April 16, 1940. C. O. NELSON 2,197,312

AUTOMATIC BROADCASTING STATION SELECTOR AND VOLUME CONTROL

Filed Oct. 28, 1938 4 Sheets-Sheet 1

Fig. 1.

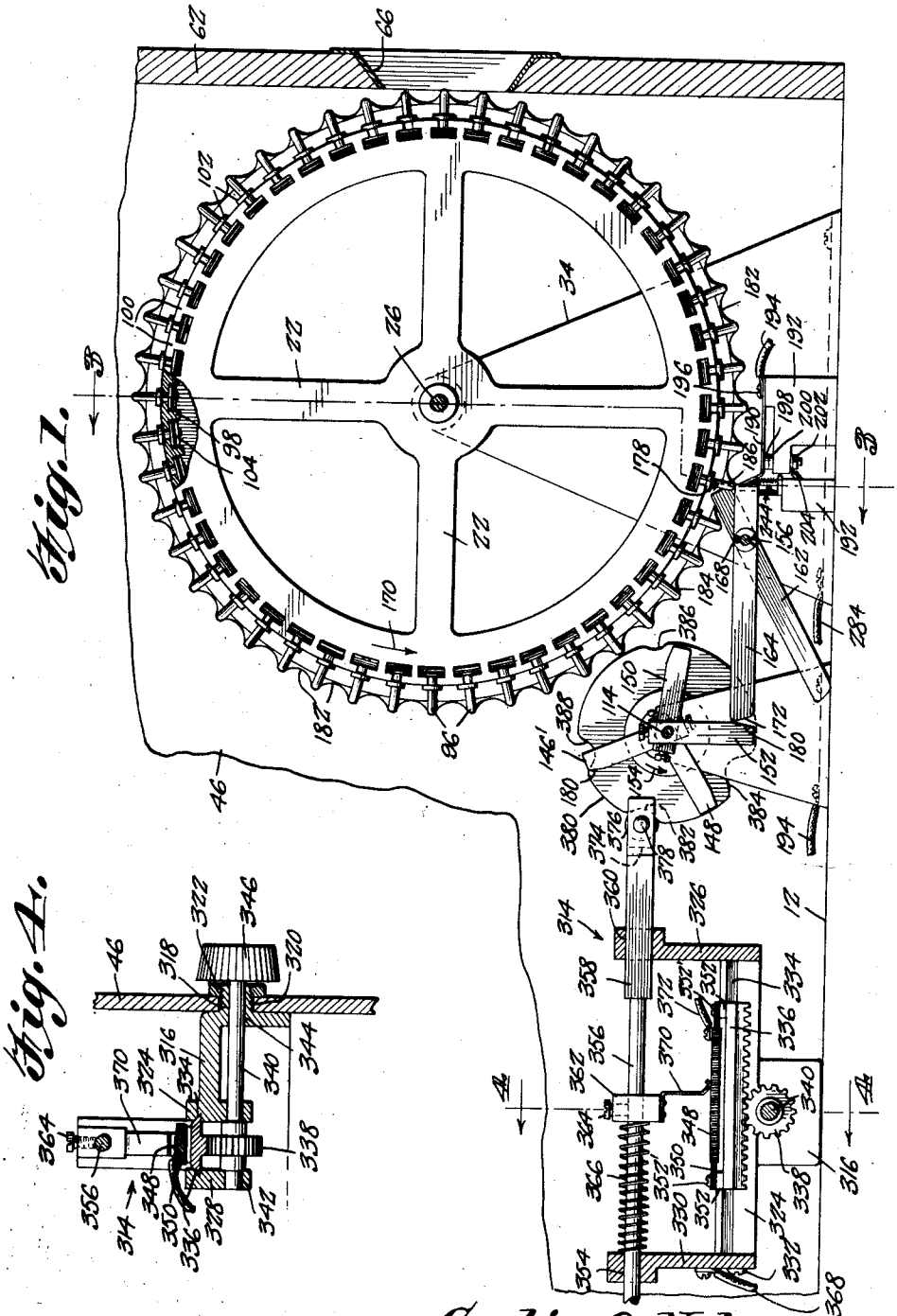

Fig. 4.

Curtis O. Nelson, INVENTOR

BY Victor J. Evans & Co.

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AUTOMATIC BROADCASTING STATION SELECTOR AND VOLUME CONTROL

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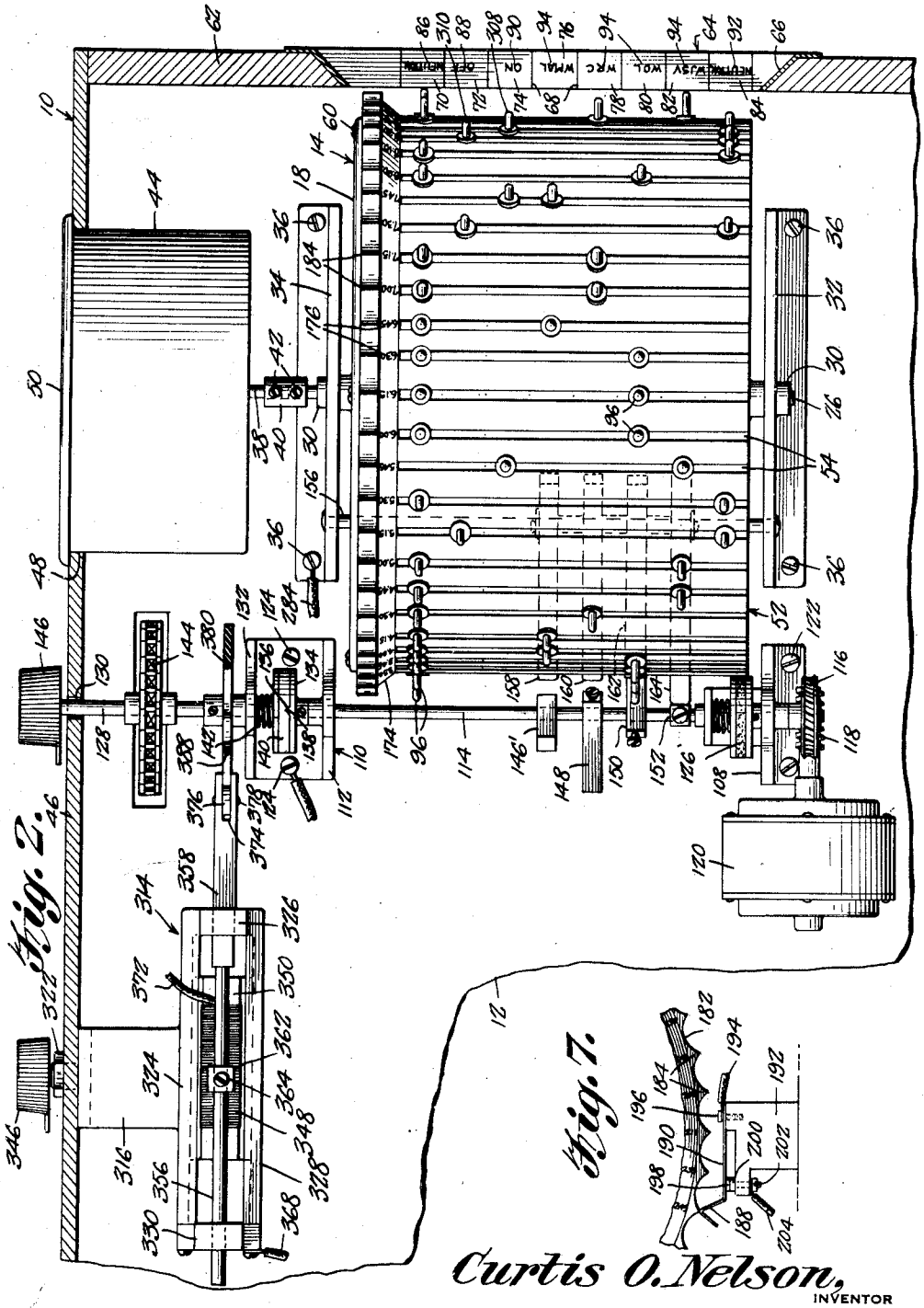

Fig. 2.

Fig. 7.

Curtis O. Nelson,
INVENTOR

BY Victor J. Evans & Co.
ATTORNEYS

WITNESS

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AUTOMATIC BROADCASTING STATION SELECTOR AND VOLUME CONTROL

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Fig. 3.

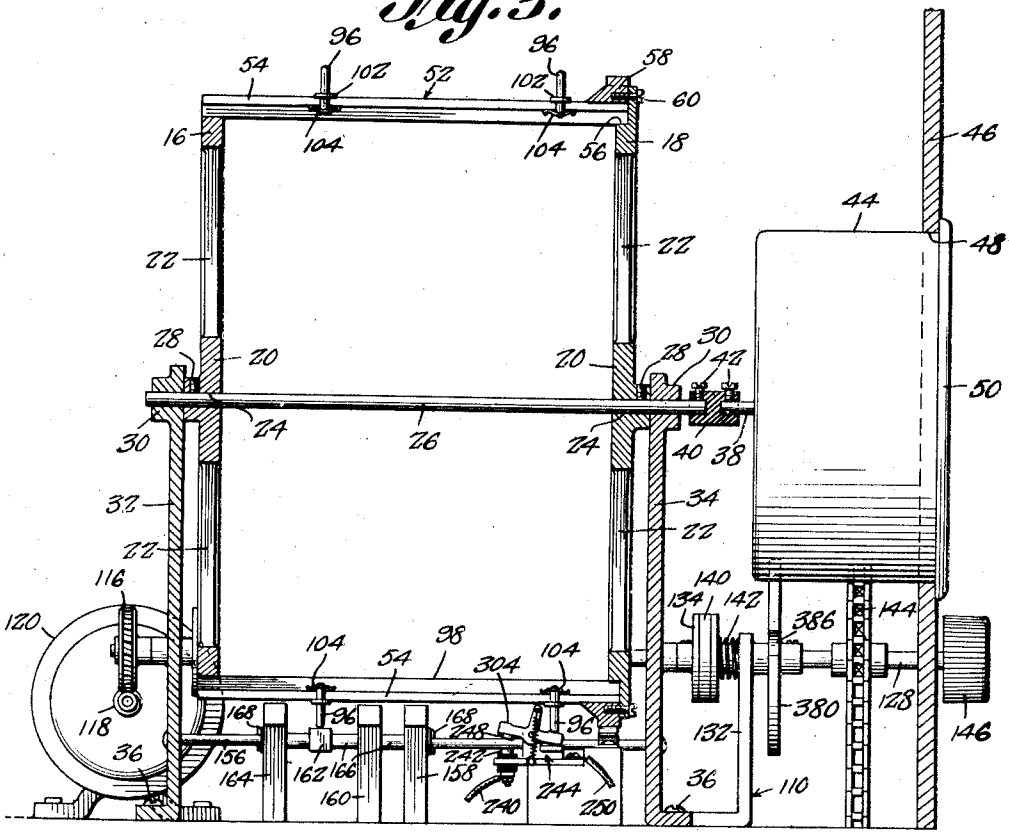


Fig. 5.

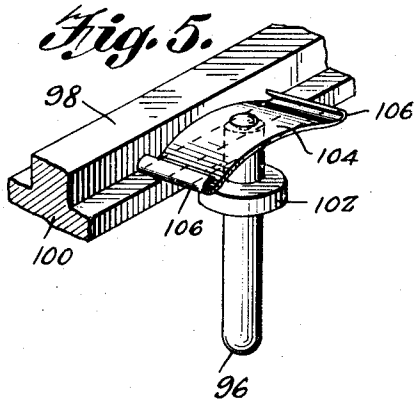
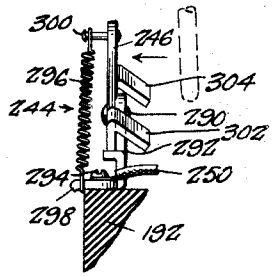


Fig. 6.



Curtis O. Nelson,
INVENTOR

BY Victor J. Evans & Co.
ATTORNEYS

P. J. Hickey.
WITNESS

April 16, 1940. C. O. NELSON 2,197,312

AUTOMATIC BROADCASTING STATION SELECTOR AND VOLUME CONTROL

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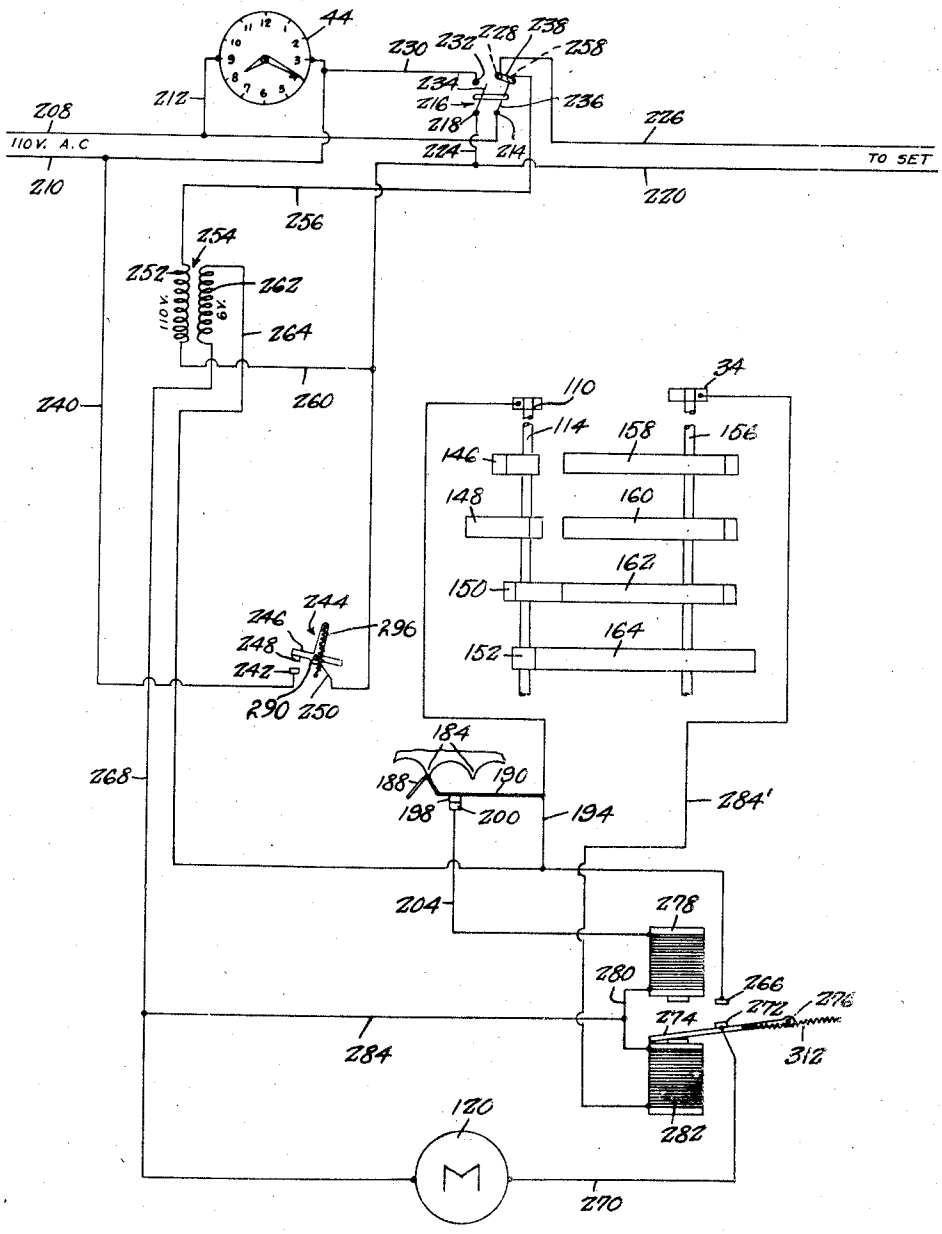
Fig. 8.



Curtis O. Nelson, INVENTOR

BY Victor J. Evans & Co.

ATTORNEYS

WITNESS

Patented Apr. 16, 1940

2,197,312

UNITED STATES PATENT OFFICE

2,197,312

AUTOMATIC BROADCASTING STATION SELECTOR AND VOLUME CONTROL

Curtis O. Nelson, Belleville, Ill.

Application October 28, 1938, Serial No. 237,563

4 Claims. (Cl. 250—20)

My invention relates to radio receivers and has among its objects and advantages the provision of an automatic broadcasting station selector and volume control.

An object of my invention is to provide novel means by which a radio receiving set may be automatically tuned to preselected broadcast frequencies at predetermined times and in which novel volume control means are incorporated. The invention embodies novel selecting means whereby the apparatus is so designed as to automatically tune different stations in and out at predetermined times. The invention may be associated with a radio receiver of conventional design and is so associated therewith as not to interfere with the manual control of the receiver independently of the automatic feature. The station selector embodies means whereby selected stations may be tuned in and out more than once, for example, during a twelve hour period.

While radio waves received by a receiving set usually vary considerably in strength, the automatic volume control is so designed as to maintain the volume of sound from the receiving set substantially uniform. The volume control embodies means which may be precisely set or adjusted to the different broadcasting stations. Atmospheric conditions, distance and the like may weaken or strengthen signals. Precise adjustment is assured through the medium of a resistor which may be employed for correcting deficiencies in the automatic volume control.

In the accompanying drawings:

Figure 1 is an elevational view of the selector drum and the automatic volume control;

Figure 2 is a top plan view of the structure of Figure 1;

Figure 3 is a sectional view along the line 3—3 of Figure 1;

Figure 4 is a sectional view along the line 4—4 of Figure 1;

Figure 5 is a perspective view illustrating the manner in which the selector pins are adjustably related to the selector drum;

Figure 6 is a view illustrating a switch;

Figure 7 is a view of the motor switch; and

Figure 8 is a diagrammatic view of the motor circuit.

In the embodiment selected to illustrate my invention, I make use of a radio receiver cabinet, a portion of which is illustrated at 10. Cabinet 10 is provided with a shelf 12 upon which I mount a selector drum 14. Drum 14 includes end flanges 16 and 18, see Figs. 1 and 3, connected with hubs 20 through the medium of spokes 22. Hubs 20 are bored at 24 for the reception of a shaft 26 fixedly related to the hubs by means of set screws 28. Shaft 26 is rotatably journaled in bearings 30 formed at the upper ends of brackets 32 and 34. Brackets 32 and 34 are secured to the shelf 12 by screws 36.

Shaft 26 is connected with a shaft 38 through the medium of a flexible coupling 40. Flexible coupling 40 is bored for the reception of the ends of the shafts 26 and 38, and the coupling is made secure by set screws 42. Shaft 38 is driven by an electric clock 44 which may be of conventional design. The flexible coupling 40 dampens any vibration incident to operation of the clock. The cabinet panel 46 is bored at 48 for the reception of the clock so as to bring it substantially within the contour of the cabinet. The clock may include a flange 50 lying adjacent the outer face of the panel 46. In the present invention, the clock operates continuously so that the selector drum 14 is rotated without interruption.

Flange 16 is formed integrally with the peripheral wall 52 of the selector drum. Wall 52 is provided with a plurality of slots 54 and is formed integrally with the flange 16. These parts may be formed by diecasting from suitable material such as zinc, white metal, or aluminum. Flange 18 is provided with a circumferential ledge 56 which supports the opposite end of the peripheral wall 52, and the latter is provided with a flange 58 fixedly secured to the flange 18 by screws 60. Flange 58 extends completely about the peripheral wall 52 and is of somewhat larger diameter than the wall.

Peripheral wall 52 includes forty-eight slots 54 which represent fifteen minute periods of time for a twelve hour period. The selector drum is positioned adjacent the cabinet side wall 62 and extends across an opening 64 in the wall. The opening in the wall may be provided with an ornamental liner 66, which liner is provided with division lines 68 to provide zones 70, 72, 74, 76, 78, 80, 82 and 84. Zone 70 is designated neutral, as at 86, while zone 72 is designated off, as at 88. Zone 74 is designated on, as at 90, while zone 84 is designated neutral, as at 92. Zones 76, 78, 80 and 82 are designated different broadcasting stations, as indicated at 94.

The peripheral wall 52 of the selector drum carries a plurality of pins 96. The pins 96 are slidably related to the slots 54, and two pins are provided for each slot. Figs. 1 and 5 best

illustrate the relation between the pins 96 and the slots 54. The wall 52 is provided with longitudinal ribs 98 intermediate the slots or centrally of the ribs 100. Ribs 98 are considerably narrower than the ribs 100. Pins 96 have close fitting relation with the walls of their respective slots 54, and each pin carries a flange 102 which bears against the outer faces of their adjoining ribs 100. Each pin 96 also includes a bowed spring 104 which bears against the inner faces of their adjoining ribs 100. Springs 104 are bent back upon themselves at 106 so as to provide gentle curvatures facilitating relative sliding movement of the pins longitudinally of the slots 54. The springs 104 are fixedly connected with the pins 96 and are under tension so as to frictionally support the pins. However, the pins may be manually shifted.

Figure 2 illustrates the pins 96 distributed over the general area of the peripheral wall 52. The distribution of the pins 96 will depend upon the broadcasting station or stations to be tuned in at a predetermined time or times. The selector drum 14 is rendered inoperative for automatic tuning by shifting the pins 96 to positions on the selector drum 14 corresponding to the neutral zones 70 and 84.

Floor 12 carries two brackets 108 and 110. Bracket 108 and the upstanding flange 112 of the bracket 110 rotatably support a shaft 114. To one end of the shaft 114 I connect a worm gear 116 arranged in mesh with the worm 118 driven by the electric motor 120. Bracket 108 is made secure by screws 122, while the bracket 110 is anchored to the floor by screws 124. I interpose a slip clutch 126 in the shaft 114. The manually rotated shaft 128 for turning the condenser of the set extends through an opening 130 in the wall 46 in the usual manner, and the opposite end of the shaft is rotatably journaled in the flange 132 of the bracket 110. Shaft 114 is fixedly connected with a flange 134 having a V-shaped lug 136 normally extending into the groove 138 in a disc 140 splined to the shaft 128 for rotation therewith but slidable longitudinally thereof. Between the disc 140 and the flange 132, I interpose a compression spring 142 which urges the disc 140 against the disc 134. Spring 142 causes the lug 136 to have such holding relation with the grooved disc 114 as to impart rotation to the shaft 128 through rotation of the shaft 114 when the motor 120 is operating. Shaft 128 may be provided with a gear or wheel 144 which may be operatively connected with the variable condenser through the medium of conventional drives. To the outer end of the shaft 128, I connect a knob 146 so that the shaft 128 may be manually rotated for tuning purposes in the usual way. The variable condenser should be of the type in which the rotary section may be rotated continuously in one direction.

With the motor 120 inoperative, the condenser may be tuned manually through the medium of the shaft 128. Manual rotation of the shaft 128 will cause the lug 132 to cam the disc 140 toward the flange 132 against the tension of the spring 142. With the motor 120 inoperative, shaft 114 remains stationary. For automatic tuning purposes, the motor 120 rotates the shaft 128 through the medium of the shaft 114 for tuning the condenser.

Upon the shaft 114 I fixedly secure a plurality of stops 146', 148, 150 and 152. Stop 146' is aligned with the zone 76, while the stop 148 is aligned with the zone 178. Stop 150 is aligned with the zone 80, while stop 152 is aligned with the zone 82. In Fig. 2, I illustrate four station zones only, but the limited number is for the purpose of illustration only. More or less zones may be employed, since the construction of the selector drum 14 and its associated mechanism remains the same regardless of the number of the broadcasting zones.

Motor 120 operates to rotate the shaft 114 in the direction of the arrow 154, see Fig. 1. Brackets 32 and 34 support a shaft 156 which parallels the shaft 114. Upon the shaft 156, I mount companion stops 158, 160, 162 and 164. Companion stops 158 to 164 are aligned with the stops 146' to 152, respectively. Companion stops 158 to 164 are loosely mounted on the shaft 156 for rotation thereon. The stops are supported in spaced relation by spacers 166, and pins 168 extending through the shaft 156 restrain the assembled companion switch arms and the spacers 166 from relative movement longitudinally of the shaft 156.

Selector drum 14 is clock rotated in the direction of the arrow 170, see Fig. 1, and pins 96 are adjustable on the selector drum for camming the companion stops to positions for abutting relation with the stops 146' to 152. Fig. 1 illustrates the companion stop 164 pivoted to a horizontal position for bringing its end 172 into abutting relation with the stop 152 to prevent further rotation of the shaft 114. Only one companion stop is pivoted to a horizontal position at a time, since each stop is associated with one broadcasting station only.

Motor 120 rotates the shaft 114 for turning the condenser of the radio receiver. One pin 96 is aligned centrally of one of the zones 76 to 82, depending upon the broadcasting station selected, and the pin 96 selected depends upon the time at which the selected broadcasting station is to be tuned in. Flange 58 includes a diagonal face 174 upon which time indicia 176 are printed. The indicia are distributed to align with the slots 54 for representing fifteen minute periods of time. Fig. 1 illustrates one of the pins 96 in the 178 position as being in camming relation with the short end of the companion stop 164. The long end of the companion stop is characterized by an overbalancing weight in such a degree as to cause the long end to pivot downwardly as soon as the pin 96 in the 178 position has moved out of camming relation with the short end. Pin 96 in the 178 position has been aligned with the zone 82. Since the pin adjustment and other cooperating parts associated with each of the zones 76 to 84 operate in the same manner, the description of one adjustment will apply to all the zones.

With the stop 152 and the companion stop 164 positioned according to Fig. 1, the condenser of the receiver will be properly tuned to the demands of the broadcasting station represented by the zone 82. Referring to Fig. 1, the companion stop 164 reaches a horizontal position substantially at the time that the stop 152 is brought into abutting relation therewith. The stops 146', 148, 150 and 152 are cut away at 180 so as to provide cam faces of gentle angularity cooperating with the ends of their respective companion stops to prevent touching between the parts before the companion stops are moved completely to their stopping positions. However, the parts are so arranged that the companion stops are cammed to their abutting positions immediately before their respective stops are brought into abutting relation therewith. Means is provided for closing the circuit through the motor 120 at

such time as to bring the stop 152 into abutting relation with the companion stop 164 at the proper time. Flange 158 is recessed peripherally at 182 to provide cam elevations 184 aligning with the slots 54. One such cam elevation is provided for each of the slots. The pin 96 in the 178 position has camming relation with the short end of the companion stop 166 for a considerable period of time, during the latter part of which time the cam elevation 184 in the 186 position is brought into pressure relation with the cam end 188 of a resilient spring conductor 190, see Figs. 1 and 7.

Spring contact 190 is anchored to an insulated support 192, and the contact is aligned with the flange 58. A conducting wire 194 is attached to a screw 196 having conducting relation with the contact 190 and anchored in the block 192. The latter is fixedly connected with the floor 12. Contact 190 carries a point 198 arranged to be moved into conducting relation with a contact 200 carried by a screw 202 to which I attach a conductor 204. The switch structure of Fig. 7 operates the electric motor 120.

Fig. 8 illustrates the motor and selector circuit. Line wires 208 and 210 lead to a source of current, with the wire 210 electrically connected with the clock 44 and the wire 208 connected with the clock through the medium of a wire 212. Wire 208 is connected with the terminal 214 of a double pole switch 216. Terminal 218 of the switch 216 is connected with the wire 220 through the medium of a wire 224. Wire 220 leads to the receiving set not illustrated. The second wire to the receiving set is illustrated at 226 and is connected with the terminal 228 of the switch 216. A wire 230 connects the terminal 232 of the switch 216 with the wire 210. Switch element 234 may be moved into conducting relation with the terminal 232 at which time the switch element 236 will be electrically connected with the terminal 228 through the medium of the element 238. Under such conditions, the circuit to the set will be closed as follows: from the wire 208 to the terminal 214, switch element 236, element 238 and wire 226; from the wire 210 to the wire 230, terminal 232, switch element 234, wire 224 and wire 220.

To the wire 210, I connect a wire 240 leading to a contact 242 of a selector switch 244. The switch element 246 includes a contact 248 arranged to be brought into electrical relation with the contact 242. Switch element 246 is electrically connected with a wire 250 connected with the wire 220. The primary coil 252 of a transformer 254 is connected with a wire 256 leading to a contact or terminal 258 arranged to be electrically connected with the terminal 228 through the medium of the element 238 when the switch 216 is positioned according to Fig. 8. Coil 252 is connected with the wire 250 through the medium of a wire 260. Switch 216, of Fig. 8, is in the selector position.

The secondary coil 262 is connected with a wire 264 leading to a contact 266. Coil 262 is also connected with a wire 268 which leads to the motor 120. The wire 270 connects the motor 120 with a contact 272 carried by a relay switch arm 274, which is pivotally mounted on a suitable support for movement about the axis 276. Wire 204 is connected with an "on" relay 278, while a wire 280 connects the on relay 278 with the "off" relay 282. Wire 280 is connected with the wire 268 through the medium of a wire 284. Off relay 282 is connected with a wire 284' which is connected with the bracket 34. Shaft 156 is of conducting material, which is also true of the bracket 34 so that the wire 284 will be electrically related to the shaft 156. Companion stops 158 to 164 are also of conducting material and are electrically related to the shaft 156.

Wire 194 connected with the spring contact 190 is connected with the wire 264 at one end and at its other end with the bracket 110. Bracket 110 is of conductive material so as to be electrically related to the shaft 114. Stops 146 to 152 are of conducting material and are arranged in electrical relation with the shaft 114. Motor 120 is of sufficient capacity to handle the shaft 114 as well as the receiver condenser through the medium of the shaft 128 and the drive between the latter and the condenser. The motor operates with a low voltage which low voltage current is supplied because of the transformer 254.

Motor 120 can be energized only when the contact 248 is moved into electrical relation with the contact 242. Switch element 246 is pivotally connected at 290 with a bracket 292 secured to the blocks 192 by a screw 294. Wire 250 is anchored to the screw 294, and the bracket 292 is of conductive material. A tension spring 296 has one end anchored at 298 to the bracket 292 and its opposite end anchored to a pin 300 fixedly connected with the upper end of the switch element 246. Referring to Fig. 8, the pivotal connection 290 is so located as to be positioned to one side of the tension spring 296 when the switch element 246 is pivoted in either direction. Switch element 246 carries cam surfaces 302 and 304 so arranged as to be engaged by certain of the pins 96 when properly located on the selector drum 14. Cam surface 302 is aligned with the zone 72, while cam surface 304 aligns with the zone 74. A pin 96 when shifted to align centrally with the zone 72 will be brought into camming relation with the off cam surface 302 for pivoting the switch element 246 to the position of Figs. 3 and 6. Similarly, when one of the pins 96 is shifted on the selector drum 14 to align centrally with the zone 74, that pin will be brought into engagement with the cam surface 304 for pivoting the switch element 246 to the on position. In the on position, the contact 248 on the switch element 246 will contact the contact 242 for electrically connecting the wire 240 with the wire 250.

With the switch 244 closed, assuming that the switch 216 is positioned according to Fig. 8, the circuit to the radio receiving set will be closed as follows: from wire 210 through wires 240 and 250, to wire 220. Wire 208 will then be electrically connected with the wire 226 through the medium of the terminal 214, switch element 236, contact 258, element 238, terminal 228 and the wire 226 which lead to the receiving set.

In operation, switch 216 is positioned according to Fig. 8 for selector tuning purposes. The circuit to the receiver will then be closed whenever the switch 244 is closed. Closing and opening of the switch 244 is consummated through the medium of two pins 96. One pin is aligned with the on zone 74, while the second pin is aligned with the off zone 72. Fig. 2 illustrates such alignment. Pin 96 in the 308 position is in advance of the pin 96 in the 310 position. The two pins are fifteen minutes apart in that they are associated with adjacent slots 54. With the on and off pins operating in adjacent slots, the switch 244 will be closed at the preselected time, which time is determined by proper selection of

the pin 96 to be aligned with the on zone 74. Indicia 176 correspond to the time reading on the face of the clock 44, so that the switch 244 will be closed at the proper time.

A number of stations may be pretuned to operate the receiver in successive fifteen minute periods, or the fifteen minute periods may be spaced at selected intervals. Similarly, one station may be pretuned and the receiver operated continuously for thirty minutes, forty-five minutes, an hour or longer. The length of time is determined by the location of the on and off pins 96 associated with the on and off zones 74 and 72. The off pin breaks the circuit to the receiver at the end of the pretuned period so that the set will require no attention other than proper setting of the selector mechanism.

Selector drum 14 is rotatable manually to facilitate selection of the pins 96. Opening 64 lends access to the selector drum. After the pins have been selected, drum 14 is manually rotated for setting the clock at the proper time after which the clock will rotate the selector drum at the speed of the hour hand of the clock. Rotation of the selector drum will bring the pin 96 in the 178 position, for example, into camming relation with the companion stop 164. At the same time, spring contact 190 is depressed for closing the circuit through the motor 120. Motor 120 rotates the shaft 114 for bringing the stop 152, for example, into abutting relation with the companion stop 164 in its horizontal position to restrain further rotary movement of the shaft. Stop 152 is fixedly related to the shaft and is adjusted so as to stop further rotation of the shaft at the moment that the variable condenser of the set has been precisely tuned.

Referring to Fig. 8, when the spring contact 190 is depressed for bringing the contacts 198 and 200 into conducting relation, the circuit will be closed through the on relay 278, at which time the arm 274 will be pulled in the direction of the relay for establishing conducting relation between the contacts 266 and 272. Thus current will be supplied to the motor 120. Arm 274 is connected with one end of a spring 312, the other end of which is fixedly anchored to a suitable support. Axis 276 is located to one side of the spring 312 when the arm 274 is in either of its two positions so as to be yieldingly supported in such positions. Companion stop 164 does not engage the stop 152 until the moment that the cam elevation 184 in the 186 position passes over the cam end 188 of the conductor 190. As the conductor 190 is freed it separates the contacts 198 and 200, at which time the stop 152 lies in contacting relation with the companion stop 164 which immediately closes the circuit through the off relay 282. Relay 282 will then attract the arm 274 to the position of Fig. 8, at which time the spring 312 is rendered effective for yieldingly holding the arm in the position illustrated until such time as the on relay 278 may again be energized.

In Figs. 1, 2 and 4, I illustrate my automatic volume control 314. The volume control includes a bracket 316 having a threaded shank 318 extending through the opening 320 in the wall 46. A nut 322 clamps the bracket to the wall. Bracket 316 carries a bar 324, an upright post 326 formed integrally with the bar and a second bar 328 paralleling the bar 324. Post 326 interconnects the bar 324 and 328 at one end, while a cross piece or post 330 interconnects the opposite ends through the medium of screws 332. Bars 324 and 328 are grooved at 334 for slidably receiving a rack 336 arranged in mesh with a pinion 338 fixed to a shaft 340. Bars 324 and 328 are provided with openings 342 for rotatably supporting the shaft 340, while the shank 318 is provided with an opening 344 loosely receiving the shaft. A knob 346 is fixed to the shaft 340 to permit manual rotation thereof.

Upon the rack 336, I mount a resistor 348, which resistor is insulated from the rack through the medium of a suitable strip 350 anchored to the elevations 352 on the rack 336 through the medium of screws 352'.

Post 330 is provided with an opening 354 for slidably receiving a shaft 356 having a square reach 358 slidable in the square opening 360 in the post 326. A collar 362 is adjustably connected with the shaft 356 through the medium of a screw 364. Between the post 330 and the collar 362 and upon the shaft 356, I interpose a compression spring 366. The wire 368 of the volume control of the receiver is electrically connected with the post 330. Post 330 is in conducting relation with the shaft 356, while the collar 362 is also in conducting relation with the shaft. A feeler wire 370 is connected with the collar 362 at one end and has its other end contacting the resistor 348 and arranged to slide therealong. The other wire of the volume control circuit of the set is illustrated at 372 and is connected with the resistor at one end. The other end of the resistor is dead.

The outer end of the squared reach 358 is slotted at 374 to receive a wheel 376 rotatably mounted on a pin 378. Wheel 376 has pressure relation with the periphery of a volume cam 380 fixedly connected with the shaft 128. Spring 366 urges the shaft 356 in the direction of the volume cam 380. Volume cam 380 is provided with peripheral recesses 382, 384, 386 and 388. Recess 382 receives the wheel 376 when the stop 152 is positioned according to Fig. 1. Movement of the feeler wire 370 along the resistor 348 in the direction of the wire 372 thus giving more power output. Recesses 382 to 388 are of different depths so as to vary the power output. One recess is provided for each of the stops 146' to 152. Recess 382 is operatively related to the stop 152, which stop is aligned with the zone 82 so that the power output value of the recess 382 will be in accordance with the demands of the broadcasting station represented by that zone. Recess 388 is associated with the stop 148, while the recess 386 is associated with the stop 146'. Recess 384 is associated with the stop 150. It will thus be seen that the volume cam 380 functions as a volume control for each of the broadcasting stations represented by the zones 76, 78, 80 and 94. The number of recesses in the periphery of the volume cam will depend upon the number of the broadcasting station zones incorporated in the station selector.

Frequently atmospheric conditions, distance and the like may weaken or strengthen signals. I provide means whereby the automatic volume control may be precisely adjusted. Rack 336 may be shifted longitudinally through the medium of the gear 338 manually actuated through the medium of the knob 346. Such adjustment of the rack 336 moves the resistor 348 relatively to the feeler wire 370. Adjustment of the resistor through the manual control increases or decreases the ratios of the recesses 382 to 388 in corresponding amounts. It will thus be seen that the manual control incorporated in the automatic

volume control permits refinement to be made in the power output of the automatic control.

I claim:

1. An automatic tuning mechanism for radio receivers including a rotatable condenser shaft adapted to be turned to predetermined radio station tuning positions, a rotary station selector drum, a time device for rotating the selector drum, a motor including a circuit for turning the condenser shaft, a motor switch in said circuit including momentary switch closing means carried by the selector drum, an on and off switch including a circuit for connection with the receiver circuit, selector pins shiftable on said drum for actuating the on and off switch at predetermined times, stops corresponding to different broadcasting stations fixed to the condenser shaft, shiftable companion stops, selector pins shiftable on the selector drum for moving the companion stops into abutting relation with said stops, to stop further rotation of the condenser shaft when rotated to respective tuning positions, said stops and said companion stops being electrically related and comprising a part of the circuit associated with the motor, and electrical means energized through contact of said stops with their respective companion stops, to maintain a broken circuit through the motor only.

2. An automatic tuning mechanism for radio receivers including a rotatable condenser shaft adapted to be turned to predetermined radio station tuning positions, a rotary station selector drum, a time device for rotating the selector drum, a motor including a circuit for turning the condenser shaft, a motor switch in said circuit including momentary switch closing means carried by the selector drum, an on and off switch including a circuit for connection with the receiver circuit, selector pins shiftable on said drum for actuating the on and off switch at predetermined times, stops corresponding to different broadcasting stations fixed to the condenser shaft, shiftable companion stops, selector pins shiftable on the selector drum for moving the companion stops into abutting relation with said stops, to stop further rotation of the condenser shaft when rotated to respective tuning positions, said stops and said companion stops being electrically related and comprising a part of the circuit associated with the motor, and electrical means energized through contact of one of said stops with its respective companion stop, to maintain a broken circuit through the motor only, all of said selector pins being shiftable to neutral positions on the selector drum.

3. The invention defined in claim one wherein the selector drum is provided with bar-like members paralleling the axis of rotation of the drum, with the bar-like members spaced to provide slots for the selector pins, said bar-like members having flanges and each selector pin having a flange slidably engaging one flange of two bar-like members, and a spring connected with each pin and frictionally engaging the opposite sides of the two flanges engaged by the flange of that pin to frictionally secure the pin in its different positions.

4. The invention defined in claim one wherein the stops fixed to the condenser shaft are in the nature of arms projecting radially from the condenser shaft, said companion stops being in the nature of bars pivotally connected to a fixed support intermediate their ends and arranged to be pivoted by their respective selector pins to position the bars in the path of their respective stops fixed to the condenser shaft.

CURTIS O. NELSON.