July 23, 1957 M. G. WRIGHT ET AL 2,800,587

MANUAL POWERED TUNER

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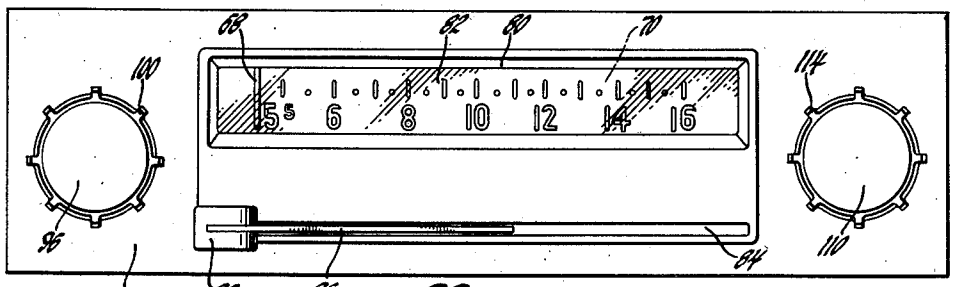


Fig. 1

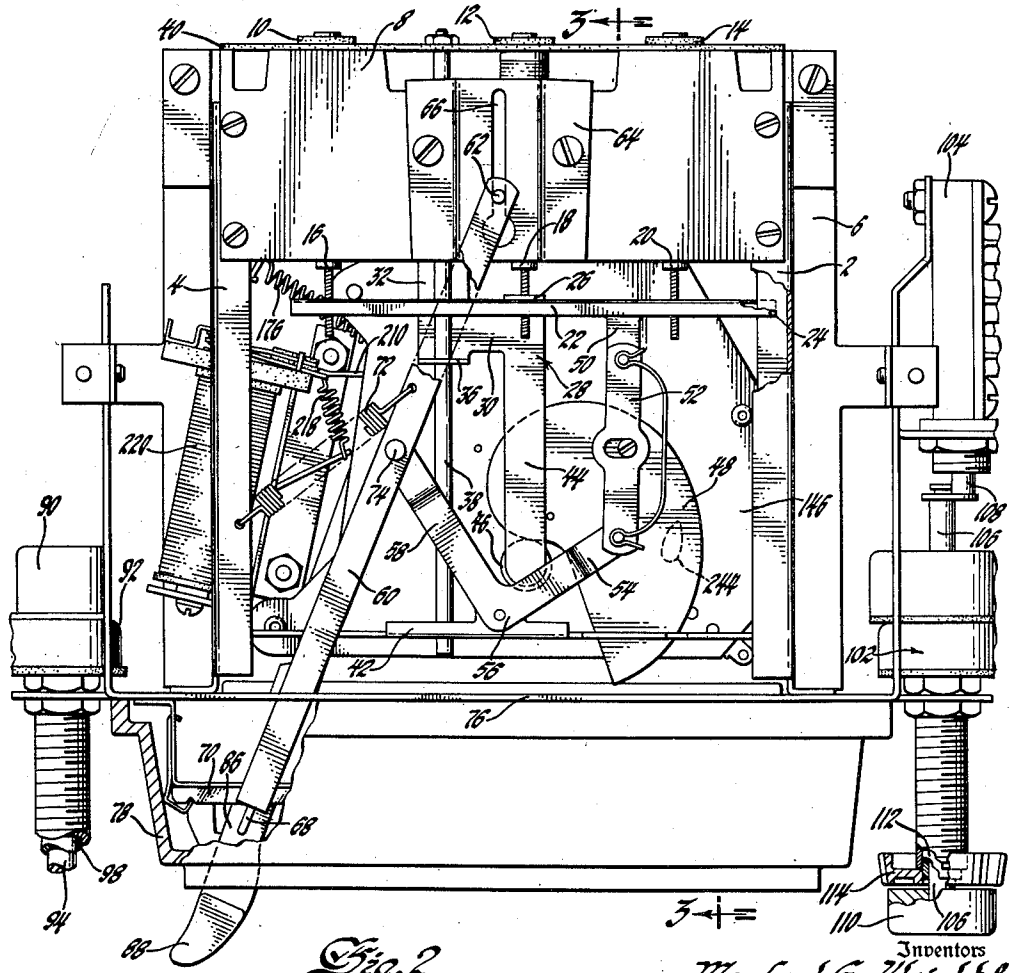


Fig. 2

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MANUAL POWERED TUNER

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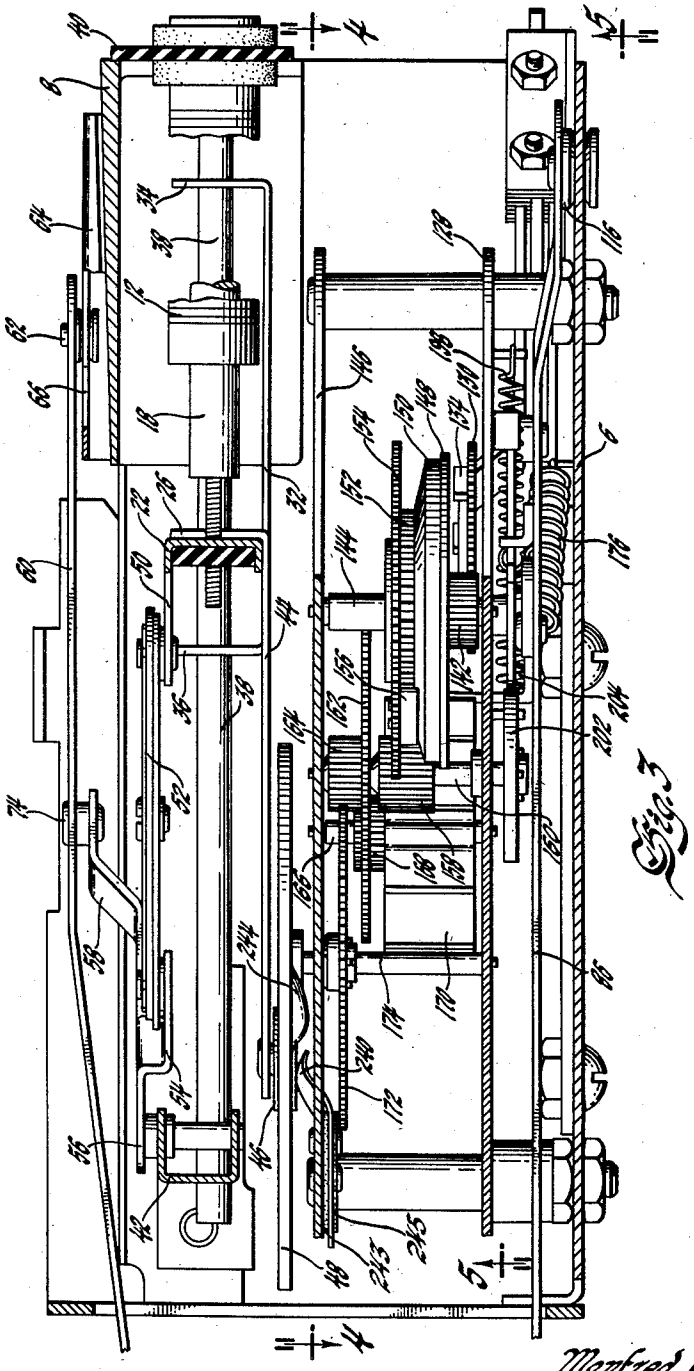


Fig. 3

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MANUAL POWERED TUNER

Filed Jan. 7, 1953 5 Sheets-Sheet 3

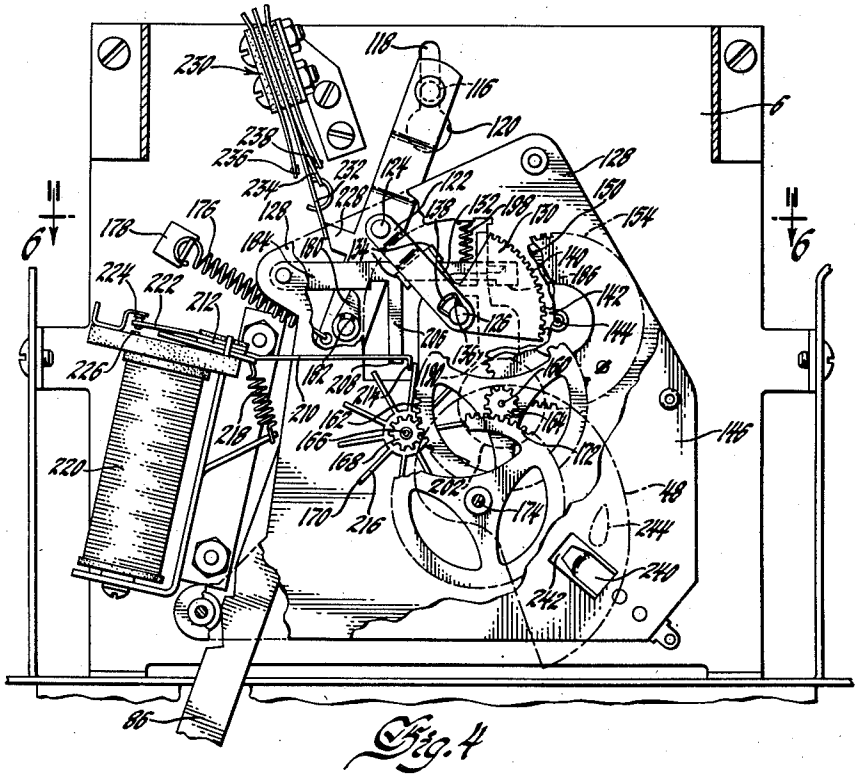


Fig. 4

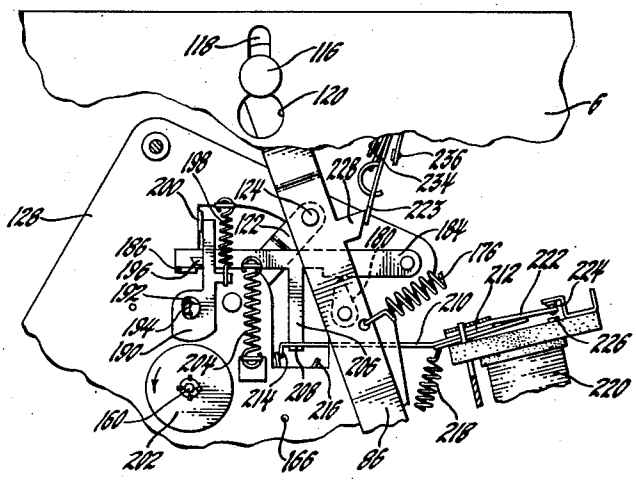


Fig. 5

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MANUAL POWERED TUNER

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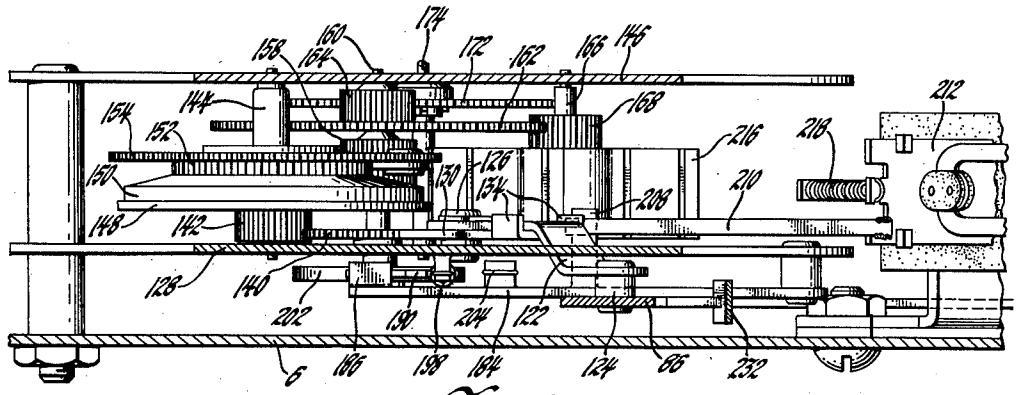


Fig. 6

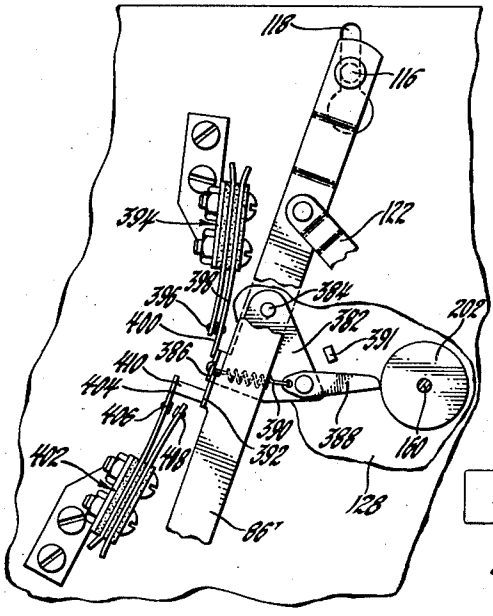


Fig. 7

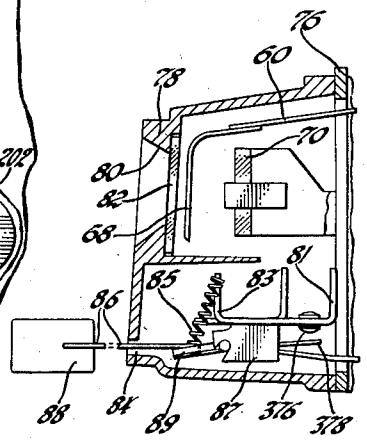


Fig. 3a

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MANUAL POWERED TUNER

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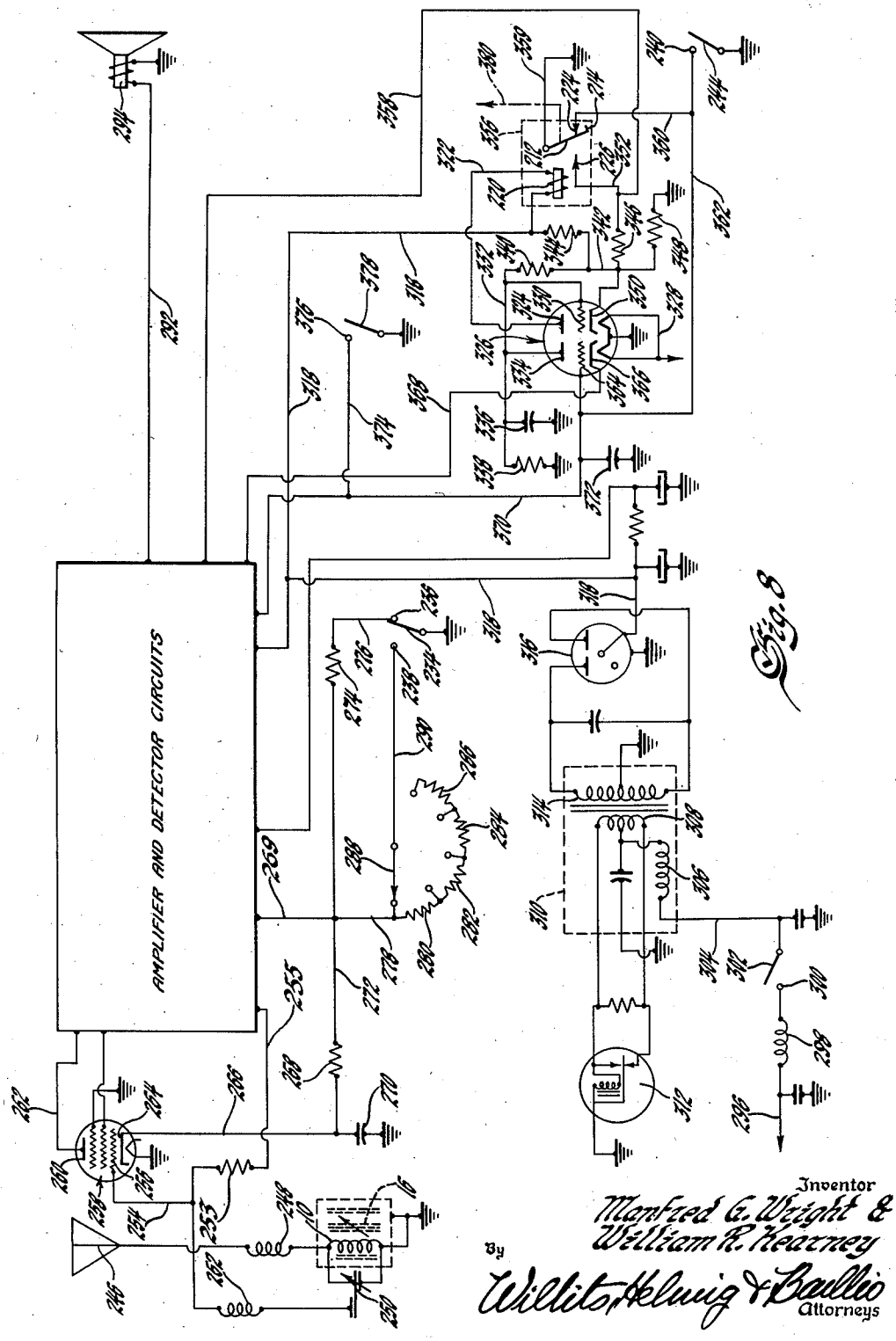


Fig. 8

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United States Patent Office

2,800,587

Patented July 23, 1957

2,800,587

MANUAL POWERED TUNER

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Application January 7, 1953, Serial No. 329,974

16 Claims. (Cl. 250—40)

This invention relates to automatic indexing means for bringing mechanical parts to predetermined selected positions, and more particularly to indexing tuning means for radio receiving apparatus so that desired stations may be automatically tuned in and received. There have previously been automatic means designed for indexing or stopping tuning means which is being driven over a predetermined band by the arrival of a signal from a transmitting station. These have been termed "stop-on-signal" tuners or "signal seeking"-tuners. Some of these tuning means have been driven by motors of various types. A co-pending application Serial No. 182,186, entitled "Inertia Drive Tuner," in the names of Bertram A. Schwarz and Manfred G. Wright, which issued as Patent 2,743,620 on May 1, 1956, discloses one type of signal seeking tuner in which driving power for moving the tuning means over the band is provided by the manual operator himself, who, in starting the mechanism, provides energy to a flywheel of some weight, which thereafter carries the tuning means a sufficient distance. The construction of the present application is a simplification of the manually driven signal seeking tuner shown in Patent 2,743,620 in that herein the manual force is continuously applied to move the tuning means along the band.

It is therefore one of our objects in making the invention to provide a manually driven means for moving apparatus over a predetermined path along which it may be automatically stopped by applied signals.

It is another object in making our invention to provide continuously manually driven means for moving tuning means over a predetermined path for radio reception which is automatically indexed or stopped on station upon the receipt of a transmitted signal.

It is a still further object in making our invention to provide a manually driven scanning or tuning means for a radio receiver for moving the same over the band which is protected from any excess movement of the manually controlled driver.

It is still another object in making our invention to provide switching means controlled by the actuation of the manual driving means to place the electrical circuit in the desired condition for indexing operation.

It is still another object in making our invention to provide a manually driven tuning means which has means for assuring release from the tuned-in station so that the tuner will proceed to the next available transmitted signal and not remain on the station being received at the time the manual drive means is initiated.

It is a still further object in making our invention to provide means for disabling the indexing or stopping means so that the manual drive means may be repeatedly operated to move the tuning means over the band at will until a desired area is reached.

With these and other objects in view which will become apparent as the specification proceeds, our invention will be best understood by reference to the following specification and claims and the illustrations in the accompanying drawings, in which:

Figure 1 is a front elevation of a radio tuning means incorporating our invention;

Figure 2 is a top plan view of a radio tuning means as shown in Figure 1, parts being broken away and shown in section;

Figure 3 is an enlarged sectional view taken on line 3—3 of Figure 2;

Figure 3*a* is a sectional view taken through the cover plate and indicator section.

Figure 4 is a reduced sectional view taken on line 4—4 of Figure 3;

Figure 5 is a reduced partial sectional view taken on line 5—5 of Figure 3;

Figure 6 is an enlarged sectional view taken on line 6—6 of Figure 4;

Figure 7 is a partial view of a modified form of switching arrangement actuated by the main manually moved lever; and

Figure 8 is a circuit diagram of a radio receiver utilizing our tuning means.

In general the present tuning or indexing means may be described as having a pivoted lever so connected that as it is moved about its pivot, it rotates an arcuate gear to drive a gear train through a clutch mechanism. The gear train in turn drives two other parts, one an air vane governor to limit the speed of the gear train to a nominal value, and secondly, means to move the tuning means of a radio receiver to tune the latter over a predetermined band; i. e., the broadcast band. It will thus be seen that moving the lever about its pivot will drive the tuning means, but if indexing means controlled by some means encounters the gear train to stop it, such as control means responsive to an incoming signal in this type of apparatus, any further movement of the lever by the operator will merely cause the clutch means to slip and will not damage any of the parts.

Other functions likewise are performed by the lever in its movement, such for example as the actuation of switching means to change the sensitivity of the radio receiver so that it will have a different sensitivity during the tuning or switching portion of the cycle from that which it has during the listening portion. The movement of the manual arm also energizes the control relay so that the gear train may operate and places the relay circuit in readiness to stop the gear train upon receipt of an incoming signal. The tuning means in this instance is disclosed as of the permeability type in which comminuted iron cores are simultaneously moved with regard to their associated coils to tune the receiver over its band. The invention can, of course, as well be utilized with other types of tuners such as the rotary condenser type and the present disclosure should not be taken in any sense as limiting the invention to tuner structures of this type. The drive for the reciprocatory carriage for the comminuted cores is provided by a cam of spiral form which causes the core carriage to gradually move outwardly and then return quickly to its innermost position. It is desirable that during this quick backstroke no incoming signal be permitted to provide a stopping pulse; in other words, the tuner will only have stopping or indexing pulses applied during its outward motion and will not be indexed during its quick inward motion, as this would result in anaccurate tuning.

Referring now more specifically to the drawings, a box framework is provided for the tuning means which consists of two parallel side frame members 2 and 4 which are mounted on a flat base plate 6 and whose upper edges are connected together near the rear portion by a rectangular plate 8. This frame provides mounting means

for the tuning apparatus. A plurality of coil means 10, 12 and 14 are mounted on the lower surface of the plate 8 and are adapted to form the tuning units in the antenna, oscillator, and radio frequency portions of the receiver for tuning the same over the band. A plurality of comminuted cores 16, 18 and 20 are associated with the coils 10, 12 and 14 respectively, and are adapted when moved with respect to the coils to vary the inductance sufficiently to provide the desired tuning. These cores are threadedly mounted in a cross-member 22 having a split end at 24 which rides on a portion of the side frame member 2 as a guide. The three cores, therefore, are simultaneously moved as the bar 22 moves along the frame and any core may be adjusted with respect to the bar and its associated cores by rotating the same individually to thread it through its connection to the bar 22. This is mainly for alignment purposes and, once accomplished at the factory, need not be later changed.

The cross-bar 22 is secured to an upstanding lug 26 of an angled elongated member 28 which extends generally from the back of the tuner to the front, having an offset jog 30 therein approximately half-way between the two extremities. The rear portion 32 of the member 28 has two upstanding ears 34 and 36 having aligned openings through which a longitudinal rod 38 extends to support the member 28 and along which the same may slide. The rod 38 is mounted at the rear in a transverse insulating cross-member 40 and extends through an opening in a front transverse cross-member 42. The forward portion 44 of the travelling carriage member 28 has mounted on its foremost end a roller follower 46 and terminates in the upstanding lug 26 which is rigidly secured to the cross bar 22. The member 28 and the cross bar 22 thus may move longitudinally of the frame, being supported by the rod 38 and the frame member 2 as a track, carrying with them the tuning cores and being moved by engagement between the spiral cam 48 and the roller follower 46.

Transverse bar 22 has a forwardly extending portion 50 to which is pivotally connected a link 52, the opposite end of which is likewise pivotally connected to an arm 54 of a bellcrank lever 56 which is pivotally mounted on the cross frame member 42. The other arm 58 of the bellcrank lever is pivotally connected at 74 to an intermediate portion of the indicating arm 60 which extends to the forward portion of the tuner and has a downwardly extending pin 62 at the rearmost extremity. On the upper surface of the cross frame member 8 there is mounted an angled bracket 64, the center portion of which is raised from the plane of the member 8 and has a longitudinal slot 66 therein in which the downwardly extending pin 62 on lever 60 may ride. An indicating needle 68 fixed to the forward end of the arm 60 extends down over the indicating dial 70 of the receiver. A tensioned spring biasing member 72 has one end secured to the lever 60 at a point adjacent the pivotal connection 74 between the lever 60 and the arm 58, the opposite end of said spring member 72 being anchored in the frame member 4. Thus, the indicating arm 60 is biased toward the left as shown in Figure 2, which in turn biases the transverse member 22 rearwardly, holding the roller follower 46 in firm engagement with the cam surface of spiral cam 48.

When the shaft 174 of cam 48 rotates and causes the cam to rotate, the spiral surface forces roller 46 toward the front of the framework, which, of course, moves the carriage 28 as a whole and the tuning cores 16, 18 and 20 from their associated coils to tune the receiver. Simultaneously, the indicating lever 60 is moved counterclockwise about its sliding pivot as shown in Figure 2, and the needle 68 traverses the dial 70. As the arm 60 swings to the right, the pivot pin 62 will move rearwardly in the slot 66 until the needle 68 is in the approximate center of the dial 70 and thereafter on continued lever movement will move forwardly again as the needle 68 continues toward the right hand side of the scale, the needle 68 having substantially straight-line motion across the dial 70.

A main transverse frame member 76 extends across the front and slightly beyond the main longitudinal frame members 2 and 4, supporting control means for the receiver and also the dial 70 and the cover plate 78, which are mounted thereon by any suitable means. The cover plate 78 has an opening 80 therein in which a plain glass plate 82 is mounted through which the dial 70 is visible. The plate also is provided with a slot 84 underneath the dial through which the end of the operating lever 86 projects. A manually engageable member 88 is secured to the end of the lever 86 outside the cover plate 78. As shown particularly in Figure 3*a*, there is secured to the main transverse frame member 76 by suitable means an angled supporting plate member 81. A plurality of spaced brackets 87 are fastened to the lower surface of the horizontal portion of the plate and have aligned slotted openings for bearing purposes. A pivoted transverse bar 89 has portions extending into these slotted openings to provide a hingeable mount therefor. A biasing spring 85 has one end secured to the forward end of the bar and its opposite end anchored to a flange 83 on plate 81 to bias the bar in a clockwise direction as viewed in Figure 3*a*. The transverse bar 89 extends under operating lever 86, the latter being movable across the top of the transverse bar, driving its travel across the housing, the spring 85 holding the transverse bar up in contact with the lower surface of the lever 86. A switch arm 378 carried by the bar 89 extends toward the rear and is adapted to contact an insulated contact 376 mounted on the plate 81 to provide desired switching action when the lever 86 is pressed downwardly at any point in its horizontal travel. On the left of the cross frame member 76 as viewed in Figure 2 there is supported control means which include an on/off switch and volume control unit 90 and a sensitivity control means 92. The on/off switch 90 is operated by a central rotatable rod 94 which extends through the front panel and has mounted on its outer end thereof a control knob 96, and the sensitivity control means 92 is connected to and operated by a rotatable sleeve 98 which extends through the forward panel around the central rotatable shaft 94 and has mounted on its outer extremity a rotatable ring or collar 100 behind the knob 96.

On the right-hand side of the cross frame member 76 as shown in Figure 2 there is likewise supported control apparatus including a tone control means 102 and a vacuum valve structure 104 for controlling the height of the associated telescopic radio antenna (not shown). A central shaft 106 extending through this control portion is connected to a second offset shaft 108 of the valving means and longitudinal movement of the shaft 106 induces similar sliding or longitudinal movement of the control shaft 108 to move the valving means so that the associated antenna will be moved either up or down, as desired. The shaft 106 projects through the forward face of the panel and a knob 110 is mounted on the projecting end on the front face of the tuner which permits the operator to either pull or push upon the shaft 106. A rotatable sleeve member 112, concentric with the control rod 106, also extends through the front panel and is connected to and operates the tone control means 102. A similar collar or ring 114 is mounted on the outer end of this sleeve behind the control knob 110 and provides adjustment for the tone control.

The operating lever 86 is mounted in much the same manner as the indicating lever 60 previously described. The innermost or rearmost extremity of such operating lever 86 is provided with a downwardly extending pin 116 (Figure 3) which is adapted to ride in a slot 118 (Figures 4 and 5) in the lower base plate 6 of the frame. The pin 116 has an enlarged end to maintain the pin and slot connection. The end of the slot 118 has an enlarged circular opening 120 of greater diameter than the en-

larged head of the pin 116 so that the latter may be initially inserted through this opening and then slid back into the slot 118. Thus, as the lever 86 is moved across the face of the tuner, it may have relatively straight-line movement, being able to slide back into the slot 118. This movement of the lever 86 provides the driving power for the cam 48. Pivotally secured to the lever 86 at point 124 is a link member 122, the opposite end of which is supported on a fixed pin 126 extending from a supporting plate 128.

Pivotally mounted also on this same anchoring pin 126 is a sector gear 130 having an extending arm 132 which lies under a portion of the link 122 and terminates in two upstanding arms 134 on either side of said link and spaced apart a distance slightly more than the width of said link. Thus, the link may move slightly transversely between the two arms without engaging either one and causing the arcuate sector to move. These two parts are also connected together through a U-shaped spring 136, the bight of which extends around the anchoring pin 126 and the outer ends of which are bent downwardly and extend through a slot 138 in the link 122 and thence into slots in the arm 132. This spring provides a biasing means to cause the two parts to move in unison, but they can be moved with respect to each other a distance equal to the additional distance between the upstanding ears 134 and the width of the member 122. Thus as the lever 86 is moved across the dial, the link 122 will be rotated about the fixed pivot 126, rotating the arcuate sector about the same pivot to drive the mechanism.

The teeth 140 of the arcuate sector 130 engage a pinion 142 mounted on shaft 144, which shaft is in turn mounted between supporting plates 128 and 146 as best shown in Figure 3. This pinion 142 is rigidly secured to a disc or plate 148 of a clutch and both pinion 142 and disc 148 are loosely mounted on said shaft 144 and may rotate with respect thereto. Clutch member 150, which engages the clutch disc 148 and through friction rotates therewith, is likewise mounted on shaft 144 and has fixedly secured thereto ratchet wheel 152, and both ratchet wheel 152 and clutch member 150 are also loosely mounted to rotate with respect to the shaft 144. A larger gear 154 is the last unit mounted on shaft 144, and carries on its undersurface, as shown in Figure 3, a pawl 156 which is adapted to engage with and be driven by the teeth of the ratchet wheel 152, being spring biased toward said teeth. Thus when the pinion 142 is rotated by sector gear 130, it will turn directly the lower disc clutch member 148, and if the gear train is unlocked, this will drive the upper clutch member 150 and its associated ratchet wheel 152. The rotation of wheel 152 in the driving direction is imparted to the associated larger gear 154 through the pawl 156, and thus rotation of the pinion 142 will cause rotation of the large driving gear 154 if the gear train is unlocked.

The large gear 154 meshes with a pinion 158 mounted on a parallel shaft 160, carried in the two plates 128 and 146, said pinion 158 being keyed or locked to shaft 160. Also mounted on the same shaft 160 and keyed thereto are, in order, a large spur gear 162 and a second pinion 164 which rotate with the shaft. A third shaft 166, carried by the supporting plates 128 and 146, has mounted thereon a pinion 168 which is keyed thereto and likewise an air vane governor 170, and pinion 168 meshes with and is rotated by gear 162. Gear 162 will drive pinion 168 and the air vane governor at a relatively high RPM. This governor is an equalizing load on the gear train and prevents too high a speed in movement of the tuning means over the frequency band.

At the same time rotation of the shaft 160 causes pinion 164 to rotate since it is keyed thereto and this drives a large spur gear 172, which is mounted upon and keyed to a shaft 174 trunnioned in plates 146 and 128. Shaft 174 extends through plate 146 and has mounted on the extending end the spiral driving cam 48. Rotation of the shaft 160 as well as causing a high speed rotation of the air vane governor likewise drives at a reduced rate the shaft 174 and the spiral cam for moving the tuning cores in and out with respect to their associated coils. Thus, when the driving lever 86 moves about its adjustable pivot pin 116, it turns link 122 about its fixed pivot 126, which drives the arcuate sector gear 130 to drive the gear train and simultaneously rotate the air vane governor 170 at a relatively high speed and the driving cam 48 to tune the receiver at a relatively low speed. Secured to the lever 86 at a point intermediate its length is one end of a tension spring 176, the opposite end of which is anchored in a bracket 178 on the frame. This spring tends to maintain the lever 86 in its left-hand or de-energized position, as shown in Figure 4.

When the lever 86 is moved from its at-rest position, which is shown as being at the left-hand side of Figure 2 or 4, the mechanical lock or detent must be removed from the governor 170 so that the gear train may rotate and the indexing relay must be energized. The mechanism for accomplishing these results is most clearly shown on Figures 4 and 5, and is described in detail as follows. A pawl 180 is pivotally mounted on the lever 86 and is spring biased by spring 182 to a position substantially in alignment with the lever 86, but can be moved slightly to either side of the position shown. A transverse lever 184 is pivotally mounted on the plate 128 and extends across the lever 86 at an angle. The outer end of said transverse arm 184 is notched to provide a flat cam face 186. An irregularly shaped latching cam 190 has an opening 192 therein through which a locating pin 194 extends. Pin 194 has a size which is considerably less than the diameter of the opening 192 so that the cam may move about this point to some extent. The major axis of the cam 190 is transverse to the end of the arm 184 and the cam is spring biased upwardly as shown in Figures 4 and 5 by a tension spring 198. A stop 200 extending from the supporting plate 128 engages the upper end of the cam 190 and prevents the same from turning counterclockwise about its supporting pivot 194 under the bias provided by spring 198. A latch 196 projects from the side of the cam and in some positions will lie under the cam surface 186 on the end of the lever 184 to support the same. The lower surface of the cam engages a rotatable wheel 202 rigidly secured to the end of the shaft 160, and therefore, tends to move therewith. Pivoted arm 184 is spring biased downwardly by a tension spring 204 which tends to rotate it counterclockwise about its pivot as shown in Figure 5. From the center of arm 184 is a downwardly extending leg 206 having a tab 208 extending at right angles thereto which underlies the indexing finger 210, which extends from the relay armature 212 and which carries on its outer end a downwardly extending tip 214 which is adapted to interfere with and engage the paddles 216 of the air vane governor 170 and mechanically stop the same. The relay armature is spring biased toward the air vane governor by a tension spring 218, in which position the tip 214 engages the vanes 216 of the air vane governor, the energization of the relay coil 220 bringing the tip 214 out of engagement against the spring bias 218 and permitting the air vane governor to rotate and the gear train to revolve.

As shown, the mechanism just described is in its position of rest and is provided to move the locking tip 214 out of engagement with the governor and hold it until the tuner moves far enough from the station to which it was tuned to energize the relay 220 which thereafter holds the locking tip 214 until the next station is reached. When the lever 86 is initially moved, pawl 180 forces lever 184 upwardly to lift tip 214 out of engagement with the governor vanes and at the same time snaps past latch 196, which moves under cam face 186 to hold the lever 184 in raised position until the relay 220 becomes energized. The gear train can now begin to move to drive the tuner. As soon as it starts and moves the tuner off station, relay 220 becomes energized to hold tip 214 away

from the governor and disc 202 rotates, swinging cam 190 clockwise, as shown in Figure 5, about its pivot 194 to move the latch 196 back to one side of the cam face 186, spring 198 returns the latch 196 to its rest position, and lever 184 may swing counterclockwise to its rest position.

The relay armature also carries a movable switch arm 222 which oscillates between two fixed switch contacts 224 and 226 for performing certain switching operations later to be described more in detail.

Arm 86 has an operating finger 228 extending from one side thereof just beyond pawl 180, which finger 228 is provided to operate a snap-over muti-contact switch indicated generally at 230. The central arm 232 of this switch, which is mounted on the base 6, engages the operating finger 228 and movement thereof causes the central contact 234 to move back and forth between stationary contacts 236 and 238. This switching arrangement is provided to change the sensitivity of the receiver from so-called "listening" to "tuning" sensitivity.

The switching arrangement provided so that the relay coil will be rendered continuously inoperative during the backstroke or return movement of the carriage and will not respond to any incoming signal is provided by grounding contact 240 mounted on the lower face of the supporting plate 146 and extending upwardly through an opening 242 therein. This contact is insulated from the plate 146 by bushings 243 and 245 and is adapted to engage a depressed area 244 on the lower surface of the grounded cam 48 to provide this switching action, preventing tripping on the return stroke of the carriage.

The electrical circuit for the present system is shown in Figure 8 and in that figure there is illustrated a receiving antenna 246 which is connected through an inductance coil 248 to a tunable inductance coil such as 10 in the antenna circuit. This coil, of course, has a comminuted core such as 16, shown in dotted lines, which core can be moved with respect to its coil 10 to vary the inductance for tuning. An adjustable trimmer condenser 250 completes the tunable resonant antenna circuit, said condenser being connected through coil 252 and line 254 to the control grid 256 of the radio frequency amplifying tube 258. Automatic volume control bias through line 255 and resistor 253 is also applied to the control grid 256. The plate 260 of this tube is connected through line 262 to the amplifier and detector circuits of the receiver. The cathode 264 of the tube 258 is connected through line 266 to one terminal of a biasing resistor 268 and also through condenser 270 to ground. The opposite terminal of biasing resistor 268 is connected to line 272 which extends to a second biasing resistor 274, the opposite terminal of which is connected through line 276 to stationary switch contact 236. Line 272 is connected through line 269 to the amplifier circuits of the receiver. Line 272 is also connected through tie line 278 with one terminal of a series of resistances 280, 282, 284, and 286 in series, taps being brought out between the resistors which are engageable by a movable switch arm 288 for changing the sensitivity of the receiver. Movable arm 288 is connected directly through line 290 with stationary contact 238 of the snapover switch 230. The central contact 234 of this switch is grounded.

The output from the audio amplifier is connected through line 292 to the loud speaker 294. The power supply for the radio receiver and the triggering system is provided from a conventional 6-volt D. C. source which is connected to line 296 which extends to a choke coil 298 and thence to a stationary switch contact 300, the movable switch arm 302 cooperating therewith and being connected through line 304 and a choke 306 to the primary 308 of a power transformer 310. A conventional vibrator 312 is connected across the primary 308 to alternately energize the halves thereof and induce in the secondary 314 an alternating current which is rectified by full-wave rectifier 316 developing a high voltage D. C. on power supply line 318, which is directly connected to the amplifier and detector circuits and also extends over to the coil 220 of the control relay. The opposite terminal of the control relay coil 220 is connected through line 322 to plate 324 of the duo-triode tube 326. The filament circuits 328 of the tube 326 are connected back to the low voltage power supply as indicated by the arrow, the specific connections being omitted for the sake of simplicity.

Control grid 330 of the second triode section of the tube 326 is connected to line 332 which in turn is directly connected to the plate 334 of the first triode section of this tube. Line 332 is also connected through condenser 336 to ground and through resistor 338 in parallel with condenser 336 to ground. Line 332 is also connected to one terminal of a resistor 340, the opposite terminal of which is connected to line 342 which extends to one terminal of a resistor 344, to one terminal of a resistor 346, to one terminal of a resistor 348, and is directly connected to the cathode 350 of the second triode section of the tube 326. The opposite terminal of resistor 344 is connected to power supply line 318. The second terminal of resistor 346 is connected to line 352 which extends to stationary contact 226 of the control relay 356. A line 358 connects line 352 back to the amplifier and detecter circuits. The relay armature 212 is directly connected by line 359 to ground. Stationary contact 224 of the relay 356 is connected through line 360 to line 362 which extends between stationary contact 240 and control grid 364 of the first triode section of the tube 326. The movable arm which cooperates with stationary contact 240 is actually the depression 244 on the face of the cam 48, which is, of course, grounded to the frame. This places a ground on the control grid 364 and prevents the stopping operation from taking effect when in contact. Cathode 366 of the first triode section of the tube 326 is connected through line 368 to the amplifier and detector block where it has a proper bias applied thereto for the tube. A pulse is generated in the detector section which appears on line 370 when a transmitted signal is tuned in, which pulse is applied directly to the control grid 364, and it is this pulse that actuates the system to deenergize the relay coil 220, dropping the armature 212 with its associated indexing finger 210 and tip 214 to engage the air governor vanes and index the receiver. The details of the means for generation of this pulse are immaterial to the present invention and will not be described here in detail. They are fully described in other co-pending applications, such as Serial No. 106,223, filed July 22, 1949, in the name of James H. Guyton, entitled "Signal Seeking Tuner," which issued as Patent 2,652,486 on September 15, 1953. A condenser 372 is connected between line 370 and ground. Tie line 374 is connected between line 370 and a stationary contact 376 which is adapted to be engaged by a movable switch arm 378 which is grounded, and which is identified as the disabling switch. A dash and dot line 380 is indicated in connection with the armature 212 of the relay 356 and indicates that at certain points mechanical movement is imparted to this armature by the mechanical starting lever 86.

The operation of our system may in general be explained as follows. When the manual switch 302 is closed, power is supplied to the receiver and to the tuning unit and the tubes are permitted to heat up. When the tubes of the receiver are properly heated, the operator grasps knob 88 on lever 86 and begins to move the same to the right as shown in Figures 1 and 2. The initial movement of the lever system including the lever 86 and the link 122 is determined by the movable pivot 116 and the fixed pivot 126. As well as moving to the right, therefore, the lever 86 will move somewhat to the rear due to the fixed pivot 126, and this action will cause the pawl 180 to press on the lower surface of the arm 184 and raise it enough to cause the finger 206

and the tip 208 thereof to physically lift the tip 214 of the detent 210 out of the path of the vanes 216 of the governor. This unlocks the gear train so that it may rotate and move the cam driven thereby. This slight movement is permitted without driving the arcuate sector gear 130, due to the fact that the side arms 134 are spaced apart slightly farther than the width of the link 122 so that it may move between them without actually moving the sector gear.

After this slight initial movement unlocking the air vane governor, continued movement of the arm 86 will cause the pawl 180 to move out from under that portion of the arm 184 which it previously contacted, and thus will no longer support the arm. However, since the gear train has not as yet started to drive the governor, the latch 196 which snapped under the cam face of the lever 184, as previously described, now holds the lever in the upper position and the tip 214 out of engagement with the governor so that the latter may rotate. Further movement of the arm 86 causes the teeth 140 of the arcuate gear to engage with the teeth of the pinion 142, and through clutch 148, 150, pawl and ratchet 152, 156, and gear train 154, 158, 164 and 172 drives shaft 174 upon which the driving spiral cam 48 is mounted, which in turn moves the carriage upon which the tuning cores are mounted to tune the receiver. Simultaneously through the same gear train up to gear 158 which drives shaft 160 and thence, through gears 162 and 168, shaft 166 is driven to turn the air vane governor and prevent the speed from reaching too high a value. When the gear train starts to move, it rotates disc 202 and this turns member 190, upon which latch 196 is provided, about its pivot, so that the latch moves from under cam face 186, and the spring 198 may return the latch to its position of rest and allow the lever 184 to likewise move downwardly to its rest position through the force of spring 204. Spring 204 is stronger than spring 198 to hold the lower surface of member 190 against disc 202 when the latch is in supporting position. By the time that the latch 196 has moved from its supporting position, the tuner will have moved far enough so that the receiver is detuned from the previous station to which it was tuned and, therefore, the relay coil 220 will now be energized to hold its armature 212 down and the tip 214 up out of contact with the air vane governor.

As this wheel which is a part of the gear train is rotated thereby, its rotation will be counterclockwise, as shown in Figure 5, and this will move the latch 196 slightly to the right far enough to move out from under the member 186 and spring 204 will then return the lever 184 to its lower position, where it may remain since it no longer needs to support the detent 210, and spring 198 will move the latching cam 190 back out of contact with the wheel 202 so that there will be no friction drag after the device has started. The continued movement of the arm 86 across the face of the tuner will drive the gear train until such time as a positive pulse from an incoming station is developed on line 370. Prior to this time the first triode section of the tube 326 has been nonconducting, being biased to cut-off, and the second triode section of the tube has been conducting to maintain energization of coil 220 of relay 356, thus maintaining the armature 212 in contact with stationary contact 226, and the mechanical finger stopping portion 210 out of contact with the air vane govenor. If the operator tends to move the lever 86 faster than the gear train is capable of rotating, the clutch 148, 150 will merely slip and no damage will be done.

When a signal is encountered, a positive pulse is developed on line 370, driving the grid 364 of this first triode section sufficiently positive to cause this section to conduct, and flow through this section reduces the voltage on grid 330 of the second section so that flow through the second triode section is reduced to such a point that the relay coil 220 is deenergized and drops armature 212 and finger 214 into contact with the air vane governor blades 216 to stop the same. This, of course, occurs very quickly, but again, if the operator continues to move the arm 86, the clutch 148, 150 will merely slip and no damage to the gear train will occur. In moving the arm 86, the operator picks up the driving cam 48 in whatever position it may be and moves it on to the next station. There is no particular relation between the position of the operating arm 86 and the tuning means 16, 18 and 20, and by repeated operations of the arm 86 the tuning cam 48 is gradually rotated to move the tuning carriage 28 along its path.

When the tuning carriage 28 is moved to its extreme outward position, slight additional rotation of the cam 48 will cause the carriage to suddenly be returned to its innermost position by the contour of the cam. At this point the cam switch 244—240 closes and it will be seen from Figure 8 that this closure applies a direct ground to the control grid 364 of the first triode section, which prevents any positive pulse from triggering this section, and therefore whether a pulse is received in the receiver or not, it will have no effect on the stopping or indexing means during this quick return motion. As soon as the carriage has returned to its innermost position, the cam 48 will have rotated so as to break this cam switch and the triggering means will now again be in condition to be activated to stop the device on the receipt of a signal. A disabling switch 378—376 is provided which may be manually closed by downward movement of arm 86 as it is moved toward the right to prevent the operation of the triggering system when the operator wishes to move some distance over the band to another section thereof, and it is not desirable to have the tuner stop at an intermediate point. As soon as the operator reaches the desired section, switch 378—376 is opened by releasing the downward force on arm 86, and thereafter the tuning means will index on the next station to be received.

It is desired to adjust the amplifier so that it will have a different sensitivity, i. e., in this case, be more sensitive during the tuning operation than when the receiver is tuned into a station and is reproducing a program. It is also desirable to be able to adjust the tuning sensitivity. The adjustable arm 283 which engages the multiplicity of contacts between the various resistors 280, 282, 284 and 286 is provided for this purpose. The snapover switch arm 234 is provided which changes from a "listening" to a "tuning" sensitivity. Arm 234 is actuated by finger 228 on arm 86. When arm 86 is returned to its normal inoperative position, finger 228 moves arm 234 so that it rests against stationary contact 238 as shown, and in this position resistors 268 and 274 and the potential on line 269 from the amplifier circuits determine the listening sensitivity of the receiver. Immediately upon inaugurating movement of the arm 86, finger 228 moves away from contact with the switch actuator 232 and arm 234 snaps over into engagement with stationary contact 236. The sensitivity at this time is therefore determined by resistor 268 in series with any one or more of the various resistances 280, 282, 284 and 286, depending upon the position of the adjustable arm 288.

Thus, the initial movement of the arm 86 has three functions: first, it raises the locking finger 214 out of engagement with one of the air vane governor blades 216 so that the gear train may rotate; secondly, it releases the switch 230 and the latter is actuated to change the sensitivity of the receiver; and thirdly, it indirectly, through movement of the tuner off the station to which the operator has been listening causes a blocking of the first triode section of the tube 326 and conductance through the second triode section to energize the relay to hold its armature to maintain the finger 214 out of engagement with the air vane governor. In order to produce the proper cycle, it is necessary to return the lever 86 to its fully inoperative position after each driving stroke.

The construction of the starting or unlocking arrangement as shown in Figures 1 through 5 may be termed a mechanical one due to the fact that mechanical movement of the lever **86** raises the locking detent **210** from engagement with one of the air vane governor blades **216** and then maintains it out of contact by moving latch **196** under lever **184**. The same result can be obtained electrically and a modification of this portion of our apparatus is best shown in Figure 7. In this form lever **86'** is illustrated, as before, mounted for straight line movement across the supporting base plate **6** through a pin **116**, which rides in a slot **118** in said plate. The driving link **122** for imparting rotary movement to the arcuate sector gear **130** is provided as before and in this case a triangular shaped plate **382** is pivotally mounted on the plate **128** at **384**. This triangular plate has an upstanding flange **386** which extends upwardly on the left-hand side of the lever **86'**, as shown in Figure 7, which acts as a limit stop for rotative movement of the lever when urged to the left by spring **176** (Figure 4). A pivoted pawl **388** is mounted on one corner of the triangular plate **382** and has one end connected to a biasing spring **390**, the opposite end of which is secured to the upstanding flange **386**. This tends to maintain the pawl pointed toward the periphery of the driving wheel **202**. A stop **391** is provided to keep the triangular plate **382** from swinging too far to the right.

A flange **392** is formed on the left side of arm **86'** to overlap a portion of flange **386** to move the plate **382** to the left. A first switch assembly **394**, mounted on the base plate **6**, consists of a substantially stationary contact **396** which is adapted to be engaged by a movable contact **398** when the end of the spring arm **400** upon which the contact **398** is mounted is engaged by the upstanding flange **386** on the triangular plate **382**. When the arm **86'** is moved to the right, pressure is released on arm **400** and the switch will open as the contacts are spring biased away from each other. A second switch **402** is likewise mounted on base plate **6** and has a spring arm **404** carrying a movable contact **406** which is adapted to cooperate with a relatively fixed contact **408**. This switch is the reverse of the first in that when all pressure is removed from spring arm **404**, the contacts will close. Arm **404** is provided with a lateral extension **410** which is adapted to engage the upstanding flange **392** on the side of lever **86'**. Switch **394** may be identified as a normally open switch and **402** as a normally closed switch.

With this type of starting and control system, when it is desired to change from one station to another, lever **86'** is, as before, moved to the right, as shown in Figure 7, about its pivot. The initial movement of the lever **86'** withdraws the flange **392** from the extension **410**, permitting the contacts **406**, **408** to close. This switch is connected in circuit with the control relay **220** and completes an energizing circuit therefor. The relay therefore, attracts its armature, lifting the finger **214** out of engagement with the air vane governor, and the gear train may be driven. Up to this point switch **394** has still remained closed due to the fact that the lever **86'** may move with respect to the triangular plate **382** which is maintained in its original position through contact between the nose of the pawl **388** and the wheel **202**. However, when the gear train starts to move and the wheel disc **202** revolves, the friction between the nose of the pawl **388** and the periphery of the wheel **202** will cause the pawl **388** to turn about its pivot against the spring bias, which permits the triangular plate **382** to rotate in a counterclockwise direction and come into contact with stop **391**, due to pressure from spring arm **400**, and contacts **396—398** will open. Switches **406—408** and **396—398** are in series in an independent supply circuit to the relay coil, and therefore during the period that they are both closed the relay **220** will be energized, irrespective of any other conditions. When switch **396—398** opens, the circuit returns to normal indexing condition when lever **86'** returns to its left-hand position of rest, switch **406—408** opens before switch **396—398** closes, so there is no independent energization of relay coil **220** on the back or return stroke. It will thus be obvious that we have provided a manually-driven means for moving tuning means of the radio receiver over the band in combination with signal tuned means to index the tuning means upon receipt of any incoming transmitted signals.

We claim:

1. In a radio receiver, movable tuning means for tuning the receiver, driving means for the tuning means including a gear train, clutch means in the gear train, manually actuatable means engageable with said gear train to drive the same through said clutch means, a governor connected to and driven by the gear train to limit the speed thereof, a mechanical detent movable into interfering position with the governor to stop the same, and relay means actuated upon receipt of an incoming signal in the receiver to move the detent.

2. In a radio receiver, movable tuning means, driving means for the tuning means, manually operated means connected to said driving means for actuating the same, mechanical stopping means operatively engageable with the driving means to index the tuning means, relay means for operating the mechanical stopping means, and auxiliary means to move said mechanical stopping means from operative engagement with the driving means upon initial movement of the manually operated means.

3. In a radio receiver, movable tuning means, driving means for the tuning means, manually operated means connected to said driving means for actuating the same, mechanical stopping means operatively engageable with the driving means to index the tuning means, and control means to move the mechanical stopping means from operative engagement with the driving means and retain it out of engagement for a short period upon initial movement of the manually operated means but releases the stopping means immediately thereafter.

4. In a radio receiver, movable tuning means, driving means for moving said tuning means, manually adjustable means connected to the driving means to actuate the same, mechanical adjustable stopping means mounted adjacent the driving means and movable into operative engagement therewith to index or stop the same, and control means connected between the manually adjustable means and the mechanical stopping means to move the latter out of operative engagement with the driving means and maintain it in that position for a short period upon initial movement of the manually adjustable means away from a position of rest.

5. In a radio receiver, movable tuning means, driving means connected to the tuning means including a gear train, a pivoted manually movable arm connected to the gear train to drive the same, a governor driven by the gear train, an adjustable detent mounted adjacent the governor and movable into engagement therewith to stop the tuning means, relay means controlled by the appearance of signal in the receiver actuating the detent, and clutch means in the gear train to prevent damage upon movement of the arm when the detent is in engagement with the governor.

6. In a radio receiver, movable tuning means, driving means connected to the tuning means including a gear train, a pivoted manually movable arm connected to the gear train to drive the same, a governor driven by the gear train, a pivoted detent mounted adjacent the governor and movable into engagement therewith to stop the tuning means, relay means controlled by the appearance of a signal in the receiver actuating the pivoted detent, and mechanical linkage means between the pivoted arm and the pivoted detent to move the detent out of engagement with the governor upon initial movement of the arm from its position of rest.

7. In a radio receiver, movable tuning means, driving means connected to the tuning means including a gear train, a pivoted manually movable arm connected to the gear train to drive the same, a governor driven by the gear train, a pivoted detent mounted adjacent the governor and movable into engagement therewith to stop the tuning means, relay means controlled by the appearance of a signal in the receiver actuating the pivoted detent, mechanical linkage means between the pivoted arm and the pivoted detent to move the detent out of engagement with the governor upon initial movement of the arm from its position of rest, and clutch means in the gear train to prevent damage upon movement of the arm when the detent is in engagement with the governor.

8. In radio receiving means having adjustable tuning means for tuning the same over a predetermined band of frequencies, means for moving said tuning means at a relatively slow rate in one direction of travel and rapidly in the opposite direction including a spiral cam operably engageable with said tuning means and a gear train connected to said cam, one-way drive means in said gear train, a sector gear driving said gear train, and a pivoted lever linked to the sector gear to drive the same, means for biasing the lever to one position, said pivoted lever being adapted to be manually actuated to drive the tuning means but to return to said position upon release.

9. In radio receiving means having adjustable tuning means for tuning the same over a predetermined band of frequencies, means for moving said tuning means at a relatively slow rate in one direction of travel and rapidly in the opposite direction including a spiral cam operably engageable with said tuning means and a gear train connected to said cam, a sector gear driving said gear train, a pivoted level linked to the sector gear to drive the same, said pivoted lever being adapted to be manually actuated, and clutch means in the gear train to prevent damage through excess movement of the pivoted lever.

10. In radio receiving means having adjustable tuning means for tuning the same over a predetermined band of frequencies, means for moving said tuning means at a relatively slow rate in one direction of travel and rapidly in the opposite direction including a spiral cam operably engageable with said tuning means and a gear train connected to said cam, one-way drive means in said gear train, a sector gear driving said gear train, a pivoted lever linked to the sector gear to drive the same, means for biasing the lever to a position of rest, said pivoted lever being adapted to be manually actuated, clutch means in the gear train to prevent damage through movement of the pivoted lever if the tuning means is locked, mechanical locking means engageable with a part of the gear train, and means to control the position of the locking means dependent upon the receipt of an incoming signal in the receiver.

11. In radio receiving means having adjustable tuning means for tuning the same over a predetermined band of frequencies, means for moving said tuning means at a relatively slow rate in one direction of travel and rapidly in the opposite direction including a spiral cam operably engageable with said tuning means and a gear train connected to said cam, a rotatable gear driving said gear train ,a movable lever linked to the rotatable gear to drive the same, said lever being adapted to be manually actuated, clutch means in the gear train to prevent damage through movement of the lever if the tuning means is locked, mechanical locking means engageable with a part of the gear train, means to control the position of the locking means dependent upon the receipt of an incoming signal in the receiver, and auxiliary unlocking means connected between the lever and the mechanical locking means to move the latter to unlocked position upon initial movement of the lever away from a position of rest.

12. In radio receiving means having adjustable tuning means for tuning the same over a predetermined band of frequencies, means for moving said tuning means at a relatively slow rate in one direction of travel and rapidly in the opposite direction including a spiral cam operably engageable with said tuning means and a gear train connected to said cam, a rotatable gear driving said gear train, an adjustable lever linked to the rotatable gear to drive the same, said lever being adapted to be manually actuated, clutch means in the gear train to prevent damage through movement of the lever if the tuning means is locked, mechanical locking means engageable with a part of the gear train, means to control the position of the locking means dependent upon the receipt of an incoming signal in the receiver, said control means including a relay, and auxiliary switching means actuated by the initial movement of the lever to energize the relay and move the locking means to unlocked position regardless of whether signals are or are not received.

13. In radio receiving means having adjustable tuning means for tuning the same over a predetermined band of frequencies, means for moving said tuning means at a relatively slow rate in one direction of travel and rapidly in the opposite direction including a spiral cam operably engageable with said tuning means and a gear train connected to said cam, a sector gear driving said gear train, a pivoted lever linked to the sector gear to drive the same, said pivoted lever being adapted to be manually actuated, clutch means in the gear train to prevent damage through movement of the pivoted lever if the tuning means is locked, mechanical locking means engageable with a part of the gear train, means to control the position of the locking means dependent upon the receipt of an incoming signal in the receiver, said control means including a relay, and means to maintain the relay energized at will so that the tuner may be moved over a portion of the band of frequencies without indexing if desired.

14. In a radio receiver, movable tuning means, driving means connected to the tuning means including a gear train, a pivoted manually movable arm connected to the gear train to drive the same, a governor driven by the gear train, a pivoted detent mounted adjacent the governor and movable into engagement therewith to stop the tuning means, relay means controlled by the appearance of a signal in the receiver actuating the pivoted detent, and switching means for independently energizing said relay actuated by the initial movement of the manually movable arm to unlock the gear train to permit moving to a new station.

15. In a radio receiver, movable tuning means, driving means connected to the tuning means including a gear train, a pivoted manually movable arm connected to the gear train to drive the same, a governor driven by the gear train, a pivoted detent mounted adjacent the governor and movable into engagement therewith to stop the tuning means, relay means controlled by the appearance of a signal in the receiver actuating the pivoted detent, switching means for independently energizing said relay actuated by the initial movement of the manually movable arm to unlock the gear train to permit moving to a new station, and additional manually operated switching means connected to the relay to energize the same independently of any other control so that the tuner may be moved over substantial sections of the frequency band without indexing.

16. In a radio receiver, movable tuning means, driving means connected to the tuning means including a gear train, a manually movable arm connected to the gear train to drive the same, a governor driven by the gear train, an adjustable detent mounted adjacent the governor and movable into engagement therewith to stop the tuning means, relay means controlled by the appearance of a signal in the receiver actuating the detent, and additional manually operated switching means connected to the relay to energize the same independently of any other control so that the tuner may be moved over substantial sections of the frequency band without indexing.

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