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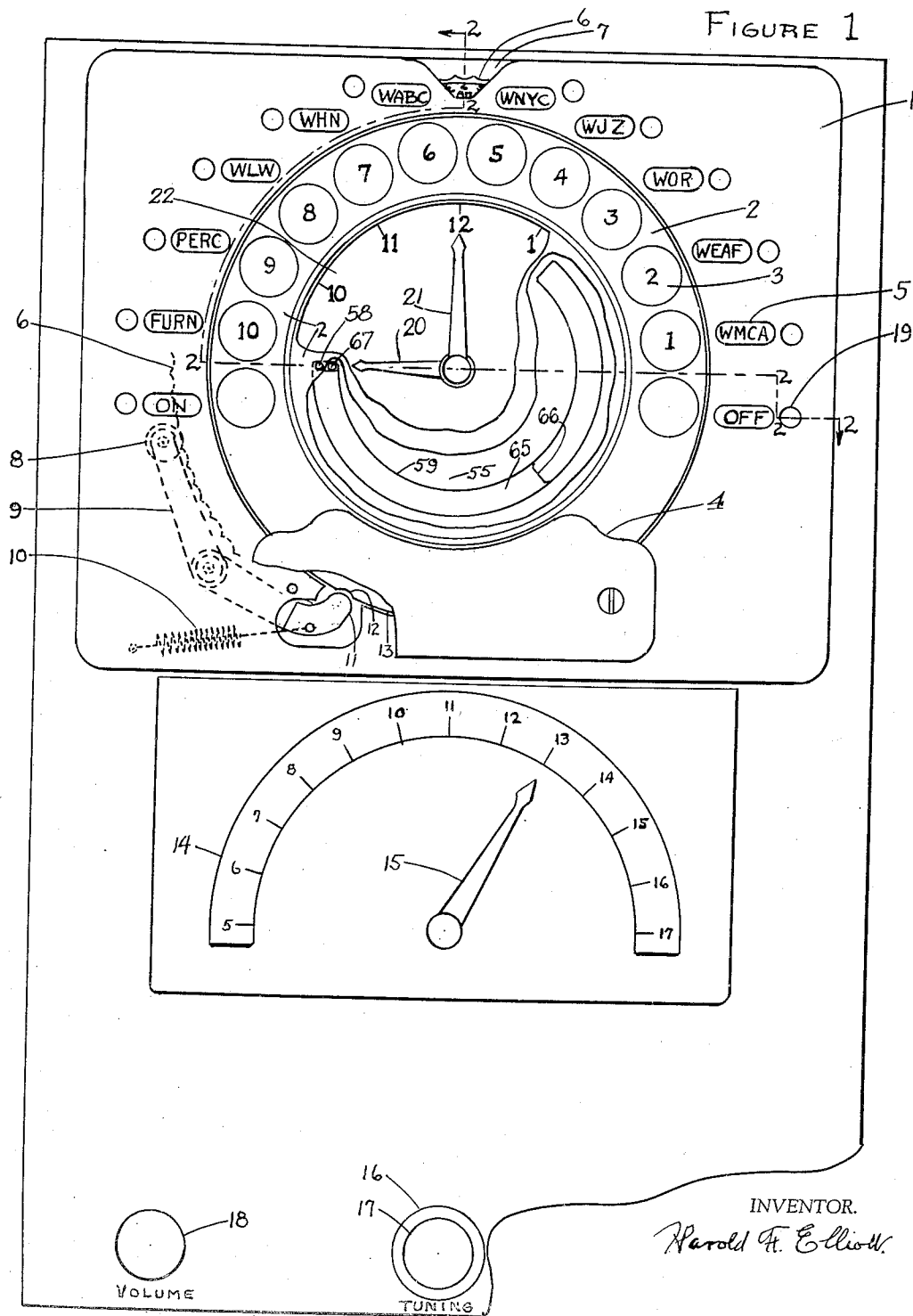
H. F. ELLIOTT

2,190,832

PRESELECTOR AND REMOTE CONTROL SYSTEM

Filed June 4, 1937

6 Sheets-Sheet 1



Feb. 20, 1940.

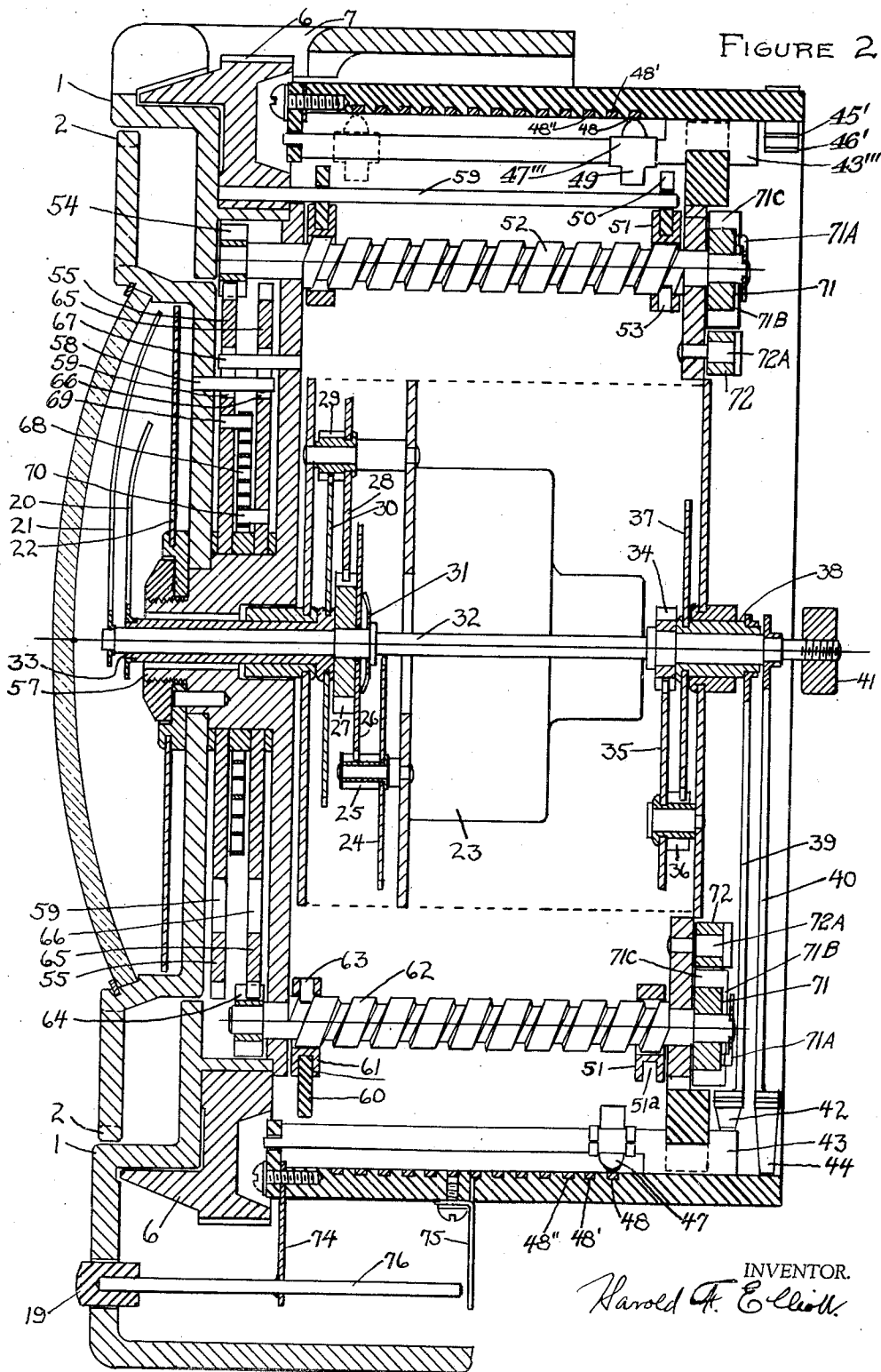
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PRESELECTOR AND REMOTE CONTROL SYSTEM

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6 Sheets-Sheet 2



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PRESELECTION AND REMOTE CONTROL SYSTEM

Filed June 4, 1937

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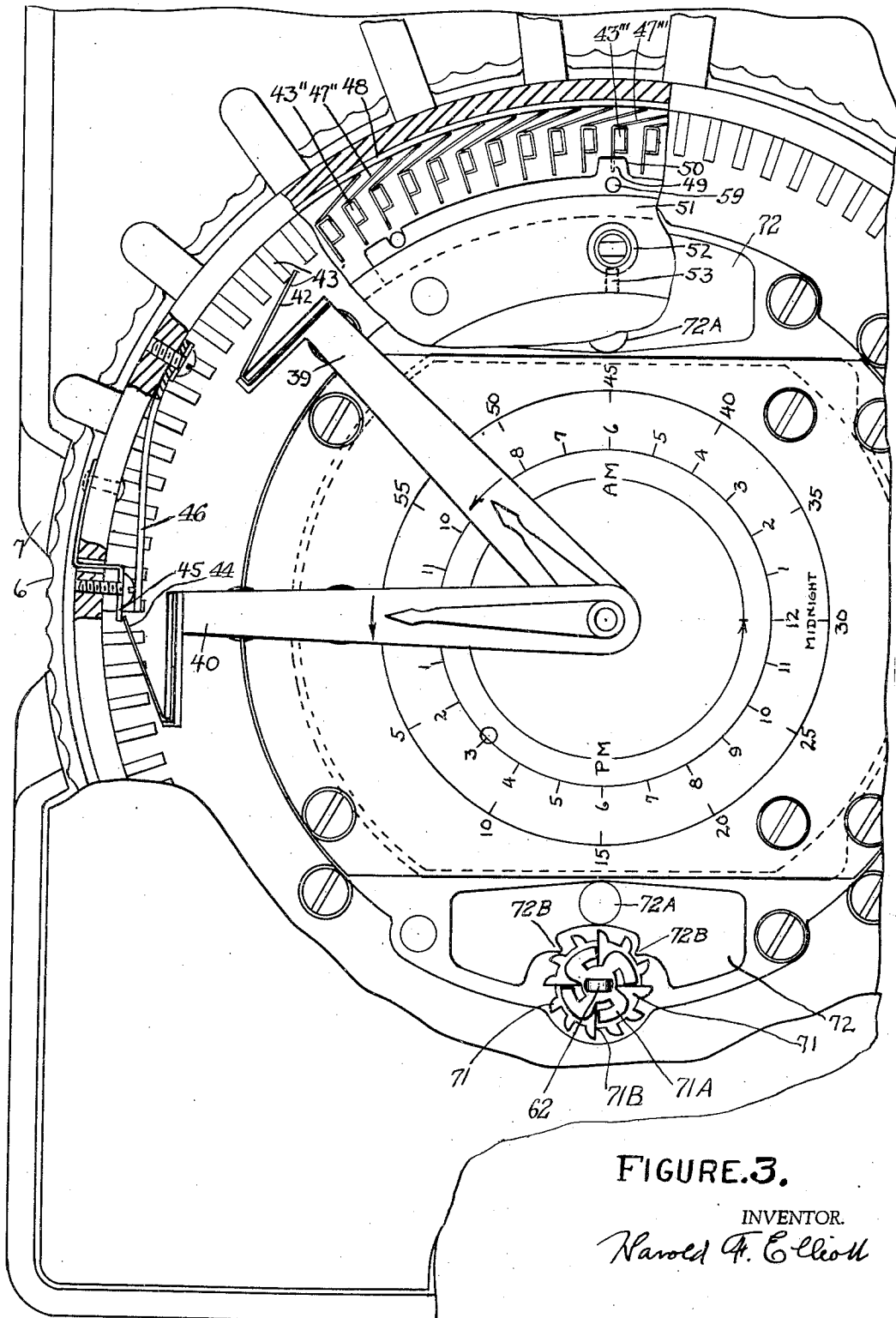


FIGURE.3.

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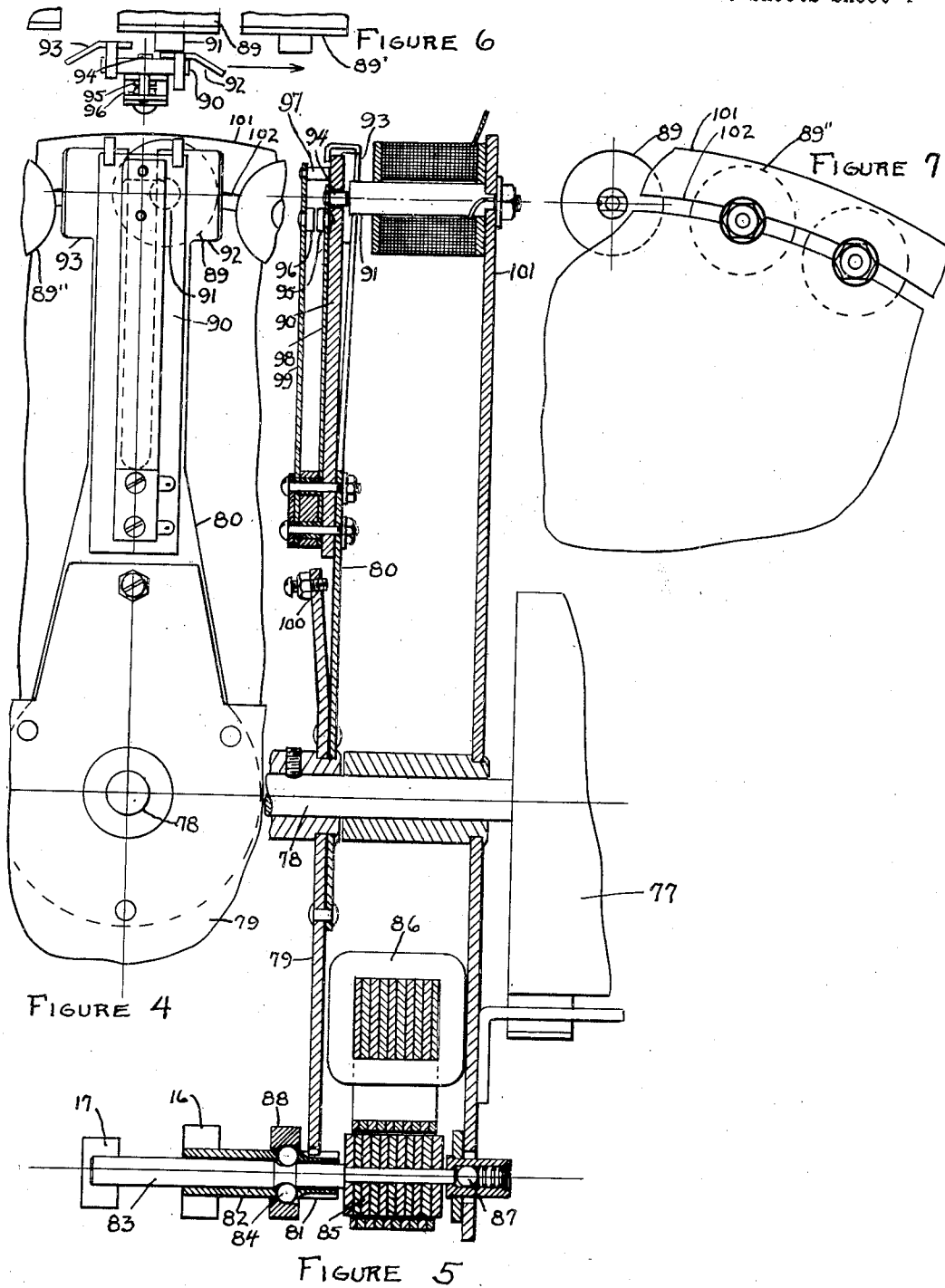
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PRESELECTOR AND REMOTE CONTROL SYSTEM

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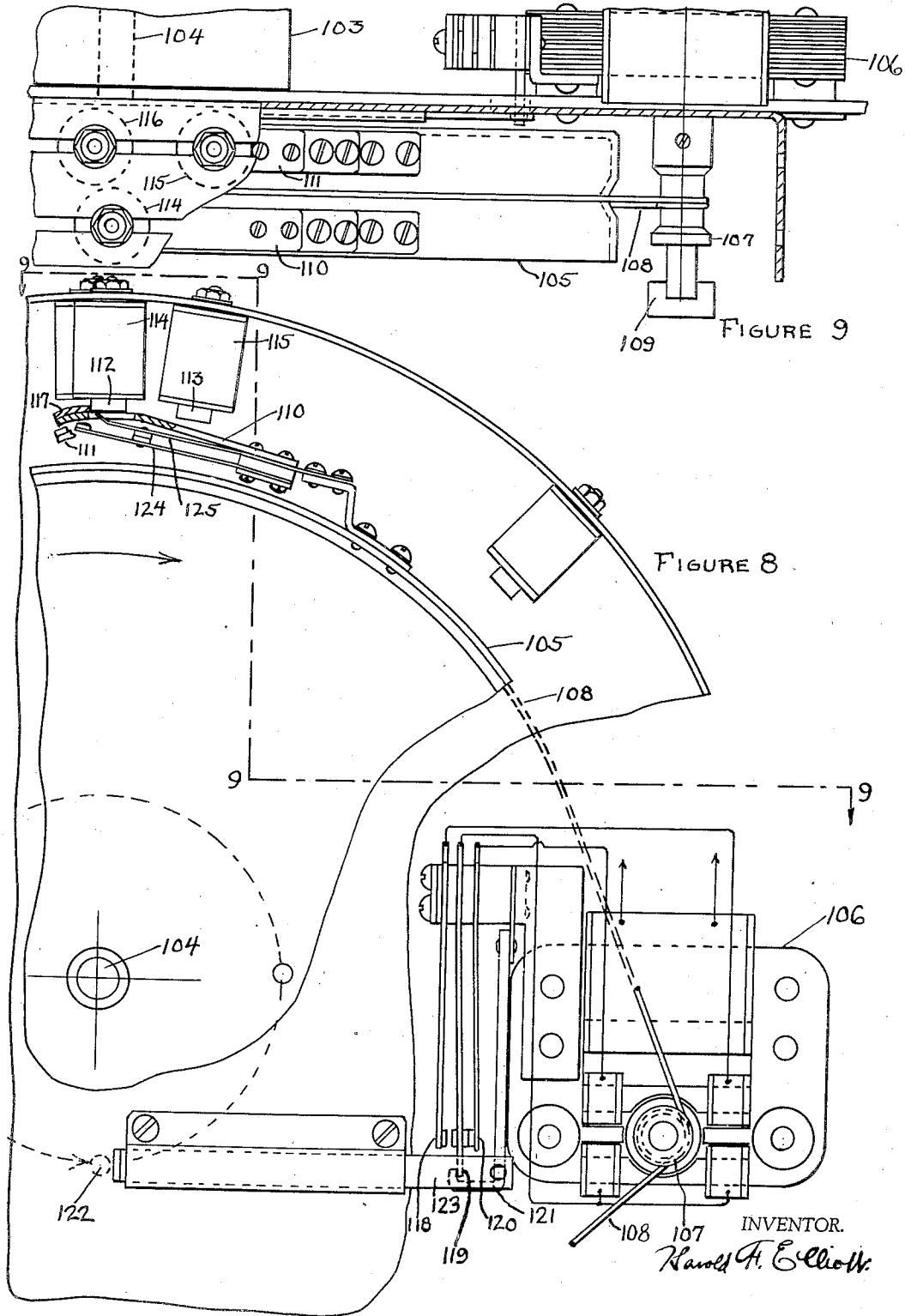
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PRESELECTOR AND REMOTE CONTROL SYSTEM

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PRESELECTOR AND REMOTE CONTROL SYSTEM

Filed June 4, 1937

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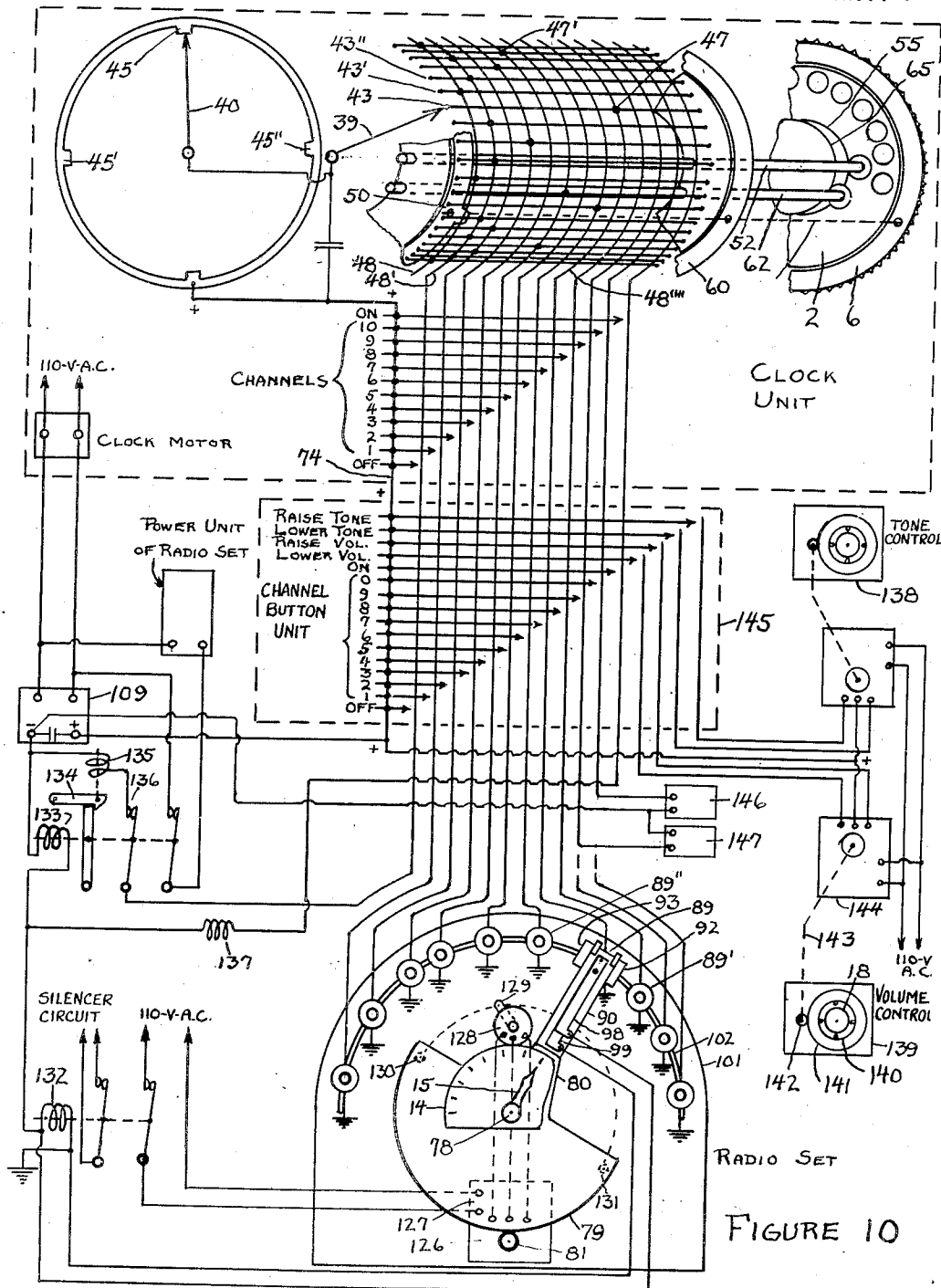


FIGURE 10

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UNITED STATES PATENT OFFICE

2,190,832

PRESELECTOR AND REMOTE CONTROL
SYSTEM

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Application June 4, 1937, Serial No. 146,359

14 Claims. (Cl. 250—40)

My invention relates to improvements in pre-selector and remote control systems. One important field of application of my invention is in the operation of radio receivers and other home appliances and I have chosen this to illustrate its construction and methods of operation but it will be evident that its field of utility is of much wider scope, having many industrial and other applications. I do not limit myself to the forms, methods and applications illustrated but claim as my invention the novel features and methods set forth in the appended claims.

One of the objects of my invention is to simplify and reduce the cost of remote control and preselector systems and so bring them into reach of radio set users generally. Another object is to increase the flexibility of and simplify the operation of such systems. Another object is to increase the precision of operation, and still another is to make it possible to apply preselection and remote control to standard types of radio receivers without requiring material alterations in their design. Another object is to make provision that various units entering into the system may readily be combined in various arrangements to meet varying needs.

My invention as described hereinafter is in part an extension of my inventions described and claimed in my copending applications Serial Nos. 82,494 and 82,495 filed May 29, 1936.

Referring to the accompanying drawings wherein I have chosen to illustrate several forms of construction and application of my invention;

Figure 1 shows a front elevation of the control panel of a broadcast radio receiver embodying my system;

Figure 2 shows a horizontal section taken along lines 2—2 of Figure 1 and shows details of construction of a preferred form of preselector for use with my system;

Figure 3 shows a rear view of this preselector;

Figures 4, 5, 6 and 7 show details of a preferred construction for applying my preselector and remote control system to the tuning system of a standard form of radio receiver;

Figure 8 is a broken away front view showing an alternative construction for applying my system to a standard type radio receiver;

Figure 9 is a sectional view on line 9—9 of Fig. 8; and

Figure 10 shows the wiring diagram of a radio receiver embodying my preselector and remote control system.

In the specific embodiment of the invention, and referring initially to Figure 1, numeral 1

represents the case enclosing the preselector unit, shown here in front elevation. This preselector unit comprises a rotatable station index dial 2, having finger holes as 3, and a stop 4, by which it may be rotated varying angular amounts, according to the hole chosen, similar to an automatic telephone dial. Tags, as 5, are provided for indicating the names of the stations from which the preselector and balance of the system are arranged to intercept and translate. A rotatable time index dial 6 concentric with and behind the index dial 2 is arranged so that it may be observed and operated through a suitable slot 7 in the top of the case 1. This time index dial, 6, is preferably notched and graduated in 96 quarter hour intervals, one for each 15 minutes of the 24 hours of a day, the notches being shown at the peripheral edge and the graduations on the front face next said edge. A roller 8 next the periphery of the index dial, mounted on a crank arm 9, is actuated by a spring 10 toward the periphery and will ride from notch to notch and seat in a notch when the dial comes to a standstill, thereby providing means for stopping the time index dial precisely at the quarter hour points. In order that the mechanism operated by these index dials, as described hereinafter may not be thrown into disorder by improper manipulation of the dials, a mechanical interlock, 11—12, is provided and arranged so that the time index dial 6 can be rotated only when the station index dial 2, is in neutral position. One exemplification of an interlock is shown in Figure 1, wherein index dial 2 is illustrated at neutral position and as providing a notch 12 juxtaposed to the end of a finger 11 on the aforementioned crank arm 9. As the roller 8 is on one end of said crank arm and finger 11 on the other end with the lever fulcrum between said ends, said finger must register with its notch 12 to permit any swinging of the lever. In this neutral position, finger 11 can enter notch 12 permitting roller 8 on the other end of crank arm 9 to be lifted and slide over the notches in time dial 6. If station dial 2 is in any other position, finger 11, hits the peripheral edge 13 of station dial 2, and the roller 8 cannot be lifted to permit rotation of time dial 6. The same action prevents station dial 2 from being rotated unless the time dial 6 is accurately positioned with roller 8 at the bottom of one of the 96 notches of the time dial.

On the front panel of case 1 and here illustrated as situated below the preselector unit, is a radio receiver arcuate dial 14 with which is associated a pointer 15 which can oscillate about the

center of the curvature of said arcuate dial. These comprise a part of the radio receiver to be controlled by the preselector. This receiver may have the customary tuning control 16, with vernier 17; also the usual volume control 18, tone control, (not shown) and other parts well known in radio receivers.

It is a feature of my invention that the preselector, and also remote control buttons, may be applied without disturbing the operation of the receiver in the customary manner, as will be set forth more fully hereinafter. Thus the preselector may be used to bring in specific stations at specific intervals, a remote control push button station may be used to tune in specific stations at any time, and these or other stations may be tuned in by conventional dial manipulation at any time. Push buttons, as 19, mounted on the preselector, and here shown as a series concentric with station and time dials 2 and 6, beyond the peripheries thereof, may also be used to tune in specific stations at any time. All these operations, together with remote control variation of volume and tone are provided and arranged so as to be mutually non-interfering, as set forth more fully in the detailed description of the preselecting and tuning mechanism hereinafter.

Turning now to Fig. 2, the preselector mechanism embodies a clock, preferably of the self starting synchronous electric type, having hour and minute hands 20 and 21, face or dial 22, motor 23, and suitable train of reduction gears, the last units of which are shown at 24 to 30 inclusive. The motor 23 drives gear 24, and pinion 25 attached to gear 24 drives a floating gear 26. This in turn drives a pinion 27 by friction between gear 26 and pinion 27, a spring 31 maintaining suitable pressure to assure such friction. Pinion 27 is attached to a shaft 32 which carries the minute hand 21. For convenience the axis of this shaft will be designated the main axis for the apparatus.

The hour hand 20, attached to hollow shaft 33, in turn rotatably carried on said shaft axially coincident therewith, is driven through a 12 to 1 reduction gear chain comprising a pinion 27, gear 28, pinion 29 and gear 30 likewise attached to shaft 33. The central shaft 32, is extended rearward through hollow shaft 38 and has attached to it pinion 34 which, with gear 35, pinion 36 and gear 37, make up a 24 to 1 reduction system. Gear 37 is attached to hollow shaft 38 and this in turn has attached to it a contact making hour hand 39. A contact making minute hand 40, is attached to central shaft 32 and a knob 41 on shaft 32 provides for setting the clock. The contact making hour hand 39 carries at its outer end a brush 42 which is arranged to contact successive time busses as 43, at quarter hour intervals. These busses 43 are in a cylindrical series concentric with the main axis of the station and time dials and at less radial distance from the axis than the concentric series of push buttons 19 above mentioned.

A rear elevation of the preselector is shown in Figure 3 where may be observed an elevation of the hour hand 39 the outer end of which is directed laterally in the direction of rotation so as to mount a flexible brush 42 thereon which slopes radially outward and rearwardly to successively contact the ends of time busses 43 (one at a time) as the hand rotates. The particular bus contacted in Fig. 3 is, for reference purposes identified by numeral 43'. The time busses are in an annular series, insulated and spaced

from each other, with the inner ends all substantially ending at the same radial distance from the center of rotation of the hands or main axis. There are preferably ninety six of the time busses, 43, evenly spaced in a complete circle, and, with the hand geared to make one revolution in twenty four hours, contact will thus be maintained by the brush with each bus for a period of fifteen minutes at which time the brush snaps from one bus to the next.

The minute hand 40 is similar to construction to the hour hand in that it also has a lateral end extending in the direction of rotation and has a flexible brush 44 thereon which slopes radially outward and rearwardly and arranged to make a contact of a few seconds duration every fifteen minutes with successive ones of four contact blocks, one of which is shown at 45. The brush 44, slides along a relatively fixed insulating strip 46 which slopes forwardly and inward, and then drops off the end of this strip on to a contact block 45, closing a circuit under the control of these contacts every fifteen minutes. After a few seconds, brush 44 drops off the end of contact block 45, breaking the circuit with a quick break action, minimizing sparking. During the interval of contact of the brush 44 with contact block 45, a connection is made from block 45, through brush 44 and minute hand 40 to hour hand 39 and thence through brush 42 to a time bus as 43'. The circuit thus formed may then be routed to select a station through the medium of an interconnection 47 slidable to selecting position along the contacted time bus 43, and cross connecting with a station bus. An elevation of this arrangement is shown at the upper left of Fig. 3 for one of the busses 43, particularly designated as 43'' and particular interconnector 47'', comprises a suitably formed metallic stamping arranged to slide longitudinally along the time bus 43'', and to make contact between this bus and any one of a plurality of preferably circular station busses, one of which is shown at 48 in Fig. 3. The station busses 48 comprise spaced circular metallic rings electrically separate and concentric with the main axis of the apparatus. The time busses 43 comprise electrically separate metallic bars on rods parallel with the said main axis and spaced around it in a circular series just inside the station busses as shown. The interconnectors, slide along the time busses and provide means for setting up any desired system of cross connections between time and station busses.

A sectional view of the time and station bus arrangement is shown in Fig. 2, wherein, at the bottom, one of the time busses 43 is shown overlying and in spaced relation from a plurality of station busses embedded in an insulative mounting therefor. On time bus 43 is shown the interconnector 47 which slides along said bus 43, cross connecting said busses 43 and 48. Now it will be evident that by providing a time bus 43', 43'', 43''' etc. with a sliding interconnector 47', 47'', 47''' etc., for each quarter hour of the 24 hour day, and by providing a station bus 48, 48', 48'' etc. for each station it is desired to receive, cross connections between selected time and station busses may be arranged to route a control circuit to select given stations at selected times. The arrangements for tuning the receiver to bring preselected stations at preselected intervals is described in detail hereinafter. Before proceeding with this feature,

however, a description will be given of the mechanism whereby the station dial 2 and time dial 6, pointed in connection with Figure 1, are utilized for setting the interconnectors to cross connect selected time and station busses.

Referring now to the upper center of Fig. 3 and upper right hand corner of Fig. 2, there is shown one of the time busses 43''' carrying sliding interconnector 47'''. The latter has a projecting lug 49 arranged to lie in the path of a selector finger 50. This finger is preferably of Bakelite or other insulation and is slidably mounted in the groove 51a of a ring 51. Ring 51 is in turn mounted upon three lead screws, one of which is shown at 52, the other two screws being positioned 120° either side of screw 52, parallel therewith, and at the same radial distance from the axis of shaft 32, thus carrying ring 51 with a three point support. Three pins 53, one for each lead screw, project radially of the ring and respective lead screws, into the respective thread-grooves thereof and thus provide for moving the ring longitudinally or in an axial direction when the lead screws are rotated. Pinions, as 54, connect the three lead screws 52 with a gear 55, so that the three lead screws rotate in unison. It will be evident that clockwise rotation of gear 55 will cause counterclockwise rotation of the three associated lead screws 52, and that this will cause longitudinal motion of ring 51, moving it to the left from the position shown in Fig. 2. (The directions of rotation are specified viewing the apparatus from what is here termed the front, which is at the left in Fig. 2.) Ring 51 carries with it selector finger 50, so if ring 51 is moved to the left, finger 50 will engage lug 49 and move interconnector 47''' to the left along the time bus 43''', to bring it successively in contact with station busses 48, 48', 48'', etc. Now the station index dial 2, Figs. 1 and 2, is arranged to rotate about the main axis upon hub 57, Fig. 2. A pin 58 attached to and projecting rearwardly from dial 2, extends through an arcuate slot 59 in gear 55 in such a manner that when dial 2 is rotated from neutral position in a clockwise manner (viewed from the front) it carries with it gear 55, rotating the latter clockwise. This rotates the lead screws 52, counterclockwise and moves ring 51 and selector finger 50 to the left. This in turn carries along to the left any interconnector as 47''' that lies in its path. Thus, if an operator inserts his finger in the hole marked 1 in Fig. 1, and rotates dial 2 clockwise until stop 4 is reached, an interconnector will be moved along a time bus until station bus 48'' is reached. In order to move a particular interconnector along a particular time bus, selector finger 50 (Fig. 2) may be placed opposite the desired interconnector by rotating time dial 6 which in turn rotates selector finger 50 through the medium of pin 59, fixed to said dial and projecting rearwardly therefrom parallel to the main axis and having sufficient length to pass over groove 51a of ring 51 in all positions of the ring. A given time bus may therefore be connected with a given station bus by two simple operations: (1) rotation of the time dial 6 to the desired quarter hour, and (2) rotation of the station dial 2 for the desired station. These operations: (1) place the selector finger 50 opposite a selected interconnector on its corresponding time bus and (2) advance the interconnector to a selected station bus. Then, when the clock reaches this particular quarter hour, a circuit will be made through hand 40 to hand 39, thence to

the time bus, as 43''' and thence through the interconnector as 47''' to the selected station bus. The manner in which this circuit may be made to tune a conventional radio receiver in accordance with my invention is set forth below in connection with Figures 4—5—6 and 7 and subsequent diagrams.

In order to place all interconnectors in a starting position preliminary to setting up a program of stations to be heard during a twenty four hour period, the unit is arranged so that all interconnectors may be moved to the right until the end bus 48, which is a neutral bus, is reached. Referring to the lower left portion of Figure 2, an insulating ring 60 is rotatably mounted in the peripheral groove 61a of a second transversely movable ring 61. This latter rides upon three lead screws, one of which is shown at 62, the remaining two being 120° either side thereof parallel thereto and equally spaced from the main axis or shaft 32. Three pins 63, one for each lead screw, project radially of the grooved ring 61 and respective lead screws 62 into the respective thread grooves of the screws, obtaining operative driving connection from the screws to the said ring, so that clockwise rotation of the screws moves rings 61 and 60 to the right. At their ends next the operating dials, the three lead screws having secured thereon each a pinion 64 which each engage a gear 65 rotatably mounted on hub 57. Rotation of gear 65 counterclockwise, (for clockwise rotation of the screws) is brought about by counterclockwise rotation of station dial 2, Figs. 1 and 2, through the medium of heretofore described pin 58, which engages gear 65 at one end of slot 66 in said gear. The construction thus described thus provides for a neutral, normal or rest position for dial 2 and a rearwardly extending pin 58 carried thereby which is always in arcuate slots 59 and 66 of the parallel pair of gears 55 and 65 respectively. At this rest position of dial 2, pin 58 is engaged at opposite sides by end walls of the two said arcuate slots 59 and 66, one slot extending away from the pin in one direction and the other slot extending away from the pin in exactly opposite direction. When the dial rotates in one direction pin 58 rides in one slot but engaging the end of the other cause that gear to rotate, and conversely, when the dial is rotated in the opposite direction the gear just mentioned remains stationary and the other one is rotated. In the specific disclosure, the arrangement is such that clockwise rotation of dial 2, causes clockwise rotation of gear 55 while gear 65 remains stationary against stationary pin 67; while counterclockwise rotation of dial 2 causes counterclockwise rotation of gear 65 while gear 55 remains stationary against pin 67. The slots 59 and 66 in gears 55 and 65 respectively permit these relative motions and engagements of the pins with the slot ends. In Fig. 1, portions of clock face 22, and dial 2 are broken away to show gear 55, slot 59 and pins 58 and 67. Gear 65 back of gear 55 may be seen through slot 59 as may also slot 66 in gear 65. Returning to Fig. 2, a spiral spring 68 situated between the two parallel gears 55 and 65 has one end secured by a pin 69 to forward gear 55 and to its other end secured by pin 70 to rearward gear 70. This spring 68 is arranged so that in neutral position of dial and gears, the dial, gears, lead screws, rings, etc. are held in the positions shown in Fig. 2, and are moved therefrom by rotation of dial 2 as already described. The spring returns all gears, lead

screws and rings to the neutral positions, as shown, when dial 2 is released after rotation. In order to retard this return motion under spring tension, a retarding mechanism such as a governor or escapement may be mounted upon one lead screw of each set of screws, as shown in Figures 2 and 3. The particular escapement mechanism chosen for this disclosure may conveniently comprise an escapement wheel 71, with suitable peripheral teeth 71C. The said wheel is mounted rotatably upon the part to be retarded, in one instance on a cylindrical end portion of screw 52 and in the other instance on a similar cylindrical end portion of screw 62 at the rear of the apparatus. A ratchet 71A is fast upon the end of each such cylindrical portion, with the spring pawls of the said ratchet pressing against the end face juxtaposed thereto of the escapement wheel. Said end face provides radial shoulders or notches 71B which the pawls will ride over when rotating in one direction but which will be engaged by the pawls when rotation is in the other direction. As shown, the screw 62 will therefore be relatively free to rotate in a counterclockwise direction (as viewed in Fig. 3) but when rotating clockwise, said screw actuates the escapement wheel by virtue of engagement of the pawls against the notches of said wheel. An escapement rocker 72 overlies escapement wheel 71, being pivoted at 72A and having escapement teeth 72B to cause the rocker to teeter back and forth as escapement wheel 71 rotates. The rocker has adequate mass to obtain the desired amount of retarding effect upon the screw and connected parts. The escapement shown permits free forward motion, but retards the return motion, thereby minimizing rebound.

In order to provide for push button operation from the preselector unit, a series of push buttons, as 19, Figs. 1 and 2, may be arranged for making connections between a common bus, as 74 and the individual station busses. This may conveniently be carried out through the medium of a contact member 75 and a rod 76, shown at the bottom of Fig. 2. Said rod 76 may be arranged to pass through the common bus 74, which at that part is a radially extending resilient ear. By having the rod 76 fixed with respect to said ear, as by soldering, depression of the button 19 moves the rod inward by virtue of flexing of the ear, permitting the end of the rod to then engage contact member 75. When pressure on the button is released, ear 74 flexes back to place and returns the rod and button to initial position.

Reference will now be had to Figures 4, 5, 6 and 7, which show a preferred form of mechanism for automatically tuning a conventional radio set either by remote control push buttons or by the circuits established through the preselector described above. The receiver tuning mechanism, such as the usual variable capacitor unit, is shown in outline at 77, with the tuning shaft indicated at 78. Upon shaft 78, are mounted a gear or gear segment 79 and an arm 80. A pinion 81 meshes with gear 79. Pinion shaft 82 connects to tuning knob 18, providing for conventional manual tuning. Vernier tuning is provided by knob 17 mounted on shaft 83 which rotates shaft 82 by the planetary action of balls 84. An extension of vernier shaft 83 carries the armature 85 of a small reversible shaded pole motor, whose field coil is shown at 86. A thrust bearing for the vernier shaft is shown at 87 and the outer ball race at 88.

When a circuit is closed through the pre-

selector or by pushing a button, one of a plurality of small magnets, such as 89, Figs. 4, 5, 6 and 7 is energized. Also a pair of small contactors, more fully described later, are energized, one for turning on the power unit of the radio circuits, the other for energizing the field coil 86 of the shaded pole motor. This latter causes armature 85 and vernier shaft 83 to rotate, the direction being immaterial and being reversed at the end of each 180° sweep by a reversing switch described in connection with the circuits hereinafter. Assuming that the direction of rotation for the moment is such that arm 80 rotates clockwise, Fig. 4, said arm sweeps over the heads of magnets as 89, 89' and 89'' until it comes to one that is energized, assumed to be 89. Arm 80 carries an iron armature 90 which is attracted by the pole 91 of the magnet 89. Provision is made for causing the energized magnet to stop and hold the said arm 80 at a very precise position and to cut off the current to the pole motor. Construction of one form of this stopping and current cut-off means will now be given. Said arm 80 is preferably resilient and has an iron armature 90 extending lengthwise thereof above the gear segment substantially as far as the end of said arm with the armature and arm being held together at the inner end of said armature, thereby permitting the outer end portion of the arm to flex toward and from the armature. The said arm is bifurcated next the armature, thereby providing resilient latch portions 92, 93 with lateral ramps for enabling the latch portion approaching a magnet, as 89, to ride onto the end of the projecting core 91 thereof. Each latch portion normally tends to flex away from the armature and has its outer end hooked over the outer end of the armature with limited play. Said latch portions 92, 93 are on the side of the armature toward the magnets and, unless a magnet is energized, will pass the end of the pole piece or core 91 substantially clear thereof. But when the arm approaches an energized magnet the armature is drawn toward the magnet and flexes the whole arm toward the magnet. Then it is that the approaching lateral ramp, as that of portion 92 in Fig. 6, rides onto the core, the said portion flexing toward the armature. The other or following latch portion 93 is not flexed, however, and so is left in position to catch upon the side of pole 91 as arm 80 rotates clockwise as shown by the arrow, Fig. 6. When latch 93 hits pole 91, the motion of the arm is arrested, coming to a definite and positive position of rest, thus affording precise tuning of tuner 77. Motor armature 85 continues rotation, with the ball planetary mechanism 84 serving as a slip clutch. As soon as latch 93 hits pole 91, the near edge of latch portion 92 passes off the pole and permits armature 90 to move forward all the way against pole 91. Passing through the armature in the area between the catch portions of the arms and in a position to be positioned opposite the magnet pole when the arm and armature are stopped as above described, is a pin 94 which normally projects through the side of the armature toward the magnets no more than and preferably slightly less than the thickness of the catch portion adjacent thereto. Thus, the pin does not disturb the placement of the arm and function of the catch as a precision stop for the arm, but when the first approaching catch member slips off the end of the pole and the armature closes up the gap between it and the pole by swinging toward the pole, said pin 94

is pushed a distance equal to its original distance of projection toward the pole. As pin 94 is fast upon a leaf spring 98 carrying a contact 95 thereby movable toward a fixed contact 96 on a fixed support 99, those contacts thereupon engage. This shorts the coil of the contactor which operates the motor, opening the contactor and stopping the motor. Insulating pin 97 spaces the contact arms 98 and 99 and contacts 95 and 96 when in open position. A stop 100 positions arm 80 with reference to the poles faces, being arranged so that the latch members 92 and 93 clear the poles until an energized magnet is reached and armature 90 is attracted thereto. A panel 101 with a slot 102 supports the magnets 89, 89' etc. and permits them to be shifted to various positions for tuning the receiver for selected stations.

Figures 8 and 9 show an alternative arrangement for the magnets and latches having features and advantages which adapt it to certain installations. A tuning unit 103, having shaft 104 is fitted with a pulley or drum 105 mounted on said shaft 104. The drum 105 and tuning unit shaft 104 are rotated by a reversible shaded pole induction motor 106, through pulley 107 and belt 108. A knob 109 on the motor shaft provides for manual tuning. The drum 105 carries a pair of latches 110 and 111, which are arranged so that they normally clear the pole tips 112 and 113 of magnets, 114, 115 and 116 when the drum is rotated for tuning. For automatic tuning from push buttons or by the preselector mechanism, one of the magnets as 114, corresponding to a desired station is energized. This attracts the armature of a latch as 110 and the latter catches upon the side of a pole tip as 112. The arrangement shown in Figs. 8 and 9 is such that latching occurs only when drum 105 is rotating clockwise. The outer tip, 117 of latch 110 is arranged so that no latching occurs for counterclockwise motion of drum 105. Since latching always occurs only for clockwise motion, all slack in the mechanism is always taken up in the same direction and very precise tuning is possible.

The motor 106 is provided with a set of reversing contacts 118, 119 and 120 and a contact holding armature 121. Matters are arranged so that the closing of a push button or preselector circuit energizes a corresponding magnet, as 114, and also closes a pair of contactors, one of which energizes the power circuits of the receiver and the other of which energizes the field winding of motor 106. Motor 106 always starts in a counterclockwise direction (contacts 118 and 119 always being initially closed) rotating drum 105 counterclockwise to its limit in this direction. As drum 105 reaches the end of its counterclockwise stroke, a pin 122 in the drum strikes interlock rod 123, moving it to the right. This moves armature 121 to the right bringing it up against motor 106 as shown in Fig. 8. The stray field of the motor holds it in this position but it is not sufficient to bring it over until it is pushed over by 123. Contacts 119 and 120 are then closed, which reverses the motor and drum 105, to clockwise rotation. Latch 110, then catches any pole tip that is energized, as 112. A pair of contacts 124 and 125, on latch 110 are then closed, shorting the operating coil of the motor contactor and stopping the motor, the belt drive acting as a slip mechanism meantime.

The drum 105 may carry two sets of latches 110 and 111, and a double row of magnets 114,

115 and 116 may be provided, thereby permitting settings for tuning in stations on closely adjoining channels.

Figure 10 shows a preferred circuit arrangement for operating a radio receiver equipped as shown in Figs. 4, 5, 6 and 7 from a preselector as shown in Figs. 1, 2 and 3, with provisions also for remote control from one or more push button stations. The magnets, as 89, 89' and 89'' are mounted upon a panel 101 and may be slid along slot 102 to positions corresponding to selected radio stations as previously described for Figures 4, 5, 6 and 7. The reversible shaded pole motor is outlined at 126 with its main-field coil terminals at 127. A reversing switch 128 is connected to the shaded pole windings and an arm 129 on this switch cooperates with pins 130 and 131 on gear 79 to cause the motor to drive gear 79, tuning shaft 78 and the associated tuning mechanism back and forth through its operating range, sweeping 180° in one direction, then reversing and sweeping 180° in the opposite direction. When an energized magnet, as 89, is encountered, armature 90 is attracted and one or the other of latches 92 or 93 hits the pole tip and brings the tuning mechanism to rest, as already described for Figures 4, 5, 6 and 7.

At the top of Figure 10, the time busses, as 43, 43', 43'' are indicated by horizontal lines representing busses or rods, while the station busses are shown as sections of circles, representing rings, as described in connection with Figures 2 and 3. Interconnectors as 47, 47' etc. are represented by black dots, indicating crossconnections between selected busses. The time dial is shown diagrammatically at 6 and the station dial at 2. Gears 55 and 65 and lead screws 52 and 62 represent diagrammatically the corresponding members previously described in connection with Figure 2, as do also selector finger 50, resetting ring 60, rod 59, hour hand 39, minute hand 40 and contact blocks 45, 45', 45'' etc.

For energizing the control circuits, a step down transformer, with preferably also a rectifier and capacity filter, are indicated at 109. For convenience in tracing the circuits, the main bus of these circuits is indicated with small + marks. A typical operating circuit for tuning in a radio station via the preselector may be traced as follows: from the + terminal of supply unit 109, via bus marked 74 to the ring in the upper left to contact block 45, thence through minute hand 40 to hour hand 39 to time bus 43, thence through interconnector 47 to station bus 43'', thence to magnet 89 and through this to ground. (The inner terminal of each magnet winding is preferably grounded so only one flexible connection is required to each movable magnet.) From ground the circuit returns to the negative terminal of unit 109 through the operating coils of contactors 132 and 133. It will be evident, that when an operating circuit is closed either through the preselector, as described above, or through a push button, two things happen: (1) a magnet, as 89, corresponding to the desired station is energized; (2) the pair of contactors 132 and 133 are energized. Contactor 132 connects the main winding of motor 126 to the 110 v. A. C. supply. It also closes (or opens) a circuit silencing the output of the receiver during the tuning operation. Contactor 133 closes a circuit energizing the power unit of the radio set. This contactor is preferably provided with a mechanical latch 134 which holds it shut once it has been closed until release coil 135 is energized. The circuit

to coil 135 is preferably routed through one of a pair of contacts 136 closed by this contactor, preventing operation of the release coil when the contactor is already open. The sequence of operations in tuning the receiver by the preselector, or by a push button, is as follows: a circuit including one of the magnets, as 89, and the coils of the two contactors 132 and 133, is energized, the power unit of the radio set is energized and motor 126 is energized; arm 88 sweeps back and forth across the heads of the magnets until the energized magnet is reached attracting armature 90 and stopping the arm by the action of one or the other of the double acting latch members 92 or 93; the contacts on contact arms 98 and 99 are then closed shorting contactor coil 132 and opening this contactor, thereby stopping the motor and turning on the speaker. The receiver then continues to operate until another button is pushed for tuning another station in like manner, or until a circuit through the preselector does the same thing. Pushing an "off" button, or a circuit through the "off" bus of the preselector energizes trip coil 135, and lifts latch 134, opening the power supply contactor and shutting off the receiver. Pushing an "on" button, or closing an "on" circuit through the preselector, energizes coil 133 through impedance 137 and closes the power supply contactor directly, the tuning magnets and motor contactor being inactive.

Tone and volume controls are shown at 138 and 139 in Fig. 10. These may be arranged for local control by means of the usual knob on the front of the control panel as shown at 18 for volume control 139. For remote control via push buttons, a slip clutch 140, gear 141, pinion 142 and shaft 143 may connect the volume control with a reversible shaded pole induction motor 144. The latter is preferably wound for continuous application of current to its field winding and the latter may be connected to the 110 v. A. C. supply at the power unit of the radio set, thus being energized whenever the set is operating. The shaded pole windings may then be connected to push buttons for raising or lowering volume by driving the motor in one direction or the other.

The circuit arrangements of Fig. 10 permits any number of push button remote control units, as 145, to be used, the operating circuits simply being connected in parallel. The system thus provided affords the greatest possible flexibility and simplicity of operation. The radio set may be tuned by the usual knobs in the usual manner. The preselector clock may be set to bring in selected stations at selected fifteen minute intervals for a full 24 hour period. Selected stations may be tuned in at any time by pushing buttons either on the preselector unit or at remote control push button stations, which may be as numerous as desired. Tone and volume may be regulated by the usual knobs at the set, or by buttons at the remote control stations. All these operations are mutually non-interfering and may be carried out in any manner at any time without disarranging the preselector operation.

The preselector may, if desired, be connected through suitable relays to operate the household furnace, percolator, oven or other appliances, as shown at 146 and 147. Sections of the preselector may be assigned to regulation of oven temperature on a time schedule, etc.

For "all wave" radio receivers, a second motor, similar to 126 Fig. 10 may be connected to the shaft of a range selector switch. This combina-

tion may have an arm with armature and latches similar to 80, 90, 92 and 93 of Fig. 10. Magnets similar to 89, 89', etc. may be provided, one for each tuning range. The operating circuits of these may be in series with the magnets of the main tuning unit as 89, the latter being routed through appropriate range selector magnets and thence to ground. Contact arms 98 and 99 on the main tuning unit may be connected in series with similar arms on the range selector, so that contactor 132 is opened only after both arms have come to rest opposite their respective magnets. The two motors, (126 and its counterpart on the range selector) may be supplied in parallel from contactor 132.

It is obvious that a great variety of combinations are possible, and I do not limit myself to the particular embodiments chosen for description but claim as my invention the improvements, features and methods recited in the appended claims.

I claim:

1. In radio control apparatus having a plurality of selectively energizable electromagnets corresponding to predetermined station frequencies and frequency changing means for the radio, control means operatively connected with the frequency changing means, said control means including a rotary unit having extending substantially radially thereon a non-magnetic split portion and a magnetic portion, with said magnetic portion being attractable to a selected electromagnet to position the frequency changing means, said split portion being movable with said magnetic portion upon the attraction thereof to an electromagnet but being yieldable independently of said magnetic portion, and with the split in said non-magnetic portion corresponding substantially with the radial center line of said magnetic portion and adapted to straddle the electromagnet upon the attraction of the magnetic portion thereto.

2. In radio control apparatus having a plurality of selectively energizable electromagnets corresponding to predetermined station frequencies and frequency changing means for a radio, control means operatively connected with the frequency changing means including a rotary unit having extending substantially radially thereon a portion yieldable in a direction axially of said unit, said yieldable portion including a magnetic member attractable to a selected electromagnet, and a pair of latch portions each being independently yieldable with reference to said magnetic member but movable therewith toward a selected electromagnet, with one of said latch portions yielding to slide over a selected electromagnet upon attraction of the magnetic portion thereto, while the other latch portion remains in a position to mechanically engage the side of the electromagnet when the magnet member is in axial alignment therewith.

3. A radio receiver comprising a tuner with indicating means and tuning controls, a reversible motor for driving said controls, a switch reversing said motor at both ends of the tuning range, a set of electromagnets and a latch for arresting the motion of the tuner at selected points in the tuning range, said electromagnets having projecting pole tips and said latch comprising a magnetic member attractable to the tip of an energized magnet, means for starting said motor in one direction whenever an electromagnet is energized, with said reversing switch acting to reverse the direction of rotation of the

motor at the end of the tuning range, and means including said latch and an energized pole tip acting in only one of the two directions of rotation of the motor to stop the motion of the tuner at a predetermined tuning position.

4. A control system for controllable apparatus having two units, with one of said units normally rotatable and the other of said units normally stationary, said normally stationary unit including a plurality of electromagnets with one magnet corresponding to each of a plurality of control positions for said apparatus and each of said magnets having a projecting pole piece, and said normally rotatable unit including a magnetic member for attraction to the projecting pole piece of an electromagnet and a spring latch having a pair of arms, with each arm engaging an opposite side of said pole piece to mechanically stop said unit upon the engagement of said magnetic member with an energized electromagnet pole piece.

5. In combination an electric control device, and means for positioning the device for a predetermined operating condition, said means comprising an electromagnet with a projecting pole tip and a latch for engaging the pole tip in positive relation thereto, said latch comprising two latch portions normally clear of the pole tip when the tip is unmagnetized, an armature on said latch intermediate said latch portions and flexible relative thereto, and means for energizing the tip to attract the armature thereto to cause the latch portions to move with said armature for engagement with the sides of the magnetized pole tip.

6. A control device with two relatively movable elements, an electromagnet with a projecting pole tip attached to one element and a double acting latch for positively engaging the pole tip attached to the other element, said latch comprising an armature of magnetic material and two latch portions of non-magnetic material with said armature and said latch portions each yieldable relative to one another and the pole tip to clear the tip when it is unmagnetized but to engage it when magnetized, said armature being attracted to the magnetized pole tip to cause one of said latch portions to yieldably pass over said tip in engagement with the end thereof, with the other of said latch portions remaining in a non-yieldable position to engage the side of the pole tip when the armature is in aligned attracted engagement with the pole tip.

7. Means for positioning relatively movable electric tuning members comprising an electromagnet with a projecting tip attached to one member and a double acting latch comprising an armature of magnetic material and two non-magnetic movable arms attached to another member, said arms being yieldably mounted and positioned relative to the armature permitting one arm to be depressed between the armature and pole tip while the other arm remains spaced from the armature in non-depressed position to engage the side of the pole tip for arresting motion and positioning the members.

8. A latch for positioning relatively movable electric tuning members comprising an armature of magnetic material and two arms of non-magnetic material yieldably attached to the armature in spaced relation thereto, each arm being free to move relative to the armature without moving the other.

9. Electromagnetic means for positioning relatively movable electric control members compris-

ing a stop consisting of an electromagnet with a projecting pole tip and a double acting latch for engaging said tip from either of two directions of motion, said latch comprising an armature yieldably mounted and positioned to swing past the tip when said tip is unmagnetized but to be attracted to the tip when it is magnetized and two latch portions yieldably mounted on the armature on the side toward the tip, said latch members being positioned to swing clear of the tip between the tip and the armature when the tip is unmagnetized but to be pressed against the tip by the armature when the tip is energized, the two latch portions being free to move independently of one another permitting either to slide over the head of the tip while the other remains spaced from the armature in position to engage the side of the tip for positively positioning the latch relative to the tip.

10. Electromagnetic positioning means for a movable member comprising a stationary electromagnet having a projecting portion, and latching means on said movable member cooperating therewith to stop said member comprising an armature portion for attraction by said electromagnet and a yieldable portion independent of said armature portion but moving therewith for mechanical engagement with said projecting portion to positively stop movement of said member at said electromagnet.

11. A control device for controllable apparatus, including in combination a plurality of magnetizable stop elements, adjustably mounted for setting to predetermined control positions, a rotatably movable member for controlling said apparatus having an armature and a latch both mounted upon said movable member, with said armature and latch each laterally movable, and one laterally movable independently of the other, said armature being attracted to a selected stop element upon magnetization thereof and said latch adapted to engage a side of said stop element upon the attraction of the armature thereto.

12. Control apparatus for a radio receiver including in combination, movable tuning means, a driving motor for said tuning means, a plurality of adjustably mounted electromagnets each having a projecting pole-piece, a control unit cooperating with said electromagnets to arrest movement of said tuning means at predetermined tuning positions, said control unit including an armature portion and a latching portion both flexibly mounted upon said movable tuning means, with said latching portion having a pair of flexible arms adjacent said armature but movable independently thereof and each of said arms having a beveled portion on the outside thereof and an engaging portion on the inside thereof, with said unit movable upon energization of an electromagnet and the substantial simultaneous energization of the driving motor therewith, with the latch arm approaching an energized electromagnet initially passing over the projecting pole-piece therein and the following latch arm engaging the side of the projecting pole-piece to stop said unit and the tuning means therewith.

13. Control apparatus for a radio receiver, including a stator, a plurality of electromagnets adjustably mounted upon the stator and each having a projecting stationary pole-piece therein, a rotary member, armature and latching means mounted upon the rotary member and extending substantially tangentially of a circular path

- through which the outer edge of the rotary member passes, said means including an armature portion adapted to be attracted to an energized electromagnet and a latching portion adapted to engage one side of a projecting pole-piece when an energized electromagnet attracts the armature portion, said latching portion acting to engage the side of a projecting pole-piece only upon one direction of rotation of the rotary member, energizable means for rotating the rotary member when an electromagnet is energized, and means deenergizing the rotating means when the latch portion engages a projecting pole-piece.
14. Control apparatus for a radio receiver having a circular stator with a pair of circular portions for carrying electromagnets thereon, a plurality of electromagnets adjustably carried at each of said portions and each of said electro-

magnets having a stationary projecting pole-piece therein, a rotary member having a pair of armature and latching units mounted thereon with each unit in a position so as to move across a corresponding plurality of electromagnets in one of said two circular portions, means for actuating said rotary member upon energization of an electromagnet, each of said units including an armature portion and a latching portion, with a latching portion adapted to engage one side of a projecting pole-piece when an energized electromagnet attracts the corresponding armature portion thereto and engaging the side of a pole-piece upon only one direction of rotation of the rotary member, and means rendering the actuating means ineffective when a latching portion engages a projecting pole-piece.

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