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RADIO TUNING CONTROL CIRCUITS

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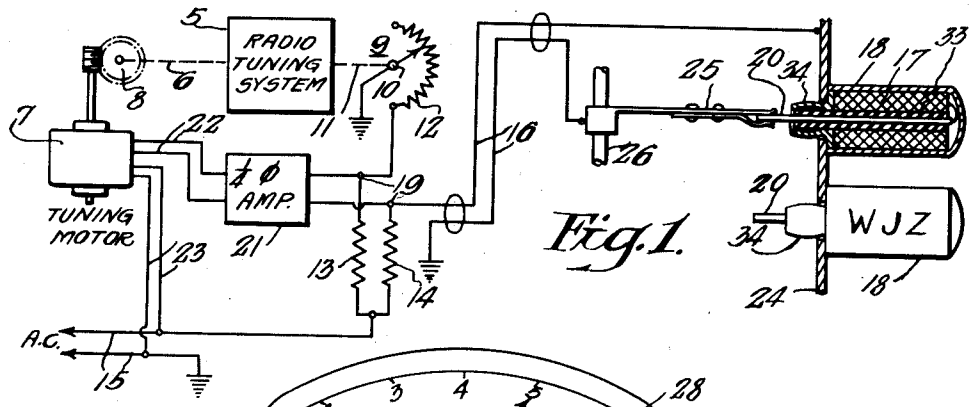


Fig. 1.

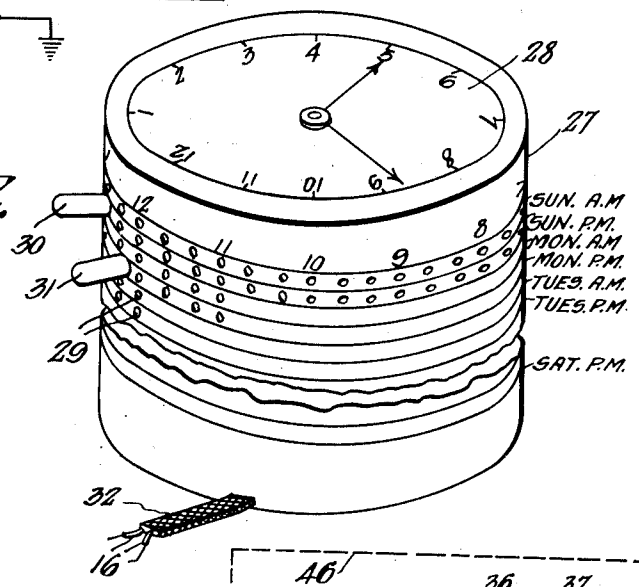


Fig. 2.

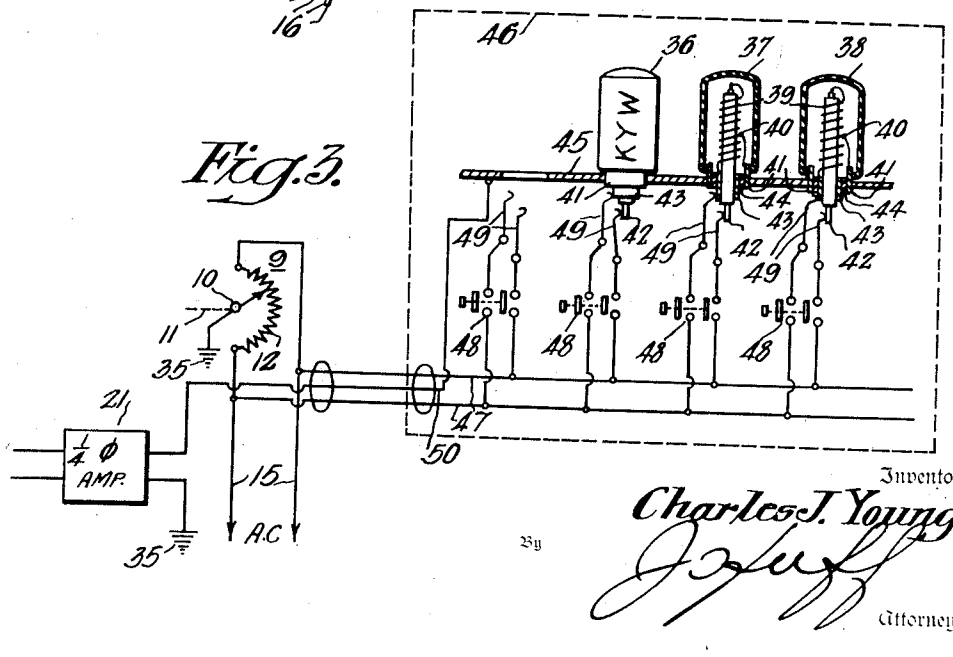


Fig. 3.

Inventor

Charles J. Young

By

Attorney

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RADIO TUNING CONTROL CIRCUITS

Charles J. Young, Ardmore, Pa., assignor to Radio Corporation of America, a corporation of Delaware

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5 Claims. (Cl. 250—40)

The present invention relates to radio tuning control systems of the type providing automatic tuning to preselected signals or broadcasting stations in response to operation of selector means such as push-buttons or a time-control device.

More particularly, the present invention relates to a radio tuning control system for preselected frequencies or signals wherein the preselection may be controlled through the medium of a plurality of interchangeable key-like elements, and has for its primary object to provide an improved preselection radio tuning system having a simplified electrical control circuit for motor tuning operation and control, wherein said key-like elements are replaceable circuit control elements preadjusted to effect predetermined operation of said system.

It is a further object of the present invention to provide an improved radio tuning control system embodying a tuning motor and a control circuit therefor provided with a plurality of key or plug elements for insertion in said circuit to change the electrical characteristics thereof in a predetermined manner.

It is a still further object of the present invention to provide a motor tuning control system for radio receiving apparatus and the like having electrical plugs or keys containing resistance elements adjusted for effecting predetermined preselection tuning operations of the system and adapted to be inserted in the control circuit of said system.

The invention will, however, be better understood from the following description when considered in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the drawing, Figure 1 is a schematic circuit diagram of a radio tuning control system embodying the invention, and including substantially full-size, side elevation and cross-sectional views of the preselection key or plug elements;

Figure 2 is a view in perspective and on a reduced scale of a time-preselection switching device, a portion of which is included in the circuit of Figure 1; and

Figure 3 is a modification of the circuit of Figure 1 showing a further embodiment of the invention, including a modification of the control key or plug units.

Referring to Figs. 1 and 2, the essential elements of any suitable motor-driven radio tuning control system is schematically indicated, a radio tuning system being indicated by the block 5 having tuning shaft control connection 6 with a reversible tuning motor 7 through a suitable reduction gearing 8.

The control circuit for the motor is preferably of the balanced potentiometer type embodying a rheostat or potentiometer device 9 having a potentiometer arm 10 connected with the tuning control shaft of the radio tuning system, as indicated by the dotted connection 11, and a resistor element 12 over which the contact 10 moves in response to the tuning control operation of the system. As is usual, an unbalance potential set up by a control operation is applied to the motor 7, causing it to operate until the potential balance is restored in the potentiometer system by movement of the arm 10 to the neutral point on resistor 12.

In the present example, an improved balanced potentiometer system is provided in that the potentiometer may include a simple resistor 12 connected in series across a pair of low-voltage alternating current supply leads 15. The resistors 13 and 12 constitute a fixed and a variable arm respectively in the one branch of a balanced potentiometer or bridge circuit. The other parallel branch of the bridge circuit includes a second fixed resistor 14 and an extended remote control circuit 16 in which are selectively inserted resistance elements 17 of differing resistance values contained in electrical key or plug devices 18, hereinafter more fully described. The second branch of the bridge circuit including the fixed resistor 14 and the remote control circuit 16 with the resistance element therein is connected in parallel with the first branch across the supply leads 15.

Control voltage for causing operation of the motor 7 is derived from the bridge circuit at terminals indicated at 19, and in the present example, is applied to the motor 7 through a suitable amplifier indicated by the block diagram 21. The motor shown is a quarter-phase motor which receives operating current from the amplifier 21 on one phase through leads indicated at 22 and directly from the alternating current supply circuit 15 through leads indicated at 23. The amplifier 21 serves to provide a potential on the leads 22 corresponding in value to the potential supplied from the line through the leads 23 when the unbalanced voltage of the bridge network is of any appreciable or relatively low value.

The invention is not limited to the use of a quarter-phase motor and an amplifier for shift-

ing the phase of the control voltage 90° as shown.

It will be seen from an inspection of the control circuit, that if the resistors 13 and 14 in the two branches of the bridge circuit are substantially equal in resistance value and the variable resistor 12 is variable over a resistance variation range including the resistance values of the key or plug units 18, the tuning motor will operate to change the adjustment of the tuning of the system 5 until the arm 10 is moved to a point to establish a corresponding resistance in the element 12. Thus, by inserting plugs or keys containing resistance elements of differing values in the circuit 16, the radio tuning system may be moved to predetermined positions of adjustment corresponding to desired frequencies or signals, such as predetermined broadcast stations. For this reason, the system may be provided with a plurality of keys or plugs having resistances preset for differing broadcasting stations and may be marked for such stations, as indicated on the lower plug 18 in Fig. 1.

The keys may be of any suitable form for convenient insertion in circuit and preferably may include a simple core wire 20 surrounded by an insulating sleeve 33 on which is wound the resistance winding 17 in any suitable manner, and the whole may be enclosed in the casing indicated by the numeral 18, of cup-like construction with the lower end closed by a ferrule 34 surrounding the projecting end of the insulating sleeve 33, as shown. The ferrule is preferably of metallic material to which one end of the winding 17 may be connected, while the opposite lead of the winding is connected to the core wire 20.

By providing a metallic mounting plate or member, a portion of which is indicated at 24, with spaced openings, the plugs 18 may be inserted therein to a firmly seated position as shown, with the ferrules in contact with the plate 24 as a common connection for the resistance elements, while the core wire terminals 20 project inwardly for connection with suitable means for selectively actuating the control system through them.

In the present example, the terminals 20 are arranged to be engaged successively in a spiral row by a time-controlled contact arm indicated at 25, mounted on a suitable driving shaft 26 contained in a clock mechanism 27 and actuated by the clock mechanism, the dial of which is indicated at 28.

The clock mechanism is surrounded by a metallic cylinder, the cross section of which is indicated by the member 24 in Fig. 1, and contains a spiral row of openings 29 of fourteen turns, one turn for each twelve hours, thereby providing for setting up radio programs for one week. Each spiral turn has forty-eight openings, one for each predetermined period of time such as fifteen, twenty or thirty minute periods, the openings being adapted for receiving the ferrule ends of the plug or key devices, two of which are shown inserted in the device at 30 and 31 of Fig. 2.

It will be noted that the device 27 may be a remote control unit and connected through the leads 16 with the remainder of the receiving and control system. The leads 16 may be included in a cable as indicated by the circles surrounding said leads in Fig. 1 and as indicated at 32 in Fig. 2. Since the cable includes two low-voltage leads operating at substantially 18 volts, for example, and merely carries the bleeder current of the bridge, the leads may be of relatively small size, whereby the cable may be made substantially flat for flexibility and convenience in use.

With the single resistor type of control in a balanced potentiometer network or bridge as shown, it will be seen that it is necessary to extend to the resistor 12 only a single lead with a ground return connection, and this is also true of the selector plug connections when they are included on the same grounded chassis with the remainder of the control circuit.

The operation of the system is greatly simplified in that the plug or key elements are inserted in the proper openings for the desired time of operation of the receiver for the broadcasting station indicated on the key, and the set-up of the keys may be changed at any time by removing the keys set up and inserting other keys as desired, in the proper openings in the cylinder.

The key or plug elements may be utilized also in a remote tuning unit for push-button preselection tuning, as shown for example in the circuit of Fig. 3, wherein the same reference numerals are applied to like parts throughout. The circuit is essentially the same as that of Fig. 1 and utilizes the same motor control system including the resistor 12 and the amplifier 21 for the motor and tuning system of Fig. 1.

The resistor 12 in the present modification is connected as a potentiometer across the supply lead 15, and the grounded contact arm 10 is connected to one side of the amplifier 21 through ground 35. The potentiometer resistor 12 thus provides one arm of a balanced bridge network, the other arm of which is provided by the resistances in the various tuning preselection plugs indicated at 36, 37 and 38.

In the present example, it will be noted that the resistance elements 39 in the key or plug units are provided with fixed taps 40 connected with outer metallic sleeve members 41, while the terminals of the resistance element are connected with the core wires 42 and intermediate insulated metallic sleeves 43 surrounding the insulating tube 44. The body of the keys or plugs may be of metal or molded insulating material. As in the previous example, the key or plug elements are adapted to be seated in openings in a metallic connector plate 45 in a remote control unit 46.

The individual resistors 39 are connected in parallel with the supply leads 15 and the potentiometer 12 through circuits comprising a pair of remote control extension leads indicated at 47, individual selector or push-button switches 48, and fixed spring-contact members 49 for engaging the core wire tip 42 and the sleeve 43 of the various plug or key elements, as shown. The common terminal connection 45 for the key elements is connected through a lead 50 with one input lead of the amplifier 21, whereby the unbalanced voltage between the arm 10 and the taps 40 in the various key units is applied to the amplifier and causes the motor to operate until the balance is restored by movement of the arm 10 to the balance point. In this manner, the receiving system is tuned to differing signals in response to operation of the control switches or push buttons 48, the station or signal selected by each button being determined by the position of the tap 40 on the resistance element in the corresponding selected plug or key. This is predetermined for each desired signal or

broadcasting channel and the keys are properly designated, as shown, for the particular channel or station to be received. With this arrangement, the plug or key elements are readily interchangeable for setting up differing groups of preselected signals or broadcasting stations to be received. It is obvious that time-control selector means may be substituted for the push-button manual selector means shown in Fig. 3, for example, in accordance with the arrangement of Figs. 1 and 2.

It will be noted that the leads **47** and **50** are included in a cable for extension between the remote control position **46** and the controlled receiving system.

I claim as my invention:

1. In a radio tuning control system, the combination with a tuning motor and a control circuit responsive to impedance change therein for operating and stopping said motor, of a plurality of tuning keys each comprising a plug-like member containing a pre-adjusted impedance element for changing the impedance of said circuit each to a predetermined degree effective to provide predetermined tuning operation and stopping of said motor corresponding to the number of keys, means providing plug-in terminal contacts for said control elements, means providing plug-in electrical connections for said circuit with said terminal contacts, and means for selectively completing said connections with said control circuit, said last named means including a timing mechanism whereby said connections are established in a predetermined time sequence.

2. In a radio tuning control system, the combination with a motor control circuit including a bridge network, of a potentiometer device in said network variable in response to tuning movement to balance said network, a fixed resistor in series therewith in said network, a second fixed resistor in said network, a series of key plugs each including a preadjusted resistance element, means for mounting said plugs in predetermined relation to each other, and means for selectively connecting said resistance elements in circuit to complete and unbalance said bridge network in a predetermined degree.

3. In a motor-driven electric tuning control system for radio receiving apparatus and the like, the combination with a tuning motor, of a balanced potentiometer bridge control circuit therefor including a balancing potentiometer device adjustable in response to tuning movement, means for effecting a predetermined unbalance and tuning movement in said system to a plurality of differing tuning positions comprising a plurality of plug-in resistor elements selectively connectible in circuit with said potentiometer device, the resistance of said elements differing one from another to adjust said system to establish said differing positions of tuning adjustment.

4. In a radio tuning control system, the combination with electric motor means, a tuning control shaft driven thereby and a resistor device variable in response to tuning control movement of said shaft, of a bridge network including said resistor, a control circuit for said tuning control system connected in said network, a plurality of electric tuning keys each including a resistance element of predetermined value, means providing a plug-in circuit connection for said keys whereby said keys may be inserted in and removed from the control system, means for selectively connecting said keys with said control circuit whereby said keys may selectively be included in said network when plugged in, and means for applying an operating current to said motor means through said network, whereby said key elements effect selective predetermined adjustment of said network and tuning movement of said tuning control shaft.

5. In a radio tuning control system, the combination with reversible electric motor means, a tuning control shaft driven thereby and a potentiometer device adjustable in response to tuning control movement of said shaft, of a series of preadjusted additional potentiometer devices each including a resistor provided with plug-in contact elements, means providing a releasable plug-in connection for each of said additional potentiometer devices, means for selectively connecting said last-named potentiometer devices selectively in parallel relation with said first-named potentiometer device to provide a bridge network adapted to be balanced by operation of the first-named potentiometer device in response to tuning control movement of said shaft, and means for applying an operating current to said motor means through said bridge network to effect tuning movement of said control shaft to predetermined selective positions corresponding to predetermined adjustments of said last-named potentiometer devices.

CHARLES J. YOUNG.