April 24, 1945. LE ROY J. LEISHMAN 2,374,293

PUSH BUTTON TUNER

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Fig.1

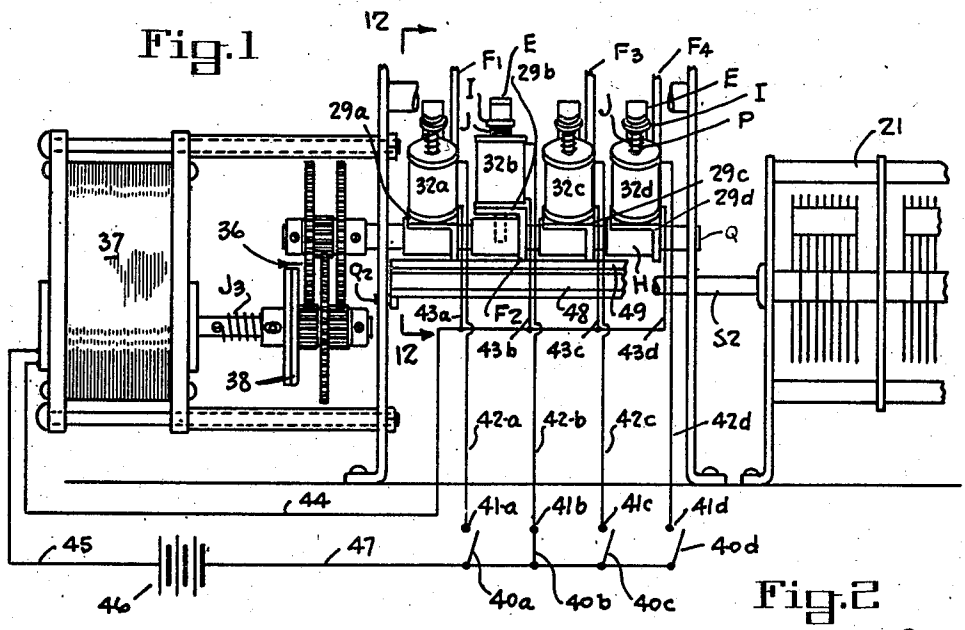


Fig.2

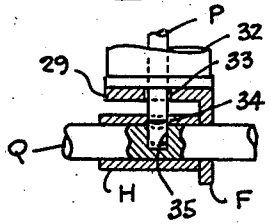


Fig.3

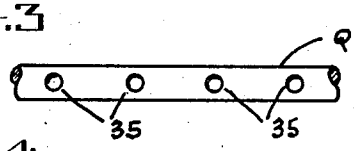


Fig.4.

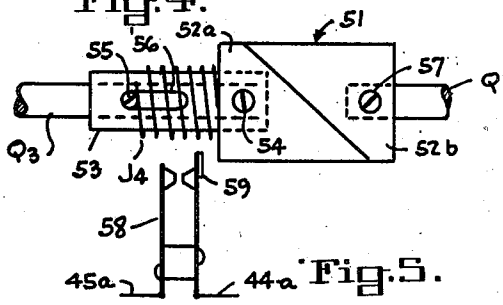


Fig.5.

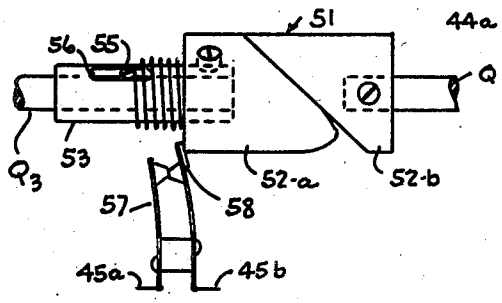
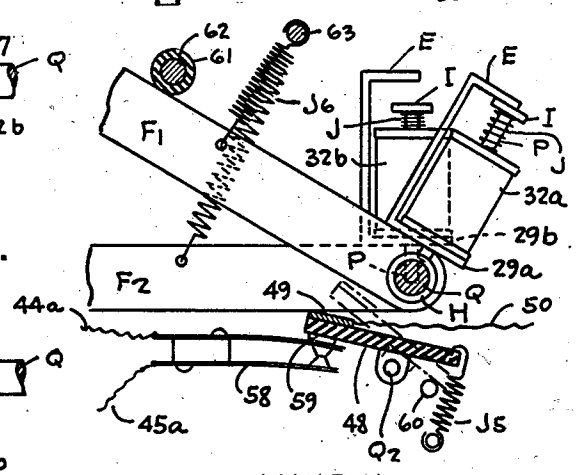


Fig.6.



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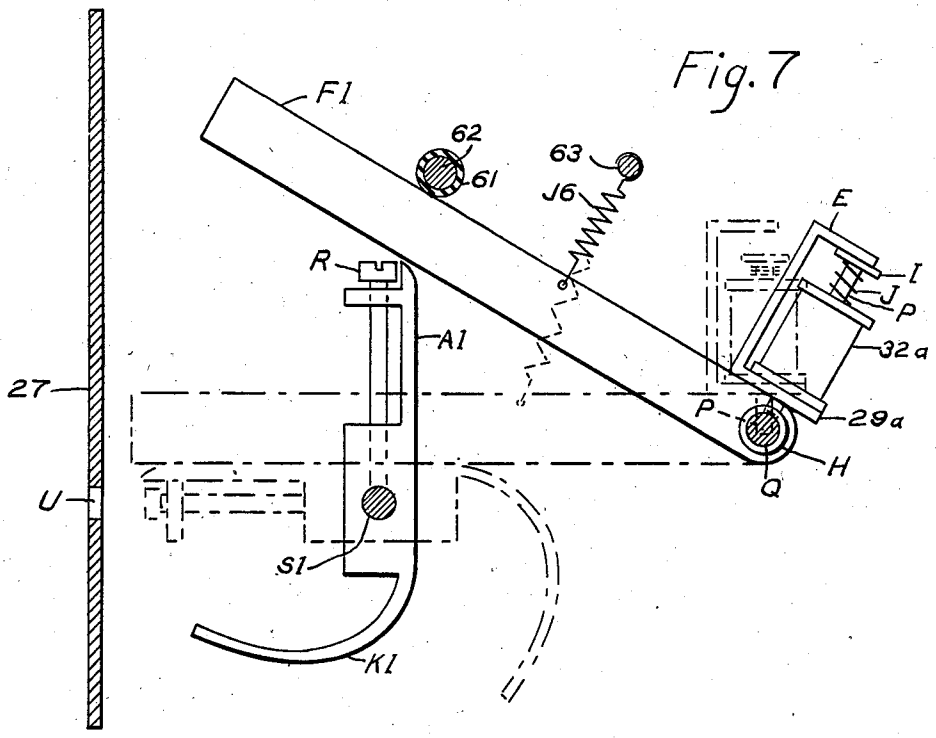
Le Roy J. Leishman

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Fig. 7



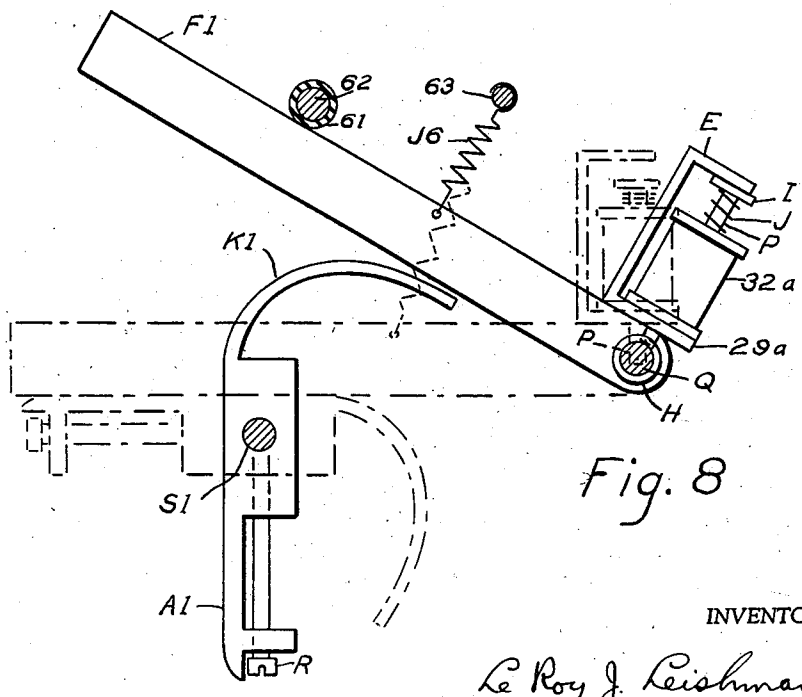


Fig. 8

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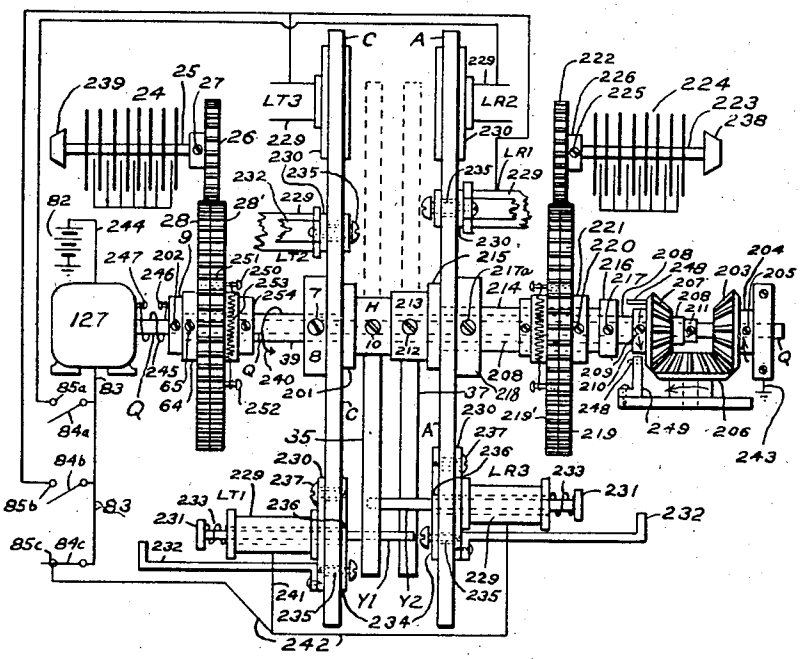


Fig. 9

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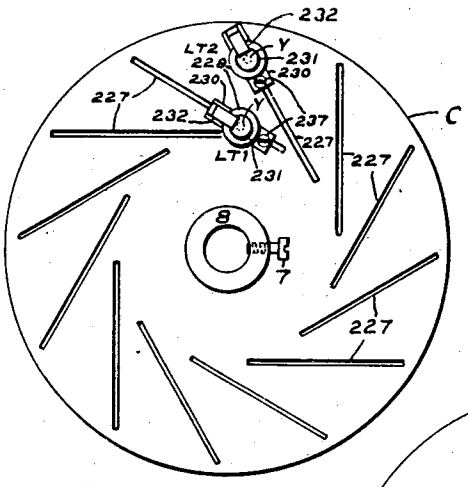


Fig. 10

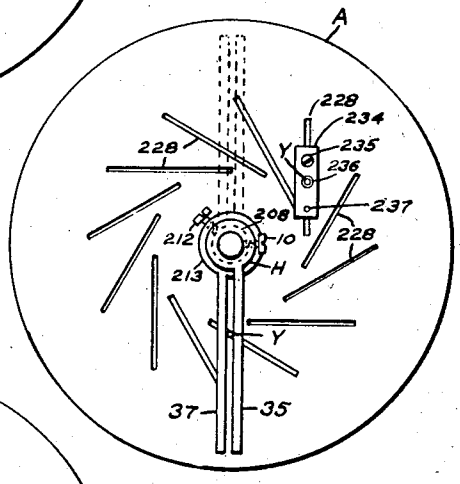
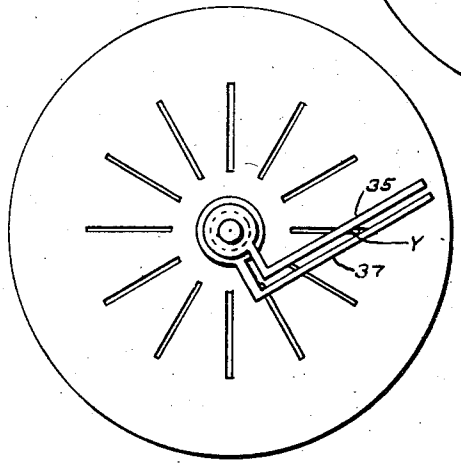


Fig. 12

Fig. 11



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Patented Apr. 24, 1945 2,374,293

UNITED STATES PATENT OFFICE

2,374,293

PUSH-BUTTON TUNER

Le Roy J. Leishman, Los Angeles, Calif.

Application June 17, 1941, Serial No. 398,502

4 Claims. (Cl. 74—10)

This application is a continuation in part of my application Serial No. 179,439, filed December 13, 1937, and a continuation in part of my application Serial No. 149,442, filed June 21, 1937, issuing June 17, 1941, as Patent No. 2,246,050, and which, in turn, was a continuation in part of application Serial No. 757,644, filed December 15, 1934.

The invention herein described relates to automatic tuners, and more particularly to those in which a plurality of independently movable positioning means turn a rotatable member to different predetermined positions. The objects of this invention are to provide means for operating a mechanical tuner electrically; to make it unnecessary to reverse the motor; to reduce the number of electrical contacts to a minimum; and to achieve these various objectives with apparatus that is simple and inexpensive. Still other objects will appear as this specification proceeds.

In the accompanying drawings:

Fig. 1 is a front elevation and diagrammatic representation of electrical means for operating automatic tuners of the type having individual selectors for each of a plurality of stations. The adjustable positionable members have been omitted for the sake of clarity.

Fig. 2 is a detail of Fig. 1.

Fig. 3 shows a section of the shaft on which the operating levers of the device of Fig. 1 are mounted.

Fig. 4 is a diagrammatic view of a clutch and automatic motor switch suitable for use with the mechanism of Fig. 1.

Fig. 5 shows a different position of the components of Fig. 4.

Fig. 6 is a schematic diagram of a modification of the electrically operated tuner, showing a muting arrangement and means for shunting the motor from the circuit when the tuning operation is completed.

Fig. 7 shows two positions of one positioning device and its associated positionable member.

Fig. 8 shows in full lines the positionable member in the opposite extreme of its possible angle of rotation than that illustrated in Fig. 7; and, in broken lines, these same parts in the final tuned-in position.

Fig. 9 is a diagrammatic representation of an electrically operated control-positioning mechanism having important features in common with the mechanism of Figs. 1 to 8.

Fig. 10 is a side elevation of disc C of Fig. 9, showing a pair of selector-solenoids adjustably mounted thereon.

Fig. 11 shows disc A of Fig. 9, together with the driving arms and other details.

Fig. 12 illustrates a modification of the apparatus shown in Fig. 11.

Positioning lever F1, Figs. 8 and 9, is pivoted on rod Q, which is journaled at one end in endplate C1, Fig. 1, and at the other end in endplate C2. Lever F1, Fig. 7, is shown about to engage positionable member A1, which may be of the type shown, or any other type adapted to lever control, such as the heart-shaped cams of Vasselli, Patent No. 1,846,289, the internal cams of Bird, Patent No. 1,925,651, the reciprocating racks and bars of Schaefer, Patent No. 1,906,106, or the positionable members of my own Patent No. 2,084,851. Positionable member A has a setscrew R and is one of a plurality of such members mounted in predetermined angular positions on shaft S1, and each is adapted to be engaged by one of a plurality of positioning levers, F1 to F4, Fig. 1. Solenoids or magnets **32a**, **32b**, **32c** and **32d**, Fig. 1, are mounted on lugs **28a**, **29b**, **29c** and **29d** respectively formed on levers F1, F2, F3 and F4 respectively. Each solenoid is equipped with a plunger P, having a flanged end or shoulder I, and each plunger is surrounded by a spring J pressing end I against abutment bracket E attached to the solenoid or lever. Each lug **29** has a hole **33**, Fig. 2 in alignment with hole **34** in hub H, and the lower end of plunger P extends normally not only through hole **33** but also part way through hole **34** in the hub. Shaft Q, on which the levers F1 to F4 are pivoted, has a series of holes **35**, Figs. 2 and 3, extending at least part way through the shaft; and each hole upon rotation of shaft Q, moves in the plane of the corresponding hole **34** in one of the hubs, and will of course come into alignment with hole **34** when shaft Q is in a suitable angular position. A gear train **36** operatively connects shaft Q with motor **37** through friction clutch **38**, the plates of which are held in engagement by spring J3. Condenser shaft S2 is operatively connected to the rotatable positionable means and the usual manual drive in any suitable manner, but no connection is shown because: (1) a satisfactory connection is illustrated in Fig. 2 of my application Ser. No. 179,439; and (2) the positionable means per se is not a part of this invention.

Push buttons **40a**, **40b**, **40c** and **40d** are individual to solenoids **32a**, **32b**, **32c** and **32d** respectively, and have contacts **41a**, **41b**, **41c** and

41*d* that are connected to these solenoids respectively by wires 42*a*, 42*b*, 42*c* and 42*d* respectively. A return circuit for solenoids 42*a*, 32*b*, 32*c* and 32*d* is provided respectively by wires 43*a*, 43*b*, 43*c* and 43*d* all connected to wire 44 going to the motor. Motor 37 has a return wire 45 connected to current supply 46, which is of any type adaptable to the various requirements of the motor, solenoids and radio receiver. The other side of the current supply is connected by wire 47 to switches 40*a*, 40*b*, 40*c* and 40*d*.

If one of the push buttons, say 40*b*, is pressed down, the current will flow from source 46 through switch 40*b*, contact 41*b*, wire 42*b*, solenoid 32*b*, wire 43*b*, wire 44, motor 37, and wire 45 back to source 46. This will energize solenoid 32*b* and the motor. The solenoid will then pull down on its plunger P, holding the lower end against shaft Q until it has been rotated by motor 37 and the interconnected gear train to a position at which the corresponding hole 35 comes into alignment with the plunger, which the energized solenoid will then force into hole 35. This locks the lever to shaft Q, causing the lever to turn with the shaft. If the positionable member is found in the position shown in full lines in Fig. 7, the downward movement of the lever causes it to turn in a counter-clockwise direction to the position shown in dotted lines. If the positionable member happens to be in any position between that shown in full lines in Fig. 8 and the tuned-in position, the lever upon its downward movement turns the positionable member in a clockwise direction to the final tuned-in position shown in dotted lines in both Figs. 7 and 8. Solenoid 32*b* and lever F2 are shown in Fig. 1 in the position to which they are turned when the solenoid and motor are actuated. The stoppage of the lever prevents the further rotation of shaft Q, but excessive strain on the motor is avoided by the fact that clutch 38 can slip until the operator removes his finger from the push button. When push button or switch 40*b* is thus opened, the motor no longer exerts any torque on shaft Q, and spring J on solenoid 32*b* forces the plunger upward and the lower end of the plunger moves out of hole 35. The subsequent pressing of any other push button will in like manner energize the motor and another solenoid which will lock its associated lever to shaft Q and thus operate the lever and tune in the proper station.

A tuner of this type may be adjusted in the following described manner so that the pressing of any button will bring in a predetermined station. One of the push buttons, say 40*a*, is pressed down, causing the positionable member to move to the position shown in dotted lines in Figs. 7 and 8. While the button is held down, set-screw R is loosened by means of a screw driver inserted through hole U in plate 27, which may be used to connect end-plates C1 and C2, Fig. 1. The loosening of this set-screw permits shaft S1 to turn freely while member A1 is held stationary. The desired station is then tuned in by means of the regular manual knob, not shown, rotating shaft S3 and transmitting the motion to condenser shaft S2 by the interconnecting means previously mentioned. After the desired station has been carefully tuned in, set-screw R is again tightened. Other positionable members are then adjusted, or "set," in like manner so that the pressing of the associated buttons will thereafter bring in preselected stations. If different positionable means are used, the appropriate adjustments are similarly made. Regardless of the type of lever-controlled positionable means employed, it will be obvious that the pressing of any button will cause the associated positioning means to return the shaft to the angular position that it occupied when the initial tuning operation was performed.

In the simple electrical tuner just described, it will be observed that it is never necessary to reverse the motor. In some tuners heretofore on the market, difficulty arises if the operator inadvertently presses two buttons at the same time. In this mechanism, the operating levers rest in various positions on the positionable means, according to their individual adjustments, and therefore if two solenoids are simultaneously energized, the first lever to become engaged with the shaft will complete its tuning action unless the rotation of the positioning means is stopped by force applied to the positioning means in an opposite direction by the next lever to become engaged, and in that case no harm results as nothing happens until the operator realizes his error and removes his finger from one of the buttons.

Fig. 4 is a diagrammatic representation of an automatic means for shunting the motor out of the circuit the instant any positioning lever has completed its downward movement. In this modification, the clutch 38 of Fig. 1 is replaced by clutch 51, which may be located in any suitable part of the transmission between the motor 37 of Fig. 1 and shaft Q. Members 52*a* and 52*b* are shaped like the two halves of solid cylinder or piece of shafting cut diagonally. Member 52*a* is mounted on tube 53 and attached thereto by means of screw or pin 54. Tube 53 is longitudinally movable on shaft Q3, and is locked against rotation by pin 55 in slot 56 in the tube. A spring J4, abutting against pin 55, holds member 52*a* in engagement with member 52*b* attached to shaft Q by pin or screw 57. Shaft Q3 is the driver, and may be the motor shaft itself or an auxiliary shaft driven by the motor. Shaft Q may be the shaft upon which the positioning levers are pivoted, or it may drive this shaft through a gear train or other means. As long as this shaft turns, which it will do while moving a positioning lever, the diagonal sides of members 52*a* and 52*b* will remain in contact and single pole single throw switch 58 will remain open. One side of this switch is connected to wire 44 by means of wire 44*a*, and wire 45*a* connects the other side of the switch to wire 45. When a positioning lever has moved to the position in which lever F2 is shown in Fig. 2, the station controlled by this lever is tuned in, and further movement of the lever and shaft Q is arrested. As the motor is still energized, shaft Q3 continues to rotate, and member 52*a* is forced to move longitudinally by the cam-like action of the diagonal sides of 52*a* and 52*b*. Member 52*a* then engages the insulated tappet 59 on one side of the switch and the contacts are forced together, as shown in Fig. 5, thus shorting and stopping the motor. No difficulty arises if the operator continues to hold the push-button down. The motor is no longer energized, because the clutch remains in the position shown in Fig. 5 as long as the current flows through the solenoid, keeping shaft Q locked to lever F2, which has reached the limit of its movement. The action of spring J4 on member 52*a* cannot force Q3 to turn in order to permit the clutch to close, as the gear train provides too great a load. When the push-button is released, however, spring J on the solenoid forces the lower end of plunger P out of shaft

Q. Spring J4 on the clutch then exerts sufficient pressure on member 52a to rotate member 52b and shaft Q until the clutch closes and permits the motor shunt switch to open. The mechanism is then again ready for operation when the next push-button is pressed.

Unless an electric tuner is very rapid in its operation, some sort of muting device is required. If the motor has little torque, necessitating great reduction in the gear train, a muting arrangement is advisable on the present tuner. A simple muting means is shown in Fig. 6, in which bar 48 is made of insulating material. This bar extends all the way across the device and therefore lies in the path of all the positioning levers. The bar has a pivot Q2, which may extend all the way across the tuner to permit the two ends to be attached to the end-plates, or else separate pivots may be arranged in axial alignment at the two ends. A metal contact strip 49 extends along the free edge of the muting bar, and a stud or rod 60 is so positioned on the end plates that strip 49, held against stud 60 by the action of spring J5, is just free from engagement with any positioning lever when all the levers are in their inactive positions against resilient bumper 61, which may be a rubber tube upon a rod 62. This position of the muting bar is shown in dotted lines. Each positioning lever, when a muting bar is used, has a spring J6, the other end of which is attached to a rod 63, extending from one end plate to the other, and this spring holds the lever against the bumper and out of engagement with strip 49. Upon slight downward movement, however, any positioning lever will engage this metal strip. The positioning levers themselves are formed of metal and are consequently automatically grounded to the chassis. Engagement with the contact strip will therefore mute the set if wire 50, connected to this strip, is also connected to the antenna post or to any other part of the receiver, which, if grounded, will effectively prevent the operation of the set. The muter is, of course, disconnected when the lever is drawn upward to its rest position after the tuning operation.

The muting bar of Fig. 6 may be used to operate a switch that will short the motor out of the circuit just before the tuning action is completed. The momentum of the motor and other rotating parts then turns shaft Q and the positioning lever through the few remaining degrees of its throw. As lever F2 nears its furthest downward position, the insulated portion of muting bar 48 engages tappet 59 of switch 58, pressing the contacts together. One side of the switch is connected by wire 44a to wire 44, and the other contact of the switch is connected by means of wire 45a to wire 45. Wires 44 and 45, as shown in Fig. 1, are the wires that go to the motor, and it will thus be seen that the closing of this switch shorts the circuit around the motor, permitting the solenoid to remain energized and retain the lever in connection with shaft Q until the tuning action is completed and the operator removes his finger from the switch.

If the motor and solenoids are not designed for the same voltage, separate circuits must be provided, and each push-button must close two circuits—one for the motor and another for the cooperating solenoids; but this is a simple modification of the invention that will offer no problem to those skilled in the art.

It will be obvious that other electrically actuated clutching means may be used for operatively connecting the levers with the motor-driven member.

Figs. 9 to 12 show a different embodiment of the invention from that illustrated in the previous figures. This mechanism may be used for positioning either a single tuning shaft or two independent shafts, in which latter case the shafts may be turned to different and unrelated angular positions. Should it be desired to broadcast television images and the accompanying sound on unrelated frequencies, disc C, Fig. 9, may be considered as operating a television tuner, and is mounted on hollow shaft, or bushing, 39, and rigidly held to said shaft by means of screw or pin 7 in hub 8. Hollow shaft 39 turns freely on shaft Q, connected to motor 127. Also mounted on hollow shaft 39 is split gear 28—28'. The half 28 of split-gear 28—28' is rigidly attached to shaft 39 by means of pin or screw 65 in hub 64. Meshing with gear 28—28' is another gear 26 rigidly mounted on shaft 25 of television tuner 24 by means of pin or screw 27 in the hub of said gear.

Positioning arm 35 is rigidly held on shaft Q by means of screw 10 in hub H.

Spacer 201, on shaft Q, serves to limit the longitudinal movement in one direction of hollow shaft 39 on shaft Q, and its movement in the opposite direction is arrested by collar 9, having a set-screw 202.

Also rigidly mounted on shaft Q, is bevel gear 203 having a hub 204 and a set-screw or pin 205. Gear 203 meshes with idler gear 206, which in turn meshes with bevel gear 207, rigidly mounted on hollow shaft 208 by means of screw or pin 209 in hub 210. Gear 207 is kept from meshing too tightly with bevel gear 206 by collar 211, rigidly mounted on shaft Q and abutting against hollow shaft 208 to which gear 207 is attached.

Shaft 208 transmits rotary motion to positioning arm 37 which is rigidly mounted on the other end of said shaft by means of screw 212 in hub 213.

From the mechanism thus far described, it will be evident that any rotation of shaft Q will cause positioning arms 35 and 37 to turn in opposite directions, the motion being reversed by gears 203, 206 and 207.

Turning freely on hollow shaft 208 is another hollow shaft 214 whose longitudinal movement is prevented by spacer 215 and collar 216 having a set-screw 217.

Disc A is rigidly mounted on hollow shaft 214 by means of screw 217a in hub 218. Split-gear 219—219' is also rigidly mounted on shaft 214 by means of screw 220 in hub 221.

Gear 222 meshes with gear 219—219', and is affixed to shaft 223 of sound-signal tuner 224 by means of pin 225 in hub 226.

Discs A and C each carry a plurality of solenoids and plungers, or magnets with station-selector pins, the number of which should be from six to twenty per disc. These electro-responsive station selectors are designated by the letter L, and are individually distinguished by an additional letter and numeral. These selectors L must be angularly adjustable within a few degrees about the center of the disc upon which they are mounted. The simplest way to do this, of course, would be to have them movable in arcs, but such an arrangement would subject their set-screws or other affixing means to the greatest strain when the discs are being rotated by means of a side-thrust applied to the pins or plungers Y. This strain is reduced, and other objectives served, by

making them movable along non-radial slots **227** or **228** extending from the outer part of the disc toward the center, as shown in Figs. 10 and 11. These non-radial slots should preferably be arranged so that any two adjoining ones will both cross a radial line so that a selector placed near the outer end of one slot, as is LT2 in Fig. 10, may approach very close in angular degrees to another selector located near the inner end of an adjoining slot, as indicated by the position of LT1. As this specification proceeds, it will be evident that this provision is a great convenience when using the automatic tuner for two stations that are very close on the tuning dial.

Each selector may consist of the following parts; a magnet or solenoid **229**, Figs. 9 and 10; a plunger or pin Y, Figs. 9, 10 and 11, having a head **231**, Figs. 9 and 10; a base **230**, Figs. 9 and 10, to which the solenoid or magnet is suitably attached; a bumper **232**, Figs. 9 and 10, attached to the base **230** and serving to prevent the spring **233**, Fig. 9, from forcing the plunger or pin too far from its normal inoperative position; a small clamping plate **234**, Figs. 9 and 11, located on the opposite side of the disc and having an aperture **236**, Figs. 9 and 11, to pass the pin Y; a guide **235**, Figs. 9 and 11, which passes slidably through the slot in the disc and serves to hold the base and plate together; and a set-screw **237**, Figs. 9, 10 and 11, to tighten the base and plate together firmly on the disc. For the sake of clearness in the drawing, various parts of selectors LT2, LT3, LR1 and LR2 have been omitted.

Fig. 11 shows the inner side of disc A, with the clamping plates, the magnets, of course, being located on the opposite side of the disc. It will be noted in this figure that the slots are closer to the center on disc A than on disc C. This is merely a precaution to keep protruding plunger pins on the two discs from colliding with each other.

To "set" the tuner, the sound and television stations are first tuned in by the tuning knobs **238** and **239**. The rotation of knob **238** not only operates the tuner **224**, but also turns gear **222**, gear **219—219'**, hollow shaft **214** and disc A. In like manner, the turning of knob **239** rotates disc C to an angular position that is different for each television station. While the pair of associated sound broadcasting and television stations are thus tuned in, the set screw **237** is loosened on the selector on each disc that is nearest to the position that arms **35** and **37** are in when they close together. This is the position shown in Figs. 9 and 11—the position to which the arms are rotated when shaft Q, Fig. 9, turns in the direction indicated by arrow **240**. These selectors are then electrically connected to the switch or push button that it is desired shall thereafter tune in this particular pair of stations. The total number of such station switches provided should equal the number of selectors on each disc, but only three switches, **84a**, **84b** and **84c** are shown in the figures.

In Fig. 9, selector LT1 on disc C and selector LR3 on disc A are shown connected by wires **241** and **242** to contact **85c** of switch **84c**. When this switch is actuated, the current passes from source **82**, one side of which is grounded, through wire **244**, motor **127**, wire **83**, switch **84c**, contact **85c**, and wires **242** and **241** to selectors LT1 and LR3. The other side of the circuit is grounded to the disc and the various metal parts of the apparatus, a ground connection being shown at **243** at the extreme right of the figure. This causes selectors LT1 and LR3 to push out their plungers Y1 and Y2 respectively and also starts the motor, which rotates shaft Q in the direction indicated by arrow **240**, and by means of the interconnected parts previously explained, the arms **35** and **37** are caused to turn to the position shown in the drawing, with pins or plungers Y1 and Y2 held tightly between them. While they are thus held, the set-screws **237** are tightened firmly so that selectors LT1 and LR3 will normally occupy this position with respect to the arms **35** and **37** when these stations are tuned in.

After the set-screws have been tightened, switch **84c** is released. Spring **245** connected to collar **9** by pin **246**, and having the other end connected to a stationary pin **247**, then rotates shaft Q in the direction indicated by the arrow on gear **203**. This turns arm **35** in the same direction, and by means of the gears, turning in the direction indicated by the arrows, causes arm **37** to turn in an opposite direction to that of arm **35**. They are prevented from making more than a half revolution by detent **248** on gear **207**, which strikes against stopper **249** in the position of **248** shown in dotted lines. The inactive position of arms **35** and **37** is shown in dotted lines in Figs. 9 and 11.

When a pair of selectors have been set in the manner described, it will be evident that regardless of the angular position that discs A and C may occupy, the discs will be returned to the position in which they were set by merely closing the proper switch, thus causing the plunger pins to be ejected and turned with the discs until the pins are firmly held in place by the closing together of arms **35** and **37**.

Other selectors are similarly set for other paired stations and connected to other switches so that each switch will control a pair of stations.

Each of the split gears mentioned in connection with Fig. 9 make it possible to avoid play between said gear and the meshing-gear, as the teeth on the two halves of the split gear are positioned by a spring so that they either spread between the teeth of the meshing gear or else each meshing tooth of the latter gear is tightly held between teeth on both halves of the split gear. In the figure, gear **28** is provided with a tightly fitting or integral pin **250** which projects through a hole **251** in gear **28'**, this hole being larger than the diameter of the pin. Gear **28'**, held against gear **28** by collar **254**, has a pin **252** projecting from the same side of said gear as the end of pin **250** that protrudes through hole **251**. A spring **253** draws these pins together, pulling the gears in opposite directions and causing teeth of gear **28** and the teeth of gear **28'** to take up any play that would otherwise exist between these teeth and those of gear **26**. The other split-gear **219—219'** is similarly equipped.

For simplicity in the drawings, motor **127** is shown connected directly to shaft Q, but in practice it is usually best to have intervening gears, or pulleys and belts, so that the motor may make several revolutions for each half revolution of shaft Q. Inasmuch as shaft Q turns only 180 degrees, it is possible to use other electrical means than a motor to drive it.

Fig. 12 shows a modification in which the slots in the discs are radial and the arms **35** and **37** non-radial. It will readily be seen that the movement of a selector along a slot will cause it to occupy a different angular position when its pin Y is grasped between the arms **35** and **37**, and

that this modification accomplishes the same purposes as the arrangements shown in Figs. 10 and 11.

Still other modifications may be made from the automatic tuning devices herein described without departing from the general nature and scope of the invention as set forth in the appended claims.

My claims are:

1. In a radio tuning mechanism, a combination including: a rotatable control shaft; a positionable element adjustably mounted on said shaft; a positioning device arranged to engage said element upon movement toward said shaft; optionally operable means for moving a part of said device from a rest position to a second position, said means comprising a push button for optionally operating the same; and power-driven means responsive to the operation of said push button for engaging said part and causing said device to engage and move said element and rotate said shaft to an angular position determined by the adjustment of said element thereon.

2. In a mechanism for angularly positioning a control element, a combination including: a rotatable positionable member; a rotatable shaft; a plurality of positioning means normally free to turn on said shaft, each of said positioning means adapted to transmit rotary motion to said member; a motor; means for transmitting motion from said motor to said shaft; a plurality of electrically operable means each adapted to lock one of said positioning means to said shaft; and a plurality of selectively operable switches each adapted to energize the motor and one of said electrically operable locking means.

3. In a radio tuning mechanism, a combination including: a positionable tuning control; a plurality of manually operable selectors; a plurality of motion-transmitting members each individual to one of said selectors and each comprising an engageable portion that moves, in response to the operation of said selector, from a rest position to an engageable position; a plurality of adjustable devices each operatively interposed between one of said members and said control; a power-driven rotatable engaging means acting in response to the operation of any of said selectors to engage the engageable portion of said selector's associated member when said portion is in said engageable position and thereby move said control to a position determined by the adjustment of the associated device; and resilient means for returning the motion-transmitting members to a rest position.

4. In a radio tuning mechanism, a combination including: a positionable tuning control; a plurality of motion-transmitting members; a plurality of adjustable devices each operatively interposed between one of said members and said control; a plurality of means each individual to one of said members for moving said members from a rest position to a second position, each of said latter means comprising a manual for effecting the operation of the same; and rotatable means responsive to the operation of any of the manuals and common to all of said members for engaging any of said motion-transmitting members in said second position and moving said control through the medium of the engaged member to a position predetermined by the adjustment of the adjustable device interposed between said engaged member and the control.

L. J. LEISHMAN.