Dec. 30, 1947. M. A. WOLFF 2,433,805

CONTROL MEANS FOR SEQUENTIALLY AND SELECTIVELY ADJUSTING VARIABLE REACTANCES OVER A BAND OF FREQUENCIES

Filed Sept. 27, 1943

FIG. 1

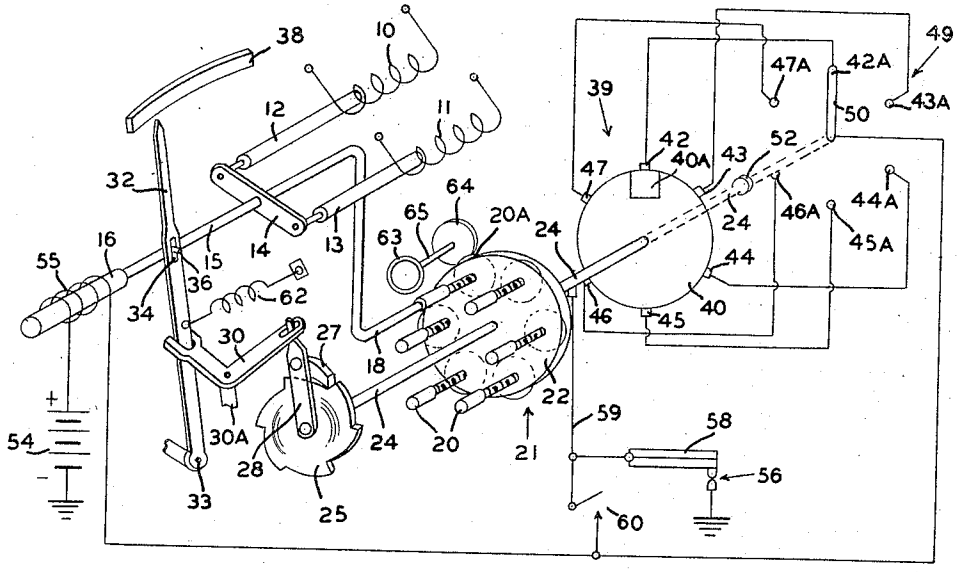


FIG. 3

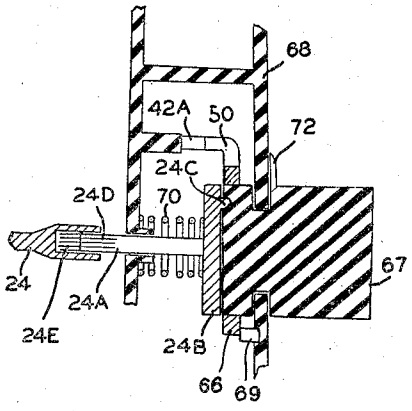


FIG. 5

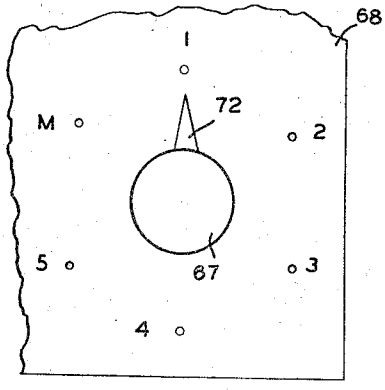


FIG. 4

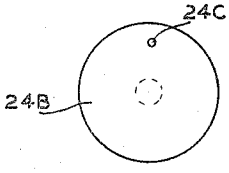
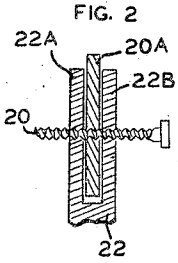


FIG. 2



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CONTROL MEANS FOR SEQUENTIALLY AND SELECTIVELY ADJUSTING VARIABLE REACTANCES OVER A BAND OF FREQUENCIES

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12 Claims. (Cl. 250—40)

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This invention relates to positioning devices and more particularly to such devices for positioning a member at one of a plurality of predetermined positions.

In radio apparatus, and in particular in a radio receiver mounted in an automobile, it is desirable to tune the radio apparatus sequentially or non-sequentially at more than one place. For example, in an automobile, it is desirable that the driver of the automobile be able to tune the radio receiver sequentially to any one station in a particular broadcast band and yet maintain his attention focused on traffic conditions, and it is also desirable that other means be provided whereby other occupants or the driver of the automobile may tune the radio receiver to any one particular preset station in a broadcast band without necessitating the sequential operation of the sequential tuning means.

Therefore, an object of my invention is to provide improved means for tuning a radio receiver sequentially to any one particular preset station in a given band of frequencies and to provide additional means whereby the radio receiver is tuned selectively to any one particular broadcast station.

Another object of my invention is to provide improved means for sequentially tuning a radio receiver to any one particular station in a broadcast band and to provide additional means for selectively tuning the radio receiver.

Yet another object of my invention is to provide means for sequentially tuning a radio receiver to particular stations in a broadcast band, additional means for selectively tuning the receiver to preset stations in a broadcast band, and means associated with the last mentioned means whereby an indication is obtained of the tuned condition of the receiver.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, 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:

Figure 1 is a schematic diagram of a circuit and certain associated parts especially suitable for use with my invention;

Figs. 2 and 3 are detailed views of certain parts of the apparatus illustrated in Fig. 1;

Fig. 4 is a detailed view of a certain part of the apparatus illustrated in Fig. 3; and

Fig. 5 is a view in elevation of some of the apparatus shown in Fig. 3.

My invention may be incorporated in a positioning device which moves a member, such as a tuning control for a radio, sequentially from one position to a subsequent position or selectively

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through several positions to one predetermined position, components of the apparatus being located at different places and having means associated therewith for rendering an indication of the position of the member.

The radio apparatus incorporating the tuning mechanism shown in Fig. 1 is of conventional type and is preferably of a type which is tuned by adjusting the position of a member of relatively high permeability in a tubular inductance coil in such a manner that the inductance of the coil depends upon the relative position of the coil and high permeability member. The tuning mechanism illustrated in Figure 1 is substantially the same as that illustrated in Figure 12 of United States patent to C. W. Wandrey, Number 2,310,720, dated February 9, 1943. As an alternative, the conventional type of radio receiver may be tuned by inserting a small cylindrical capacitance element into a cooperating tubular capacitance element in such a manner that the capacitance between the two cooperating elements depends upon the relative position of the cylindrical element and the tubular element.

In Fig. 1, the coils 10 and 11 are connected in conventional radio receiving apparatus wherein the inductance of coils 10 and 11 determine the frequency of a signal received or transmitted by the apparatus.

The inductances of coils 10 and 11, which determine the frequency of the received or transmitted signal, are varied respectively by adjusting jointly the positions of members 12 and 13, of relatively high permeability material with respect to coils 10 and 11. Only two inductance coils are shown in Fig. 1 for simplicity, but it should be understood that more than two and preferably three or four of such coils are tuned simultaneously by positioning relatively high permeability members similar to members 12 and 13 with respect to inductance coils 10 and 11 which are connected in the radio apparatus. The tuning members, or control members, such as members 12 and 13, are carried on a movable carriage 14, which is secured upon a rod 15 connected to a movable solenoid core 16. The rod 15 has its forward end 18 bent so as to cooperate with one of a plurality of stops or abutments 20 of the assembly 21; and these stops 20 are adjustably held in a turret member 22 by cooperating screw threads on stops 20 and turret member 22 (Fig. 2).

The turret member 22 is secured upon a rotatable shaft 24 which carries a ratchet wheel 25 engageable with pawl 27 so as to rotate the shaft 24 one step, or one-sixth of a revolution, for each reciprocation of the pawl 27. The pawl 27 is pivotally mounted on an arm 28 which swings about the shaft 24 and is pivotally and slidably connected to one arm of a bell crank 30, which

has its other arm pivotally and slidably connected to a lever member 32, the latter being pivoted on a fixed pivot pin 33. The lever member 32 at a point removed from its pivot pin 33 has a slot 34 accommodating a pin 36 secured upon the rod 15. The upper end of the lever 32 is preferably positioned so as to be visible and cooperates with a scale 38 having suitable graduations thereon whereby a suitable indication of the position of rod 32 and tuning members 12 and 13 is obtained.

With the apparatus thus far described in Fig. 1 it is clear that when rod 15 moves to the left in the direction of its axis, the bell crank 30 rotates behind an adjacent tooth on the ratchet wheel 25, and that, when the rod 15 returns to the right, the ratchet wheel 25 is rotated one-sixth of a revolution to a position where an adjacent stop 20 on turret 22 limits further movement of the rod 15 and inductance tuning members 12 and 13 carried thereon. The solenoid core 16 and associated rod 15 are actuated by electromagnetic means, described hereinafter.

Upon turret shaft 24 is mounted homing device 39 having a rotatable electrical contact making member 40 which rotates when and as turret shaft 24 rotates and which effects certain electrical switching. Homing device 39 has six equally spaced fixed contacts 42, 43, 44, 45, 46 and 47 arranged so that when the turret 22 is in one of its six positions corresponding to the position wherein rod 18 engages one of the stop members 20, the contact making member 40 has an insulating segment 40A engaging one of the six contacts 42 to 47 on the homing device.

Each one of the contact members 42 to 47 is connected to a respective fixed contact 42A, 43A, 44A, 45A, 46A and 47A on a selecting switch 49 having a movable contact making member 50. The contact making member 50 is arranged to engage one of the cooperating contacts 42A to 47A when the axis of rod 18 and the axis of a stop member 20 are in line. As explained hereinafter, contact making member 50 may be manually operated, whereby it engages any one of the six contacts 42A to 47A independently of the movement of turret shaft 24 which is coupled to rotatable contact making member 50 through a releasable connection 52 described hereinafter.

The rotatable contact making member 50 is electrically insulated from shaft 24 at the releasable connection 52 (Fig. 3) and is connected to the positive terminal of a voltage source 54 through an electromagnet actuating winding 55. The other terminal of voltage source 54 is connected through a ground connection to one terminal of a normally closed thermostatic switch 56 whose other terminal is connected to the thermostatic element 58 which is heated when current flows therethrough, causing the normally closed switch 56 to open. Conductor 59 and a portion of shaft 24 carrying the heating current for thermostatic element 58 serve as an electrical connection between rotatable switch member 40 and the thermostatic element 58.

A normally open switch 60, preferably of the footswitch type operable by the driver of an automobile, has one of its terminals connected to conductor 59 and the other one of its terminals to the terminal of electromagnet winding 55 and contact making member 50.

With the circuit thus far described, when switch 60 is closed, for example by the foot of the driver of an automobile, current flows from voltage source 54 through electromagnet winding 55, the switch 60, the thermostatic element 58 and switch 56 to the other terminal of voltage source 54 through a ground connection. Current flows through winding 55 for a sufficiently long period of time that rod 15 is moved to the left against the action of tension spring 62 before the current is interrupted by the opening of switch 56 by movement of thermostatic element 58.

When electromagnet winding 55 is energized, for example, by thus producing a current flow through the footswitch 60, solenoid core 16 and rod 15 are moved to the left in Fig. 1 to a position where pawl 27 is moved a distance somewhat greater than the angular distance between teeth on ratchet wheel 25. When the current flow through winding 55 is interrupted by opening footswitch 60 or the opening of contact 56, solenoid core 16, under the pull of spring 62, returns to its furthermost position to the right while pawl 27 turns the turret 22 an angular distance corresponding to the distance between adjacent stops 20.

When the turret member 22 is rotated by actuating footswitch 60, rotatable contact member 50 is rotated a corresponding amount whereby it engages a contact 42A to 47A corresponding to a contact 42 to 47 which is in engagement with the insulating segment 40A on rotatable contact member 40. That is, the position of rotatable contact member 50 is changed each time footswitch 60 is operated, and the position of rotatable element 50 serves as an indication of the position of turret 21 and the frequency of signals received or transmitted by the radio apparatus connected to inductance coils 10 and 11.

When rotatable contact member 50 is rotated manually independently of turret shaft 24 by actuating the knob shown in Fig. 3, a current from voltage source 54 flows through electromagnet winding 55, switch element 50, one of the contacts 42A to 47A, rotatable contact member 40, a portion of shaft 24, conductor 59, thermostatic element 58, and switch 56 to the other terminal of voltage source 54. The thermostatic switch 56 repeatedly breaks this circuit until insulating segment 40A is rotated by the resulting movement of electromagnet core 16 to a position where it engages that one of the contact members 42 to 47 corresponding to the one of the contact members 42A to 47A engaged by rotatable switch member 50.

In summary, when it is desired to select one of a plurality of broadcast stations determined by the relative position of a particular stop member 20 in turret member 22, the rotatable switch member 50 is rotated to a position corresponding to that particular stop member, so as to energize electromagnetic winding 55. When winding 55 is energized due to current flowing from voltage source 54, solenoid coil or rod 16 is moved to the left against the action of tension spring 62, and pin 36 on rod 15 engages lever 32 which pivots around its pivot pin 33 so as to rotate the bell crank 30 counterclockwise around its pivot member 30A. When and as bell crank 30 moves thus counterclockwise, arm 28 pivotally mounted on shaft 24 and having pivotally mounted thereon pawl 27, rotates counterclockwise about its supporting shaft 24 a distance somewhat greater than one-sixth of a revolution so as to allow pawl 27 to drop behind and engage an adjacent tooth on ratchet wheel 25. When solenoid 55 is deenergized due to the opening of switch 56 under the influence of movement of thermostatic ele-

ment 58, tension spring 62 causes clockwise movement of lever arm 47 and causes the turret 22 to be moved an angular distance corresponding to the angular distance between teeth on ratchet wheel 25, which distance corresponds to the angular distance between stops 20.

Such action continually repeats itself until ratchet wheel 25 and stops 20 together with insulating segment 40A are turned to the fixed contact connecting to that one of switches 42A to 47A which is engaged by member 50, and when insulating segment 40A is at that fixed contact on homing device 39, the circuit through the switch contacts 42A to 47A is broken, the repeated action stops, and the desired position of cores 12 and 13 is selected.

Stops 20 are adjustably mounted in turret member 22 and the relative position of each particular stop 20 in turret member 22 determines the distance tuning members 12 and 13 project respectively within inductance coils 10 and 11 after the turret member 22 is rotated around to a position where that particular stop limits movement of rod 18.

Usually, in order to tune the receiver by actuating the footswitch 60, the switch 60 is sequentially closed and opened until a particular stop 20, corresponding to a desired station, limits movement of rod 18. When the receiver is tuned by manual movement of rotatable switch 50 to one of the switch contacts 42A to 47A, for example, contact member 45A, the rotatable switch member 40 is rotated by resulting movement of core 16 until insulating segment 40A engages contact member 45 without further actuation of switch member 50.

Alternatively, when tuning the receiver by means of footswitch 60, the footswitch 60 may be depressed for a sufficiently long period of time whereby the thermostatic element 58 is heated and its resulting movement causes switch 56 to interrupt the current flow to actuating winding 55. Then, when the thermostatic element 58 cools its resulting return movement causes switch 56 to close and again reestablish a current flow through winding 58 whereby the turret member 22 is rotated another step or one-sixth of a revolution. This action continues until the footswitch 60 is allowed to open, whereupon the receiver is tuned to a station by keeping switch 60 closed for a certain time interval.

The receiver may be also tuned manually by turning tuning means 63. Tuning means 63 is arranged to adjust the position of an engaged stop member 20 in the turret member 22. For that purpose, tuning means or knob 63 is coupled to gear 64 through shaft 65. Gear 64 is arranged to engage at least one of the stop gears 20A which, as shown in Fig. 2, is threaded on stop member 20 and is confined within a hollow portion of turret member 22 between walls 22A and 22B. Conventional means, not shown, is provided to prevent rotation of stop 20 within member 22 when gear 20A is turned. When knob 63 is turned manually, the stop 20 is pushed in or out of turret member 22 in a direction depending upon direction of rotation of knob 63. Rod 18 which is pressed against stop 20 by tension spring 62 follows the movement of stop member 20. The position of rod 18, as explained previously, determines the inductance of coils 10 and 11 and hence tuning of the receiver.

In addition to serving as a manual tuning means, the knob 63 may be turned to adjust the position of the other stop members 20 in turret

22 so that the stop members 20 may be in suitable position for tuning when the footswitch 60 is closed or when one of the switches 42A to 47A is engaged by manual operation of rotatable switch contact 50.

Fig. 3 shows a practical embodiment of the releasable connection 52 in Fig. 1. The function of the apparatus shown in Fig. 3 is to cause rotatable switch member 50 to be moved synchronously with turret shaft 24 when the footswitch 60 is closed and to allow the rotatable contact member 50 to be rotated by manual operation of knob 67 independently of turret shaft 24.

In Fig. 3, rotatable contact member 50 is rigidly mounted on a metal ring 66 on insulating spindle or knob 67 which is journaled and frictionally held in the insulating stationary member 68. A brush 69 embedded in stationary support 68 serves as an electrical connection to rotatable contact 50. Rotatable contact 50 is arranged to engage successively the six contacts 42A to 47A mounted on the insulating supporting member 68. Knob or spindle 67 carrying rotatable contact member 50 is rotated when turret shaft 24 is rotated due to the fact that the rotatably mounted and longitudinally movable clutch member 24A having a splined portion 24D in constant engagement with the splined portion 24E of shaft 24 has an enlarged circular face 24B with a projection 24C thereon cooperating with a suitable recess in spindle 67. A compression spring 70 disposed between support 68 and face 24B presses projection 24C into the cooperating recess in spindle 67 whereby the spindle 67 is turned when shaft 24 is turned as by actuating the footswitch 60 in Fig. 1.

Contact member 50 can be adjusted to a position corresponding to a desired station frequency by rotation of knob 67. Upon rotation of knob 67 projection 24C, which is rounded at its tip, rides out of the cooperating recess in knob 67 because the force produced by spring 70 tending to prevent such action and to cause rotation of shafts 24 and 24A is considerably less than the resistance to rotation produced by frictional forces between the apparatus mounted on shaft 24 and its cooperating apparatus. In addition, motion of shaft 24 in one direction is prevented by the cooperation of ratchet 25 and pawl 27.

That is, in Figure 3 when knob 67 is turned manually, clutch member 24A moves to the left along its longitudinal axis in the cooperating splined portion 24E of shaft 24 and the knob 67 together with pointer 72 turns to any one of six positions shown in Fig. 5 without any resultant turning of shaft 24.

In the manual operation of knob 67, when contact 50 is moved to one of the six positions shown in Fig. 5, for example, from a position where contact 50 engages contact 42A to a position where contact 50 engages contact member 45A, the actuating winding 55 becomes energized and deenergized three times during which time clutch projection 24C rides on the inner smooth face of spindle 67 without turning spindle 67 until the projection 24C is pressed by compression spring 70 into the cooperating recess in spindle 67. During the time clutch member 24A is rotated by the resulting energization of winding 55, the spindle 67 remains stationary, even though the operator releases his grip on knob 67, because of the static friction forces existing between the knob or spindle 67 and its supporting member 68. After the shaft 24 is rotated by the

resulting energization of winding 55 to a position where projection 24C enters its cooperating recess in spindle 67, all current flow is interrupted and the apparatus is in a tuning position corresponding to the position of pointer 72.

It should be noted also that the position of pointer 72 at all times except during selective tuning gives an indication of the tuned condition of the radio apparatus, even when the apparatus is tuned by actuating footswitch 60. Hence, when manual tuning knob 67 is located at a point remote from the radio apparatus or footswitch 60, the operator at that remote point may observe the tuned condition of the receiver by noting the position of pointer 72.

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

I claim:

1. In radio receiving apparatus mounted in an automobile, an electrical circuit including a normally open foot switch, a rotatable shaft means including said rotatable shaft and said electrical circuit including said normally open foot switch operable by the driver of the automobile arranged to sequentially tune the receiving apparatus to predetermined frequencies in predetermined order upon recurrent closing and opening said circuit through said foot switch, a thermostatic switch element serially connected with said foot switch in said circuit and operable to open and close said circuit when said foot switch is held in its closed position for a prolonged period of time wherein said thermostatic switch element is alternately heated and allowed to cool whereby the receiving apparatus may either be tuned sequentially by alternately closing and opening said foot switch or may be tuned selectively by holding the foot switch in closed position for a predetermined period of time, a homing device having switch contacts including a rotatable contact mounted on said shaft, a selecting switch having a rotatable contact releasably mounted on said shaft and movable to one of a plurality of predetermined positions corresponding respectively to one of said predetermined frequencies wherein said rotatable contact makes contact with a corresponding first contact, parallel circuit connections extending from opposite terminals of said selecting switch to opposite terminals of said foot switch through a series circuit including opposite terminals of said homing device, said rotatable contact being rotated through said releasable connection when the foot switch is recurrently opened and closed or closed for a prolonged period of time and and being movable manually to a predetermined position corresponding to a predetermined frequency independently of the position of the shaft whereby said circuit is closed through said selecting switch until the shaft and homing device are rotated to a predetermined position corresponding to the last mentioned predetermined frequency and the apparatus is selectively tuned to a position corresponding to the position of said rotatable contact.

2. In a tuning system for a radio receiver, a tuning member movable in substantially a straight line, a series of adjustable stops arranged to limit movement of said tuning member, means normally holding the tuning member in adjusted position with respect to one of the stops, an electromagnet, means including a rotatable shaft and said electromagnet operable to move said tuning member and to move the stop member, means including a normally open switch in circuit with said electromagnet arranged to energize said electromagnet whereby said closing and opening of said switch results in sequential tuning of the receiver to preset frequencies determined by settings of said adjustable stops, a selecting switch including a rotatable switch element releasably connected to said shaft, said rotatable switch element being rotated synchronously with movement of said shaft to predetermined positions when the receiver is tuned by actuating said normally open switch, and means including a manual control knob operable to move said switch element independently of said shaft to said predetermined positions corresponding to predetermined frequencies to tune said receivers selectively to a frequency corresponding to the position to which the control knob is moved.

3. In combination, in radio apparatus, a tuning member movable in substantially a straight line, a series of adjustable stop members arranged to limit the movement of said tuning member, means normally holding the tuning member in adjusted position with respect to one of the stops wherein said radio apparatus is tuned to a predetermined frequency determined by the position of said one stop, means including a normally open switch operable to move said member and stop member and to simultaneously produce heat in response to current flow through said switch, and a thermostatic switch serially connected with said normally open switch and responsive to said heat to render said last mentioned means ineffective after a predetermined time long enough to move the tuning member from one stop member to the next stop member in said series for sequential tuning, whereby normal closing and opening of said normally open switch results in sequential tuning of the apparatus and selective tuning results when the normally open switch is closed for a prolonged period of time.

4. In selective control apparatus for the control of electrical equipment, movable control means, a shaft, a series of movable members mounted on said shaft for rotary movement, means normally holding the control means in adjusted position with respect to one of the members, an electrical circuit, a switch element in said circuit releasably connected to said shaft and actuated synchronously with movement of the members when connected thereto, means including said electrical circuit energized through said switch element operable to move the control means and series of members upon energization of said electrical circuit to different positions wherein said control means is positioned with respect to the other members in the series, manual control means, and means including said manual control means operable to release said switch element from said shaft and to move said switch element with respect to the series of members so as to close said circuit whereby said movable control means and series of members are moved to a predetermined position corresponding to the position to which said switch element is moved by said manual control means.

5. A tuner for radio apparatus comprising a movable tuning device, an electromagnet for moving said tuning device in one direction, resilient means tending to move said device in the opposite direction, a movable stop assembly com-

prising spaced stops, means successively to position said stops for cooperation with said tuning device, said last named means operating in timed relationship with said electromagnet, switching means actuated synchronously with movement of said stop assembly, said switching means being releasably connected to said stop assembly, an electrical circuit including said switching means for energizing said electromagnet, and means including manual control means operable to release said switching means from said stop assembly and to move said switching means with respect to said stop assembly so as to close said circuit to move said tuning device and series of stop members to a predetermined tuning position determined by the position to which said manual control means is moved.

6. In a tuning system for a radio receiver, a tuning member, a series of stop members, means normally holding the tuning member in adjusted position with respect to one of the stop members, an electromagnet, means including said electromagnet operable to disengage the tuning member from one of said stop members and to move the tuning member and stop members, a first series of switches having at least one terminal thereof fixedly mounted with respect to said stop members actuated synchronously with movement of the stop members, a second series of control switches having a common switch operating member releasably connected to said stop members, said first and second series of switches being in turn serially connected to the electromagnet as the stop members move, and manual control means operable to disengage said common switch operating member and to move it to a predetermined position whereby the tuning member is moved to a predetermined tuning position determined by the position to which said common switch operating member is moved by said manual control means.

7. In a tuning system for a radio receiver, a tuning member, a series of stop members, means normally holding the tuning member in a first adjusted position with respect to one of the stop members, an electromagnet, means including said electromagnet operable to disengage the tuning member from one of said stop members and to move the tuning member and stop members to a second adjusted position, a first series of switches having at least one terminal thereof fixedly mounted with respect to said stop members actuated synchronously with movement of the stop members, a second series of control switches having a common switch operating member releasably connected to said stop members, a normally open switch operable to energize the electromagnet to position the tuning member, a voltage source arranged to energize the electromagnet through said first and second series of switches, said voltage source being arranged to energize the electromagnet through the normally open switch, a control knob and means including said control knob operable to position the common switch operating member independently of the position of the stop member to a predetermined position whereby the receiver is tuned to a predetermined frequency determined by the setting of said control knob.

8. In radio receiving apparatus, a tuning member, means including a first switch arranged to sequentially move said tuning member to adjusted positions to tune the receiving apparatus to predetermined frequencies in predetermined order upon recurrent operation of said switch, a

multi-position switch cooperatively associated with said means to effect repeated operation of said means until said tuning member is positioned in a position corresponding to the position of said multi-position switch thereby to selectively tune said receiving apparatus, a manual control member releasably connected to said means and arranged to position said multi-position switch thereby to effect movement of said tuning member and selectively tune said receiver upon manual independent movement of said control member, said manual control member being automatically moved when said first switch is operated whereby the position of said manual control member serves also as an indication of the tuned condition of the receiver.

9. In a radio receiving system, the combination of, a tuning member, means including a first control element arranged to sequentially move said tuning member to adjusted positions to tune said receiving system to predetermined frequencies in predetermined order upon recurrent operation of said first control element, a second control member cooperatively associated with said means to effect repeated operation of said means and movement of said tuning member to a predetermined position corresponding to the position of said second control member, a manual control member releasably connected to said means to move said second control member independently of said means thereby to selectively tune said receiving system upon independent manual movement of said control member, said manual control member being automatically moved when said first control element is operated whereby the position of said manual control member serves also as an indication of the tuned condition of the receiver.

10. In radio apparatus, a tuning member, a first means including a first control member arranged to sequentially move said tuning member to adjusted positions to tune the radio apparatus to predetermined frequencies in predetermined order upon recurrent operation of said first control member, a multi-position control means cooperatively associated with said first means to effect repeated operation of said first means until said tuning member is positioned in a position corresponding to the position of said multi-position control means, a second control member releasably connected to said means and automatically moved when said first control member is adjusted to indicate the position of said tuning member, said second control member, upon independent movement thereof being arranged to position said multi-position control means threby to effect selective tuning of said apparatus.

11. In a radio receiving system, a normally open switch, an electrical circuit including said normally open switch, a rotatable shaft, means including said rotatable shaft and switch arranged to tune the receiving system to predetermined frequencies in predetermined order upon recurrent closing and opening said circuit through said switch, a thermostatic switch element serially connected with said switch in said circuit and operable to open and close said circuit when said normally open switch is held in its closed position for a prolonged period of time wherein said thermostatic switch element is alternately heated and allowed to cool whereby the receiving system may either be tuned sequentially by alternately closing and opening said normally open switch or may be tuned selectively by maintain-

ing said normally open switch in closed position for a predetermined period of time, a homing device having switch contacts including a rotatable contact mounted on said shaft, a serial circuit including a selecting switch, said selecting switch, switch contacts of said homing device being connected in a series circuit across the terminals of said normally open switch whereby a closed circuit may exist across the terminals of said normally open switch by actuation of said selecting switch and the receiver may be tuned selectively to a frequency determined by the relative position of the selecting switch cooperating electrically with the switch contacts of the homing device.

12. In a tuning system for a radio receiver, a tuning member movable in substantially a straight line, means including a series of adjustable members arranged to maintain said tuning member in adjusted position with respect to one of said members, an electromagnet, means including a rotatable shaft and said electromagnet operable to move said tuning member and to move said one member, means including a normally open switch in circuit with said electromagnet arranged to energize said electromagnet whereby said closing and opening of said switch results in sequential tuning of the receiver to preset frequencies determined by settings of said adjustable members, a selecting switch element releasably connected to said shaft, said rotatable switch element being rotated synchronously with movement of said shaft to predetermined positions when the receiver is tuned by actuating said normally open switch, and means including a manual control knob operable to move said switch

element independently of said shaft to said predetermined positions corresponding to predetermined frequencies to tune said receiver selectively to a frequency corresponding to the position to which the control knob is moved.

MARVIN A. WOLFF.

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