

Jan. 5, 1943.

E. F. McDONALD, JR

2,307,329

RADIO CONTROL SYSTEM

Filed Sept. 30, 1940

3 Sheets-Sheet 1

Fig. 1

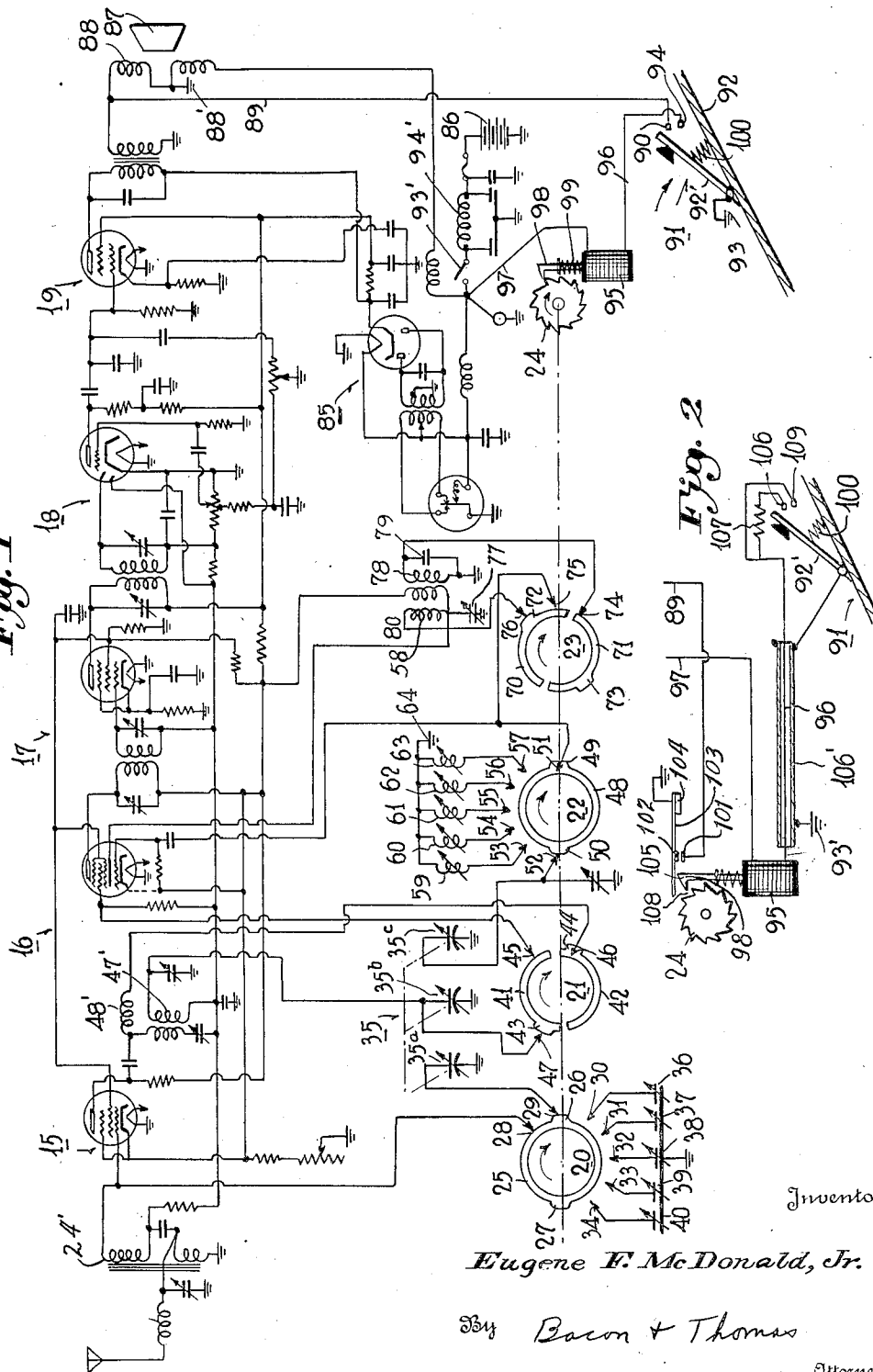
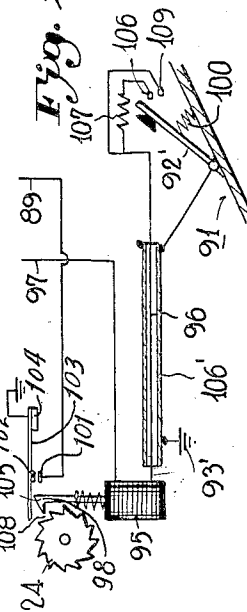


Fig. 2



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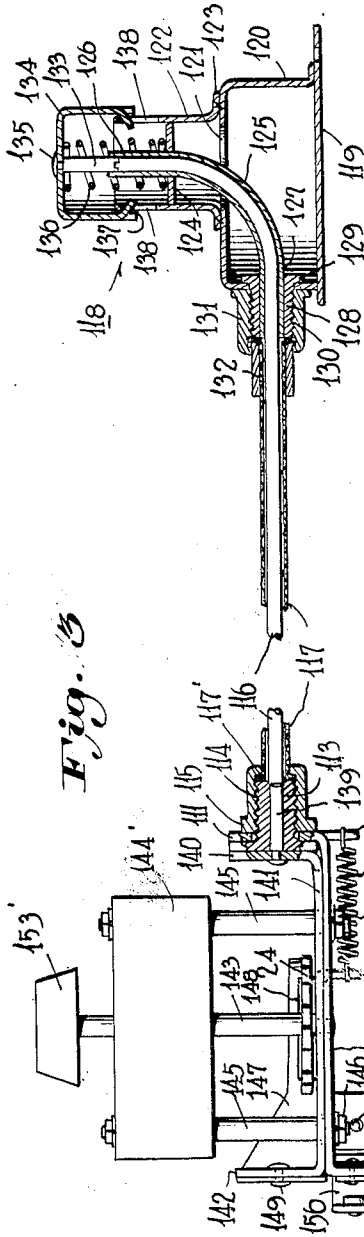


Fig. 3

Fig. 6

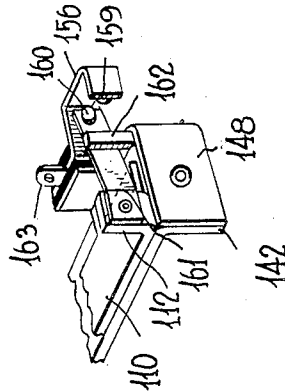


Fig. 4

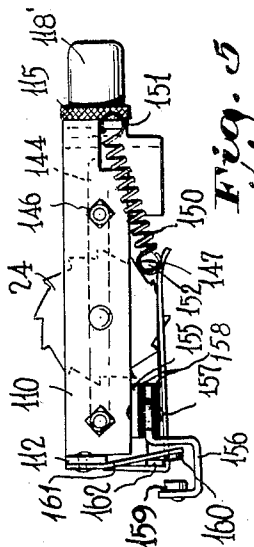
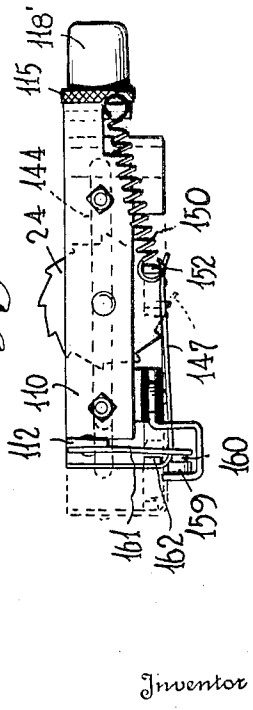


Fig. 5



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Fig. 8

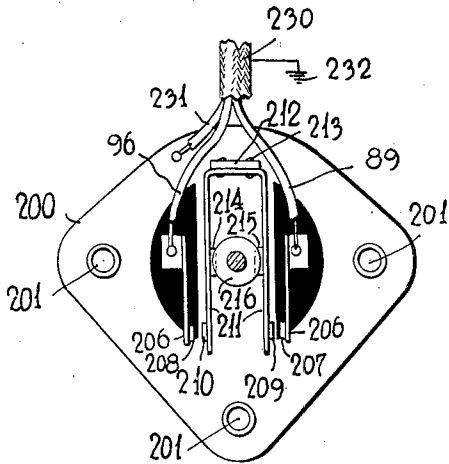


Fig. 9

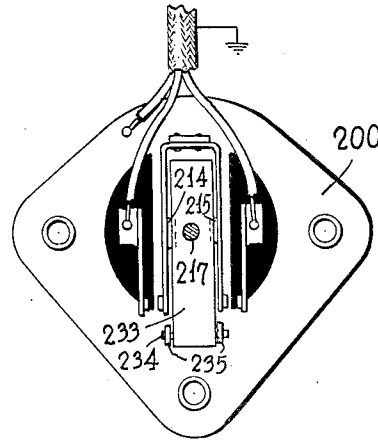


Fig. 7

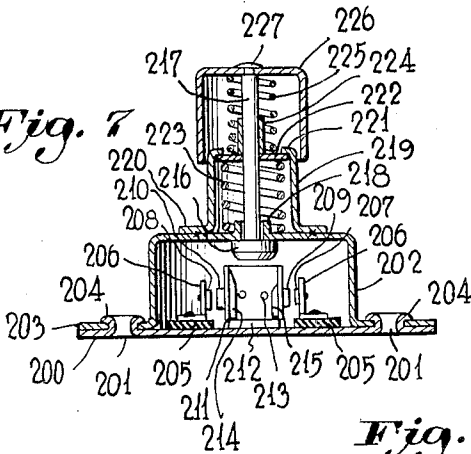


Fig. 12

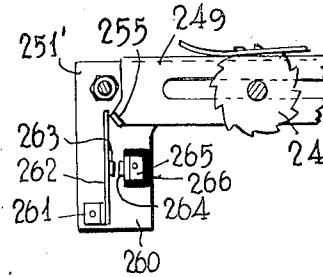


Fig. 10

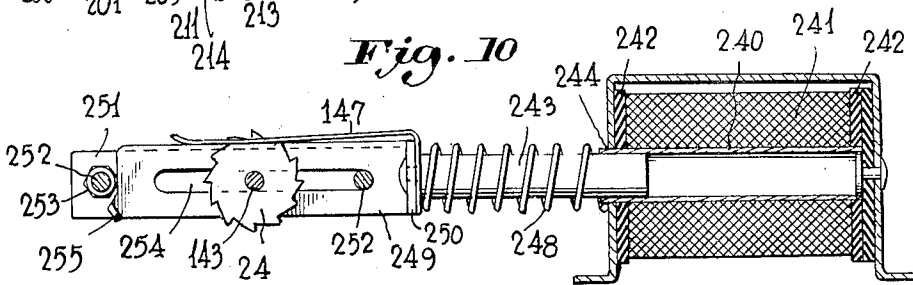
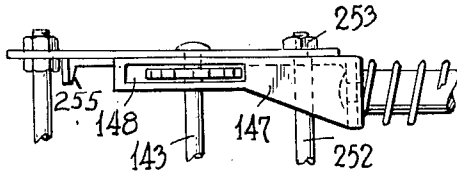


Fig. 11

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UNITED STATES PATENT OFFICE

2,307,329

RADIO CONTROL SYSTEM

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Application September 30, 1940, Serial No. 359,137

10 Claims. (Cl. 250-14)

This invention relates to a control system for a radio set and more particularly to an improved system by which certain functions of a radio receiving set may be controlled in a simpler and more expeditious manner.

The present invention is particularly useful in connection with radio receivers mounted in automobiles although it has general application wherever it is desired to control a radio receiver. The conventional hand tuning or actuation by hand of station selectors with conventional automobile radio receiver installations constitutes a serious hazard as the driver's attention is distracted and serious accidents have frequently resulted. Furthermore, it is many times im-
portant to mute the radio receiver for short periods of time in order to be able to listen for warning bells at railroad crossings or for the sounds of approaching vehicles or trains.

In accordance with the present invention, muting of the radio receiver for controlled periods of time as well as the selection of the desired signal to be received can be accomplished through a single member actuated, for example, by foot control with a special type of switch mounted on the floorboard of an automobile. This enables the control operations of the radio receiver, which ordinarily require close attention by the driver, to be carried out without requiring the driver to look at the radio set or remove either hand from the steering wheel.

In addition to the safety features above discussed the driver can easily mute the radio receiving set in order to engage in conversation with passengers and furthermore, a plurality of control devices can be employed so that control of the radio set may be accomplished from the rear seat or the passenger's side of the front seat, if desired.

It is, therefore, an object of the present invention to provide an improved control system for a radio receiving set.

Another object of the invention is to provide an improved safety control system for an automobile radio receiving set.

Another object of the invention is to provide an improved device for muting a radio receiver or selecting a desired signal or performing both of these functions simultaneously.

A further object of the invention is to provide a system for controlling the changing of the transmitting station being received and muting of the radio set from a remote point by single actuating member.

A further object of the invention is to provide

a mechanically actuated switch for controlling a radio set from a remote point by means of a single actuated member.

A still further object of the invention is to provide an electrically actuated switch for controlling a radio set from a remote point by means of a single actuated member.

Other objects and advantages of the invention will appear in the following description of preferred embodiments thereof disclosed in the attached drawings, of which:

Fig. 1 is a schematic diagram of a radio set and control mechanism embodying the present invention.

Fig. 2 is a view similar to Fig. 1 of a modification of the control circuit of Fig. 1.

Fig. 3 is a view partly in section of a mechanically operating mechanism showing the station selecting switch rotating mechanism and muting contacts.

Fig. 4 is an elevation of the station selecting switch rotating mechanism and muting contacts of Fig. 3.

Fig. 5 is a view similar to Fig. 4 showing the mechanism of Fig. 4 in a partially operated position.

Fig. 6 is a fragmentary perspective view of the mechanism illustrated in Figs. 3 to 5, showing the details of the muting contacts.

Fig. 7 is a section through an electrical switch, adapted to control the operation of a solenoid operated switch, and including a muting switch.

Fig. 8 is a plan view of the contacts of the switch in Fig. 7.

Fig. 9 is a plan view of the contacts of a modification of the switch of Fig. 8.

Fig. 10 is an elevation partly in section of a solenoid operated switch.

Fig. 11 is a plan view of the switch portion of Fig. 10.

Fig. 12 is a fragmentary elevation of a modification of the switch of Figs. 10 and 11, in which the solenoid is adapted to control both the muting of the set and the changing of the stations.

In general Fig. 1 illustrates a radio circuit, various portions of which are controlled by a plurality of switches. These switches are actuated by a solenoid, the power to which may be controlled by a foot operated switch mounted on the floor-board. With reference to Fig. 1, 15 indicates in general the radio frequency amplifying circuit of the set; 16 indicates the oscillator and mixer circuit; 17 the intermediate frequency circuit; 18 the detector circuit and 19

the audio frequency circuit of the set. Most of these circuits are more or less conventional and require no detailed description. Only the portion of the radio set which controls the operation of the various circuits and the various circuits affected thereby will be described in detail.

A plurality of rotary switches 20, 21, 22 and 23 are operatively connected to the ratchet gear 24. This operative connection is indicated by the dotted line through the centers and may be obtained by mounting the switches upon the same shaft as the ratchet or in any other suitable manner, such as by means of gears, belt drives, etc. Switch 20 selectively connects any one of a plurality of adjustable or variable condensers effectively across the coil 24' of the antenna coupling circuit and may comprise an annular rotatable member 25 having diametrically opposed tabs 26 and 27. Stationary contact 28 connected to one terminal of the coil 24' slides upon the annular member 25 and is continuously in contact therewith. Stationary contacts 29, 30, 31, 32, 33 and 34 are spaced from the body of the annular member and are adapted to be contacted only by the tabs 26 and 27. Contact 29 is connected to variable condenser 35a of the three gang condenser generally indicated as 35. The position of the switch shown in the drawing is the manual tuning position and it will be apparent that variable condenser 35a is effectively connected across coil 24' in the antenna coupling circuit of the radio frequency circuit. Rotation of the switch through 180° will connect in sequence adjustable condensers 36, 37, 38, 39 and 40 and then 35a into the antenna coupling circuit and further rotation will repeat the cycle. Condensers 35 to 40, inclusive, may be each preset to tune the antenna coupling circuit to any desired station.

Switch 21 is used to introduce a tuned coupling circuit between the radio frequency amplifying circuit and the oscillator and mixer circuit when the set is used for manual tuning. It introduces an untuned coupling circuit when the preset stations are tuned. It is composed of an annular rotatable ring split in two halves 41 and 42. The half 41 has a tab 43 and the half 42 has a tab 44 diametrically opposed to the tab 43. The body of each half of the annular ring is adapted to engage stationary contacts 45 and 46 and the tab portions engage stationary contact 47. In the position shown in the drawing one terminal of a tuned coupling circuit including a coupling coil 47' across a variable condenser 35b of the gang condenser 35 is connected to the oscillator and mixer circuit through contact 47, half annular member 41 and contact 45. This is the position of the switch when the receiver is set for manual tuning. (It will be noted that there is no connection through the switch between contacts 45 and 46 because of the gaps between the half members 41 and 42). Rotation of the switch 21 in the direction indicated will disconnect the condenser 35b and coil 47' from the oscillator and mixer circuit since contact 47 does not engage the body of the half members 41 and 42. However, an untuned coupling circuit including the inductance 48' will be introduced between the radio frequency amplifying circuit and the oscillator and mixer circuit since both contacts 45 and 46 will then engage a half member 41 or 42. Thus, the tuned coupling circuit is disconnected and an untuned circuit substituted when the receiver is tuned to one of the preset circuits. It will be observed that rotation of the switch 21 through

180° will complete the cycle to disconnect the untuned coupling circuit and reconnect the tuned coupling circuit.

Switch 22 is composed of an annular rotatable member 48 having diametrically opposed tabs 49 and 50. Contact 51 engages the body of the annular member while contacts 52, 53, 54, 55, 56 and 57 are adapted to engage the tabs 49 and 50 only. In the position shown in the drawing the switch is set for manual tuning. In this position variable condenser 35c of the gang is included in the oscillator grid circuit, and serves to tune that circuit in conjunction with the oscillator grid coil 58. Rotation of the switch 22 disconnects the condenser 35c. At the same time contact 53 is engaged by tab 50 and introduces the adjustable inductance 59 into the oscillator circuit. Further rotation introduces in sequence adjustable inductances 60, 61, 62 and 63. Each of the inductances 59 to 63 is connected to ground at 64, and is part of a preset oscillator circuit.

Switch 23 has a split annular ring composed of the half members 70 and 71, having tabs 72 and 73, respectively. Contacts 74 and 75 engage the body of each half member whereas contact 76 is adapted to engage only the tab portions 72 and 73. The position shown in the drawing is for manual operation and connects the oscillator grid coil 58 into the oscillator circuit by means of contact 76, tab 72, half member 70 and contact 75. A tracker condenser 77 is included between ground and one end of the oscillator grid coil 58. Rotation of the switch in the direction of the arrow disconnects the coil 58 from the oscillator circuit since contact 76 does not engage the body of a half member 70 or 71. However, a second oscillator grid coil 78 is substituted. This is accomplished through contact 75, half member 70 and contact 74. It will be observed that a condenser 79 is connected in parallel with oscillator grid coil 78 and that rotation of the switches 22 and 23 from the position shown, selectively connects inductances 59 to 63 in parallel with the coil 78 to form the tuned oscillator grid circuits for the preset stations. Coil 78 is magnetically coupled to an oscillator plate coil 80 as is the coil 58. Thus for all positions of the switch 23 other than that illustrated, coil 78 and condenser 79 form part of the tuned oscillator grid circuit.

The power supply is generally indicated as 85. It may be of conventional design and requires no specific description. It is connected to any suitable source of power, such as battery 86. The set may be provided with a speaker 87 operated by a voice coil 88 supplied by the output of the receiver and having one terminal connected to ground at 88'. Conductor 89 connects the other terminal of the voice coil 88 to the contact 90 of a switch 91 mounted on floorboard 92 and having an operable member 92' connected to ground at 93.

Switch 91 has a second contact 94 connected to a solenoid 95 through conductor 96. This solenoid is connected to one terminal of the battery 86 through the main power switch 93' of the set and a choke 94', the other terminal of the battery being connected to ground. Depressing the switch 91 in the direction indicated by the arrow short circuits the voice coil 88 through ground. This serves to mute the speaker. A further depression of the switch 91 completes the circuit through the solenoid from conductor 97 and conductor 96 to contact 94 and ground at 93. The solenoid has a core 98 with a pawl adapted to engage the teeth of ratchet 24. When

the circuit through the solenoid is completed this core is retracted to rotate the ratchet 24 in the direction indicated. The ratchet illustrated has twelve teeth so that a single actuation of the solenoid will rotate the shaft on which the ratchet is mounted through 30°. Since the switches 20 to 23 are mounted on this same shaft or operatively connected thereto in some manner it is apparent that these switches will also be rotated through an angle of 30°.

After the solenoid has rotated the ratchet, the switch may be released and it will be returned to its original position by means of spring 100. The pawl will be returned to its original position by means of spring 99. The switch 91 is preferably designed so that contact 90 will be maintained in engagement with the movable member 92' upon further depression thereof after it has first engaged contact 90. This insures the continued muting of the set while the station is being changed.

It will be seen from the above that in the position of the switches shown in Fig. 1 the antenna coupling circuit will be manually tuned by means of condenser 35a, the radio frequency coupling circuit by means of condenser 35b, and the oscillator grid circuit by means of condenser 35c. The inductance of the oscillator grid circuit under these conditions will be furnished by coil 58. Rotation of the switches through 30°, that is, by means of a single actuation of the solenoid will remove the variable condensers of the gang 35 from the various circuits. The tuned antenna coupling circuit will then contain adjustable condenser 36. The coupling between the radio frequency amplifying circuit and the oscillator and mixer circuit will then be by means of an untuned circuit in place of the tuned circuit. The oscillator grid circuit will be tuned by means of the adjustable inductance 59 in conjunction with the inductance of the oscillator plate coil 78 and condenser 79. It will be apparent that rotation through further steps of 30° will substitute other adjustable condensers in the antenna coupling circuit and other adjustable inductances in the oscillator circuit, will leave the untuned coupling between the radio frequency amplifying circuit and the oscillator and mixer circuit and will leave the coil 78 and condenser 79 in the oscillator grid circuit. When the switches have been rotated through 180° it will be apparent that a cycle has been completed and further rotation will merely serve to repeat the cycle.

In Fig. 2, I have illustrated a modified circuit for actuating the solenoid and for muting the speaker. In this case the solenoid is used to perform the function of both muting and of changing stations and only one conductor other than a ground connection is necessary between the set and the solenoid controlling switch. In this figure similar numbers are used to designate the same elements as in Fig. 1. Conductor 89 from the voice coil is connected to a fixed contact 101. This contact is positioned to be engaged by a second contact 102 mounted upon a spring 103 carried by support 104. The pawl 98 on the solenoid is adapted to engage the end of the spring 103 to hold the contact 102 spaced from contact 101 in the normal position of the solenoid core. Switch 91 when depressed in the direction indicated makes contact with contact 106 which completes a circuit through line 97, solenoid 95, line 96, resistance 107, contact 106 to ground at 93'. A shielding sheath 106' may be employed as a ground connection if the switch 91 is mount-

ed upon an insulated member. The resistance 107 is of suitable value so that the solenoid will receive sufficient power to cause the pawl 98 to move and contacts 102 and 101 to engage, thereby connecting the voice coil to ground and thus muting the speaker. This is accomplished by allowing a slight amount of play at 108 between the pawl 98 and the adjacent tooth on the ratchet 24. Thus, the pawl 98 is permitted to move a slight distance sufficient to complete the circuit through contacts 101 and 102 before it picks up the teeth on the ratchet. The resistance is of sufficiently low value to permit this movement of the pawl 98 but is sufficiently high in value to prevent enough power being developed by the solenoid to rotate the ratchet 24. In this manner it is possible to use the solenoid to mute the speaker without changing stations. Further depression of the switch 91 engages contact 109, thus short circuiting the resistance 107. In this position the solenoid 95 receives sufficient power to rotate the ratchet 24, thereby changing stations.

Figs. 3 to 6 illustrate a mechanically operated switch operating mechanism adapted to carry out the function shown in Fig. 1. The switch rotating mechanism is composed of a base member 110 having an upturned flange 111 and a downturned flange 112 disposed at opposite ends thereof. The upturned flange 111 has a hole through which a tubular connector 113 is adapted to be placed. This connector has a threaded portion 114 which passes through the hole in the flange 111. A cap nut 115 screwed on the threads 114 serves to hold the connector locked in position. The connector has a hole through which the Bowden wire 116 is adapted to pass. This Bowden wire is enclosed within a flexible housing 117 provided with a flange 117' adapted to be engaged by the cap nut 115 threaded upon the connector 113 to secure the housing 117 to the switch rotating mechanism. Bowden wire passes into a switch operator generally indicated at 118. The other end of the operator is composed of a base plate 119 and a body member 120. The body member has a hole 121 in its upper face. Superimposed over this hole is a tubular member 122 having an outturned flange 123 which may be spot welded to the base member. Intermediate its height the tube 122 has a washer 124 fastened to its inner sides. Disposed within the hole in this washer is a curved tube 125 which is suitably fastened to the washer as by brazing. This tube has a portion 126 which extends above the hole in the washer and also has a portion 127 adapted to pass through a hole in a vertical wall of the base member. A tubular connector 128 having a shoulder 129 and a threaded portion 130 surrounds the tube at the point 127. This tubular member 128 is held in position by means of the cap nut 131 which also holds the flexible housing 117 by means of the connector 132, having a flange adapted to be engaged by the cap nut. The Bowden wire 116 engages at its upper end a cylindrical plunger 133 which passes through a hole in the cap 134 and is riveted over at 135. A spring 136 is disposed between the inner side of the cap and the upper face of the washer 124 and serves to hold the cap 134 in its uppermost position. The cap 134 is held on the assembly by means of fingers 137 on the side of the cap which fingers are adapted to be bent into and to move up and down in slots 138.

The lower end of the Bowden wire engages

a plunger 139 slidable in the tubular connector 114 and secured to the flange 140 of the movable member 141 of the switch. This movable member has another upturned flange 142 disposed at its other end. The shaft of the switch which is adapted to be rotated is shown at 143. Fixed near one end of the shaft is the ratchet 24. The end of the shaft extends through a slot 144 in the movable member and through a hole in the base member 110. The base member of the switch is held in spaced relation from the stationary contact supporting portion of the switch shown in outline at 144' by means of bolts 145 and nuts 146. On its far side the movable member has a spring pawl 147 with a slot 148 therein adapted to surround the ratchet 24. The spring pawl is bent at right angles and fastened to the flange 142 by means of a rivet 149. Movement of the Bowden wire causes the movable member to move to the left. In so doing the pawl engages a tooth on the ratchet and causes the rotation of the same and thus of shaft 143. The movable member is returned to its original position by means of spring 150 supported from members 151 and 152 carried by the base member and the movable member, respectively. The other end of the shaft 143 may extend through the switch and be provided with a knob 153' to enable the shaft to be also turned by hand so that station selection may be performed optionally either by hand or foot operation. By making the slot 148 in the spring pawl 147 of sufficient length so that the pawl clears the ratchet 24 when in normal position the switch may be turned by hand in either direction.

With particular reference to Fig. 4, which is an elevation of the switch in Fig. 3, the base member has a downwardly extending bracket 155. The contact support 156 is supported by the bracket 155 through the means of rivet 157. The layers of insulation 158 serve to insulate the contact support 156 from the bracket 155. The contact support 156 carries contact 159 of the muting switch. The other contact of the muting switch 160 is carried by a spring member 161 supported by the downturned flange 112 of the base member. A finger 162 carried by the movable member engages the spring 161 to normally hold the contacts 159 and 160 separated. Movement of the movable member to the left allows contact 160 to approach the contact 159 and to finally complete the circuit. In Fig. 5 the switch is indicated in solid lines in the position in which contact is made. The dotted lines indicate the ultimate position of the movable member after it has rotated the ratchet 24. The ultimate position of the spring member 147 is also shown in dotted lines in Fig. 5. In Fig. 6 is shown a perspective view of the switch in inverted position to illustrate the relative positions of the various elements. It will be seen that the flange 142 carries the finger 162 which is adapted to engage the spring 161 to separate contacts 160 and 159. The spring 161 is shown as being carried by the flange 112 of the base member 110. Likewise the contact support 156 is shown carried by the base member. The connection 163 on the contact support is used for connecting line 89 from the voice coil.

The slot 148 in the spring pawl 147 is preferably long enough to permit sufficient movement of the movable member to complete the circuit through contacts 159 and 160 before the end of the slot engages the tooth of the ratchet 24 to rotate shaft 143. In this manner depressing the

cap 134 of the foot switch must be made against springs 136 and 150. These require a constant exertion of effort up to the point at which contacts 159 and 160 meet to mute the speaker. At this point, or shortly thereafter, the end of the slot 148 engages the tooth 124 and puts an additional load on the Bowden wire. Further movement of the Bowden wire requires a greater exertion on the cap 134 and thus it is possible for the operator to sense the point at which muting occurs and before which station changing occurs. In this way one is able to mute the set and hold it in a muted position without the station being changed. The added load required to rotate shaft 143 is generally provided by means of a spring detent (not shown) since the switch connected to shaft 143 is preferably of the snap action type.

Fig. 7 is a section through an electrical switch adapted to mute the speaker and to complete the solenoid circuit so as to change stations, the muting being performed before the station changing. The switch is composed of the base member 200 having cylindrical portions 201. The body member 202 is cylindrical in shape and has a flange 203, which is superimposed on the base member 200. The cylindrical portions 201 pass through holes in the flange 203 and are riveted over as shown at 204. The base plate carries insulating blocks 205 upon which contact supports 206 are mounted. These contacts supports carry contacts 207 and 208. The opposite contacts 209 and 210, respectively, are carried by spring members 211 supported on the member 212 by means of rivets 213. Near the middle of the spring members 211 are cam members 214 and 215. Cam member 214 is longer and extends higher than cam member 215. These cam members are adapted to be actuated by cam 216 on one end of a plunger 217 which passes up through a cylindrical flange 218 in the top of the body member 202. This plunger 217 is surrounded by a cylindrical body 219 which has an outwardly turned flange 220 by means of which it is fastened to the top of the body member 202, for example, by spot welding. At the opposite end of the body 219 is an inwardly turned flange 221 which serves to retain a washer 222 which in turn holds spring 223 partly compressed. Above the washer 222 is a cylindrical sleeve 224. This sleeve is surrounded by another spring 225 and the whole enclosed by a cap 226 which is riveted onto plunger 217 at 227. In this manner spring 225 is somewhat compressed under ordinary conditions. Upon the exertion of pressure on the cap 226 the spring 225 is compressed until the inner surface of cap 226 engages the top surface of the sleeve 224. This movement of the shaft 217 causes cam 216 to engage the cam member 214 and thus forces the spring member 211 to the side making contact between contacts 208 and 210. This completes a circuit from the voice coil to ground, thereby muting the speaker. At this point the cam 216 has not yet engaged the cam member 215. Further movement of the cap 226 must necessarily cause compression of the spring 223 since there is now a direct connection between the cap 226, the sleeve 224 and the washer 222. This additional resistance enables the operator to sense the point at which station changing is about to occur. Upon the additional movement of the shaft 217 cam 216 engages cam member 215 and causes the spring member 211 to move to the side, thereby engaging contacts

207 and 209. This completes a circuit through the solenoid and serves to change stations.

In Fig. 8 is illustrated a top view of the contacts of the switch of Fig. 7. The manner of operation will be apparent from the previous description. Wires 89 and 96 which connect the voice coil and the solenoid, respectively, are shown in this figure. The contacts 209 and 210 are electrically connected to the base plate 200 by means of the springs 211 and the support member 212. The metallic sheath 230 surrounding the insulated wires is electrically connected to the base plate by means of wire 231. This metallic sheath is connected to ground at 232.

Fig. 9 illustrates a modification of the switch shown in Fig. 8. In this figure the base plate, the insulation, the contact supports, the contacts, the spring members and the support for the spring members and the cam members 214 and 215 are the same as in Fig. 8. The modification in this instance consists of a lever 233 which is pivotally mounted on the shaft 234 supported by ears 235. This lever extends between the two spring members 211 and is adapted to engage the cams 214 and 215. This lever is actuated by means of the plunger 217 and does not require a cam at the end of the plunger. This modification is of advantage in that the lever 233 may be aligned with respect to the cam members 214 and 215 before the switch is completely assembled. It is not necessary that the plunger 217 approach the lever 233 at exactly a right angle since any reasonable angle of approach will cause the lever 233 to properly engage the cams and actuate them and also exact centering of the plunger with respect to the movable contacts is unnecessary. Upon release of pressure on the foot button, the lever 233 may be returned to its normal position by a suitably disposed spring.

In Fig. 10 is illustrated the means whereby the solenoid rotates the ratchet 24. The solenoid is composed of a sleeve 240 preferably of brass and preferably slit to reduce time delay action. Winding 241 is wound upon this core and is retained thereon by means of insulating washers 242. The sleeve forms a guide for the solenoid core 243 of magnetic material and extends through a hole 244 in the front of a bracket of magnetic material forming a return path for the flux so as to separate the relatively movable magnetic elements. The core 243 is adapted to slide in the sleeve 240 and is normally held in the indicated position by means of spring 248. The movable member of the switch 249 has a flange 250 to which is rigidly secured end of the core 243. The spring pawl 147 is fastened between the flange 250 and the end of the core 243. This spring member has a slot 143 adapted to receive the ratchet 24. It will be observed that the slot 143 is of sufficient length to permit partial movement of the movable member before the pawl engages a tooth of the ratchet 24. The station changing switch may be secured in spaced relation to the fixed member 251 of the switch rotating mechanism by bolts 252 and nuts 253 and the switch shaft 143 may likewise have a knob on its other end for manual operation. A slot 254 in the movable member permits the shaft 143 to pass through the movable member and be journaled in the fixed member. A stop 255 on the movable member limits the motion of the movable member by engaging in a notch on the ratchet 24 when moved to the right in Figs. 10 and 11. This switch is particularly useful in the circuit shown in Fig. 1 and with the foot button shown in Figs. 7 and 8.

Muting is accomplished by means of the muting contact in the foot button and the change of station is accomplished by means of the solenoid, the circuit of which is completed by means of the contact in the foot button.

Fig. 12 is a modification of the switch rotating mechanism shown in Figs. 10 and 11. The movable member, the pawl, the ratchet, the spring, the solenoid and the supports may be the same as in Figs. 10 and 11. The fixed member 251' may have a bracket 260 adapted to carry the muting contacts. One contact 263 is electrically connected to the bracket 260 by means of support 261 and spring 262. The other contact 264 is supported by bracket 265 which is insulated from the bracket 260 by means of the insulator 266. The end of the spring 262 abuts the stop 255. In the normal position of the movable member 249 the stop 255 contacts the spring 262 and holds contact 263 separated from contact 264. The first movement of the solenoid moves the movable member 249 sufficiently to permit the spring 262 to force contact 263 against contact 264, completing the circuit from the voice coil to ground. This serves to mute the speaker before the change of station occurs.

This switch rotating mechanism is particularly adapted for operation with the circuit illustrated in Fig. 2. When the switch 91 makes contact at 106 a circuit is completed through the solenoid 95 and through the resistance 107. The resistance 107 limits the amount of power applied to the solenoid and, therefore, permits its movement only under the limited load required to operate the muting switch. When the pawl engages the gear 24 an additional load is applied to the solenoid. This will stop the solenoid since insufficient power is supplied through the resistance 107 for further movement under the additional load. Further movement of the switch 91 closes a circuit through contact 109, thereby eliminating the resistance 107 from the circuit. In this position full voltage is applied to the solenoid and it is able to move against the additional load to change the station.

It will be seen that in each of the switching arrangements shown, muting will occur upon partial actuation of an actuatable member. Release of the actuatable member will remove the muting. Complete actuation of the actuatable member of any of the modifications described will change stations. Partial release of the actuatable member after complete actuation maintains the muting. The pawl can be released sufficiently to engage the next succeeding tooth on ratchet 24 without removing the muting action. If the actuatable member is then depressed from its partially actuated position, another change of station will occur. It is apparent, therefore, that the devices herein disclosed can be used to mute a radio set and maintain the same muted during any desired number of station changes. In this way the operator may skip as many stations in the sequence as he desires without having the speaker connected.

A plurality of actuatable devices may be employed in parallel so that the receiver may be controlled from more than one point. Likewise, such devices may be located in other places than on the floorboard.

The system of the present invention enables station changing and muting of an automobile radio set by a single foot operated control device without the operator having to look at the set or dial or remove his hand from the automobile

controls. The system of the present invention is particularly applicable to the control of automobile radio sets and has been described in detail with respect to operation from low voltage batteries. However, other types of radio sets, such as sets operated from alternating current or higher voltage direct current, may be operated from a remote point in accordance with the principles of the present invention. The invention has been illustrated in connection with an "electrical" type of automatic tuning wherein individual presettable condensers or inductances are employed, but is also applicable to other types of automatic tuning arrangements.

This application is a continuation in part of my copending application Serial No. 347,516, filed July 25, 1940, now Patent 2,216,671 granted July 25, 1940.

While I have disclosed the preferred embodiments of my invention, it is understood that the same is not limited to the details disclosed but may be varied within the scope of the following claims.

I claim:

1. A radio receiving system comprising a receiving set having a plurality of presettable means for presetting said set to receive a signal from any one of a plurality of transmitting stations, muting means for muting said set, a step-by-step selecting means for selecting a desired one of said presettable means, said selecting means including a movable member, remote control means for operating said movable member from a remote point, said muting means being actuated by partial movement of said movable member, said selecting means being actuated by further movement of said movable member, and means to permit the operator to sense a point at which the set is mute before said movable member actuates said selecting means.

2. A radio receiving system comprising a receiving set having a plurality of presettable means for presetting said set to receive a signal from any one of a plurality of transmitting stations, muting means for muting said set, a step-by-step selecting means for selecting a desired one of said presettable means, ratchet means for operating said selecting means, a pawl for actuating said ratchet, means operatively associated with said pawl for operating said muting means, and means for actuating said pawl.

3. A radio receiving system comprising a receiving set having a plurality of presettable means for presetting said set to receive a signal from any one of a plurality of transmitting stations, a step-by-step selecting means for selecting a desired one of said presettable means, ratchet means for operating said selecting means, a pawl for actuating said ratchet, said pawl having a normal and an actuated position, means for moving said pawl from normal position to actuated position for actuating said ratchet, additional means for operating said selecting means, said pawl in its normal position being spaced from said ratchet sufficiently to permit said additional means to operate said selecting means in either direction.

4. A radio receiving system comprising a receiving set having a plurality of presettable means for presetting said set to receive a signal from any one of a plurality of transmitting stations, muting means for muting said set, a step-by-step selecting means for selecting a desired one of said presettable means, ratchet means for operating said selecting means, a pawl for actuat-

ing said ratchet upon complete movement of said pawl, said pawl having a limited movement before engagement with said ratchet, said muting means being actuated by said limited movement of said pawl, and means for selectively actuating said pawl through either said limited movement or through said complete movement, said limited movement of the pawl permitting the set to be muted before operation of said selecting means occurs.

5. A radio receiving system comprising a receiving set having a plurality of presettable means for presetting said set to receive a signal from any one of a plurality of transmitting stations, muting means for muting said set, a step-by-step selecting means for selecting a desired one of said presettable means, ratchet means for operating said selecting means, a pawl for actuating said ratchet, said pawl having a limited movement before engagement with said ratchet, said muting means being operatively associated with said pawl and actuated by said limited movement of said pawl, means including a solenoid for actuating said pawl, and means for supplying a limited amount of power to said solenoid to actuate said pawl to its limited movement and for supplying a larger amount of power to fully actuate said pawl, thereby actuating said selecting means.

6. A radio receiving system comprising a receiving set having a plurality of presettable means for presetting said set to receive a signal from any one of a plurality of transmitting stations, muting means for muting said set, a step-by-step selecting means for selecting a desired one of said presettable means, ratchet means for operating said selecting means, a pawl for actuating said ratchet, said pawl having a limited movement before engagement with said ratchet, said muting means being actuated by said limited movement of said pawl, and actuating means for said pawl including a flexible member for actuating said pawl from a remote point, said limited movement of the pawl permitting the set to be muted before operation of said selecting means occurs.

7. A radio receiving system comprising a receiving set having a plurality of presettable means for presetting said set to receive a signal from any one of a plurality of transmitting stations, muting means for muting said set, a step-by-step selecting means for selecting a desired one of said presettable means, ratchet means for operating said selecting means, a pawl for actuating said ratchet, said pawl having a limited movement before engagement with said ratchet, said muting means being actuated by said limited movement of said pawl, means including a solenoid for actuating said pawl, a power circuit for said solenoid, a switch in said circuit, said switch having at least two contacts, the first engaged of said contacts completing said circuit to supply limited power in said circuit so as to move said pawl through said limited movement but insufficient to fully actuate said pawl, the second engaged completing said circuit to supply sufficient power to fully actuate said pawl.

8. A radio receiving system comprising a receiving set having a plurality of presettable means for presetting said set to receive a signal from any one of a plurality of transmitting stations, selecting means for selecting a desired one of said presettable means, ratchet means for operating said selecting means, a pawl for actuating said ratchet, said pawl having a normal and an actuated position, means for moving said pawl

from normal position to actuated position for actuating said ratchet, and manual means independent of said ratchet and pawl for operating said selecting means, said pawl being constructed and arranged to permit said manual means to operate said selecting means when said pawl is in its normal position.

9. An automobile radio receiving system comprising a receiving set having a plurality of presettable means for presetting said set to receive a signal from any one of a plurality of transmitting stations, selecting means for selecting a desired one of said presettable means, and means for operating said selecting means to select any one of said presettable means including a foot pedal positioned on the floor board of said automobile to be actuated by the driver of said automobile and a mechanical connection between said

foot pedal and said selecting means for mechanically operating said selecting means from said foot pedal.

10. In an automobile receiving system, a receiving set having a plurality of presettable means for presetting said set to receive a signal from any one of a plurality of transmitting stations, a step by step rotary selecting device for selecting a desired one of said presettable means, and means for rotating said device in steps to select any one of said presettable means including a foot pedal positioned on the floor board of said automobile to be actuated by the driver of said automobile and a mechanical connection between said foot pedal and said rotary selecting means for mechanically rotating said selecting means in steps from said foot pedal.

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