March 7, 1939. E. L. BARRETT 2,149,570

RADIO TUNER

Filed May 21, 1938 3 Sheets-Sheet 1

Fig. 1

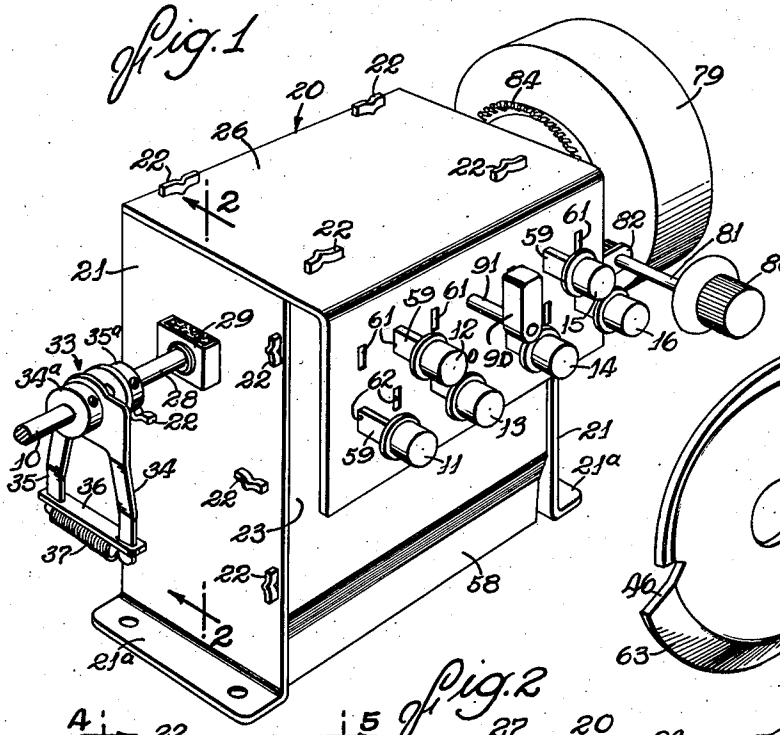


Fig. 3

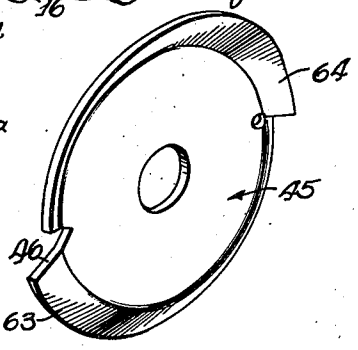
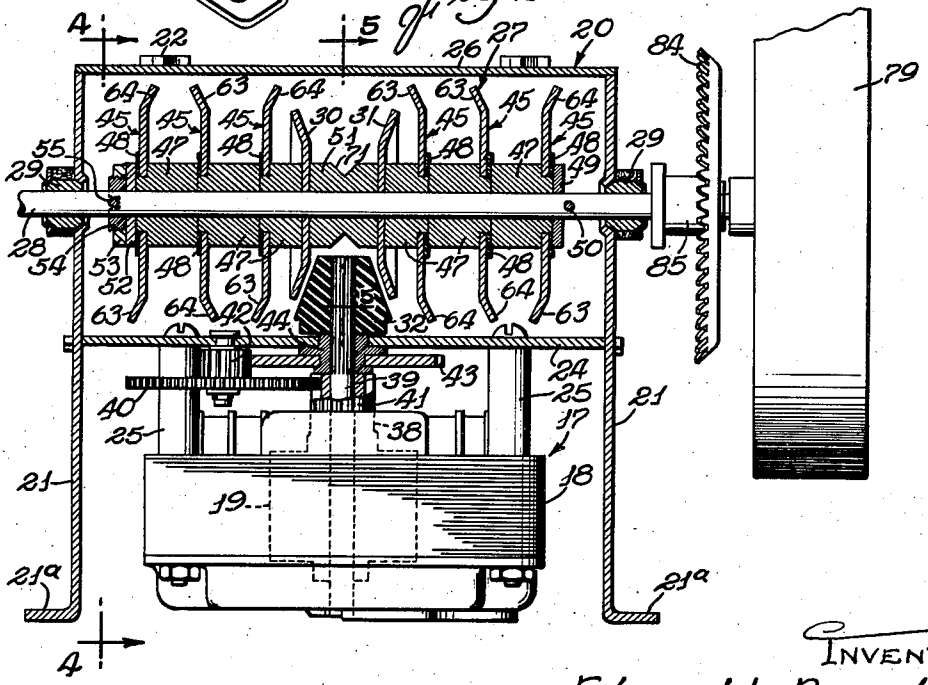


Fig. 2



INVENTOR

Edward L. Barrett

By Parker, Carlson, Pfleger & Hubbard

ATTORNEYS

March 7, 1939. E. L. BARRETT 2,149,570

RADIO TUNER

Filed May 21, 1938 3 Sheets-Sheet 2

Fig. 4

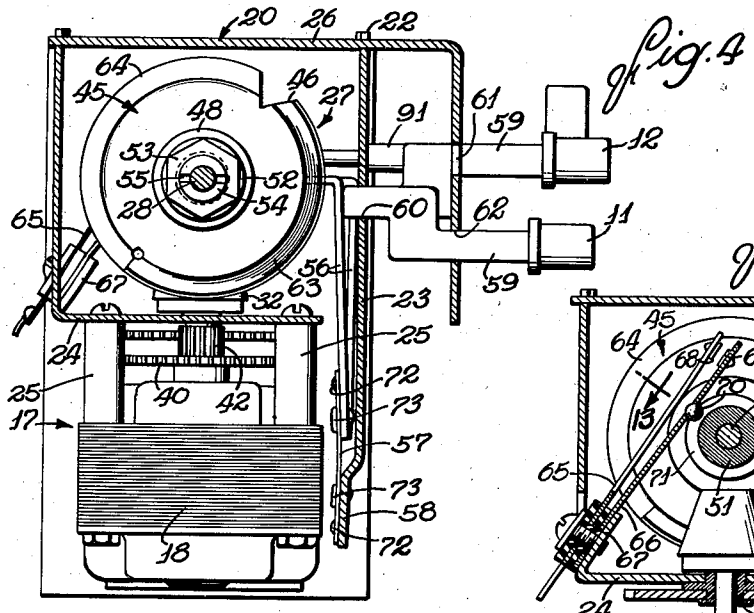


Fig. 5

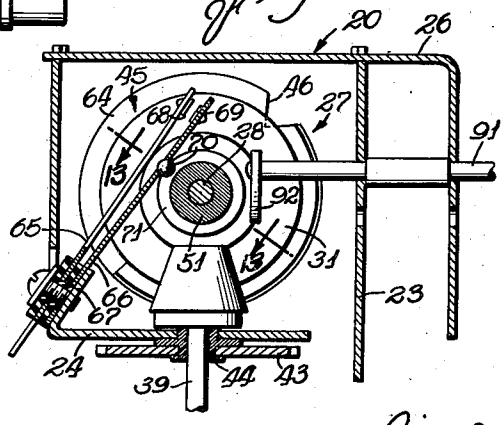


Fig. 6

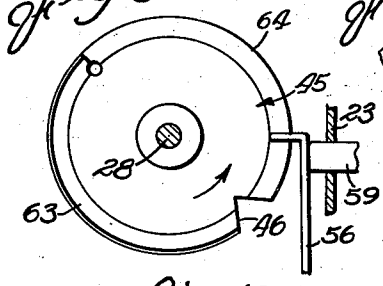


Fig. 7

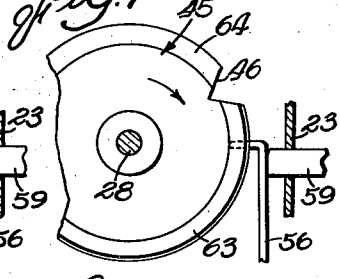


Fig. 8

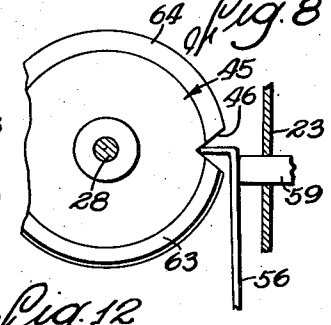


Fig. 10

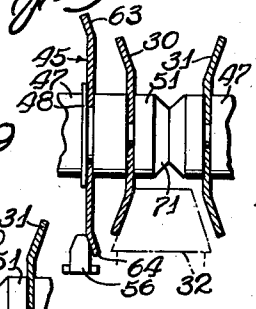


Fig. 11

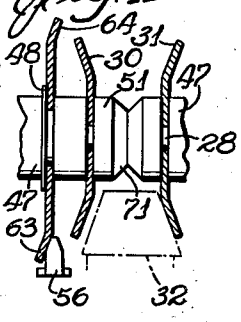


Fig. 12

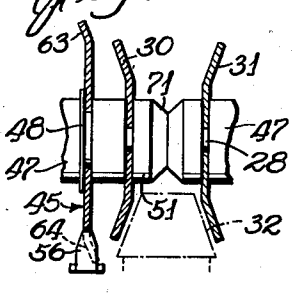
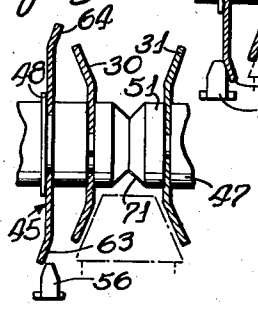


Fig. 9



INVENTOR

Edward L. Barrett

By Parker, Carlson, Pilger & Hubbard

ATTORNEYS

March 7, 1939. E. L. BARRETT 2,149,570

RADIO TUNER

Filed May 21, 1938 3 Sheets-Sheet 3

Fig. 13

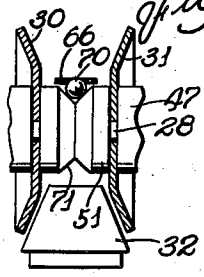


Fig. 14

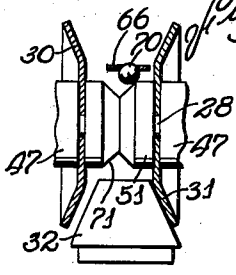


Fig. 15

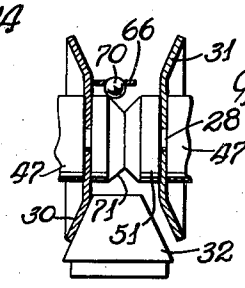


Fig. 17

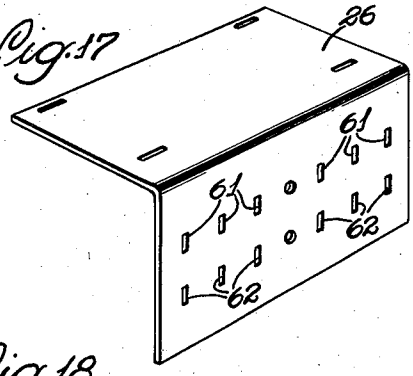


Fig. 16

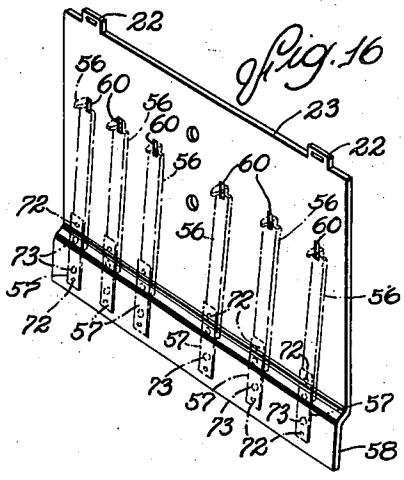


Fig. 18

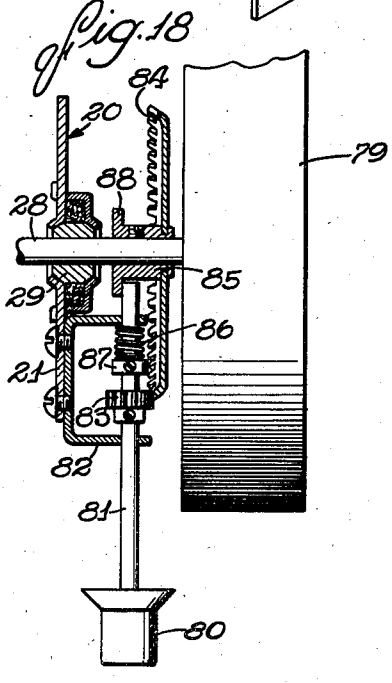
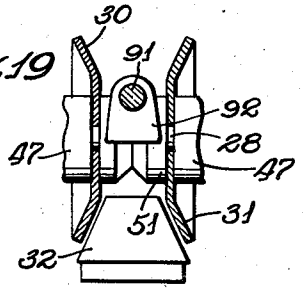


Fig. 19



INVENTOR

Edward L. Barrett

By Parker, Carlson, Pitzner & Hubbard.

ATTORNEYS

Patented Mar. 7, 1939 2,149,570

UNITED STATES PATENT OFFICE

2,149,570

RADIO TUNER

Edward L. Barrett, La Grange, Ill., assignor to Utah Radio Products Company, Chicago, Ill., a corporation of Illinois

Application May 21, 1938, Serial No. 209,250

17 Claims. (Cl. 250—40)

The invention relates to radio tuners and more particularly to tuners of the station selector type, that is, those which are arranged to tune a radio receiver for the reception of signals from any selected one of a predetermined series of broadcasting stations.

The general object of the invention is to provide such a station selector type tuner which is positive and accurate in operation, simple to manipulate during its normal operation as well as simple to adjust initially for a selected set of station tuning positions, and which is economical to manufacture.

A more specific object of the invention is to provide a station selector type tuner embodying not only a driving device, such as an electric motor, and a power driven rotor and cooperating non-rotatable stops individually actuatable into engagement with the rotor to determine various positions of tuning adjustment for the rotor, but also embodying means for utilizing a relative axial shifting movement caused between the rotor and the stops by the actuation of any one of the latter for initiating rotation of the rotor by the driving device and for automatically determining the direction of such rotation.

Another object of the invention is to provide a station selector type tuner embodying an improved form of power actuated rotor cooperable with a set of stop fingers arranged to be urged into engagement therewith, such that the engagement of one of the fingers with the rotor causes an axial shift of the rotor to initiate operation of the rotor driving means but in which the stop fingers permit the rotor to return to its initial axial position to stop such rotation when the final tuning position is reached.

Still another object of the invention is to provide a station selector type tuner embodying a power actuated rotor having cam surfaces thereon cooperable with a set of cam followers arranged to be urged individually into engagement with the rotor, such that the engagement of one of the cam followers with the rotor causes a relative shifting movement between the cam followers and rotor axially of the latter to initiate operation of the rotor driving means and in which the cam followers automatically permit the axially displaced parts to return to their initial position upon the rotation of the rotor to a selected tuning position corresponding to the cam follower selected so that the rotor is thereby automatically disconnected from its driving means at such point.

A further object of the invention is to provide a station selector type tuner mechanism including a selector rotor embodying a novel form of selector disk provided with cam surfaces engageable by a non-rotatable cam follower member to shift the rotor axially for controlling an associated rotor drive mechanism and for also automatically determining the direction of rotor rotation.

The invention also resides in various improvements embodied in the scanning and manual control devices which are preferably incorporated in the tuner for use as alternatives to the station selector mechanism.

Further objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is a perspective view of a radio receiver tuner embodying the invention;

Fig. 2 is an enlarged vertical sectional view along the line 2—2 in Fig. 1;

Fig. 3 is an enlarged detail perspective view of one of the selector disks embodied in the tuner;

Fig. 4 is an enlarged transverse sectional view along the line 4—4 in Fig. 2;

Fig. 5 is a partial transverse sectional view along the line 5—5 in Fig. 2;

Figs. 6, 7 and 8 are fragmentary end elevations of a portion of the selector mechanism illustrating various steps in its operation;

Fig. 9 is a partial detail front elevation of a portion of the selector mechanism and clutch in neutral position;

Figs. 10–12 inclusive are partial detail front elevations of a portion of a selector mechanism and associated clutch illustrating various steps in its operation corresponding respectively to Figs. 6, 7 and 8;

Figs. 13–15 inclusive are partial sectional views along the lines 13—13 in Fig. 5 illustrating various positions of the clutch mechanism;

Fig. 16 is a detail perspective view of the front plate of the unit shown in Fig. 1, together with the selector stops carried thereby;

Fig. 17 is a detail perspective view of the actuator mounting plate of the unit shown in Fig. 1;

Fig. 18 is an enlarged horizontal sectional view of the manual control device included in the tuner unit; and

Fig. 19 is a detail view of the scanning control cam and associated clutch parts.

General construction and operation

Referring more particularly to the drawings, the invention has been shown herein (Fig. 1) as embodied in a station selector type tuner unit

adapted to be incorporated in a radio receiver within any suitable type of cabinet or housing. Such units are ordinarily supplied to or made by radio set manufacturers and are built into the set during its construction, although in some instances the tuner may be housed in a separate cabinet and connected to a complete receiver. The improved tuner herein illustrated is arranged to rotate a shaft 10 of a movable tuning element of a radio receiver, such as an oscillatable variable condenser (not shown) which is conventionally movable through an arc of 180°. In general, the tuner rotates the shaft 10 to any selected one of a predetermined series of positions of angular adjustment in which the receiver is conditioned for the reception of radio signals from a corresponding series of broadcasting stations. A separate actuator is provided for obtaining each tuning position. These actuators are shown as being of the manually operable push button type although other means of operating the actuators, such as solenoids controllable from a distance may be provided if desired. Upon the actuation of any selected one of a series of push buttons 11–16, the tuning element shaft 10 is rotated by an electric driving motor 17 (Fig. 2) to a position for tuning in the signals of the corresponding station. Furthermore, the selector mechanism controlled by the push buttons also serves to locate the tuning element mechanically in precisely the desired tuning position. In addition to this station selection type of tuning for a series of predetermined stations, the tuner also preferably embodies means for effecting a so-called "scanning" type of tuning as well as purely manual tuning.

The electric motor 17 is arranged to drive the tuning element shaft 10 in either direction to a selected tuning position under the control of a selector mechanism embodying a shaft 28 (Fig. 1) coupled in driving relation with the tuning element shaft 10. Preferably the actuation of any selected one of the push buttons 11–16 conditions the motor 17 to drive the tuner shaft 28, and its coupled tuning element shaft 10, directly to the corresponding station tuning position. This preferred "homing" type of tuner device is to be distinguished from the alternative fixed direction type in which the tuner rotor is always started in one direction and if it fails to pass the selected position before reaching the end of its path of travel is automatically reversed at the end of its path and driven in the opposite direction until it reaches the selected tuning position. The direction of rotation for the preferred "homing" drive is determined automatically in the tuner herein disclosed so that the tuning element will move directly to the selected position from any point to which rotation may have been initiated. Upon reaching the selected tuning position, the motor is automatically rendered inoperative to drive the tuner shaft farther.

Preferably mechanical stops are used to locate the tuner in its various tuning positions. This stop arrangement may embody a rotor 27 (Fig. 2) carried by the shaft 28 having a series of cam recesses therein engageable by complemental ones of a series of individually actuatable stop fingers (Fig. 4) movable by the associated push buttons. In order that the simple sliding movement of the push buttons as they are depressed may be used for not only urging the stops into engagement with the tuner rotor, but also to control the electric driving motor, an arrangement has been provided for effecting a relative axial shifting movement between the rotor and its cooperating non-rotatable stop mechanism. In particular, the rotor and the non-rotating stops are caused to move axially with respect to each other whenever one of the stops is urged into engagement with the rotor and this axial movement in turn is utilized to render the driving motor operative to turn the rotor. As soon, however, as the stop enters the corresponding rotor recess, the axial displacement of the parts noted is released so that they return to their former neutral position and the motor is thereby automatically rendered inoperative to drive the rotor farther.

Power actuating mechanism

The power actuating mechanism for the tuner may be an electric driving motor 17, energized by electric current from any suitable source as, for example, by low voltage single phase alternating current from the usual power transformer in the radio receiver. This driving motor has been shown herein as being a two-pole motor of the shaded pole induction type and is provided with a stator 18 and a cooperating rotor 19. The driving motor is mounted in the lower portion of a sheet metal casing or framework 20 which houses the unit (Fig. 1).

The casing 20 comprises sheet metal end plates 21, having suitable mounting flanges 21a at their lower ends, and joined by a front plate 23. An L-shaped motor base plate 24 (Figs. 2 and 4) forms a central horizontal partition in the casing as well as a back wall for the upper portion of the casing. The motor 17 is supported on the lower side of the horizontal part of this plate 24 by studs 25. The top wall of the casing is formed by an inverted L-shaped plate 26 (Figs. 1 and 4), having a depending front leg arranged in spaced relation with the front plate 23 and cooperating therewith to support the push button actuators. The several plates making up the casing are secured together by suitable lugs 22.

The rotor or rotatable member of the station selector mechanism, designated generally by the numeral 27 (Fig. 2), is housed in the upper part of the casing 20. This rotor includes the shaft 28 rotatably journaled in self-alining bearings 29 secured to the casing end plates 21. In the preferred construction illustrated, the relative axial movement between the rotor 27 and cooperating stop mechanism for controlling the motor is achieved by mounting the rotor 27 for axial movement with respect to the stop mechanism rather than the reverse arrangement. Accordingly the bearings 29 are fashioned to support the shaft 28 for axial as well as rotative movement. A suitable clutch mechanism is utilized to connect the shaft 28 in driven relation with the motor 17 in response to axial shifting of the shaft. To minimize the cost of the unit a motor of the unidirectional type is preferably used and the associated clutch mechanism is made reversible so that the tuner shaft 28 can be driven in opposite directions as required, although, if desired, the opposite arrangement of a reversible motor and a unidirectional clutch may be used.

The clutch mechanism illustrated (Fig. 2) includes two alternatively available driven clutch disks 30—31, carried by the shaft 28, and a frusto-conical driving element or head 32 made of rubber or the like. The disks 30—31 are preferably fashioned as stampings from sheet metal and the edge portions thereof are bent into gen-

erally frusto-conical shape complementing the taper of the driving head 32. By shifting the tuner shaft 28 axially in one direction or the other from the central neutral position illustrated in Figs. 2 and 9, the clutch disks 30 and 31 are alternatively engaged with the driver 32 (Figs. 10 and 11) so as to rotate the shaft 28 in corresponding opposite directions. In general, the mechanism actuated by the push buttons 11–16, hereinafter described, is arranged to shift the shaft 28 automatically in an axial direction to engage the clutch for a direction of rotation of the shaft 28 such that the receiver tuning element shaft 10 will be rotated directly to the selected tuning position.

In order to accommodate the relative axial shifting movement of the shaft 28 with respect to the shaft 10, which latter shaft is ordinarily fixed against such axial movement, a coupling 33 (Fig. 1) is interposed between the shafts. Any suitable coupling may be utilized for this purpose and the particular construction illustrated forms no part of the present invention but is described and claimed in my copending application Serial No. 209,252, filed May 21, 1938. In general, the coupling shown includes two sheet metal arms 34 and 35 having offset outer ends which are arranged in a common plane and are connected by a loose link 36. The ends of the arms extend through apertures in the link 36 and are urged toward each other by helical tension spring 37. Bushings 34a and 35a serve to secure the arms 34 and 35 respectively to the shafts 10 and 28. With such a coupling rotational movement is transmitted from the shaft 28 to the driven shaft 10 without lost motion and without interference due to changes in axial displacement of the shaft 28.

A speed reduction gearing (Fig. 2) is preferably interposed between the motor 17 and the clutch driver head 32 in view of the high speed of the two-pole type of motor used. Even with the speed reduction gearing, however, the tuner is driven so rapidly that it moves through substantially its full range in one second. In the present instance, the motor rotor 19 is fast on the sleeve 38 which is journaled on a relatively rotatable shaft 39 on the knurled upper end of which is vulcanized the rubber clutch driver head 32. A gear 40 meshes with a pinion 41 fast on the sleeve 38 and similarly, a gear 42 fast on the shaft 39 meshes with the pinion 43 fixed to the upper side of the gear 40. This gear 40 and its associated pinion 42 are journaled on a stub shaft 43 fast in the motor base plate 24 while a hub 44 on the gear 42 is journaled directly in the base plate. This gearing arrangement is particularly easy to assemble in view of the fact that only two centers, namely, that for the stub shaft 43 and hub 44, need be accurately determined in the base plate. Furthermore, by arranging the axis of the motor shaft 39 at right angles to the tuner shaft 28 and by placing the clutch mechanism at approximately the center of the tuner shaft an especially compact and simple assembly is accomplished.

Selector mechanism

In order to insure accurate location of the tuner shaft 28 in its various selected positions, a mechanical stop mechanism is utilized for positively determining the final tuning positions. As will hereinafter appear, this same mechanism also controls the clutch as well as a switch governing the motor energization so that the motor is automatically started and connected in driving relation with the tuner shaft as soon as one of the push buttons 11–16 is depressed and subsequently automatically stopped and disconnected from the shaft when the latter reaches the selected tuning position. In general, the stop mechanism embodies a series of radially projecting members included in the rotor assembly 27 and a cooperating series of non-rotatable stops adapted to engage these radially projecting members and positively locate the rotor in its selected tuning positions. In the preferred construction illustrated, the radially projecting members are shown as a series of disks 45 (Figs. 2 and 3) preferably fashioned as stampings from sheet metal. Each of these disks is provided with a peripheral recess or V-shaped notch 46 into which a stop member is projected to locate the tuner shaft 28 positively in a predetermined position of rotational adjustment.

A yieldable frictional connection is provided between each of the disks 45 and the shaft 28 so that the disks can, when necessary, be rotated individually about the shaft by holding a selected disk fixed and rotating the shaft by hand. As is hereinafter explained, this type of rotational adjustment is used in presetting the tuner for a selected list of stations. Each of the disks 45 is mounted on the reduced end portion of a corresponding supporting bushing 47 which is slipped on the shaft 28 (Fig. 2). Interposed between each disk and the abutting face of the next adjacent bushing is an annular friction washer 48, which frictionally resists rotation of the disk with respect to the bushing against which it is clamped. In assembling the rotor, all of the parts are slipped on the shaft 28 in proper order, including: the disks 45, the bushings 47, the friction washers 48, the clutch disks 30—31, and their spacing bushing 51. These parts are strung on the shaft so that they abut against an end washer 49 held against further movement by a transverse pin 50. Then an end washer 52 is placed in position together with an internally threaded locking nut 53 and externally threaded locking bushing 54 (Figs. 2 and 4). A second transverse pin 55 is then inserted in a transverse hole in the shaft and in engagement with a complemental slot in the outer face of the locking bushing 54. Finally, the locking nut 53 is threaded along the bushing 54 so that the bushings 47 are jammed tightly against each other and against the pin 50 at the other end of the assembly. In this way the disks 45 are held firmly in position on the shaft 28. The frictional connection between the disks and shaft is, however sufficiently yieldable that the disks can be rotated about the shaft during the presetting of the tuner for a selected set of stations.

Cooperating with the notched disks 45 is a series of stop fingers or cam followers individually actuatable by the push buttons 11–16. These stop fingers 56 are preferably of inverted L-shape (Fig. 4) being fashioned as stampings from sheet metal and the active ends thereof are tapered or pointed (Fig. 9). Each of these stop fingers 56 is carried by a flexible flat cantilever spring 57 secured to an offset lower edge portion 58 on the bottom of the casing plate 23. These springs may be both spot welded and riveted not only to the inner face of the offset 58 in the supporting plate, but also to the stop fingers 56 as indicated at 72 and 73 (Figs. 4 and 16). The welding prevents sidewise skewing of the springs and the rivets prevent breakage of the

welds. The front face of the offset 58 is preferably disposed at a slight angle to the vertical so that the stop fingers 56 will normally be held in a position out of contact with the disks 45.

A series of axially slidable actuator or push button bars 59, carrying the push buttons 11–16 on their outer ends, are arranged to thrust the stop fingers 56 inwardly into contact with their cooperating selector disks in response to depression of the attached push buttons. The springs 57 normally urge the push button bars 59 to their outermost position. In order to facilitate a maximum number of push button patterns on the front of the unit with a minimum number of standard parts, the actuator bars 59 are preferably fashioned as stampings from sheet metal in a general Z-shape as shown in Fig. 4. The central portions of the actuator bars are located between the casing front plate 23 and the overhanging front leg of the top plate 26 with the inner ends of the bars slidably mounted in a series of apertures 60 in the front plate (Figs. 4 and 16). All of these apertures 60 are arranged in a single row, but two rows of rectangular apertures 61 and 62 are provided in the depending leg of the top plate 26 (Fig. 17). Accordingly, the offset front extensions on the actuator bars 59 may be slidably mounted in the corresponding aperture 61 or 62 by simply turning the actuator bars over. For example, the push buttons 11–16 may be staggered as shown in Fig. 1 by arranging the actuator bars to project through alternate ones of the apertures 61 and 62 or, if desired, all of the push buttons may be placed in a single line with the actuator bars projecting either through the row of apertures 61 or the row of apertures 62.

Means is provided for yieldably urging the tuner shaft 28 to a neutral or central position in which the clutch connecting it to the driving motor is disengaged. In the preferred construction illustrated, a switch mechanism, which controls the energization of the driving motor 17, is also utilized for this purpose. This switch mechanism includes two resilient spring fingers 65 and 66 (Fig. 5) mounted in insulated relation on a supporting tongue 67, struck out from the upstanding rear leg of the motor base plate 24. A pair of normally open contact points 68—69 carried by the outer ends of the spring fingers 65—66 are interposed in series with the motor energizing circuit and accordingly the motor 17 is deenergized so long as these contacts remain open. Completion of the motor energizing circuit by a closure of the contact points 68—69 is accomplished in response to an axial shifting movement of the tuner rotor 27 in either direction from its central neutral position by means of a ball 70 seated in an annular groove 71 (Fig. 13) and in an aperture in the spring finger 66. This latter aperture is of smaller diameter than the ball. When the tuner shaft 28 is shifted to the left (as viewed in Fig. 13) the ball 70 rides up on the right hand side of the groove 71 to the position shown in Fig. 14 thus closing the contact points 68—69. Similarly, when the tuner shaft 28 is moved to the right, the ball 70 rides up on the left hand side of the groove 71 (Fig. 15) again closing the motor contact points. As soon, however, as the axial thrust on the tuner shaft is released, the resiliency of the spring fingers 56 forces the ball 70 back into the root of the groove 71 thereby returning the shaft 28 and the attached rotor assembly 27 to its central or neutral position.

As was previously noted the inward movement of the push button bars 59 is utilized to cause a relative axial shifting movement between the rotor assembly and stop assembly, and this axial movement is in turn utilized to render the motor operative to drive the tuner rotor. Furthermore, the arrangement is preferably such that the direction of rotation of the rotor will be automatically determined so that the disk notches 46 will move directly into register with cooperating selected one of the stop fingers 56. To accomplish such action, cam surfaces are preferably provided on the tuner rotor 27 engageable by the movable stop fingers or associated parts to effect a relative axial shifting movement between the stop mechanism and the rotor assembly so that the axial movement can be utilized to control a motor clutch mechanism. In the preferred construction illustrated, the cam surfaces are fashioned on the disks 45. For this purpose, the edge portion of each disk 45 is bent to form two oppositely facing segmental frusto-conical cam surfaces 63 and 64 lying on opposite sides of a diameter passing through the notch 46. The noses on the stop fingers 56 are tapered at an angle complementing the angle of taper of the frusto-conical cam surfaces on the disks (Fig. 9) and accordingly, when one of the stop fingers 56 is pushed forwardly into engagement with its cooperating disk it shifts the same, together with the entire rotor assembly 27, to the right or left depending upon which one of the segmental cam surfaces 63 or 64 it engages. By the use of two such segmental cam surfaces the direction of rotation of the rotor is automatically determined for any position of the rotor since the rotor shaft 28 and attached tuning element have a maximum turning angle of only 180°.

Résumé of station selector operation

The push buttons 11–16 are ordinarily marked by suitable indicia to show the radio broadcasting station to which they are adapted to tune the associated radio receiver. The disks 45 are initially adjusted about the shaft 28 so that their notches 46 are disposed to locate the shaft 28 in the tuning position corresponding to the indicia marked on the push buttons as is hereinafter described in further detail.

In the normal operation of the selector tuning mechanism, it is only necessary for the operator to depress the push button corresponding to the station to which he desires to tune the radio set. The push button is maintained depressed until the tuning operation is completed, although with the motor drive described, the tuning operation is so rapid that the general impression is that of almost a momentary pressing of the push button. Upon so depressing one of the push buttons as, for example, the button 11 (Fig. 4) the attached actuator bar 59 is thrust inwardly thus pushing its associated stop finger 56 into contact with the corresponding disk 45 so that the stop finger engages one of the cam surfaces 63 or 64 on the disk (Figs. 10 and 11 respectively). The disk cam surface engaged depends, of course, upon whether the notch 46 is at the moment located above or below the stop. If, for example, the notch 46 is located below the active end of the stop 56 (Figs. 6 and 11), the stop finger engages the cam surface 64 and cams the rotor assembly 27 axially to the right, thereby engaging the clutch disk 30 with the clutch driver head 32 (Fig. 11). As a result the tuner

rotor 27 is driven in a counterclockwise direction (as viewed in Fig. 6). Similarly, if the notch 46 is located above the stop finger 56 (Figs. 7 and 11) the latter engages the cam surface 63 and pushes the rotor assembly axially to the left to engage the clutch disk 31 with the clutch driver 32 (Fig. 10). In such case the rotor 27 is driven in the opposite or clockwise direction (as viewed in Fig. 7). In either case, the clutch is engaged to rotate the shaft 28 directly to a position in which the notch 46 registers with the stop finger 56.

The driving motor 17 is automatically rendered inoperative to drive the tuner rotor 27 farther as soon as the stop finger 56 leaves the surface of the cam track against which it has been pressed and enters the disk notch 46. The disengagement of the stop finger from the cam track 63 or 64 frees the rotor assembly 27 to return to its normal central position (Fig. 9) under the bias of the switch spring finger 66 as previously described. Such a return of the rotor to its central axial position disengages the clutch and simultaneously opens the motor circuit. Accordingly, rotation of the selector rotor 27 by the electric driving motor is effectively stopped in at the tuning position selected. It will be noted that because of the disengagement of the clutch the momentum of the driving motor 17 as it coasts to a stop cannot cause the tuning mechanism to overrun despite the fact that the motor may have been operating at a comparatively high rate of speed.

The positive mechanical stoppage of the selector rotor 27 into its final and precise tuning position is effected by the continued pressure exerted on the selected push button by the operator. This continued inward pressure on the push button causes the nose of the stop finger 56 to seat in the root of the selector disk notch (Figs. 8 and 12). The rotor 27 is thereby positively or mechanically located in its final tuning position and any further rotation of the rotor is arrested despite its momentum or the speed of rotation which it may have previously attained.

Initial tuner adjustment

The initial adjustment or a readjustment of the tuner for some selected series of stations can be made very easily and without the necessity of opening up the unit, adjusting any set screws or the like, or manipulating any auxiliary setting devices. In general, if it is desired that the push button 11, for example, should be adjusted to tune in station "A" this push button 11 is thrust inwardly and the motor 17 permitted to rotate the tuner rotor 27 in the manner described above until the associated stop finger 56 enters the notch 46 in its corresponding disk 45. The operator then continues to hold the push button 11 in its depressed position with its associated stop finger engaging the rotor disk, and the shaft 28 is rotated by hand, as, for example, through the medium of the manual tuning mechanism hereinafter described, until signals from station "A" are tuned in on the radio set. The push button 11 is then released. By such a manipulation of the device the disk 45 cooperating with the push button 11 is rotated about the shaft 28 until it is in exactly the angular position corresponding to the adjustment of the radio receiver for tuning in station "A". The same series of operations is repeated for conditioning push button 12 to tune in station "B", and for each of the successive push buttons to adjust the angular position of their associated disks for tuning in other stations of the series desired. Thereafter the stations thus selected can be tuned in at any time by simply depressing the corresponding push button in the manner previously described in connection with the normal operation of the tuner.

Manual tuning

The mechanism for tuning the associated radio receiver manualy, as distinguished from automatic tuning to a selected one of a series of stations, comprises a rotatable manual operating knob 80 (Figs. 1 and 19). This knob is carried by a shaft 81, which is journaled for both rotational and axial sliding movement in a U-shaped bracket 82 screwed to the outer end of the tuner casing 20. The shaft 81 carries a pinion 83 arranged to mesh with a stamped sheet metal crown gear 84, fixed to the shaft 28 by bushing 85. To maintain the pinion 83 normally out of engagement with the gear 84, a helical compression spring 86 is interposed between one leg of the bracket 82 and a collar 87 on the shaft 81.

When the manual tuning knob shaft 81 is in its outward position with the pinion 83 disengaged, the tuner shaft 28 is free to turn or move axially without interference of the tuning shaft or gear. When the tuning knob 80 is pushed inwardly, however, to engage the pinion 83 with the gear 84, the tuner shaft 28 is held against axial movement thereby preventing inadvertent simultaneous driving of the shaft 28 by the motor 17 and manually rotatable shaft 81. The interlock for this purpose includes a flange 88 in the inner end of the bushing 85 which abuts against the inner end of the shaft 81 when the latter is thrust inwardly thus preventing axial displacement of the tuner shaft 28 to the right (as viewed in Fig. 19). Similarly, engagement of pinion 83 with the gear 84 prevents axial displacement of the tuner shaft 86 to the left.

In the operation of this manual tuning device the operator pushes the knob 80 and shaft 81 axially inward so that the pinion 83 engages the crown gear 84 and the shaft 28 is locked against axial movement. By rotation of the knob 80 the tuner shaft 28 and the coupled radio tuning element shaft 10 can then be rotated to any desired position. Preferably a visual indicating dial such as the drum dial 79 (Fig. 1) is attached to the tuner shaft 28 so as to indicate in the usual manner the frequency for which the radio receiver is tuned.

Scanning

In some instances it may be desired to use a so-called "scanning" type of tuning in which the electric driving motor 17 is used to drive the radio receiver tuning element with stoppage at any random point determined by the operator, as contrasted with automatic stoppage at a series of selected station tuning points. In order to accomplish this type of tuning, the operator turns a scanning control knob 90 (Fig. 1) mounted on the end of a shaft 91 journaled in the plates 23 and 26 (Fig. 5). The inner end of this shaft carries a generally triangular cam 92 interposed between the clutch plates 30—31 (Figs. 5 and 19).

Upon turning the shaft 91 in a clockwise direction (as viewed in Fig. 19) the cam 92 contacts the clutch plate 30 thus shifting the shaft 28 to the left so that the clutch plate 31 engages the clutch driver 32, and the switch contacts 68—69 complete the motor circuit, so that the motor rotates the tuner shaft 28 continuously in

the corresponding direction. This rotation may be stopped at any point desired simply by turning the cam 92 to its initial position to disengage the clutch. Similarly, the clutch may be shifted to cause the motor to drive the tuner shaft in the opposite direction by oscillating the cam 92 in a counterclockwise direction (as viewed in Fig. 19). By this means the tuning motor 17 can be utilized to adjust the tuning position of the radio receiver quickly and effectively to any desired point.

Although a particular embodiment of the invention has been shown and described in some detail for purposes of illustration and explanation of the various features of the invention there is no intention to thereby limit the invention to such embodiment but on the other hand the appended claims are intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention.

I claim as my invention:

1. A station selector tuner for a radio receiver comprising, in combination, a rotatable and axially shiftable shaft adapted to be connected to a rotatable tuning element of a radio receiver, a disk mounted on said shaft and having a peripheral notch therein, the edge portion of said disk being fashioned to present two segmental frusto-conical cam surfaces facing generally axially of the disk in opposite directions and lying on opposite sides of a diameter passing through said notch, means including a cam follower projectable into engagement with said edge portion of said disk in a direction radially thereof for engaging one or the other of said cam surfaces to shift said disk and shaft axially and for engaging said notch upon rotation of the latter into registry with said cam follower to locate said shaft positively in a predetermined position of rotational adjustment, reversible power actuated means for rotationg said shaft, and means responsive to the relative axial shifting movement of said shaft resulting from the contact of said cam follower with said cam surfaces for controlling the direction of rotation of said shaft by said reversible power actuated means to effect rotation of said shaft directly to a position in which said notch registers with said cam follower.

2. A station selector tuner for a radio receiver comprising, in combination, a rotatable and axially shiftable shaft adapted to be connected to a rotatable tuning element of a radio receiver, a disk mounted on said shaft and having a peripheral V-shaped notch therein, the edge portion of said disk being fashioned to present two segmental frusto-conical cam surfaces facing generally axially of the disk in opposite directions and lying on opposite sides of a diameter passing through said notch, means including a cam follower shiftable into engagement with said edge portion of said disk in a direction radially thereof for engaging one or the other of said cam surfaces to shift said disk and shaft axially and for engaging said notch upon rotation of the latter into registry with said cam follower to locate said shaft positively in a predetermined position of rotational adjustment, said cam follower being generally L-shaped with a tapered nose portion engageable with said disk, means including a cantilever spring yieldably supporting said cam follower out of engagement with said disk, an axially slidable actuator bar for shifting said cam follower into engagement with said disk by flexure of said spring, reversible power actuated means for rotating said shaft, and means responsive to the relative axial shifting movement of said shaft resulting from the contact of said cam follower with said cam surfaces for controlling the directing of rotation of said shaft by said reversible power actuated means to effect rotation of said shaft directly to a position in which said notch registers with said cam follower.

3. In a power actuated radio receiver tuner a rotor sub-assembly for defining predetermined tuning positions of a rotatable tuning element and controlling the direction of rotation of the element in moving to the selected positions, comprising, a shaft, a sheet metal disk, said disk having a peripheral notch therein and having the edge portion thereof fashioned to form two segmental oppositely tapering frusto-conical cam surfaces facing generally axially of the disk and lying on opposite sides of a diameter passing through the said notch, and means for adjustably securing said disk on said shaft.

4. A station selector tuner for a radio receiver comprising, in combination, a rotatable member adapted to be connected to a rotatable tuning element of a radio receiver, said member presenting two segmental frusto-conical cam surfaces facing generally axially on opposite sides of a common plane transverse to the axis of said member and each extending about separate halves of the periphery of said member, said rotatable member having a peripheral recess therein lying in a diametrical plane thereof passing between adjacent ends of said cam surfaces, a stop mechanism including a cam follower arranged to be actuated from a disengaged idle position along a path in said common plane into engagement with one or the other of said cam surfaces depending upon which one is presented thereto, said stop mechanism including a part arranged to enter said recess to position said rotatable member in a corresponding predetermined position upon rotation of said recess into registry therewith, means supporting said rotatable member and stop mechanism for relative axial movement, reversible power actuated means for rotating said member, and means for utilizing the relative axial shifting movement between said member and said stop mechanism in alternative opposite directions resulting from the contact of said cam follower and the respective alternatively presented cam surfaces for controlling the direction of rotation of said member by said reversible power actuated means to effect rotation of said member directly to a position in which said recess registers with said stop mechanism.

5. A station selector tuner for a radio receiver comprising, in combination, a rotatable member adapted to be drivingly connected to a radio receiver tuning element, means including a set of mechanical stops movable individually into and out of operative position for positively arresting the rotation of said member in any one of a selected series of angular tuning positions corresponding to different station tuning positions of the tuning element, means supporting said member and said set of stops for relative movement axially of said member, means responsive to the actuation of any selected one of said stops into operative relation with said member for effecting relative axial movement therebetween from a central neutral position in a direction determined by the direction of angular displacement of said member from the tuning position corresponding to the selected stop, power actuated means for rotating said member, and means responsive to said relative axial movement for rendering said

power actuated means operative to rotate said member in a direction to move directly to the selected tuning position.

6. A power actuated station selector radio tuner comprising, in combination, a rotatable shaft adapted to be connected to the tuning element of a radio receiver, means supporting said shaft for rotational and axial sliding movement, two spaced and opposed driven clutch members fixed on said shaft, means including radially extending members carried by said shaft and a series of cooperating stationary stop members engageable with said radially extending members for locating said shaft in any selected one of a series of predetermined positions of angular adjustment, a driving clutch member disposed between said driven clutch members and engageable alternatively therewith upon axial shifting of said shaft, an electric motor operatively connected to said driving clutch member, and means responsive to the actuation of any selected one of said stop members into a position to engage one of said radially extending members when the latter is rotated into registry therewith for shifting said shaft axially in a direction to engage said clutch to rotate said shaft directly to such position of registry.

7. A selector type tuner for a radio receiver comprising, in combination, a rotatable and axially movable member adapted to be connected to a rotatable tuning element of a radio receiver and having a recess therein, an electric driving motor, means including a clutch for connecting said motor in driving relation with said rotatable member, means for locating said member precisely in a predetermined position of rotational adjustment corresponding to a selected tuning position of the tuning element, said last named means including a stop actuatable from an idle inoperative position into an operative position in which a part of said stop lies in the path of said recess for entry therein upon registry therewith to position said member accurately in said predetermined position, means including a cam track carried by said member and engageable with said stop upon actuation thereof for shifting said member axially from a normal idle position, said cam track being contoured to disengage said stop when said stop part registers with said recess, and means responsive to axial movement of said member out of and into said idle position for respectively engaging and disengaging said clutch.

8. A station selector type tuner for a radio receiver comprising, in combination, a rotatable and axially movable member adapted to be connected to a rotatable tuning element of a radio receiver and having a recess therein, an electric driving motor including an energizing circuit having a control switch therein, means including a clutch for connecting said motor in driving relation with said rotatable member, means for locating said member precisely in a predetermined position of rotational adjustment corresponding to a selected tuning position of the tuning element, said last named means including a stop actuatable from an idle inoperative position into an operative position in which a part of said stop lies in the path of said recess for entry therein upon registry therewith to position said member accurately in said predetermined position, means including a cam track carried by said member and engageable with said stop upon actuation thereof for shifting said member axially from a normal idle position, said cam track being contoured to disengage said stop when said part registers with said recess, and means responsive to axial movement of said member out of and into said idle position for not only respectively engaging and disengaging said clutch but also actuating said motor control switch.

9. A station selector tuner for a radio receiver comprising, in combination, a rotatable and axially movable member adapted to be drivingly connected to a rotatable tuning element of a radio receiver, means including a plurality of mechanical stops actuatable individually into and out of operative position for positively arresting the rotation of said member in any one of a selected series of angular tuning positions corresponding to different station tuning positions of the tuning element, means responsive to the actuation of any selected one of said stops into operative relation with said member for shifting said member axially from a central neutral position in a direction determined by the direction of angular displacement of said member from the tuning position corresponding to the selected stop, power actuated means for rotating said member, and means responsive to said axial movement of said member for rendering said power-actuated means operative to rotate said member to move directly to the selected tuning position in a direction determined by the direction of axial movement of said member.

10. A motor driven tuner for a radio receiver comprising, in combination, an electric driving motor having an energizing circuit with a pair of normally open contact points interposed therein, a rotatable axially shiftable member adapted to be drivingly connected to the tuning element of a radio receiver and having an annular peripheral groove therein, means including a reversing clutch for connecting said motor to said member to rotate the same in alternative directions in response to axial movement of said member in opposite directions from a central neutral position, a resilient spring finger supporting one of said contact points in operative relation with the other and overlying said annular groove, said finger having a recess therein registering with said groove when said rotatable member is in its central neutral position, and a ball seated in said recess and arranged to enter said groove when said member is in its neutral position for shifting said one contact point into engagement with the other as the ball rides up on the sides of said groove in response to an axial shift of said member, the resiliency of said finger tending to force said ball into said groove and thereby serving to urge said member yieldably into its central neutral position.

11. A motor driven tuner for a radio receiver comprising, in combination, an electric driving motor having an energizing circuit with a pair of normally open contact points interposed therein, a rotatable axially shiftable member adapted to be drivingly connected to the tuning element of a radio receiver and having an annular peripheral groove therein, means including a reversing clutch for connecting said motor to said member to rotate the same in alternative directions in response to axial movement of said member in opposite directions from a central neutral position, a resilient spring finger supporting one of said contact points in operative relation with the other and overlying said annular groove, said finger having a recess therein

registering with said groove when said rotatable member is in its central neutral position, a ball seated in said recess and arranged to enter said groove when said member is in its neutral position for shifting said one contact point into engagement with the other as the ball rides up on the sides of said groove in response to an axial shift of said member, the resiliency of said finger tending to force said ball into said groove and thereby serving to urge said member yieldably into its central neutral position, a disk mounted on said member and having a peripheral notch therein, the edge portion of said disk being fashioned to present two segmental frusto-conical cam surfaces facing generally axially of the disk in opposite directions and lying on opposite sides of a diameter passing through said notch, and means including a cam follower projectable into engagement with said edge portion of said disk in a direction laterally thereof for engaging one or the other of said cam surfaces to shift said disk and said member axially and for engaging said notch upon rotation of the latter into registry with said cam follower to locate said member positively in a predetermined position of rotational adjustment.

12. A station selector type radio receiver tuner comprising, in combination, a rotor adapted to be connected in driving relation with a tuning element of a radio receiver and movable to a position of rotative adjustment corresponding to a predetermined tuning position of such element, a cam follower movable generally laterally of said rotor into and out of operative relation therewith, power actuated means for rotating said rotor, means for rendering said power actuated means operative to rotate said rotor only in response to relative movement between said cam follower and rotor axially of the latter from a predetermined neutral position, and means including a cam surface on said rotor engageable with said cam follower upon actuation of the latter into operative relation with said rotor for maintaining said rotor and cam follower displaced axially from said neutral position only until said rotor is rotated by said power actuated means to said tuning position.

13. A station selector type tuner for a radio receiver comprising, in combination, a rotor adapted to be connected in driving relation with a radio receiver tuning element rotatable through a tuning range of approximately 180°, said rotor having two segmental generally conical cam surfaces thereon facing in opposite directions axially thereof and located on opposite sides of a diameter thereof, two contiguous ends of said cam surfaces being disposed in spaced relation with the space therebetween defining a preselected tuning position of said rotor, means supporting said rotor for axial as well as rotational movement, power actuated means for rotating said rotor, means for rendering said power actuated means operative to rotate said rotor in alternative opposite directions only in response to axial shifting of said rotor in corresponding opposite directions from a central neutral position, means for yieldably urging said rotor to said neutral position, and means including a cam follower projectable generally radially of said rotor into engagement with the one of said cam surfaces presented thereto for shifting said rotor axially in one direction or the other from said central neutral position and for releasing said rotor to return to said central neutral position upon registry thereof with said space between said cam surface ends to free said rotor to return to its neutral position at such point.

14. A combined station selector and scanning type tuner for a radio receiver comprising, in combination, an electric driving motor, means including a reversible clutch for connecting said motor in driving relation with a tuning element of a radio receiver, said clutch embodying a power actuated generally conical driver and a pair of frusto-conical driven members disposed on opposite sides thereof and shiftable axially in opposite directions for alternative engagement therewith, station selector means for initiating operation of said motor and stopping the same at predetermined tuning positions, means operable in response to the actuation of said station selector means for shifting said clutch driven members axially in a direction to engage the one thereof required to move said tuning element directly to the selected position, and means including a manually oscillatable scanning control cam interposed between said clutch driven members and oscillatable from a disengaged position into engagement with alternative ones thereof to shift said members axially for engaging said clutch to effect either forward or reverse rotation of the tuning element throughout any desired portion of its range of movement.

15. A combined power actuated and manual tuner for a radio receiver comprising, in combination, a rotatable and axially movable shaft adapted to be connected to a rotatable tuning element of a radio receiver, an electric motor, means including a reversible clutch movable from a central neutral position into respective forward and reverse engaged positions in response to axial shifting of said shaft in respective opposite directions from a central position for connecting said motor in driving relation with said shaft, a rotatable manually operable member, disengageable means for connecting said member to said shaft, and interlock means for preventing engagement of said last named means except when said shaft and clutch are in their respective neutral positions.

16. A push button operated station selector radio tuner comprising, in combination, a rotatable shaft adapted to be connected to the tuning element of a radio receiver, means including radially projecting members carried by said shaft and a series of cooperating non-rotating stop members movable into and out of engagement with said radial members for locating said shaft in any selected one of a series of predetermined positions of angular adjustment, two spaced panels extending along one side of said shaft, the inner one of said panels having an alined series of apertures therein registering with said movable stops, the outer one of said panels having two rows of apertures therein with the apertures in each row displaced respectively above and below said apertures in said inner panel, and actuator bars for said stops slidably mounted in said apertured panels, each of said bars including a central portion positioned between said panels and an inner extension slidable in said apertures in said inner panel as well as an offset outer extension carrying a push button on its outer end and adapted to be positioned in either the corresponding upper or lower aperture in said outer panel upon reversal of said bar, whereby said push buttons may be staggered or alined as desired by simply reversing said bars.

17. A power actuated station selector radio tuner comprising, in combination, a rotatable shaft adapted to be connected to the tuning element of a radio receiver, a chassis supporting said shaft for rotational and axial sliding movement, two spaced and opposed driven clutch members fixed on said shaft adjacent the center thereof, means including radially projecting members carried by said shaft on the opposite outer sides of said clutch members and a series of cooperating stationary stop members engageable with said radially extending members for locating said shaft in any selected one of a series of predetermined positions of angular adjustment, a driving clutch member disposed between said driven clutch members and engageable alternatively therewith upon axial shifting of said shaft, an electric motor operatively connected to said driving clutch member, and means supporting said motor on said chassis as a unitary structure therewith.

EDWARD L. BARRETT.

CERTIFICATE OF CORRECTION.

Patent No. 2,149,570. March 7, 1939.

EDWARD L. BARRETT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 11, for "manualy" read manually; page 6, first column, line 40, for "rotationg" read rotating; and second column, line 3, claim 2, for "directing" read direction; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of April, A.D. 1939.

Henry Van Arsdale

Acting Commissioner of Patents.

(Seal)