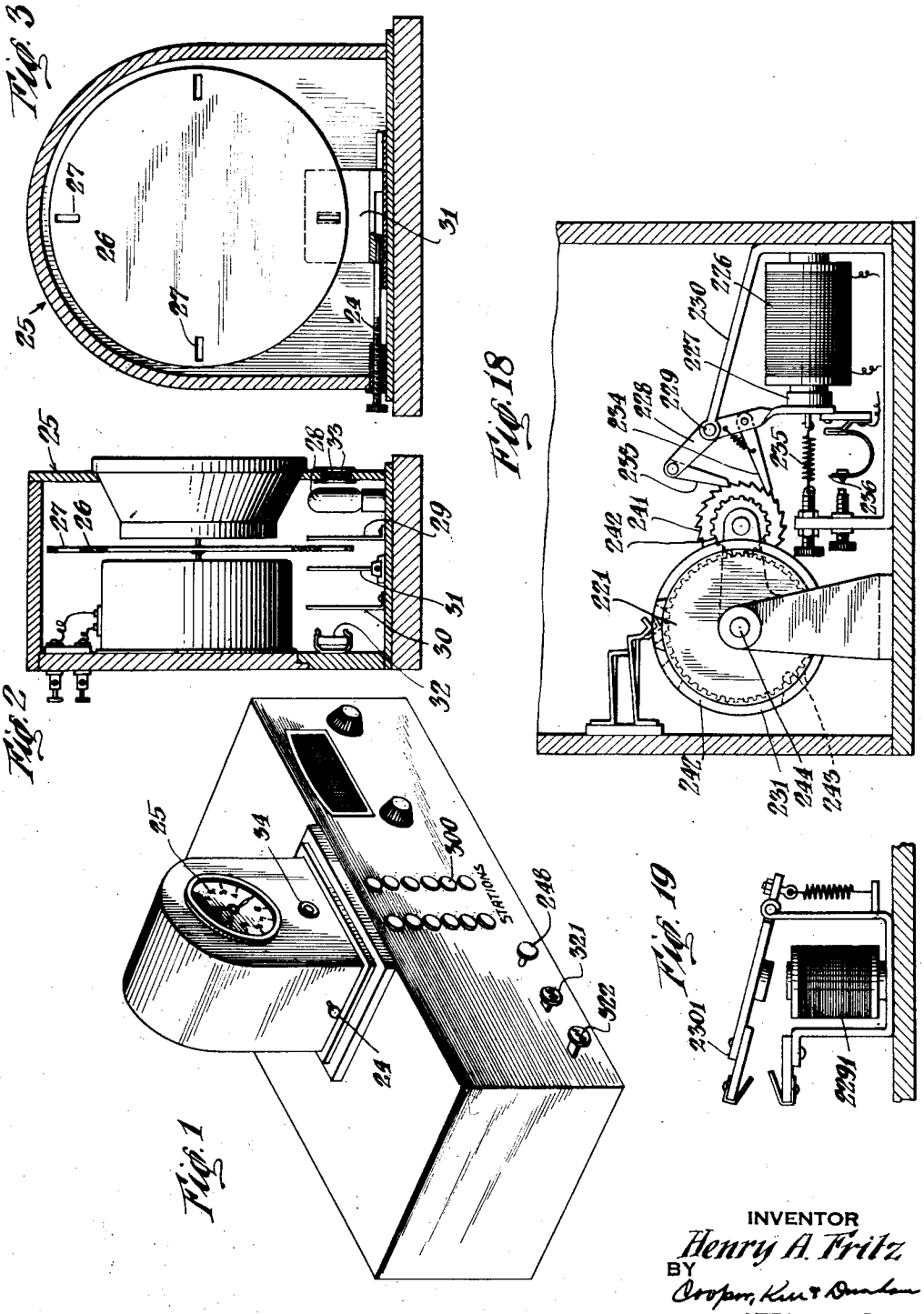
Oct. 10, 1939. H. A. FRITZ 2,175,561

RADIO RECEIVING SET

Original Filed Nov. 15, 1933 6 Sheets-Sheet 1



Oct. 10, 1939. H. A. FRITZ 2,175,561

RADIO RECEIVING SET

Original Filed Nov. 15, 1933 6 Sheets-Sheet 2

Fig. 4

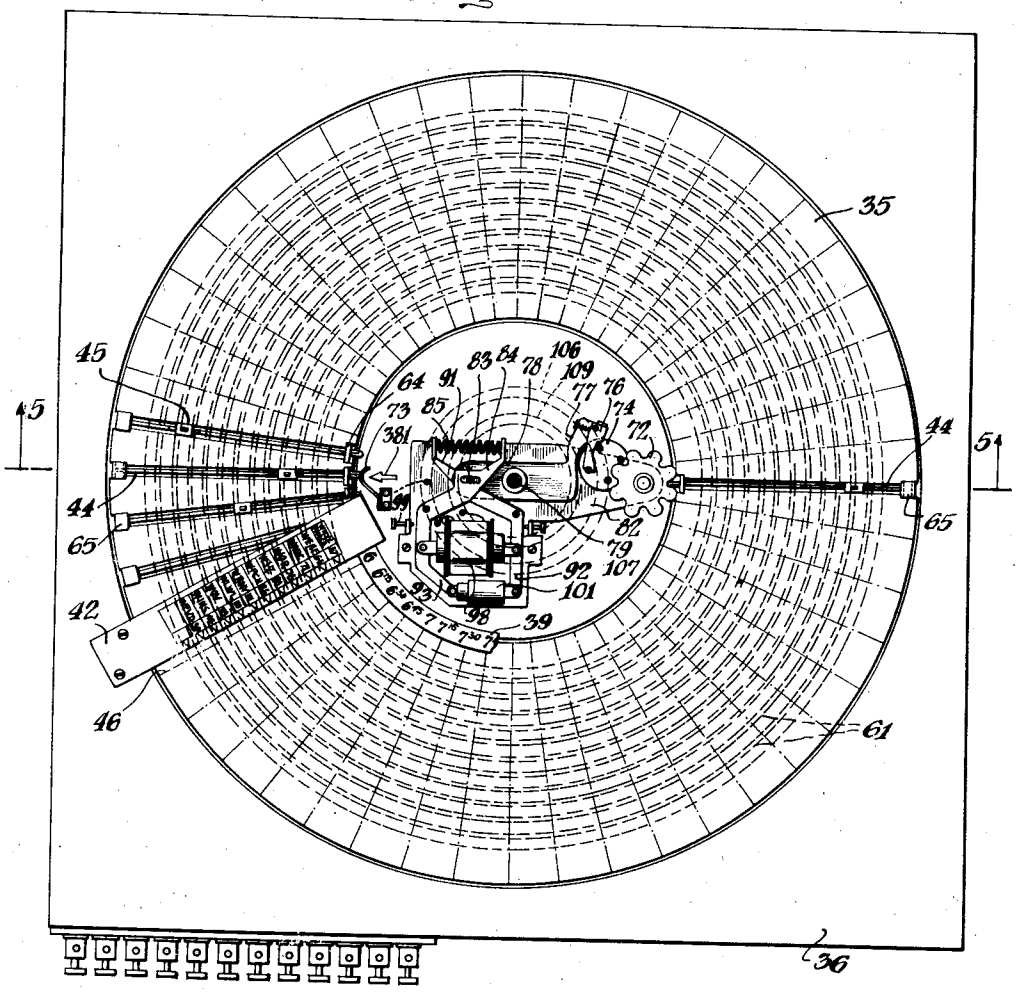
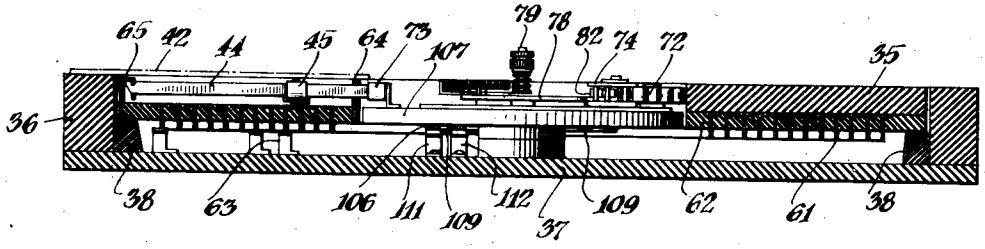


Fig. 5



INVENTOR
Henry A. Fritz
BY
Cooper, Kerr & Dunham
ATTORNEYS

Oct. 10, 1939. H. A. FRITZ 2,175,561

RADIO RECEIVING SET

Original Filed Nov. 15, 1933 6 Sheets-Sheet 3

Fig. 6

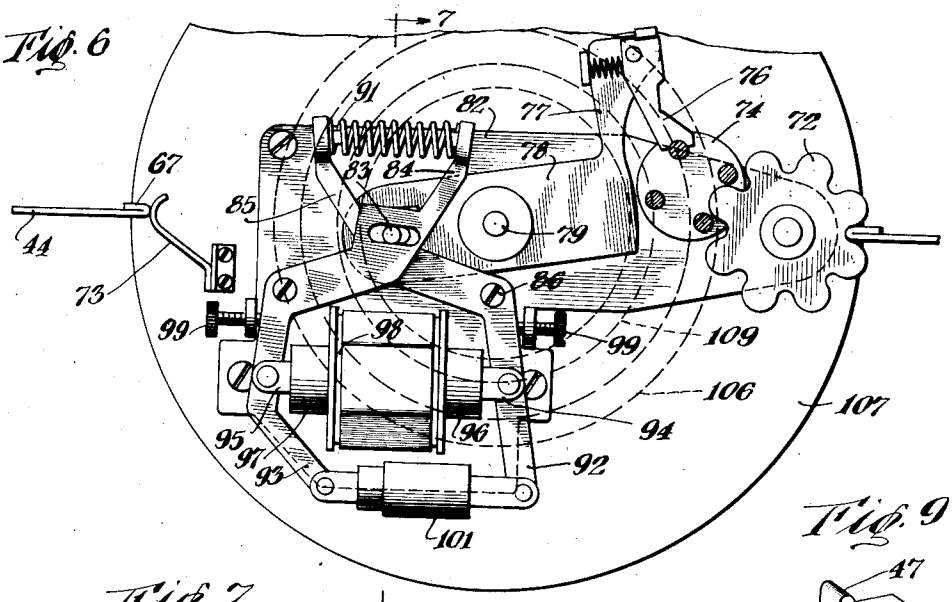


Fig. 7

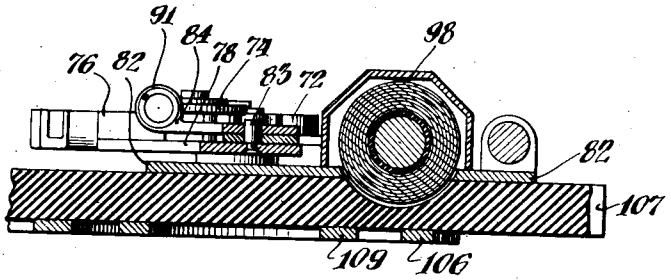


Fig. 9

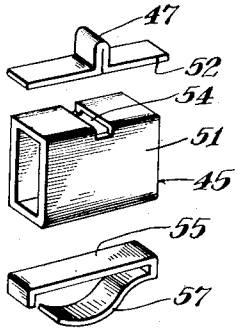


Fig. 8

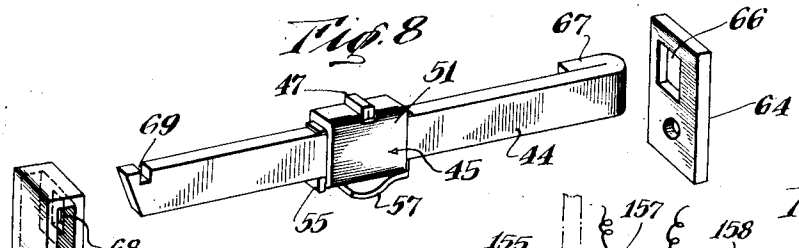


Fig. 14

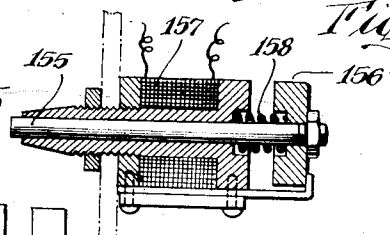
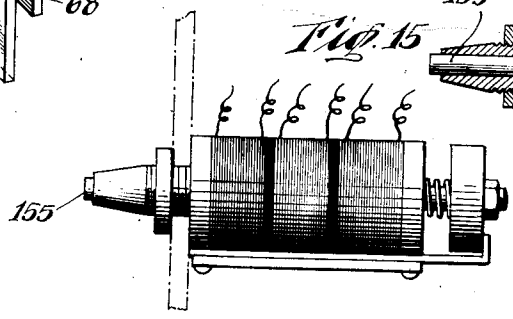


Fig. 15



INVENTOR
Henry A. Fritz
BY
Cooper, Kerr & Dunham
ATTORNEYS

Oct. 10, 1939. H. A. FRITZ 2,175,561

RADIO RECEIVING SET

Original Filed Nov. 15, 1933 6 Sheets-Sheet 4

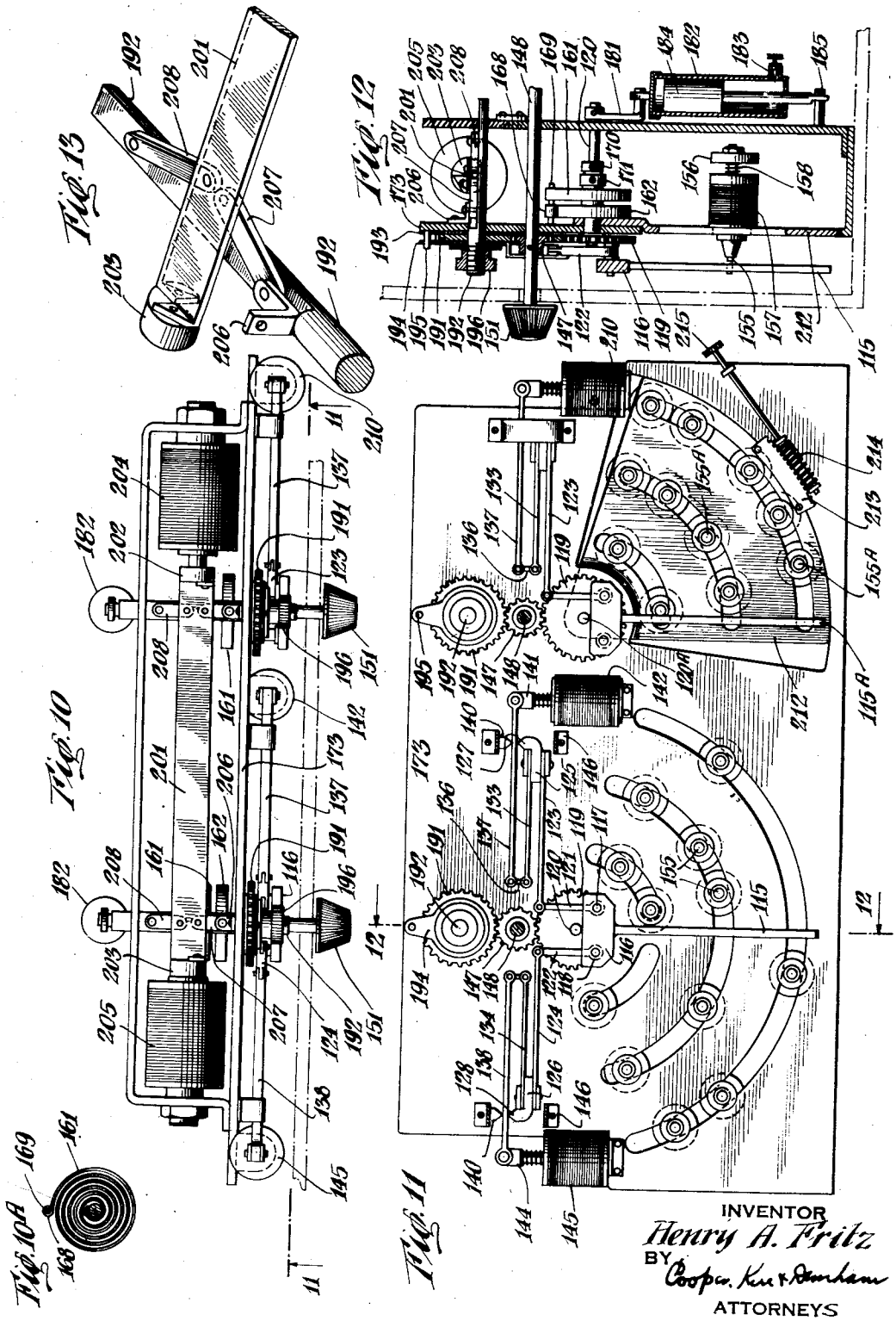


Fig. 13

Fig. 12

Fig. 10

Fig. 11

Fig. 10A

INVENTOR
Henry A. Fritz
BY
Cooper, Kerr & Dunham
ATTORNEYS

Oct. 10, 1939. H. A. FRITZ 2,175,561

RADIO RECEIVING SET

Original Filed Nov. 15, 1933 6 Sheets-Sheet 5

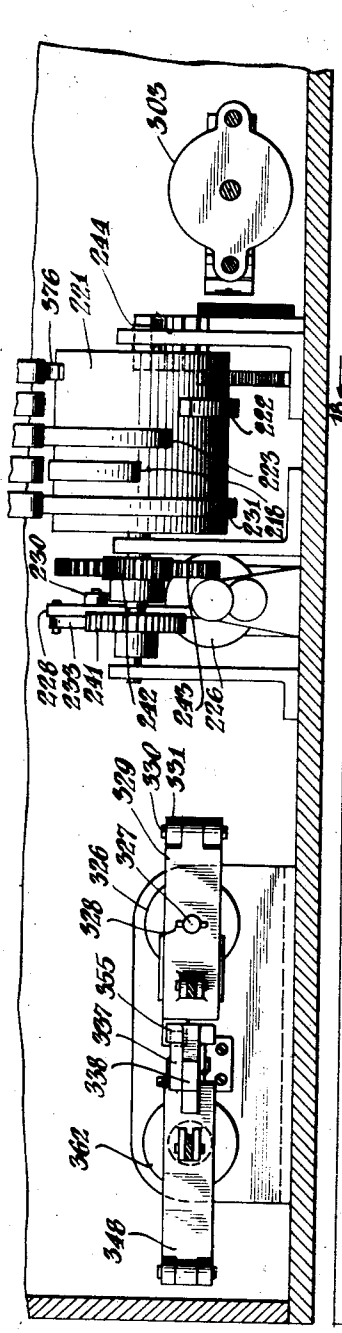


Fig. 16

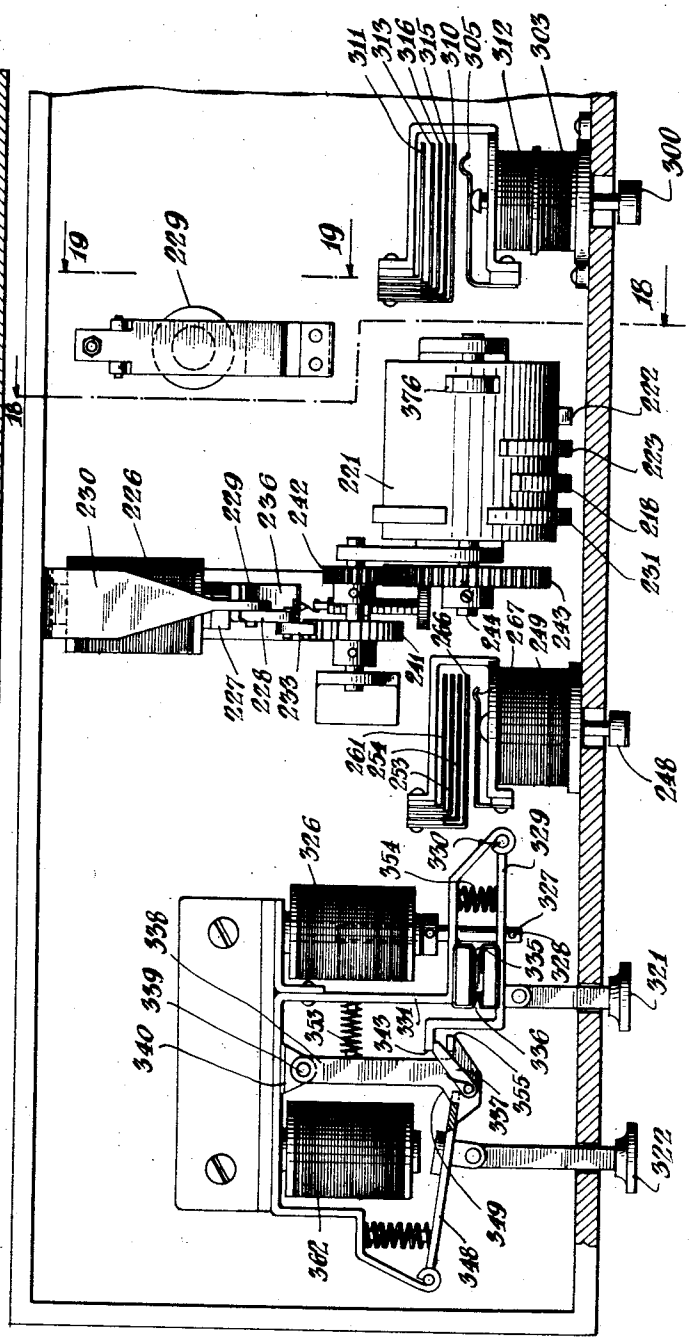


Fig. 17

INVENTOR
Henry A. Fritz
BY
Cooper, Kerr & Dunham
ATTORNEYS

Oct. 10, 1939. H. A. FRITZ 2,175,561

RADIO RECEIVING SET

Original Filed Nov. 15, 1933 6 Sheets-Sheet 6

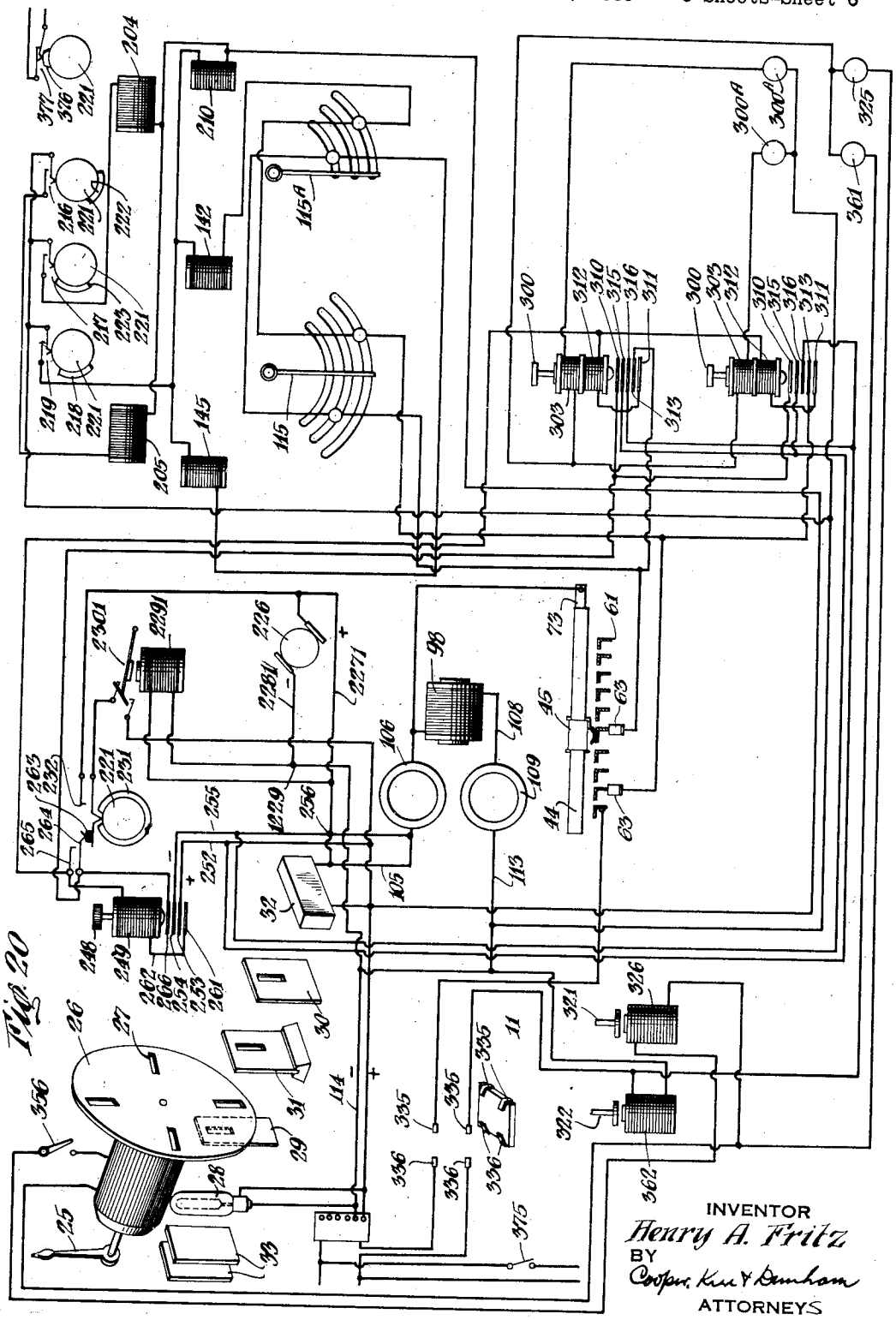


Fig. 20

INVENTOR
Henry A. Fritz
BY
Cooper, Kerr & Dunham
ATTORNEYS

Patented Oct. 10, 1939 2,175,561

UNITED STATES PATENT OFFICE

2,175,561

RADIO RECEIVING SET

Henry A. Fritz, Woodhaven, N. Y.

Application November 15, 1933, Serial No. 698,039
Renewed August 5, 1938

17 Claims. (Cl. 250—20)

This invention relates generally to radio receiving sets and has particular reference to controls for selecting broadcasting stations and controlling the volume of such sets.

One object of the invention is to provide a construction which includes a set of control members which may be adjusted to set up a program of broadcasting stations and which will thereafter automatically adjust the receiving set to bring in the selected stations in a fixed sequence. An advantage of the construction is that the control members may be so adjusted that the receiving set will be automatically turned off when it is desired to omit part of a program, or they may be so adjusted that the same station will be automatically continued for any desired length of time.

Another object is to provide a construction in which operation of the program mechanism may be controlled by a clock. The program mechanism may be adjusted to start the program at any desired time under control of the clock and thereafter the entire predetermined program may, if desired, be left under the control of the clock.

Another object is to provide a means for regulating the volume according to the power of the various stations. This may be made a part of the program devices above mentioned.

Another object is to provide a station selecting mechanism which can be used independently of the above mentioned automatic program control when it is desired to select stations without any reference to the adjustment of the control members.

Another object is to provide a volume control which can be adjusted to control the volume independently for each station or to regulate the volume simultaneously for all stations.

Still another and incidental object is to provide a construction which is simple in the mechanism employed and which is not subject to accidental damage or displacement of parts in its operation.

With the foregoing and other objects in view, all of which will be apparent later on, the invention consists in a novel construction and relation of parts and electrical connections, a preferred embodiment of which is shown in the accompanying drawings and the novel features of which are pointed out in the claims appended to and forming a part of this specification.

In said drawings:

Figure 1 is a perspective view of a receiving set which contains some of the control and selecting mechanism comprised in the invention.

Fig. 2 is a left-hand side view of the mechanism provided for controlling the selecting and volume mechanism by a clock.

Fig. 3 is a front view of the clock controlled disc which in turn controls the station selecting mechanism, also the mechanism for regulating the light beam which through suitable devices causes operation of the station selecting mechanism.

Fig. 4 is a plan view of the mechanism for setting up a program and some of the mechanism for operating the program devices to effect station selecting.

Fig. 5 is a section on line 5—5 of Fig. 4 looking in the direction of the arrows.

Fig. 6 shows on a larger scale the mechanism appearing near the center of Fig. 4.

Fig. 7 is a section on the line 7—7 of Fig. 6 looking in the direction of the arrows.

Fig. 8 is a detail of one of the contact members forming a part of the program devices shown in Fig. 4.

Fig. 9 is a group of details of the sliding station selecting device shown in Fig. 8 and elsewhere.

Fig. 10 is a top plan view of the solenoid mechanism used for the brake mechanism employed for holding the station selecting and volume control devices in adjusted position.

Fig. 10A is a detail of one of the springs shown in Fig. 12.

Fig. 11 is a front view on the line 11—11 of Fig. 10 and shows details of the station selecting and volume control mechanism.

Fig. 12 is a section on the line 12—12 of Fig. 11.

Fig. 13 shows in detail some of the parts of the brake operating and releasing mechanism.

Fig. 14 is a view partly in section of one of the solenoid operated stops for determining the adjustment of the station selecting and volume control devices.

Fig. 15 is a detail of a solenoid operated stop where the same stop is employed for several different stations.

Fig. 16 is a front view of the start and stop mechanism employed for placing the receiving set in operation and also shows details of the motor driven control mechanism for regulating different functions in the receiving set.

Fig. 17 is a top plan view of the mechanism shown in Fig. 16, with the "on" key pressed in.

Fig. 18 is a section on the line 18—18 of Fig. 17.

Fig. 19 is a view along the line 19—19 of Fig. 17 and shows the solenoid or magnet controlling operations of the motor and of the device which is usually referred to herein as the cycle ring.

Fig. 20 is a wiring diagram showing how various parts of the mechanism are connected and controlled.

The embodiment shown in the drawings is of a device which includes a control by a clock to select stations automatically according to a previously set up program device. It also includes devices which can be adjusted to effect station selecting independently of the program devices and in one form includes a remote control which is connected by suitable wiring to push buttons or keys which may be at some distance from the receiving set. These remote control push buttons and their connections may be employed for turning the receiving set on and off and may also be connected for use in effecting station selection. For this purpose push buttons or keys may be provided in the receiving set, each forming a part of a solenoid or magnet operating device which is connected to the remote control, so that by pushing the buttons or keys at the remote control the receiving set is regulated in the same way as by the buttons or keys in the receiving set.

Stated in a general way the apparatus includes a clock 25 which may be of any desired kind, although it is preferred to use an electrically operated clock of the alarm type. Rigid with the minute hand of the clock is a disc 26, Fig. 20, provided with a slot 27 for each fifteen (15) minutes of a one hour period. These slots are part of an electric eye apparatus comprising the lamp 28, and slotted plates 29 and 30 which are fixed to any suitable stationary support, and a plate 31 which is also slotted and is adjustable to regulate the width of the beam passing from the light 28 through the slots in the plate 29, disc 26 and plate 30. The plate 31 may be adjusted by the hand screw mechanism 24 shown in Fig. 3. The light from the lamp passing through the various slots mentioned strikes the selenium cell 32 to cause an electric impulse which brings various parts into play as hereinafter described. The lamp 28 also serves as a pilot light to indicate whether or not the receiving set has been turned on. For this purpose two color filters 33 are employed and the light passing through them is visible at the opening 34 in Fig. 1.

When the selenium cell is rendered effective by the light ray from the lamp 28 it immediately causes a step movement of what is usually referred to herein as the program device. This program device is preferably separate from the receiving set proper, but is connected by a set of wires to the set through an opening (not shown) in the casing enclosing the set. The program device includes a disc 35, Figs. 4 and 5, rotatable in a circular opening in a plate 36 attached to a base or foundation plate 37. Supports 38 for the disc 35 extend up from the plate 37. By this construction the disc 35 is freely rotatable by hand to various positions, and may be latched or retained in those positions in any suitable way.

Around the inner edge of the disc 35 is an indicator 39 marked to represent quarter hours. Each time indication is in line with a division extending radially of the disc. In the construction shown the indicator 39 contains all of the quarter hour divisions for a twelve hour program.

Fixed to the plate 36 is an indicator 42 bearing the names of broadcasting stations and figures representing the frequency of the respective stations. This indicator is to guide the operator in setting up a program.

The disc 35 is provided with a radial slot for each fifteen minute time division and each of these slots contains a contact bar or rod 44. Movable along each of these rods is a sliding contact unit or member 45 (shown in detail in Figs. 8 and 9). In setting up the program the disk 35 is turned manually to bring one of the radial slots to the position 46, Fig. 4, parallel with the edge of the indicator 42. The contact device 45 is then shifted along the member 44 until a portion 47 of the device is in line with the indication of the station which it is desired to hear at the particular time indicated. The sliding contact member 45 consists of three parts, one being a rectangular sleeve 51, a member 52 having a portion 47 formed to extend through a slot 54 in the member 51, and a member 55 fitting within the lower part of 51 and formed to provide a contact spring 57 extending below the member 51. The organization of the unit 45 comprising the parts 51, 52 and 55 is such as to provide friction against the bar 44 sufficient to hold the contact spring 57 in any position to which it may have been adjusted.

It might be stated here that when a contact member 45 is moved inward as far as it will go it will not form a control connection but will simply be at a neutral point. This makes it possible to skip one or more time indications in setting up a program and the station last brought in will continue to be heard from until a time division is reached in which a contact device 45 has been adjusted into a station selecting position. It should also be stated here that when a contact device is adjusted outward as far as it will go the receiving set will be turned off when that time division is reached.

The devices 45 make their electrical contact through a series of circular and concentrically arranged members which are preferably embedded in a circular plate 62 of insulating material. Each of these rings 61 is connected by suitable wiring to one of the stops mentioned later on for the station selecting devices. The wiring includes contact springs 63 fixed to the base 37, which base also is of insulating material.

The contact bars or rods 44 are held in position in the radial slots of the disc 35 by the devices illustrated in Fig. 8. These consist of a plate 64 and a member 65 which are fastened by screws or the like to the inner and outer edges respectively of the disc. The plate 64 has an opening 66 to engage a formed over end 67 on the bar 44, while the member 65 has an opening 68 which may be first engaged with a notch 69 in the bar 44 and then secured by a screw or the like to the outer edge of the disc 35. This construction provides a rigid alignment and firm support for the bars 44 and is so arranged as to permit convenient assembling and disassembling for repair or replacement of contacts.

The mechanism for imparting a step-by-step station selecting connection through the station selector disc 35 will next be described. This mechanism includes a gear 72 of insulating material engaging the formed ends 67 of the bars 44. Each time the gear 72 is turned one step it will turn a unit of which the gear 72 is a part so as to move a contact spring 73 from engagement with the end of one station bar 44 into the

engagement with the next adjacent bar. In this way the next selected station will be brought in by adjustment of the station selecting devices in the receiving set referred to later on, or if the control member 45 at the next adjacent station is at the innermost or neutral position the station already coming in will be left on. On the other hand, if the control member 45 is at its outermost position the receiving set will be turned off.

The mechanism for operating the gear 72 includes a lantern gear 74 journaled on a stud projecting from a base plate 82. The lantern gear 74 is actuated by a pawl 76 pivoted on an arm 77 extending from a member 78 pivoted at 79 to the base plate 82. Extending from the member 78 is a stud 83 engaging slots in a pair of members 84 and 85 pivoted respectively at 86 and 87 to the base plate 82. A spring 91 tends at all times to hold the members 84 and 85 in the positions shown in Fig. 6. Connected to two arms 92 and 93 integral with the members 84 and 85 are links 94 and 95 extending from armatures 96 and 97 cooperating with a magnet 98. When the magnet is energized the arms 92 and 93 are moved inward and the spring 91 compressed. This movement will cause the slots surrounding the stud 83 to rock the member 78 and impart a feeding movement to the pawl 76 and thereby rotate the gear 72 and move the contact spring 73 to the next station selector bar 44. An air dash pot 101 of any usual construction may be used to prevent too sudden a movement of the arms 92 and 93 by the magnet 98, thereby preventing an overthrow of the gear 72 when the magnet acts to turn the gear.

It should be made clear at this point that when the operator is setting up a program on the disc 35 the disc may be turned by hand and the lantern gear 74 will simply ratchet over the pawl 76 in case the pawl should be in contact with the lantern gear. It is preferred, however, to arrange the parts so that the pawl will not be in engagement with the pins of the lantern gear when the parts are in their normal or unoperated positions, thereby preventing interference with movement of the disc 35 when it is adjusted by hand in setting up the program. Adjustable stops 99 may be used to arrest the return movements of the members 92 and 93 and thereby determine the home position of the pawl 76.

The magnet 98 for operating the station selector feed pawl 76 is energized directly from the selenium cell 32. For this purpose the cell is connected by means including a lead 105, Fig. 20, to a contact ring 106 (see also Figs. 5 and 7) on the bottom of a turn table 107 which supports the magnet 98 and the feed pawl operating mechanism associated therewith. This ring is electrically connected to the contact 73. The magnet 98 is also connected by a lead 108 to another ring 109 on the bottom of the turn table 107. The rings 106 and 109 run in engagement with two spring contacts 111 and 112 which are on the base 37 and are electrically connected through the cell and magnet 98 with the lead 105, a lead 113 electrically connected as at 114 to the negative side of the transformer circuit. When the light ray strikes the selenium cell the magnet 98 causes a feeding movement of the pawl 76 to turn the table 107 and engage the contact 73 with the next adjacent contact bar 44. If the selector contact 45 has been adjusted away from a neutral position the station selecting mechanism hereinafter mentioned will be actuated to turn to a station different from the last one. If the device 45 is at a neutral position then the last station will remain on to continue the program from that station.

The operating mechanism for selecting the stations and for controlling the volume is illustrated in detail principally in Figs. 10 to 13 inclusive. The station selecting mechanism will be first described. It comprises an arm 115 extending from a plate 116 attached by bolts or studs 117 and 118 to a gear 119 which is fastened to a shaft 120. The studs 117 and 118 are connected respectively by links 121 and 122 to the free ends of arms 123 and 124 forming part of the mechanism for operating the arm 115. The arms 123 and 124 are fastened to devices 125 and 126 terminating in knife edges 127 and 128. Also secured to the members 125 and 126 are arms 133 and 134, so that the arms 123 and 133 will always move together as a unit. The arm 133 is connected by a link 136 to a lever 137 resting upon the bevel or knife edge 127 and under a similar stationary bevel or knife edge 140. The lever 137 is connected to the armature 141 of a magnet or a solenoid 142. The arm 138 is connected in the same way as just described to an armature 144 of a solenoid or magnet 145. Stops 146 in the paths of the members 125, 126 arrest movements of the members and cause the knife edges 127, 128 to serve as supports for the arms 137 and 138 when the armature 141 or the armature 144 is drawn downward by the corresponding coil. From the foregoing it will be seen that the arm 115 may be swung around the shaft 120 in either direction from the vertical position in which it is shown in Fig. 11, by energizing either the magnet 142 or the magnet 145.

Meshing with the gear 119 is a gear 147 attached to the usual shaft 148 for station selecting in a radio receiving set. Turning the gear 147 will, therefore, give the same results as though the station selecting knob 151 is operated by hand.

The arm 115 is arrested in different positions by plungers 155, one of which is shown in detail in Fig. 14. Each plunger is secured to an armature 156 which is normally held away from a magnet 157 by a spring 158. When the magnet 157 is energized the end of the plunger 155 is caused to project into the path of the arm 115. These magnets are each in the circuit with one of the station selectors comprising the adjustable device 45 on the bar 44 so that when the turn table 107 is actuated one step the plunger 155 corresponding to the selected station will be caused to project into position to arrest the control arm 115.

The magnets 142 and 145 for swinging the arm 115 are each in series with (in the construction shown) half of the magnets 157 for operating the stop plungers 155. That is to say, referring to Fig. 11, the magnets for the plunger 155 shown at the right of the arm 115 in Fig. 11 are each in series with the magnet 142 while the ones at the left of the arm 115 are in series with the magnet 145. From this it is clear that when the adjustable contact 57 makes the circuit through one of the rings 61 and the associated contact 63 the proper stop plunger magnet will be energized and the corresponding magnet 142 or 145 will also be energized to swing the arm 115 until arrested by the projecting stop plunger 155.

Mechanism is provided for swinging the arm 115 to the neutral position in which it is shown

in Fig. 11 when the receiving set is off and between adjustments of the arm by the magnets 142 and 145. This is effected by oppositely wound clock springs 161 and 162, Fig. 12. The spring 161 is shown in detail in Fig. 10A. At their inner ends these springs are secured to separate adjusting sleeves 170 and 171, the latter being telescoped within the former and provided with set screws for clamping the sleeves or collars to the shaft 120 to secure proper relation of the springs. At their outer ends these springs are each formed to provide a hook 168 to engage a pin 169 projecting from a stationary mounting plate 173. When the arm 115 is swung away from vertical position either the spring 161 or the spring 162 will be tensioned and when the arm is released the tensioned spring will restore the arm to its neutral position.

In order to prevent swinging the arm 115 at an excessive speed the shaft 120 carries an arm 181 (Fig. 12) suitably connected to the casing 182 of an air dash pot provided with a regulating valve 183. In the casing 182 is a piston 184 connected to a stationary stud 185 so that when the shaft 120 is rocked the casing 182 will be moved relative to the piston thereby slowing down the operation of the shaft and the parts attached to or connected thereto.

Mechanism is provided for holding the arm 115 in adjusted position after a station is selected and until the next station selecting adjustment. This mechanism is in the form of a brake or lock operated to set and release the brake by two magnets. Meshing with the gear 147 is a gear 191 freely rotatable around a shaft 192. At the sides of the gear 191 are friction plates 193 and 194, each of these plates having a hole or perforation engaging a pin 195 projecting from the mounting plate 173. At the outer end of the shaft 192 is a set nut 196 which may be used to adjust the friction or grip to be applied by the brake; this friction or adjustment being brought about by an endwise movement of the shaft 192.

This endwise movement of the shaft is effected by a toggle mechanism actuated by endwise movement in one direction or the other of a bar 201 carrying at its ends armatures 202 and 203 cooperating respectively with magnets 204 and 205. The toggle mechanism referred to includes a bracket 206 secured to the mounting plate 173 and connected by a link 207 to the bar 201. Another link 208 connects the bar 201 to the rod or shaft 192. When the magnet 205 is energized the bar 201 will be drawn toward the magnet and the toggle 206 will be straightened to pull the shaft 192 and nut 193 thereon toward the stationary mounting plate 173, thereby causing the nut to press the gear 191 and friction plates 193 and 194 together to hold the gear 191 and, consequently, the arm 115 in adjusted position. When the arm is to be set to a different position the magnet 205 is deenergized and the magnet 204 energized to break the toggle and free the gear 191 so that the arm 115 will be left free for adjustment or return to neutral position. The connections for selectively energizing the magnets 204 and 205 will be referred to later on.

The volume control mechanism is the same in principle and operation as the station selecting mechanism just described, the principal differences being that the volume control arm 115A swings in one direction only, and, consequently, only one magnet 210 and one return spring (like 161) is needed. In order to make the mechanism more compact, however, it is preferred to use, wherever possible, a single volume control stop 155A for several stations. This means that the multi-winding construction illustrated in Fig. 15 may be used, the illustration in that figure showing the winding for operating the stop 155 from each of three station connections.

The same mechanism as has been described in connection with the arm 115 is used for setting and releasing a brake for the volume control arm 115A. This mechanism is shown at the right of Fig. 10 and need not be described in detail.

In order to make it possible to adjust the volume control with greater nicety it is preferred to have all of the volume control stops 155A mounted on a segment 212 which is movable about the center 120A with reference to the volume control arm 115A. Attached to the dge of the segment 212 is a rack 213 engaging a worm gear 214 on a shaft which carries at its outer end a hand knob 215 for turning the shaft to adjust the segment 212 to regulate the volume control as a unit. For instance in a residence a low volume for all stations is desirable while other places may require a louder volume for all stations. Manipulation of the knob 215 makes such adjustment or regulation convenient and very effective.

Energizing and de-energizing the brake magnets 204 and 205 is controlled by what is for convenience referred to as a cycle drum. This drum is operated for a full turn by a separate motor whenever a new station is brought in by the step-by-step movement of the turn table 107 and contact 73 thereon. This cycle drum is shown in Figs. 17 and 18. It consists of a cylindrical portion 221 carrying on its surface five partial rings or segments for different purposes. Of these the segment 222 controls a switch 216 (Fig. 20) for energizing the brake mechanism by throwing in the magnet 205, Fig. 10, while the segment 223 controls a switch 217 for energizing the magnet 204 to release the brakes and allow the arms 115 and 115A first to return to neutral, if necessary, and then be swung to their new positions.

Energizing the magnets 142, 145 and 210 for swinging the arms 115 and 115A of the station selecting and volume control devices is controlled as to time by a segment 218 on the cycle drum 221 and a switch 219 (Fig. 20) cooperating with the segment. The arrangement is such that the arms 115 and 115A are swung immediately after the brakes are released by the magnet 204 and the arms returned to neutral by the springs 161 and 162.

The cycle drum 221 is rotated by a make and break apparatus of the bell ringing type comprising a magnet 226, Fig. 18, and an armature 227 attached to a lever 228 pivoted at 229 on a fixed arm or bracket 230. Pivoted on the lever 228 are two pawls 233 and 234. When the magnet 226 is energized the lever 228 will be swung around its pivot by the magnet and a return spring 235 under the control of the make and break contact 236, thereby causing the pawls 233 and 234 alternately to engage and actuate a toothed disc 241 rigid with a gear 242 meshing with a gear 243. The gear last mentioned is fastened to a shaft 244 to which the drum 221 is secured. The mechanism and connections for causing the magnet 226 to actuate the cycle drum are so constructed and arranged that the drum will automatically come to a stop after the drum has been given one complete turn.

The cycle drum is normally given its turn each time that one of the slots **27** in the disc **26** comes in alignment with the ray from the lamp **28**, Figs. 3 and 20, although other means are provided for causing a turn of the drum **221** under certain conditions where the clock control is not sufficient. These other means will be described at another point.

When the disc **26** is turned to a position where one of the slots **27** permits the light rays to strike the selenium cell **32** the motor magnet **226** is energized through connections including the positive lead **2271** and the negative lead **2281** (Fig. 20). This starts the motor **226** and energizes a magnet **2291**. The magnet **2291** operates a switch designated generally by **2301** to close the contact or switch and the first movement of the motor **226** causes the cycle drum **221** to start its rotation. A segment or partial ring **231** on the cycle drum closes a switch designated generally as **232** to complete the circuit and continue the motor in operation until the cycle drum **221** has completed one full turn to open the switch **232**. By the time the switch **232** has opened, the slot **27** will have been carried into position to prevent the light ray from striking the selenium cell **32** but the magnet **2291** will remain energized because of the fact that its coil is in circuit with the motor and connected directly to the transformer circuit. The switch **2301** is therefore held closed until the cycle ring **231** has completed its full turn and allowed the switch **232** to open to interrupt the circuit. This will bring the motor **226** to a stop.

The construction shown in the drawings comprises a key which can be used to bring the contact **73**, Fig. 6, into engagement with any desired one of the contact bars **44**. This key designated **248** in the drawings is preferably located in the receiving set but may be made a part of a remote control mentioned later, or may be made a part of the program device shown in Fig. 4. Each time the key **248** (Figs. 1 and 17) is depressed the motor **226**, Fig. 18, is operated to cause a complete cycle of movement of the cycle drum **221**; and the magnet **98**, Fig. 6, of the program mechanism is actuated to turn the gear **72**, and, thereby, the contact **73** one division. The key **248** forms part of the core of a solenoid, the coil **249** of which is energized after the key is depressed to hold the key depressed until the cycle drum has made a complete turn. The electrical connections are illustrated in Fig. 20. The lead **252** is connected to the positive side of the transformer circuit and terminates in a switch element **253**. Adjacent to the element **253** is an element **254** connected to a lead **255** which is connected at **256** to the motor lead **2271** previously mentioned. The negative lead **2281** from the motor is connected at **1229** to the negative lead **114** previously mentioned. Operation or depression of the key **248** will bring about other results mentioned later, but will also cause the two switch elements **253** and **254** to come into electrical contact, thereby establishing a driving circuit through the motor. The coil **249** is energized through a switch element **261** connected to the coil by a lead **262**, but the circuit through the coil is not completed until the cycle drum has turned far enough to close the switch **232** previously mentioned. This completion of the circuit through the coil is effected by an extension **263** of one of the arms of the switch **232**, this extension engaging another arm **264** on an auxiliary switch and raising it to make electrical contact with another arm **265** to complete the circuit through the coil, the circuit having otherwise been completed by engagement of the inner end of the key **248** with a switch element **266**.

A leaf spring **267**, Fig. 17, is moved by the key **248** and applies a yielding pressure to the four switch elements **261**, **253**, **254**, and **266** to force the elements into close electrical contact. When the key **248** is released and the coil **249** is deenergized the spring **267** will restore the key and allow the four switch elements to return to their normal or separated positions to break the respective circuits.

The construction shown in the drawings includes a set of station keys **300** which are preferably mounted in the casing of the receiving set. There is one of these buttons for each of the principal broadcasting stations. Depression of a button will set the corresponding stop **155** previously mentioned and will also energize either the magnet **142** or the magnet **145** to swing the station setting arm **115** in the proper direction until arrested by the set stop. The key will also close the contacts to cause the cycle drum **221** to make a complete turn and will also actuate the pawl **76** to turn the gear **72** on the turn table **107**. This latter operation will, however, be an ineffective one because preparatory to using the station keys **300** all of the program selecting devices **45** should always be moved to inner or neutral positions. It is obvious, of course, that the program device might be omitted and the station keys **300** only relied upon in selecting the broadcasting stations.

While the keys **300** have been shown mounted in the casing of the receiving set it is obvious that they might be located at a point removed from the receiving set and connected up by suitable wiring to the station selecting and volume control arms **115** and **115A** and the stops **155** and **155A** associated with those arms. This remote control is indicated conventionally by the keys **300A** and wiring connections illustrated in the lower right corner of Fig. 20. Each of the keys **300A** is constructed to close a circuit through a solenoid coil which will cause the corresponding key **300** to be drawn down to effective position just the same as though the key **300** was depressed by hand. In other words, the keys **300** may be operated directly by finger pressure or they may be operated by pressing the corresponding remote control key **300A**.

The solenoid coil energized by depression of a key **300A** is designated **303** in the drawings. Positioned opposite the inner end of the key **300** are five switch contacts which are forced together to close their circuits in much the same manner as described in connection with the delayed start key **248**. The details of this construction are shown in Figs. 17 and 20. The end of the key **300** contacts a spring **305** which when flexed by movement of the key will press the five switch contact leaves or members into electrical contact. Of these leaves, **310** and **311** complete the circuit through the coil **312** and energize the coil to hold the key in depressed or operated position. The leaf or switch member **313** completes the circuit through the associated solenoids for setting the proper stops **155** for a station selecting and volume control and also energizes one or the other of the magnets **142**, **145** to swing the station selecting arm **115** and effect operation of the motor **226** and cycle drum **221** in the manner previously explained. This movement of the cycle drum will release and set the brakes for the arms

115 and 115A in the same way as previously explained in connection with operation under the control of the program device. The switch blades 315 and 316 close the circuit to cut out the senenium cell 32 in operations where the station keys 300 are depended upon for station selection.

The receiving set has two keys which may be operated to turn the set on and off. These keys are designated respectively 321 and 322. The "on" key or button will close the circuit from the power line and the "off" button 322 will open it to shut down the receiving set. In addition the set may be turned on by the remote control key 325, Fig. 20, which will close the circuit and energize a coil 326 to draw the solenoid core 327 inward. The solenoid core carries a pin 328 on the outside of a lever 329 pivoted at 330 to a stationary bracket 331. The bracket 331 carries one-half of each of two circuit closing switches, the corresponding pair of switch elements being carried by the pivoted arm 329. One pair of the contacts designated 335, Fig. 20, is to complete an energizing circuit through the coil 326 while the other pair 336 completes the main line circuit to place the set in operation. In Fig. 17, the parts are shown in the positions they occupy when the key 325 has been pushed in or has been drawn in by operation of the solenoid 326. The key is retained in its inner or depressed position by a spring pressed latching pawl 337 pivoted on the forward end of an arm 338, this arm being pivoted at 339 to a lug 340 on a stationary part of the frame work. When the key 321 is pushed in, the pawl 337 is fixed against its spring by a lug 343 on the pivoted arm 329 until the key has moved far enough to close the switch contacts, whereupon the pawl will be moved by its spring above the lug 343 to hold the key in its inner position. The receiving set may also be turned on by a modification of an alarm mechanism in the clock 25. This may be accomplished in any suitable way and is, therefore, represented conventionally at 356 in the upper left hand corner of Fig. 20. When the switch 356 is closed by the clock the coil 326 will be energized and will, through the connections previously described, pull "on" key 321 to its inner position and close the contacts 335 and 336, Fig. 20.

The receiving set may be turned off by manual operation of the key 322, or it may be turned off by a connection to the remote control device, or it may be turned off by the program device. In direct manual operation the key 322 is pushed in to move a pivoted arm 348 inward until a clearance 349 in the lever 338 is brought opposite the end of the arm 348 whereupon a spring 353 will swing the arm 338 and carry the pawl 337 out of engagement with the lug 343 and allow the arm 329 to be swung by a spring 354 until the lug 343 engages a laterally projecting stop 355 to arrest the arm 329. When the arm 329 is arrested by the lug 355 the switch contacts 335 and 336 will have been separated to open the circuits through the coil 326 and the main line circuit, and the key 321 will have been returned to its undepressed position.

In turning the set off from the remote control, a remote control key 361 is depressed to close a circuit through the magnet 362. When the magnet is energized its armature, carried by the pivoted arm 348, will be drawn toward the magnet and release the arm 338 in the same way as previously described in connection with the manual or hand operation of the key 322.

The control from the program device over the "off" key 322 includes the outer one of the concentric rings 61 embedded in the disc 62. When one of the sliding station selector contacts 45 is moved to the outer end of its bar it will rest above the outer ring 61 and when the contact 73 comes in line with the associated contact or conductor bar 44 a circuit will be established which will include the magnet 362 thereby causing the magnet to act upon the armature carried by the arm 348 to pull the "off" key in and release the "on" key to open the circuits in the same way as previously described in explaining a hand operation of the "off" key 322.

The mechanism as so far explained has to do with station selecting and volume control in one way or another. The radio receiving mechanism proper has not been explained, but the connection is indicated conventionally at 375, Fig. 20.

In order to prevent any disturbing noise from the loud speaker, when shifting from one station to another, for instance, the cycle drum 221 carries a short segment 376 which operates a switch 377 to hold the switch closed between operations of the cycle drum. As soon as the cycle drum begins to turn the segment 376 is withdrawn and the circuit through the loud speaker opened, the circuit remaining open until the completion of the rotation of the cycle drum.

Assuming that the receiving set is "off", that is, for example, in the condition which exists when the key 322 is pressed in, the set may be turned "on" by the clock alarm mechanism represented conventionally at 356 (Fig. 20). Previous to this the program devices will have been adjusted to set up a program, and the program table adjusted to set opposite the arrow 381 the time division on the indicator 39 which corresponds with the setting of the alarm mechanism of the clock. When the clock reaches that period of time the switch 356 will be closed and the receiving set trned "on" in the manner previously described. The clock 25 is, of course, running continuously and the electric eye mechanism will be operated at each 15 minute period to actuate the feed pawl 76 (Fig. 6). In the event that the receiving set is turned on manually between the beginning and the end of a fifteen minute period the delayed start key 248 can be used. This will actuate the feed pawl 76 and cause a rotation of the cycle drum 221 to operate the selector arm 115 and volume control arm 115A under control of the switch 265 to effect the proper setting for the broadcasting station brought in by the adjustment of the contact 45 which is in alignment with the contact 73. Through the connection established by the adjustable contact 45 the arms 115 and 115A are set to correspond with the adjustment of the contact 45 and the brakes previously described are then rendered effective to hold the arms in position. In other words, depression of the delayed start key 248 has the same effect throughout as an impulse produced by light from the lamp 28 striking the selenium cell 32.

The construction and operation of the program device of Figs. 4, 5 and 6 have been explained in detail. In setting up the program, the adjustable contacts 45 are adjusted with respect to the index or indicator 42 and the disc 35 turned a step at a time after each contact is adjusted. The program device may be mounted on any suitable support separate from the radio receiving set or it may be mounted on or made a part of the enclosing cabinet for the set. After a program has been set up the disc 35 should be turned

manually so that the first station which will be brought in by the electric eye or by the key **248**, is represented by the slide **45** and conductor bar **44** resting opposite the arrow **381** (Fig. 4). When the pawl **76** is operated either by depression of the delayed start key **248** or by a light ray striking the selenium cell **32** the contact **73** will be brought into engagement with the bar **44** opposite the arrow and the electrical connections for that broadcasting station will be made effective.

If it is desired to control the selection of stations by hand, that is, independently of the program device, the keys **300** may be used for station selecting and the receiving set turned on or off by means of the keys **321** and **322**. Operation of the keys **300** will effect the adjustment of the station selection and volume control arms **115** and **115A** in the same way as though they were controlled by the sliding contacts **45** of the program device.

The remote control device above referred to may be a set of simple key operated contacts for closing circuits through the solenoids or magnets associated with the keys **300**, **321** and **322** on the receiving set. In other words, the remote control key board is at some distance from the receiving set as, for example, in another room, and is connected electrically to the station selecting and volume controlling mechanism through the solenoids **303** for operating the keys **300** to cause the keys to close the collection of switches opposite the ends of each key. That is to say, operation of the remote control keys **300A** will effect operation of the keys **300** in the same way as though the later keys were pushed in by hand. The remote control device also includes keys **325** and **361** which may operate on off switches directly but which are preferably connected to operate either the magnets **326** or **362** associated respectively with the on and off keys **321** and **322**.

While the construction and operation of the specific embodiment have been gone into in considerable detail, it is not the desire to be limited by the embodiment or its description except as defined in the claims which follow and form a part of this specification.

What is claimed is:

1. An apparatus of the character described comprising volume control devices, a member connected to the volume control devices and movable to control the volume, a set of stops for said member, means for selectively setting the stops, means for moving the member until arrested by a set stop to determine the volume, a movable support for the stops, and devices comprising a manually operable member for moving said support and the stops thereon to regulate the volume.

2. In an apparatus of the character described, combination with the station selecting devices of the receiving set, of a clock, a program device comprising a manually adjustable device for each of a number of time intervals to determine the station to be brought in during each of said intervals, a swinging arm connected to the station selecting devices and means controlled by the clock for swinging said arm in either direction from a neutral position, springs for returning said arm to neutral position, devices controlled by the clock for holding the arm in adjusted position against the tension of the springs during a predetermined time interval, and means also controlled by the clock to release the holding means at the end of the time interval.

3. In an apparatus of the character described, a time clock, a slotted disc turned by the clock, a lamp, a selenium cell in position to receive a light beam from the lamp passing through the slots in the disc, a program device comprising manually adjustable elements for setting up a program of broadcasting stations, station selecting devices for a radio receiving set, and means connected to said selecting devices and actuated under the control of the selenium cell for adjusting the station selecting devices to correspond with the adjustable elements of the program device.

4. In an apparatus of the character described, a time clock, a perforated disc turned by the clock, a lamp, a selenium cell in position to receive a light beam from the lamp passing through the perforations in the disc, perforated members through which the light beam also passes, one of which members is adjustable to regulate the time of exposure of the selenium cell to the beam, a program device comprising manually adjustable elements for setting up a program of broadcasting stations, station selecting devices for a radio receiving set, and means controlled by the selenium cell for adjusting the station selecting devices to correspond with the positions of the manually adjustable elements of the program device.

5. A control apparatus for a radio receiving set comprising station selecting devices, devices for controlling the volume, switches for rendering said selecting and volume control devices effective and ineffective, a motor, a cycle drum turned a rotation at a time by each operation of the motor, switches controlling the extent of rotation of the cycle drum, and switch operating cams on the drum for controlling all of the aforesaid switches.

6. A control apparatus for a radio receiving set comprising station selecting devices, devices for controlling the volume, brakes for holding the selecting devices and volume control in various positions of adjustment, switches controlling said brakes, a switch for shutting off the receiving set while the selecting and volume control devices are being adjusted, switches operable to render the selecting and volume control devices effective and ineffective, a motor, a cycle drum driven by the motor, and switch operating cams on the drum for closing and releasing all of the aforesaid switches in a predetermined time relation.

7. The combination with a radio receiving set provided with station selecting devices and volume control, of a control apparatus for automatically selecting stations and regulating the volume comprising a motor, a cycle drum driven by the motor, segmental cams on the drum controlling operations of the volume control and station selecting devices, a clock and a program device controlling operations of the motor, and means comprising a manually operable key for effecting operations of the motor independently of the clock and program device.

8. In an apparatus of the character described, the combination with a radio receiving set provided with station selecting devices, a loud speaker and devices for controlling the volume, of a control apparatus for automatically selecting stations and regulating the volume comprising a clock, a program device including a rotatable disk and manually adjustable station selecting elements adjustable on said disk, a fixed contact, the disk being rotatable to bring any element in line with said contact, connections established

by the element through said element to the aforesaid control apparatus, and means controlled by the clock for actuating the disk to bring successive elements in line with the stationary contact.

9. In an apparatus of the character described, the combination with the station selecting devices of a radio receiving set, a program device comprising a dial, a circuit member carried on the dial for each broadcasting station, a slidably mounted manually adjustable device mounted on the dial, one for each of a plurality of time intervals and each adjustable to engage any of said circuit members to set up a predetermined selection of stations, a clock, means for adjusting the station selecting devices periodically under control of the clock and the adjustable devices, means for maintaining the selecting devices in adjusted position independently of the clock during time intervals not represented by a manually adjustable device, a circuit member on the dial connected to a switch for shutting off the receiving set when one of the manually adjustable devices is in contact with the said switch connected circuit member and other circuit connections to the switch closed by adjustment of any of the aforesaid manually adjustable members.

10. An apparatus of the character described comprising radio station selecting mechanism, a clock, a lamp, a selenium cell, a disk rotated by the clock between said lamp and said cell and having slots spaced apart distances representing units of time, said station selecting mechanism including a motor, and an operating electrical circuit for the motor energized when light from the lamp passing through a slot in the disk strikes the selenium cell.

11. An apparatus of the character described comprising radio station selecting mechanism, a clock, a lamp, a selenium cell, a disk rotated by the clock between said lamp and said cell and having slots spaced apart distances representing units of time, said station selecting mechanism including a motor, an electrical circuit for energiing the motor connected to and energized when the selenium cell receives light from the lamp through the slots in the disk, a switch in said circuit, a magnet energized to operate the switch when the light strikes the selenium cell, and means driven by the motor for holding the switch closed until the selection of a station has been effected and then releasing the switch to break the circuit.

12. An apparatus of the character described comprising radio station selecting mechanism, a clock, a lamp, a selenium cell, a disk between said lamp and said cell driven by the clock and having slots through the disk spaced apart distances representing units of time, said station selecting mechanism including a motor an electrical circuit for energizing the motor including a switch for closing the motor power circuit, a magnet for operating the switch connected to and energized when the selenium cell receives light from the lamp through the slots in the disk, and an adjustable slotted member between the lamp and the selenium cell for regulating the time duration of the light through the slots in the disk.

13. An apparatus of the character described comprising radio station selecting mechanism, a clock, a program device comprising a manually movable support and station selecting devices manually adjustable on said support to set up a program of stations to be heard over a period of time, said radio station selecting circuits being controlled by the manually adjustable devices on the movable support, a single contact common to said circuits, the movable support and said contact being relatively movable manually to establish a program relation between the manually adjustable devices on said support and the single contact, and means controlled by the clock for thereafter effecting a periodic relative movement of the contact and the movable support to effect station selection.

14. An apparatus of the character described comprising radio station selecting mechanism, a clock, a lamp, a selenium cell, a disk rotated by the clock between said lamp and said cell and having slots spaced apart distances representing units of time, said station selecting devices including a motor, an electrical circuit for energizing the motor connected to and energized when the selenium cell receives light from the lamp through the slots in the disk, connections including a switch for maintaining an operating circuit through the motor, and means including a cam turned by the motor for holding said switch closed until the motor has completed a cycle of movement.

15. An apparatus of the character described comprising the radio station selecting mechanism and volume control devices of a radio receiving set, a member connected to the volume control devices and movable to actuate said devices to control the volume, a set of magnetically operable stops for variably controlling movements of said member to determine the volume according to the station selected including a single stop common to certain stations having the same volume, and means for operating said single stop including a plurality of magnetic coil windings associated with said single stop and separately energized according to the station selected to operate the stop.

16. In an apparatus of the character described, an automatic program device comprising a clock, a movable support divided into sections each marked to indicate a time interval, a radio station selecting device mounted on the support in each section and comprising a manually adjustable element for determining the station to be heard during the indicated time interval, the adjustment of the elements setting up a program of stations to be heard successively during a plurality of time intervals, a contact member common to the sections, the movable support and said contact member being relatively movable to establish the time relation between the program set up and the clock, means controlled by the clock for effecting a step of relative movement of the movable support and the contact member for each time interval whereby to establish successively electrical contacts between the contact member and the station selecting devices in successive sections of the support, and a radio station selecting mechanism electrically operated through said contact and the manually adjustable elements according to the setting of the manally adjustable elements in the successive sections of the aforesaid movable support.

17. In an apparatus of the character described, an automatic program device comprising a clock, a movable support divided into sections each marked to indicate a time interval, a radio station selecting device mounted on the support in each section and comprising a manually adjustable element for determining the station to be heard during the indicated time interval, the adjustment of the elements setting up a program of stations to be heard successively during a

plurality of time intervals, a contact member common to the sections, the movable support and said contact member being relatively movable to establish the time relation between the program set up and the clock, means controlled by the clock for effecting a step of relative movement of the support and the contact member at the end of each time interval, a radio station selecting mechanism operated electrically through said contact and the manually adjustable elements according to the settings of said elements, a key, and connections controlled by said key independently of the clock for effecting relative movements of the movable support and the contact.

HENRY A. FRITZ.