April 20, 1943. H. F. ELLIOTT 2,316,776

ELECTRICAL CONTROL APPARATUS

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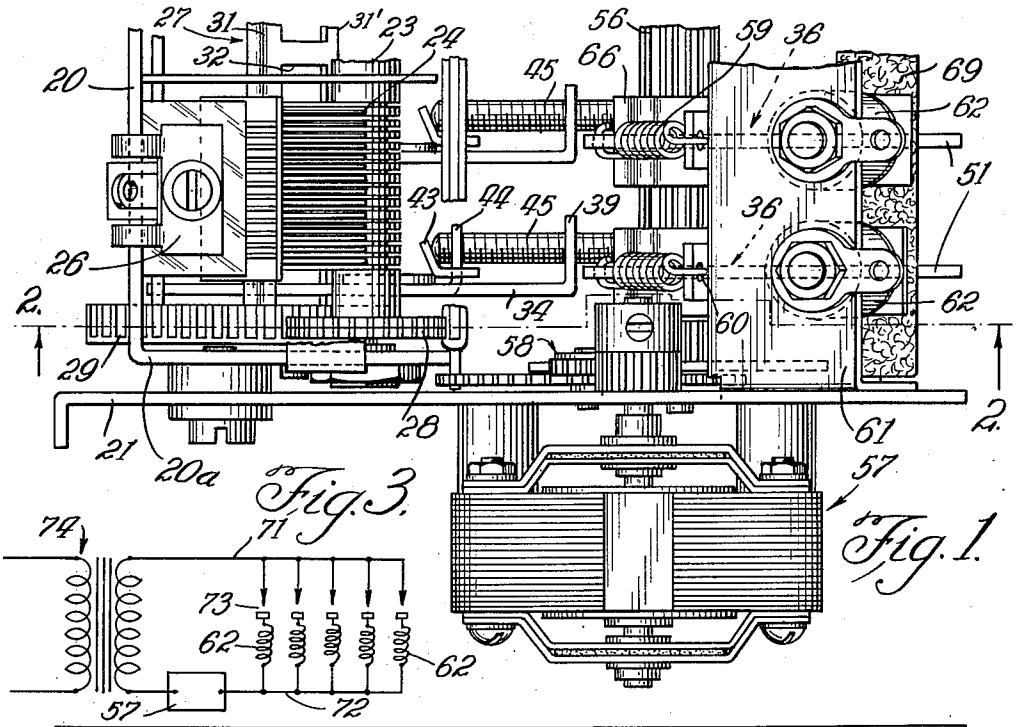


Fig. 3.

Fig. 1.

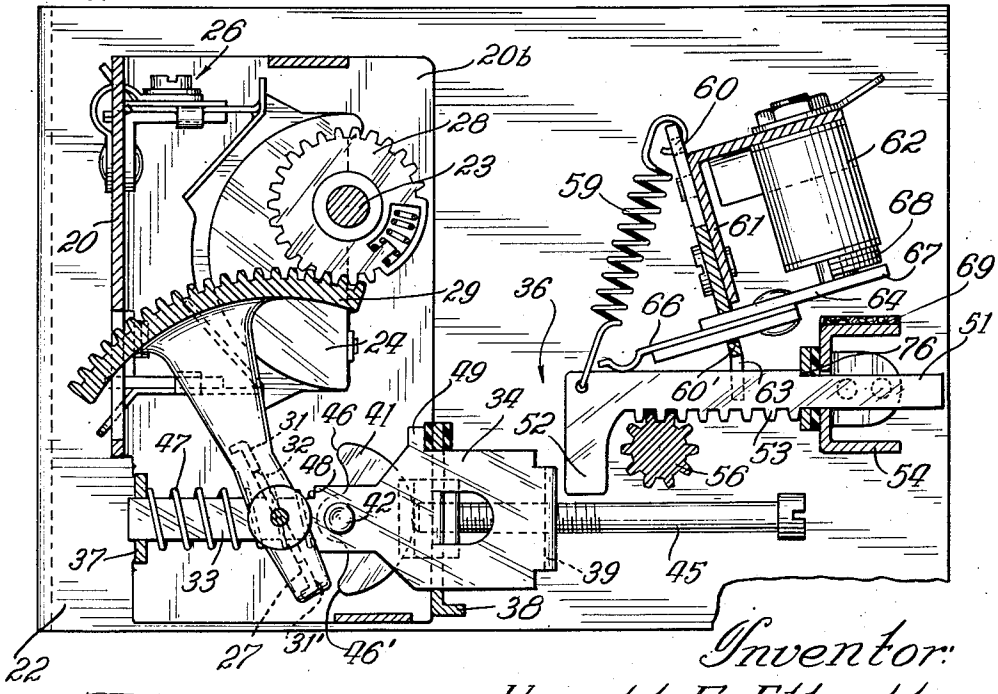


Fig. 2.

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Fig. 4.

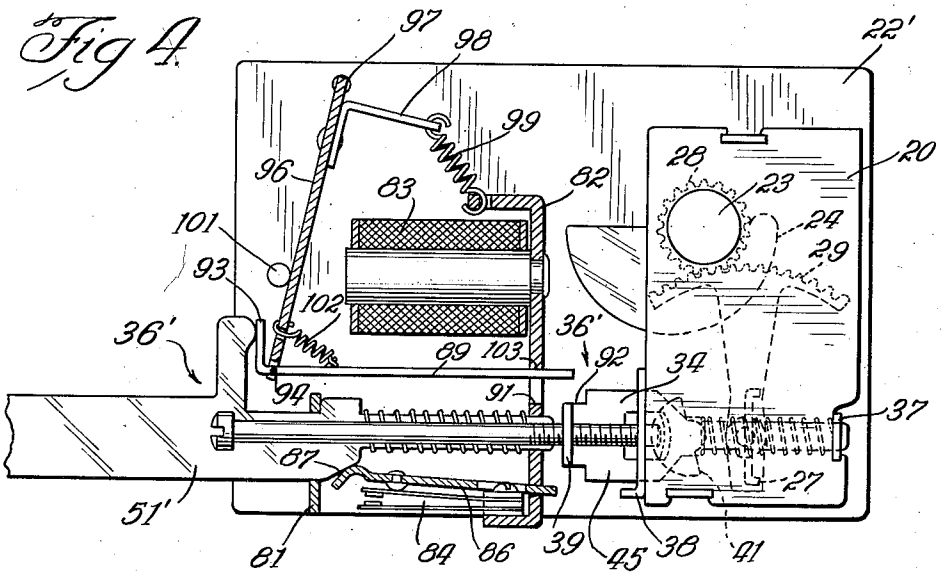


Fig. 5.

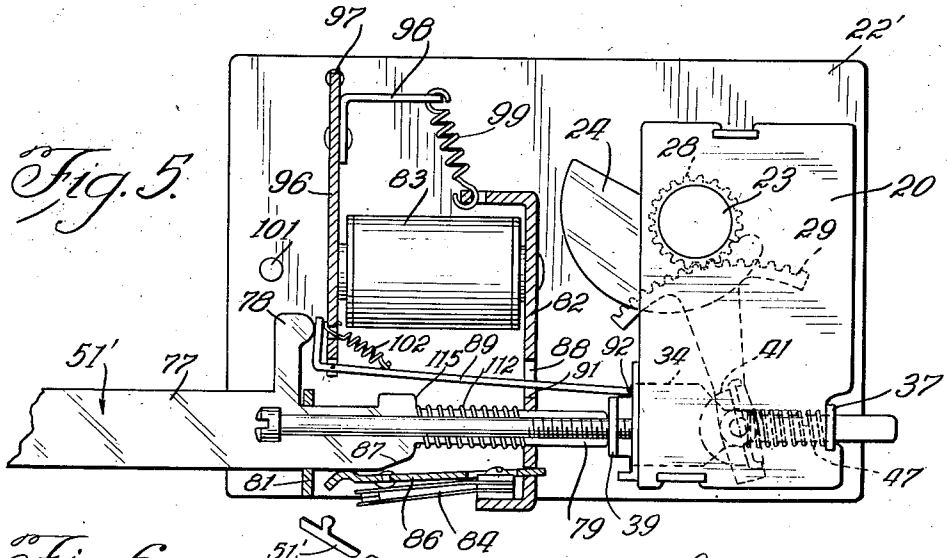
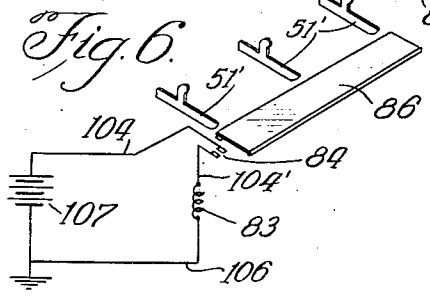


Fig. 6.



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ELECTRICAL CONTROL APPARATUS

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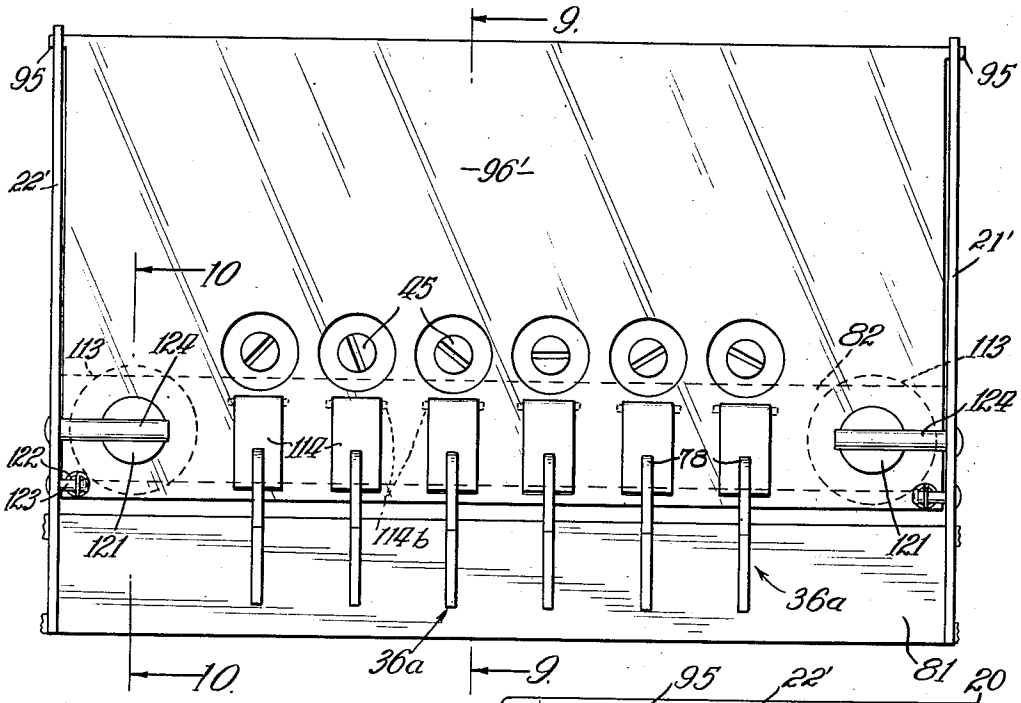


Fig. 8.

Fig. 9.

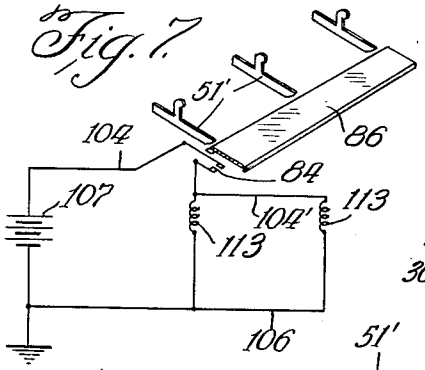


Fig. 7.

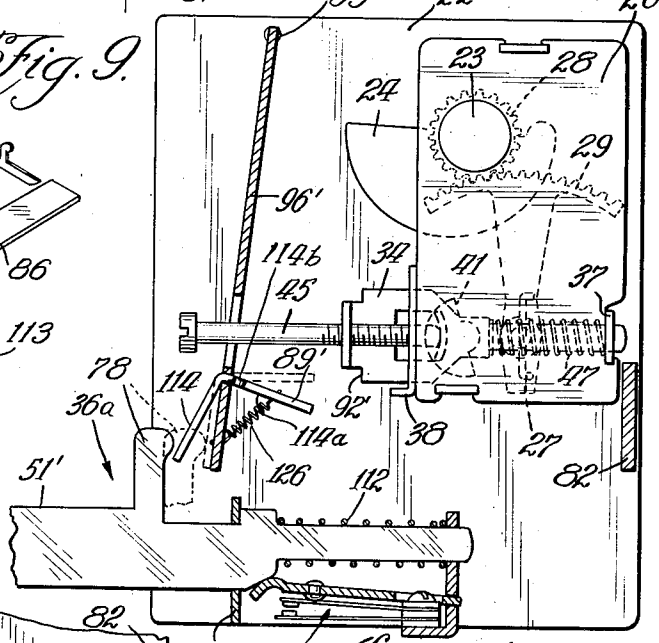
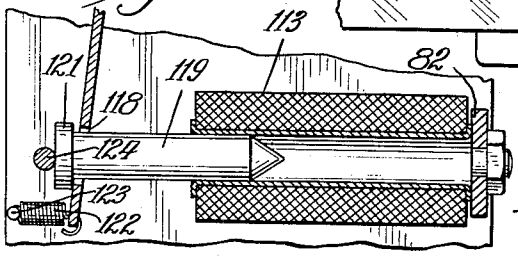


Fig. 10.



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Fig. 12.

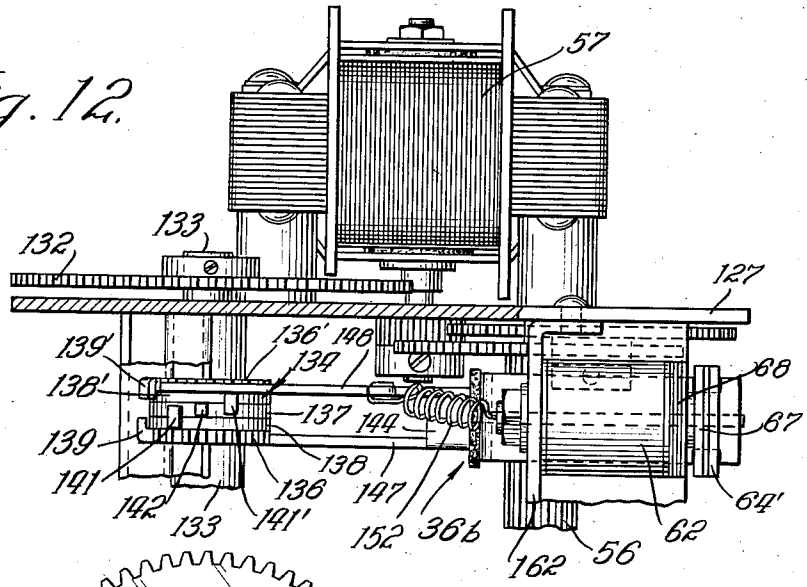
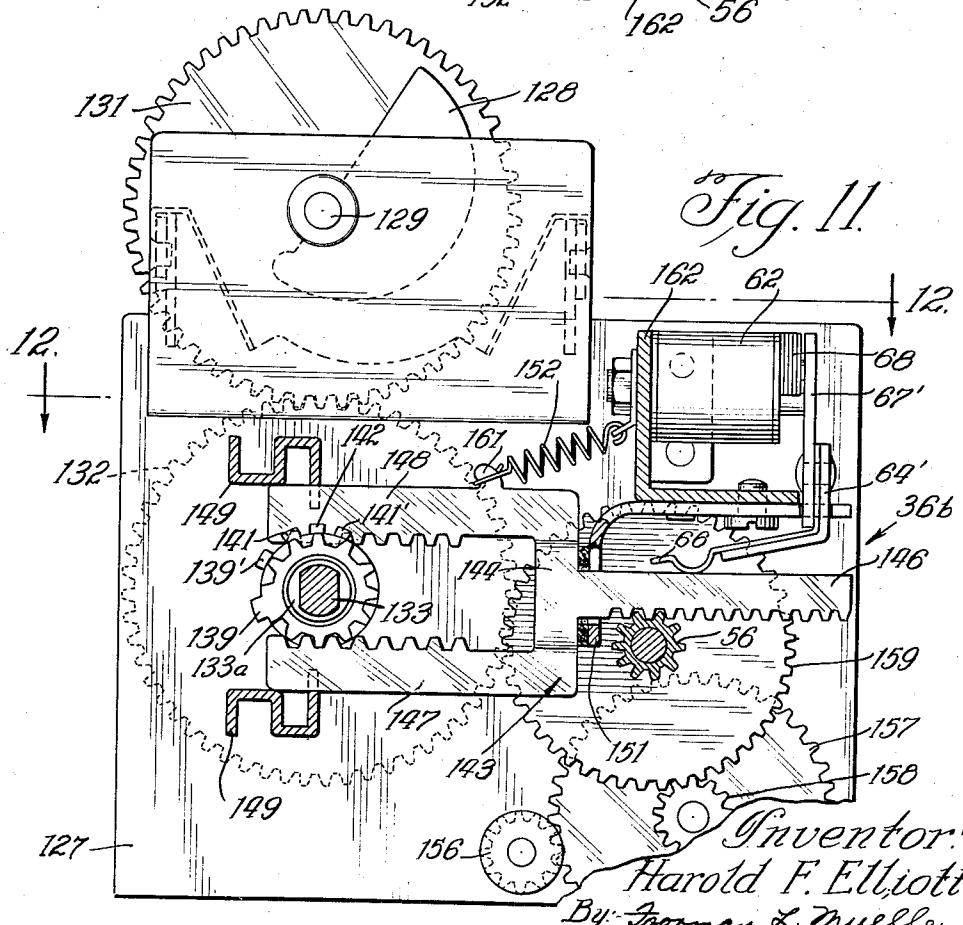


Fig. 11.



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2,316,776

UNITED STATES PATENT OFFICE

2,316,776

ELECTRICAL CONTROL APPARATUS

Harold F. Elliott, Palo Alto, Calif.

Application September 21, 1940, Serial No. 357,745

20 Claims. (Cl. 192—142)

This invention relates to electrical control apparatus and in particular to an electrical tuning system for radio receiving apparatus.

It is an object of this invention to provide an improved electrical tuning system for radio receiving apparatus.

A further object of this invention is to provide a tuning device having normally manually actuated selector units in which such units are electrically operated by compact mechanism which is simple and rugged in construction, and efficient and quiet in operation.

Yet another object of this invention is to provide an electrical tuning device embodying a rotary control shaft which is driven to predetemined control positions by electrically operated linearly movable selector units.

A feature of this invention is found in the provision of electrical tuning apparatus embodying linearly movable operating members in which actuating magnets are utilized to provide a trip action for mechanically engaging the operating members.

Another feature is found in the provision of electrical control apparatus in which a rotary control shaft is rotated in either direction of rotation by linearly movable operating members driven by a solenoid or an A. C. or D. C. unidirectional motor.

A further feature of this invention is found in the provision of an electrical tuning device embodying a rotary control shaft in which a plurality of linearly movable selector units having a common electrical driving means are operated by selectively actuated control means.

Yet another feature of this invention is found in the provision of electrical tuning apparatus embodying a rotary control shaft in which a plurality of selector units are driven by a common driving gear. Each unit includes linearly movable operating and actuating portions, with the actuating portion being operable as a clutch element and arranged to selectively engage the driving gear to provide for the operation of the selector unit.

Further objects, features and advantages of this invention will become apparent from the following description when taken in connection with the accompanying drawings in which:

Fig. 1 is a fragmentary plan view of one embodiment of the invention;

Fig. 2 is a sectional view as seen along the line 2—2 in Fig. 1;

Fig. 3 is a control circuit for the embodiment of Fig. 1;

Fig. 4 is a sectional view of a modified form of the invention;

Fig. 5 is a view illustrated similarly to Fig. 4 showing the parts thereof in changed position;

Fig. 6 is a control circuit for the embodiment of Fig. 4;

Fig. 7 is a modified form of the control circuit shown in Fig. 6;

Fig. 8 is a fragmentary front elevation showing the embodiment of Fig. 4 arranged for operation by a solenoid rather than a magnet;

Fig. 9 is a sectional view as seen along the line 9—9 in Fig. 8;

Fig. 10 is a fragmentary sectional view as seen along the line 10—10 in Fig. 8;

Fig. 11 is a sectional view of another modified form of the invention, and

Fig. 12 is a fragmentary plan view as seen along the line 12—12 in Fig. 11.

Referring to the drawings similar numbers throughout the several views shall designate similar parts. In Figs. 1 and 2 the tuning or preselector unit includes an inner frame 20 of substantially rectangular shape supported on the main frame end plates 21 and 22. A condenser shaft 23 is rotatably supported in the end plates 20a and 20b of the frame 20, the condenser 24 being illustrated as of gang type with each condenser section thereof being electrically associated with a trimmer condenser 26. It is to be understood, however, that other frequency changing means may be satisfactorily used. The condenser 24 is rotated to its tuning positions by a treadle bar 27 which is likewise rotatably supported in the end plates 20a and 20b, operative connection therebetween being made through a split gear 28 mounted on the condenser shaft 23 and a gear segment 29 mounted on the treadle bar 27. Bar 27 is of flat substantially rectangular shape having axially extending parallel portions 31 and 31' with axially spaced apertures 32 formed therebetween. Extending through each aperture 32 is a projecting finger 33 of an operating member 34, which forms part of a selector unit 36. The operating member 34 is slidably supported for linear motion through the aperture 32 by longitudinal frame members 37 and 38 which are supported in the end plates 20a and 20b.

As is clearly indicated in Fig. 1 the operating member 34 is of substantially flat form and is provided at one end with a laterally bent portion 39, for a purpose to be later described. Substantially intermediate the ends of the member 34, and to the right of the treadle bar 27 as viewed

in Fig. 2, is an adjustable element 41 of substantially semi-circular shape and pivotally supported on the member 34 at 42. Element 41 is frictionally locked in an adjusted position by a clamping member 43 which is pivotally or hingedly connected to a laterally extending portion 44, which is bumped out of the operating member 34. The lateral extension 44 is provided with a threaded aperture for engagement with an adjusting screw 45, which has an end portion engageable with the clamping member 43 to urge the clamp into frictional engagement with the adjustable element 41 in an obvious manner.

With the element 41 in an adjusted position and with the operating member 34 and treadle bar or control shaft 27 in the relative positions indicated in Fig. 2, movement of the operating member 34 to the left moves the finger portion 33 through the aperture 32 until engagement is made between the treadle portion 31' and the end portion 46' of the element 41. Since the element 41 is in its locked position continued movement of the operating member 34 rotates the treadle bar 27 in a clockwise direction, as viewed in Fig. 2, until engagement is also made between the treadle bar portion 31 and the element portion 46, whereby to lock the operating member 34 against further linear movement. This engagement between the corresponding portions 31' and 46', and 31 and 46 on the treadle bar 27 and adjustable cam 41, respectively, designates the tuned or home position of the selector unit 36, as will be later fully described. The operating member 34 is returned to its rest or idle position, indicated in Fig. 2, by a spring 47 which is positioned about the finger portion 33 and arranged in compression between the longitudinal frame member 37 and the shoulder portion 48. This rest position of the operating member is defined by the engagement of the projection 49 thereon with the frame member 38. It is to be understood, of course, that the treadle bar 27 may be rotated in either direction of rotation depending upon its prior position and hence upon which pair of corresponding engaging portions on the control shaft and element 41 are first engaged.

The operating or carriage member 34 is moved to its shaft operating position, as above described, by a linearly movable actuating member 51 which is of flat form and of substantially L-shape. The leg portion 52 of member 51 is engageable with the laterally bent portion 39 of the operating member while the leg or clutch portion 53 of the member 51 is slidably supported in a frame member 54 of substantially U-shape, but pivotally movable therein to provide for the engagement and disengagement of the clutch portion 53 with an elongated driving pinion 56. Pinion 56 is rotatably supported in the end plates 21 and 22 and is common to all of the selector units 36. Driving of the pinion is accomplished by a motor 57 through a suitable gear train 58. The motor 57 may be either A. C. or D. C. and is uni-directional in rotation. In one commercial embodiment of the invention a solenoid instead of the motor 57, is used to drive the pinion 56.

Member 51 is normally held out of an engaged position with the pinion 56 and operating member 34 by a coil spring 59 which is connected at one end to the leg portion 52 and at its opposite end to a frame or finger portion 60, which is secured to a supporting bracket 61 for a plurality of magnets 62, one of which is provided for each of the selector or control units 36. The bracket member 61 is mounted on the end plates 21 and 22; the lower end of each finger 60, as viewed in Fig. 2, depending therefrom and being formed with a notch or recess 63 for guiding the movement of the actuating member 51.

An armature 64 for each magnet 62 is pivotally supported in a dovetailed engagement between the bracket 61 and lateral projections 60' on each finger 60, to provide for its tripping the member 51 into meshing engagement with the rotary member or pinion 56 on its movement to an attracted or closed position. It is contemplated that the armature 64 be comprised of a pair of longitudinally offset pieces having a flat spring 66 arranged therebetween and extending longitudinally therefrom for engagement with the member 51 near the leg portion 52. This flexible structure of the armature 64 assures a positive and flush contact of the armature portion 67 with the magnet pole face 68 regardless of the relative positions of the teeth on the rack 53 and pinion 56. The open position of the armature 64 is limited by the cushioned stop or bumper portion 69 on the frame member 54, which is arranged to provide for a free pivotal movement of the member 51 from its meshed engagement with the driving pinion 56.

The operation of the armature 64 and the actuating member 51 is best understood from the circuit diagram of Fig. 3, in which the magnets 62 are illustrated as being connected in parallel between conductors 71 and 72 and in series connection with the motor 57, the power for the circuit being supplied from source 74. It is thus seen that on closing of a push-button 73, which push buttons may be mounted on the radio receiving apparatus or remotely therefrom, a magnet 62 and the motor 57 are concurrently energized. Let it be assumed that the armature 64 is in its rest position against the bumper 69 with the clutch portion 53 of the actuating member 51 disengaged from the driving pinion 56 by virtue of the action of the spring 59. At this position of the armature the tension of the spring 59 is such as to always pull the member 51 away from the operating member 34 and into abutting engagement with the member 54 at the projection 76. Since closing of a push button 73 concurrently energizes the corresponding magnet 62 and the driving motor 57 the gear 56 is rotated substantially simultaneously with a movement of the armature 64 to its attracted or closed position. This movement of the armature 64, by virtue of the engagement of the spring portion 66 with the actuating member 51, moves the clutch portion 53 into engagement with the driving gear 56 against the pressure of the spring 59. Immediately upon engagement of the member 51 and gear 56, the member 51 is moved to the left, as viewed in Fig. 2, to engage the leg portion 52 with the bent portion 39 of the operating member 34. Since the spring 59 acts to always return the member 51 to an innermost position relative to the frame member 54, the member 51 is linearly movable to an extent corresponding to the length of the clutch portion 53. The movement of the actuating or pusher member 51 is thus always sufficient to provide for a complete engagement of the pair of corresponding portions 46 and 31, and 46' and 31', on the cam 41 and treadle bar 27, respectively, which engagement represents the home or tuned position of the selector unit 36 as was above fully described. On completion of the tuning operation and release of the push button 73, the operating member 34 is returned to its rest position

by the spring 47, as was previously explained, and the actuating member 51 is lifted out of engagement with the driving pinion 56 and moved to its rest position by the spring 59. The selector unit 36 is thus in its rest or idle position so as to be ready for operation upon any later actuation of the push button 73 corresponding to such unit.

In the adjustment of the cam 41 to an adjusted position, the adjusting screw 45 is retracted to relieve the pressure on clamp 43 to permit a free rotation of the cam 41. The condenser 24 is then rotated by manual tuning means (not shown) to a predetermined tuning position, which may be indicated by suitable tuning indicia (not shown). With the condenser held in its tuned position the push button 73 is actuated to operate the selector unit 36. This operation of the unit 36 engages the corresponding engaging portions 31' and 46', and 31 and 46, it being understood, of course, that the treadle bar 27 is stationary and that engagement occurs by virtue of the free rotation of the cam 41. With the push button held in its closed position, the adjusting screw 45 is tightened to move the clamp 43 into frictional locking engagement with the cam 41. Cam 41 is thus locked in its adjusted position so that the condensed 24 will always be returned to such predetermined tuned position on later operation of the actuating unit 36.

In the modified form of the invention shown in Figs. 4–10, inclusive, the operating member 34, treadle bar 27, and condenser 24 are similar in construction and operation to the same parts as described in connection with Figs. 1 and 2, and their further explanation is, therefore, believed to be unnecessary. With reference to Figs. 4 and 5 the actuating or push rod member 51' is of flat form and comprised of a body portion 77 having a transversely extending projection 78 and a longitudinally extending finger portion 79, which is engageable with the bent portion 39 on the operating member 34. Member 51' is slidably supported for linear movement toward the treadle bar 27 in a frame member 81 and a mounting bracket member 82 for a magnet 83 which is common to all of the selector units 36'. The bracket 82 is of substantially U-shape and is mounted in the end plates 21' and 22'. A normally opened spring switch 84, common to all of the units 36', is assembled at the lower end of the bracket 82 and includes a contact blade or gate member 86 which is arranged in the path of movement of all the members 51'. The gate 86 is engageable with a cam portion 87 on each actuating member to close the switch and hence energize the magnet 83, as will be explained.

An aperture 88 is formed in the bracket 82 substantially intermediate its sides and above the finger portion 79 of the member 51', the lower side 91 of the aperture being in substantial horizontal alignment with a shoulder portion 92 formed on the operating member 34 adjacent the bent engaging portion 39. Extending through the aperture 88 is a pusher or clutch member 89, which is of substantially L-shaped and pivotally supported near its bent end 93 at 94 to an armature or gate member 96 for the magnet 83. Armature 96 is pivotally supported at each end thereof, in the end plates 21' and 22' as at 97, and is common to all of the selector units 36'. An angular bracket 98 secured near the upper end of the armature is connected to one end of a spring 99, which retains the armature in its rest or open position, the opposite end of the spring 99 being connected to the bracket 82. The rest position of the armature is defined by its engagement with pins 101, one of which is mounted in each of the end plates 21' and 22'. Another spring 102 is connected at one end to the lower end of the armature, while its opposite end is connected to the clutch element or lever 89. It is seen, therefore, that the pressure of the spring 102 acts to normally retain the lever 89 in a substantially horizontal position and in engagement with the top side 103 of the aperture 88. Energization of the magnet 83 to attract the armature 96 to its closed position thus linearly moves the arm 89 in a horizontal plane which is above the upper level of the operating member 34, and hence completely clear of the shoulder portion 92. However, the projection 78 on the actuating member 51' is normally in engagement with the bent end 93 of the lever 89 while the lever 89 is of a length to extend over the shoulder portion 92. Thus, when the lever 51' is manually pushed toward the right the lever 89, by virtue of its pivotal support on the armature 96, is tripped downward as indicated in Fig. 5, until it engages the shoulder 92 of the operating member 34 for a purpose now to be explained.

With reference to Fig. 6 the switch 84 is indicated as being normally open and arranged between conductors 104 and 104', and in series connection with the magnet 83, which is connected between conductors 104' and 106. Since it is contemplated that the embodiment of Figs. 4 to 10, inclusive, be adaptable particularly to farm and automobile receiving sets, the electrical energy for the circuit is supplied from a battery 107, which is connected between the conductors 104 and 106. With the parts in their relative positions shown in Fig. 4, a manual pushing on the push rod 51' toward the right trips the push lever 89 into an engaging position with the shoulder 92 substantially concurrently with a closing of the switch 84 by the engagement of the cam portion 87 with the gate member 86. It is contemplated that the member 51' be manually pushed and in engagement with the member 34 at the finger portion 79 until completion of the tuning operation so that the lever 89 is always held in its engaging position with the operating member 34. Energization of the magnet 83, therefore, attracts the armature or gate member 96 to actuate the lever 89 to push the member 34 into engagement with the treadle bar 27. It is thus seen that the electrical push of the lever 89 on the member 34 aids the manual push of the push rod 51' to move the operating member 34. In this manner the operating member 34 is moved from its position indicated in Fig. 4 to its engaging position with the treadle bar 27, as shown in Fig. 5, which position represents the home or tuned position of the selector unit 36'.

On release of the actuating member 51' the operating member 34 is returned to its rest position by the spring 47, as was above fully explained in connection with Fig. 2. The actuating member 51' is returned to its rest position by the spring 112 which is arranged in compression between the bracket member 82 and a projection 115 formed on the body portion 77. Lever 89 is immediately returned to its horizontal position against the side 103 of the aperture 88 by the spring 102 and the armature 96 is returned to its open position by the action of the spring 99.

Although the magnet 83 and armature 96 are common to all of the selector units 36' it is to be noted that only the particular unit 36' being

actuated operates to move the treadle bar 27. This is accomplished by virtue of the assembly of the lever 89, which permits the lever 89 to be tripped on a manual pushing of its corresponding actuating member 51'. Thus with the actuating member 51' retained in its rest position, energization of the magnet 83 functions merely to linearly move the trip lever 89 in a horizontal plane, but always in slidable engagement with the top 103 of the aperture 88 so that the lever 89 is moved above the operating member 34. The member 34 is thus not engaged either by the finger portion 79 of the actuating member 51' or by the trip lever 89 so that it is positively retained in its rest position.

It is to be understood that a magnet and armature may be provided for each of the selector units 36' to move the lever 89. A switch 84 would thus be used with each unit, with each switch and its associated magnet being connected in series, but in parallel between conductors 104 and 106 relative to the other corresponding magnets and switches.

In Figs. 7, 8, 9, and 10 the gate member 96' is illustrated as being movable by a pair of solenoids 113, which are arranged at opposite ends of the gate member. Each operating member 34 and actuating member 51', apart from being vertically spaced relative to each other, are similar in all other respects to the operating and actuating members described in Figs. 4 and 5 and, therefore, will not be further explained. The gate member 96' is common to all of the selector units 36a and is pivotally supported at its opposite ends, as at 95, in the end plates 21' and 22'. Hingedly secured near the lower end of the gate 96' are trip or clutch members 89' of substantially right-angle shape, one of which is provided for each of the units 36a. Each member 89' extends through the gate member 96' in a manner to have a depending portion 114 thereof in engagement with the projection 78 of the operating member 51'. The pivoted gate member 96' (Figs. 8 and 10) is formed with an aperture 118 corresponding to each solenoid 113. A movable plunger or core element 119 for each solenoid 113 extends through the aperture 118, the enlarged end 121 thereof being engageable with the gate member 96' at the aperture 118. The gate is thus pulled toward the right, as viewed in Figs. 9 and 10 on energization of the solenoids 113, as will be later explained. As indicated in Fig. 10 each element 119 and the gate member 96' are held in their idle or rest positions by tension springs 122 which are connected at one end to pins 123 mounted in the end plates 21' and 22', and at their opposite ends to the gate member. This rest position is indicated by the engagement of the element end 121 with pins or stop members 124 which are supported in the end plates 21' and 22'. It is to be noted that the springs 122 function also to keep the element 119 in frictional engagement with the gate member 96' at all times.

The control circuit for operating the selector units 36a is shown in Fig. 7 and is seen to be substantially similar to the circuit illustrated in Fig. 6. The solenoids 113 are arranged in parallel between conductors 104' and 106 and in series with the switch 84. Thus with the parts arranged in the position shown in full lines in Fig. 9, manual pressure on the actuating member 51' to move it linearly toward the right, substantially concurrently closes the switch 84 and trips the lever portion 114a of the clutch member 114 into an engaging position with the shoulder 92' on the operating member 34, as indicated by the dotted lines. This tripping action is accomplished by engagement of the projection 78 with the lever portion 114 as is also indicated by dotted lines. Since the solenoids 113 are arranged in the circuit similarly to the magnet 83 of Fig. 6 closing of the switch 84 energizes the solenoids to attract the movable elements 119 to their operated positions. By virtue of the shoulder 114b formed on each member 89', the lever portion 114a, after its engagement with the shoulder 92', is engaged with the gate member 96' so that the pull of the plungers 119 is effective in pushing the member 89' which in turn pushes the operating member 34 into engagement with the treadle bar 27. It is to be understood, of course, that the gate member 96' is also pushed by the plunger 51' by virtue of the relative engagement between the projection 78, lever portion 114 and gate member 96'.

On completion of the tuning operation, that is, after the treadle bar 27 has been turned to its predetermined control position by its engagement with the cam element 41, as was previously fully described, the manual pressure on the actuating member 51' is removed. Operating member 34 is returned to its rest position by the spring 47 and the gate member 96' and solenoid plunger 119 are returned to their rest positions by the pulling action of the spring 122. A spring 126 arranged in tension between the gate member 96' and the lever portion 114a may be provided to assure a movement of the lever 89' out of an engaging position with the shoulder portion 92'. As was previously explained, the actuating member 51' is returned to its idle position by the spring 112. Since the clutch member 89' is retained in a neutral position by the spring 126 until tripped by the actuating member 51, it is readily apparent that only the selector unit 36a, which is operated is effective in driving the rotary control shaft 27 to a predetermined control position. It is readily apparent also that a solenoid 113 and switch 84 may be provided for each of the units 36a.

The modified form of the invention shown in Figs. 11 and 12 includes end plates 127 having a condenser 128 rotatably supported thereon. The condenser shaft 129 is provided with a gear 131 which is in meshing engagement with a gear 132 mounted on a rotary control shaft 133 having oppositely arranged flat portions formed thereon, the shaft 133 being likewise supported in the end plates 127. A plurality of adjustable control units 134 (only one of which is shown), one for each of the selector units 36B are mounted axially of the shaft 133. Each unit 134 includes a pair of spaced gears or toothed members 136 and 136', an adjustable or center washer 137 arranged between such gears, and a washer element 138 and 138' positioned between the adjustable washer 137 and each gear 136 and 136'. Each gear 136 and 136' and a corresponding washer 138 and 138', respectively, are freely rotatable on a bushing 133a mounted on the shaft 133; with two bushings being included in each control unit 134. The bore of the bushing 133a is formed with flats corresponding to the flat portions on the shaft so as to lock the bushing for rotation with the shaft but permitting movement thereof axially of the shaft. The gears and washers 138 and 138' are provided on the periphery thereof with axially extending ears 139 and 139' and 141 and 141', respectively. The adjustable element 137 is freely rotatable on the

shaft 133 and is normally frictionally held between the bushings 133a in a fixed position relative to the shaft. A radially extending ear 142 is formed on the element 137, for a purpose to be explained.

Each gear 136 and 136' is in continuous meshing engagement with an operating or carriage member 143 having a substantially U-shape portion 144 and an actuating or clutch portion 146 of gear rack form. The legs 147 and 148 of the portion 144 are parallel but laterally offset from each other as is clearly indicated in Fig. 12. Thus with the portion 144 in a straddling position relative to a control unit 134, leg portion 148 engages the gear 136' and the leg 147 engages the gear 136, the legs 147 and 148 being of rack or toothed form along their inner facing sides. The operating member 143 is slidably supported for linear movement in frame members 149 and 151, but is adapted to be pivotally moved about the shaft 133, as will be later explained. Thus with the member 143 in its position indicated in Fig. 11, linear movement toward the left thereof rotates the gears 136 and 136' in opposite directions. As the gears rotate ear 139 of the gear 136 engages the ear 142 of the washer 138, and the ear 139' of the gear 136' engages the ear 141' of the washer 138', to in turn rotate the washers 138 and 138' in relative opposite directions. It is apparent, therefore, that the washer ears 141 and 141' engage opposite sides of the ear 142 of the adjustable element 137, whereby to lock the gears 136 and 136' against any further rotation. This locked position of the control unit 134 represents the predetermined control position of the shaft 133 or tuned position of the condenser 128. Since the washers 138 and 138' are not concurrently engageable with the element 137, it is obvious that the direction of rotation of the shaft 133 to its control position is dependent upon which washer 138 or 138' first engages the element 137.

Movement of the operating member 143 to rotate the shaft 133 to a predetermined control position, as above described, is accomplished by means including an elongated pinion or rotary driving member 56 which is in driven engagement with a motor 57, of uni-directional type, through gear 156, fibre gear 157 and reduction gears 158 and 159. Pinion 56 is common to all of the selector units 36b and is rotatably supported in the end plates 127. The clutch portion 146 of the member 143 is selectively engageable with the pinion 56 to linearly move the carriage member 143 to drive the shaft 133, but is normally retained out of an engaging position with the pinion by a spring 152. Spring 152 is connected at one end to a projecting ear 161 on the member 143 and at its opposite end to a mounting bracket 162 for a plurality of magnets 62, one of which is provided for each unit 36b. The bracket 162 also carries the frame member 151 which guides and supports the operating member 143. Since the supports 149 and 151 for the operating member 143 permit pivotal movement of such member, the portion 146 is readily lifted out of engagement with the pinion 56 when the unit 36b is in its rest position; the spring acting also on completion of the tuning operation to return or pull the member 143 into its rest position in engagement against the frame member 151.

An armature 64' for the magnet 62 is pivotally supported on the frame member 151 and includes a flexible spring portion 66 which is engageable with the clutch or actuating portion 146 on energization of the magnet. On energization of the magnet 62 the armature 64' opposes the action of the spring 152 and moves the portion 146 into meshing engagement with the pinion 56 to linearly move the operating member 143. This engagement of the clutch portion 146 and the pinion 56 immediately on closing of the armature is indicated in Fig. 11. The spring 66 assures a positive contact between the armature portion 67' and the magnet pole face 68 so that the meshing engagement is maintained at all times when the magnet 62 is energized. Since the motor 57 and magnet 62 are connected in series member 143 is immediately moved linearly to the left, as viewed in Fig. 11, whereby to drive the shaft 133 to its predetermined control position, the circuit for the motor 57 and magnet 62 and its operation being similar in all respects to that previously described in Fig. 3, in connection with Figs. 1 and 2. On completion of the tuning operation and the release of a push button 73 the operating member 143 is returned to its rest position by the spring 152, the lifting of the clutch portion 146 by the spring in turn lifting the spring portion 66 to move the armature portion 67' out of engagement with the pole face 68, so that the unit 36b is ready to repeat the tuning operation on a later actuation of the push button 73. It is apparent, of course, that the movement of the carriage member 143 to the right, as viewed in Fig. 11, breaks the locked engagement of the gears 136 and 136' with the adjustable element 137 to permit their free relative rotation on the shaft 133.

To adjust the various units 134 to a predetermined control position for the adjustable element 137, suitable thrust mechanism (not shown) is provided on the shaft 133, which is operable normally to frictionally lock the element 137 between each pair of bushings 133a in fixed positions relative to the shaft 133. With the thrust mechanism in its released position the condenser 128 is adjusted to a desired tuning position by a suitable manual control knob (not shown), which is in operative engagement with the condenser shaft 129. A unit 134 is then operated to its locked position by pushing a button 73, while the operator holds the manual control knob and hence the shaft 129 from turning. The member 137 is thus adjusted to a predetermined control position for the shaft 133. A similar procedure is repeated for the other control units 134. During this setting operation, the members 137 are maintained in adjustment by virtue of the fact that their frictional engagement with the bushings 133a as effected by the thrust mechanism is sufficient to maintain their relative positions on the shaft 133. When all of the units 134 have been adjusted the thrust mechanism is tightened whereby to frictionally lock all of the members 137 in fixed positions relative to the shaft 133.

It is to be understood that only preferred embodiments of the invention have been illustrated and described herein and that modifications and alterations thereof can be made which are within the full intended scope of the invention as defined by the appended claims.

I claim:

1. In a radio tuning apparatus having rotary control means, a selector unit for rotating said control means to a predetermined control position and including an actuator portion and an operator portion, adjustable means operatively connected with said operator portion and movable thereby into operating position with said ro-

tary control means, electrical means for driving said selector unit, spring-pressed means connected to said actuator portion, said latter means on movement thereof in one direction cooperating with said actuator portion to operatively connect said operator portion and electrical means, and means for moving said spring-pressed means in said one direction substantially concurrently with the energization of said electrical means.

2. In radio tuning apparatus having rotary control means and manually actuated selector units for normally driving the rotary control means to a predetermined control position, the means for electrically operating the normally manually actuated selector units including an elongated pinion common to all of said units, energizable means for driving said pinion, each of said units having an actuating portion with a gear rack thereon, an operating portion, means for slidably supporting said two portions for linear movement toward said control means but permitting pivotal movement of the gear rack on said actuating portion into and out of operative engagement with said pinion, said actuating portion normally being disengaged from said pinion, adjustable means operatively connected with said operating portion and movable thereby into operating position with said rotary control means, electro-magnetic means including a pivoted armature connected with said actuating portion, a circuit for said electro-magnetic and energizable means, said armature on energization of said circuit pivotally moving the gear rack on said actuating portion into engagement with said pinion, which in turn linearly moves said actuating and operating portions toward said control means.

3. Control apparatus including rotary control means, a selector unit for turning said rotary control means to a predetermined control position including an actuating member having a cam portion, an operating member engageable with said actuating member and movable thereby, frame means slidably supporting said two members for linear movement toward said rotary control means, an adjustable element mounted on said operating member and engageable with said rotary control means, electro-magnetic means including a pivoted armature for moving said operating member, clutch means movably connected to said armature, said clutch means being in engagement with said actuating member, and an energizing circuit for said electro-magnetic means including a normally open control switch mounted in said frame means and engageable with said cam portion, with initial linear movement of said actuating member toward said rotary control means closing said switch to energize said electro-magnetic means and moving said clutch means to engage said operating member, to provide for the linear moving of said operating member toward said rotary control means by the combined action of said electro-magnetic means and the continued movement of said actuating member.

4. In electrical control apparatus having frame means and control means rotatably supported in said frame means, a plurality of selector units for rotating said control means to predetermined control positions, each of said units including an actuating member, a carriage member movable by said actuating member, said two members being slidably supported in said frame means for linear movement toward said rotary control means, an adjustable element on said carriage member engageable with said rotary control means, a gate member common to all of said units, axis means pivotatlly supporting said gate member in said frame means, electro-magnetic means operatively associated with said gate member to pivotally move the same, means operatively connecting said actuating and operating members including a spring-pressed lever pivotally supported on said gate member and in engagement with said actuating member, and an energizing circuit for said electro-magnetic means including normally open switch means mounted in said frame means in the path of movement of said actuating member, with initial movement of said actuating member pivotally moving said lever to operatively connect said operating member with said gate member and closing said switch means to energize said electro-magnetic means to provide for the moving of said operating member by said electromagnetic means and continued movement of said actuating member.

5. In electrical control apparatus having a rotary control shaft and an adjustable control member and toothed means thereon with the latter means operatively connected with the former member in shaft operating position, the combination of an operating member in continuous meshing engagement with said toothed means, means slidably supporting said operating member for linear movement but permitting pivotal movement thereof about said toothed means, electrically driven driving means, said operating member having a clutch portion movable into and out of engagement with said driving means on pivotal movement of said operating member, said clutch portion when in an engaged position connecting said operating member for linear movement by said driving means, means for normally holding said clutch portion out of engagement with said driving gear, and selectively actuated means for pivotally moving said clutch portion.

6. In electrical control apparatus embodying rotary control means and a plurality of actuating units for rotating said control means to predetermined control positions, with each of said units including a linearly movable operating portion and adjustable means movable by said operating portion into a position to rotate said rotary control means, the combination of electrical driving means common to all of said units, clutch means for each of said units including an actuating portion for linearly moving said operating portion, means slidably supporting said actuating portion for linear movement by said driving means but permitting pivotal movement thereof into and out of engagement with said driving means, means for normally retaining said actuating portion out of engagement with said driving means, and selectively actuated means for operating said clutch means.

7. In electrical control apparatus having a rotary control shaft and a plurality of selector units for rotating said control means to predetermined control positions, with each of said selector units including a linearly movable operating member and an adjustable element supported on said operating member and movable thereby into a shaft operating position, a manually operated actuating member for moving said operating member, means slidably supporting said actuating member for linear movement, a clutch member in engagement with said actuating member and movable

thereby into engagement with said operating member, electro-magnetic means including an attractable element, means pivotally connecting said clutch member and attractable element, and a circuit for said electro-magnetic means including normally open switch means arranged in the path of movement of said actuating member, said actuating member being adapted on initial manual moving thereof to move said clutch member to operatively connect said attractable element with said operating member, and to close said switch means to energize said electro-magnetic means to move said operating member concurrently with the continued manual movement of said actuating member.

8. In electrical control apparatus having a rotary control shaft and a selector unit for rotating said shaft to a predetermined control position, said selector unit including an operating member and an actuating member for manually moving said operating member, means slidably supporting said two members for linear movement toward said shaft, an adjustable element supported on said operating member and movable thereby to a shaft operating position, a pivoted member for electrically moving said operating member, a clutch member operatively connected with said pivoted member, and engaged at one end with said actuating member, with the opposite end thereof being engageable with said operating member, energizable means for driving said pivoted member, and a circuit for said energizable means including a normally opened switch arranged in the path of movement of said actuating member, said actuating member on initial movement thereof pivotally moving the opposite end of said clutch member into engagement with said operating member and closing said switch so that said operating member is moved toward said control means by the combined action of said actuating member and energizable means.

9. In a radio tuning system including frequency changing means and a control shaft adapted to move said frequency changing means to predetermined tuning positions, a plurality of control units including a linearly movable operating member having an adjustable element thereon engageable with said shaft, a manually operated actuating member, a pivoted trip lever for operatively connecting said two members, said lever being in engagement with said actuating member, electro-magnetic means including an armature for driving said trip lever to move said operating member, means pivotally supporting said lever on said armature, and a circuit for said energizing means including a normally open control switch arranged in the path of movement of said actuating member, said actuating member being adapted to be manually pushed to pivot said trip lever into engagement with said operating member and to close said switch means to energize said electro-magnetic means so that said operating member is moved by the cooperating action of said electro-magnetic means and said actuator member.

10. In a radio tuning system having frequency changing means and a control shaft adapted to move said frequency changing means to predetermined tuning positions, a plurality of selector units, with each of said units including a carriage member and a manually operated actuating member engageable with said carriage member, and means slidably supporting said two members for linear movement toward said control shaft, electro-magnetic means common to all of said units including a pivoted armature, a clutch member for operatively connecting said armature and carriage member, pivotally supported on said armature and movable thereby to move said carriage member, means for normally retaining said clutch member in a neutral position in engagement with said actuating member and out of engagement with said carriage member, and a circuit for said energizable means including a normally open switch adapted to be operated by said actuating member, with initial movement of said actuating member pivotally moving said clutch member into engagement with said carriage member and closing said switch to provide for a combined manual and electrical moving of said carriage member to its shaft operating position.

11. In a tuning device for radio receiving apparatus having a rotary control shaft, a plurality of control units mounted on said shaft, with each of said units including a pair of freely rotatable members and an adjustable member arranged therebetween, with said latter member and rotatable members being operatively connected in a shaft operating position, a carriage member in continuous engagement with each of said rotary members, a rotary driving member common to all of said units, energizable means for operating said driving member, means supporting said carriage member for linear movement but permitting pivotal movement thereof about said shaft, said carriage member having a clutch portion thereon movable into and out of engagement with said driving means on pivotal movement thereof, means for normally retaining said clutch portion out of engagement with said driving means, second energizable means connected with said actuating member for moving said clutch portion into engagement with said driving member, and a circuit common to said two energizable means arranged to provide for their concurrent energization.

12. In electrical tuning apparatus for a radio receiver having rotatable tuning means, means for rotating said tuning means to predetermined tuning positions and including a rotary control unit having a pair of freely rotatable gears and an adjustable member thereon, with said gears operatively connected with said latter member in shaft operating position, an operating member in continuous engagement with each of said gears and arranged to rotate said gears in opposite directions, means for slidably supporting said operating member for linear movement but permitting pivotal movement thereof, electrical driving means for operating said control units, said operating member having a rack portion movable into and out of engagement with said driving means on pivotal movement of said operating member, means normally retaining said rack portion out of engagement with said driving means, and electrical means including a spring-pressed pivoted armature connected with said operating member for moving said rack portion into engagement with said driving means, said two electrical means being connected in series for concurrent energization.

13. In electrical control apparatus having rotary control means and a plurality of selector units, with each unit including a linearly movable carriage member, adjustable means operatively connected with said carriage portion and movable thereby into an operating position with

said rotary control means, an actuating portion for moving said carriage member, means slidably supporting said actuating portion for linear movement but permitting pivotal movement thereof, a rotary driving pinion common to all of said units, said actuating portion having a gear rack thereon pivotally movable into and out of engagement with said pinion, means normally retaining said actuating portion out of engagement with said driving pinion, and selectively actuated means for moving said gear rack into engagement with said driving pinion to provide for the moving of said carriage portion by said actuating portion.

14. In electrical control apparatus having a rotary control shaft and a plurality of selector units for rotating said shaft to predetermined control positions, with each unit including a linearly movable operating member having an adjustable element thereon engageable in an operating position with said shaft, the combination of a rotary member common to all of said units, electrical means for driving said rotary member, a member for actuating said operating member having a rack portion thereon engageable with said rotary member, means slidably supporting said actuating member for linear movement but permitting pivotal movement thereof to move said rack portion into and out of engagement with said driving member, means for normally retaining said actuating member out of engagement with said operating and rotary members, and electrical means including a spring-pressed pivoted armature connected with said actuating member, said armature on movement to a closed position pivotally moving said rack portion into engagement with said rotary member, with said two electrical means being connected in series for concurrent energization.

15. I control apparatus having rotary control mechanism movable to a control position, the means for moving said rotary control mechanism to a predetermined position including in combination actuating mechanism, with one of said two mechanisms having a part therewith adjustable to a position corresponding to a predetermined control position and being movable to move said part into operating connection with the other mechanism, magnet means with a pole face energized substantially upon initiation of a moving operation, and means connecting said magnet means with said actuating mechanism including a spring-tensioned multi-portion means having a first portion normally out of an operating position relative to said actuating mechanism but being pivotally movable into an operating position relative thereto substantially upon initiation of said moving operation for said rotary control mechanism, and having another portion pivotal relative to the first portion, connected therewith, and acting to maintain the first portion in the operating position during the rotary-control-mechanism-moving operation, with said second portion having an armature part in substantially flush engagement with the pole face during at least the last part of the moving operation.

16. In control apparatus having rotary control mechanism movable to a control position, the means for moving said rotary control mechanism to a predetermined position including in combination actuating mechanism, with one of said two mechanisms having a part therewith adjustable to a position corresponding to a predetermined control position and being movable to move said part into operating connection with the other mechanism, electrical means for operating said actuating mechanism, and means for operatively connecting said electrical means with said actuating mechanism including a spring-tensioned multi-portion means having a first portion normally out of an operating position relative to said actuating mechanism but being pivotally movable into an operating position relative thereto upon initiation of a moving operation for said rotary control mechanism, and having another portion pivotal relative to the first portion, connected therewith, and acting to maintain the first portion in the operating position during the rotary control mechanism moving operation.

17. In control apparatus having control mechanism movable to a control position, the means for moving said control mechanism to a predetermined control position including in combination means initially manually movable, and electrical means energized substantially upon initiation of said manual movement to at least assist in the completion of a movement of said control operation, and means mechanically connecting the manual means and the electrical means including a pivoted member, a second pivoted member mounted on said first pivoted member and engageable by said manual means upon movement thereof to be pivoted by such engagement with said manual means into a driving position, and a switch engageable by said manual means upon initiating movement thereof electrically connected with the electrical means to energize the same for moving said first pivoted member.

18. In control apparatus having movable control mechanism and a plurality of selector units for selectively moving said control mechanism to a predetermined position, the means for driving a selector unit including a driven pinion common to all of said units, means for connecting said unit with said pinion including a gear-rack member movable into and out of engagement with said pinion and operatively connected with the selector unit, magnet means energizable substantially upon initiation of a control operation, and an armature for said magnet means pivotal relative thereto and relative to said gear rack member having a magnet engaging portion at one end, and a yieldable portion at the other end engageable with the gear rack member and being yieldable to adapt the armature to varying lateral positions of the gear rack member while permitting a substantially flush engagement between the magnet engaging portion of said armature and the magnet means, with said pinion upon the positioning of said connecting means for operation acting to move the gear rack member and the selector unit therewith.

19. In control apparatus having control mechanism movable to a predetermined position, the means for moving said control mechanism including a rotary driven gear, a rack member for engaging the control mechanism, means pivotally mounting said rack member, and means for moving said rack member into operating engagement with said rotary gear, including a magnet, and means pivoted intermediate its ends having an armature portion at one end to be attracted to the magnet, and a yieldable portion at the other end engaging the rack member and upon energization of the magnet moving said rack member into engagement wtih the rotary gear.

20. In control apparatus having control mechanism including a rotary shaft having driven gear means thereon, the means for driving said gear means and the shaft to a predetermined control position including in combination a driving member having a portion in engagement with said gear means and another portion toothed for driving engagement with a driver, a driver, with said driving member normally being out of engagement with said driver, and means for pivoting said driving member into engagement with said driver, including a magnet, and a pivoted armature attracted at one end to the magnet, and having a portion engaging said driving member to pivot the same.

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