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2,435,522

RATCHET DRIVEN TUNING MEANS

Original Filed Sept. 27, 1943

FIG. 1

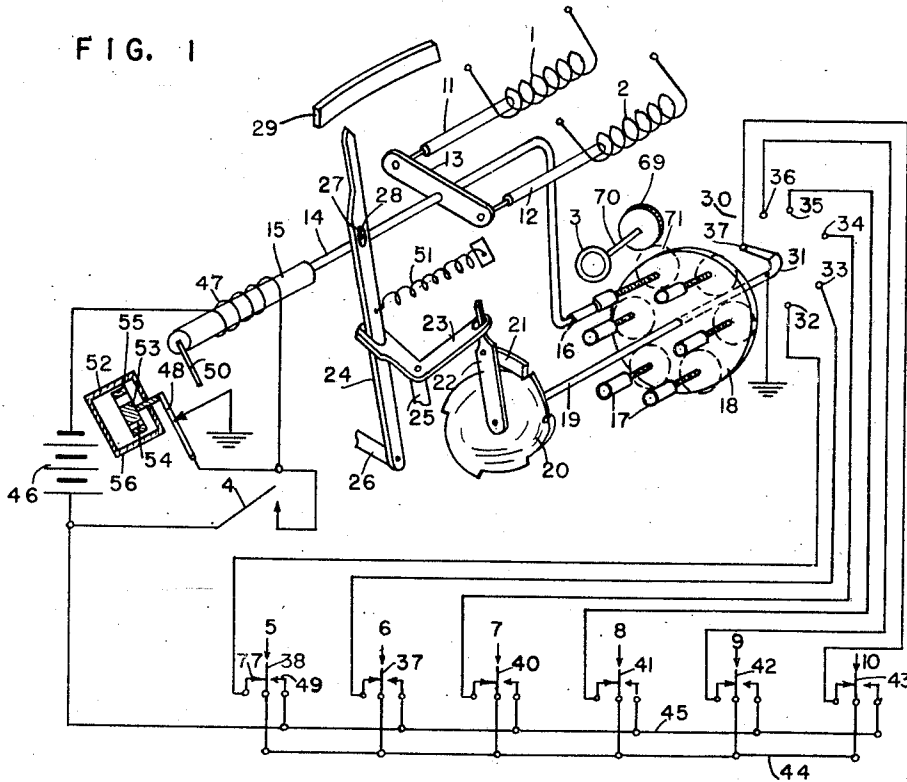


FIG. 3

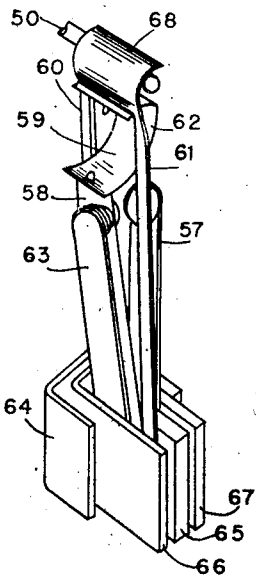


FIG. 4

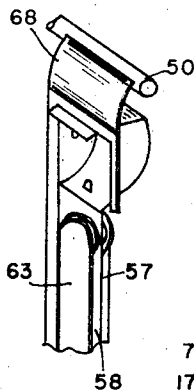


FIG. 5

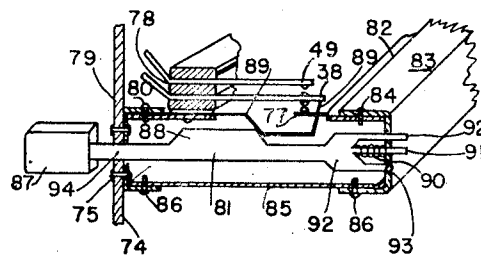
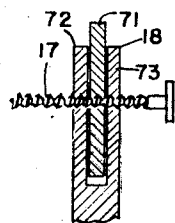


FIG. 2



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2,435,522

RATCHET DRIVEN TUNING MEANS

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Original application September 27, 1943, Serial
No. 503,878. Divided and this application De-
cember 29, 1944, Serial No. 570,281

12 Claims. (Cl. 192—142)

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This invention relates to improved means for positioning an adjustable or variable element and, in particular, to improved tuning means for radio apparatus.

The present application is a division of my co-pending application Serial No. 503,878, filed September 27, 1943, now abandoned, and assigned to the same assignee as the present application.

It is desirable to be able to tune radio apparatus sequentially or selectively to predetermined radio frequencies in addition to being able to tune such apparatus continuously over a range of frequencies including such predetermined frequencies. This is especially so when the radio apparatus is mounted in an automobile wherein a footswitch of the type shown in the McDonald Patent 2,216,671 is operable by the driver of the automobile for tuning the apparatus sequentially when his attention is needed elsewhere for careful driving. The occupants of the automobile, other than the driver, and also the driver when his attention is not needed elsewhere, will find it more satisfactory to tune the apparatus selectively to a predetermined frequency, in which case the apparatus is not on most occasions tuned to other stations before the one selected is tuned. On other occasions, particularly when the automobile is very distant from the broadcast station to which the automobile radio apparatus was pretuned, it is more desirable to tune in stations near the vicinity of the automobile at that time, and in such case the radio apparatus is preferably tuned continuously over a standard broadcast band.

It is therefore an object of the present invention to mount a complete radio receiver in an automobile and to provide means for manually tuning the receiver continuously over a standard broadcast band, and for sequentially tuning the receiver by a footswitch operated by the driver of the automobile, and to provide means on the dashboard or other convenient part of the automobile for selecting a signal from any one of a plurality of broadcast stations without performing sequential tuning operations such as is necessary in tuning by the use of said footswitch.

A further object of the present invention is to provide means for selectively tuning a radio receiver of the type having an electromagnet for positioning a tuning element with respect to preset stops.

The features of the present invention, which are believed to be novel, are set forth with particularity in the appended claims. This invention itself, both as to its organization and man-

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ner 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:

Fig. 1 is a schematic diagram of a circuit and certain associated parts especially suitable for use with my invention and incorporating the present invention,

Figs. 2 and 5 are detailed views of certain parts of the apparatus illustrated in Fig. 1, and

Figs. 3 and 4 illustrate a modified form of certain portions of the apparatus shown in Fig. 1.

By the term "sequential tuning" in this specification it is understood that reference is made to step-by-step tuning of radio apparatus to frequencies in a predetermined sequence.

By the term "selective tuning" in the specification it is understood that reference is made to tuning radio apparatus to predetermined frequencies selectively in accordance with the particular wish of the operator.

Also, by the term "continuous tuning" in the specification it is understood that reference is made to tuning radio apparatus continuously through the entire range or a fractional part of a range of frequencies in, for example, a standard broadcast band.

In Fig. 1, radio apparatus, including tuning coils 1 and 2, is tuned by means of a turret tuner of the type shown and claimed in United States Letters Patent No. 2,310,720, issued February 9, 1943, to Clarence W. Wandrey and assigned to the same assignee as the present application.

The turret tuner may be adjusted manually by turning knob 3 located on the header plate of an automobile as shown in the parent application of which this is a division, or the knob 3 may be located on other accessible portions of the automobile. As will be shown presently, the knob 3 is operable to tune the associated radio apparatus continuously or to produce "continuous tuning" of the type mentioned above. Alternatively, the associated receiving apparatus is tuned sequentially to one of a plurality of frequencies by sequential operation of a footswitch 4 controlled by the driver of the automobile, or tuned selectively and nonsequentially by actuating one of a series of switches 5, 6, 7, 8, 9 and 10 located at some convenient place in the automobile. That is, the arrangement illustrated in Fig. 1 tunes the radio apparatus, of which tuning inductances 1 and 2 are a part, either upon actuation of the manual tuning knob 3, the footswitch 4 or any one of the selecting switches 5 to 10.

The inductances of coils 1 and 2 determine the frequency of the received signal and these inductances are varied respectively, by adjusting the position of members 11 and 12 of relatively high permeability with respect to coils 1 and 2. Only two tuning 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 11 and 12 with respect to inductance coils which are connected in the radio receiving apparatus. The tuning members or control members, such as members 11 and 12, are carried on a movable carriage 13, which is secured upon a rod 14 connected to a movable solenoid core 15. The rod 14 has its forward end 16 bent so as to cooperate with one of a plurality of stops or abutments 17 of the assembly 18; and these stops 17 are adjustably held in a turret member 18 by cooperating screw threads on stops 17 and turret member 18 (Fig. 2).

The turret member 18 is secured upon a rotatable shaft 19 which carries a ratchet wheel 20 engaged with pawl 21 so as to rotate the shaft 19 one step or one-sixth of a revolution for each reciprocation of the pawl 21. The pawl 21 is pivotally mounted on an arm 22 which swings about the shaft 19 and is pivotally and slidably connected to one arm of a bell crank 23 having its other arm pivotally and slidably connected to a lever member 24, the latter being pivoted on a fixed pivot pin 25. The lever member 24 extends from its pivot pin 26 and has a slot 27 to accommodate a pin 28 secured upon the rod 14. The upper end of the lever 24 is preferably positioned so as to be visible and cooperates with a scale 29 having suitable graduations thereon whereby a suitable indication of the position of rod 14 and tuning members 11 and 12 is obtained.

With the apparatus thus far described in Fig. 1, it is clear that when rod 14 moves to the left in the direction of its axis, the bell crank 23 rotates behind an adjacent tooth on the ratchet wheel 20, and that when the rod 14 returns to the right the ratchet wheel 20 is rotated one-sixth of a revolution to a position where an adjacent stop 17 on turret 18 limits further movement of the rod 14 and inductance tuning members 11 and 12 carried thereon. The manner in which the solenoid core 15 and associated rod 14 are actuated by electromagnetic means is described hereinafter.

Upon turret shaft 19 is mounted homing device 30 having a rotatable and grounded electrical contact making member 31 which rotates when and as turret shaft 19 rotates for effecting suitable electrical switching. It is clear from the drawings that contact making member 31 is attached to turret shaft 19 which has secured thereon turret member 18. It is obvious therefore that contact making member 31 is firmly attached to turret member 18 through shaft 19 and for purposes of explanation it may be said that contact making member 31 is carried by turret member 18 inasmuch as member 31 is firmly connected with and always moves with turret member 18. Homing device 30 has six equally spaced fixed contacts 32, 33, 34, 35, 36 and 37 arranged so that when the turret 18 is in one of its six positions corresponding to the position wherein rod 14 engages one of the stop members 17, the contact making member 31 engages one of the fixed contacts 32 to 37 on the homing device.

Each one of the contact members 32, 33, 34, 35,

36 and 37 is connected to a respective normally closed stationary contact on a respective one of the station selecting switches 5, 6, 7, 8, 9 and 10; and the other contacts 38, 39, 40, 41, 42 and 43, which are movable, are each connected to a common low resistance conductor 44. Each one of the selecting switches 5 to 10 has a normally open fixed contact connected to corresponding contacts on the other selecting switches by means of low resistance connection 45 which is also connected to one terminal of a voltage source 46. The other terminal of voltage source 46 is connected to a terminal of actuating solenoid 47 which has its other terminal connected to ground through an automatically operated position responsive switch 48.

Thus, when one of the selecting switch contact members 38 to 43, for example—switch contact member 38 is moved from its normally closed position to the position where it engages contact 49, current flows from one terminal of voltage source 46 through solenoid actuating winding 47, switch 48, ground, arm 31, contact 37, the normally closed contact on electric switch 10, movable contact 43, conductor 44, movable contact 38, and the normally open contact 49 on selecting switch 5 back to the other terminal of voltage source 46.

When solenoid 47 is energized, for example, by thus producing a current flow through the normally open contact 49 on switch 5 in the manner described above, solenoid core 47 and rod 14 are moved to the left in Fig. 1 to a position where solenoid extension 50, of insulating material, engages and actuates the switch 48 from circuit closing position to circuit opening position and thus opens the circuit to solenoid winding 47, and in so doing allows solenoid core 15 to return to its furthestmost position to the right under the influence of tension spring 51, after pawl 21 has turned the turret 18 an angular distance corresponding to the distance between adjacent stops 17.

In the return movement of rod 14 to the right, in order to be sure that the rod 14 moves sufficiently far to the right to move the ratchet wheel 20 one-sixth of a revolution before the solenoid is energized again through switch 48, time delay means 52, illustrated as a fluid dashpot, are connected to the resilient movable contact of switch 48, which time delay means delays reclosing of the switch 48 after it has been opened by member 50. It is clear that the time delay means 52 may take other forms than the liquid dashpot shown in Fig. 1, and, in fact, the switch 48 may have time delay means incorporated therein as shown in Figs. 3 and 4.

The liquid dashpot as illustrated has a movable piston 53 with an orifice 54 for controlling the speed of piston travel to the right in Fig. 1. A second and larger piston orifice 55 is opened by conventional means (not shown) only when the piston moves to the left in Fig. 1 in cooperating cylinder 56 so that the piston 53 may move faster to the left than it moves to the right with the same forces applied thereto.

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 17 in turret member 18, one of the switches 5 to 10, corresponding to that particular stop member, is actuated so as to energize solenoid 47. When solenoid 47 is energized due to current flowing from voltage source 46, solenoid rod 14 is moved to the left against the action of tension

spring 51, and pin 28 on rod 14 engages lever 24 which pivots around its pivot pin 26 so as to rotate the bell crank 23 counterclockwise around its pivot member 25. When and as bell crank 23 moves thus counterclockwise, arm 22 pivotally mounted on shaft 19 and having pivotally mounted thereon pawl 21 rotates counterclockwise about its supporting shaft 19 a distance somewhat greater than one-sixth of a revolution so as to allow pawl 21 to drop behind and engage an adjacent tooth on ratchet wheel 20. When solenoid 47 is deenergized due to the opening of switch 48, tension spring 51 causes clockwise movement of lever arm 24 and causes the turret 18 to be moved an angular distance corresponding to the angular distance between teeth on ratchet 20, which distance corresponds to the angular distance between stops 17.

Such action continually repeats itself until wheel 20 and stops 17, together with arm 31, are turned to the fixed contact connected to that one of switches 5 to 10 which is actuated, and at that fixed contact, the circuit, through the switches 5 to 10 being broken by its actuation, the repeated action stops and the desired station is selected.

Stops 17 are adjustably mounted in turret member 18 and the relative position of each particular stop 17 in turret member 18 determines the distance tuning members 11 and 12 project respectively within inductance coils 1 and 2 after the turret member 18 is rotated around to a position where that particular stop limits movement of rod 14.

It is thus clear that when one of the switches 5 to 10 is actuated, the turret member 18 is rotated, due to current flow through solenoid 47, which current also flows intermittently through the normally open contact of that particular switch and the normally closed contact of the other switches until the rotating contact 31 of homing device 30 engages one of the contacts 32 to 37 corresponding to the switch which is actuated. When the rotating contact 31 engages the stationary contact corresponding to the particular switch actuated, then current flow to the solenoid 47 is interrupted. That is, when switch 5 is actuated, turret member 18 is rotated until rotating contact 31 engages contact 32, and when switch 6 is actuated, contact 31 stops at contact 33, etc.

It is also clear that when footswitch 4, which is connected in a series circuit with source 46 and solenoid 47, is closed, solenoid 47 draws the core 15 to the left and causes the arm 22 to rotate one step corresponding to the angular distance between stop members.

Therefore, in order to tune the receiver by actuating the footswitch 4, it is necessary that the switch 4 be sequentially closed and opened until a particular stop 17, corresponding to a desired station, limits movement of rod 14, whereas, when the receiver is tuned by actuating one of the switches 5 to 10, the particular switch member—for example, switch member 38—is moved to make contact with stationary contact 48, and the receiver is tuned without further actuation of switch member 38.

Figs. 3 and 4 show, respectively, the circuit closing and circuit opening positions of a switch which may be substituted for the switch 48 in Fig. 1 and having suitable time delay means incorporated therein. This substitute switch comprises the relatively fixed contact member 57 and the relatively movable contact member 58 which is coupled to the free end of movable mem-

ber 59, having spring supports 60 and 61, through a substantially U-shaped spring member 62 for producing a suitable time delay. The other contact member 63 serves as a stop for limiting movement of movable contact member 58. The fixed adjacent ends of members 60 and 61, the fixed end of relatively movable contact member 58 and relatively fixed members 57 and 63 are firmly held in a U-shaped clamping member 64 with insulation 65 separating the relatively movable contact 58 from the stationary contact 57, and with insulation 66 and 67 spacing the clamping member 64 from the contact members.

Relative movement between the free end of contact member 57 and movable contact member 58 is produced when and as the member 50 of insulating material on solenoid core 14 (Fig. 1) moves to the left after engaging the free end of member 68 which pivots about its clamped end.

When, as in Fig. 4, member 50 does not engage the free end of pivotable member 68, contact members 57 and 58, comprising switch 48, are in circuit closing position. When, as in Fig. 3, member 50 has engaged member 68 and has moved it to the left, contact members 58 and 63 are in circuit opening position. When member 50 moves to the right from its position shown in Fig. 3, it may move a relatively large distance before contacts 57 and 58 assume circuit closing position because of the resilient connection 59, and thereby a time delay is produced because it takes time for pin 50 to move.

The relatively large distance which member 50 attached to solenoid core 15 (Fig. 1) moves without effecting a closing of switch 48 comprising contacts 57 and 58 is sufficient to allow pawl 21 to move ratchet wheel 20 an angular distance substantially equal to the angular distance between adjacent stops 17. Then, after the member 50 moves further than said large distance, switch 48 closes and thus allows deenergization of solenoid 47.

With a receiver including the delayed action switches of Figs. 3 and 4 in the arrangement of Fig. 1, in tuning the receiver by actuating one of the switches 5 to 10—for example, switch 5—movable contact member 38 need only engage normally open contact 49 for a relatively short time within which time contact member 31 is rotated rapidly to contact 32. That is, it is not necessary to operate movable member 38 recurrently as is the case when tuning with the footswitch 4. As a matter of fact, when the time delay means, such as the dashpot in Fig. 1 or switch shown in Figs. 2 and 3, is properly adjusted, the turret member 18 is rotated one turn within a time of the order of one second when one of the switches 5 to 10 is actuated.

The receiver may be also tuned manually by turning tuning means 3. Referring to Fig. 1, tuning means 3 is arranged to adjust the position of at least one of the stop members 17 in the turret member 18. For that purpose, tuning means or knob 3 is coupled to gear 69 through shaft 70. Gear 69 is arranged to engage at least one of the stop gears 71 which, as shown in Fig. 2, is threaded in stop member 18 and is confined within a hollow portion of turret member 18 between walls 72 and 73. Conventional means, not shown, is provided to prevent rotation of stop 17 within member 18 when gear 71 is turned. When knob 3 is turned manually, the stop 17 is turned in or out of turret member 18 in a direction depending upon the direction of rotation of knob 3; and rod 14 which is pressed against stop

17 by tension spring 51 follows the movement of stop member 17. The position of rod 14, as explained previously, determines the inductance of coils 1 and 2 and, hence, the tuning of the receiver.

In addition to serving as a manual tuning means, the knob 3 may be turned to adjust the position of the other stop members 17 in turret 18 so that the stop members 17 may be in suitable position for tuning when the footswitch 4 or one of switches 5 to 10 is actuated.

The switches 5 to 10 shown in Fig. 1 may be of the pushbutton type and, as shown in Fig. 5, may be mounted on header enclosure member 74, or on the instrument panel or other convenient place by fastening means—for example, rivets 75. For simplicity, only one switch 5, having normally closed fixed contact member 77, relatively movable contact member 38 and normally open fixed contact member 49, is shown in Fig. 5, and it should be understood that the other switches 6 to 10 are of similar construction and are spaced in side-by-side relationship to switch 5.

In Fig. 5, the adjacent fixed ends of contact members 38 and 49 are separated by insulation 78 and are fastened to insulating support 79 by fastening means—for example, rivet 80—which is insulated from the contact members 38 and 49 and also serves to clamp one end of actuating member 81. The bottom contact member 77 is mounted on insulation 82 by fastening means similar to screws (not shown), and the insulation 82 is fastened to support 83 by fastening means—for example, screws 84. Supporting members 79 and 84 are held together in spaced relationship by means of plate 85 and fastening means 86.

Pushbutton 87, shown in its furthestmost left position in Fig. 5, has an extension 88 with a cam surface arranged to engage spring actuated member 89, which abuts the relatively movable spring contact 38 so as to move it from a position where contact member 38 engages fixed contact member 77 to a position where contact member 38 engages member 49 when pushbutton 87 is pressed to the right against the action of compression spring 90 on extension 91, and which spring is disposed between support 83 and the pushbutton extension 92. Pushbutton extensions 91, 92 and 93, movable in cooperating apertures in support 83, and extension 94, movable in a cooperating aperture in support 79, serve as guide members for movement of the pushbutton 87. Pushbutton extension 93 projecting through support 83 is bent so that it cannot be withdrawn through support 83 whereby the extension limits the movement of pushbutton 87 produced by compression spring 90.

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

I claim:

1. In a system for positioning a control member, a movable control member, a series of stops movable as a unit, means normally holding the control member in engagement with one of the stops, an electromagnet, movable actuating means operated by energization of said elec-

tromagnet for disengaging the control member from said one stop and for moving the stop member, a switch actuated by the movement of the stop members in a series circuit with said electromagnet, and switch means operated by the movement of said movable actuating means for recurrently energizing the electromagnet through said first switch to cause said control member to engage a predetermined stop.

2. In a tuning system for a radio receiver, a movable tuning member, a control member attached to said tuning member, a series of stops movable as a unit, means normally holding the control member in engagement with one of the stops, an electromagnet, movable actuating means operated by energization of said electromagnet for disengaging the control member from said stop member and for moving the control member and stop member, switching means actuated in response to movement of the stop members, a series of control switches, a voltage source, an electrical circuit including the voltage source for energizing the electromagnet through the switching means and the series of control switches, and delay means for recurrently closing said electrical circuit to cause said control member to engage a predetermined stop.

3. Selective control apparatus for the control of electrical equipment, movable control means, a series of movable stop members, means normally holding the control means in engagement with one of the stop members, a switch actuated in response to movement of the stop members, means including an electrical circuit energized through said switch for moving the control means and stop members, and a switch actuated in response to movement of the control means for interrupting said electrical circuit to cause said control member to engage a predetermined stop member.

4. In apparatus for the control of electrical equipment, a movable control member, a series of stop members, means normally holding the control member in engagement with one of the stop members, a switch actuated in response to movement of the stop members, means including an electrical circuit through said switch for disengaging the control member from engagement with the stop and for moving the stops, and a switch actuated in response to the movement of the control member for interrupting said electrical circuit to cause said control member to engage a predetermined stop member.

5. Selective tuning apparatus for the control of electrical equipment comprising a movable controlling member, an electromagnet for moving said member in one direction, resilient means tending to move said member in the opposite direction, a stop assembly comprising spaced stops, means on said movable controlling member for cooperation with said stop assembly, means to bring about cooperation of said stops with said member in a predetermined order, a switch actuated in response to movement of the stop assembly, an electrical circuit including said switch for controlling the energization of said electromagnet through said switch, and means actuated after energization of said electromagnet for interrupting said electrical circuit to cause said controlling member to assume a predetermined position.

6. A tuner for a radio receiver 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 comprising spaced stops, means successively to position said stops for cooperation with said tuning device, said last named means operating in timed relationship with energization of said electromagnet, switching means actuated in response to movement of said stop assembly, an electrical circuit including said switching means for energizing said electromagnet, and a series of switches in parallel connected to said switching means for energizing said electromagnet through said switching means.

7. In apparatus for the control of electrical equipment, a movable control member, a series of stop members, means normally holding the control member in engagement with one of the stop members, a switch actuated in response to movement of the stop members, means operated by an electrical current flowing through said switch for disengaging the movable control member from engagement with one of the stop members and for moving the stop members, a normally closed switch actuated in response to movement of the control member for interrupting said electrical circuit, and delay means for maintaining the last mentioned switch in circuit interrupting position a predetermined period of time after movement of said control member to cause said control member to engage a predetermined stop.

8. In a system for tuning radio apparatus, a tuning member, a series of frequency determining members rotatable as a unit and operatively associated with said tuning member to position said tuning member, a rotatable indexing member, step by step means to rotate said indexing member and to rotate said series of frequency determining members, solenoid means to move the step by step means in one direction, spring means to move said step by step means in the opposite direction, switch means operated by the movement of the step by step means to alternately energize and deenergize the solenoid means, and switching means actuated by the rotation of the indexing member in series with the first named switching means to cause the member to stop at a desired index and to position the tuning member.

9. In a system for tuning radio apparatus, a tuning member, a series of frequency determining members rotatable as a unit and operatively associated with said tuning member to position said tuning member, a rotatable indexing member, step by step means to rotate said indexing member and to rotate said series of stops, solenoid means to move the step by step means in one direction, spring means to move said step by step means in the opposite direction, switching means operated by the movement of the step by step means to alternately energize and deenergize the solenoid means, switching means actuated by the rotation of the indexing member in series with the first named switching means to cause the indexing member to stop at the desired index, and a plurality of switches in

parallel connected to the switching means actuated by the rotation of the member to individually initiate an energizing circuit.

10. In a system for tuning radio apparatus, a tuning member, a series of frequency determining members rotatable as a unit and operatively associated with said tuning member to position said tuning member, a rotatable indexing drum, ratchet solenoid means to rotate the drum and to rotate said series of frequency determining members, switching means, a portion of which is mounted adjacent the drum and a portion carried by the drum controlling the solenoid ratchet drive, and a second series of switching means connected to the first named switching means to index the drum and position the tuning member.

11. In an indexible positioning device, a rotatable indexing member, a plurality of stops carried by said member, an adjustable element biased against one of said stops, a ratchet solenoid for moving said element from said one stop and for rotating said member to move a subsequent stop into position to engage said element, a switch in circuit with said electromagnet for opening the circuit therethrough upon movement of said element away from any one of said stops, and a switching arrangement actuated by rotation of said member in series with said switch to cause said member to stop with a desired one of said stops in engagement with said element.

12. In an indexible positioning device, a rotatable indexing member, a plurality of stops carried by said member, an adjustable element movable to abut against one of said stops, a spring biasing said element against said one stop, an electromagnet connected with a step-by-step ratchet for moving said element against the force of said spring from said one stop and for rotating in step-by-step fashion said member to move a subsequent stop into position to engage said element against the force of said spring, a switch in circuit with said electromagnet for opening the circuit therethrough upon movement of said element away from any one of said stops, and a switching arrangement actuated by rotation of said member in series with said switch to cause said member to stop with a desired one of said stops in engagement with said element.

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