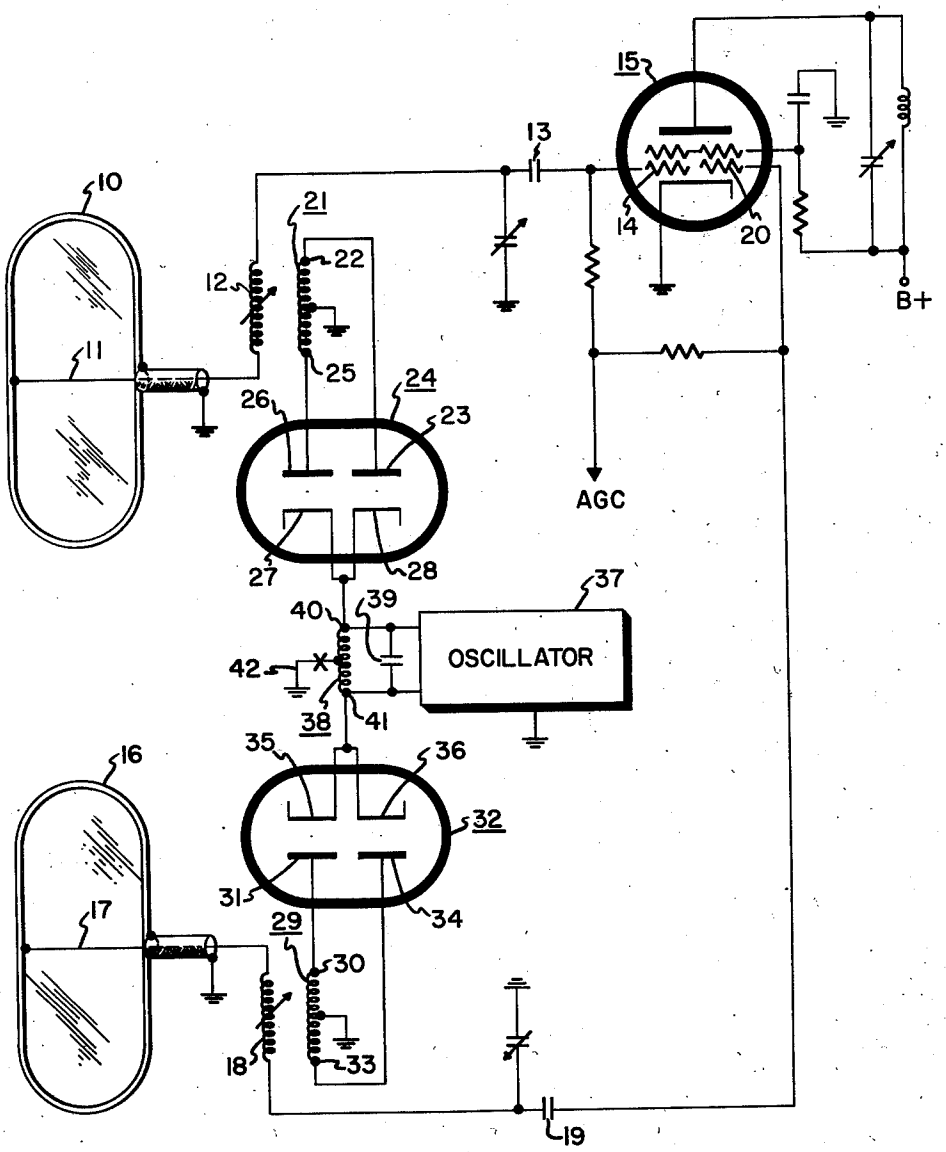
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R-F CIRCUIT SELECTOR OR THE LIKE

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R.-F. CIRCUIT SELECTOR OR THE LIKE

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This invention relates to R.-F. couplers and, more particularly, to an electronic circuit which provides for the sequential coupling of signals between a plurality of R.-F. circuits, for example the sequential coupling of two separate antennas to the input stages of associated radio apparatus.

In a co-pending application, Serial No. 503,190, filed April 22, 1955 by this inventor, there is described a multiple receiving or transmitting antenna system particularly suited for automobiles in which a plurality of space-phased signals is derived from one or more openings in the structure, and are utilized sequentially by the associated receiving apparatus. A number of devices have been proposed for effecting the sequential coupling between the antennas and the input circuits of the receiver, one of them being the mechanical system described in an application entitled "Sequential Coupler for R.-F. Circuits," and in the name of the same inventor as this application. An electronic system for effecting such sequential coupling is desirable because of its freedom from moving parts. While some gating systems are shown in the prior art in connection with diversity antennas, they are generally subject to undesirable coupling of the control signal into the input circuits of the receiver. Such extraneous signals result in undesirable noise in and spurious responses of the receiver.

Therefore, it is an object of this invention to provide an electronic R.-F. circuit selector which permits sequential operation of the circuits, for example antenna circuits, and which is free from introduction of undesired signals into the receiver.

According to the present invention a source of signals varying alternately between two conditions is utilized to alternately bring to conduction two sets of normally non-conducting diodes, or conversely, to alternately cut off two sets of normally conducting diodes, each set being effectively in shunt with an associated inductance which is, in turn, coupled to the tuning inductance for each of the associated R.-F. circuits, for example antenna circuits. The inductances to which the diodes are coupled are center tapped, the center taps being grounded. During periods of non-conduction of each diode set, any stray signals passing through the diodes as a result of inter-electrode capacity are cancelled out in the center-tapped inductance or in the anode circuit of the sequential mixer. During the period when the diode sets are conducting, any leakage of control signals into the associated inductance is of no significance since that inductance presents substantially a short circuit to the associated tuning inductance. Therefore, the tuning inductances associated with the separate R.-F. circuits, or antennas, are alternately damped to a high degree. Correspondingly, in those damped periods, little signal arrives at the sequential mixer stage from the associated circuit. The sequentially arriving signals appear at the anode of the sequential mixer. The circuit may be easily adapted to transmitter applications.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawing, in which:

The sole figure is a schematic diagram of one embodiment of the present invention.

In the sole figure, antenna 10 is represented as a closed loop and may be the boundary surrounding a discontinuity in a structure or vehicle body. Of course, any other type of antenna may suffice. Signals are conducted from antenna 10 through conductor 11 to antenna tuning inductance 12 which is coupled through condenser 13 to grid 14 of vacuum tube 15. Correspondingly, signals from antenna 16 are coupled through conductor 17 to antenna tuning inductance 18 which, in turn, is coupled through condenser 19 to grid 20 of vacuum tube 15. Damping inductance 21 is inductively coupled to tuning inductance 12 and is center tapped, with its center tap grounded. One end 22 of inductance 21 is connected to anode 23 of duo-diode 24. The remaining end 25 of inductance 21 is connected to anode 26 of duo-diode 24. Cathodes 27 and 28 are interconnected. In fact, of course, a tube having a single cathode and a pair of diode plates may be utilized in this operation. Correspondingly, two separate diodes may be utilized. Triodes may be utilized but are generally unnecessary for this type of application. Damping inductance 29 is inductively coupled to tuning inductance 18 and has a center tap which is grounded. One terminal 30 of inductance 29 is connected to anode 31 of duo-diode 32, the remaining end 33 of inductance 29 being connected to anode 34 of that duo-diode. Cathodes 35 and 36 of duo-diode 32 are interconnected. Oscillator 37 which, for this application, should operate outside the range of audible frequencies, has an output tank circuit including inductance 38 and condenser 39. One end 40 of inductance 38 is connected to the interconnected cathodes 27 and 28. The remaining end 41 of inductance 38 is connected to interconnected cathodes 35 and 36. Oscillator 37 need not be a sine wave oscillator but must be capable of producing alternately and periodically two conditions. For example, oscillator 37 may be a square wave generator of any circuit configuration. By reason of the connection of the two sets of cathodes to opposite ends of inductance 38, the control signals supplied to the two sets of cathodes are out of phase with each other. The amplitude of the control signal from oscillator 37 must be sufficiently great so that it will produce conduction sufficient to damp the strongest signals received.

The circuit of the sole figure operates as follows. Assume for the moment that oscillator 37 is a sine wave oscillator. During one half of the cycle, duo-diode 24 will operate and during the other half of the cycle duo-diode 32 will operate. When duo-diode 24 is operating or conducting, there is substantially a short circuit across damping inductance 21 which reflects as a very low impedance across tuning inductance 12 and damps it to the point where substantially no signal passes from antenna 10 to grid 14. During the next half cycle duo-diode 24 is non-conductive and duo-diode 32 conducts with a resultant short circuiting of damping inductance 29. This reflects as a very low impedance across tuning inductance 18 and substantially eliminates any application of signals from antenna 16 to grid 20. As the oscillator continues, the alternate operation of duo-diodes 24 and 32 occurs. During the time when duo-diode 24 is not conducting there exists a small amount of capacity between anode 26 and cathode 27 and between anode 23 and cathode 28. How-

ever, any control signals from oscillator 37 which pass through this inter-electrode capacitance of duo-diode 24 oppose each other in damping inductance 21 by reason of its balanced and center tapped nature. Therefore, the resultant flux is zero and none of the control signal leaks back into tuning inductance 12. Further, cancellation of stray signals occurs at the interconnected anodes of sequential mixer 15. The same analysis applies to the non-conducting condition of duo-diode 32. Thus, sequential coupling of signals from antennas 10 and 16 to grids 14 and 20, respectively, and hence to the input stages of the receiver which follow is effected while at the same time preventing leakage of control oscillator signals to the receiver. By breaking grounding lead 42 at point "X" and connecting in series a biasing battery poled with its positive terminal grounded and having a voltage just sufficient to bias duo-diodes 24 and 32 to conduction in the absence of signals from oscillator 37 the operation of the circuit of the sole figure varies slightly but the results are substantially the same. With this circuit biased as indicated, both tuning coils 12 and 13 are normally damped heavily and a positive impulse from oscillator 37 of sufficient magnitude to overcome the bias voltage is required to effect coupling from antennas 10 and 16 to their respective grids in amplifier tube 15.

It should be noted that if more than two R.-F. circuits are to be selected sequentially the present concepts may be utilized by simply increasing the number of phases generated by oscillator 37, adding the desired number of damping circuits each controlled by the oscillator, and providing the appropriate number of mixing grids and associated circuits.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

1. An antenna selector including first and second antenna input terminals adapted for connection to first and second antennas, respectively, a sequential mixer circuit having first and second input circuits and an output circuit, a first tuning inductance coupled between said first antenna input circuit and said first input circuit of said mixer circuit, a second tuning inductance coupled between said second antenna input terminal and said second input terminal of said mixer circuit, a source of control signals alternating between first and second conditions, first means inductively coupled to said first tuning inductance and responsive to signals from said control source for inductive damping of said first tuning inductance during said first condition of said control signal and second means inductively coupled to said second tuning inductance and responsive to signals from said control source for inductive damping of said second tuning inductance during said second condition of said control signal, said alternating inductive damping of said first and second tuning inductances being of a magnitude sufficient to alternately substantially prevent the coupling of a signal from the respective said antennas to said mixer circuit during said damping.

2. Apparatus according to claim 1 in which said source of control signals is a sine wave oscillator operating at frequencies above the audio range.

3. Apparatus according to claim 1 in which said first and second means each includes a center tapped inductance with such center tap connected to ground potential, and a pair of diodes having their respective anodes coupled to opposite ends of the associated inductance, and having effectively a single cathode coupled to said control signal source.

4. Apparatus according to claim 3 in which the said diodes are vacuum diodes.

5. Apparatus according to claim 3 in which said signal source has first and second output terminals providing at any one instant said control signal in opposite conditions, said diode cathodes associated with said first means being coupled to said first output terminals, and said diode cathodes associated with said second means being coupled to said second output terminals.

6. Apparatus according to claim 5 in which said first condition corresponds to conduction of said diodes and said second condition corresponds to non-conduction of said diodes.

7. A circuit for the selective translation of signals from a plurality of R.-F. circuits, each including an inductance, said selective circuit including a source of control signals alternating between first and second conditions, means inductively coupled to each of said inductances for normal inductive damping of each of said inductances to substantially prevent the translation of signals from said R.-F. circuits and responsive to signals from said control source to prevent said inductive damping of each of said inductances in sequence, and mixing means coupled to each inductance for providing to a common load the signals supplied in sequence from said inductances.

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