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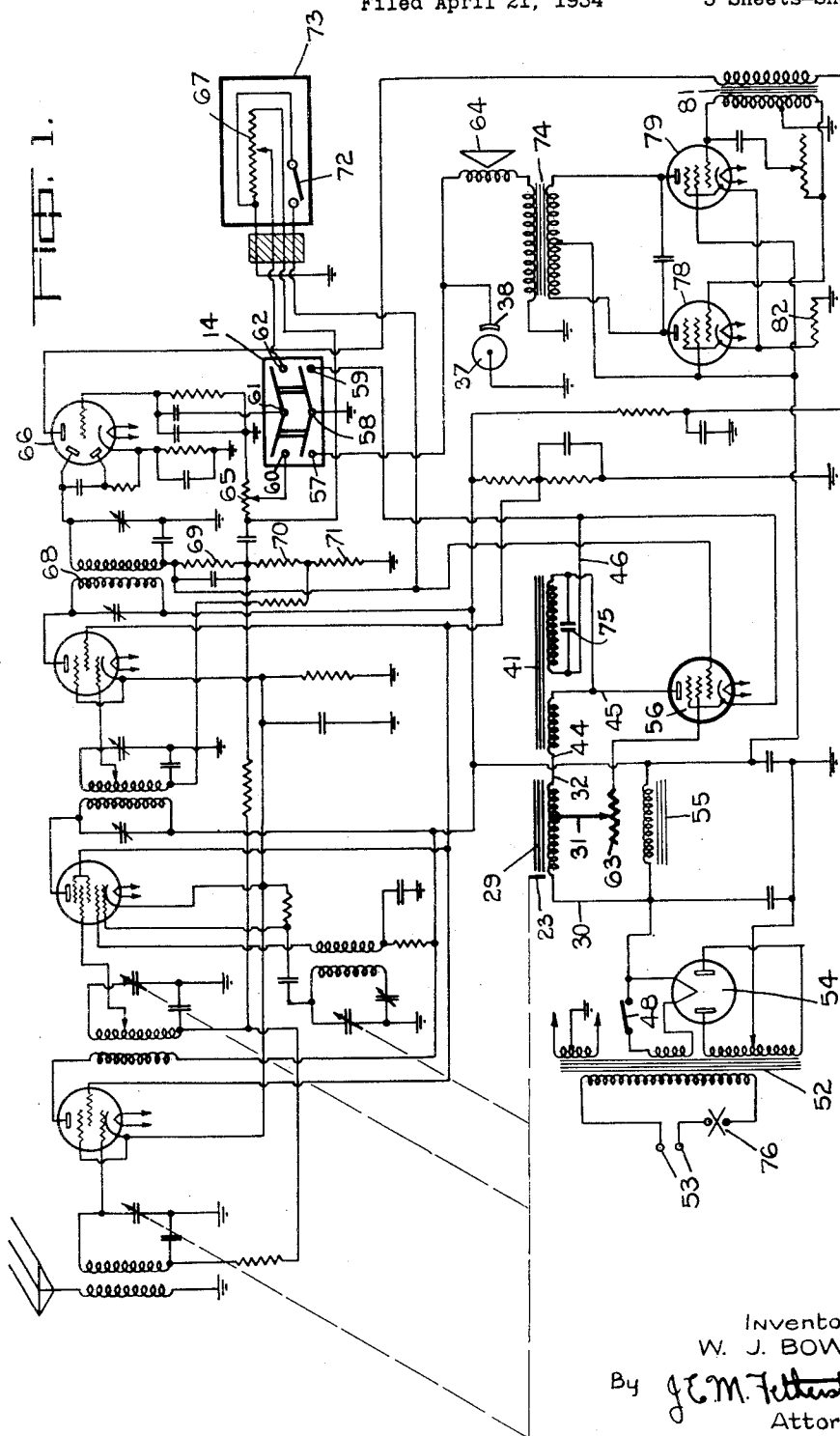
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2,098,331

AUTOMATIC STATION SELECTOR FOR RADIO RECEIVERS

Filed April 21, 1934

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

FIG. 2.

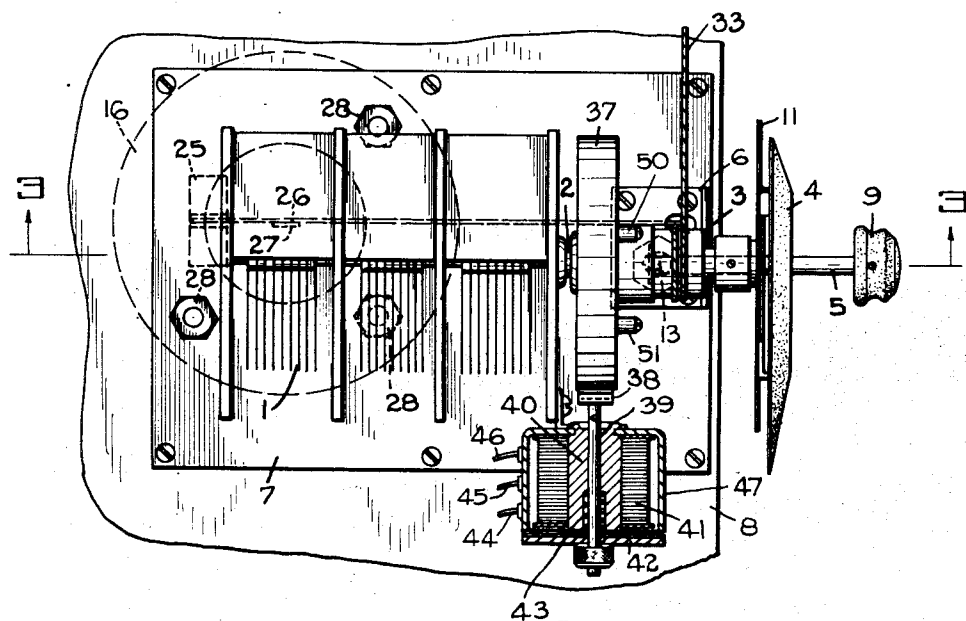
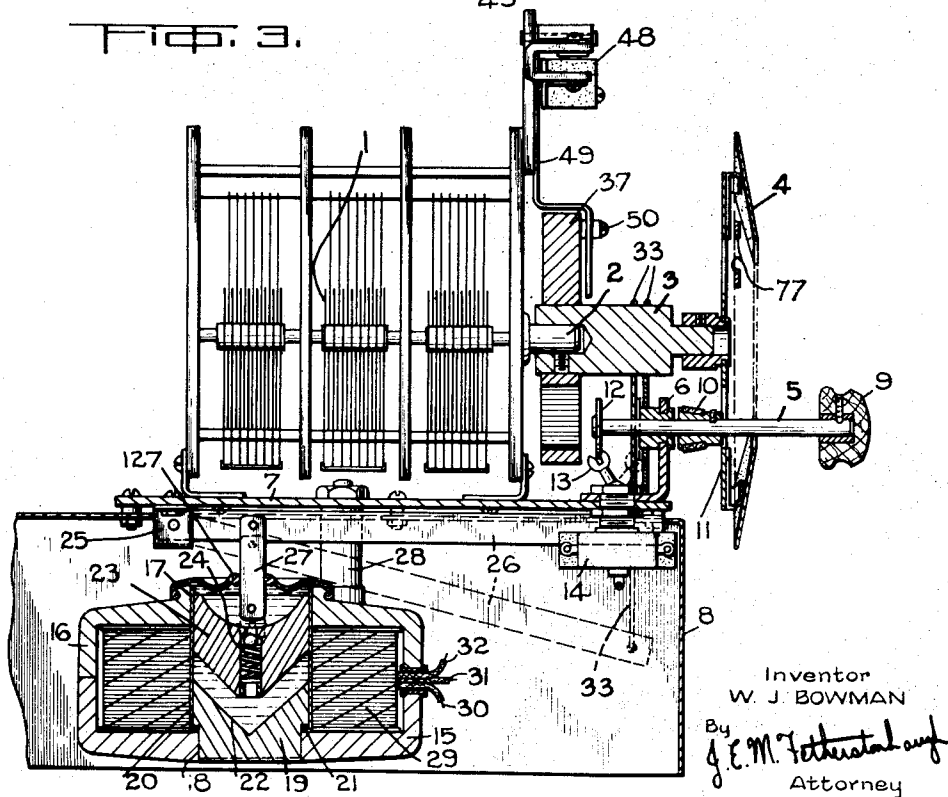


FIG. 3.



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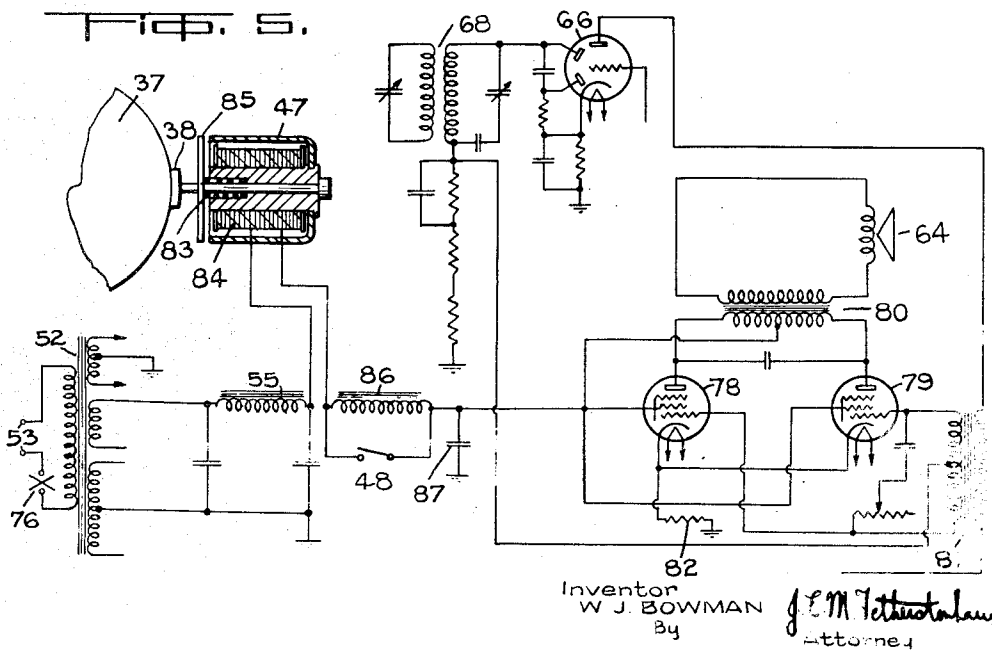
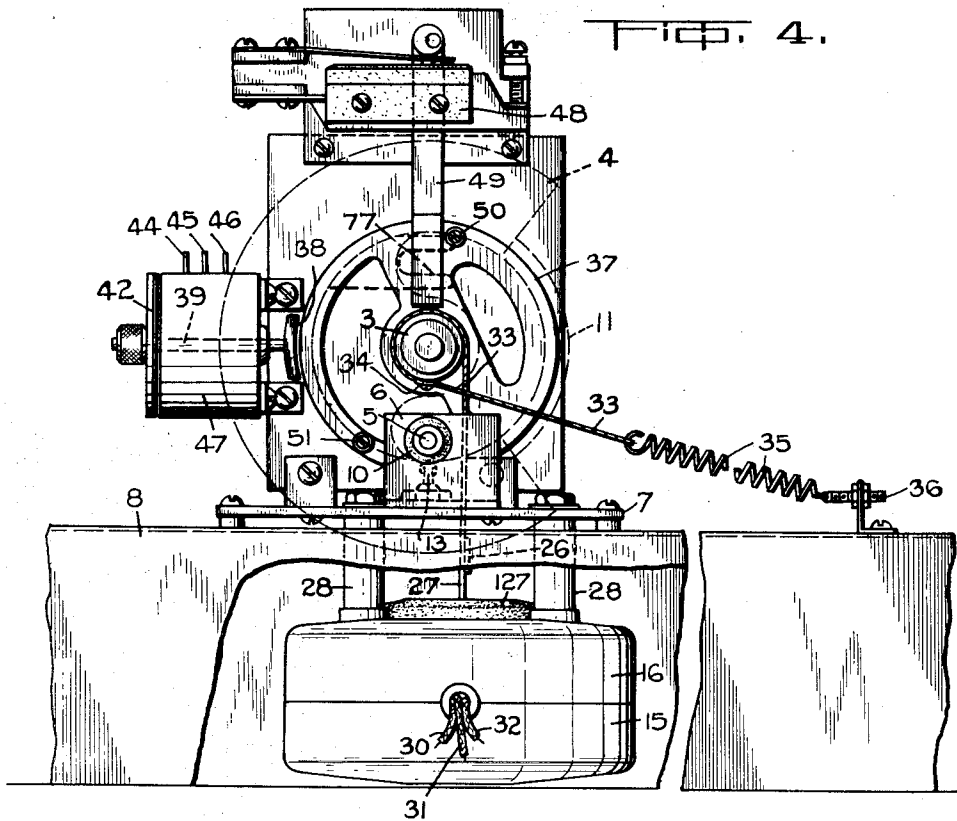
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AUTOMATIC STATION SELECTOR FOR RADIO RECEIVERS

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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,098,331

AUTOMATIC STATION SELECTOR FOR
RADIO RECEIVERSWilliam John Bowman, Kitchener, Ontario,
Canada

Application April 21, 1934, Serial No. 721,693

16 Claims. (Cl. 250—20)

My invention relates to improvements in automatic station selectors for radio receivers, and the object of the invention is to devise an apparatus which will automatically tune in only those stations of a signal strength above a predetermined level rejecting those below such level, such stations being capable of selection, at the will of the operator, successively across the frequency spectrum for which the radio receiver is designed.

A still further object is to provide means whereby any station selected by the apparatus may be rejected when the apparatus will automatically operate to select the next station of requisite signal strength, such means being controlled by the operator either at the receiver or at any desired point distant therefrom.

Another object is to devise means whereby the tuning in of the selected station is effected closer to substantial resonance than is possible manually without the use of resonance indicators.

Another object is to devise means whereby the selection of the stations is effected directly by the carrier of such station.

Another object is to provide means whereby the selection of stations by remote control is so arranged that the characteristics of its circuit are such that there is no danger of fire hazard or shock, such means being achieved without the use of relays or other complicated devices, and yet another object is to provide means for controlling the rejection of selected stations by the use of a single control switch.

Among other objects of the invention, which will hereinafter appear as the description proceeds, is the provision of means whereby the frequency regulating condenser gang may be alternatively operated automatically according to my invention or manually in the orthodox manner at will.

My invention consists of an apparatus, which in one practicable form, is constructed and arranged all as hereinafter more particularly described and illustrated in the accompanying drawings in which:—

Fig. 1 represents a circuit diagram of an orthodox radio receiver equipped with automatic volume control showing my apparatus connected in circuit therewith.

Fig. 2 is a plan view of the orthodox condenser gang assembly including the frequency indicating dial showing my apparatus operatively connected therewith.

Fig. 3 is a vertical section through the line 3—3 (Fig. 2).

Fig. 4 is a front elevation of the condenser gang

assembly as illustrated in Fig. 2, with the dial removed and indicated in dotted lines, and the chassis broken away to show my means for rotating the condenser rotor shaft.

Fig. 5 is a circuit diagram of part of the complete orthodox receiver circuit illustrated in Fig. 1 showing an alternative application of my control circuit in which the extra control tube hereinafter referred to with regard to the control circuit described in connection with Fig. 1 is dispensed with.

Like characters of reference indicate corresponding parts in the different views.

In the form of my apparatus as illustrated, the orthodox condenser gang includes rotors 1 and their shaft 2 as well as the shaft extension 3 to which latter is connected the frequency indicating dial 4.

The manual actuating means for the rotors of the condenser gang and dial has been modified to serve a dual purpose and according to my invention the spindle 5 is longitudinally slidable and rotatably mounted in the bracket 6 secured to the base plate 7 of the condenser gang which is, in turn, mounted on the chassis 8. The spindle 5 includes the operating knob 9 and a friction cone 10 which, when the spindle is in the forward position, is adapted to engage the preferably serrated friction ring 11 constituting an internal friction drive for the rotors of the condenser gang. The rear end of the spindle 5 is provided with a disc 12 adapted to extend into the bifurcated end of the lever 13 of a double pole double throw tumbler switch 14, the spring of the tumbler switch giving a trigger action to the lever 13. The spindle 5 will hold in either the forward or rear set positions.

Although my automatic driving means for the rotors of the condenser gang may consist of any suitable apparatus, as illustrated, it consists of a combination electromagnet and dash-pot, the dash-pot being required to check the speed of the condenser rotors. It comprises a magnet case 15 and a cover 16, both preferably constructed of a material of high magnetic permeability. Registering orifices 17 and 18 are provided in the magnet cover and case respectively. A shouldered core 19 is inserted into the orifice 18 and secured therein, for instance by turning its exposed extremity onto the undersurface of the magnet case. A dash-pot tube 20 of non-magnetic material surrounds the inwardly protruding portion of the core 19 having a lower lip extending over the core shoulder and a gasket 21 is provided to constitute a fluid seal.

The upper surface of the core 10 has an inverted conical indenture 22 disposed concentrically of the core, and a reciprocable plunger 23 is inserted into the tube 20, said plunger having a conical lower end corresponding to the conical indenture 22 in the core, both plunger and core being preferably constructed of material of high magnetic permeability. A one-way valve 24, as illustrated of the ball type, is provided in the plunger 23 adapted to admit fluid between plunger and core on the upstroke of the former.

The underneath surface of the base plate 7 carries a stud 25 to which one end of a lever 26 is pivotally connected. A link 27 is pivotally connected at one end to the lever intermediately of its length, the other end being pivotally connected to the plunger 23, said link extending through a flexible fluid seal 127 which closes the open end of the tube 20.

The driving magnet assembly may be supported from the base plate 7 by means of the upright studs 28.

Surrounding the tube 20 is an annular energizing coil 29 enclosed in the magnet case and having the leads 30, 31 and 32 extending through an orifice in such case.

33 is a flexible cable attached at one end to the free end of the lever 26 and adapted to be wound around the periphery of the shaft extension 3, being attached at one point 34 thereto, the other end of the cable being connected to a spring 35 which, in turn, is secured to an adjustable screw 36 mounted on the instrument chassis.

A combination brake drum and balance wheel 37 is mounted on the shaft extension 3, a shoe 38 being adapted to coact with the brake drum, said shoe being secured to the extremity of a spindle 39 of non-magnetic material extending freely through the core 40 of an electromagnet 41. An armature 42 is adjustably secured to the other end of the spindle 39, and a return spring 43 is interposed between the armature and the core. The energizing coil of the electromagnet comprises two sections, and three leads 44, 45 and 46 extend through the casing 47 which is part of the magnetic circuit, said electromagnet being mounted on the stationary frame of the condenser gang being insulated therefrom and constituting means for locking the condenser rotor assembly in any position dictated by the automatic tuning means.

A lever operated single pole single throw switch 48 is provided preferably on the frame of the condenser gang and its lever 49 preferably depends in front of the combined brake drum and balance wheel, said lever being adapted to be actuated into the closed and open positions respectively by two stops 50 and 51 mounted on the face of the combined brake drum and balance wheel. The point at which the switch operates may be varied by adjusting the position of the switch relatively to the lever.

Referring now to the circuit diagram illustrated in Fig. 1 which shows the complete circuit connections for a superheterodyne receiver including the loud speaker and power supply connections, the latter operated from the usual alternating current mains.

The power supply unit consists of a power transformer 52 having a primary winding connected to the alternating current mains 53, a high voltage secondary winding and two auxiliary windings for supplying filament current to the rectifier tube 54 and all other tubes employed in the receiver. The ends of the high voltage secondary winding are connected to the plates of the

above orthodox full wave rectifier tube 54. The centre tap of the high voltage secondary winding is connected to the chassis and will constitute the negative connection to the receiver, the positive connection is made to the filament of the rectifier tube and extends therefrom to one end of the energizing winding of the dynamic speaker field 55, the same serving as a filter choke as well. Both sides of the speaker field are by-passed to ground through condensers. One lead 30 from the coil 29 of the automatic condenser rotor driving mechanism is connected to the above positive connection, and the lead 32 is connected to the lead 46 of the electromagnet 41. The lead 45 which internally of the casing 47 connects the two coil sections together in such a way that their resultant fields are in opposition also extends externally and is connected to the plate of an additional vacuum tube 56, the lead 46 of the electromagnet being connected to the cathode of such tube 56 and, at the same time, to the terminal 59 of the switch 14 which also includes the respective terminals 57, 58, 60, 61 and 62. The lead 31, which is tapped into the coil 29 intermediately, extends to rheostat 63 and thence to the screen of the tube 56.

The terminal 58 is connected to the chassis, the terminal 57 is connected to the shoe 38 through the casing 47 of the electromagnet 41, and also to one terminal of the voice coil of the dynamic speaker 64, the terminal 60 is connected to the sliding member of the volume control 65 which is part of the receiver proper, the terminal 61 is connected to the control grid of the tube 66, which tube in the illustrated circuit serves the combined purposes of second detector, automatic volume control and first audio frequency amplifier, and the terminal 62 is connected to the sliding member of a subsidiary remote volume control 67.

The control grid of the tube 56 is connected to the low potential side of the secondary of the last intermediate radio frequency transformer 68. Resistors 69, 70 and 71 in the orthodox circuit supplying automatic volume control biasing voltages are, in the present invention, increased in resistance value.

One terminal of a remote control switch 72 is tapped into the connection between the control grid of the tube 56 and the intermediate frequency transformer 68 and the other terminal of such switch is connected to the chassis, i. e. the ground, said switch and remote volume control 67 being preferably disposed in the same unit 73, and the above connections preferably being flexible cables to make the unit 73 portable.

The other terminal of the voice coil of the dynamic speaker 64 is connected to one terminal of the secondary winding of the output transformer 74, the other end of the latter being grounded to the chassis.

The switch 48, which is connected into the filament circuit of the rectifier tube 54, serves to open or close such circuit.

The heater of the tube 56 is so connected as to be common with the heater circuits of the orthodox tubes.

A condenser 75 is connected between the terminals 45 and 46 of the electromagnet 41.

When it is desired to utilize the automatic station selecting means and upon the power supply switch 76 being closed, the apparatus is actuated as follows:—

The spindle 5 is disposed in the rearward position so that the switch 14 is in such position that the automatic condenser rotor driving means and

the automatic lock therefor, as well as the tube 56, are in circuit with the result that the coil 29 is energized drawing down the plunger 23 into the tube 20, the fluid between plunger and the core 19 checking the speed of its travel. Consequently the lever 26 connected to the plunger by the link 27 is pulled down and the shaft extension 3 and its attached condenser rotors are rotated in a clockwise direction by the movement of the cable 33 which is attached to the free end of the lever. The rotation of the condenser rotors continues until a signal of sufficient predetermined strength is tuned into resonance at which point a sufficiently high potential has been impressed upon the control grid of the tube 56 as to cause the latter to cut off or block. This causes that part of the current through the section of the coil 41 between the terminals 44 and 45 which is drawn by the plate of the tube 56 to fall to zero at the same time causing the current through the other section of the coil 41 to reach its maximum value, thus creating a magnetic flux of sufficient strength to attract the armature 42 and cause the connected shoe 38 to engage the brake drum 37 and hold the condenser rotor in the position corresponding to substantial resonance. The lock constituted by the magnetically operated shoe 38 is provided to stop the condenser rotors at the point of substantial resonance as it is obvious that without such means the condenser rotor assembly may oscillate about such point.

The section of coil 41 between terminals 44 and 45 is so connected with respect to the other section that the resultant magnetomotive force from the first section is opposed to that of the second section resulting in the lock operating more efficiently than it would with a single coil.

The rheostat 63 connected to the coil 29 through the intermediate lead 31 enables the speed of rotation of the condenser rotors to be varied, also regulating the point of cut off of the control tube 56 thereby governing the signal strength level above which the stations are selected.

The total screen current drawn by the tube 56 is compelled to pass through part of the above coil 29 and thus influences the retarding effect on the motion of the condenser rotors caused by the decrease in the plate current of the control tube 56.

In the event of its being desired to reject the station selected, the switch 72 of the remote control unit is closed thereby connecting the grid of the tube 56 to the chassis or ground resulting in restoring the current through the tube 56 thus simultaneously re-energizing coil 29 and also that section of coil 41 between the terminals 44 and 45, and de-energizing that section of coil 41 between terminals 45 and 46 so that the spring 43 in the magnetic locking device disengages the brake shoe 38 from the drum 37. The re-energizing of the coil 29 restores to operation the automatic driving means which functions again to further rotate the condenser rotors immediately the magnetic locking device is released. This cycle of operations can be repeated at will across the entire spectrum provided for in the receiver.

When the shoe 38 is disengaged from the brake drum 37 it will be observed that the voice coil circuit of the speaker 64 is open thus providing inter-station noise suppression. When the shoe 38 is brought into contact with the drum it acts as a switch for closing the speaker voice coil circuit.

The stations selected as opposed to the stations rejected by the automatic means are governed by

the magnitude of the rectified component of the current through the secondary of the last intermediate frequency transformer 68, which component is in fixed relation to the signal strength impressed upon the aerial of the receiver, although this relation may, of course, be affected to any desired extent by the automatic volume control.

The potential produced across the secondary of the transformer 68 by the above referred to current therethrough is impressed on the control grid of the tube 56, and thereby controls the operation of the tube. The section of the coil 41 between the leads 45 and 46 is connected across the plate and cathode of the tube 56, and when sufficient potential is impressed on the control grid of the tube it will block, cutting off all current flowing through the portion of the coil 29 between the leads 30 and 32 except that due to the current drawn by the portion of the coil 41 shunted across the tube. The resistance of this latter coil section is arbitrarily chosen at such a value that it permits sufficient current to flow through the coil 29 when the tube is blocked to produce a pull on the plunger 23 which just balances the opposing pull of the spring 35 with the result that rotation of the condenser rotors is stopped when the tube 56 blocks. Whenever, also the tube 56 is blocked by an incoming signal of sufficient strength to generate a blocking potential across the coil 68, the screen of the tube, which is connected in series with the rheostat 63, will draw no current. The screen potential of the tube 56 will govern the magnitude of the potential across the coil 68 which is required to block the tube, and by adjusting the setting of the rheostat 63 the strength of a signal required to generate such a potential across the coil may be predetermined, to thereby predetermine the minimum strength of a signal held at resonance with the receiver by the tuner.

When the condenser rotors reach the limit of rotation which corresponds with one end of its spectrum, the stop 51 engages the lever 49 of the switch 48 opening the switch and the filament circuit of the tube 54 and shutting off the high voltage supply to the entire receiver including the automatic condenser rotor driving and locking means. The extended spring 35, through the medium of the cable 33 which is wound about the shaft extension 3, now restores the condenser rotors to their initial position by rotating them in a counterclockwise direction. The valve 24 in the plunger 23, as the latter is pulled up by the lever mechanism attached to the cable, opens and permits the fluid to flow freely back between such plunger and the core 19, thus obviating any checking of the rapid return of the condenser rotors to their initial position under the influence of the spring. As the condenser rotors reach their initial position the stop 50 engages the lever 49 closing the switch 48 and the connected filament circuit of the rectifier tube 54 and thus the apparatus will recommence the scanning of the spectrum.

It will be noted that, by virtue of the conical indenture 22 in the core 19, the conical shape of the lower end of the plunger 23, and the fact that the plunger 23 is of such length that an air gap is opened up between its outer end and the magnet cover 16 as it is drawn completely within the coil 29, the electromagnetic force exerted on the plunger 23 at any instant on energization of the coil 29 is substantially a linear function of the distance of the plunger from the fixed core 19.

As the plunger is drawn into the coil, a part of the magnetic flux fringes into a direction at right angles to the line of travel of the plunger, while the remainder fringes into a direction perpendicular to the conical surfaces of the plunger and core. The proportion of flux taking the latter path increases as the plunger approaches the fixed core, thereby decreasing the rate of increase of pull on the plunger when compared with the rate of increase obtaining if the plunger and core were of conventional form. In addition to this effect, the opening of the air gap at the outer end of the plunger as it approaches the inner limit of its travel further decreases the rate of increase of pull on the plunger and the two effects in combination result in the linear relationship between the force on the plunger and its position with relation to the fixed core above referred to.

To operate the receiver in the orthodox manner manually in which case the automatic control will be inoperative, it is only necessary to pull forward the spindle 5 of the condenser rotor drive so that the cone 10 engages the ring 11 when, by turning the spindle, the condenser rotors can be rotated. As the spindle 5 is pulled forward the switch 14 is actuated to render the automatic condenser rotor driving means and the locking means therefor inoperative. A stop 17 is provided on the dial support adapted to engage the spindle 5 for limiting the rotation of the dial and connected brake drum so that the stop 51 cannot engage the switch lever 59 to open the switch 48. If the switch 48 is connected elsewhere in the circuit, for instance, in the connection made to terminal 59 of switch 14, the above referred to stop may be eliminated. Since the magnetic locking means including the means therein for closing and opening the voice coil circuit of the speaker is inoperative during manual operation of the receiver, such voice coil circuit is completed during the manual operation of the receiver by the connections to the terminals 58 and 57 of the switch 14.

While one practicable form of my invention has been described above and illustrated, I recognize that there are an almost infinite number of ways of incorporating the broad idea of continuously and automatically scanning the frequency spectrum of a radio receiver, and automatically arresting the operation of scanning when the receiver is at substantial resonance with a signal of predetermined strength by an energizing impulse furnished to the scanning means by the signal itself, in each of a number of different orthodox radio circuits.

It is also possible by suitably re-arranging an orthodox receiver circuit, to provide the automatic tuning system with its arresting impulse at the frequency of a suitable signal without using any tube such as the control tube 56 described above.

In the alternative form illustrated in Fig. 5, the two output tubes 78 and 79 are shown as connected in push-pull serving the double purpose of transmitting power at audio frequency to the loud speaker 64 and controlling the automatic condenser rotor driving and locking mechanism. The plates of the tubes 78 and 79 are fed through the centre tapped primary of the output transformer 80 and also through the driving unit coil 86 (the equivalent of the coil 29) and the locking magnet coil 84 (the equivalent of the coil 41), both coils being in this instance simple coils instead of sectional coils as

used in the control circuit illustrated in Fig. 1. Since these coils are part of said plate circuit, they must be fed with a properly filtered current which is obtained from the positive side of the filtered high-voltage output, instead of the filament terminal of the rectifier tube 54 as is the case in the circuit illustrated in Fig. 1.

The centre tap of the secondary of the interstage transformer 81 is connected to the low potential side of the secondary of the last intermediate radio frequency transformer 68. The plate return for the tubes 78 and 79 is made through the automatic bias resistor 82, the resistance value of which must be reduced in comparison with that applicable in the case of the control described with reference to Fig. 1, while the current carrying capacity of the resistor 82 and of the primary of the output transformer 80 must be increased.

In this modified application the shoe 38 instead of being operated magnetically into engagement with drum 37 as in the case of the preceding form is now adapted to be spring-held in such engagement by the spring 83 and is disengaged from the drum by magnetic means i. e. the coil 84 and armature 85 to which latter the shoe 38 is secured. If interstation noise suppression is desired, it may be effected by different means than that above described.

The condenser 87 is connected to the chassis as shown for the purpose hereinafter described.

The voltage delivered by the high voltage secondary of the transformer 52 must be increased in order to compensate for the voltage drop introduced by the resistance of the coils 86 and 84.

The functions of the other parts of the device, such as the return switch 48, the switch 14 and the remote control switch 72 remain the same as described with reference to Fig. 1, with the exception that switch 48 is connected across coil 86, and is adapted to remain open while the condenser rotors are being driven by the magnetic driving means, and to be closed while the rotors are being revolved in the return direction by the spring 35.

The operation of the automatic tuning means in this alternative form is similar to that described with respect to the circuit shown in Fig. 1 except for the method of utilizing the controlling potential obtained from the low potential side of the secondary of the last intermediate frequency transformer 68, which is as follows:—

When power is supplied to the receiver by closing switch 76, with the spindle 5 disposed in the rearward position, the plates of the tubes 78 and 79 draw current considerably in excess of their normal operating current by virtue of the decreased bias potential supplied to said tubes by the voltage drop across resistor 82. This excess current passing through the coil 86, energizes the automatic condenser rotor driving means thus causing the condenser rotors to revolve. When the radio circuit approaches resonance with a signal, the voltage impressed upon the control grids of tubes 78 and 79 causes the plate current thereof to decrease, until, at resonance, said current through coil 86 produces just sufficient torque in the driving means to balance the torque exerted by the spring 35, bringing the rotors to a stop. While the receiver is not at resonance with a signal, excess current to the plates of tubes 78 and 79 energizes the locking magnet coil 84, attracting the armature 85 against the tension of spring 83 and holding the rotor locking shoe 38 away from the drum 37. At resonance, owing

to the decrease in the current through the coil 84, the spring 83 will overcome the magnetic attraction of the coil and force the shoe against the drum locking the condenser rotors in position.

In this alternative arrangement the switch 48 short-circuits the coil 86 of the driving mechanism and renders the same inoperative so that the spring 35 will rotate the condenser rotors in the reverse direction after the spectrum has been searched over. Condenser 87 forms, along with the reactance of the driving unit and locking units, additional filtering means for the current supplied to the plates of tubes 78 and 79.

The driving means for the condenser rotors shown and described above may also be replaced by any other means responsive to the changes in the electrical characteristics of the radio circuit and/or its power supply circuit occasioned by the receiver being tuned to resonance with a signal. One example of such other means would be a bimetallic strip anchored at one end to the chassis, with means attached to the other end for transmitting any movement thereof to the condenser rotors and with a heating coil around such bimetallic strip connected similarly to the magnetic coil 29 in the driving unit of the above form of my invention thereby causing the bimetallic strip to deform and drive the condenser rotors in a manner similar to the above electromagnetic means.

What I claim as my invention is—

1. In tuning devices for radio circuits, the combination with power actuated frequency changing means for the radio circuit for scanning the spectrum through which the circuit is adapted to tune, of continuously operative power controlling means for the frequency changing means actuated by an incoming signal including means for causing the power controlling means to exert a controlling effect as resonance with the incoming signal is approached such that the magnitude of the controlling effect is a function of the amplitude of the signal resonance curve and its rate of application is a function of the steepness of such curve.

2. In tuning devices for radio circuits, the combination with power actuated frequency changing means for the radio circuit for scanning the spectrum through which the circuit is adapted to tune, of continuously operative power controlling means for the frequency changing means actuated by an incoming signal above a predetermined strength at the moment of tuning including means for causing the power controlling means to exert a controlling effect as resonance with the incoming signal is approached such that the magnitude of the controlling effect is a function of the amplitude of the signal resonance curve and its rate of application is a function of the steepness of such curve.

3. In tuning devices for radio circuits, means for scanning a spectrum containing a plurality of signals, means for causing the scanning means to select from such signals only those which are of at least a predetermined signal strength, and continuously operative controlling means for the selecting means responsive to each signal received and exerting a controlling effect as resonance with a signal is approached such that the magnitude of the controlling effect is a function of the amplitude of the signal resonance curve and its rate of application is a function of the steepness of such curve.

4. In tuning devices for radio circuits, means for selecting from a plurality of incoming signals one signal of at least a predetermined signal strength, continuously operative means for controlling the selecting means by each signal received and exerting a controlling effect as resonance with each signal is approached such that the magnitude of the controlling effect is a function of the amplitude of the signal resonance curve and its rate of application is a function of the steepness of such curve, and means for subsequently temporarily nullifying the controlling effect of the first mentioned signal to permit the continuously operative means to select the next signal of at least the said predetermined strength.

5. In tuning devices for radio receivers, in combination, a plate supply circuit including a rectifier and a filter, frequency changing and controlling means for automatically selecting from a plurality of incoming signals one signal of at least a predetermined signal strength, continuously operative means for controlling the selecting means by each signal received and exerting a controlling effect as resonance with each signal is approached such that the magnitude of the controlling effect is a function of the amplitude of the signal resonance curve and its rate of application is a function of the steepness of such curve, and means for subsequently temporarily nullifying the controlling effect of the first mentioned signal to permit the continuously operative means to select the next signal of at least the said predetermined strength, and power means for actuating the frequency changing means by the unfiltered current supplied by the rectifier.

6. In tuning devices for radio receivers, in combination, a plate supply circuit including a rectifier and a filter, frequency changing means, power means for actuating the frequency changing means by the unfiltered current supplied by the rectifier, means for causing an incoming signal to generate a control potential in the receiver circuit as resonance with the signal is approached, and means for controlling the supply of unfiltered current to the frequency changing means inversely proportionally to the magnitude of the control potential.

7. In tuning devices for radio receivers, as claimed in claim 6, means for temporarily short-circuiting the control potential to thereby nullify the effect of the control potential on the means for controlling the supply of current to the frequency changing means.

8. In tuning devices for radio receivers, the combination with a variable tuning condenser, of power driven means for varying the capacity of the condenser to scan the spectrum through which the receiver is adapted to tune, means for causing each signal received to generate a potential in the radio circuit, and continuously operative means for automatically controlling the power driven condenser capacity varying means by the potential generated by the incoming signal including means for causing the potential to exert a controlling effect as resonance with the incoming signal is approached such that the magnitude of the controlling effect is a function of the amplitude of the signal resonance curve and its rate of application is a function of the steepness of such curve.

9. In tuning devices for radio receivers as claimed in claim 8, means for subsequently nullifying the controlling effect of the potential gen-

erated by the incoming signal for permitting the power driven means to vary the capacity of the condenser to tune the circuit into resonance with another signal.

5 10. In tuning devices for radio receivers, in combination, a plate circuit, a plate supply circuit including a rectifier and a filter, frequency changing means and power means controlled by a potential generated by the incoming signal for
10 actuating the frequency changing means by the unfiltered current supplied by the rectifier such that the power is an inverse function of the distance of the radio circuit from resonance.

11. In tuning devices for radio receivers, in
15 combination, a plate circuit, a plate supply circuit including a rectifier and a filter, frequency changing means and power means controlled by a potential generated by the incoming signal for actuating the frequency changing means by the
20 unfiltered current supplied by the rectifier such that the power is an inverse function of the distance of the radio circuit from resonance and provided the potential of the signal is at least of predetermined strength the power application to the
25 frequency changing means becomes zero at substantial resonance.

12. In tuning devices for radio receivers, the combination with power actuated frequency changing means for the radio circuit, of continuously operative power controlling means for the
30 frequency changing means for causing the latter to scan a spectrum and select signals of a predetermined strength including means for causing the power controlling means to exert a controlling effect as resonance with each signal selected
35 is approached such that the magnitude of the controlling effect is a function of the amplitude of the resonance curve of each signal selected and its rate of application is a function of the steepness of such curve, means for rendering the power
40 controlling means inoperative upon the frequency changing means reaching the end of its travel which corresponds with the end of the spectrum, means for subsequently restoring the frequency
45 changing means to its initial position corresponding to the opposite end of the spectrum, and means for rendering the power controlling means operative again upon such frequency changing means reaching such initial position whereby the
50 spectrum is rescanned.

13. In tuning devices for radio receivers as claimed in claim 12, means for temporarily interrupting the power controlling means for the frequency changing means for rejecting a selected station.

14. In tuning devices for radio receivers, the combination with a variable tuning condenser, of electromagnetic means for actuating the variable tuning condenser to cause the same to scan a spectrum and select signals of a predetermined strength, means for energizing the electromagnetic means from a unidirectional current source, controlling means for such current actuated by a potential generated in the radio circuit by the incoming signal, means for temporarily nullifying
15 the potential generated by such signal whereby the electromagnetic means functions to actuate the variable tuning condenser to substantial resonance with another incoming signal of different frequency, means for rendering inoperative the
20 electromagnetic means upon the tuning condenser reaching the limit of its travel corresponding with the end of the spectrum, means for subsequently returning said tuning condenser to its initial position, and means for rendering the electromagnetic means operative again to cause the
25 tuning condenser to rescan the spectrum, the said means functioning upon the tuning condenser reaching its initial position.

15. In tuning devices for radio receivers, the combination with a variable condenser, of electromagnetic means for actuating the condenser comprising an energizing coil, a magnetic circuit including a fixed core and a movable core within the coil and an external connection completing
35 the magnetic circuit, a dash-pot tube surrounding the fixed and movable cores, the latter reciprocable in the tube and constituting a dash-pot plunger, damping fluid in the tube, fluid sealing means for the end of the tube remote from the fixed core, and means for operatively connecting
40 the movable core to the variable condenser through the sealing means.

16. In a device as claimed in claim 15, a construction such that the electromagnetic force exerted on the movable core upon the coil being energized is a linear function of the distance of the movable core from the fixed core.

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