

June 26, 1945.

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2,379,284

RADIO RECEIVER CONTROL MEANS

Filed Oct. 11, 1943

4 Sheets-Sheet 1

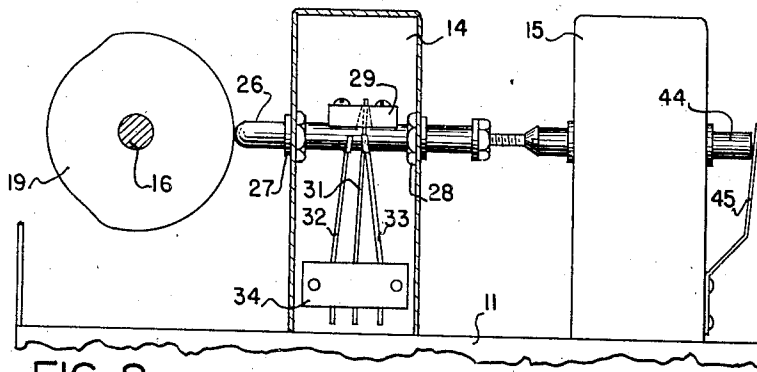


FIG. 2

FIG. 4

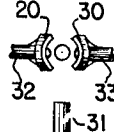


FIG. 3

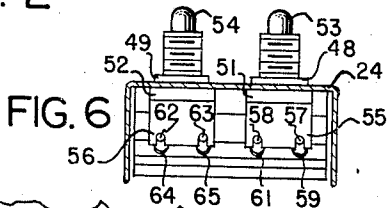
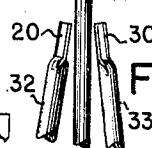


FIG. 6

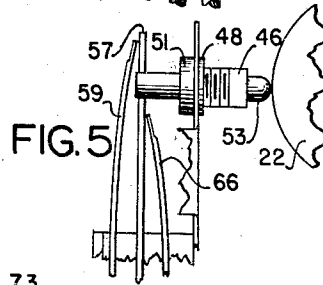


FIG. 5

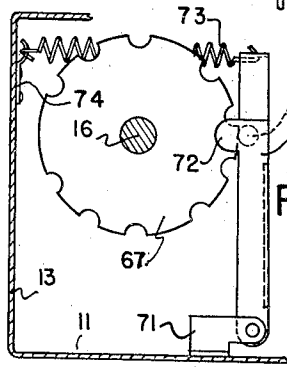
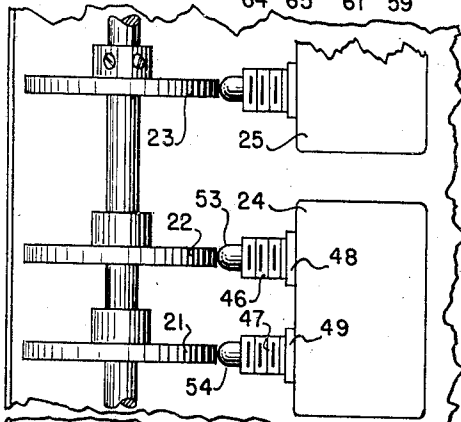


FIG. 7

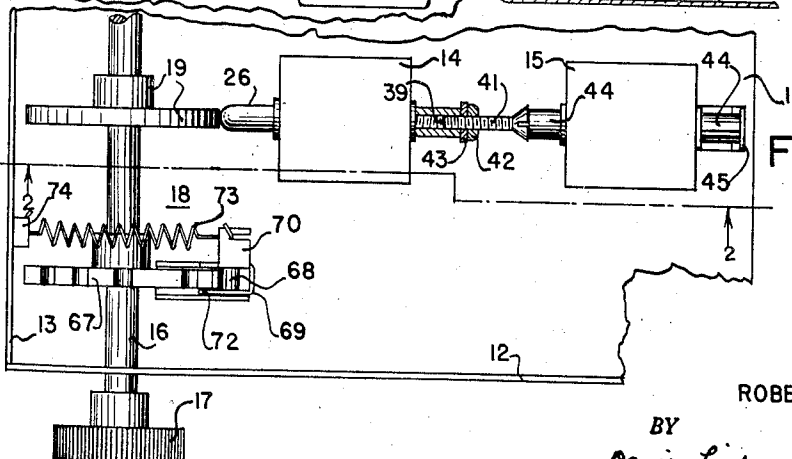


FIG. 1

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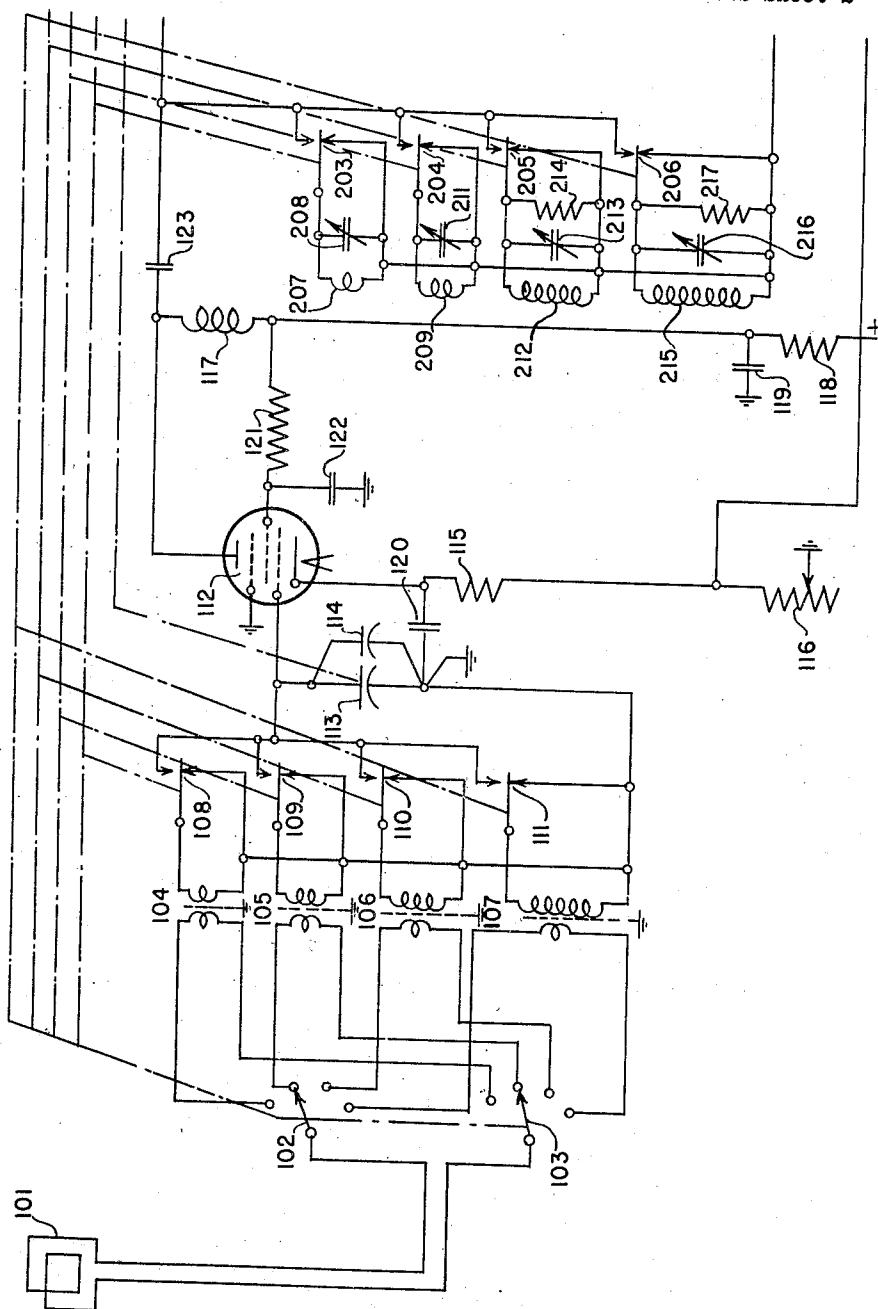
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FIG. 8



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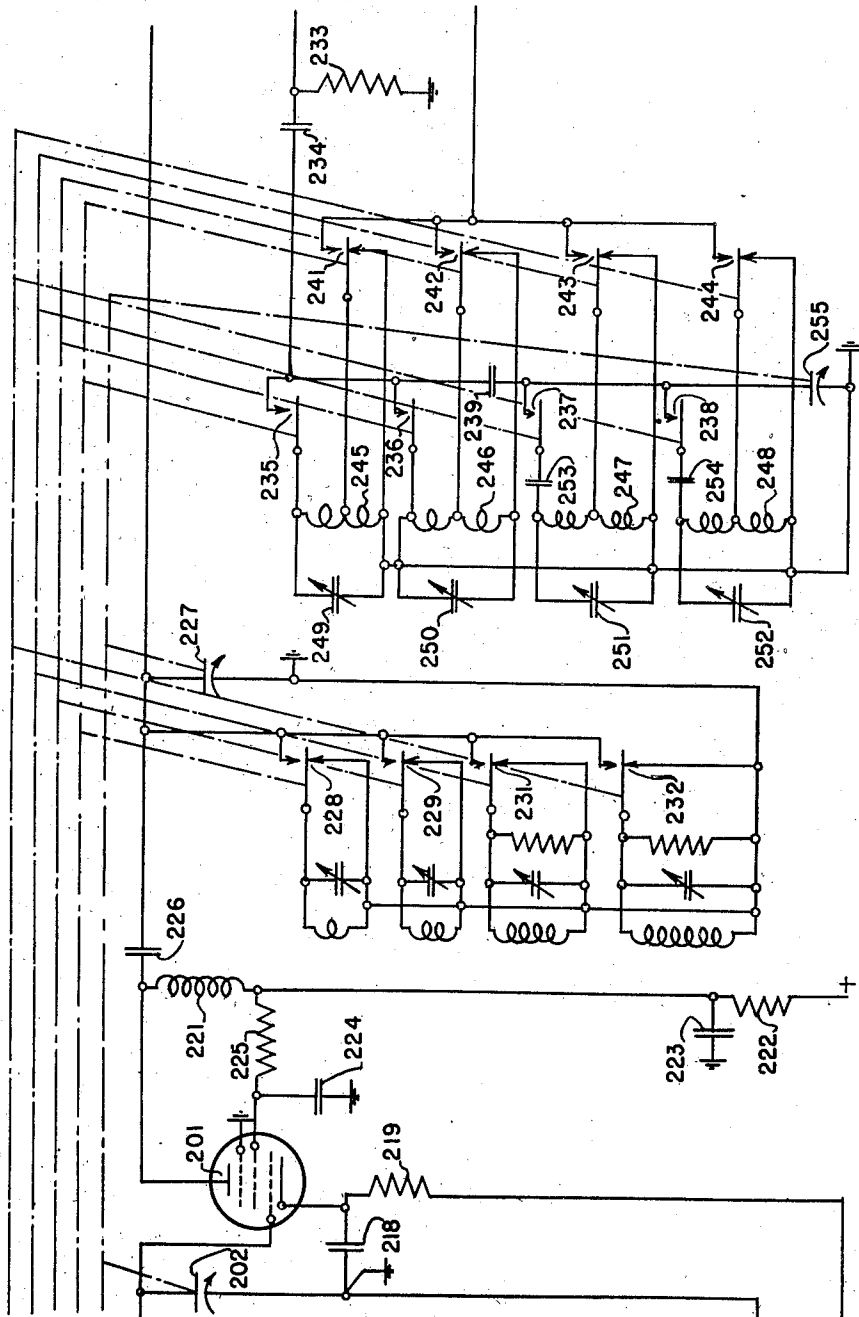
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FIG. 9



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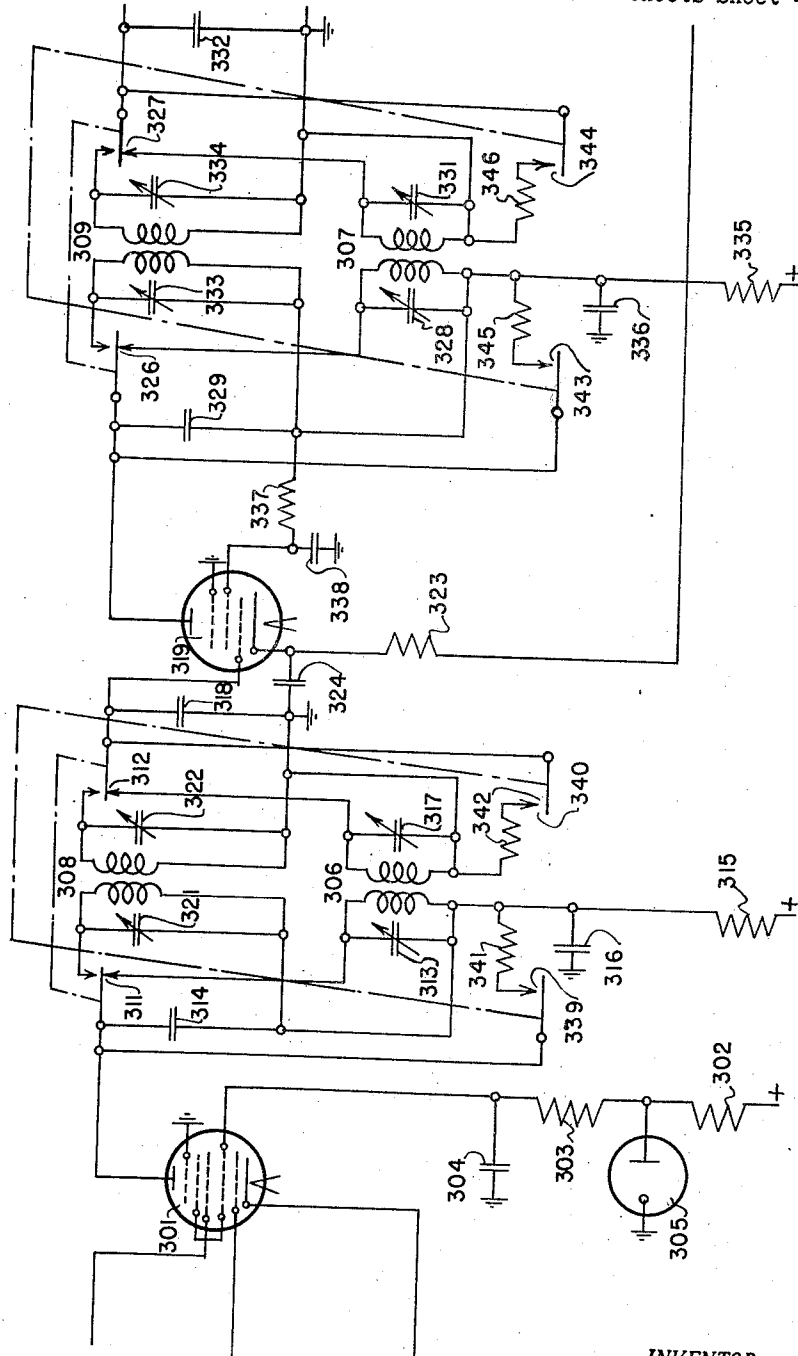
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4 Sheets-Sheet 4

FIG. 10.



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UNITED STATES PATENT OFFICE

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RADIO RECEIVER CONTROL MEANS

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Application October 11, 1943, Serial No. 505,771

8 Claims. (Cl. 250—40)

The present invention relates to radio receivers and, more particularly, to a unitary control means for changing the frequency range of the radio receiver and for changing the frequency of the intermediate frequency amplifier.

It has been common in multi-band radio receivers to provide a band switching arrangement for changing the frequency range over which the receiver is to be operative. Heretofore such arrangements have generally operated to connect into circuit a selected one of a plurality of tuning inductors in the radio frequency input and the radio frequency amplifier portion of a receiver by merely completing the necessary connection. In a radio receiver which has a high overall gain, as, for example, a receiver utilizing a rather small loop antenna, the ordinary band switching schemes are inadequate. Furthermore, where a radio receiver is to operate over a wide range of frequencies, as, for example, one band might be 2 to 3 megacycles and a band at the other range of frequencies might be from 30 to 50 megacycles, in order that the tuning inductors be provided to cover these frequency ranges and other intermediate frequency bands, it is necessary to enclose each tuning inductor in a separate shielded container and, furthermore, to short circuit each unused tuning inductor so that it will be unable to affect the operation of the receiver. The intermediate frequency amplifier also must be arranged to operate at one frequency for the lower radio frequency band operation and at another frequency for the higher radio frequency band operation.

In accordance with the present invention a unitary control means is provided for selectively changing the frequency range of the radio receiver and for changing the frequency range of the intermediate frequency amplifier. This unitary control means for the radio frequency amplifier and the intermediate frequency amplifier comprises a single actuating member arranged to be moved to any one of a plurality of predetermined positions, each of which corresponds to a particular band over which the radio receiver is to operate, and in accordance with a shift from the lower radio frequencies to the higher radio frequencies the same apparatus operates to change the operating frequency of the intermediate frequency amplifier. In order to provide for the simultaneous switching into operation of a plurality of radio frequency tuning inductances it has been found advantageous to cause a single cam to actuate all of the switches associated with a particular frequency band. In order that these

various switches might be operated simultaneously, adjustable operating means are provided which interconnect the various switch actuating means of the radio frequency tuning inductances.

Therefore it is an object of the present invention to provide in a radio receiver an improved unitary control means for selectively changing the frequency range of the radio receiver and for changing the operating frequency of the intermediate frequency amplifier.

Another object of the present invention is to provide in a radio receiver an improved unitary control means for selectively changing the frequency range of the radio receiver and which is provided with adjustable means whereby simultaneous switching of a plurality of switches associated with a plurality of radio frequency tuning inductors may be obtained.

The invention itself is set forth with particularity in the appended claims. Other and further objects of the present invention will subsequently become apparent by reference to the following description taken in connection with the accompanying drawings, wherein Figure 1 is a top view of a portion of a radio receiver chassis provided with the present invention; Fig. 2 is a view partly in cross section along the line 2—2 of Fig. 1; Fig. 3 is a detailed view of the switch contacts shown in a part of Fig. 2; Fig. 4 is a top view of the switch contacts shown in Fig. 3; Fig. 5 is a side view of the switch contacts contained within the intermediate frequency transformer shield; Fig. 6 is a top view of the switch contacts shown in Fig. 5; and Fig. 7 is an end view of a portion of certain apparatus shown in Fig. 1; and Figs. 8, 9 and 10 show a circuit utilizing the apparatus comprising the present invention.

Referring more particularly to Figs. 1 and 2, there is shown a radio chassis 11 having a front supporting panel 12 and a side wall 13. Mounted on the chassis 11 are a plurality of containers 14 and 15 each comprising a shield containing a radio frequency tuning inductor and a switch. While only two radio frequency units 14 and 15 for a two stage radio frequency amplifier have been shown, it, of course, will be appreciated that a greater number might be utilized, wherefore the additional units would correspond more nearly to the radio frequency unit 14. It, furthermore, is to be understood that while only one group of such units is visible in the drawing by virtue of the break in the chassis, other groups of such units are provided, each group corresponding to the apparatus associated with the various stages of radio frequency amplification in a selected band

of frequencies. It furthermore will be appreciated that where each stage of amplification is to be arranged to operate over a plurality of frequency bands, all of the inductors for a single stage might be contained within a single shielded structure which, of course, would then be provided with a plurality of switches corresponding to the number of inductors contained therein. The various shielded structures, however, would be aligned along the axes of the switch actuating means and in order that the switches operate simultaneously, adjustable means are provided so that the entire series of switches will operate at the same time. The switching apparatus provided for the control of the radio frequency transformers or inductors and also for the intermediate frequency transformers comprises a shaft 16 suitably supported upon the radio receiver chassis 11 and extending to the exterior of the front panel 12 where the shaft is provided with a suitable actuating knob 17. The shaft 16 is arranged to be angularly displaced to a selected one of a number of predetermined angular positions. In order to retain the shaft 16 in any selected predetermined position there is provided a suitable retaining mechanism 18 which is also shown in Fig. 7 and which will subsequently be described in detail. Beyond the retaining apparatus 18 the shaft 16 is provided with a plurality of adjustably positioned cams, such as cams 19, 21, 22 and 23. The latter cams 21 to 23 are arranged to control the operation of a plurality of intermediate frequency transformers contained within suitable shielded housings 24 and 25.

The cam 19 is arranged to control the radio frequency tuning inductors contained within the shielded containers 14 and 15 by a cam follower apparatus engaging the surface of the cam 19. This cam follower apparatus includes a rod 26 suitably supported in bearing members 27 and 28 positioned in the sides of the shielded container structure 14. At an intermediate point on the cam follower rod 26 there is suitably secured a switch actuating block 29 which is provided with a conical aperture into which there is fitted the movable switch blade 31 which cooperates with relatively stationary switch blades 32 and 33 positioned at opposite sides of the switch blade 31. The lower extremities of all the switch blades 31 to 33 are secured in suitably insulated supporting means 34.

In the position shown in Fig. 2 the cam 19 has actuated the switch blade 31 from the off-normal position so as to remove the short circuit from the associated tuning inductor connected across the switch blades 31 and 32 and to connect into circuit the associated tuning inductor by contact with the switch blade 33. One extremity of the rod 26 is arranged to bear against the movable member, such as the cam surface 19, and the other extremity of the rod 26 is provided with a tapped opening 39 into which there is fitted a threaded screw member 41. The position of the threaded screw member 41 may be varied and secured in a desired position by the application of a lock nut 42 bearing against a suitable washer 43 which engages the end of the shaft member 26. The adjustable spacing means comprising the threaded screw member 41 and lock nut 42 permits compensation for slight displacements in the assembly of the individual shielded units relative to each other. Thus there is provided an arrangement which is readily installed and which, nevertheless, will provide for simultaneous operation of all of the switches involved at any one

selected time. The head of the screw 41 is arranged to engage one end of another movable shaft, such as 25 or 44, where the succeeding radio frequency tuning inductor is housed in a structure similar to the one just described. In other words, a number of units such as 14 may be provided in seriatim which is terminated by a unit such as 15 which is provided with a longitudinally movable shaft member 44 which also actuates a switch structure corresponding to that shown in the cross-sectional view of the shielded container 14. The other end of the movable shaft member 44 is engaged by a flat spring member 45, one end of which is secured to one side of the shield 15. The flat spring member 45 urges all of the rods, such as 44 and 26, toward the cam 19 so that the high portion of the cam 19 will simultaneously actuate all of the switches contained within the shielded containers, such as 14 and 15.

The switch structure utilized within the shielded containers 14 and 15 is one which provides positive contact operation with a minimum amount of movement and which has its switch blades so formed that the inter-element capacity is reduced to a minimum. By referring to Figs. 3 and 4 it will be seen that the lower extremity of each of the switch blades 31 to 33 is in the form of a rod or wire, as contrasted to the usual flat spring structure which has a much greater interelement capacity. The upper extremity of each of the switch blades 32 and 33 is provided with arcuate shaped contact portions 20 and 30, respectively, which are arranged to be engaged by an intermediate portion of the center switch blade 31.

Reference may now be had to Figs. 1, 5 and 6, from which it will be seen that each intermediate frequency transformer container, such as 24, is associated with two operating cam members such as 21 and 22. Suitable bearing members 46 and 47 are each secured in position by cooperating lock nuts 48 and 49. Each of the members 46 and 47 is provided at its interior portion with an enlargement such as the enlargements 51 and 52 which bear against the inside of the shielded structure 24. These bearing members are provided with a cylindrical opening within which there is supported a member having rod-like outer terminations 53 and 54, respectively, having inner terminating portions 55 and 56 which are more or less rectangular in cross section. The rectangular end portion 55 is provided with a pair of notches which engage movable spring contacts 57 and 58 arranged to cooperate with the relatively stationary contacts 59 and 61. Similarly, the end portion 56 of the other switch actuating apparatus is provided with notches engaging movable contacts 62 and 63 arranged for cooperation with the relatively stationary contacts 64 and 65. One of the contacts 57 is visible in Fig. 5 and this contact cooperates with the contact 59. The contact 57 is also arranged to cooperate with another relatively stationary contact 66 with which it is in engagement whenever the actuating portion 53 is not in engagement with the high portion of a cam, such as the cam 22. Another similar contact is arranged for cooperation with the contact 58 so that the two movable contacts 57 and 58 actuated by the rod 53 are arranged to switch the conductors leading to the associated vacuum tubes from one intermediate frequency transformer to another intermediate frequency transformer.

For certain conditions of operation of the

radio receiver it is desired to broaden the response of the intermediate frequency transformer and in order to effect this the cam 21 was provided to actuate the rodlike member 54. Each of the pairs of contacts 62, 64 and 63, 65 is arranged to connect across one winding of the associated intermediate frequency transformer a broadening resistor. It will be noted that the switch blades, such as 57, 59 and 66 shown in Fig. 5, are of a configuration and structure analogous to the type of switch blades shown in Figs. 3 and 4. In other words, the movable switch contact 57 is a cylindrical rod or wire which cooperates with cylindrical or wirelike switch contact members 59 and 66, the free extremities of which are provided with arcuate end portions for cooperation with a movable switch contact.

In order that the shaft 16 may be retained in any one of a plurality of predetermined positions, there is provided the retaining means 18 which is also shown in Fig. 7. Mounted upon the shaft 16 is a detent wheel 67 having a plurality of semicircular notches arranged about its periphery. These notches are engageable with a roller 68 supported at an intermediate point on a channel-like lever 69. The channel-like lever 69 is pivoted at one end and supported by a suitable bracket 71 secured to the chassis 11. Adjacent the roller 68 the lever 69 is provided with a pair of projecting ears 72 extending on either side of the detent wheel 67. Extending beyond the roller 68 is an angular portion 70 provided with a notch which is engaged by a biasing spring 73. The other extremity of the biasing spring 73 engages a bracket 74 secured to the side wall 13 of the chassis. This arrangement utilizing a U-shaped channel structure for the lever 69 which has cooperating ears 72 at either side of the detent wheel 67 insures positive cooperation of the roller 68 with the notches in the detent wheel. Such structure, furthermore, by having the roller 68 at an intermediate point on the lever 69, has the advantage of providing a positively engaging detent which is relatively free from vibration whenever the roller 68 engages one of the detent wheel notches as the shaft 16 is rotated. This produces a positive centering action so that the cams associated with the shaft 16 are properly stopped at the correct angular displacement. The circular notch and roller arrangement furthermore permits rapid adjustment to other positions and, as each new position is encountered, this is distinctly felt by the operator of the knob 17.

In order to illustrate more clearly the manner in which the apparatus shown in Figs. 1 to 7 cooperates to produce the desired changes in the operation of a radio receiver, a portion of such receiver has been shown in Figs. 8, 9 and 10. It may be assumed that the receiver is to operate over a number of bands such as 2 to 3 megacycles, 3 to 4.5 megacycles, 20 to 30 megacycles, and 30 to 50 megacycles. Because of the difference between the lower frequency bands and the higher frequency bands it is desirable to provide for the operation of the intermediate frequency amplifier at two different frequencies. The radio receiver is arranged to be energized from a suitable antenna which has been illustrated in Fig. 8 as comprising a loop antenna 101 connected to the movable contact arms 102 and 103 of a pair of switches each having a plurality of contacts. The contacts of the switches 102 and 103 are connected to the upper and lower terminals of the primary windings of a plurality of radio frequency input transformers

104, 105, 106 and 107. Each of the transformers 104 to 107 is provided with an electrostatic shield between the primary and secondary windings so that the antenna 101 is maintained balanced with respect to ground.

The secondary windings of the transformers 104 to 107 are each connected to one of a plurality of single pole double throw switches 108, 109, 110 and 111 which are arranged so as to normally short circuit the secondary windings so that any transformers not in use will not affect the operation of the radio receiver. One of the contacts of each of the switches 108 to 111 is connected to the control grid or electrode of a vacuum tube 112 which is also connected to one section 113 of a single control variable capacitor. In order to obtain the optimum resonant condition of the input circuit of the vacuum tube 112 an auxiliary or vernier capacitor 114 may be connected to capacitor 113. Both the capacitors are connected to ground. The cathode of the vacuum tube 112 is suitably biased by self-biasing resistors 115 and 116, the latter one being adjustable so that the gain of the radio frequency amplifier might be controlled manually. The cathode of the vacuum tube 112 is by-passed to ground by the capacitor 120. The anode circuit of the vacuum tube includes a radio frequency choke coil 117 connected to a resistor 118 which, in turn, is connected to a suitable source of anode potential. The resistor 118 is by-passed to ground by a capacitor 119. The screen grid of the vacuum tube 112 receives potential through a voltage drop resistor 121 connected to the common juncture between the choke coil 117 and the resistor 118. The resistor and the screen grid are by-passed to ground by a capacitor 122. The anode of the vacuum tube 112 is capacitively coupled by the coupling capacitor 123 which is connected to the control electrode of the succeeding vacuum tube 201.

The input circuit to the vacuum tube 201 is tuned by another section 202 of the same gang capacitor which tunes the input to the preceding amplifier tube. A plurality of tuned inductors or impedances are arranged for selective connection to the input of the vacuum tube 201 by a plurality of single pole double throw switches 203 to 206 each arranged to normally short circuit its associated tuned circuit. The switch 203 is connected to a circuit including an inductor 207 and a trimmer capacitor 208. The switch 204 is associated with an inductor 209 and a trimmer capacitor 211. The switch 205 is associated with an inductor 212, a trimmer capacitor 213 and a broadening resistor 214. The switch 206 is associated with an inductor 215, a trimmer capacitor 216 and a broadening resistor 217. The cathode of the vacuum tube 201 is by-passed to ground by a capacitor 218 and is biased by the resistors 219 and 116.

In a manner similar to the preceding stage of amplification the anode of the vacuum tube 201 is connected to a radio frequency choke coil 221, a resistor 222 and a grounded capacitor 223. The screen grid is by-passed to ground by a capacitor 224 and receives its supply of potential through a voltage drop resistor 225, which is connected to the juncture between the choke coil 221 and the resistor 222. The anode of the vacuum tube 201 is coupled through a capacitor 226 to the input electrode of the succeeding vacuum tube 301 which serves as the first detector of the radio receiver set. The input circuit of the vacuum tube 301 is arranged to be tuned by another section

227 of the same gang capacitor which tunes the preceding stages.

The grid circuit of the vacuum tube 301 is associated with a plurality of switches 228, 229, 231 and 232 which are selectively operable to connect into circuit tuned circuits comprising inductors and capacitors, and in certain cases broadening resistors in a manner similar to the input circuit of the vacuum tube 201. In addition the vacuum tube 301 is provided with an oscillator section connecting the cathode and one of the grids. This grid is provided with a grid resistor 233 which is grounded and a blocking capacitor 234. The capacitor 234 is connected to a plurality of single pole single throw switches 235 to 238. The cathode of the vacuum tube 301 is connected to one contact of a plurality of single pole double throw switches 241 to 244, which are arranged so as to normally short circuit one half of an associated inductor such as the inductors 245 to 248, respectively. Inductors 245 to 248, respectively, are associated with trimmer capacitors 249, 250, 251 and 252. Interposed between the switches 236 and 237 is a padding capacitor 239. Interposed between the switch 237 and the inductor 247 is a padding capacitor 253, and similarly between the switch 238 and the inductor 248 is a padding capacitor 254. The padding capacitors and the trimmer capacitors cooperate with a variable capacitor 255 which comprises another section of the gang control capacitors.

In order to illustrate how a cam, such as 19, simultaneously operates a plurality of switches to change the band over which the radio frequency amplifier operates, a dotted line has been drawn between the switches 102, 103, 108, 203, 228, 235 and 241 to show that these switches will be operated by a single cam. The inductors or transformers associated with such switches are contained within a series of shielded structures such as 14 and 15 shown in Fig. 1. Another cam similar to cam 19 would be utilized to control switches 109, 204, 229, 236 and 242, and still another cam would control the switches 110, 205, 231, 237 and 243, etc.

The vacuum tube 301 is provided with a grounded suppressor grid, and with screen grids which are energized from a suitable source of potential through the voltage drop of resistors 302 and 303. The connection to the grids and the resistor 303 is by-passed to ground by a capacitor 304. If desired a voltage regulator tube 305 may be connected between ground and the common juncture of the resistors 302 and 303.

The intermediate frequency amplifier may comprise a plurality of stages of amplification and for the purposes of illustration two such stages have been shown in Fig. 10. The intermediate frequency amplifier normally operates at a certain frequency as determined, for example, by the operation of transformers 306 and 307. When it is desired to operate the intermediate frequency amplifier at another frequency alternate transformers 308 and 309 are switched into the circuit. A pair of switches 311 and 312 control the connections to the transformers 306 and 308. The transformer 306 is normally connected by the switch 311 to the anode of the vacuum tube 301. The primary winding of the transformer 306 is provided with a trimmer capacitor 313 which operates in parallel with a padding capacitor 314. Suitable anode potential is provided through a voltage drop resistor 315, one terminal of which is by-passed to ground by a capacitor 316. The resistor 315 is connected

to one terminal of the primary winding of the transformers 306 and 308. The secondary winding of the transformer 306 is tuned by a trimmer capacitor 317 arranged to operate in parallel with a padding capacitor 318 which is connected between ground and the control electrode of the succeeding vacuum tube 319. Thus normally the switches 311 and 312 connect the transformer 306 between the vacuum tubes 301 and 319. When the switches 311 and 312 are actuated they are arranged to connect the transformer 308 between the vacuum tubes 301 and 319.

The primary winding of the transformer 308 is tuned by a trimmer capacitor 321 arranged to operate in parallel with the padding capacitor 314. The secondary winding of the transformer 308 is tuned by a trimmer capacitor 322 arranged to operate in parallel with the padding capacitor 318. The cathode of the vacuum tube 319 is connected through a resistor 323 to a suitable source of gain control bias. The cathode of the vacuum tube 319 is by-passed to ground by a capacitor 324.

The transformers 307 and 309 are arranged to couple the vacuum tube 319 to a succeeding amplifying tube or second detector. A pair of switches 326 and 327 normally connect the transformer 307 between the vacuum tube 319 and the next vacuum tube. The primary winding of the transformer 307 is tuned by a trimmer capacitor 328 arranged to operate in parallel with a padding capacitor 329. The secondary winding of the transformer 307 is tuned by a trimmer capacitor 331 arranged to operate in parallel with a padding capacitor 332. The primary winding of the transformer 309 is provided with a trimmer capacitor 333 arranged for operation in parallel with the padding capacitor 329. The secondary winding of the transformer 309 is provided with a trimmer capacitor 334 arranged for operation in parallel with the padding capacitor 332. Suitable anode voltage is supplied to the vacuum tube 319 through a voltage drop resistor 335 which is connected to a grounded by-pass capacitor 336 and to one terminal of the primary winding of the transformers 307 and 309. From this common connection to the primary windings of the transformers 307 and 309 there is provided a voltage drop resistor 337 connected to the screen grid of the vacuum tube 319. The screen grid is by-passed to ground through a capacitor 338.

It thus becomes apparent that with the connections as shown, the vacuum tubes 301 and 319 and the succeeding vacuum tube are interconnected normally by transformers 306 and 307. In order to change the frequency of the intermediate frequency amplifier a pair of cams, such as the cams 21 and 23, are arranged to actuate simultaneously the switches 311, 312, 326 and 327. In addition two other cams corresponding to cam 22 are provided for broadening the frequency response characteristic of the intermediate frequency transformers. These cams are arranged to actuate pairs of switches, such as the pair of switches 339 and 340 associated with the transformers 306 and 308. A pair of resistors 341 and 342 are associated with the switches 339 and 340 so that when these switches are actuated the resistors are effectively connected across the primary and secondary windings of the transformer then interconnecting the vacuum tubes 301 and 319, dependent upon the condition of operation of the switches 311 and 312. Similarly a pair of switches 343 and 344 are provided for coopera-

tion with a pair of resistors 345 and 346 arranged to be connected across the windings of either of the transformers 307 or 309, dependent upon whether or not the switches 326 and 327 have been actuated. Thus a single pair of resistors is provided for each set of intermediate frequency transformers for controlling the response characteristic thereof. Thus these resistor controlling switches are actuated by a cam corresponding to the cam 22.

While one embodiment of the invention has been disclosed, it will be understood that various modifications may be made therein which are within the true spirit and scope of the invention.

What is claimed is:

1. In a radio receiver, the combination comprising a radio frequency amplifier having a plurality of tuned circuits for each stage, an electric switch for each circuit including contacts for short-circuiting each of said tuned circuits, an intermediate frequency amplifier having an electric switch and two sets of tuned circuits for each stage, and a single control means for selectively changing the frequency band of said first amplifier and for changing the frequency of said intermediate frequency amplifier comprising a rotatable shaft provided with means for retaining said shaft in any selected one of a plurality of predetermined positions, said shaft being provided with a plurality of angularly adjustable cams, certain of said cams each being arranged to control the switches and said short-circuiting contacts of said tuned circuits of said radio frequency amplifier, thereby to connect the tuned circuits of a particular frequency band to said radio frequency amplifier and to remove the short circuit from the connected ones of said tuned circuits, certain other of said cams being arranged to control the switches of said tuned circuits of said intermediate frequency amplifier, and means for indicating the position of said shaft.

2. In a radio receiver having a plurality of vacuum tubes the combination comprising a plurality of radio frequency transformer units each having a shielded housing containing a tuning inductor, a switch and longitudinally reciprocable means for actuating said switch, said plurality of transformers being adapted to be connected in operative relation with said plurality of vacuum tubes whereby said radio receiver will operate over a selected frequency band, said transformer units being aligned along the axis of said longitudinally reciprocable actuating means, a single control means arranged to move said longitudinally reciprocable actuating means, and means for biasing all of said actuating means toward said control means.

3. In a radio frequency amplifier adapted to operate over one of a plurality of selected frequency bands, the combination comprising a plurality of radio frequency inductance units each comprising a shielded housing containing a tuning inductor, a switch therefor and a longitudinally reciprocable switch operating rod, said radio frequency units being arranged with the switch operating rods in axial alignment, a cam for actuating said operating rods, means associated with the end one of said units for urging said rods towards said cam, each of the other of said units being provided with adjustable means mounted on one end of its operating rod whereby the switches of said rods may be caused to be operated simultaneously by said cam.

4. In a radio frequency amplifier adapted to operate at any one of a plurality of selected frequency bands, the combination comprising a plurality of radio frequency tuning units each comprising a shielded housing containing a tuning inductor, a switch therefor and a longitudinally operating rod, said radio frequency units being arranged with switch operating rods in axial alignment, a cam for actuating said operating rods, means associated with the end one of said units for urging said rods towards said cam, and means mounted on said rods intermediate said radio frequency tuning units for aligning the operating positions of said rods to obtain simultaneous operation of the switches controlled by said rods.

5. In a radio frequency amplifier adapted to operate at any one of a plurality of selected frequency bands, the combination comprising a plurality of radio frequency tuning units each comprising a shielded housing containing a tuning inductor, a switch therefor and a longitudinally reciprocable switch operating rod, the rods of each of said radio frequency units except one being provided adjacent one end with a longitudinally adjustable spacing means, said one radio frequency unit being provided with biasing means urging its rod in one direction, a cam for actuating said rods, said radio frequency units being positioned in series with the operating rods in axial alignment and with said one radio frequency unit positioned farthest from said cam whereby all said rods are biased towards said cam.

6. In a radio frequency amplifier adapted to operate at any one of a plurality of selected frequency bands, the combination comprising a plurality of groups of radio frequency tuning units, each group being operative to cause said radio frequency amplifier to operate over a different frequency band, each group of tuning units comprising a plurality of shielded housings each containing a tuning inductor, a switch and a longitudinally reciprocable switch actuating means, said tuning units of said group being aligned along the axis of said actuating means, a rotatable cam arranged for cooperation with said actuating means, and means associated with the remote shielded housing for urging all of said switch actuating means towards said cam.

7. In an intermediate frequency amplifier adapted to operate at either of two frequencies, the combination comprising a pair of intermediate frequency transformers for each stage of said amplifier, a pair of transformers enclosed within a shielded housing, a plurality of switches supported by said housing, a pair of resistors supported within said housing, certain of said switches being arranged to selectively connect said transformers in and out of circuit with an associated stage of said amplifier, certain of said other switches being arranged for selectively connecting said resistors across the windings of either of said transformers thereby to broaden the response characteristic thereof, a single control means for actuating said switches comprising a shaft having a predetermined angular positions, a pair of cams supported on said shaft for each of said shielded housings, and means interconnecting said switches with said cams.

8. In a radio receiving set capable of being tuned to a number of different frequency bands, the combination of a radio frequency amplifier having a high frequency tuning system compris-

ing a plurality of high frequency tuning units for adjusting the tuning range thereof, a switch for each of said tuning units including contacts normally short-circuiting the associated tuning unit, an operating element for each of said switches, said tuning units divided into groups in accordance with said predetermined different frequency bands, the tuning units in a group being positioned with their operating elements in alignment, a cam for each of said groups, and means 10

for actuating said cams to select a particular one of said groups of tuning units at a time, thereby to actuate said operating elements of the tuning units of a predetermined frequency band to connect the selected group of tuning units to said amplifier and to actuate the associated contacts to remove the short circuit from the selected tuning units.

ROBERT P. DIMMER.

CERTIFICATE OF CORRECTION.

Patent No. 2,379,284.

June 26, 1945.

ROBERT P. DIMMER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, first column, line 33, claim 1, for the word "turned" read --tuned--; and second column, line 67, claim 7, before "predetermined" strike out "a"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of October, A. D. 1945.

Leslie Frazer

(Seal)

First Assistant Commissioner of Patents.

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Patent No. 2,379,284.

June 26, 1945.

ROBERT P. DIMMER.

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Signed and sealed this 9th day of October, A. D. 1945.

Leslie Frazer

(Seal)

First Assistant Commissioner of Patents.