April 3, 1934. D. SATINOFF ET AL 1,953,435

RADIO DEVICE FOR OPERATING RADIO RECEIVING SETS

Filed Nov. 12, 1930 2 Sheets-Sheet 1

Fig. 1.

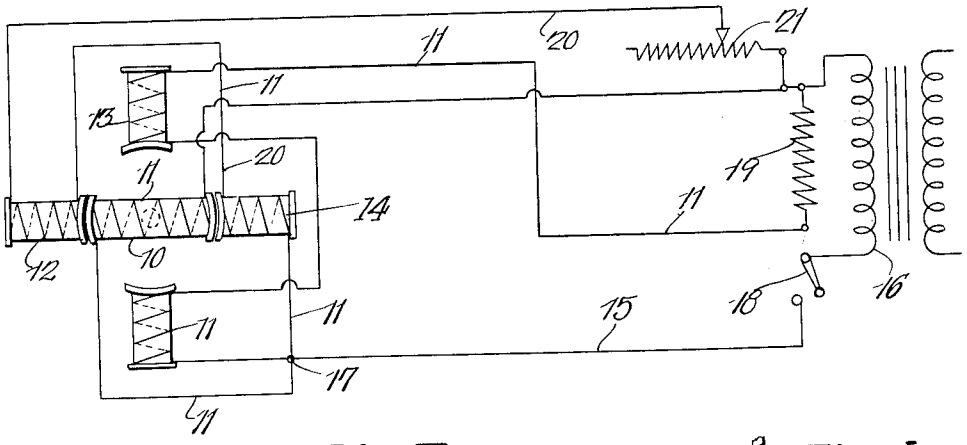


Fig. 2.

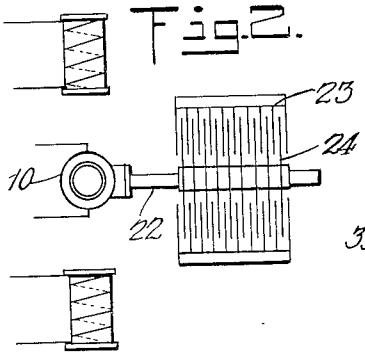


Fig. 4.

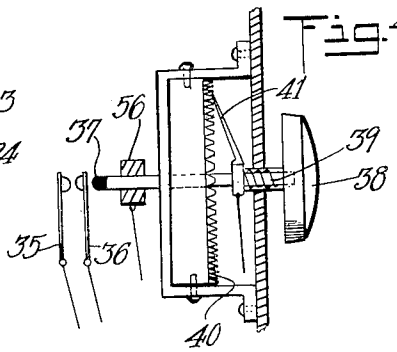
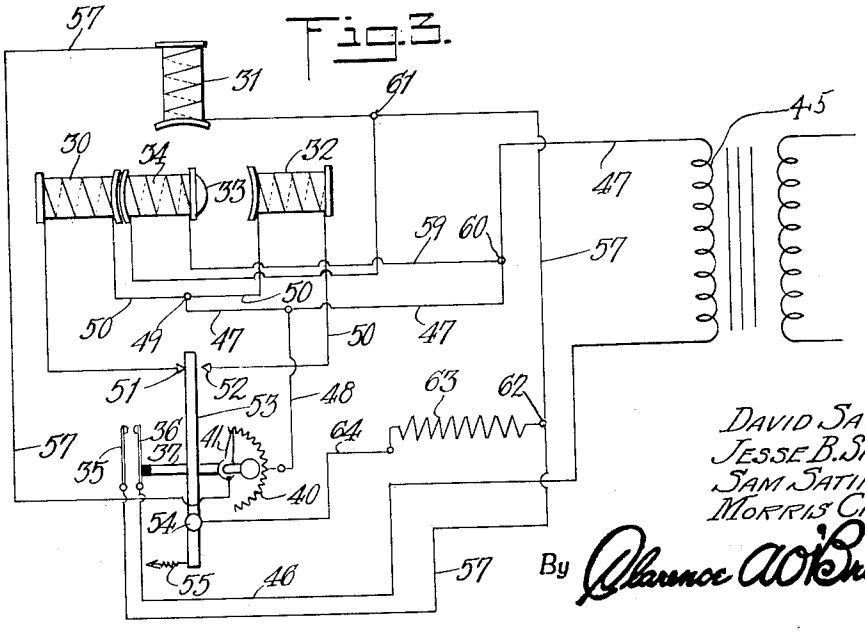


Fig. 3.



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Filed Nov. 12, 1930 2 Sheets-Sheet 2

Fig. 5

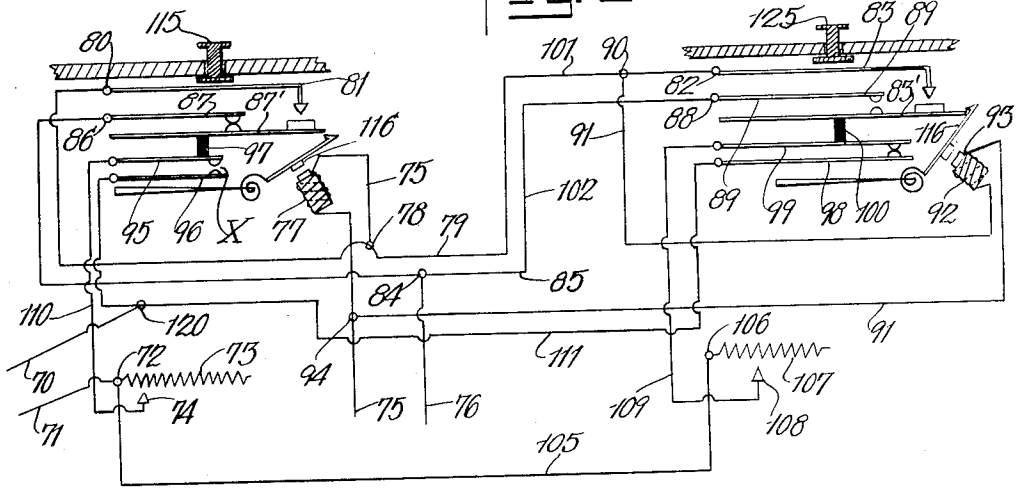
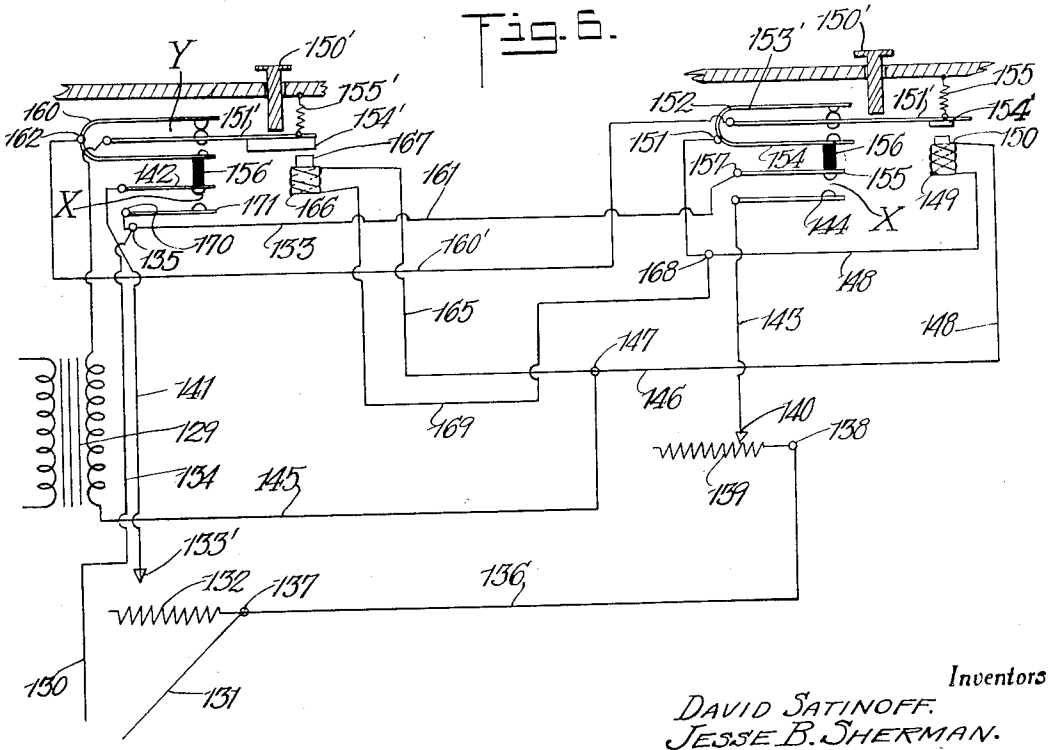


Fig. 6.



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RADIO DEVICE FOR OPERATING RADIO RECEIVING SETS

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Application November 12, 1930, Serial No. 495,220

12 Claims. (Cl. 250—40)

The present invention relates to improvements in controlling devices for radio apparatus and more particularly it pertains to a new and improved remote controlling means therefor.

In a prior application filed by us October 16, 1930, Serial Number 489,200, we show a tuning instrument, in this case, a variable condenser which is operated in one direction of movement through its tuning range by mechanical means such as a spring.

Such devices as disclosed in this prior application, require that the electrical means be maintained energized in order to maintain the tuning instrument in its adjusted position since as soon as the electrical means is de-energized, the tuning instrument is returned to its starting or zero position. Also in this type of device, fluctuations of current in the circuit of the electrical means are liable to vary the adjustment of the tuning instrument thereby throwing the radio apparatus out of tune.

It is the object of the present invention to improve the construction and method of operation of remote control devices for radio apparatus.

A feature of the invention resides in the provision of means whereby a plurality of remote control units may be employed in such a manner that only one of said units is capable of operation at a time.

A further feature of the invention resides in the provision of novel means whereby a variable tuning instrument may be operated in both directions electrically throughout its entire tuning range.

A further feature of the invention resides in the provision of novel means whereby the electrical operating means of a variable tuning instrument may be de-energized after the instrument has been adjusted without affecting the adjustment of the instrument.

A further feature of the invention resides in the provision of electrical operating means for a tuning instrument of the variable multiple plate condenser type, which is capable of use in connection with variable tuning instruments in which the movable element thereof moves through either ninety degrees, (90°), or one hundred eighty degrees, (180°), as its tuning range.

Other features of the invention relates to certain novel and improved constructions, arrangements and combinations of parts hereinafter described and particularly pointed out in the claims, the advantages of which will be readily understood and appreciated by those skilled in the art.

The invention will be clearly understood from the accompanying drawings illustrating the invention in its preferred forms, and the following detailed description of the constructions therein shown.

Figure 1 is a diagrammatic view illustrating one form of the present invention in which the movable element of a variable radio control instrument such as a variable condenser, rheostat, switch, potentiometer or the like is moved through a ninety degree, (90°) tuning range,

Figure 2 is a diagrammatic view illustrating the manner in which the device of Figure 1 is attached to an instrument of a radio receiving apparatus,

Figure 3 is a diagrammatic view of a modified form of the invention illustrating the invention applied to a radio instrument in which the movable element is movable through a tuning range of one hundred eighty degrees, (180°),

Figure 4 is a detail view illustrating a switch or rheostat for use in connection with the device of the present invention,

Figure 5 is a diagrammatic view illustrating the invention applied to the volume control of a radio receiving set or other radio apparatus, and;

Figure 6 is a diagrammatic view illustrating a modified form of the invention as illustrated in Figure 5.

Referring to Figures 1 and 2 of the drawings, the reference character 10 designates an armature, which is electrically wound and included in a circuit designated 11 in said figure. The armature is adapted for operation by means of a plurality of coils forming electro-magnets 11', 12, 13 and 14, these coils being arranged in circuits in pairs with the coils 11 and 13 in one circuit, and the coils 12 and 14 in a separate circuit. It will be noted by reference to said figure that the coils 12 and 14 are in the same circuit with the winding of the armature 10, which circuit is designated 11 in the drawings and that this circuit is electrically connected with a coil 16 of the induction type, through a branch 15, it being connected thereto as at 17. Also mounted in this circuit there is a switch 18 by which the circuit may be opened and closed, and the coils 11', 12, 13 and 14, and the winding of the armature 10 will be de-energized when the switch is opened. This circuit 11 has a suitable resistance 19 mounted therein.

The coils 12 and 14 are in a circuit designated 20, and said circuit is connected at the point 17 heretofore mentioned with the branch 15. This circuit 20 includes a rheostat 21 by means of which the potential of the circuit may be controlled,

By reference to Figure 2, it will be noted that the armature 10 is mounted on a shaft 22, and this shaft carries the movable element of a variable electrical instrument herein illustrated as a variable condenser 23. The movable plates 24 of the variable condenser are mounted upon the shaft 22, and thus as the armature is rotated by the electro-magnets formed by the coils 11', 12, 13 and 14, the plates of the variable condenser will be moved between the stationary plates thereof to give the proper adjustment to the instrument.

In this form of the invention, the operation is as follows:—

When the switch 18 is closed, the several electro-magnets 11', 12, 13 and 14 and armature 10 will be energized. It will be understood that the magnets 11' and 13 are of fixed value, and tend to hold the armature 10 in alignment with the lines of magnetic force thereof which position is approximately ninety degrees, (90°) with respect to that position in which the armature is shown in Figure 1. If, now, the rheostat 21 be moved to cut out a portion of the resistance of this circuit thereof, the electro-magnets 12 and 14 will be increased in value, and will tend to attract the armature 10 to a position where its longitudinal axis lines up with the lines of force of the electro-magnets 12 and 14, and as the resistance is further cut out, and as the magnetism of the coils 12 and 14 increases, the armature 10 will be moved to the position in which it is illustrated in Figure 1, thus moving the movable member 24 of the variable instrument through its entire tuning range of ninety degrees, (90°). Armature 10 may be held in any position throughout ninety degrees, (90°) range depending on relative magnetic field intensities of 11', 13 and 12, 14 as adjustable by variation of field 12, 14 by rheostat 21. Immediately the rheostat 21 is again adjusted so that the resistance thereof is introduced into the circuit 20, the magnetic force of the electromagnets 12 and 14 is reduced, and the fixed electro-magnets 11' and 13 attract the armature 10 and tend to move the same to a position where its longitudinal axis is in alignment with the lines of magnetic force of the electro-magnets 11' and 13.

Thus it will be seen that by movement of the rheostat 21, the electro-magnets 12 and 14 will be variably energized to set up a rotation of the armature 10 and thereby provide for adjustment of the movable elements of a variable type instrument in connection with a radio apparatus.

In Figure 4, there is shown one type of rheostat which may be used in connection with the present invention, but this type of rheostat is particularly adapted for use in connection with that form of the invention illustrated in Figure 3, and will be hereinafter specifically described.

In Figure 3, there is illustrated a form of the invention in which the movable elements of a variable electrical instrument may be moved through a tuning range of one hundred eighty degrees, (180°) and in this form of the invention, there are three coils 30, 31 and 32 which form electro-magnets for successively operating upon an armature 34 which in itself is in the form of an electro-magnet, and is suitably mounted as at 33 upon a shaft such as 22 in the heretofore described form of the invention.

The switch or rheostat illustrated in Figure 4, is employed in this form of the invention, and its stem member 37 operates to cause engagement of two contact members 35 and 36 when the operating knob 38 is pressed inwardly against the action of a spring 39 which normally holds said knob extended, and leaves the contact members 35 and 36 out of engagement with each other. The resistance element of this switch is designated 40, and the operating knob 38 and the stem 37 together carry a contact member 41 which engages permanently with said resistance to vary the value of the current flowing therethrough.

The source of current which is a transformer 45 is connected to the contact member 36 by means of a suitable conductor 46, and the opposite end of said transformer coil 45 is connected by means of a conductor 47 and branch conductor 48 with the resistance element 40 of the rheostat. The conductor 47 is connected at 49 to a conductor 50 one length of which extends around the coil 30 and forms the winding thereof and terminates in a switch point 51, while the other leg of the conductor 50 extends around the coil 32 forming the winding thereof and terminates in a switch point 52. Adapted to be contacted with the switch points 51 and 52, there is a swinging switch arm 53, which is arranged to rock about a pivotal point such for example as that indicated at 54 against the action in one direction of a coil spring 55, the arm 53 being moved by means of a cam member 56 mounted on the stem 37 of the rheostat in a manner to be hereinafter described.

The electromagnet 31 is in a circuit designated 57 and said circuit extends from the resilient member 41 of the rheostat through the electromagnet 31, to the contact member 35. The armature 34 is in a circuit designated 59, and one leg of this circuit is connected as indicated at 60 to the conductor 47, and the other leg of the circuit is connected as indicated at 61 to the conductor 57. Connected as indicated at 62 to the conductor 57 is a suitable resistance 63, and the other end of this resistance is connected by means of a conductor 64 to the pivoted switch arm 53 heretofore mentioned.

This form of the invention operates in the following manner.

With the parts in the positions shown in Figure 3, the electromagnet 30 and the armature 34 will be energized and the magnetic force of the electromagnet 30 and that of the armature 34 will combine to maintain the armature 34 in the position in which it is shown in the drawings. To rotate the armature, the operating knob 38 is grasped and depressed until the contact members 35 and 36 are caused to engage each other which engagement closes a circuit through the electromagnets 30, 31 and the armature 34, the circuit through the electromagnet 32 being left open. By rotating the operating member 38, resistance is gradually introduced into the circuit of the electromagnet 30, and as this resistance increases, the magnetic force in electro-magnet 30 is decreased and that in electro-magnet 31 increased so that the armature tends to move under the influence of the magnetic force of the electromagnet 31 away from electro-magnet 30 toward a position where its longitudinal axis will aline with the longitudinal axis of the electro-magnet 31. Armature 34 can be held at any point between complete alignment with 30 and complete alignment with 31, and at points between 31 and 32. As the armature reaches the position in which its longitudinal axis is in alignment with

the longitudinal axis of the electro-magnet 31, the coil 30 is entirely cut out by engagement of the cam 56 with the rocking switch arm 53 which moves the arm 53 out of engagement with the point 51 and into engagement with the switch point 52. This action takes place at the central point of the rheostat resistance, which is electrically the zero point, and the engagement of the arm 53 with the contact 52 energizes the magnet 32, the magnet 31 and the armature also being energized and the magnet 30 deenergized. Upon further movement of the member 41 of the rheostat, resistance is introduced into the circuit of the magnet 31, so that the armature 34 moves toward the magnet 32 and finally into a position just opposite to that in which it is shown in the drawings. If at any time the rheostat knob be released, the contact members 35 and 36 separate as illustrated in the drawings, thereby deenergizing all of the magnets and the armature so that the armature will remain in the position to which it was rotated.

Thus it will be seen that this form of the invention provides for the operation of the rotatable elements of a variable electrical instrument through an arc of one hundred eighty degree, (180°) tuning range as distinguished from that form of the invention illustrated in Figure 1, in which the tuning range is limited to ninety degrees, (90°).

Figures 5 and 6 of the drawings, illustrate two forms of remote control for radio apparatus, and it is to be understood that while these forms of the invention are herein illustrated as employed in connection with the volume control circuit of a radio receiving apparatus, it is to be understood that they are capable of use in otner connections, and may be if desired employed to operate or control the operation of other instruments such for example as those mentioned in connection with the forms of the invention illustrated in Figures 1 to 4 inclusive.

In Figure 5 of the drawings, the conductors 70 and 71 represent the volume control circuit of a radio receiving apparatus, and by reference to said figure it will be noted that the conductor 71 is connected as at 72 to the resistance element 73 of a rheostat, the contact arm of said rheostat being designated 74. The conductors 75 and 76 are connected with a suitable source of power not shown. The conductor 75 extends around a coil 77 and forms an electro-magnet, said conductor 75 being connected as at 78 to a conductor 79. One leg of this conductor 79 is connected as at 80 to a contact member 81, and the other leg of the conductor is connected as at 82 to a contact member 83. The conductor 76 of the input is connected as at 84 to a conductor 85, and this conductor 85 is connected as at 86 to a contact member 87, and as at 88 to a contact member 89. Leading from the conductor 79 and connected thereto as at 90, there is a conductor 91 which forms a coil 92 for an electro-magnet 93, and this conductor 91 is connected as at 94 to the conductor 75.

The reference characters 95 and 96 designate two contact members, and the contact member 95 is connected with the contact member 87' heretofore mentioned by means of a suitable block or the like of insulating material 97, it being understood that the connection between these two contact members 95 and 87' is of the non-electrical type. The reference characters 98 and 99 designate two contact members, and the contact member 99 is connected with a contact member 83' by means of a suitable block of insulating material 100, it being understood that the connection between these two contact members 99 and 83' is of the non-electrical type. The contact member 81 heretofore mentioned is connected with the contact member 83 by a conductor 101 and the contact member 87 heretofore mentioned is connected with the contact member 89 by means of a conductor 102. Leading from the resistance element 73 of the rheostat heretofore mentioned, there is a conductor 105, and said conductor 105 is connected as at 106 to the resistance element 107 of a second rheostat, the contact arm of which is designated 108. The contact arm 108 is connected by means of a conductor 109 with the contact member 99. The contact arm 74 of the first mentioned rheostat, is connected with the contact member 95 by a conductor 110, and the contact member 96 is connected with the contact member 98 by means of a conductor 111.

From the foregoing description it will be apparent that Figure 5 illustrates two separate and independent remote control devices, and that the volume control of a radio receiving set or other radio apparatus may be controlled by either of these devices.

The operation of these two devices will now be described, and after describing the operation thereof, it will be apparent that while but two of these remote control devices have been herein illustrated, the device is capable of use with any number of such devices.

With the several parts in their position illustrated in Figure 5 it will be noted that the circuit controlling the volume of the radio receiving apparatus and designated by the conductors 70 and 71, is open at the point designated X in Figure 5.

To close this circuit at X and assume control thereof at the remote control station at the left of Figure 5, a button or similar device such as 115 is depressed. As this member 115 is depressed, it engages the contact member 81 which in turn engages the contact member 87' and moves it downwardly. As the contact member 81 engages the contact member 87', an electrical circuit is established through the electro-magnets 77 and 92, energizing them, and attracting their respective catches 116. This releases the contacts held by a previously set catch 116, for example contacts 83' and 99 at the right of Figure 5. This operation breaks the circuit between the contacts 98 and 99, at which time the volume control circuit 70 and 71 is open. Upon further depression of the contact member 87' the circuit of the electro-magnets 77 and 92 is broken to de-energize said magnets and release their respective catches 116, and the circuit is completed at X between the contact members 95 and 96, and the several parts are maintained in this position by reason of engagement of the spring catch 116 with the contact member 87'. Movement of the contact arm 74 of the rheostat illustrated at the left hand side of Figure 5 will now control the volume circuit of the conductors 70 and 71 since the circuit will be for example through the conductor 71, resistance element 73 of the rheostat, spring arm 74 of the rheostat, conductor 110, contact members 95 and 96, and conductor 70 which is connected to the conductor 111 as at 120.

The parts in this position give an operator at the rheostat at the left hand of Figure 5 complete control over the volume controlling circuit of the radio receiving set.

In Figure 6 of the drawings we have shown a slightly modified form of the invention, and in this form of the device, the source of current is a transformer designated 129. The reference characters 130 and 131 designate the volume control circuit of a radio receiving set, and the reference character 132 designates the resistance element of a rheostat, the movable member or arm thereof being designated 133'. The conductor 130 is connected to a conductor 133 by means of a conductor 134, the point of connection being designated 135. The conductor 131 is connected to a conductor 136 as at 137, and this conductor 136 is connected as at 138 to the resistance element 139 of a rheostat, the movable member of which is designated 140. A conductor 141 connects the movable member 133' of the first mentioned rheostat with a contact member 142 and the movable member 140 of the second mentioned rheostat is connected by means of a conductor 143 with a contact member 144. The transformer is connected by means of a conductor 145 with a conductor 146 as at 147, and the leg 148 of the conductor 146 forms a coil 149 which provides an electro-magnet 150. The conductor 148 is connected as at 151 to a U-shaped contact member 152. This U-shaped contact member 152 has two legs 153' and 154, and the leg 154 is connected with a contact member 155 by means of a block of insulating material 156. The contact member 155 is connected as at 157 to a conductor 161.

Connecting a contact member 151 with a U-shaped contact member 160, there is a conductor 160', this conductor being connected to the contact 160 as at 162. The other leg 165 of the conductor 146 passes around and forms a coil 166 to provide an electro-magnet 167, and said conductor is extended as at 169 and connected as at 168 to the conductor 148. The conductor 133 heretofore mentioned is connected as at 170 to a contact member 171.

In this form of the invention there are illustrated two remote control stations, and each remote control station employs a manually operated button 150'. These buttons 150' are adapted to engage these respective contact members 151' mounted between the legs of the U-shaped contact members and each of the contact members 151' is provided with an armature 154' for its respective electro-magnets, and each contact member is held in its upward position by means of a spring 155'.

This device operates in the following manner:—

With the parts in the position shown in Figure 6, the volume control circuit designated by the reference characters 130 and 131 is open at both points X in the remote control stations. In this position, both electro-magnets 150 and 167 are energized, but their strength, although sufficient to hold their respective armatures when engaged with the coil, is not strong enough to attract their armature when out of contact therewith. Upon depressing the button 150' of the remote control station at the left of Figure 6, the contact arm 151' is depressed and the circuit of the electro-magnets 150 and 167 is broken at the point Y. A circuit including the contact member 151' is, however, completed by engagement of the contact member 151' with the lower leg of the U-shaped contact, and this circuit includes the conductor 145, conductor 165, coil 166 of electro-magnet 167, conductor 169, U-shaped contact member 152, contact member 151' and the electrical conductor 160' which connects the two U-shaped contact members 152 and 160. This circuit energizes the electro-magnets 150 and 167 and the armature 154' is engaged with electro-magnet 167 which holds the contact member 151' depressed. Depression of the contact member 151' also depresses the contact member 142, and causes a completion of a circuit at the point X, which circuit includes the conductor 141, contact member 142, and the movable member 133' of the rheostat at the left hand of Figure 6, contact member 171, conductor 134, and conductor 130. Thus by movement of the movable member 133' of the rheostat at the left of Figure 6, there will be established a control of the volume control circuit designated by the reference characters 130 and 131.

Assuming now that the operator of the volume control station at the left of Figure 6, leaves the volume control station, and it is desired to operate the volume control circuit of the conductors 130 and 131 from the remote control station at the right of Figure 6. Upon the depression of the button 150' of this station, the contact member 151' is depressed which breaks the circuit of the coils 150 and 167, and de-energizes the electro-magnets provided thereby. Thereupon the contact member 151' of the control station at the left of Figure 6 moves to the position in which it is shown, and the contact member 151' at the control station at the right of said Figure 6, is held depressed by re-energization of the electro-magnet 150. Depression of the contact member 151' establishes a circuit between the contact members 144 and 155, and between contact members 151' and 154. The contact between the members 144 and 155 gives the operator at this remote control station control of the volume control circuit in the conductors 130 and 131 through the medium of the rheostat shown at the right of Figure 6, and it will be apparent that by movement of the movable member 140 of said rheostat, the volume of the volume control circuit of the radio receiver may be controlled.

From the foregoing, it will be apparent that the present invention provides a new and novel means of operation and control of radio apparatus, and while the invention has been herein illustrated and described in connection with a radio receiving set, and a variable instrument has been herein illustrated as of the variable condenser type, it is to be understood that the invention is applicable to other forms of radio apparatus, and that it is not limited to the specific instrument shown and may be capable of use in connection with any type of instrument employing a movable part.

Having thus described the invention, what we claim as new and desire to secure by Letters-Patent of the United States, is:

1. A remote controlled tuning device for a rotatable tuning element of a radio apparatus, said tuning device comprising an armature comprising an electro-magnet projecting axially from one side of the rotatable tuning element, a plurality of circumferentially spaced, radially arranged electro-magnets with which the radially outward end of the armature is arranged to cooperate in magnetic relation, two of the electro-magnets being diametrically aligned, a connection between one end of the windings of the diametrically aligned electro-magnets, a source of electrical energy having one side connected to said connection, variable resistance switch means interpolated between and connected to said remaining ends and the remaining side of the source of electrical energy and to the remain-

ing electro-magnet, a pair of normally disengaged contact members in the switch means, one of the contact members having connected thereto one end of the winding of the said remaining electro-magnet, the other contact member being connected to the said remaining side of the source of electrical energy, said switch means being arranged to be operated to close said contact members to selectively energize certain of the electro-magnets, and permit simultaneously reducing the relative magnet effect of adjoining electro-magnets for rotating the armature, said armature being directly in circuit with said other electro-magnets and the source of electrical energy.

2. A remote control device for a rotatable radio apparatus tuning element, said device comprising an armature in the form of an electro-magnet having its axis extending radially from one side of the rotatable tuning element, a plurality of radially arranged circumferentially spaced electro-magnets surrounding the axis of the tuning element and in magnetic relation to the armature, said armature and at least two adjoining electro-magnets being arranged to be simultaneously and selectively energized to different degrees for turning the armature away from one of them and toward the other, means for effecting selective energization of the plurality of electro-magnets and of the armature, said means comprising a source of electrical energy, variable resistance switch means, said variable resistance switch means comprising connecting means for selectively connecting the electro-magnets and armature for energization, variable resistance means arranged to be connected with one of any two adjoining energized electro-magnets for diminishing the supply of energy thereto so as to diminish the magnetic force thereof and cause movement of the armature toward the other electro-magnet, said variable resistance means and selective connecting means being simultaneously operable.

3. In a device for rotating a tuning shaft, a plurality of electro-magnets arranged in circumferentially spaced manner around the shaft, an armature on the shaft in the form of an electro-magnetic arm extending radially from one side of the shaft in magnetic relation to the plurality of electromagnets, a source of electrical energy, connections between the plurality of electro-magnets and the armature and between the plurality of electro-magnets and the armature and the source of electrical energy, switch means interpolated between the source of electrical energy and the plurality of electro-magnets and the armature, selective switch means interpolated between the first switch means and two of the plurality of electro-magnets for selectively determining which of them shall be energized at one time, rheostat means interpolated between the selective switch means and said two electro-magnets and other adjacent ones of the plurality of electro-magnets for relatively increasing the energization of adjacent ones of said plurality of electro-magnets, for exerting a turning effect upon the armature, and manual means for simultaneously coordinating and regulating the action of the first switch means, the selective switch means, and the rheostat means for controlling the rotation of the tuning shaft.

4. In a device for rotating a tuning shaft including a plurality of spaced electro-magnets arranged around the axis of the shaft, an electro-magnetic armature on the shaft and arranged to be in magnetic relationship to only some of the plurality of electro-magnets at one time, and a source of electrical energy; selective switch means interpolated between the source of electrical energy and the magnets for selectively energizing adjacent magnets while maintaining the armature energized, and rheostat means interpolated between the selective switch means and the magnets for changing the relative degree of energization of energized adjacent magnets for exerting a turning effect on the armature.

5. In a device for rotating a tuning shaft including a plurality of spaced electro-magnets arranged around the axis of the shaft, an electro-magnetic armature on the shaft and arranged to be in magnetic relationship to only some of the plurality of electro-magnets at one time, and a source of electrical energy; selective switch means interpolated between the source of electrical energy and the magnets for selectively energizing adjacent magnets while maintaining the armature energized, and rheostat means interpolated between the selective switch means and the magnets for changing the relative degree of energization of energized adjacent magnets for exerting a turning effect on the armature, said selective switch means and rheostat means being simultaneously operable.

6. In a device for rotating a tuning shaft including a plurality of spaced electro-magnets arranged around the axis of the shaft, an electro-magnetic armature on the shaft and arranged to be in magnetic relationship to only some of the plurality of electro-magnets at one time, and a source of electrical energy; selective switch means interpolated between the source of electrical energy and the magnets for selectively energizing adjacent magnets while maintaining the armature energized, and rheostat means interpolated between the selective switch means and the magnets for changing the relative degree of energization of energized adjacent magnets for exerting a turning effect an the armature, and operating means for coordinating and operating the selective switch means and rheostat means for controllably rotating the tuning shaft.

7. In a device for rotating a tuning shaft, a pair of opposed electro-magnets located at opposite sides of the shaft, a third electro-magnet located at another side of the shaft, an armature on the shaft in the form of an electro-magnet extending from one side of the shaft and arranged to be in magnetic relationship to the pair of opposed and the third magnets, a source of electrical energy connected to the magnets and to the armature, selective switch means interpolated between the source of electrical energy and the magnets for selectively energizing at one time one of the opposed magnets and the third magnet, and rheostat means interpolated between the selective switch means and the opposed magnets and the third magnet for changing the relative degree of energization of one of the opposed magnets and of the third magnet for exerting a turning effect upon the armature.

8. In a device for rotating a tuning shaft, a pair of opposed electro-magnets located at opposite sides of the shaft, a third electro-magnet located at another side of the shaft, an armature on the shaft in the form of an electro-magnet extending from one side of the shaft and arranged to be in magnetic relationship to the pair of opposed and the third magnets, a source of electrical energy connected to the magnets

and to the armature, selective switch means interpolated between the source of electrical energy and the magnets for selectively energizing at one time one of the opposed magnets and the third magnet, and rheostat means interpolated between the selective switch means and the opposed magnets and the third magnet for changing the relative degree of energization of one of the opposed magnets and of the third magnet for exerting a turning effect upon the armature, said armature being constantly energized during energization of any of the magnets.

9. In a device for rotating a tuning shaft, a pair of opposed electro-magnets located at opposite sides of the shaft, a third electro-magnet located at another side of the shaft, an armature on the shaft in the form of an electro-magnet extending from one side of the shaft and arranged to be in magnetic relationship to the pair of opposed and the third magnets, a source of electrical energy connected to the magnets and to the armature, selective switch means interpolated between the source of electrical energy and the magnets for selectively energizing at one time one of the opposed magnets and the third magnet, and rheostat means interpolated between the selective switch means and the opposed magnets and the third magnet for changing the relative degree of energization of one of the opposed magnets and of the third magnet for exerting a turning effect upon the armature, and master switch means interpolated between the source of electrical energy and the selective switch means.

10. In a device for rotating a tuning shaft, a pair of opposed electro-magnets located at opposite sides of the shaft, a third electro-magnet located at another side of the shaft, an armature on the shaft in the form of an electro-magnet extending from one side of the shaft and arranged to be in magnetic relationship to the pair of opposed and the third magnets, a source of electrical energy connected to the magnets and to the armature, selective switch means interpolated between the source of electrical energy and the magnets for selectively energizing at one time one of the opposed magnets and the third magnet, and rheostat means interpolated between the selective switch means and the opposed magnets and the third magnet for changing the relative degree of energization of one of the opposed magnets and of the third magnet for exerting a turning effect upon the armature, and master switch means interpolated between the source of electrical energy and the selective switch means, and manual means operatively connecting the selective switch means, rheostat means, and master switch means for coordinating and simultaneously operating the same whereby the tuning shaft may be controllably rotated and stopped.

11. In a device for rotating a tuning shaft, a pair of opposed electro-magnets located at opposite sides of the tuning shaft, a third electro-magnet located at another side of the shaft, an armature on the shaft in the form of an electro-magnet extending from one side of the shaft and arranged to be in magnetic relationship with either one of the pair of opposed electro-magnets and the third electro-magnet, a source of electrical energy connected to the magnets and to the armature, selective switch means interpolated between the source of electrical energy and the magnets, said switch means comprising a pair of separated switch points connected to different ones of the pair of magnets, a pivoted switch arm swingable into engagement with either of the switch points and connected to the source of electrical energy, a resistance interpolated between the source of electrical energy and the opposed magnets, a movable contact arm connected to the third magnet and slidable along the resistance, and manual means for coordinating and simultaneously operating the pivoted switch arm and the movable contact arm, whereby one of the opposed magnets and the third magnet may be simultaneously energized while the remaining opposed magnet is deenergized and the degree of energization of said one of the opposed magnets and of the third magnet may be changed to produce turning of the armature for rotating the tuning shaft.

12. In a device for rotating a tuning shaft, a pair of opposed electro-magnets located at opposite sides of the tuning shaft, a third electro-magnet located at another side of the shaft, an armature on the shaft in the form of an electro-magnet extending from one side of the shaft and arranged to be in magnetic relationship with either one of the pair of opposed electro-magnets and the third electro-magnet, a source of electrical energy connected to the magnets and to the armature, selective switch means interpolated between the source of electrical energy and the magnets, said switch means comprising a pair of separated switch points connected to different ones of the pair of magnets, a pivoted switch arm swingable into engagement with either of the switch points and connected to the source of electrical energy, a resistance interpolated between the source of electrical energy and the opposed magnets, a movable contact arm connected to the third magnet and slidable along the resistance, and manual means for coordinating and simultaneously operating the pivoted switch arm and the movable contact arm, whereby one of the opened magnets and the third magnet may be simultaneously energized while the remaining opposed magnet is deenergized and the degree of energization of said one of the opposed magnets and of the third magnet may be changed to produce turning of the armature for rotating the tuning shaft, said manual means being rotatable and axially movable, and master switch means interpolated between the source of electrical energy and the opposed and third magnets and the armature and operable by axial movement of the manual means while rotating the manual means for operating together the pivoted switch arm and the movable contact arm.

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