April 15, 1941. G. E. MASTERS 2,238,391

RADIO TUNING SYSTEM AND DEVICE

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Fig. 1.

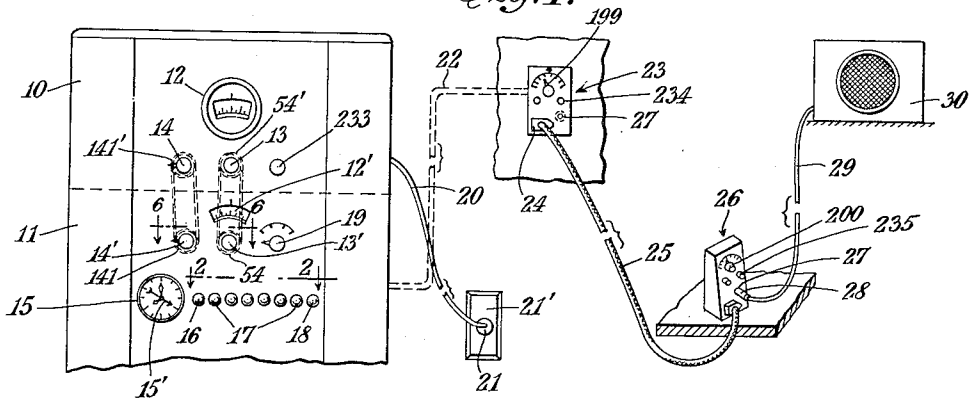


Fig. 2.

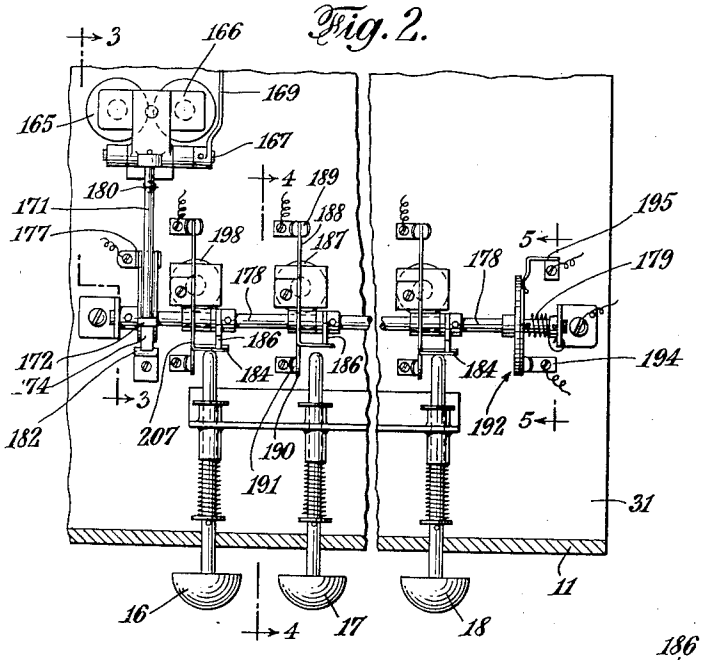


Fig. 5.

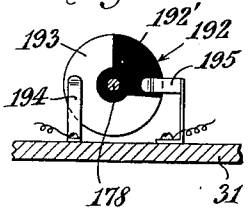


Fig. 3.

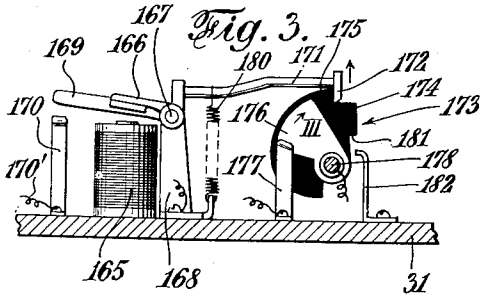
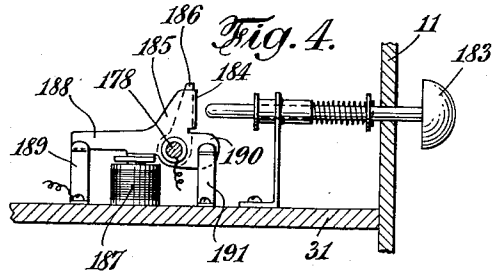


Fig. 4.



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Fig. 6.

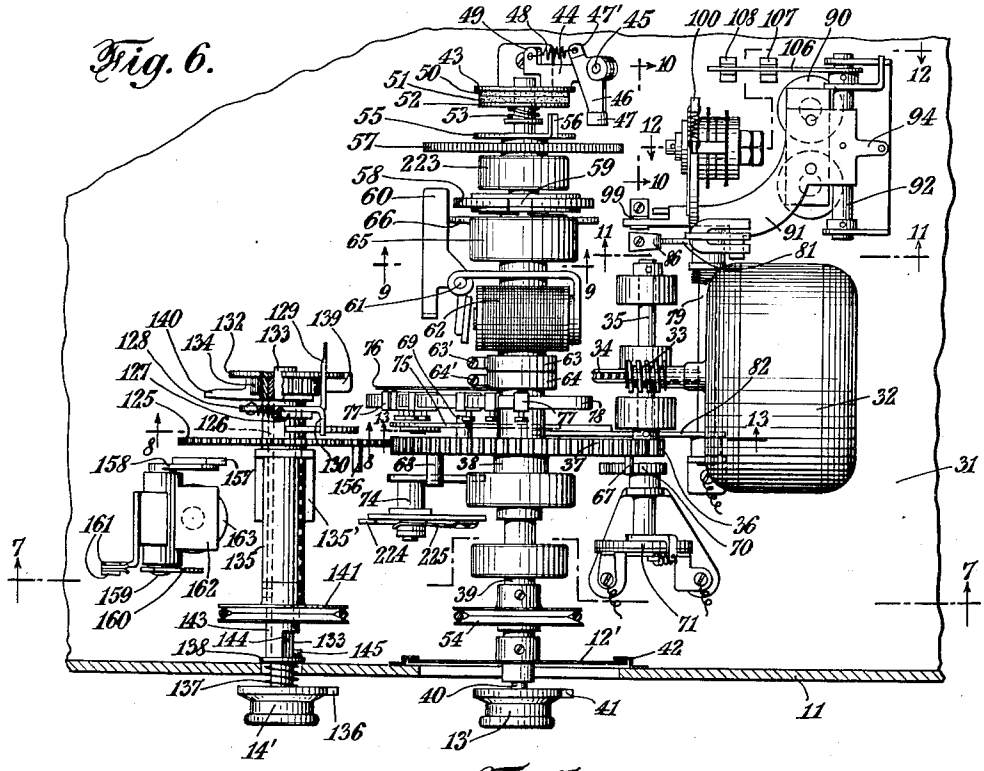


Fig. 7.

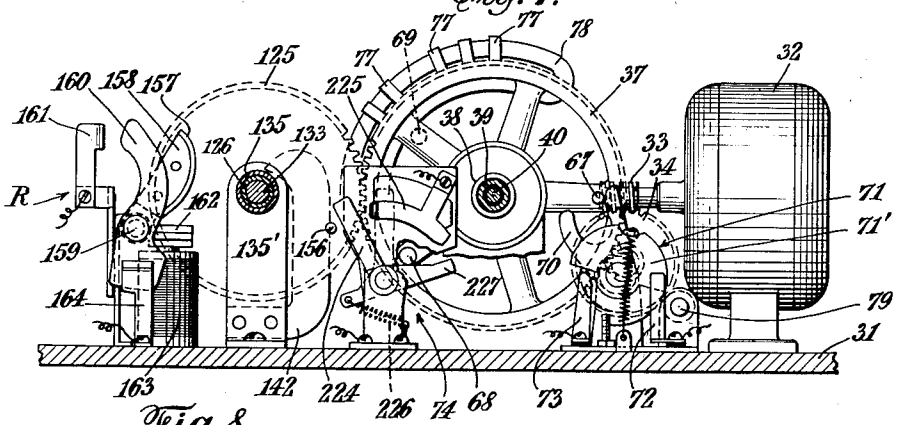


Fig. 8.

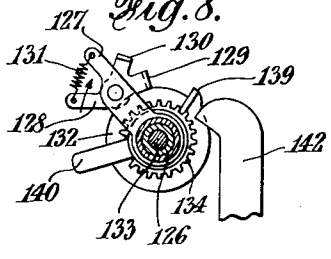
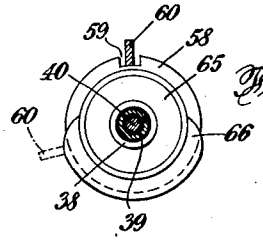


Fig. 9.



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Fig. 10.

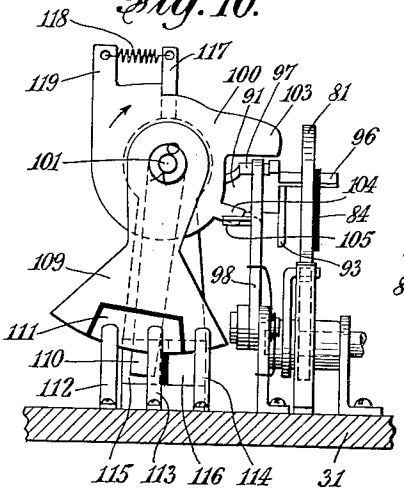


Fig. 11.

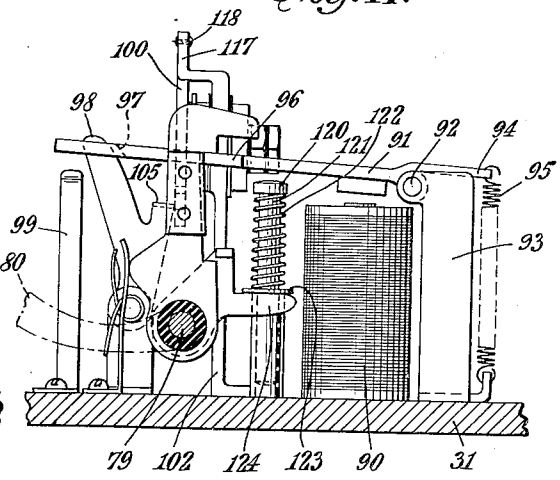


Fig. 12.

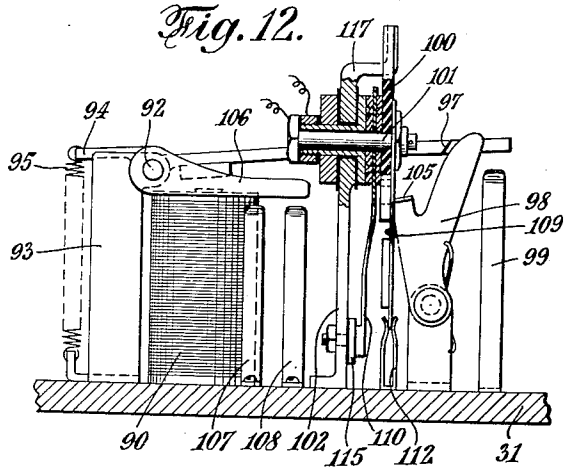


Fig. 13.

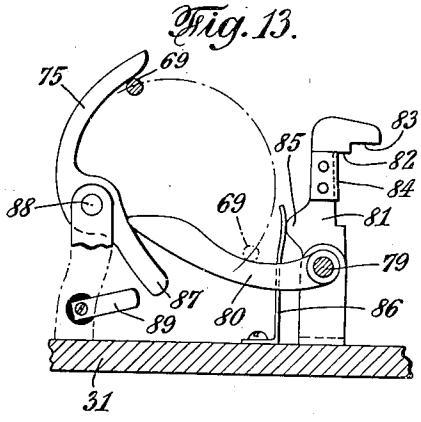
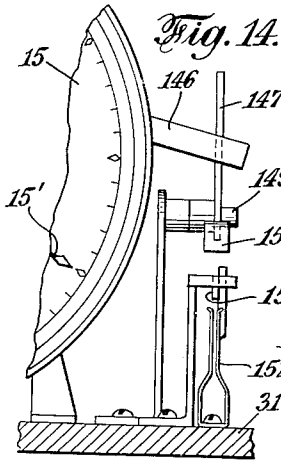


Fig. 14.



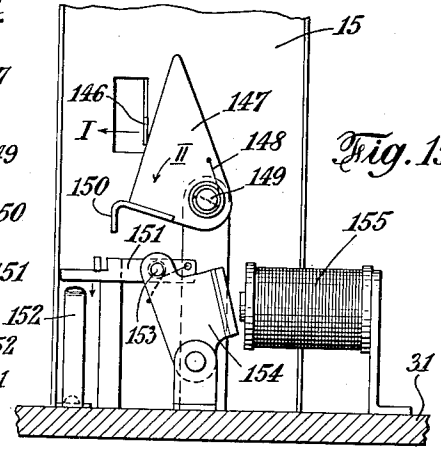


Fig. 15.

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Fig. 16.

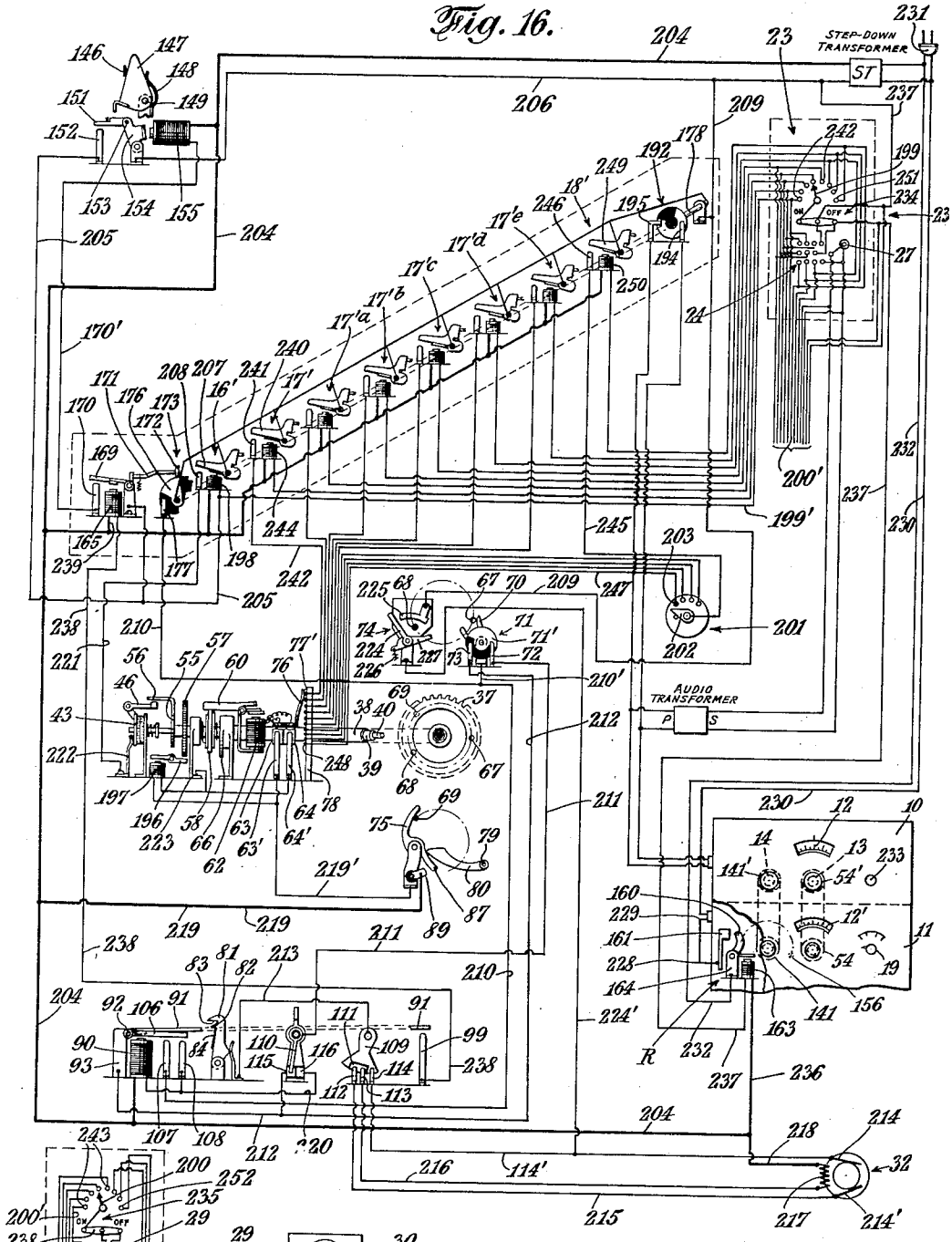
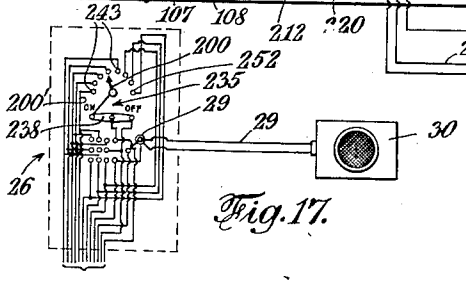


Fig. 17.



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Patented Apr. 15, 1941

2,238,391

UNITED STATES PATENT OFFICE

2,238,391

RADIO TUNING SYSTEM AND DEVICE

George E. Masters, Miami, Fla.

Application March 23, 1939, Serial No. 263,625

6 Claims. (Cl. 250—20)

This invention relates broadly to means for tuning radio receivers, and especially to a novel system of, and a mechanism for automatically tuning any type of existing radio receivers, designed originally for manual tuning operation, by either a clock controlled operation, or by means of individual station tuning units, which latter may be optionally operated either through push buttons or by stationary or portable remote controls, and wherein, simultaneously with such automatic station tuning, an automatic setting of the volume control or controls of the receiver is also effected.

Automatic and time controlled tuning is generally known. In these so-called "automatic" tuning devices, the station tuning is accomplished by either levers, keys, buttons, or similar means, which, however, are limited in numbers, with the consequence that only relatively few stations may be tuned automatically.

The prime object of my invention is to provide an entirely self-contained mechanism, adapted to be applicable to, and readily connectable with any existing radio receiver, from which latter the mechanism is originally absolutely independent, and which mechanism, when applied to an existing receiver, becomes virtually only mechanically connected with the receiver, with the exception of the power input and audio output circuits of the receiver, which circuits are controlled by the mechanism.

The present invention further contemplates a novel system and a novel combination of devices, whereby not only ordinary manual tuning and manual control of the volume may be had, but whereby an automatic station tuning, as well as an automatic setting of the volume control for a station automatically tuned in by a clock mechanism, by push buttons or by remote control, is provided, and wherein the number of stations to be automatically tuned in by push buttons may be increased to any desired number without an increase of tuning buttons or the like, for the additional stations desired.

A further object of this invention is to provide, in addition to the automatic and time controlled tuning, means for facilitating the tuning by remote control, and wherein such remote control tuning device may take the form of one or more major stationary controls, having provisions for connecting thereto portable or extension remote controls.

Summarizing the outstanding features of the present invention, the same consists of a radio tuning system, involving automatic push button tuning operation, time controlled automatic station tuning operation, and stationary or portable remote control operation, all of which tuning operations may be accompanied, at will, by a simultaneous, automatic setting of a pre-adjusted volume control for any station to be tuned in.

The foregoing novel objects and additional advantages of the present invention will become more clearly apparent from the ensuing description of the accompanying drawings, in which

Fig. 1 diagrammatically illustrates a radio receiving device with an automatic tuning system and remote controls, in accordance with my invention.

Fig. 2 is a partial detailed view in section, taken on lines 2—2 of Fig. 1, and illustrating a fragmentary portion of the push button controlled relays.

Fig. 3 is a detailed cross sectional view, taken on lines 3—3 of Fig. 2, showing an elevation of the motor control switch and its relay.

Fig. 4 is a partial cross sectional view, taken on lines 4—4 of Fig. 2, showing a typical push button arrangement in elevation.

Fig. 5 is a sectional detailed view, taken on lines 5—5 of Fig. 2, illustrating a switch controlling the loud speaker operation.

Fig. 6 is a plan view of the motorized mechanism for operating the tuning and volume controls of a receiver.

Fig. 7 is an elevation of the mechanism, partially in cross section, taken on lines 7—7 of Fig. 6.

Fig. 8 is a cross section, taken on lines 8—8 of Fig. 6, showing a portion of the pre-adjusting mechanism for automatically setting the volume control for a tuned-in station.

Fig. 9 is a detail cross section, taken on lines 9—9 of Fig. 6, illustrating a release arrangement for an essential part of the device.

Fig. 10 is an enlarged detail elevation, observed from lines 10—10 of Fig. 6, showing a motor reversing switch mechanism.

Fig. 11 is a side elevation, partially in cross section, taken on lines 11—11 of Fig. 6, showing the details of the means for controlling the switch mechanism illustrated in Fig. 10.

Fig. 12 is another side elevation of the same mechanism, with the switch parts thereof in cross section, taken on lines 12—12 of Fig. 6.

Fig. 13 is a detailed view of a control lever arrangement, taken on sectiton 13—13 of Fig. 6.

Fig. 14 is an enlarged detailed front elevation of my time controlled switch mechanism.

Fig. 15 is a side elevation of the latter.

Fig. 16 is a diagram of my tuning system, and

Fig. 17 is a continuation of a portion of Fig. 16, showing a loud speaker arrangement connected with the remote control of this system.

For the purpose of better understanding of the present invention, my system and most of the devices employed therein, are diagrammatically illustrated in Figs. 16 and 17. In the following specification I shall always refer to these figures, when describing the purpose, function, and construction of some of the devices which are shown in detail in other figures. Consequently, the numerals indicating the various parts of my system and devices, appearing in other figures, should be closely followed and compared with the corresponding numbers indicated in Figs. 16 and 17.

Referring now specifically to Fig. 1, there is illustrated a cabinet, the upper section 10 of which denotes a cabinet portion for accommodating any existing type of radio receiving apparatus, while the lower portion, indicated at 11, houses an entirely self-contained mechanism, adapted to facilitate the automatic tuning and the automatic setting of the volume control or controls of such radio receiver, when suitably connected with the latter.

The radio receiver is assumed to be provided with the usual radio tuning dial 12, knob 13 for a tuning shaft, and knob 14 for a volume control shaft. The mechanism contained in lower cabinet portion 11 houses a time piece 15 for providing automatic time tuning, and a row of push buttons, controlling automatic station tuning units. The push button nearest to time piece 15 is indicated at 16, and controls the same tuning unit as the time piece. The next six buttons are designated by numeral 17, and the last button by numeral 18.

Additionally, there will be observed in the lower cabinet portion 11 a tuning dial 12' corresponding to tuning dial 12 of the upper portion, a tuning knob 13', the shaft of which is operatively connected with the receiver tuning shaft controlled by knob 13, and a volume controlled knob 14', the shaft of which is operatively connected with the shaft of tuning knob 14 of the upper cabinet portion. Furthermore, there is provided additional station tuning knob 19, for facilitating the automatic tuning of additional stations, as will be explained presently.

A multiple electric conductor 20, leading from the radio receiver portion of the cabinet, is provided with a plug 21, and is adapted to be inserted into an electric outlet 21' in the usual manner, for supplying electric energy to the device. From the cabinet extends a multiple cable 22, shown in broken lines, and leads through an existing wall to one or more wall-mounted stationary remote controls 23, with which latter may be connected by means of a multiple plug 24 and multiple conduit 25, a portable remote control 26. In each of the remote controls 23 and 26 are provided plug-in holes 27 for accommodating a plug 28, which is connected by means of conduit 29 to a portable loud speaker 30.

Details of tuning mechanism

My system may be employed in connection with any conventional existing radio receiver, (having a tuning shaft and volume control), and is mechanically independent of the latter; it does not affect any of its functions for which the receiver is designed, including direct hand tuning operations. It may, therefore, be connected with almost any type of radio receiver, by simply mounting the latter above or below my mechanism, and by providing suitable rotation transmitting means for the respective operating shafts. The only electrical connection between the mechanism and a receiver with which it may be associated, is limited to the audio output circuit of the receiver, since that circuit is intended to be controlled by the mechanism.

The mechanism is operated both electrically and mechanically, and will be best understood by first consulting Figs. 6 and 7. In these figures the lower cabinet portion 11 contains a dielectric platform 31, upon which is mounted a reversible electric motor 32, for the operation of the movable parts of my device. Driven by worm 33 of the motor is a worm gear 34, mounted on shaft 35, to which shaft is keyed a pinion 36, in operative engagement with main gear 37.

Gear 37 is mounted upon an outer, hollow shaft 38, which is supported by, and insulated from another, interior hollow shaft 39. This shaft is again insulated from and supported by a solid interior shaft 40, mounted in insulated bearings. Secured to the outer end of solid shaft 40 is tuning knob 13', provided with an indicator or pointer 41, adapted to read upon dial 12', which latter is secured in fixed position at 42 to the front panel of the cabinet. At the other end of shaft 40 there is secured a disk 43, supporting a bracket 44. Pivotally mounted at 45 upon the bracket is a contact lever 46, provided with a contact end 47. This contact end is urged in radially outward direction by a spring 48 interposed between outer end 47' of lever 46 and a bracket extension 49.

At the interior face of disk 43 there is provided a friction facing 50, adapted to engage a similar friction facing 51, secured to shaft supporting bearing 52. Friction face 50 is normally urged into frictional engagement with friction face 51 by means of spring 53.

Secured at the front to inner hollow shaft 39 is a pulley or sheave 54, connected by means of chain, cord, belt, or other rotation transmitting means with a similar pulley or sheave 54' (Fig. 16), mounted on the tuning shaft of the radio receiver. Keyed also to hollow shaft 39 at its rear end is a disk 55 provided with a contact arm 56, the latter being adapted to cooperate with, and to contact, at certain moments, with spring biased arm 46 of disk 43. Also mounted on shaft 39 are a brake disk 57, designed to stop the rotation of shaft 39, and a motion transmitting disk 58. The latter is provided with a notch 59 for the reception of a motion transmitting lever 60, which is pivotally lodged at 61 and forms a part of an armature for relay 62. This relay is mounted upon exterior hollow shaft 38. Lever 60 is normally urged against the edge of disk 58 by a suitable spring, not shown.

Next to relay 62, and mounted also upon outer shaft 38, but insulated therefrom and from one another, are two contact rings 63 and 64, against which bear brushes 63' and 64'. Shaft 38 is lodged near disk 58 in a bearing 65, from which extends at its lower portion a crescent-shaped ridge or cam 66, which is adapted to lift lever 60 from contact with the edge of disk 58 when lever 60 is swung either to the right or to the left by the rotation of shaft 38. Section 9—9 of Fig. 6, illustrated in Fig. 9, clearly shows the arrangement of disk 58 with its notch 59, lever 60, bearing 65, and the crescent-shaped cam 66. The

position which lever 60 has to assume to be lifted away from the edge of disk 58 by cam 66 is indicated in broken lines at the left-hand portion of this figure.

Gear 37 is provided with three operating pins, two at the front, indicated, respectively, at 67 and 68, and a rear pin 69. Front pin 67 is intended to operate, by means of a fork lever 70, a dielectric toggle switch 71, having a conductive contact segment 71'. The latter is designed to alternately make or break contact with contact blades or brushes 72 and 73. (See Figs. 6, 7 and 16.) The other front pin 68 of gear 37 operates another switch 74, while rear pin 69 operates switch lever 75, more clearly illustrated in Figs. 13 and 16.

Fixedly secured to, but insulated from outer shaft 38 is a station tuning contact arm 76. This arm is electrically connected with contact ring 64, and is adapted to glide over a plurality of individual station contacts 77, which are adjustably mounted upon an insulated, stationary, arcuate support 78, located in rear of gear 37.

Lodged in suitable bearings, next to and below motor 32, there is a shaft 79, seen clearly in Figs. 6, 7 and 13. To this shaft is rigidly secured at its front end an operating lever 80, and at its rear end a locking detent 81. The latter is provided with a lower locking step 82, and an upper locking step 83, and an insulating member 84. The purpose of the detent and its construction will be presently evident. Detent 81 is further provided with a hump-like extension 85, against which bears a contact spring 86, which urges detent 81 in one direction, and against the movement of lever 80, when the latter is depressed by rear pin 69 of gear 37.

Lever 80 normally rests against the lower leg 87 of switch lever 75 (seen clearly in Fig. 13), which latter is pivoted at 88 in a suitable bracket. To this bracket is attached, and is insulated therefrom, a pair of contact springs 89, which are adapted to receive lower lever leg 87, when lever 80 is turned downwards by pin 69. This rear pin of gear 37 is intended to alternately operate levers 75 and 80. When lever 80 is depressed, the latter brings leg portion 87 of lever 75 in contact with springs 89, while at the same time, turning shaft 79, and thereby operating detent 81 against the tension of spring 86. When lever 75 is engaged by the pin, lever extension 87 leaves contact springs 89 and pushes upwards lever 80, thus assuring the repositioning of detent 81 to its normal station.

Referring now to the upper right-hand portion of Fig. 6, and to Figs. 10, 11, 12 and 14, as well as to the left-hand lower corner of Fig. 16, there will be seen a solenoid 90, with which cooperates an armature in the form of a lever arm 91, which latter is pivoted at 92 upon electroconductive stand 93, and which arm has a rearward extension 94, normally pulled downwards by means of a spring 95, so that arm 91 is normally pulled upwards (see Fig. 11).

Lever arm 91 is designed for a number of functions, and is suitably shaped in order to cooperate with different parts of my device. Thus the arm is provided with a side extension 96, adapted to be alternately engaged by the two steps 82 and 83 of detent 81. (See Figs. 10 and 11.) Near its free end, arm 91 is recessed at 97 for its cooperation with a spring-induced detent lever 98. The extreme end of the arm is intended to engage contact blades 99. Furthermore, the arm is adapted to cooperate with a rotatably mounted fibre, or otherwise dielectric disk 100, pivoted at 101 on an insulated standard 102. This fibre disk is provided with an upper side extension 103, by means of which the disk may be moved when engaged by the upwardly forced arm 91, and a lower side extension 104, serving as stop against the downward swing of disk 100, when the latter is released by arm 91. This happens, when rest 105 of pivoted detent lever 98 moves beneath extension 104, the moment detent lever 98 becomes released by recess 97 at the end of arm 91. Pivot 92 for arm 91 serves also as fulcrum for switch bar 106, adapted to engage spring contacts 107 and 108, when relay 90 becomes energized and attracts its armature, of which arm 91 and bar 106 form parts.

Rotatably supported in bracket 102, and insulated therefrom and from one another, are switch arms 109 and 110, which are adapted to be simultaneously operated with fibre disk 100. Switch arm 109 has a conductive inlay 111, which is insulated from arm 109; the latter is adapted to pass between three contact clips 112, 113, and 114 (see Fig. 10). Switch arm 110 is adapted to glide over two independent, insulated contacts 115 and 116, and is itself supported by and insulated from standard 102. From this standard there extends upwards a bracket 117, to which is attached one end of spring 118, the other end of the spring being connected to extension 119 of fibre disk 100. Spring 118 normally urges disk 100 in the direction of the arrow, and consequently against the top of arm 91.

Referring to Figs. 11 and 13, there will be observed (in Fig. 11), below about the middle of arm 91, head 120 of vertical slide pin 121, against which head bears the upper end of coil spring 122, whereas its lower end rests upon a washer 123, supported by lever 124. The latter is connected with, but is insulated from shaft 79. Washer 123 is slidably mounted upon pin 121, and when shaft 79 is operated by means of arm 80 (Fig. 13), lever 124 will elevate washer 123, thereby compressing spring 122 and forcing head 120 against arm 91, pushing it upwards.

Construction of volume control mechanism

Referring to the left-hand, lower portion of Fig. 6, and to Figs. 7 and 8, and to the broken-off portion of the cabinet, illustrated near the right-hand lower portion of Fig. 16, it will be seen that main gear 37 engages a spur gear 125, which is rotatably mounted upon a hollow shaft 126. To the hub of gear 125 is attached a bracket 127 (see Fig. 8), which rotates with the gear. Pivotally mounted upon bracket 127 is a lever 128, having a rearward extension 129 and a forward extension 130. A spring 131 normally urges lever 128 in the direction of the arrow, against the edge of disk 132, which latter is fixedly secured to the inner end of solid shaft 133. The latter is lodged within hollow shaft 126.

Disk 132 is designed to normally abut with gear 134, secured to the inner end of hollow shaft 126. This shaft is rotatably mounted in a sleeve 135, supported by standard 135'. At the front end of solid end 133 is secured knob 14' (see Figs. 1, 6 and 16), provided with a pointer 136. Knob 14' and shaft 133 are urged outwards by expansion spring 137, which bears against a suitable plate or washer 138, secured to panel 11. The action of spring 137 presses disk 132 against gear 134, which

latter serves for facilitating the pre-setting of the volume control of the receiver.

Extending from disk 132 is a stop 139, adapted to connect disk 132 with gear 134, and thereby solid shaft 133 with hollow shaft 126, by entering any one of the spaces between two adjacent teeth of the gear, at any desired setting of the disk in respect to the gear. Such setting is accomplished by pressing knob 14', and thereby shaft 133 and disk 132, against spring 137, until stop 139 clears the teeth of the gear. Now the disk is free to turn, and stop 139 may be adjusted to any desired position in respect to the gear, whereupon knob 14' is released, permitting spring 137 to force stop 139 into engagement with the teeth of gear 134.

Extending from the gear is a stop bracket 140, which latter, as well as adjustable stop 139, are intended to become engaged, from time to time, by rear extension 129 of lever 128 during the automatic setting of the volume control of the receiver, while the latter is being automatically tuned.

At the front end of hollow shaft 126 is secured a sheave or pulley 141, which moves together with gear 134, also mounted upon the shaft. Sheave 141 transmits its movement to a corresponding sheave 141', provided with the shaft of the volume control of the receiver.

Mounted at the rear of spur gear 125 will be observed a fixed cam 142, serving for the purpose of disengaging rear lever extension 129 from stop 139, when front lever extension 130 comes in contact with, and rides over the upper edge of cam 142.

From Fig. 6 it will be seen that hollow shaft 126 has an extension 143, between sheave 141 and washer 138. This extension is provided with a cutout 144, which accommodates a pin 145 extending from solid shaft 133. The position of the pin coincides with that of stop 139 of disk 132. Cutout 144 serves as limiting means for the movement of pin 145, and therefore limits the movement of solid shaft 133 in respect to hollow shaft 126 to an arc of about 180°.

Setting of volume control

When knob 14' is pressed against spring 138, shaft 133 moves inwards and releases disk 132 with its stop 139 from engagement with gear 134. In order to adjust the volume knob to the proper volume setting for a station to be tuned in, pressed-in knob 14' is now turned to the left, or in anti-clockwise direction, until extension 129 engages bracket 140 of the gear, and volume control of the receiver is set to zero. Then knob 14' is released and turned in clockwise direction until the desired volume is reached. Then knob 14' is again pressed inwards and turned in anti-clockwise direction until it encounters resistance, whereupon the knob is again released.

When the tuning mechanism is then operated, main gear 37 will first rotate in clockwise direction, whereby volume control gear 125 is caused to turn in anti-clockwise direction; thus the volume control is brought to a zero position. Upon further operation of the tuning device, gear 37 will be reversed in its rotation, moving anti-clockwise, and causing gear 125 to rotate in clockwise direction. During the anti-clockwise rotation of volume gear 125, rear extension 129 of pivoted lever 128 (which latter is suspended from bracket 127 moving in unison with gear 125), will engage bracket 140 of gear 134, whereby the latter, as well as hollow shaft 126 and pulley 141, will be simultaneously moved in anti-clockwise direction. Through this movement the volume control in the radio receiver will be turned down to zero. When the rotation of gear 125 is changed, rear extension 129 will engage stop member 139 and rotate gear 134 and pulley 141 in clockwise direction, until forward extension 130 of lever 128 will ride over the cam surface 142, whereby lever 128 is tilted so that its rear extension 129 will clear stop 139. At this moment the rotation of wheel 141 will stop, this being the proper volume setting for the station tuned in.

Time control

The tuning of my device may be automatically controlled by a time piece, such as indicated at 15. The mechanism of this control is shown in Figs. 14 and 15, and at the left upper corner of Fig. 16. In these figures is illustrated an arm 146, extending from time piece 15, and which is adapted to operate in the direction of arrow I when the clock mechanism releases it. Against arm 146 normally rests a lever 147, which is urged by a spring 148 to rotate in the direction indicated by arrow II. Lever 147 is pivotally mounted at 149 and is provided with a downward extension 150, which is adapted, when lever 147 is released, to descend upon knife blade 151, which latter is intended to engage contact springs 152. Knife blade 151 is pivotally mounted at 153 to an armature 154 in cooperation with solenoid 155. When this solenoid is energized, armature 154 is attracted, whereby knife blade 151 leaves contact springs 152.

Control of supply current to receiver

Referring again to Figs. 6, 7, and 16, there will be seen that from volume control gear 125 extends forwards a pin 156, which is adapted to engage insulated cam 157 when gear 125 rotates in anti-clockwise direction through its first movement. Cam 157 is part of a lever arrangement comprising a cam support 158, which is pivotally mounted on shaft 159, and upon which shaft is also mounted a switch blade 160, adapted to pass between spring contacts 161. The lever arrangement, comprising lever 158 and blade 160, forms a part of an armature 162 of solenoid 163.

Knife blade 160 is in permanent electric contact with an upright brush or contact spring 164, as clearly seen in Fig. 7. When pin 156 comes in contact with cam 157 of lever 158, blade 160 slips between contact blades 161, whereby the current for energizing the receiver is turned on. When solenoid 163 is energized, blade 160 is caused to leave contact blades 161, whereby the current supply to the receiver is cut off.

Motor switch relay

Referring to Figs. 2, 3, and 16, there is illustrated a solenoid 165, provided with an armature 166, which is pivoted at 167 in an upright 168. Associated and operative with armature 166 is a contact blade 169, adapted to engage contact springs 170 when the solenoid is energized. Also operatively secured to armature 166 is a detent lever 171, at the free end of which is detent 172, adapted to cooperate with a motor control switch 173. The latter consists of an insulated segment 174, provided with a notch or tooth 175, designed to be engaged by detent 172 when the motor of my device is to be energized. Insulating segment 174 carries metal contact plate 176, adapted to pass between two contact brushes 177. The metal plate of insulated segment 174, rotatably

mounted upon shaft 178, is electrically connected with the shaft, as are also all armatures of the clock and push-button relays, described later on. Shaft 178 is normally urged by a torsion spring 179, in the direction indicated by arrow III in Fig. 3. Detent 172, urged against the notch or tooth 175 in segment 174 by a spring 180, prevents spring 179 from turning shaft 178 when the detent engages the segment as seen in Fig. 3. In this position plate 176 of the segment makes contact with brushes 177, whereby the motor 32 of my device becomes energized.

When solenoid 165 attracts armature 166, detent lever 171 is elevated, whereby detent 172 releases segment 174, and spring 179 is now free to rotate shaft 178 in the direction of arrow III, until the movement is terminated by notch 181 of segment 174 coming to rest against a stop 182. At the same time, blade 169 is caused to engage contact springs 170, and closes, through lead 170', the electric circuit for energizing solenoid 155 of the clock controlled mechanism. The position of motor switch segment 174 when released by detent 172, is shown in Fig. 16, at which position the supply current to the motor is cut off.

Push button control construction

Referring now to Figs. 2, 3, 4, 5, and 16, and particularly to Figs. 2, 4, and 16, it will be seen that shaft 178 electrically connects all armatures of the entire push button control mechanisms, plate 176 of the motor switch (shown in Fig. 3), and is mechanically connected with, but insulated from the speaker switch shown in Fig. 5. A typical push button arrangement is illustrated in Fig. 4, showing a spring controlled push button 183, which may be any one of buttons 16 to 18, operating against a push plate 184, which is a part of a mounting 185, rotatably supported upon shaft 178. Fixedly secured to the shaft is a lever 186, which bears against push plate 184 and tends to swing mounting 185 in clockwise direction, due to the action of shaft spring 179. Mounting 185 constitutes the armature of an individual solenoid 187, and possesses a longer contact blade 188, adapted to engage spring contacts 189, and a shorter contact blade 190, the latter being constantly engaged by a contact spring 191, which latter is electrically connected with shaft 178, to assure positive electric connection between the latter and mounting 185. The position of the mounting illustrated in Fig. 4 shows that the mounting became actuated either by push button 183, or by energized solenoid 187; this position of the mounting corresponds to the position of the motor switch illustrated in Fig. 3. The mounting is held in this position by detent 172, then engaging insulated segment 174, since, as has been said before, shaft 178 connects all push button mountings, as well as the motor and loud speaker switches. When detent 172 releases segment 174, extensions 183, bearing against push plates 184 of mounting 185, will bring the latter into the position illustrated in Fig. 16.

Loud speaker control switch

The loud speaker of the receiver is controlled by a switch 192, shown in Fig. 5 in detail, and illustrated in Figs. 2 and 16. This switch consists of a dielectric disk 192', which is fastened to shaft 178, and possesses a metal contact surface 193, adapted to bridge contacts 194 and 195, after a station has been tuned in. The circuit closing position of switch 192 is illustrated in Fig. 16, while the open position of the switch is shown in Fig. 5. This open position of the switch is maintained during the automatic tuning operation and until a station is tuned in. Only then the switch is moved to its circuit closing position.

Brake mechanism

In order to stop excess rotation of the mechanism, due to the momentum of the parts driven by electric motor 32, there is provided a brake disk 57, already mentioned, against which operates a brake lever 196 (see middle portion of Fig. 16), designed to be operated by a relay 197, which latter becomes simultaneously energized with relay 62 mounted upon outer hollow shaft 38.

Automatic station tuning units

Referring to Figs 1, 4, and 16. The automatic tuning control mechanisms operated by push buttons, such as described in connection with Fig. 4, are all alike, and are designated in Fig. 16, corresponding to the numerals denoting the push buttons, as follows: The combined clock and push button controlled switch mechanism is numbered 16'. The next six units are numbered 17', 17'*a*, 17'*b*, 17'*c*, 17'*d*, and 17'*e*. The last control is designated as 18'. Each of these mechanisms may be operated either manually by push buttons or electrically by their individual solenoids. Thus, mechanism 16' may be operated by either button 16 or by the clock controlled solenoid 198. The latter may be also energized through the operation of either glide contact 199 of stationary remote control 23, or by glide contact 200 of portable remote control 26, closing circuit leads 199' and 200', respectively.

All units 17' to 17'*e*, inclusive, may be actuated by either their respective push buttons 17 or through stationary or portable remote control switches 23 and 26, by means of which latter their respective individual relays (such as typical relay 187 of Fig. 4, or clock relay 198) may be energized.

Connected with and controlled by the last automatic tuning mechanism 18' is a glide switch arrangement 201, having gliding contact arm 202, operated by knob 19 (Fig. 1), which arm is adapted to close any of the circuits controlled by a number of contacts, such as 203 (Fig. 16). The number of such contacts is optional. Switch 201, in conjunction with mechanism 18', is intended to provide means for facilitating automatic tuning of additional stations, beyond the number of stations controlled by the individual station tuning mechanisms 17' to 17'*e*.

Operation

My system of controls provides, as has been stated previously,

First, automatic push button controlled tuning for a limited number of stations;

Second, automatic time controlled tuning of one pre-selected station;

Third, automatic tuning of additional stations through tuning control 18' and multiple station switch 201;

Fourth, remote control tuning by fixed or stationary remote control 23;

Fifth, remote control tuning by portable remote control 26, and finally,

Sixth, automatic volume control for any station to be either manually or automatically tuned in by any of the five mentioned tuning provisions.

Clock-controlled tuning

The hereinafter described operations of my device may be considered typical for any mode of automatic tuning provided in my system, with but a few changes.

Assume that it is desired to tune in a certain station at a certain hour. Pointer 15' of the clock is set to the desired hour, at which arm 146 of time piece 15 releases lever 147. The latter will actuate switch blade 151 to engage contacts 152, and close the following circuit: From the step-down transformer ST, through heavy lead 204, to clock controlled solenoid 198 of tuning unit 16', from the solenoid through thin lead 205, to contacts 152, through switch blade 151, armature 154, and thin lead 206, back to the transformer. In this manner solenoid 198 becomes energized, and attracts the armature 207 of tuning mechanism 16'. The armature descends and engages contact 208. (See Figs. 1, 14, 15 and 16.) The movement of armature 207 causes common shaft 178 to turn against spring 179 (Fig. 2); shaft 178 is connected by lead 209 to the thin lead 206, issuing from the step-down transformer.

As armature 207 engages contact 208 and turns shaft 178, motor switch 173 is moved to bring contact segment 176 into engagement with contacts 177, in the manner illustrated in Fig. 3. Contacts 177 are connected by lead 210 to contact 197 of the device shown in Fig. 12. It is to be noted that during the rotation of shaft 178, caused by the action of armature 207, the loud speaker switch 192 is turned to its contact breaking position, shown in Fig. 5, thereby cutting out the loud speaker during the automatic tuning operation.

Lead 210 of contacts 177 and 197 branches off at 210' into the conductive base of toggle switch 71, and passes current through its shaft and contact face 71' to contact 72 and into conduit 211, which latter leads to switch arm 110, now resting on contact 115. (See Figs. 10, 12 and 16). From contact 115 leads a short branch to the lower end of conduit 212, which conduit connects toggle switch contact spring 73 with armature supporting post 93 of relay 90. Through this post current flows through armature arm 91 to lower detent rest 82 of detent 81, and from the detent through conduit 213 to motor rotation-changing switch lever 109. Through the body of lever 109 current continues to flow over switch contact 114, lead 114' to motor brush 214, through the motor armature to motor brush 214', through conduit 215 to switch contact 112, over insulated plate 111 of switch arm 109 to contact 113. From there the current flows over conduit 216, motor field 217, conduit branch 218 to thick-line lead 204, connected with transformer ST.

Thus the motor 32 is energized, and is caused to rotate in anti-clockwise direction, in consequence whereof gear wheel 37 will turn in clockwise direction. This gear movement causes pin 67 to engage fork 70 of toggle switch 71, which is thrown to a position whereby contact face 71' disengages contact 72 and engages contact 73. The rotation of gear 37, however, still continues in clockwise direction (since the flow of current through the operation of the toggle switch has not been changed, except that it flows now from contact 73 to armature support 93 through the entire length of conduit 212), until rear pin 69 of the gear engages lever 80 (see Fig. 13). The moment lever 80 is depressed by pin 69, it will turn shaft 79, and swing detent 81 backwards, thereby releasing arm 91 to move upwards, until stopped by the upper step 83 of the detent. At the same time, lever 124 (see Fig. 11) is caused to push head 120 against arm 91, which latter, being thus forcibly propelled in upward direction, moves fibre disk 100, by way of its upper extension 103 (see Fig. 10), against the tension of spring 118. This turning motion of disk 100 causes switch arms 109 and 110 to turn also, in which position they are temporarily held by lower disk extension 104, under which moves stop 105 of detent lever 93, which latter became released from recess 97 of arm 91, when the arm was forcibly propelled upwards.

While fibre disk 100, and switch arms 109 and 110 remain in their newly assumed, temporary position, certain changes in the circuit will take place.

Reversing of motor rotation

From transformer ST current is supplied through conduits 206 and 209, shaft 178, closed motor switch 173, its contact 177, through conduit 210 and through conduit 210' to the conductive post of toggle switch 71, and its plate 71', as before. From the plate the current is now directed through contact 73 and conduit 212 directly to armature support 93, from there through arm 91 to the upper step 83 of detent 81; through the latter and conduit 213 to the now switched-over arm 109.

As this switch arm changes its position, contact spring 112 connects directly with arm 109, while contact springs 113 and 114 engage insulated plate 111. Thus the current is caused to flow through arm 109 to spring 112, and from there through conduit 215 to motor brush 214', through the motor armature to brush 214, from there through conduit 114' to contact 114, over plate 111 to contact 113, from there over conduit 216 to field 217, and from there over branch 218 to thick-line conduit 204, leading to the transformer. The motor rotation is now reversed and causes gear 37 to travel in anti-clockwise direction.

It is to be noted that when pin 69 of gear 37 depressed lever 80, during the initial clockwise travel of the gear, the end of lever 80 forced switch blade 87 of lever 75 into engagement with contact springs 89 (see Figs. 13 and 16), and thereby established, through lead 219, contact between heavy transformer lead 204 and, through lead 219', the brush 63' of insulated brush ring 63, mounted upon shaft 38.

Attention is also called to switch lever 110, now resting against contact plate 116, which latter is connected through lead 220 to contact spring 103 and to relay 90 of arm 91.

When clock relay 198 of tuning unit 16' became first energized, armature 207 engaged contact 208, thereby charging, through lead 221 extending from contact 208, glide contact spring 222 in engagement with disk 43 of shaft 40, upon which disk is mounted contact lever 46. This lever corresponds in position to that of pointer 41 of tuning knob 13' (see Fig. 6), and must be preset to the station which is to be automatically tuned in by the time piece.

Contact arm 56 of disk 55, mounted on hollow shaft 39, is electrically connected through bearing post 223 to brush contact 64'. As now gear 37 of shaft 38 turns in anti-clockwise direction, inner hollow shaft 39 is also caused to turn, since rotation-transmitting armature lever 60 of relay 62 meantime engaged notch 59 of rota-

tion-transmitting disk 58, which latter is keyed to shaft 39, as is also disk 55, supporting contact arm 56.

The moment contact arm 56 engages contact lever 46 of disk 43 (which lever 46 is pre-set to the desired station by knob 13'), relay 62 on shaft 38 becomes energized, attracts its armature connected with rotation-transmitting lever 60, and swings the latter out of engagement with notch 59 of disk 58. Consequently the movement of shaft 39 stops, while gear 37 and shaft 38 continue to turn. The instantaneous stopping of shaft 39 is assured by the brake-action of armature 196 against brake disk 57, keyed to shaft 39, since relay 197 becomes simultaneously energized with relay 62.

It is obvious that during the aforedescribed movements, lever extension 87 of lever 75 (see Fig. 13) is kept in engagement with contact springs 89, whereby the circuit, controlled by brushes 63' and 64', for energizing relays 62 and 197, remains closed. When shaft 39 stops, its sheave 54, operatively connected with sheave 54' of the radio tuning shaft, also stops, thereby completing the automatic tuning-in of the desired station by means of time piece 15, in accordance with the pre-setting of knob 13'.

Automatic volume control setting

As now gear 37 continues in its anti-clockwise rotation, it will continue rotating volume controlling spur gear 125 in clockwise direction. Similarly to pre-setting tuning knob 13', the volume control knob 14' is pre-set to the desired volume. The knob pointer 136, corresponding in position to stop 139 of disk 132 (see Figs. 6 and 8) is adjusted to a desired volume. As gear 125 turns clockwise, rear extension 129 (of lever 128, suspended from bracket 127, which is secured to the hub of gear 125) will engage stop 139 and will turn hollow shaft 126, and with it sheave 141, connected with the volume control shaft of the receiver, until front lever extension 130 comes in contact with, and is lifted by cam 142. At that moment rear extension 129 disengages stop 139, causing the stopping of the movement of hollow shaft 126 and of the volume control shaft of the receiver, in accordance with the volume control pre-setting by knob 14'.

While gear 37 still travels in anti-clockwise direction, its rear pin 69 engages lever 75, thereby disconnecting lever extension 87 from contact blades 89, breaking the circuit to brushes 63', and 64'. During the reversed, anti-clockwise rotation of gear 37, its front pin 67 throws toggle switch 71 into the position shown in Fig. 16; this movement of switch 71 does not, however, alter the flow of current to motor brush 214'. As gear 37 nears the end of its anti-clockwise movement, its other front pin 68 will throw switch lever 224 of switch 74 (see Fig. 7) into engagement with spring contacts 225. The latter are connected by leads 209 and 206 to the step-down transformer, whereas switch lever 224 is connected through its support and lead 224' to lead 114' and motor brush 214. By this contact making action of switch 74, the flow of current to the motor brushes is changed, in that it now enters brush 214 instead of brush 214', which results in a momentary reversal of the motor and of the rotation of gear 37, to overcome, by what may be termed a "kick-back," the momentum of the moving parts.

Since switch lever 224 is usually held out of contact with contact springs 225 by means of spring 226, the moment gear 37 is momentarily reversed in its movement (by the reversal of the motor) and travels now for a short distance in clockwise direction, pin 68 will release lever 227 of pin contact arm 224, permitting spring 226 to pull switch lever 224 out of engagement with contact springs 225, thereby breaking the circuit leading to motor brush 21, in consequence whereof the motor and gear 37 will stop.

When, through the action of time piece 15 motor 32 is first energized and commences to rotate gear 37 in clockwise direction, gear 125 will move anti-clockwise and will cause, through its pin 156, the movement of lever 158 of radio switch R (connected with armature 162 of relay 163), in left hand direction, until switch blade 160 engages spring contacts 161 and closes the circuit energizing the receiver. This circuit may be easily traced in Fig. 16. Contacts 161 are connected by lead 228 to plug 229, from which latter leads conduit 230 to plug 231. From this plug another lead 232 returns and connects with the bracket supporting switch blade 160 through spring 164.

In order to turn off the supply current to the receiver, either hand switch 233 of the receiver, or switches 234 or 235 of the stationary or portable remote controls 23 and 26, respectively, must be operated. This operation of the remote control switches energizes relay 163, which then attracts its armature 162, causing contact blade 160 to slide out of engagement with contact springs 161. Heavy lead 236 connects relay 163 through heavy-line lead 204 to the step-down transformer, while lead 237 passes from the relay over switches 234 and 235 of the remote controls to light-line conduit 206 of the transformer. Both these switches are connected in parallel, whereby either one of them may be operated independently.

Energizing of audio circuit

As stated previously, the audio circuit, controlled by switch 192, became deenergized at the moment shaft 178 was turned by armature 207, of tuning unit 16', when relay 198 became energized by the time piece. This movement of switch 192 took place simultaneously with the action of motor switch 173 to close the motor circuit, i. e. prior to the automatic tuning and volume setting accomplished by the operation of the now energized motor.

Motor switch 173, held by detent 172, necessarily remains in this motor circuit closing position during the entire tuning operation, and holds switch 192 in open position. When the automatic tuning operation is completed, it becomes necessary to move audio circuit control switch 192 to its closing position. This is accomplished by the movement of toggle switch 71 to the position shown in Fig. 16, to which position the switch is brought during the anti-clockwise rotation of gear 37 and its pin 67.

Current is now directed from contact 72 of the switch through conduit 211 to switch lever 119, still in contact with plate 116, to both the relay 90 and contact spring 108, whereby relay 90 becomes energized and attracts arm 91. As the arm leaves upper detent rest 83 and skips over lower rest 82, it temporarily contacts with insulating member 84 and breaks the circuit flowing through detent 81, until arm 91 is

brought into engagement with lower rest 82 by the action of arm spring 95 (see Fig. 11).

At the time arm 91 moves downwards, switch levers 110 and 109 are brought to the position shown in Fig. 16 by the spring 118 of fibre disk 100, which is moved towards extension 117 (see Fig. 10). The switching over of lever 110 from contact 116 to contact 115 would deenergize relay 90, for which reason contact blade 106 of the relay armature, moving simultaneously with arm 91, is caused to engage contact springs 107 and 108. This establishes the following connection: from contact blade 72 over conduit 211 to lever 110, contact 115, lower end of conduits 212 to armature support 93, contact blade 106, spring contact 108 to the thin lead 220 of relay 90, whereby the latter is re-energized and pulls down arm 91.

At the time arm 91 descends, its extreme ends engages contact spring 99, connected through lead 238 to relay 165 of the motor switch. Since this relay is also connected by branch 239 to heavy conduit 204 of the transformer, it will become energized and will attract its armature 169 and lift detent 172 out of engagement with the tooth or notch provided in the dielectric segment 174 of motor switch 173. This movement releases shaft 178 to turn, due to the action of torsion spring 179 (see Fig. 2), with the result that all push button mechanisms are brought to a "cocked", ready-to-be-operated position, while audio or loud-speaker switch 192 is so turned that its contact plate 193 will connect contact prongs 194 and 195, thereby energizing the audio transformer circuit and the loud speaker leads, illustrated in Figs. 16 and 17.

Automatic tuning by push buttons

With the exception of push button 16, all other push buttons 17 and 18 may be employed for automatically tuning in stations, without the requirement of any manual pre-adjustment in the manner explained in connection with the clock controlled tuning operation.

By pushing in, for instance, the first button 17 (next to button 16), a conductive connection is established between current-supplied shaft 178, armature 240 of push button mechanism 17', contact blades 241, lead 242 and top contact 77', which latter is mounted upon dielectric support 78.

When armature 240 is turned, shaft 178 must follow and causes motor switch 173 to energize motor 32, while the loud speaker switch 192 is moved to a deenergizing position.

Now follow all the functions mentioned in connection with the automatic, time-controlled tuning, except that rotating relay 62 becomes now energized, when glide contact 76, mounted with glide ring 64 upon gear shaft 38, touches contact point 77', during the second or reversed movement of gear 37, thereby causing motion transmitting lever 60 to disengage motion transmitting disk 58. Thus while shaft 38 may still rotate, shaft 39 is stopped from further rotation. The position of shaft 39 at the moment of its stopping corresponds to the station setting controlled by push-button mechanism 17'.

The following will explain the operation of the circuits and mechanisms controlled by push-button 17.

As armature 240, actuated by push-button 17, engages contact 241 and turns shaft 178, motor switch 173 is moved to bring contact segment 176 into engagement with contacts 177. At the same time the rotation of the shaft 178 breaks the contacts of loud speaker switch 192 and cuts out current to the loud speaker. Contacts 177 are connected through leads 210 to contact 107 of Figure 12. A branch 210' of leads 210 connects with the base of toggle switch 71 and permits current to flow through its switch shaft and contact face 71' to contact 72 and into conductor 211, which latter terminates in switch arm 110, resting upon contact 115, as shown in Figure 16. A short connection leads from contact 115 to conductor 212 which is connected with contact spring 73 of switch 71, as well as with post 93 of relay 90. This post being conductive, passes current to armature arm 91 and from there to lower detent rest 82 of detent 81 and from the detent through conduits 213 to motor rotation changing switch lever 109.

Through the body of lever 109 current continues to flow over switch contact 114, lead 114' to motor brush 214, through the motor armature to motor brush 214', through conduit 215 to switch contact 112, over insulated plate 111 of switch arm 109 to contact 113. From there the current flows over conduit 216, motor field 217, conduit branch 218 to thick-line lead 204, connected with transformer ST.

Thus the motor 32 is energized, and is caused to rotate in anti-clockwise direction, in consequence whereof gear wheel 37 will turn in clockwise direction. This gear movement causes pin 67 to engage fork 70 of toggle switch 71, which is thrown to a position whereby contact face 71' disengages contact 72 and engages contact 73. The rotation of gear 37, however, still continues in clockwise direction (since the flow of current through the operation of the toggle switch has not been changed, except that it flows now from contact 73 to armature support 93 through the entire length of conduit 212), until rear pin 69 of the gear engages lever 80 (see Fig. 13). The moment lever 80 is depressed by pin 69, it will turn shaft 79, and swing detent 81 backwards, thereby releasing arm 91 to move upwards, until stopped by the upper step 83 of the detent. At the same time, lever 124 (see Fig. 11) is caused to push head 120 against arm 91, which latter, being thus forcibly propelled in upward direction, moves fibre disk 100, by way of its upper extension 103 (see Fig. 10), against the tension of spring 118. This turning motion of disk 100 causes switch arms 109 and 110 to turn also, in which position they are temporarily held by lower disk extension 104, under which moves stop 105 of detent lever 98, which latter became released from recess 97 of arm 91, when the arm was forcibly propelled upwards.

While fibre disk 100, and switch arms 109 and 110 remain in their newly assumed, temporary position, certain changes in the circuit will take place.

Reversing of motor rotation

From transformer ST current is supplied through conduits 206 and 209, shaft 178, closed motor switch 173, its contact 177, through conduit 210 and through conduit 210' to the conductive post of toggle switch 71, and its plate 71', as before. From the plate the current is now directed through contact 73 and conduit 212 directly to armature support 93, from there through arm 91 to the upper step 83 of detent 81; through the latter and conduit 213 to the now switched-over arm 109.

As this switch arm changes its position, con-

tact spring 112 connects directly with arm 109, while contact springs 113 and 114 engage insulated plate 111. Thus the current is caused to flow through arm 109 to spring 112, and from there through conduit 215 to motor brush 214', through the motor armature to brush 214, from there through conduit 114' to contact 114, over plate 111 to contact 113, from there over conduit 216 to field 217, and from there over branch 218 to thick-line conduit 204, leading to the transformer. The motor rotation is now reversed and causes gear 37 to travel in anti-clockwise direction.

It is to be noted that when pin 69 of gear 37 depressed lever 80, during the initial clockwise travel of the gear, the end of lever 80 forced switch blade 87 of lever 75 into engagement with contact springs 89 (see Figs. 13 and 16), and thereby established, through lead 219, contact between heavy transformer lead 204 and, through lead 219', the brush 63' of insulated brush ring 63, mounted upon shaft 38.

Attention is also called to switch lever 110, now resting against contact plate 116, which latter is connected through lead 220 to contact spring 108 and to relay 90 of arm 91.

When armature 240 engages contact spring 241, while push-button 17 was first depressed, electric connection was established through conductor 242, between contact spring 241 and stationary station contact 77' mounted in support 78.

In connection with the tuning operation controlled by the clock movement it was stated that contact arm 56 of disk 55 controls, together with contact lever 46 of disk 43, relay 62 which is mounted on shaft 38.

In push-button tuning, contact arm 76 takes the place of contact arm 56, while stationary contacts 77' of contact support 78 take the function of contact lever 46 of disk 43. Contact lever 76, controlling relay 62, will energize the latter the moment the arm touches tuning contact 77'. At that moment connection is established from thin lead 209 through shaft 178, armature 240 to spring contact 241, and from there through lead 242 to contact point 77', through contact arm 76 to relay 62, from the relay through brush contact 63' over leads 219', through switch blade 89 (see Figures 13 and 16), to lead 219 and back to heavy conductor 204. The moment relay 62 is energized, motion transmitting lever 60 is released from motion transmitting disk 58, and the further rotation of shaft 39 is terminated, while shaft 38 may still continue to rotate. Again the instantaneous stopping of shaft 39 is accomplished by the break action of armature 169 against break disk 57.

Automatic tuning by remote control

By moving pointers or glide contacts 199 or 200 of stationary and portable remote controls 23 and 26, respectively, into engagement with any one of the contact points indicated 242 and 243 in Figures 16 and 17, their respective relays, such as relay 244 in push button mechanism 17' in Fig. 16, becomes energized and attracts armature 240. Thereupon follow all operations and movements incidental to the actuation of button 17, described in connection with the automatic tuning by push buttons.

Automatic tuning of additional stations

Inasmuch as the tuning of stations by operating the limited number of buttons 17 is not adequate, my system is designed to add any number of stations for automatic tuning. For this purpose I have provided an auxiliary contact dial 201, having a glide contact 202 and a plurality of contact points 203, the number of which points is limited only by the size of the dial and by the capacity of dielectric contact support 78.

Slide contact 202 is electrically connected through conduit 245 to contact clip 246 of push button mechanism 18'. Contacts 203 are connected by conductors 247 to corresponding contacts 248, similar to contacts 77, mounted upon dielectric support 78.

Assume that glide contact 202 is placed upon the left end contact point 203 seen in Fig. 16. When now push button 18 is depressed, armature 249 is caused to engage contact springs 246, while shaft 178 is turned. Again motor switch 173 is thus moved into motor energizing position, whereupon gear 37 is set into motion and brings shaft 39 to a stop position, when glide contact 76 engages contact point 248, secured to contact point support 78.

Instead of actuating armature 249 by push button 18, the same results may be obtained by energizing relay 250 through remote controls 23 or 26, by placing slide contacts 199 and 200, respectively, upon the last right-hand contact points 251 and 252. The tuning operations are identical.

Recapitulation

From the foregoing detail description of the various devices employed in my system, as well as the indicated mode of operation by which the different types of automatic tuning are accomplished, clearly point to the essential fact that my invention broadly involves a novel method, whereby a considerably greater number of stations may be automatically tuned in, without the employment of complicated, expensive and cumbersome machinery, requiring endless attention and frequent repairs.

It is furthermore evident that my system provides for many different types of automatic tuning by the use of a single, compact, self-contained and simple mechanism, which is virtually independent from, but which may be adopted to any conventional type of existing receivers, without mechanical, electrical or other difficulties, and which mechanism effects an automatic setting of the volume control of the receiver, for an automatically tuned-in station, which volume setting takes place simultaneously with the automatic tuning. Under "volume adjustment" I include any one or more instrumentalities for regulating the strength, the tone quality, or otherwise modulating the audio output of a receiver, and I wish it to be known that the part of my mechanism shown to be connected with but the single volume control of the indicated receiver, is meant to be only symbolic of its purpose, and that any suitable number of similar devices may be included in my mechanism for operating any number of volume modulating devices with which a receiver may be provided.

Incidental to the automatic setting of the volume control, which takes place simultaneously with the automatic tuning-in of a station, it may be noted that it is not essential to pre-set the volume control for each individual station, since usually a what may be termed "universal presetting" for the majority of stations will suffice. This applies equally to those additional stations which are controlled by tuning unit 18'.

Attention is again called to the loud speaker or audio-output-circuit control switch 192 and its operation, whereby prior to and during the tuning and volume control setting to audio output circuit is deenergized, until these operations are fully completed, whereupon switch 192 is closed, while at the same time the motor control switch 173 is caused to open.

A notable feature of my mechanism is the arrangement and the cooperation of the different automatic station tuning units 16', 17' to 17'e, and 18', which may be actuated either manually by purely mechanical means, or electrically, when energized through the time piece or by way of the remote control devices previously mentioned. Particularly notable is the fact that the actuation of any one of the automatic tuning units, by any one of the three available methods, will move shaft 178, which mechanically connects the units, and thereby cause the operation of both the audio circuit control switch and of the motor switch.

It is also to be noted, that my entire mechanism, including the motorized portions, the automatic tuning units and the time control, constitutes, in principle, an entirely self-contained arrangement, which is fully independent of, and has nothing in common with a radio receiver, except that it is equiped with means whereby it may be mechanically and electrically connected with the usual controls of such receiver. The mechanical connection or connections between my mechanism and a receiver are of the simplest construction, consisting of elementary motion transmitting means, such as sheaves and belts, gears (not shown) or any other effective instrumentalities; the electric connections are similarly simple and involve no changes whatsoever in the original wiring of the receiver, since they concern merely the audio output circuit and nothing else. Due to the foregoing provisions, my mechanism may be most easily associated with any type of existing receivers.

Obviously, the specific structural details of the devices described in connection with my system are meant to be considered rather symbolic as to their intended functions, since it is quite evident that they may be constructed differently, or may be arranged in a different order, or may be considerably simplified and compacted, and yet be equally effective for their ultimate, intended purposes.

For the above reasons I reserve for myself the right to make changes and improvements as may become necessary or advisable, in adopting my system to economical and efficient production of my invention, without departing from the broad principle thereof, as defined in the annexed claims.

I claim:

1. In a device for facilitating the automatic and simultaneous setting, for any desired station, of the tuning and volume controls of an existing, normally manually operable radio receiver, a self-contained, motorized mechanism, independent from, but readily attachable to, or detachable from such receiver, and having means, corresponding to and operatively connectable with the tuning and volume controls of the receiver, said mechanism comprising a plurality of automatic station tuning units, operable both mechanically and electrically, manually actuated means for operating said units mechanically, time controlled means and remote controls for operating the units electrically, said units having means for mechanically connecting them, a motor control and an audio control switch operative with said connecting means, the latter means being adapted to be operated by the operation of any one of said units, to close the motor control switch and open the audio control switch, and means in said mechanism for keeping the latter switch open prior to and during the tuning and volume setting operation, and to close it, when that operation terminates, while at the same time opening said motor control switch.

2. In a system for automatically tuning and automatically modulating the volume of a radio receiver, having the usual tuning and volume regulating instrumentalities, a self-contained automatically operating, motorized mechanism, normally independent from such receiver, but having means corresponding to and operatively connectable with said instrumentalities of the receiver, said mechanism comprising a time-controlled automatic tuning unit, a plurality of manually and electrically operative automatic tuning units, one of the latter units controlling a device for selecting and automatically tuning of additional stations, said mechanism including a motor, a plurality of rotatable devices driven by the motor, means for stopping the rotation of some of the devices when a desired station is tuned in, while the other rotatable devices continue operating, means for mechanically and electrically connecting all of said units, a motor switch and an audio circuit control switch associated with said units-connecting means, but electrically insulated from the latter switch, and means actuated by said rotatable devices for changing the direction of their rotation during the tuning operation.

3. In a system for automatically tuning and automatically adjusting the volume of a radio receiver, provided with normally hand-operable tuning and volume regulating instrumentalities, a self-contained mechanism, normally independent from a receiver, but having means corresponding to, and capable of becoming operatively connected with such instrumentalities of a receiver, said mechanism comprising a motor driven device for automatically tuning-in desired stations and for automatically setting the volume control of the receiver, means for changing the rotation of said driven device, switch means controlling the supply of energy to the receiver operable by said driven device, a series of mechanically and electrically operable station selecting units, a shaft mechanically and electrically connecting said units, a motor switch and an audio circuit control switch connected and operating with said shaft, push buttons for manually operating said units, switch-controlled relays for operating them electrically, said units, when operated, causing the turning of said shaft, whereby said motor switch is brought to a circuit closing position for energizing the motor, while said audio control switch is simultaneously brought to its circuit opening position for deenergizing the audio circuit of the receiver, means for maintaining the motor switch closed and the audio control switch open during the tuning operation of the driven device, and means, controlled by the latter device, for opening said motor switch and for simultaneously closing said audio control switch upon completion of the tuning operation.

4. A system, as set forth in claim 3, and switch means, controlled by said driven device, for momentarily reversing the operation of the latter, at the end of its working cycle.

5. In an automatic tuning mechanism, adapted to be operatively associated with the tuning and volume controls and the audio circuit of an existing radio receiver, a driven station tuning and volume setting device, a motor for operating it, a series of individual, manually and electrically operable station selecting units, an auxiliary station selecting member for tuning-in additional stations, controlled by one of the units, a time control governing another of the units, a shaft operatively and electrically connecting all of the units, a motor circuit control switch electrically and mechanically associated with the shaft, an audio circuit control switch mechanically connected with, but electrically insulated from the shaft, means for normally urging the shaft to turn in one direction, each of the units adapted, when actuated, to turn the shaft in opposite direction, and thereby to close the motor switch and to open the audio switch, means for keeping the shaft in this oppositely turned position, and the switches in their respective closed and open positions, during the tuning and volume setting operations, induced by the said device, and means, controlled by said device, for releasing the shaft to revert to its normal position, when the tuning and volume setting and the operating cycle of the device is completed, thereby opening the motor switch and closing the audio switch.

6. In a system for automatically tuning and automatically controlling the volume of a radio receiver, an independent mechanism adapted to be removably associated therewith, said mechanism comprising a series of operation-inducing, station-selecting units, which are actuable either manually or electrically, and a motorized device, the latter having means corresponding to and operatively associated with the tuning and volume controls of such radio receiver, one of the units being electrically actuable by a time piece, an auxiliary multiple station tuning instrumentality electrically connected with and actuable by another of said units, stationary and portable remote controls electrically connected with and capable of actuating all of the units, except the one actuable by a time piece, a shaft connecting all of the units mechanically and electrically so that each individual unit may operate the shaft, means for urging the shaft to normally turn in one direction, said units being adapted, when actuated, to turn the shaft in opposite direction, a motor circuit controlling switch mechanically and electrically associated with the shaft and adapted to normally remain open when the shaft is in its normal position, an audio circuit controlling switch mechanically associated with, but electrically insulated from the shaft and adapted to normally remain closed when the shaft is in its normal position, means in cooperation with said motor switch for either engaging and holding the latter in closed motor energizing position, or for releasing it to assume its normal open position, said cooperating means being adapted to engage and hold the switch when the latter is moved by the turning of the shaft induced by the operation of one of the units, whereby the shaft is held in its oppositely turned position, and the audio switch in its open position; said motorized device comprising a rotatable instrumentality, reversible in its rotary movements, and provided with means for transmitting motion to the tuning and volume setting controls of a radio receiver, an instrumentality for reversing the rotation of the motor controlled by said device, and switch means, also controlled by the latter, for closing or opening the circuit for supplying electric energy to both the mechanism and the receiver.

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