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W. J. BROWN

HIGH FREQUENCY SIGNALING SYSTEM

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Fig. 1.

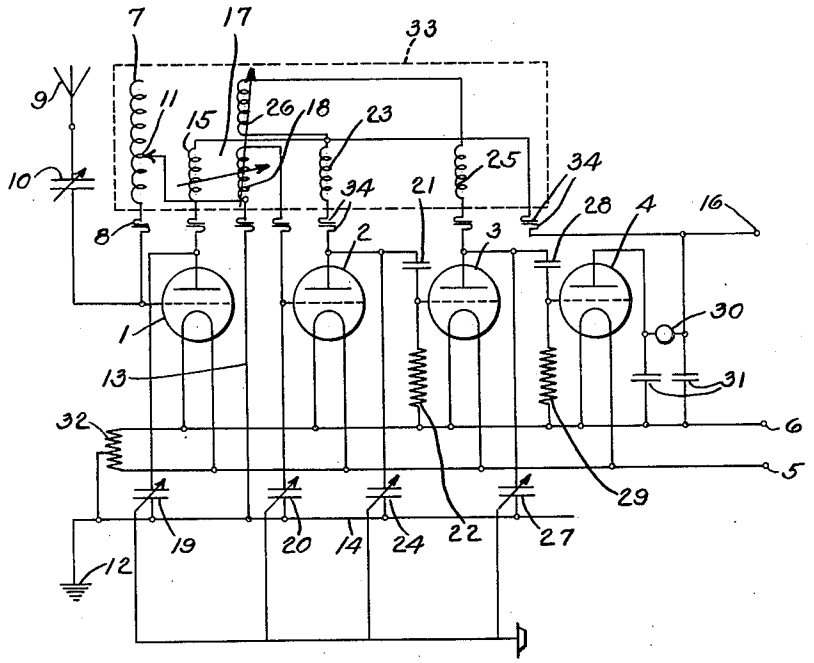
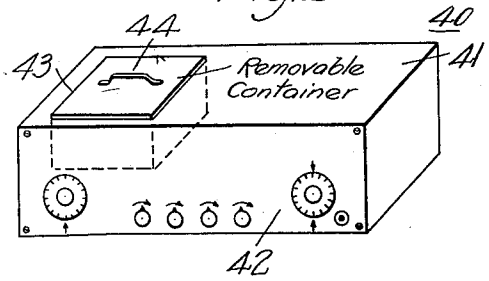


Fig. 2.



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UNITED STATES PATENT OFFICE.

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HIGH-FREQUENCY SIGNALING SYSTEM.

Application filed June 2, 1924, Serial No. 717,248, and in Great Britain June 9, 1923.

My invention relates to radio signaling systems and more particularly to systems having means for rendering them operative with a wide range of frequencies.

One object of my invention is to provide a radio receiving set which shall be self-contained and which shall receive efficiently, over a plurality of desired bands of wave lengths.

Another object of my invention is to produce a radio receiving device having conveniently interchangeable inductances and feed-back means whereby a change of sensitivity from one group of frequencies to another group of frequencies is made by means which provide maximum convenience of operation.

Another object of my invention is to provide a receiving system having feed-back means which shall be difficult to set into oscillation even when operated by unskilled persons.

Another object of my invention is to produce a radio receiving system having a plurality of groups of interchangeable inductances adapting the device to be operated at different wave lengths.

Another object of my invention is to produce a radio receiving apparatus having a plurality of interchangeable groups of inductances and feed-back means adapted to be interchanged conveniently and to make connection automatically to other portions of the apparatus to be contained in a sub-container and adapted to be mounted with thermionic discharge devices in a main container.

In the prior art of the reception of radio signals by means of regenerative receptors, it is well known that when the regenerative feed-back coupling is increased to a certain value, depending on several conditions of the apparatus, undesirable continuous oscillations will be set up which may result in radiations from the aerial. Thus when the regenerative coupling is effected by means of an inductance coil which is in, or related to, the output circuit of a triode electron discharge valve and which is magnetically coupled with an inductance coil of an input circuit of the said valve or a preceding valve, the conditions for self-oscillation are determined by the mutual inductance between the coils of the output and input circuits. They are also determined by the ratio of the self-induction and capacity in the circuits, the ohmic resistance and especially by the self-induction of the reaction coil when the back coupling is controlled by variation of the physical position of the reaction coil with respect to an input coil.

Thus in a complete and self-contained receiving set the coils between which the back coupling is effected may be made of such a size that when the circuits are otherwise suitably adjusted, undesirable self-oscillations cannot be set up, while, at the same time, reception at relatively high efficiency is obtainable. These effects are only possible, however, over a relatively small band of wave lengths since under these conditions, the self-induction of the reaction coil necessary to give the required degree of back coupling will be too small at higher wave lengths. If, on the other hand, a reaction coil suitable for use with an input inductance for a relatively long wave length is used along with an input inductance for receiving shorter wave lengths, undesirable self-oscillation may be readily set up and may even be difficult to stop.

According to one feature of the present invention the inductances, such as a tuning inductance in the input circuit of a valve and a tuned anode coil, or a reaction coil are disposed in a compartment, framework or casing which is separate from, and removable with respect to, the main casing containing the valve and other apparatus, such as condensers, filament rheostats, various external terminals and other devices. The connections between the removable compartment and the main casing may be effected by means of contacts which are adapted to engage corresponding contacts provided on the main casing and at the same time preferably rendered inaccessible when the said removable compartment is placed in its operative position. The coils contained in the removable compartment are suitable for reception over a definite band of wave lengths without the possibility of setting up strong self-oscillation and are preferably rendered inaccessible by suitably sealing the compartment. A plurality of such removable compartments may be provided, each one containing a different set of coils, permitting reception over bands of progressively increasing wave lengths.

In the case of a multivalve high frequency amplifying receiving set, all the inductance coils are located in the aforesaid removable compartment or casing. The various condensers by means of which said inductance coils are tuned are contained within the main casing containing the valves and other devices, and the several condensers pertaining to the intervalve coupling coils are preferably operable simultaneously by a single control handle or knob, as illustrated.

Other objects and structural details of my invention will be apparent from the following description when read in connection with the accompanying drawing wherein:

Figure 1 is a diagrammatic representation of circuits and apparatus embodying my invention.

Figure 2 is a perspective view of a conventional receiving set cabinet modified according to a preferred form of my invention.

In the drawing, the valves are indicated at 1, 2, 3 and 4. The valves 1, 2 and 3 are high-frequency amplifiers and the valve 4 is a detector. The filaments of several valves are supplied with current from a suitable source (not shown) the positive pole of which is connected to the conductor 5 and the negative pole to the conductor 6. The filament current may be regulated in any desired manner. For example, a rheostat (not shown) may be arranged in one of the filament leads of each of the valves.

The aerial tuning inductance is indicated at 7 and may be variable. One terminal 8 of the inductance 7 is connected to the aerial 9 through a series tuning condenser 10. It will be understood that the tuning condenser may be connected in parallel with the inductance 7 or the inductance 7 may be a variometer used with or without a tuning condenser. The other terminal 11 of the inductance 7 is connected to earth as indicated at 12, through a conductor 13 and an earthed bus-bar 14 which will be hereinafter again referred to.

The terminal 8 of the inductance 7 is connected to the grid of the first valve 1 as shown, and the anode of the valve is connected to a high tension battery through an inductance 15 and positive terminal 16. The negative pole of the high tension battery is connected to the conductor 5 as will be well understood. The inductance 15 constitutes the primary winding of a loose-coupled high-frequency transformer 17, the secondary winding 18 of which is connected at one end to the grid of the second valve 2 and at the other end to the earthed bus-bar 14.

The primary winding 15 of the transformer 17 is adapted to be tuned by means of a variable condenser 19 which is connected between the anode of the first valve and the earthed bus-bar 14. The secondary winding 18 of the high frequency transformer is adapted to be similarly tuned by means of a variable condenser 20 connected between the grid of the second valve and the buss-bar 14.

It will be understood that the coupling between the first and second valves may assume other forms. For example, the coupling between the primary and secondary windings of the transformer 17 may be close and fixed and only one of the windings tuned by means of a condenser. The invention also includes the use of an inductance-capacity coupling between the first and second valves in place of a high-frequency transformer, but the loose-coupled transformer is to be preferred when selectivity is required.

The third valve 3 is coupled to the second valve 2 by means of a small condenser 21 connected between the anode of the second valve and the grid of the third valve, a grid leak 22 being connected between the grid of the third valve and the negative filament conductor 6.

The second valve is provided with an anode inductance 23 which is connected to the high-tension positive terminal 16 and which is tuned by means of a variable condenser 24, connected between the anode of the second valve and the bus-bar 14. The third valve is provided with an anode coil 25 which is connected through a reaction coil 26 to the high tension positive terminal 16. The anode circuit of the third valve is tuned by means of a variable condenser 27 which is connected between the anode of the third valve and the bus-bar 14. The reaction coil 26 is variably coupled with the secondary winding 18 of the high frequency transformer 17.

If desired, the reaction between the third and second valves may be floating, that is to say, it may comprise a coil such as 26 having a fixed coupling with the winding 18 of the transformer and a second coil in parallel therewith variably coupled with the anode coil 25 of the third valve. Alternatively, the coil 26 may have a variable coupling with the winding 18 of the transformer, while the second coil has a fixed coupling with the anode coil 25. Or, if desired, both the couplings may be variable. The floating circuit containing two such reaction coils may be connected to a part of the circuit which is normally at a fixed potential, for example, the bus-bar 14.

The anode of the third valve 3 is connected to the grid of the fourth valve 4 by means of the small coupling condenser 28, a grid leak 29 being provided as in the case of the coupling between the second and third valves. The anode of the fourth valve 4 is connected through a telephone receiver in-

dicated at 30 to the high-tension positive terminal 16. The usual telephone and high tension battery bridging condensers 31 may be provided as shown.

The potential of the earthed bus-bar 14 with respect to the filament is adjusted by means of a potentiometer 32 which may be connected across the positive and negative filament leads 5 and 6. The potentiometer 32, which may be fixed or variable, determines the potential of the grids of the valve 1 and 2 with respect to the filaments of these valves.

All the tuning coils including the windings of the transformer 17 and the reaction coil 26 are disposed in a compartment or casing which is indicated at 33 by dotted lines. Such compartment or casing is separate from, and removable with respect to, the main casing (not indicated) containing all the other devices of the receiver, including the aerial tuning condenser 10, the inter-valve tuning condensers 19, 20, 24 and 27 and the external terminals. The connections between the removable compartment 33 and the main casing are preferably effected by means of pairs of contacts 34 so arranged as severally to engage one another when the compartment 33 is properly located with respect to the main casing. As previously set forth, the pairs of contacts 34 may be so located that they are inaccessible when the compartment 33 is in its operative position.

Referring to Fig. 2, the receiving set 40 comprises a main casing 41, to the front of which is affixed a panel 42 carrying a plurality of control devices. The main casing is further provided with an opening 43, in which is removably positioned a compartment, or container 44, having mounted therein the inductance devices 7, 15, 18, 26, 23 and 25. Means for adjusting the coupling between the several inductance devices, 15, 18 and 26, and for varying the operative position of the inductance device 7 are preferably carried by the compartment 44 and should be so arranged as to be accessible from the exterior thereof. These control devices are not illustrated, inasmuch as the manner in which they would be mounted is believed to be sufficiently obvious.

The co-operating contacts carried by the removable container and by the main casing are also not illustrated, inasmuch as their specific arrangement would be a matter well within the capacity of anyone skilled in the art. The manner in which the said contacts co-operate is clearly shown in Fig. 1.

The invention is not limited, however, to the use of pairs of contacts 34 since ordinary terminals may be employed adapted to be connected by wire. The coils in the compartment 33 are suitable for reception over a definite band of wave lengths. A plurality of movable compartments 33 may be provided, each containing a different set of coils suitable for reception over different bands of wave lengths. In this manner, the possibility of setting up strong self-oscillation which is liable to be radiated from the aerial and cause disturbance is minimized or may even be prevented if the compartment 33 is sealed and the contacts 34 are rendered inaccessible as above mentioned. The main casing is conveniently provided with an open compartment adapted to receive the compartment 33.

While I have shown but a single embodiment of my invention in the accompanying drawing, it is capable of various changes and modifications without departing from the spirit thereof and it is desired, therefore, that only such limitations shall be imposed thereon as are indicated in the prior art or in the appended claims.

I claim as my invention:

1. A radio receiving system comprising in combination a radio receptor circuit comprising an inductance, a triode amplifier device comprising electron discharge means and grid and plate inductances electromagnetically coupled and associated with said receptor circuit, additional amplifier means comprising electron discharge means and inductances, a detector, a container, a removable sub-container therewithin, said inductances being positioned therein, and removable therewith, and means whereby the inductances positioned in said sub-container are connected in circuit when the sub-container is inserted into said container.

2. A radio receiving system comprising in combination a radio receptor circuit comprising an inductance, a triode amplifier device comprising electron discharge means and grid and plate inductances electromagnetically coupled and associated with said receptor circuit, additional amplifier means comprising electron discharge means and inductances, connections between said electron devices and said inductances, a detector, a container and a removable sub-container therewithin, said inductances being positioned therein and removable therewith, said connections separably extending between said inductances in said sub-container and said electron devices in said other container.

3. A radio receiving system comprising in combination a radio receptor, an electron discharge device having a grid coil, and a feed-back coil inductively coupled thereto, a container, a removable sub-container therein having said coils positioned therewithin, and means whereby the coils positioned in said sub-container are connected in circuit when the sub-container is inserted into said container.

4. A radio receiving system comprising in combination a radio receptor circuit having an inductance device therein, an ampli-

fier apparatus comprising electron discharge means, an input inductance, an output inductance and a feed-back inductance, a detector, capacitive tuning means associated with said inductances, a removable sub-container, said inductances being positioned therein, a main container, and means for connecting said inductances to said discharge means by the operation of placing said sub-container within said main container.

5. A radio receiving system comprising in combination a radio receptor circuit having an inductance device therein, an amplifier apparatus comprising electron discharge means, an input inductance, an output inductance and a feed-back inductance, a detector, capacitive tuning means associated with said inductances, a removable sub-container, said inductances being positioned therein, a main container, and means for connecting said inductances to said discharge means by the operation of placing said sub-container within said main container, and a plurality of other sub-containers and other inductances therein, interchangeable with said first-mentioned sub-container and therewith inductances.

6. A radio receiving system comprising in combination a radio receptor circuit having an inductance device therein, an amplifier apparatus comprising electron discharge means, an input inductance and a feed-back inductance, a detector, capacitive tuning means associated with said inductances, a removable sub-container, said inductances being positioned therein, a main container and means for connecting said inductances to said discharge means by the operation of placing said sub-container within said main container, and a plurality of other sub-containers and other inductances therein, interchangeable with said first-mentioned sub-container and therewith inductances, said connecting means cooperating with said interchangeable sub-containers and inductances to complete circuits therethrough.

7. In radio receiving apparatus, means for preventing re-radiation comprising a sealed container in which are positioned a plurality of inductors including a reaction coil variably coupled to at least one of the remaining inductors, contact devices carried externally by said container, additional radio receiving apparatus including thermionic devices and variable reactors, and contact devices connected to said thermionic devices and variable reactors and arranged to cooperate with the contact devices carried by said container, the said reaction coil having insufficient inductance to cause oscillation at any position of its variable coupling range.

In testimony whereof, I have hereunto subscribed my name this 9th day of May, 1924.

WALTER JOHN BROWN.