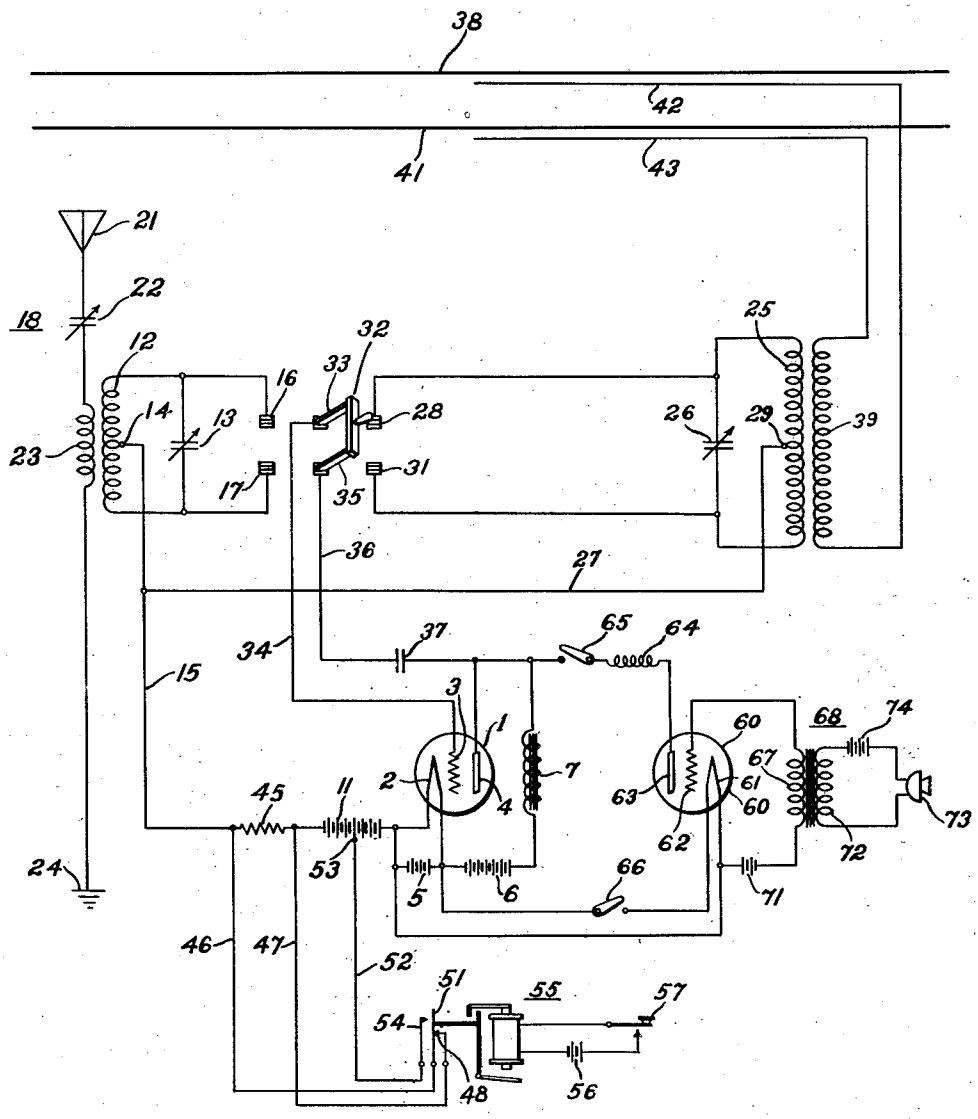
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RADIO TRANSMITTING SYSTEM

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WITNESSES:

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RADIO TRANSMITTING SYSTEM

Application filed January 29, 1927. Serial No. 164,548.

My invention relates to radio transmitting systems, and it has particular relation to systems in which power lines or telephone lines are available as channels over which the carrier frequency may be transmitted.

An object of my invention is to provide apparatus and circuit connections whereby a single radio-frequency oscillation-generator may be operatively associated with either a power-line or with an antenna of the usual type, such as is utilized for space-radio transmission.

Another object of my invention is to provide, in a system of the type referred to, means whereby the change from power-line communication to space-radio communication may be accomplished without the necessity of changing the tuning of any part of the apparatus associated with the oscillation generator.

Another object of my invention is to provide a radio transmitting system that is capable of being instantly converted from short-wave space-radio transmission to long-wave wire-channel transmission by manual, or automatic, adjustment of a single movable element.

The utilization of power lines as wave-transmission channels is becoming more and more important in connection with the remote control of power-generating stations, and in connection with power distribution.

Heretofore, in the event that communication over the wire channels was interrupted by reason of breakage, short circuits, grounding, etc., it has been necessary to wait until appropriate repairs should be made in order that communication could be resumed. Under certain conditions, these interruptions to communication have proved extremely embarrassing to the power companies operating the power-distributing networks, and have been the cause of considerable expense.

I have, accordingly, by my invention, provided a dual system of communication by equipping each power-line transmitting station with a short-wave space-radio transmitting antenna in addition to the usual means for coupling the transmitter to the power lines. In addition, I have provided means whereby the transmitter may, at will, be changed from operative connection with the power lines to operative connection with the antenna without the necessity of changing the tuning.

The novel features that are considered characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawing.

The single figure of the drawing is a diagrammatic view of a preferred embodiment of my invention.

A thermionic device 1, having a filament 2, a grid 3 and a plate 4, is provided with a source of filament power 5. The plate 4 is supplied with potential from a source 6 through an audio-frequency choke coil 7 of the type usually known as a "modulation choke".

An oscillatory circuit comprising an inductor 12 and a tuning condenser 13 has a midpoint 14 thereon connected to the negative terminal of a grid-biasing potential source 11 through a conductor 15. One end of the inductor 12 is connected to a contact element 16 and the opposite end of the inductor is connected to a contact element 17. The inductor 12 is coupled to an antenna-ground system 18, comprising an antenna 21, a tuning condenser 22, an inductor 23 and a ground connection 24.

A second oscillatory circuit, comprising an inductor 25 and a tuning condenser 26, is provided. A midpoint 29 on the inductor 25 is connected by a conductor 27 to the conductor 15 which is connected to the negative terminal of the grid-bias-potential source 11. One end of the inductor 25 is connected to a contact element 28, and the opposite end of the inductor is connected to a contact element 31. The contact elements 16 and 17, associated with the first-mentioned inductor 12, and the contact elements 28 and 31, are so arranged as to cooperate with a movable switching device 32. An arm 33 of the switch-

ing device 32 is connected, by a conductor 34, to the grid of the thermionic device 1. Another arm 35 of the device 32 is connected, by a conductor 36 and a condenser 37, to the plate 4. The blocking condenser 37 is employed to prevent the application of plate potential to the grid of the tube.

The inductor 25 is coupled to an inductor 39, which, in turn, is capacitively coupled to a plurality of power lines 38 and 41 through coupling devices 42 and 43. These coupling devices may either be antennæ, as illustrated, or may be coupling condensers of any well known type.

The method of controlling oscillations in a system constructed according to my invention is somewhat analogous to that illustrated and described in the patent to Colpitts No. 1,198,700. The battery 11 has a sufficiently high voltage to reduce the space current flowing between the anode 4 and the cathode 2 from the battery 6 to zero or the point where oscillations cannot be generated. In order to transmit signalling currents, it is necessary to reduce the negative voltage impressed on the input circuit sufficiently to permit the flow of the normal space current. To accomplish this a resistor 45, preferably of several thousand ohms, is interposed between the conductor 15 and the negative terminal of the grid-biasing battery 11. A plurality of conductors 46 and 47 lead from the ends of the resistor 45 and terminate in a fixed contact 48 and a movable contact member 51, respectively, the normal position of the contact members being closed. A conductor 52 leads from an intermediate point 53 of the battery 11 and terminates in a fixed contact member 54 associated with the movable member 51.

The movable contact member 51 is actuated by a relay 55, the relay being arranged for energization by a battery 56 under the control of a telegraph key 57.

The operation of the system is as follows, in the event it is desired to transmit telegraphic signals: The switching device 32 is first so actuated as to associate the plate and grid of the thermionic tube with either of the oscillatory circuits 25—26 or 13—14, depending upon whether wire-line long-wave transmission, or short-wave space-radio transmission is contemplated. By reason of the connections 14, 15 and 27, the oscillatory circuits referred to will be provided with feed-back energy, and oscillations will be generated therein upon energizing the thermionic device 1 from the sources 5 and 6, in the manner well known to those skilled in the art.

In the normal, or non-signalling condition of the system, the full negative potential of the battery 11 is impressed on the grid 3, the resistor 45 being short-circuited by the relay contacts 48 and 51. When the telegraph key is depressed, closing the circuit through the relay winding, contacts 48 and 51 are opened, and contacts 51 and 54 are closed, thus short-circuiting a portion of the battery 11 through the resistor 45 and altering the grid potential sufficiently to permit the flow of plate current in the thermionic device 1 and the consequent generation of oscillations in the circuits associated therewith.

The resistor 45 serves to prevent a heavy current drain on the battery 11 when a portion thereof is short circuited through the action of the relay 55.

There is no necessity for changing the predetermined tuning of either the short-wave oscillatory circuit 13—14 or the long-wave oscillatory circuit 25—26 previous or subsequent to throwing the switching device 32 to one side or the other. In either case, it will be noted that the thermionic device 1 is so connected to the oscillatory circuit that the conditions for generating oscillations are present. Those skilled in the art will recognize that, when the inductor having the mid-tap filament connection is associated with the grid and plate by moving the switching device, the well-known "Hartley" oscillating circuit is set up.

In order that voice modulation may be impressed upon the system, when either space-radio or wired-radio is employed, it is preferable to provide a second thermionic device 60 having a filament 61, a grid 62 and a plate 63 and to connect the plate 63 to the plate 4 of the oscillator tube 1 through a radio-frequency choke-coil 64 and a switching device 65. The filament 61 may be energized from the battery 5 which energizes the filament of the oscillator tube 1, a switch 66 being interposed in the connection therebetween. The grid 62 of the modulator tube 60 is connected, through the secondary 67 of an audio-frequency transformer 68 and a source of grid biasing potential 71, to the filament 61 thereof. The primary 72 of the transformer is connected in series with a microphone 73 and a source 74 of current therefor.

In order that the system shall be placed in the oscillatory state preparatory to voice modulation being impressed thereon, it is necessary that the key 57 be first depressed and retained in the depressed position, thus altering the grid potential of the oscillator tube 1 to the point where oscillations may be generated. After the key 57 has been depressed, the switches 65 and 66 may be closed and the microphone energized, thus modulating the output of the oscillator 1 in a manner now well known to those skilled in the art.

It is thus apparent that, with a system constructed according to my invention, communication may be carried on at a low frequency over power or telephone lines, or may, by the adjustment of a single element only,

be carried on at a high frequency over space radio. It is a very simple matter for the operator to change from wired radio to space radio in the event of such accident or damage to the power lines that communication thereover is interrupted.

Various modifications may be made in the instrumentalities embodying my invention without departing from the spirit and scope thereof, and I desire that only such limitations shall be placed thereon as are imposed by the prior art and by the appended claims.

I claim as my invention:

1. In a transmission system, a thermionic device capable of generating oscillations when associated with a suitable circuit network, a radio antenna and a network associated therewith tuned to a relatively high frequency, a power system and an independent network associated therewith tuned to a relatively low frequency, and means for at will placing said thermionic device in operative relation to either network.

2. In combination, an electric power system, a radio antenna, an oscillation generator, means for modifying said oscillations in accordance with signals, and means for selectively associating said oscillation generator with either said radio antenna or said power system and for simultaneously determining the frequency of the oscillations generated in either event.

3. In combination, a radio antenna, tunable means for introducing oscillatory energy therein, a metalic conductor, additional tunable means for introducing oscillatory energy into said conductor, means whereby a device capable of generating oscillations may be operatively associated with either of said tunable means, means for interrupting the continuity of said oscillations at signal frequency whereby messages may be transmitted in code, and means for modifying the amplitude of said oscillations whereby voice modulations may be transmitted.

4. In combination, an oscillation generator having input and output terminals, a plurality of communication channels having different characteristics, an oscillatory circuit coupled to each of said channels, each of said circuits being tunable to a frequency which the associated channel transmits efficiently, and means for, at will, associating the terminals of any desired one of said oscillatory circuits with said input and output terminals, whereby said oscillation generator may be utilized to impress energy on either of said channels.

In testimony whereof, I have hereunto subscribed my name this 28th day of January, 1927.

CLARENCE A. BODDIE.