tube circuits of said main receiver, a control network including at least a carrier wave detector, at least one circuit in the detector output circuit which is resonated to a predetermined sub-audible frequency, means responsive to currents of said sub-audible frequency, for electrically connecting said energizing source to the tube circuits of said main receiver, and means for impressing upon said control network and main receiver modulated carrier waves including a modulation frequency equal to said sub-audible frequency.

2. A radio receiving system comprising a main carrier wave receiver network, an energizing source for the various tube circuits of said main receiver, a control network including at least a carrier wave detector, at least one circuit in the detector output circuit which is resonated to a predetermined sub-audible frequency, means responsive to currents of said sub-audible frequency, for electrically connecting said energizing source to the tube circuits of said main receiver, means for impressing upon said control network and main receiver modulated carrier waves including a modulation frequency equal to said sub-audible frequency, and means for simultaneously tuning said control network and main receiver to the frequency of said carrier waves.

3. A radio receiving system comprising a main carrier wave receiver network, an energizing source for the various tube circuits of said main receiver, a control network including at least a carrier wave detector, a plurality of circuits in the detector output circuit which are resonated to different sub-audible frequencies, means responsive to currents of a selected sub-audible frequency, for electrically connecting said energizing source to the tube circuits of said main receiver, means for impressing upon said control network and main receiver modulated carrier waves including a modulation frequency equal to a selected sub-audible frequency, and means for simultaneously tuning the control network and said main receiver to the frequency of said carrier waves.

4. A radio receiving system comprising a main carrier wave receiver network, an energizing

source for the various tube circuits of said main receiver, a control network including at least a carrier wave detector, at least one circuit in the detector output circuit which is resonated to a
5 predetermined sub-audible frequency, means responsive to currents of said sub-audible frequency, for electrically connecting said energizing source to the tube circuits of said main receiver, means for impressing upon said control network
10 and main receiver modulated carrier waves including a modulation frequency equal to said sub-audible frequency, said main receiver being of the superheterodyne type, means for simultaneously tuning the control network and said main
15 receiver to the frequency of said carrier waves, and means operatively associated with the superheterodyne receiver for accurately tuning the latter in response to the received carrier waves.

5. In combination with a radio receiver of the

type including means for tuning the receiver to a desired modulated carrier wave, a demodulator and a modulation current reproducer, means adapted to energize the tube circuits of said receiver, an energization control receiver including
5 at least one electron discharge tube having a means for tuning it to said carrier frequency, said last named tube being continuously energized, means providing a plurality of resonant circuits in the output of the last named tube, the circuits
10 being resonant to different sub-audible modulation frequencies, and each circuit including a device for selectively opening or closing its associated resonant circuit, and means common to the said resonant circuits for electrically connecting
15 the energizing source to the tube circuits of said radio receiver upon current flow through any of said sub-audible frequency resonant circuits.

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