

May 2, 1939.

L. F. CURTIS ET AL

2,156,679

TUNING MECHANISM FOR RADIO APPARATUS

Filed July 24, 1937

6 Sheets-Sheet 1

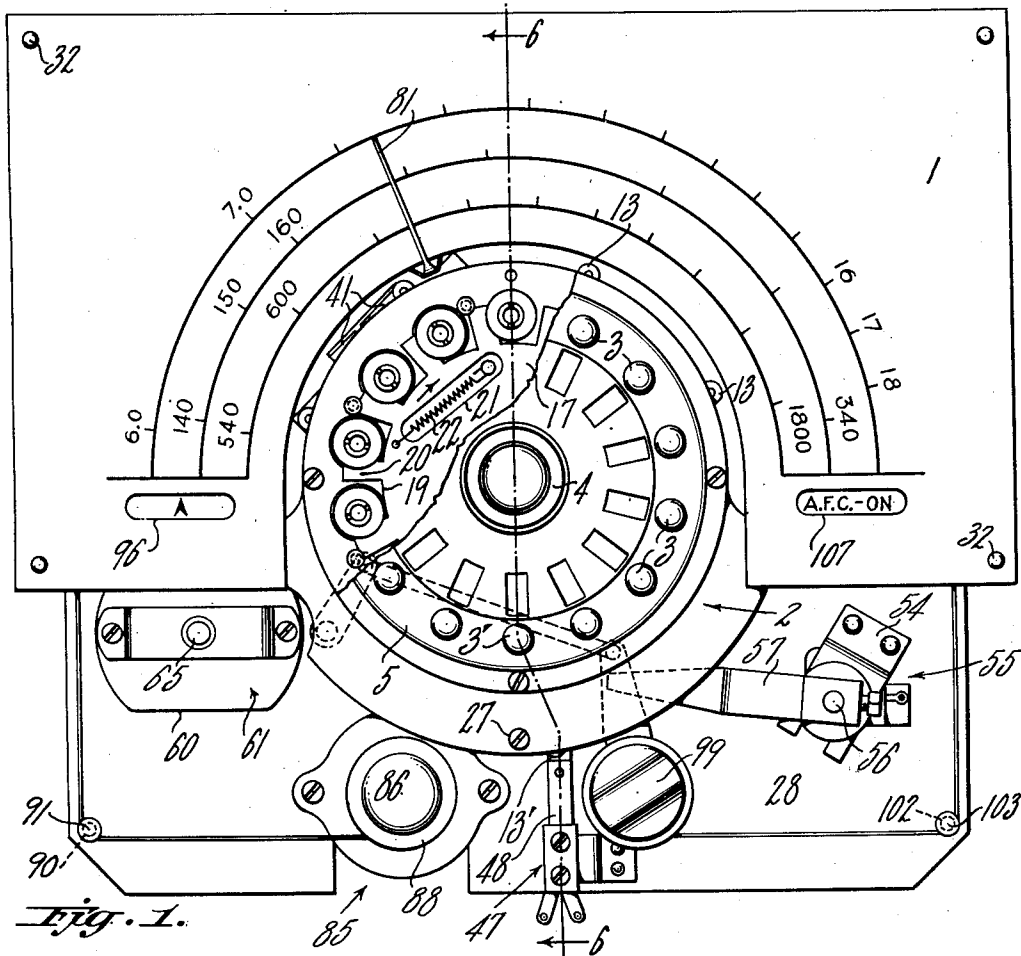


Fig. 1.

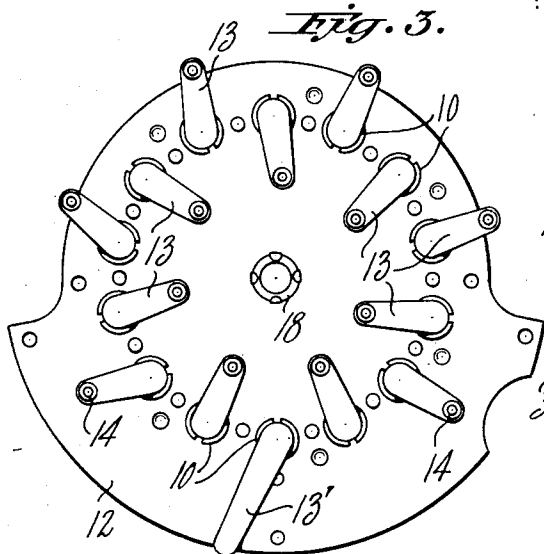


Fig. 3.

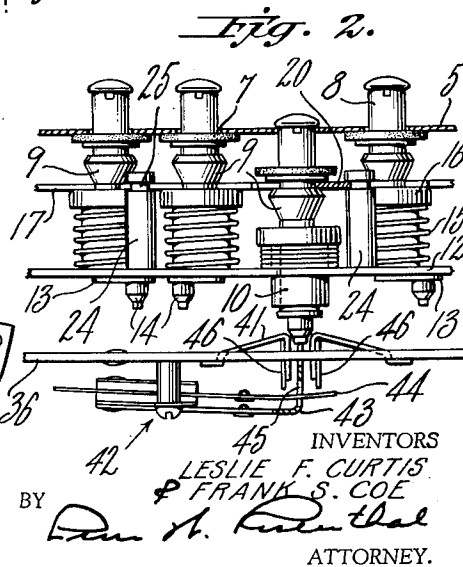


Fig. 2.

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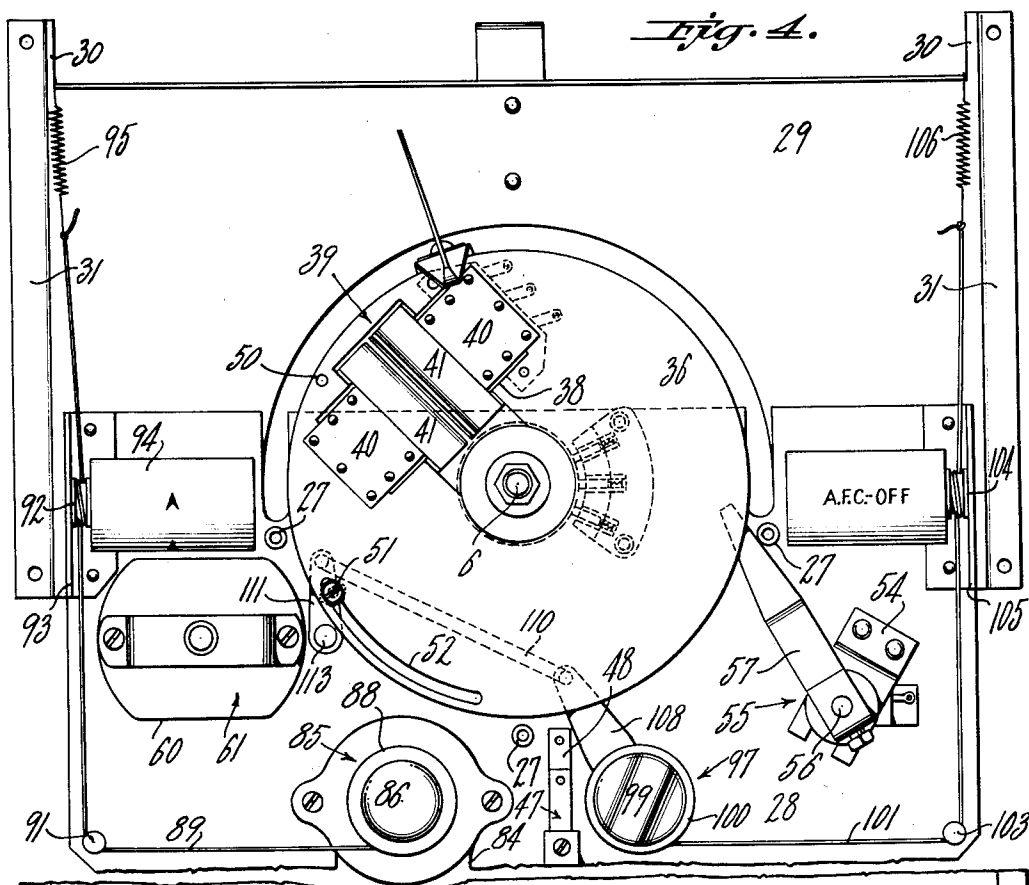
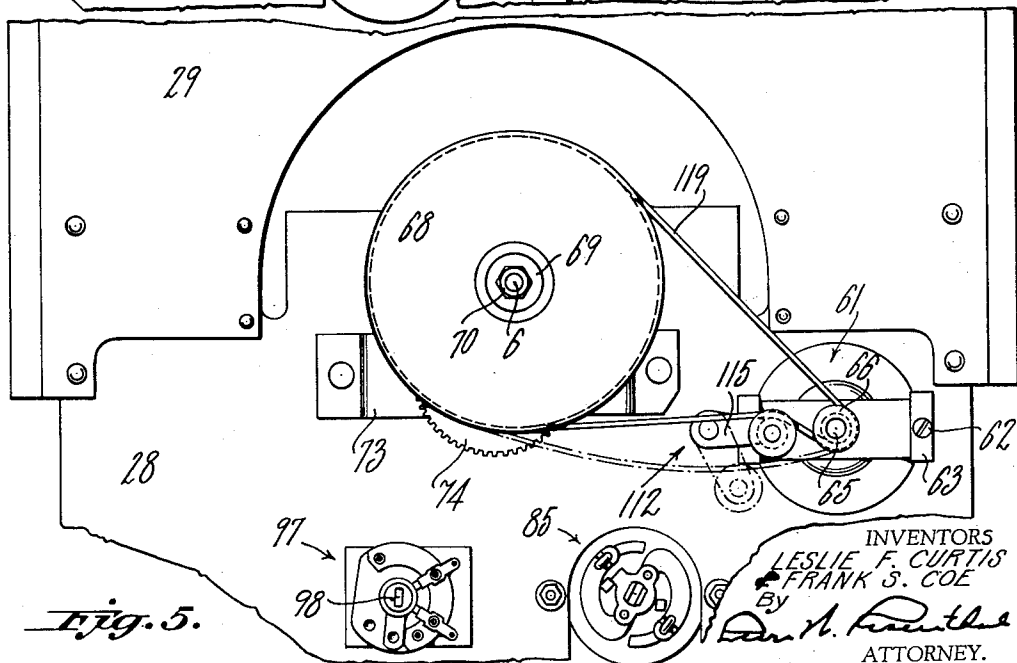
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6 Sheets-Sheet 2



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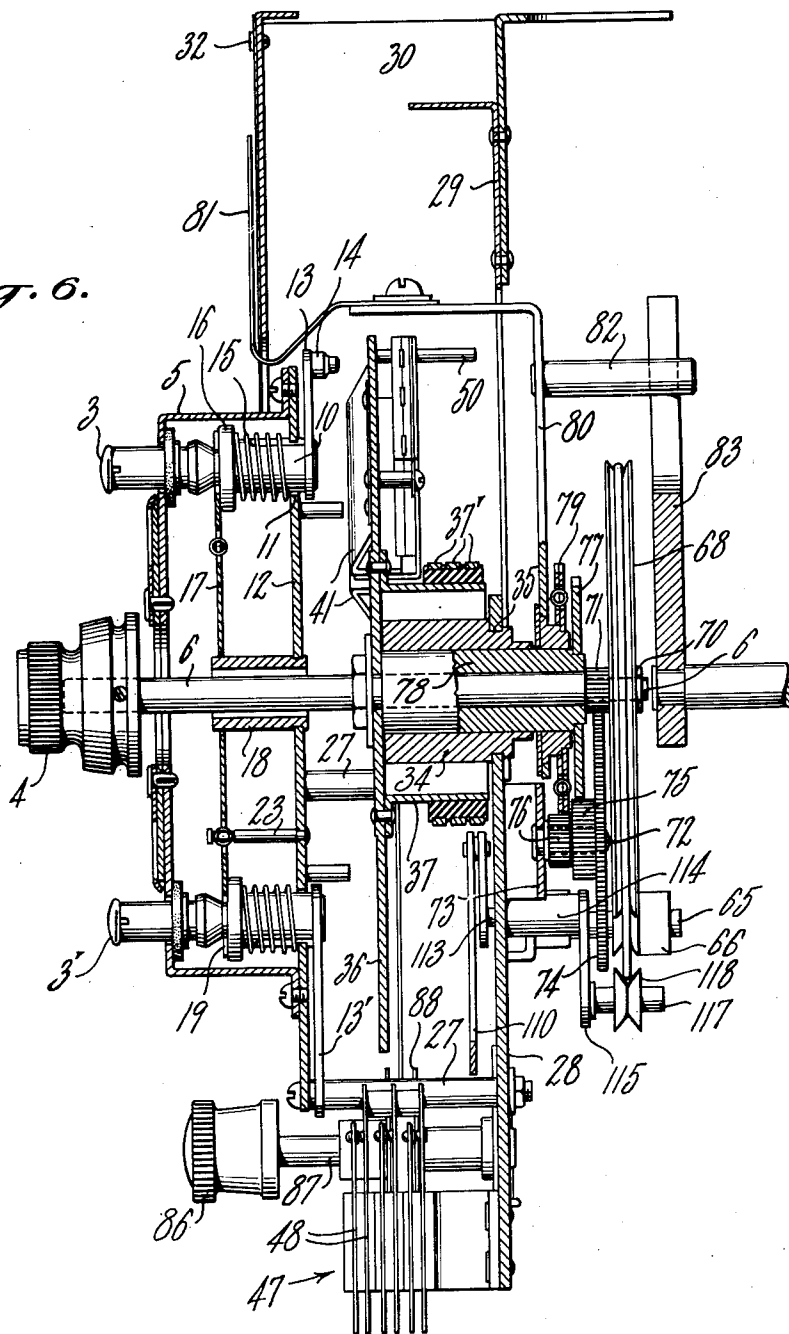
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TUNING MECHANISM FOR RADIO APPARATUS

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6 Sheets-Sheet 3

Fig. 6.



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TUNING MECHANISM FOR RADIO APPARATUS

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6 Sheets-Sheet 4

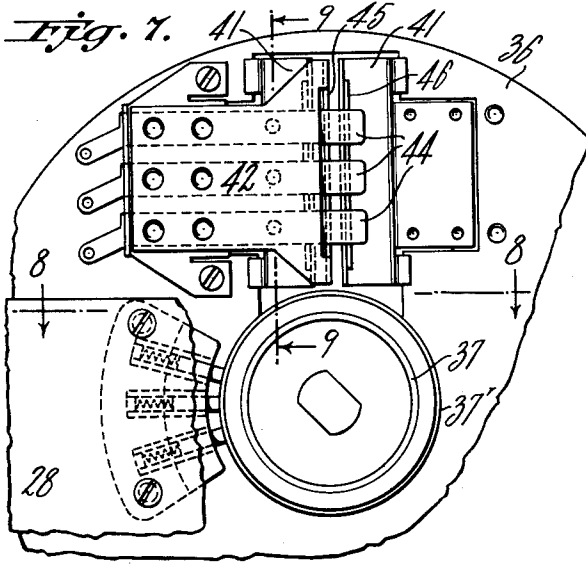
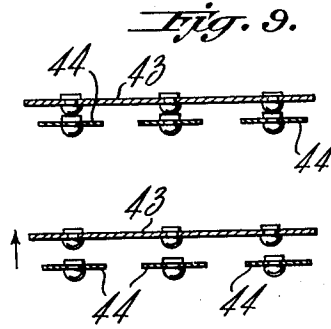
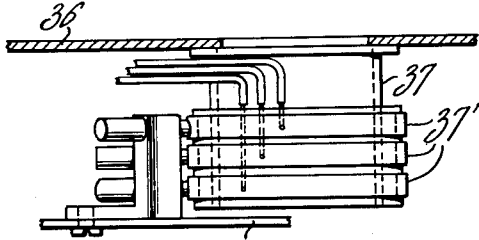
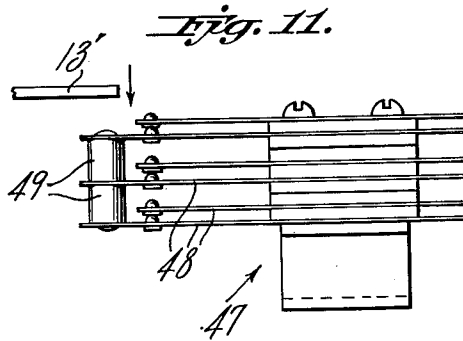
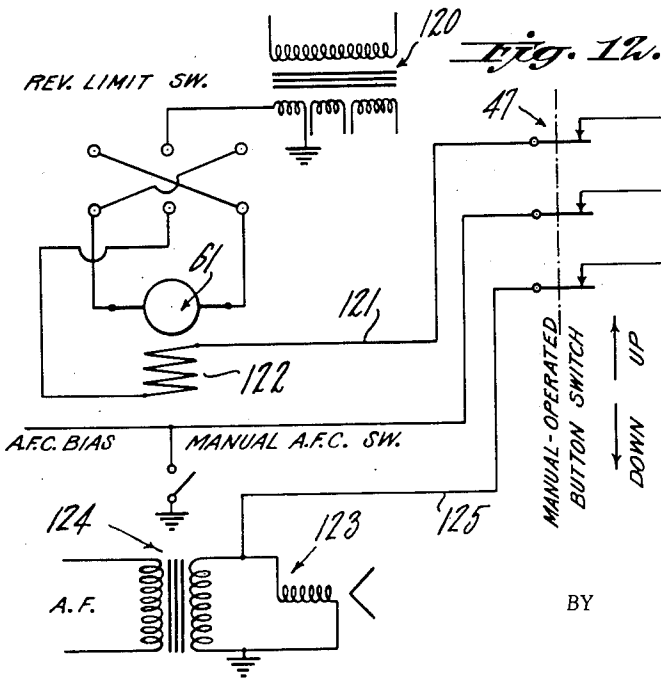


Fig. 10.



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2,156,679

TUNING MECHANISM FOR RADIO APPARATUS

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6 Sheets-Sheet 5

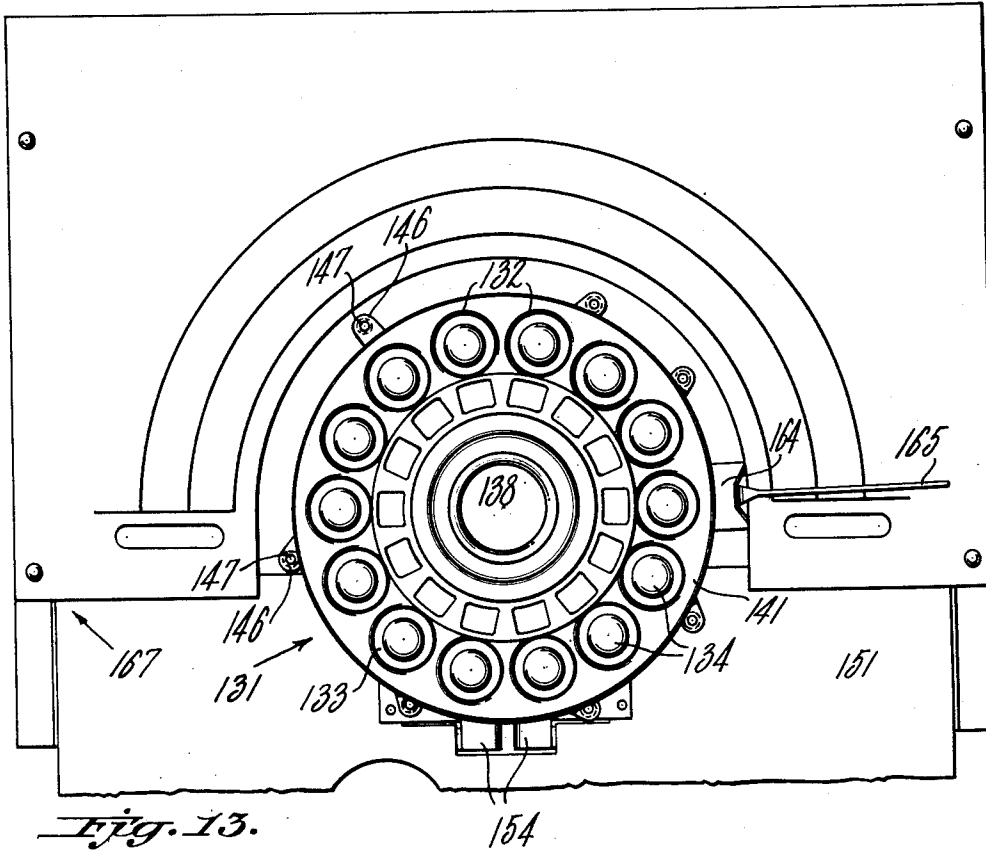


Fig. 13.

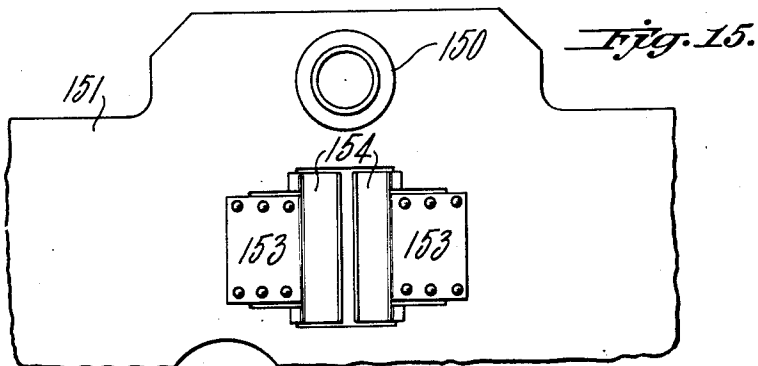


Fig. 15.

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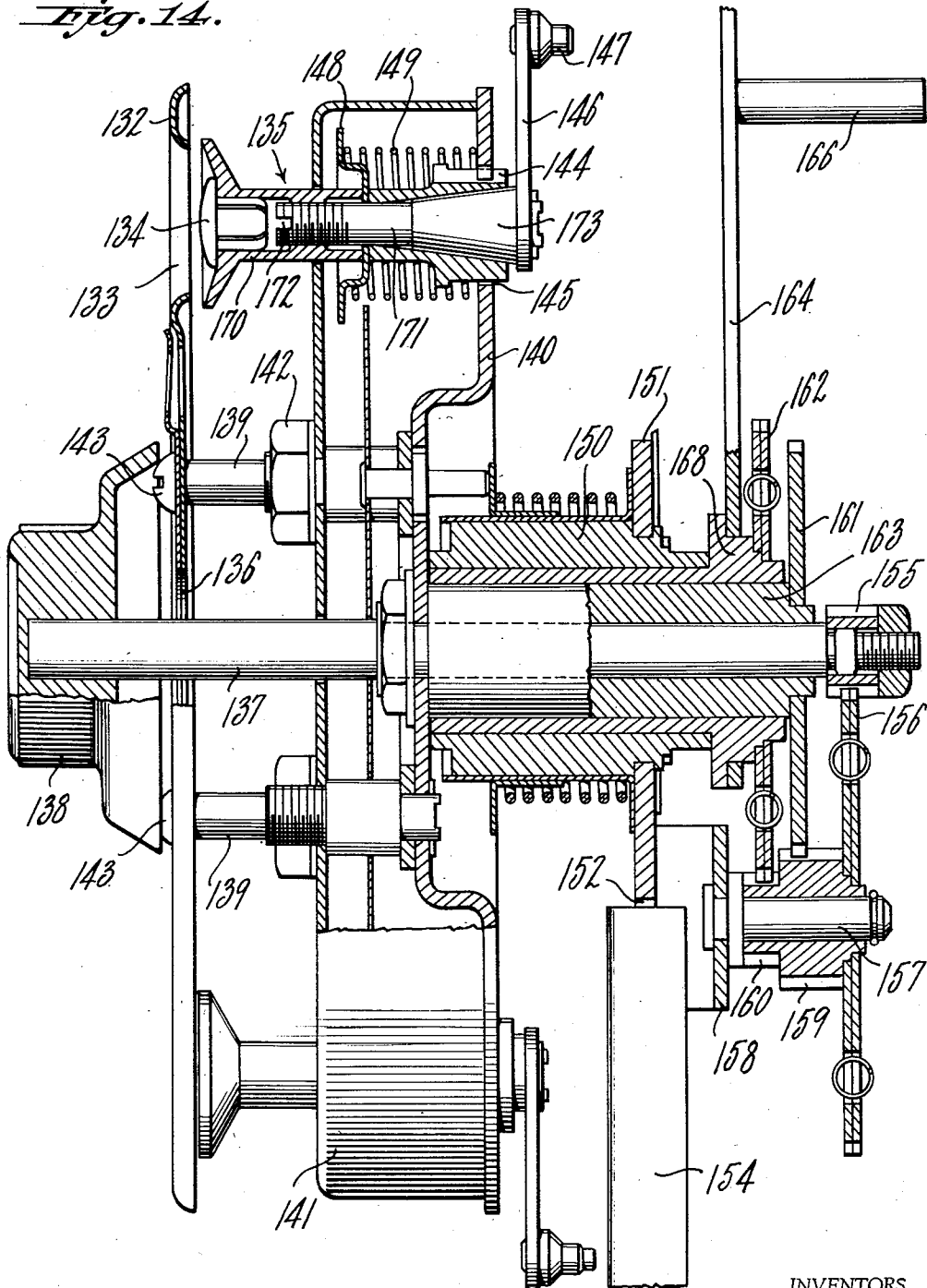
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TUNING MECHANISM FOR RADIO APPARATUS

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6 Sheets-Sheet 6

Fig. 14.



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UNITED STATES PATENT OFFICE

2,156,679

TUNING MECHANISM FOR RADIO APPARATUS

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Application July 24, 1937, Serial No. 155,388

4 Claims. (Cl. 250—40)

This invention relates to improvements in radio tuning devices of the automatic type which may be either manually or electrically operated.

It is among the objects of this invention to provide a tuning device in which certain selected stations may be tuned in by merely pressing a button or by pressure upon such a button combined with a movement of the dial mechanism.

It is a further object of this invention to combine such an automatic tuning mechanism with means permitting manual tuning in a conventional manner when so desired and for also combining such mechanism with means for controlling automatic frequency control circuits which will insure the accuracy of the tuning in either case, and furthermore with means for muting the loud speaker during tuning operations.

A further object of the invention is to provide simplified mechanism for selecting one of a plurality of stations, and for releasing the control of any previously selected station, when the button controlling some other station is depressed.

The invention resides in the novel construction, combination and arrangement of parts as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiments of the herein disclosed invention may be made as come within the scope of the claims.

The above and other objects and features of the invention will be more fully set forth in the following description taken in conjunction with embodiments of the invention which will enable those skilled in the art to apply the same to either motor driven or manually driven automatic tuners.

In the drawings, Fig. 1 is a front elevation of a motor driven automatic tuning device embodying the invention with parts broken away to show internal structure; Fig. 2 is a detail of the control unit; Fig. 3 is a bottom plan view of the control unit; Fig. 4 is a plan view of the device shown in Fig. 1 with the panel scale of the station selector unit removed; Fig. 5 is a bottom plan view of the device shown in Fig. 1; Fig. 6 shows, on an enlarged scale, a section taken on the line 6—6 of Fig. 1, with parts in side elevation; Fig. 7 is a detail showing the electrical connections between a gate switch and the slip rings and brushes for effecting an electrical connection therewith; Fig. 8 is a detail of the slip rings and brushes; Fig. 9 is a detail showing a motor switch in closed position; Fig. 10 is a detail showing the same switch in open position; Fig. 11 is a detail of a manual control switch; Fig. 12 is a wiring diagram of the tuning mechanism shown in Fig. 1; Fig. 13 is a front elevation of a manually driven automatic tuning device embodying the invention; Fig. 14 shows, on an enlarged scale, a vertical axial section with parts in side elevation,

of the device shown in Fig. 13; and Fig. 15 is a detail of the latch plate of the device shown in Fig. 13.

Referring to the drawings, reference numeral 1 indicates a panel having a plurality of semi-circular scales for different frequency bands. A circular selective station control unit 2 is disposed within and partially surrounded by the semi-circular panel 1 and comprises a plurality of push buttons 3 circularly disposed about a central tuning knob 4. The push buttons 3 project through a cover 5 having a central opening for the tuning shaft 6, and also having circumferential openings 7 through which the push rods 8 project. The rods 8 are provided with cam surfaces 9 intermediate their ends and grooved guide members 10 on the lower ends thereof mounted for reciprocative but not rotative movement through openings 11 in a back plate 12 of the control unit. Stop member levers 13 carrying stop members 14 are affixed to the extreme ends of the rods 8 below the guide members 10. Springs 15, acting at one end upon collars 16 affixed to the rods 8 at a point below the cams 9, act against the back plate 12 to maintain the rods 8 in an outward position while the levers 13 prevent the guide members 10 from passing outwardly through the openings 11 in the back plate 12.

A latch plate 17 is mounted upon and maintained in spaced parallel relation to the back plate 12 by means of a central spacer bushing 18. The latch plate 17 is provided with cut away portions 19 leaving radially projecting fingers 20. Slots 21, only one of which appears in Fig. 1, cut through the latch plate 17 near its outer circumference, and accommodate springs 22 attached at one end to the latch plate and at their opposite ends to spring studs 23 projecting outwardly from the back plate 12 through the slots 21. The springs 22 tend to rotate the latch plate upon the bushing 18 in the direction of the arrow and maintain the fingers 20 against the button rods 8 which project through the cut away portions 19, the contact of the fingers with the rods being made at points adjacent the cam surfaces 9. A plurality of guide studs 24 projecting outwardly from the back plate 12 are provided with grooves 25 near their outer ends. The guide studs are so positioned relative to the outer ends of the latch fingers 20 that the latch plate is held rigidly against lateral motion relative to the back plate 12 but permitted an angular motion relatively thereto. The station selector control unit above described is supported by a plurality of studs 27 projecting perpendicularly from a base plate 28 which is riveted to a bracket member 29 having upturned side portions 30 with outwardly extending flanges 31 to which the scale panel 1 is attached by means of button clips 32.

The tuning shaft 6 projects through the spacer bushing 18 and through a second spacing bushing 34 supported in an opening 35 in the base plate 28. A disk 36 coaxial with and rotatably mounted 5 relatively to the tuning shaft 6 lies immediately behind and spaced from the back plate 12 of the control unit. A collar 37 attached to and projecting rearwardly from disk 36 supports slip rings 37' suitably insulated therefrom for effecting certain electrical connections hereinafter more 10 particularly described. The disk 36 is provided with a large cruciform opening 38 through which a gate switch 39 projects. The gate switch 39 comprises a pair of flat springs 40, each of which 15 are riveted at one end to the disk 36 and their free ends are riveted to latch members 41, each of which has a portion projecting outwardly through the opening 38 and providing surfaces slightly inclined to the plane of the disk 36. Attached 20 to the back face of this disk, at a point adjacent the opening 38, is a switch 42 having an outwardly extending portion 43 which projects between the members 41. Contact members 44 project through an opening 45 in the upwardly extending portion 43 and rest upon insulating strips 46 25 riveted to the end of downwardly projecting portions of the members 41. Each of the stops 14 on the levers 13 are adapted upon depression thereof to enter the gap between the two latch members 41 and contact the upwardly projecting portion 43 of the switch 42. The lever indicated at 13' however carries no stop member 14 but merely projects a sufficient distance to overlies a stationary switch 47, the details of which may 30 be seen in Fig. 11. This switch comprises a plurality of spaced metallic strips 48 carrying suitable contact points with alternate strips projecting somewhat beyond the others and the projecting ends rigidly connected through insulating 40 members 49. The projecting portion of the switch lies in the path of lever 13' and is contacted by the downward motion thereof.

The disk 36 carries a stud 50 rigidly attached thereto and projecting rearwardly therefrom and 45 a second stud 51 angularly spaced from the stud 50 and adjustable circumferentially of the disk 36 in a circumferential slot 52. An angle bracket 54 is riveted to the base plate 28 and carries a reversing switch 55, a shaft 56 of which carries 50 a lever 57 rigidly held thereto by means of a set screw 58. The lever 57 has its free end bent inwardly and extended beneath the disk 36 in a position to be contacted by the projecting studs 50 and 51.

An opening 60 is provided in the base plate 28 and a driving motor 61 is mounted to project therethrough, being held in position by tie rods 62 which extend through clamping yokes 63 on the rear face of the plate 28. The shaft 65 of the 60 motor projects rearwardly of the plate 28 and carries a pulley wheel 66. The tuning shaft 6 carries a pulley 68 rigidly secured to the end thereof which projects rearwardly of the plate 28 by means of washer 69 and lock nut 70. A small 65 pinion 71 is positioned upon the tuning shaft adjacent the pulley 68 and is rigidly secured thereto for rotation therewith. An idler shaft 72 is mounted on a bracket 73 riveted to the back face of the plate 28 and the shaft carries a large gear 70 74 meshing with the pinion 71. A large pinion 75 and a small pinion 76 are mounted on the idler shaft 72 for rotation with the gear 74. The large pinion 75 meshes with a gear 77 coaxial with but mounted for relative rotation to the tuning shaft 75 6. The gear 77 is coupled with the disk 36 by

means of a sleeve 73. The smaller pinion 76 on the idler shaft meshes with a gear 78 larger than the gear 77 but mounted coaxial therewith and for rotation relative thereto. A pointer arm 80 carrying a pointer 81 is rigidly connected with the gear 79. The pinions 75 and 76 and the gears 77 and 79 are of such relative sizes that the angular rotation of the disk 36 is twice as great but in the same direction as the angular rotation of the pointer arm 80. A stud 82 projecting rearwardly 10 from the pointer arm 80 is adapted to cooperate with a forked arm 83 for actuating the shaft of a tuning condenser gang not shown.

The plate 28 is provided with a cut out portion 84 to accommodate a three way switch 85 for the wave band selector circuits. The switch may be manually actuated by means of a knob 86 upon shaft 87. Intermediate the ends of the shaft 87 15 is a pulley 88 having one end of a cord 89 attached thereto. The cord 89 is suitably guided through a groove 90 in a stud 91 and is wrapped about a spool 92 supported from the plate 28 on a bracket 93. The spool 92 carries a suitable band indicator 94. The free end of the cord 89 is attached to one end of a spring 95, the opposite end 20 of which is hooked to the bracket 29. The band indicator is visible through an oblong slit 96 in the panel 1 and markings thereon register with one end of the panel scales in accordance with the setting of the band indicator switch. 30

An automatic frequency control switch 97 also is provided on the back face of the plate 28, and an actuating shaft 98 extends through a suitable opening in the plate and is provided with a knob 99 on the opposite end thereof. A pulley 100 35 intermediate the ends of the shaft 98 is attached to one end of a cord 101 which cord is suitably guided in a groove 102 on a stud 103. The cord is thence wrapped about a spool 104 supported by a bracket 105 and the free end of the cord 40 is attached to one end of a tension spring 106, the opposite end of which is hooked to the bracket 29. The spool 104 carries an "on" and "off" indicator visible through an oblong opening 107 in the panel 1 to indicate to the operator whether the automatic frequency control switch is on or off. 45 Below the pulley 100 on the shaft 98 is a lever 108 rigidly fixed to the shaft 98. The opposite end of the lever 108 is pivotally connected to a connecting rod 110, which extends to an arm 111 of a bell crank 112. The shaft 113 of the bell crank 112 is journaled in bushing 114 which extends through an opening in the plate 28 positioned near the motor 61. A second arm 115 of the bell 50 crank 112 is connected to the shaft 113 and the free end of the arm 115 carries a stud 117 upon which a tension pulley 118 is rotatably mounted in the plane of the motor pulley 66. The arrangement of these parts is such that the belt 119 between the motor pulley 66 and the tuning shaft 60 pulley 68 is under no tension when the automatic frequency control switch is in "off" position. Thus when this switch is off, the tension pulley will be in the position shown in dotted lines in Fig. 5, but when the automatic frequency control 65 switch is on, the tension pulley 118 is in the position shown in full lines in this figure and the motor is effective to drive the tuning shaft pulley 68 and the motor cannot drive the tuning shaft pulley when the automatic frequency control switch is in "off" position. 70

In the operation of the form above described, when one of the push buttons 3, but not the one marked 3', is depressed, the switch 39 which controls the motor 61 is closed and if the automatic 75

frequency control switch is in "on position" as above described the motor drives the pulley 68 on the tuning shaft at a slow speed relative to that of the motor. This motion is directly transmitted to the tuning shaft 6 to which the pulley 68 is directly connected and the motion is also transmitted at a greatly reduced speed through the pinion 71 on the tuning shaft and the gear 74 on the idler shaft to the two gears 77 and 79 by means of pinions 75 and 76. The ratio of these gears is such that the large pinion 75 drives the smaller gear 77 at twice the speed which the small pinion 76 drives the large gear 79. Thus the pointer arm 80 which rotates with the large gear 79 moves the pointer 81 through an arc of 180 degrees while the disk 36 is moved through an arc of 360 degrees by the sleeve 78 connected with the small gear 77. The gate switch 39 is thus moved through the necessary arc up to 360 degrees required for the stop 14 of whichever of the push rods that has been depressed to slip into the gate switch 39 in which position the motor circuit will again be opened and the disk 36 locked in the stop position. One of the fingers 20 of the latch plate 17 having been locked in a groove above the cam surface 9, the removal of pressure upon the button 3 does not release the button and the gate remains locked at the station indicated. If the selected station happens to lie at the left of the pointer 81 when the station has been selected by the depression of its corresponding button, the disk 36 carrying the gate switch 39 may be rotated to the right by motor 61. However, after rotation of the disk to the right to the limit permitted by the pointer arm 80 coming to the extreme end of the dial, one of the studs 50 or 51 will trip the reverse switch 55 to reverse the motor causing the same to rotate the disk 36 to the left, thus insuring that the gate switch will, during the course of its rotation in this direction pass under the depressed stop member permitting the same to be locked in the desired position without action upon the part of the operator other than the original depression of the desired button. The tuning arm is thus stopped at a point very close to the correct position and the automatic frequency control circuit which is necessarily on at this time insures tuning accuracy. The depression of any of the other buttons causes the latch plate 17 to be rotated slightly by the corresponding cam surface in a direction opposite to that in which it is biased by the springs 22. The rotation in this direction thus removes one of the fingers 20 from any of the depressions in the push rods 8 with which it might have been engaged and as the cam 9 of any newly depressed rod forces the latch plate to the left the previously depressed rod will be released. Immediately thereafter as a finger 20 of the latch plate 17 rides over the cam surface 9 and sinks into the depression the newly depressed rod will be latched in the depressed position.

If the push button 3' is depressed any previously depressed button is released by the action of the associated cam 9 upon the latch plate 17 as described in connection with the operation of the buttons 3. However, the motor does not begin to rotate because the lever 13' associated with button 3' immediately contacts the projecting portion of the switch 47 to open the motor circuit. The button 3', therefore, corresponds to no call station but acts as a release of the automatic control so that the set may then be tuned manually by rotation of the tuning shaft through

the knob 4. In practice the button 3' is colored differently from the other push buttons.

The electrical circuits associated with the above mentioned parts are shown in Fig. 12, in which it will be seen that current supplied from a transformer 120 flows by way of the reversing switch to the motor 61. A field circuit 121 which includes a field coil 122 of the motor leads by way of one of the sets of contacts of switch 47 and thence through one of the sets of contacts of switch 42 to the ground. An A. F. C. bias circuit also leads to a second set of contacts of the stationary switch 47 and thence through a second set of contacts of the switch 42 to the ground. The loud speaker circuit, indicated at 123 and supplied with audio frequency current by transformer 124, is provided with a lead 125 which connects to a third pair of contacts of switch 47 and thence to a third set of contacts of switch 42. From this it will be seen that when switch 47 is closed, lever 13' being out of contact with the projecting ends of the strips 48, the motor circuit will be closed and the disk bearing the gate switch will be rotated until the stop member 14 of any depressed lever enters the gate switch to open the three circuits described. Should the lever 13' be in depressed position, all three of the sets of contacts of the three circuits described will be opened. The manually adjustable A. F. C. switch may, however, be closed if desired.

Referring to Figs. 13-15 it will be observed that this modified form of the device is provided with a front panel and scale similar in construction to that of the form previously described and the structure is in general similar except that the motor drive being eliminated the construction is modified in certain respects to facilitate the manual actuation of the selective control unit. In this instance the control unit indicated at 131 comprises a cover member 132 having a plurality of openings 133 arranged at closely spaced intervals near the outer circumference thereof and through which buttons 134 of push rods 135 may be actuated. The cover 132 is provided with a central opening 136 through which a tuning shaft 137 carrying the knob 138 projects. The cover is supported by tie rods 139 which extend from a back plate 140 through a casing 141 which is rigidly secured to the back plate by means of nuts 142 upon the tie rods 139. The tie rods project outwardly for a sufficient distance to provide a support for the cover 132 which maintains it in spaced relation to the casing 141, screws 143 being provided for securing the cover 132 to the outer ends of the tie rods.

The push rods 135 are provided at their outer ends with grooved guides 144 mounted for reciprocal but non-rotative motion through openings 145 in the back plate 140. At their outer ends, immediately beyond the guide members 144, push rods carry levers 146 having stop members 147 on the outer ends thereof. The push rods are provided with collars 148 on the intermediate portion thereof and springs 149 acting at one end against the collars 148 and at the opposite end upon the back plate 140 maintain the push rods in a normally outward position with the levers 146 pressed against the rear of the back plate 140. The entire control unit is rotatably mounted as a body upon a collar 150 rigidly secured to a base plate 151 which collar maintains the unit in spaced relation from but relatively movable to said base plate. The base plate 151 is provided with a cruciform opening 152, and leaf springs 153 having ends rigidly attached to

the base plate adjacent the opening 152 are riveted at their opposite ends to latch members 154 which project upwardly through the opening 152 to provide oppositely disposed surfaces extending angularly relative to the surface of the base plate 151.

The tuning shaft 137 projects rearwardly of the base plate 151 and carries on its outer end a pinion 155. This pinion meshes with a gear 156 which is mounted upon an idler shaft 157 carried by a bracket 158 supported from the base plate 151. The idler shaft carries a relatively large pinion 159 and a smaller pinion 160 which rotate with the idler gear 156 and which mesh respectively with a small gear 161 and a large gear 162 which are mounted concentric with the tuning shaft for relative motion thereto and for relative motion with each other. The small gear 161 is rigidly connected with a sleeve 163 which projects through the collar 150 and is rigidly connected at its opposite end with the control unit 131. The larger gear 162 is connected to a sleeve 168 rotatably mounted upon sleeve 163 within the collar 150 and a pointer arm 164 which carries a dial pointer 165 and a stud 166 for actuating an arm upon a shaft of a variable condenser in a manner similar to that described in connection with the form previously discussed is mounted upon the sleeve 168 for rotation therewith. The base plate 151 is riveted to a bracket 167 which provides a panel support in the manner noted in connection with the previously described modification.

In each of the forms above described, and as more particularly shown in Fig. 14, the push rods 135 are of two part construction to permit the angular adjustment of the stop levers 146. Referring to this figure the outer portion of the push rod 135 consists of a sleeve 170, one end of which accommodates the snap button 134 and the opposite end of which receives a stem 171 which is externally screw threaded to correspond with internal screw threads within the sleeve. A groove 172 is provided in the outer end of the stem 171 and the opposite end of the stem is provided with a conical portion 173 which conforms to an internal surface of the guide member 144 so that upon removal of the snap button 134 a screw driver may be inserted within the sleeve 170 to rotate the stem 171 and thus adjust the angular position of the lever 146. The position of the stop member 147 may thus be adjusted to any dial position between that of its corresponding push button and that of the next preceding or succeeding push button. Since each of the levers 146 may thus be adjusted any point on the dial may be selected by the use of the push button corresponding approximately to the desired position and the adjustment of the corresponding lever 146 to the exact position.

The operation of the form shown in Figs. 13-15 is in general similar to the operation of the form previously described, except that upon depression of one of the buttons 34 the operator must rotate the control unit 131 until the stop member 147 of the depressed button enters the gap between the two latch members 154 which holds the control unit from further rotation. The gearing between the control unit and the pointer arm 164 is such that as the operator rotates the control unit through an arc of 360 degrees the pointer is moved through an arc of 180 degrees. Thus any point on the dial corresponding to any de-

sired station is within the range of adjustability of one or more of the stop members 147. In this form it will be observed that no switch mechanism need be associated with the latch members 154, the depression of the stop member merely acting to position the dial pointer at a predetermined point upon the dial.

Having thus described the invention, what is claimed is:

1. In an automatic tuning device for radio receivers, a central shaft, a plurality of push-rods disposed about said tuning shaft, stop members associated with said push rods, and a pair of spring pressed latch members having adjacent portions spaced to form a slot extending radially of said tuning shaft, said push rods and said latch members being relatively movable, and a switch member projecting into said slot for actuation by said stop members.
2. In an automatic tuning device for radio receivers; a tuning shaft; and a selective station control unit comprising a plurality of push rods, stop members associated with said push rods, adjustable angularly about the axis thereof from the front of said tuning device, a gate mechanism including a pair of oppositely disposed spring pressed latch members, a switch member positioned between said latch members for actuation by said stop members, said control unit and said mechanism being mounted for relative motion, means transmitting said motion to said tuning shaft and means effective upon the depression of a selected push rod whereby the associated stop member is held between said latch members to prevent further relative motion at a predetermined position of said tuning shaft.
3. In an automatic tuning device for radio receivers, a tuning shaft, an electric motor, a belt for transmitting motion from the motor to said tuning shaft, a tension pulley movable to apply tension to said belt, means for stopping said motor at one of a plurality of predetermined positions of said tuning shaft, an automatic frequency control switch, and means associated with said automatic frequency control switch for moving said tension pulley to remove the tension upon said belt to prevent operation of said tuning shaft by said motor when said automatic frequency control switch is in "off" position.
4. In an automatic tuning device for radio receivers, a tuning shaft, a selective station control unit comprising a plurality of push rods disposed about said tuning shaft and mounted for longitudinal movement, springs biasing said rods toward outward position, stop members connected to the inner ends of said rods, cams on the intermediate portions of said rods, a circular latch plate having a central opening through which said tuning shaft projects, fingers projecting radially of said latch plate, and extending adjacent said cams and resilient means biasing said fingers toward said rods, said cams being so shaped that depression of one of said rods first causes oscillation of said latch plate in one direction against the action of said resilient means to remove said fingers from contact with any previously depressed rod and to subsequently be returned by said resilient means into a depressed portion of said cam to lock said rod in depressed position.

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