

Nov. 9, 1948.

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2,453,252

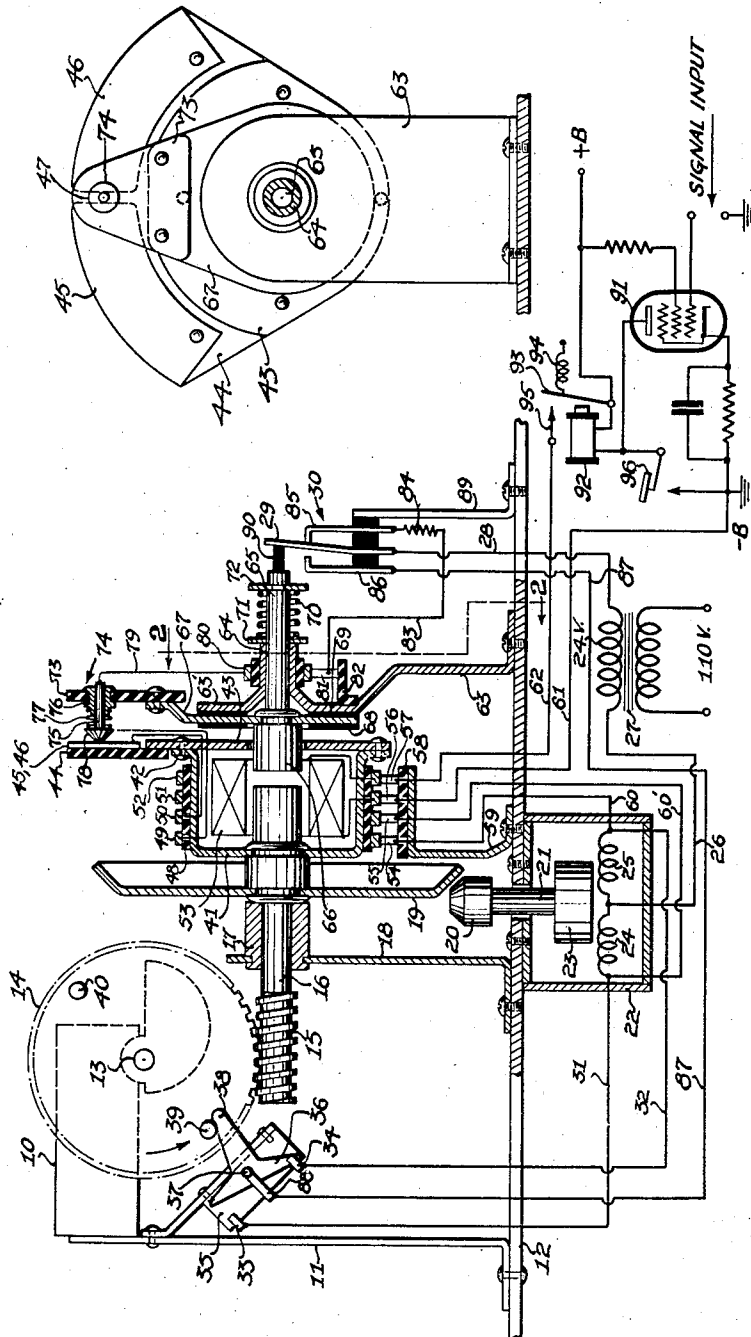
TUNING CONTROL MECHANISM FOR RADIO RECEIVERS

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Fig. 2.

Fig. 1.



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Fig. 4.

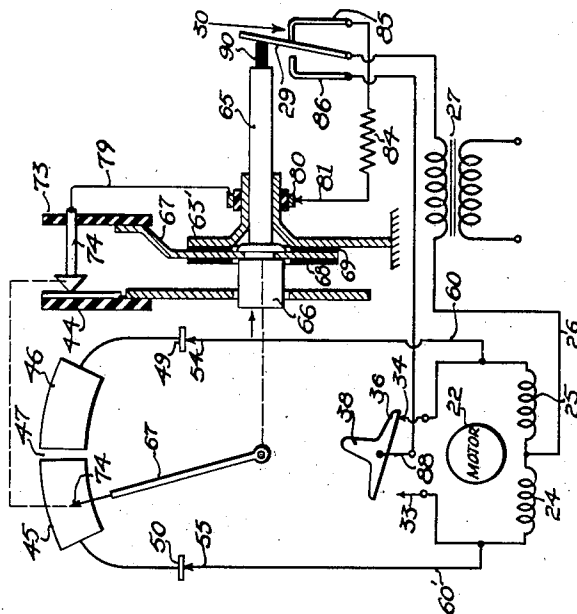
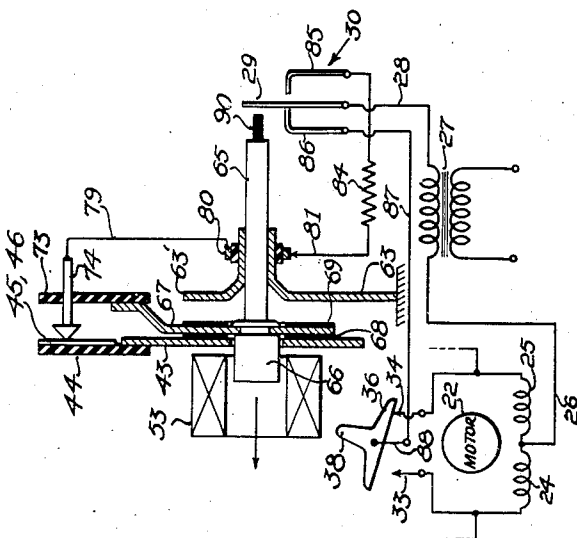


Fig. 3.



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Fig. 6.

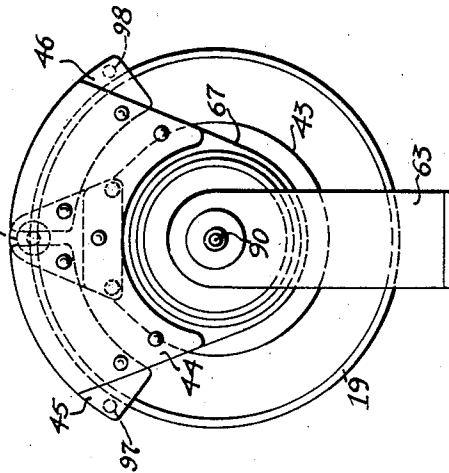
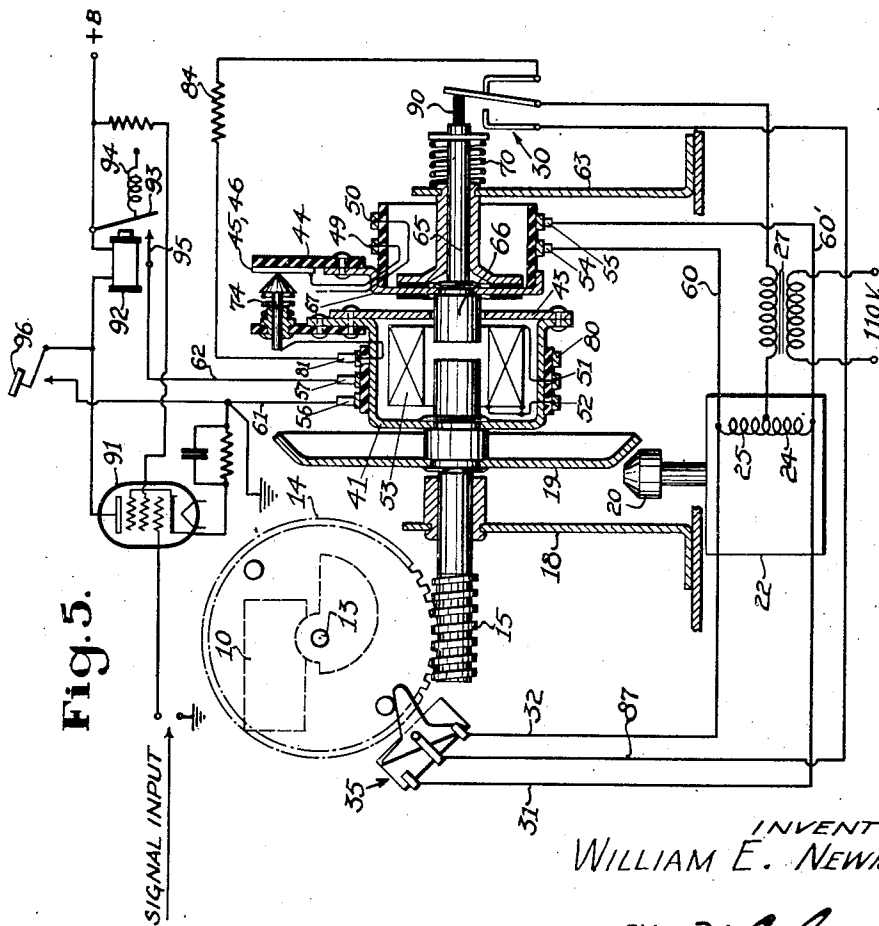


Fig. 5.



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2,453,252

TUNING CONTROL MECHANISM FOR RADIO RECEIVERS

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Application December 5, 1944, Serial No. 566,666

8 Claims. (Cl. 250—40)

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This invention relates in general to tuning control mechanism for radio receivers, and more particularly to control mechanism for effecting in a sequential manner the automatic adjustment of the tuning device of a radio receiver to a plurality of transmitted carrier waves having a signal strength above a predetermined minimum.

In control systems of this general type an electric motor is utilized to effect the tuning, the motor being set into operation by manually actuated means and rendered inoperative automatically when the receiver has been tuned to the carrier wave of a broadcasting station received with sufficient strength.

It is one of the objects of the present invention to provide a high degree of tuning accuracy in a control system of the type mentioned wherein there is utilized a high ratio gearing between the tuning element and the station selector means.

A further object of the invention is to provide a combination scanning and hunting type of selector which permits of effecting in the first instance a rough adjustment of the receiver to a station of sufficient signal strength followed by an accurate adjustment of the receiver tuning means.

A still further object of the invention is to provide in combination with an adjustable tuning device of a radio receiver tunable through a certain frequency range, a reversible electric motor, means operable in response to manual control for energizing the motor to actuate the tuning device in a manner such that it is permitted to scan said frequency range for a signal wave having an amplitude above a predetermined minimum, and means operable upon reception of such signal carrier wave for discontinuing the scanning operation and effecting operation of the motor in a manner such that the tuning device is permitted to hunt for said received carrier wave prior to final adjustment of said tuning device to said carrier wave.

A more specific object is to provide a control mechanism for effecting the automatic adjustment of the tuning device of a radio receiver to a transmitted signal carrier wave having an amplitude above a predetermined minimum, which includes a reversible electric motor for actuating the tuning device, a rotary member movable with the tuning device carrying a pair of commutator segments separated by an insulating gap or dead spot for determining the direction of motor operation, means for actuating said member from the motor, a contact pin cooperatively related with said rotary member, means for effecting ro-

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tation of the segment carrying member and contact pin in unison, means in response to a signal carrier wave having an amplitude above said predetermined minimum for stopping the contact pin in a radial position corresponding to said carrier wave, and means for effecting closure of the motor circuit through the contact pin and one or the other of the commutator segments to cause continued operation of the motor in the corresponding direction until the dead spot between segments contacts the contact pin at which time the motor will be deenergized to stop the tuning device.

The novel features characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its construction and mode of operation together with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a view, partly in section, disclosing schematically the control mechanism according to one form of the invention;

Fig. 2 is a cross-sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a partial view of Fig. 1 showing the condition of the apparatus when operating as a scanning type of tuner;

Fig. 4 is a view similar to Fig. 3 showing the condition of the apparatus when operating as a hunting type of tuner;

Fig. 5 is a modified form of the invention; and Fig. 6 is an end view of Fig. 5.

In accordance with the invention, the station selector means of the control mechanism consists of a motor-actuated two-segment commutator separated by a dead spot or insulating gap which upon arriving in contact with a single contact, adjustably positioned in reference to the station carrier to be received, stops the hunting operation of the motor. The motor is of the reversible type having its field windings connected to the two segments of the commutator in the conventional manner. The selector contact and commutator both rotate together when the selector is scanning or running from one station to the next, but when a station carrier is found by the tuning element the selector contact is locked in position, and the commutator and tuning element continue in their original direction of rotation due to inertia. Eventually they stop and then reverse their direction of rotation due to the motor torque being reversed. The moment

the signal carrier is found by the tuning element, the selector contact locks itself to a fixed part of the mechanism and becomes a "marker" or reference point to which the selector finally comes to rest. The contact is carried by a rotatable arm of low mass so that it has practically no over-travel and will therefore stop almost instantly whereas the tuning element and the commutator have in comparison a much greater mass.

Briefly, the device functions as a scanning type of selector when running from one station to the next, having a motor reversing means at each limit of the tuning stroke, and is automatically converted to a hunting type of selector when the tuning element arrives at a station carrier of sufficient strength. With the use of this principle only one contact point is required for stopping at any angular position, since the contact point and the commutator rotate together until the two are separated by the incoming signal. It is possible, therefore, to obtain extreme accuracy in the stopping positions of the tuning element by gearing down so that the selector makes thousands of revolutions to one revolution of the tuning element.

Referring now to the drawings, and more particularly to Figs. 1 and 2, there is shown at 10 the tuning device of a radio receiver represented as a conventional type of rotary variable condenser, suitably supported from a bracket 11 mounted on a support 12 which may be the receiver chassis. On the shaft 13 of the rotary element of the tuning device is mounted a worm wheel 14 which meshes with a worm 15 formed at one end of a motor-driven shaft 16. The shaft is journaled in a bearing 17 carried by a bracket 18 also affixed to the receiver chassis 12. Affixed to the shaft 16 is a friction wheel 19 which is adapted to be driven by a second friction wheel 20 mounted on a shaft 21 of an electric motor indicated generally at 22.

The motor is of the reversible type being provided with an armature 23 to which the driving shaft 21 is attached and with a pair of field windings 24 and 25. The armature is capable of slight axial movement, being constrained, by spring means not shown, to assume the non-driving position shown in Fig. 1. Upon the motor becoming energized, the armature is thrust outwardly in an axial direction in opposition to the spring means to effect the coupling or driving relation between the driving wheel 20 and the driven wheel 19.

The common terminal of the motor field windings 24 and 25 is connected by way of a conductor 26 to one side of a source of power 27 which is constituted by a step-down transformer for stepping down the 110 volts available at the house current power supply mains to about 24 volts necessary for operating the motor. The other side of the power source (transformer secondary) is connected through a conductor 28 to a movable contact 29 of a switch 30, to be described later. The opposite terminals of windings 24 and 25 are connected, respectively, by way of conductors 31 and 32 to fixed contacts 33 and 34 of a motor reversing switch 35. The moveable element of this switch is in the form of a blade 36 which is centrally pivoted at 37 and is provided with an operating lever 38 disposed in the path of travel of a pair of pins 39 and 40 affixed to the side of worm wheel 14. The pins are spaced apart 180° to correspond with the two limiting positions of the tuning device.

In the position shown in Fig. 1 the tuning de-

vice has just reached one of its limits (the minimum capacity position) whereat switch blade 36 is snapped into the position shown, by action of pin 39 against lever 38. This closes the motor circuit through the field winding 25 which causes the motor to operate in the reverse direction, that is in the direction opposite to that which moved the tuning device to the minimum capacity position. The motor will so operate until the tuning condenser is moved to its other limit (the maximum capacity position) whereat switch blade 36 is snapped into its other position by action of pin 40 against lever 38. This closes the motor circuit through the other field winding 24 which causes the motor to again reverse its direction of operation. The back-and-forth movement of the tuning device between minimum and maximum capacity positions brought about by the motor when under control of the reversing switch 35 will hereinafter be referred to as the "scanning" operation.

Affixed to the motor-driven tuning shaft 16 at the right is a drum member 41 provided with a flange 42 to which there is attached a plate 43. Carried by this plate is a strip of insulation 44 to which there is attached a pair of commutator segments 45 and 46 separated by a narrow gap or dead spot 47. An insulating sleeve 48 is provided on the outer surface of the drum and carried on the sleeve are a plurality of collector rings 49, 50, 51 and 52. Rings 49 and 50 are electrically connected, respectively, to commutator segments 45 and 46, and rings 51 and 52 are electrically connected to the opposite terminals of a solenoid 53 contained within and adapted to rotate with the drum 41. Each ring has associated with it a contact brush, these being shown respectively at 54, 55, 56 and 57, suitably supported on an insulating block 58 carried on a bracket 59. Contact brushes 54 and 55 are connected respectively to the uncommon terminals of the motor field windings 25 and 24 by way of conductors 60 and 60', and contact brushes 56 and 57 have connected to them, respectively, a conductor 61 which leads to the -B terminal, and a conductor 62 which leads to the +B terminal of the receiver power supply through a solenoid-controlled armature, later to be described.

A bracket 63 mounted on the receiver chassis 12 has its upper part 63' offset slightly toward plate 43 to present a surface in parallel relation therewith. Formed integral with bracket part 63' or otherwise attached thereto is a bushing 64 which serves as a bearing for an axially shiftable and rotatable shaft 65, disposed in axial relation with reference to shaft 16. The left end of shaft 65 carries a plunger 66 which in the deenergized state of solenoid 41 extends partly into the drum in the manner shown in Fig. 1. The shaft 65 also carries to the right of the plunger a contact arm 67 which is provided on its opposite faces, in concentric relation with the plunger, with annular layers 68 and 69 of friction material, such as rubber. In the position shown for contact arm 67 the friction layer 69 is in contact relation with the side of bracket part 63' facing it, shaft 65 and contact arm 67 being urged to that position by means of an expansion spring 70 disposed between a pair of washers 71 and 72. The latter is keyed to move with the shaft while the former always remains in fixed position in contact with the end of bushing 64. With shaft 65 and arm 67 axially shifted to the left, due to energization of solenoid 41, the friction layer 68 on the opposite side of the arm 67 is forced into contact relation with the rotary

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drum plate 43. As a consequence contact arm 67 is caused to be rotated along with drum 41.

Contact arm 67 has affixed to it an insulating member 73 which carries a contact pin 74. In order that contact may be had between the pin and the commutator 45—47 at all times regardless of the axial position of the contact arm, the shank 75 of the pin is slidably mounted with a bushing 76 carried by member 73 and a coil spring 77 is disposed between the flange of the bushing and the pin head 78.

A flexible conductor 79 is connected between the contact pin and a collector ring 80 insulatingly mounted on the bushing 64. A brush contact 81 suitably supported on an insulating bracket 82 and arranged to contact with ring 80 is connected by way of a conductor 83 and a resistor 84 to a fixed contact 85 of the switch 30. A second fixed contact 86 of the switch 30 is connected by way of a conductor 87 to the center contact 88 of motor-reversing switch 35 which is electrically connected to the pivoted switch blade 36. Switch 30 is supported from the chassis 12 by a bracket 89 and is so positioned that its center flexible contact 29 is disposed adjacent to and in the path of an insulating member 90 carried at the end of shaft 65, the position of switch contact 29 being determined by the axial position of the shaft 65.

At 91 is shown a control tube which may constitute one of the radio frequency or intermediate frequency stages of the radio receiver to be controlled or a separate tube which is arranged to have impressed on its input electrodes a portion of the received signal energy. A solenoid 92 is connected in the plate circuit of tube 91, that is, between the plate electrode of the tube and the +B terminal of the receiver power supply. The armature 93 is also connected to the +B terminal and is arranged by spring means 94 to assume the normal position shown, that is, away from a fixed contact 95 to which conductor 62 is connected. For initiating operation of the control mechanism, there is connected between the plate side of the solenoid 92 and the -B terminal or ground a manual station selector switch or push-button 96.

The control mechanism above described operates in the following manner: For tuning in a station all that need be done by the operator is to actuate push-button 96. This completes a circuit through solenoid 92 as follows: from +B, solenoid 92, closed switch 96, to -B or ground. As a result armature 93 will be pulled over to contact 95 in opposition to spring 94 to close a circuit through solenoid 53 as follows: from +B, armature 93, contact 95, conductor 62, brush contact 57, collector ring 52, solenoid 53, collector ring 51, brush contact 56, conductor 61, to -B or ground. Sufficient current will then flow through solenoid 53 to pull the plunger 66 and the shaft 65 to the left in opposition to spring 70. This movement locks contact arm 67 to the face of drum plate 43 and permits flexible contact 29 of switch 30 to fall against contact 86, causing closure of the motor circuit through one or the other of the field windings 24, 25 depending upon the position of blade 36 of motor reversing switch 35. This condition of the mechanism for carrying out the "scanning" operation is shown diagrammatically in Fig. 3, the motor actuating the tuner 10 between its two limiting positions in order to scan the frequency range of the receiver. During the scanning operation commutator 44—47 and contact pin 74 will rotate in

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unison but due to the axial movement of shaft 65 contacts 29 and 85 which provide continuity from the contact pin to the motor are broken. The motor having started rotating, the station selector button 96 may be released but the solenoid remains energized due to the flow of current in the plate circuit of control tube 91 and will continue to be energized as long as the tuner is not tuned to a carrier wave of requisite signal strength.

When, however, the tuner is actuated to a position where the receiver is tuned to a station carrier of predetermined strength the plate current through control tube 91 will be reduced sufficiently to cause release of plunger 66 and, incidentally, contact arm 67 which, due to action of spring 70 is forced against the face of bracket part 63', arm 67 remaining fixed in a radial direction as determined by the point of release. The commutator 45—47, however, continues in its original direction of rotation due to inertia. Switch contacts 29 and 85 are now closed by reason of the return of shaft 65 to the right, so that contact pin 74 on one or the other of commutator segments 45, 46 provides continuity for the motor circuit. This condition of the mechanism for carrying out the "hunting" operation is shown diagrammatically in Fig. 4, the motor driving the commutator back and forth until its gap 47 coincides with contact pin 74 when the motor circuit is broken, deenergizing the motor and causing the tuner 10 to stop at the tuned-in position at which the receiver is adjusted to the carrier wave having a signal strength of predetermined value.

During the hunting operation the commutator gap passes the contact pin several times, the commutator coming to rest when the energy due to inertia is used up. In order to reduce the motor speed and therefore the number of back and forth movements of the commutator during the hunting operation, the resistor 84 is connected in series with the motor circuit. The motor-reversing switch 35, it will be noted, is not included in the motor circuit when the commutator is hunting since switch 30 is open at its contacts 29, 86.

After a station is tuned-in in the manner described, the next station in sequence of requisite signal strength can be tuned-in by actuating the station selector button anew.

It will be seen therefore from the description given above that by reason of the instantaneous setting of the low mass contact arm in response to a predetermined signal and by reason also of the high ratio gear reduction between the commutator and the tuning element there is secured a high degree of tuning accuracy.

A modified form of the invention is disclosed in Figs. 5 and 6 in which the positions of the contact pin 74 and the commutator 45—47 are transposed, the same reference characters as employed in Figs. 1 and 2 being used to designate the same or equivalent elements. Except for the fact that the commutator is shifted in an axial direction upon energization of the solenoid 53 to be locked for rotation with drum 41 during the scanning operation, and that contact pin 74 is oscillated back and forth with respect to the commutator segments during the hunting operation, the control mechanism shown in Figs. 5 and 6 operates in exactly the same manner as that disclosed in Figs. 1 and 2. A further description thereof is therefore believed unnecessary.

While I have shown and described preferred embodiments of the invention, it will be under-

stood by those skilled in the art that modifications and changes may be made without departing from the spirit and scope of the invention.

What I claim is:

1. The combination in a radio receiver, of an adjustable tuning device tunable through a certain frequency range, a reversible electric motor for actuating the tuning device, first control means including a solenoid and a two-position switch which is under the control of the armature of said solenoid, said control means being operable in response to manual control for energizing the solenoid and, through said switch in one of its positions, also the motor to actuate the tuning device in a manner such that it scans said frequency range in search for a carrier wave of a signal strength above a predetermined minimum, and second control means operable upon reception of such signal carrier wave adapted to deenergize said solenoid thereby to move the switch to its other position for deenergizing the motor and discontinuing the scanning operation, and circuit means closed through the switch in said other position for effecting operation of the motor in a manner such that the tuning device hunts for said received carrier wave prior to final adjustment thereof to said carrier wave.

2. The combination in a radio receiver, of an adjustable tuning device tunable through a certain frequency range, a reversible electric motor for actuating the tuning device having associated with it alternative energizing circuits, first control means including a solenoid and a two-position switch which is under the control of the armature of said solenoid, said control being operable in response to manual control for energizing the solenoid and, through said switch in one of its positions, also the motor through one of its circuits to actuate the tuning device in a continuous manner such that it scans said frequency range for a carrier wave of a signal strength above a predetermined minimum, and second control means operable upon reception of such signal carrier wave adapted to deenergize said solenoid thereby to move the switch to its other position for deenergizing said one motor circuit to thereby discontinue the scanning operation, and circuit means closed through the switch in said other position for effecting operation of the motor through its other circuit in a manner such that the tuning device hunts for said received carrier wave prior to final adjustment thereof to said carrier wave.

3. Control mechanism for effecting the automatic adjustment of the tuning device of a radio receiver to a transmitted signal carrier wave having an amplitude above a predetermined minimum, comprising a reversible electric motor for actuating the tuning device, a rotary member movable with the tuning device carrying a pair of commutator segments separated by a dead spot for determining the direction of motor operation, means for actuating said member from the motor, a contact pin cooperatively related with said rotary member, means for effecting rotation of the segment carrying member and contact pin in unison, means in response to a signal carrier wave having an amplitude above said predetermined minimum for stopping the contact pin in a radial position corresponding to said carrier wave, and means for effecting closure of the motor circuit through the contact pin and one or the other of the commutator segments to cause continued operation of the motor in the corresponding direction until the dead spot between segments con-

tacts the contact pin at which time the motor will be deenergized to stop the tuning device.

4. Control mechanism for effecting the automatic adjustment of a radio receiver tuning device to a transmitted signal carrier wave having an amplitude above a predetermined minimum, comprising a reversible electric motor, a commutator provided with a pair of conducting segments spaced apart by an insulating strip, means operable during operation of the motor for actuating the tuning device and the commutator, a rotary contact pin arranged in cooperative relation with the commutator, a control member adapted upon actuation to initiate operation of the mechanism, means operable in response to actuation of the control member for effecting rotation of the commutator and contact pin in unison, and means operable in response to a signal carrier wave having an amplitude above said predetermined minimum for making the last-mentioned operable means ineffective, whereby the contact pin is stopped in a radial position corresponding to said carrier wave, the contact pin in its stopped position remaining in contact with one or the other of the commutator segments to thereby determine the direction of motor operation which continues until the insulating strip of the commutator arrives in contact with the contact pin to deenergize the motor and cause the tuning device to stop at the position which tunes the receiver to said carrier wave.

5. Control mechanism as defined in claim 4 wherein the means operable during operation of the motor effects actuation of the tuning device and commutator in unison, the latter at a greater speed than the former.

6. Control mechanism as defined in claim 4 wherein the actuating means for the commutator includes a direct drive from the motor and that for the tuning device includes reduction gearing.

7. Control mechanism for effecting automatic adjustment of the tuning device of a radio receiver to a transmitted signal carrier wave having an amplitude above a predetermined minimum, comprising a reversible electric motor for driving the tuning device, a pair of alternative circuits for energizing the motor, a rotary member movable with the tuning device in a predetermined relation carrying a pair of commutator segments separated by a dead spot, an axially shiftable shaft, a rotary arm affixed to said shaft and carrying a contact pin, a two-position switch controlled by said shiftable shaft adapted in one position to energize the motor through one of said alternative circuits and in the other position to energize the motor through the other motor circuit which includes the commutator segments and contact pin, a control member upon actuation adapted to initiate operation of the mechanism by energizing said one motor circuit, means operable in response to actuation of the control member for effecting rotation of the commutator and contact pin in unison, and means operable in response to a signal carrier wave having an amplitude above said predetermined minimum for making the last-mentioned operable means ineffective whereby the contact pin is prevented from rotating with the commutator and is stopped at a radial position corresponding to said carrier wave, said contact arm in said stopped position cooperating with one or the other of the commutator segments to cause continued operation of the motor in the corresponding direction until the dead spot between segments is moved in contact with

the contact pin at which time the motor is deenergized to stop the tuning device at the point of adjustment whereat the radio receiver is tuned to said signal carrier wave.

8. Mechanism for effecting automatic adjustment of a radio receiver tuning device to a transmitted signal carrier wave having an amplitude above a predetermined minimum, comprising a reversible electric motor, means including reduction gearing for actuating the tuning device from the motor, a rotary member carrying a pair of commutator segments for determining the direction of motor operation, a fixed member spaced from the rotary member, means including a direct drive for actuating said rotary member from the motor, a rotary contact arm adapted for axial movement between said rotary and fixed members, a contact pin carried by said arm and arranged to cooperate with said commutator segments, a solenoid upon being energized arranged to shift the contact arm in driving relation with the rotary member, a normally open switch included in the motor circuit actuated to closed position with the shifting of the contact arm, means for energizing the solenoid in the absence of a signal carrier wave having an amplitude above said predetermined minimum and for deenergizing the solenoid upon reception of such carrier wave, manual means for initiating operation of the mechanism, means in response to a signal carrier wave having an amplitude above said minimum for deenergizing the solenoid to thereby release the contact carrying arm which assumes a fixed position in a radial direc-

tion, said contact arm in said fixed position cooperating with one or the other of the commutator segments to cause continued operation of the motor in the corresponding direction until the dead spot between segments is moved in contact with the contact pin, at which time the motor is deenergized to stop the tuning device at the point of adjustment whereat the radio receiver is tuned to said signal carrier wave.

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