Sept. 10, 1929. A. H. GREBE 1,727,641

FREQUENCY RANGE EXTENSION SWITCH

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Fig. 2.

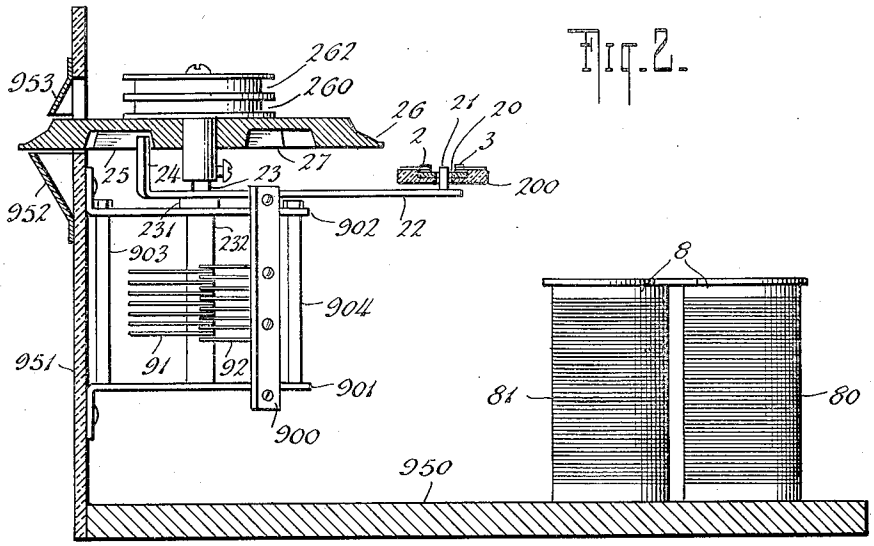
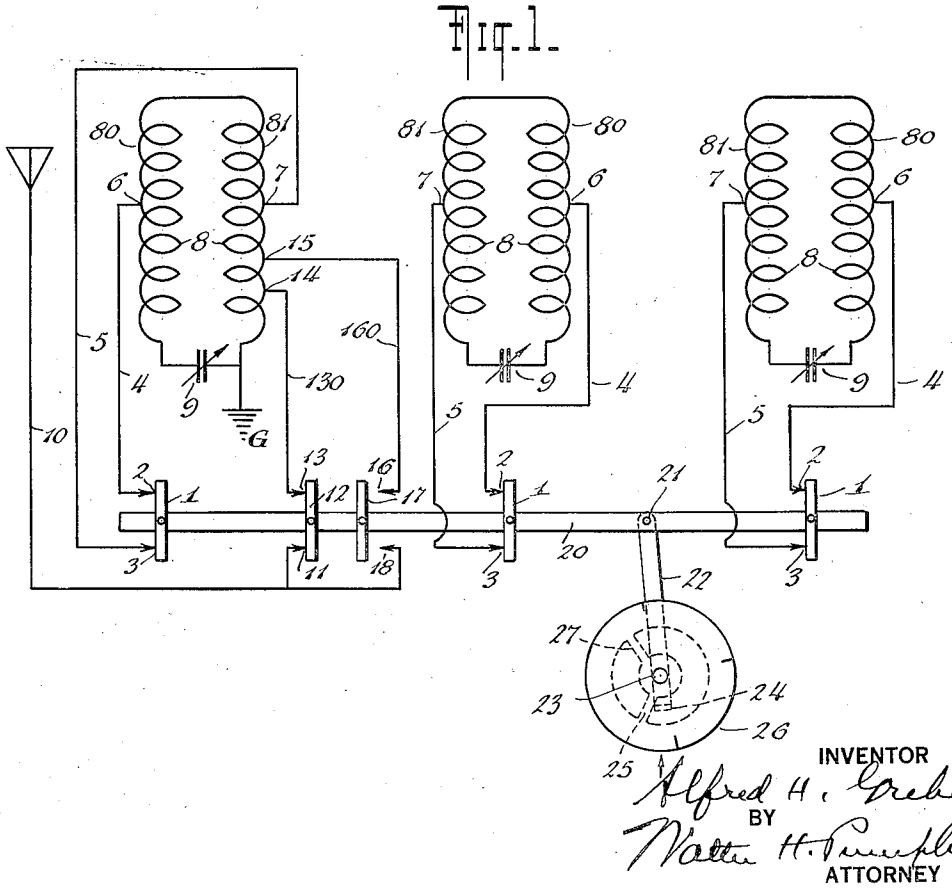


Fig. 1.



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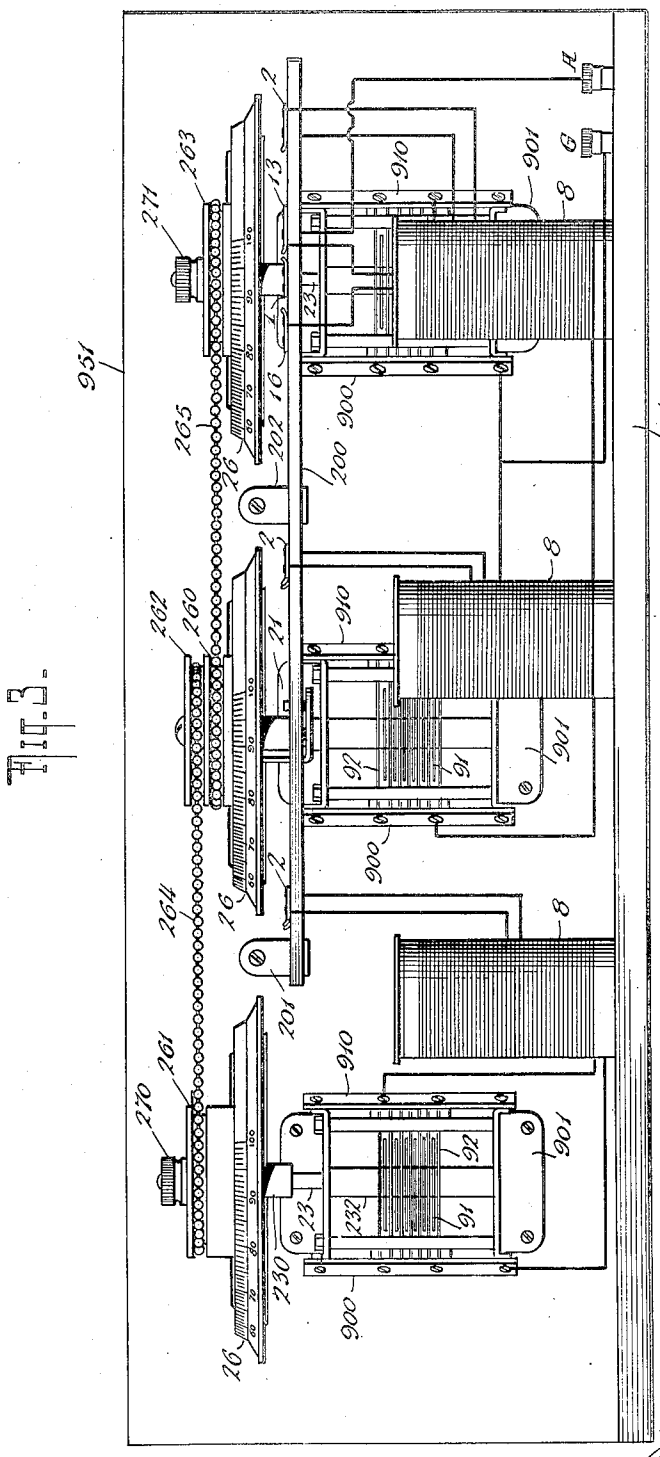


Fig. 3.

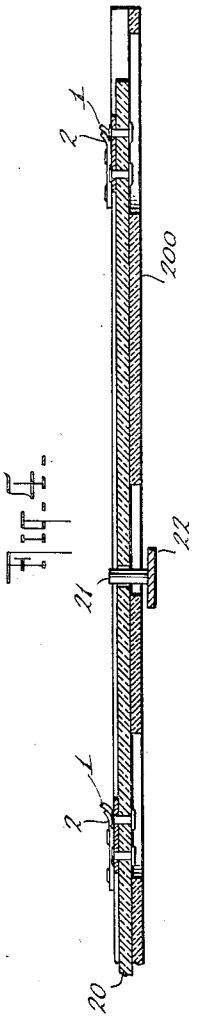


Fig. 4.

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FREQUENCY RANGE EXTENSION SWITCH

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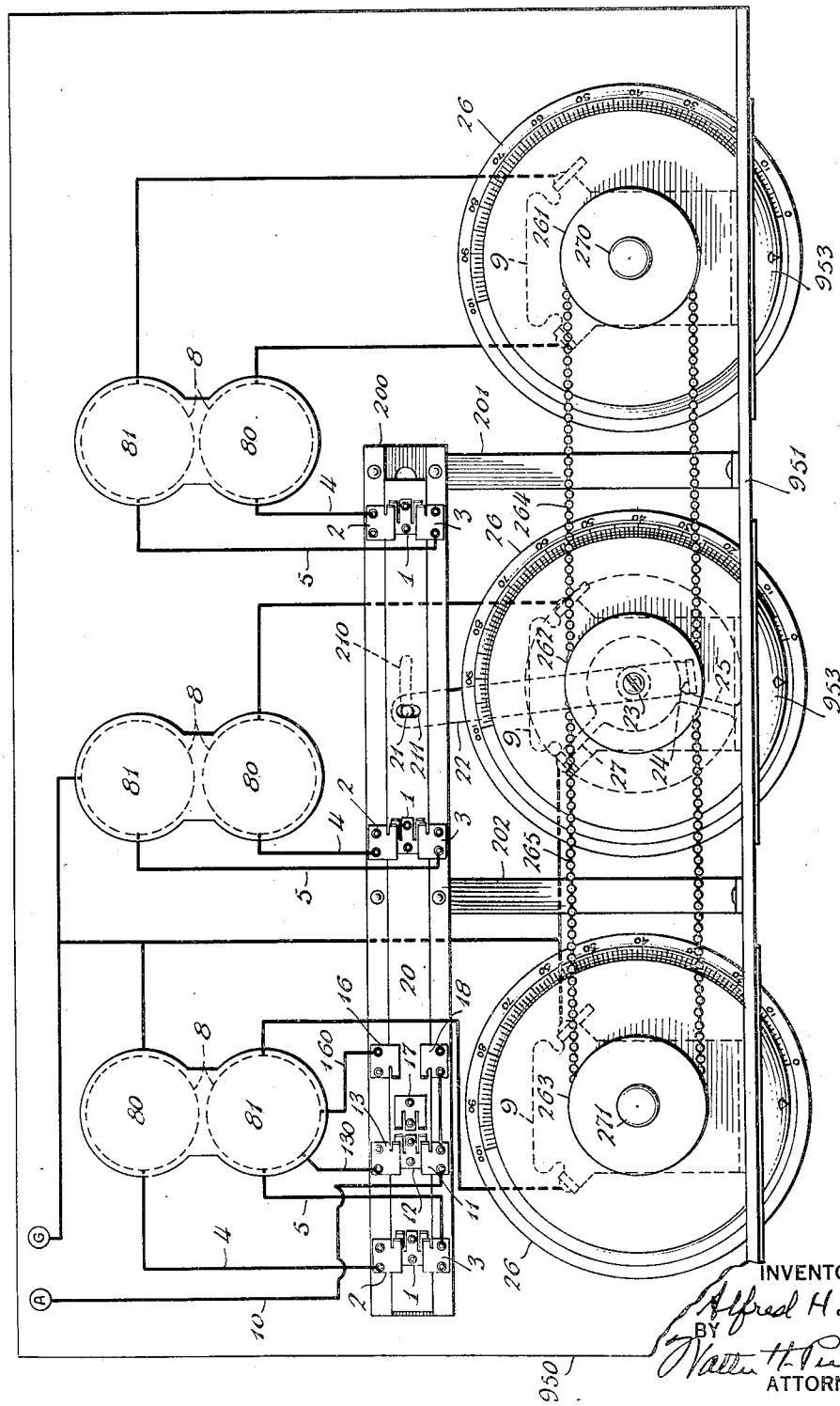


FIG. 5.

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UNITED STATES PATENT OFFICE.

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FREQUENCY-RANGE EXTENSION SWITCH.

Application filed January 30, 1926. Serial No. 84,922.

This invention relates to range extension switches and has for its principal object the extension of the range of frequencies over which a radio tuning system is capable of operating efficiently.

In carrying out my invention, I provide successive tuning systems made up of inductances and variable capacities and switches operated simultaneously, preferably by a common member, to change the inductances in all of the circuits when the variable capacities reach their upper limits and when they reach their lower limits of capacity.

In the manufacture of radio tuning systems for receiving broadcasting stations, it has been found impractical to construct efficient combinations of an inductance and variable capacity that can be satisfactorily tuned to all frequencies used in broadcasting and I therefore provide two values of inductance, one value of inductance being such as to make the receiver tunable to a frequency which is as high or higher than the frequency of any broadcasting station and the other inductance value being such as to make the receiver tunable to a frequency which is as low or lower than that of any broadcasting station.

The two frequency ranges thus provided may overlap more or less and give a total range from above to below the frequencies at present used by broadcasting stations. I also provide an arrangement whereby one control knob simultaneously varies the frequencies of all of the circuits and automatically switches to the lower values of inductance when the condensers, connected to the higher values of inductance, are varied beyond the point of their minimum capacity and vice versa, switches to the higher inductance values when the condensers, connected to the lower value of inductance, are varied beyond the point of maximum capacity.

I thus provide an extension of receiving range covering the entire broadcasting range, and means for automatically and conveniently changing from either one to the other of the overlapping ranges.

My invention is described and explained in further detail in connection with the following illustrations:

Fig. 1 is a diagrammatic sketch of the circuits and switches of a receiving set.

Fig. 2 is a cross sectional view of a receiving set illustrated in Figs. 3 and 4, showing the main control dial switch operating lever, common bar of the control member and supporting members.

Fig. 3 is a rear view of the set, showing control members, switches, condensers and inductance coils.

Fig. 4 is an enlarged sectional view of a portion of the common movable member carrying the switch contacts; and

Fig. 5 is a top view of the set, showing the control members, switches, inductance coils and circuit connections operated by the switches.

Referring now to the drawings, I have shown in Fig. 1, an arrangement of inductances and capacities as used in one form of a radio broadcast receiver wherein I provide for the use of two values of inductance in the antenna to ground circuit and two values of inductance in each of three tunable circuits, comprising an inductance and variable capacity. Three inductances 8, each comprising two coils 80, 81 connected in series with condensers 9, are so varied by my switching system, hereinafter described in detail, that two ranges of radio frequencies may be covered.

A bar 20 of insulating material, carries five switch blades 1, 12, 17 and is movable from left to right in the arrangement shown in this figure. When moved to the left position, blades 1 connect with contacts 2, 3 and blade 12 connects with contacts 11, 13. When moved to the right hand position blade 17 connects with contacts 16, 18.

In the left position antenna lead 10 connects through contact 11, blade 12, contact 13, lead 130, coil 81 at 14 and thence to ground G. Also in this left position, portions of inductances 8, are short circuited between points 6 and 7 through the switch blades 1, by way of contacts 2, 3 and connecting leads 4, 5.

In the right hand position a greater amount of inductance is operable in all circuits as the antenna lead 10, is connected

through contact 18, switch blade 17, contact 16, lead 160 and connection 15 through more turns of coil 81 to ground G; and inductances 8 are not short circuited in any position.

Dial 26, attached to shaft 23 of one of the variable condensers 9, turns with the variation of the condenser so that a rib 25, on dial 26, presses against a boss 24 when condenser 9 is at minimum capacity and a rib 27 presses against boss 24 when condenser 9 is at maximum capacity.

When the minimum range has been reached with all of the inductances or when the maximum range has been reached with the lesser inductances dial 26 is movable beyond the point of minimum capacity and rib 25 or 27 can push against boss 24 causing arm 22 to turn about shaft 23 and transfer the motion through pin 21 to bar 20 and thereby move the switch blades from left to right or vice versa, automatically shifting from one set of inductance values to the other.

Fig. 2 shows in more detail a base 950, front panel 951, dial shields 952, 953, variable condenser frames 900, 901, 903, movable plates 91 and fixed plates 92, of a condenser, condenser shaft 23, shaft enlargement 232, washer 231, boss 24, arm 22, ribs 25 and 27, dial 26, bar 20, pin 21, contacts 2 and 3 and supporting frame 200 for bar 20, together with attached flanged wheels 260 and 262, and coils 81 and 80 comprising inductance 8.

Fig. 3 shows a rear view of the complete receiver, in which three similar tuning condensers are so coupled together by belts that all variations of the middle condenser, for example, are duplicated in the adjoining condensers.

Beaded belts 264 and 265, extending around and secured to flanged wheels 261, 262, 260 and 263, operatively connect the condensers so that the movement of the dial of any one condenser will produce a similar movement of the other two dials.

Thumb nuts 270, 271, clamp the flanged wheels 261, and 263 against the dials and when one or the other is unscrewed slightly, it allows that wheel to slip, without transmitting motion to the condenser, when another dial is turned. Thus, it will be seen, that the dials may be turned separately, in pairs or all three simultaneously. If the slack provided in the belts 264 and 265 is not sufficient to allow the condenser to be set with slight differences in capacities to make up for capacity variation due to the effect of the antenna or metal framework in the vicinity, the clamp nuts 270 and 271 may be used to extend the adjustment.

The details of the construction and operation of the unit control means for radio receiving sets, above briefly described, will be found fully disclosed and claimed in my application filed May 13, 1925, and serially numbered 30,033, now Patent No. 1,608,734, dated November 30, 1926.

Supporting frame 200 is shown fastened by brackets 201 and 202 to the panel 951. The details of the frame 200, bar 20, switch blades 1, contacts 2, pin 21 and arm 22, are shown in Fig. 4.

Fig. 5 shows a top view of the parts including the belts 264, 265, flanged wheels 261, 262, 263, ribs 25, 27, arm 22, pivot point 23, clearance hole 211 in bar 20 for pin 21, clearance slot 210 in support 200, brackets 201, 202, slotted spring switch blades 1, 12, 17, and slotted spring contacts 2, 3, 11, 13, 16, 18 together with antenna binding post A, ground G and other numbered parts corresponding to the similarly numbered parts described in the other figures.

Referring to all figures, the operation is as follows:

When control dial 26, on the shaft 23 of a variable condenser, is moved beyond the minimum capacity point of the condenser, it presses rib 25 against boss 24, causing arm 22 to pivot about 23 and push bar 20 with which it is connected through pin 21, so that switch blades 1 and 12 connect with contacts 2 and 3 and 11 and 13, thereby reducing the number of effective turns of wire in the coils 80 and 81. Likewise when dial 26 is tuned beyond the maximum capacity of the condenser, rib 27 presses against boss 24 and moves bar 20, so that switch blade 17 is brought into contact with 16 and 18 and switch blades 1 and 12 are disconnected so that the effective number of turns is increased.

The many important advantages of the invention will be apparent from the foregoing description.

Having, therefore, described my invention, what I claim is:

1. Tuning apparatus comprising a plurality of independent inductance units, condensers normally rotatable through only 180° connected in shunt with each of said inductance units providing circuits responsive to a predetermined frequency range said inductances being tapped at a plurality of points along the length thereof, switch contacts connected with the taps on said inductances, an actuator, a plurality of switch blades carried by said actuator and arranged to cooperate with said contacts, rotary means for simultaneously varying the capacity of each of said condensers, and a lost motion connection between said rotary means and said actuator for shifting said actuator to a selected one of either of two positions and connecting or disconnecting said switch blades with respect to said contacts.

2. Tuning apparatus comprising a plurality of independent tuning circuits, each of said circuits including inductance and variable condenser normally rotatable through

only 180°, each inductance being divided into a plurality of portions connected in series, a plurality of sets of switch contacts connected to portions of said inductances, an actuating member, a plurality of switch blades carried by said actuating member and arranged to establish connection with said switch contacts when said actuating member is moved to a selected position, a rotary control device for simultaneously varying the capacity of each of said condensers, and a lost motion connection between said rotary control device and said actuating member for shifting said actuating member to either of two limiting positions and connecting or disconnecting said switch blades with selected sets of contacts for rendering effective or ineffective selected portions of said inductances in proportion to the adjustment of said condensers.

3. Tuning apparatus comprising a plurality of tuning circuits each including inductance and capacity elements connected in series, said capacity elements being normally rotatable through only 180° of motion, an actuator for simultaneously controlling the adjustment of said capacity elements, said inductance elements being tapped at predetermined points and connected to sets of switch contacts, switch blades for establishing connection with said contacts, an independent actuator for controlling the movement of said switch blades and a lost motion connection between said first mentioned actuator and said last mentioned actuator for shifting said last mentioned actuator to either of two limiting positions when said capacity elements are shifted to maximum or minimum positions.

4. Tuning apparatus comprising a plurality of independent circuits each including inductance and capacity elements connected in series, said capacity elements being variable condensers normally rotatable through only 180°, taps extending from predetermined points on said inductance elements to sets of contacts, switch blades cooperating with each of said sets of contacts, a rotary actuator for simultaneously adjusting said capacity elements, a control member connected with said switch blades, means extending between said control member and said rotary actuator for imparting movement to said control member when said rotary actuator is moved to either of two limiting positions, whereby said switch blades may be shifted with respect to said contacts.

5. Tuning apparatus comprising a plurality of independent tuning circuits each including inductance and capacity elements, said capacity elements being variable condensers normally rotatable through only 180°, and said inductance elements being tapped and having connections extending to sets of contacts, switch blades arranged to bridge said sets of contacts, a control member carrying said switch blades, a rotary actuator for simultaneously adjusting said capacity elements between maximum and minimum capacity values, means extending between said control member and said rotary actuator for shifting said control member to either of two selected positions when said capacity elements approach maximum or minimum values whereby selected ones of said switch blades connect with sets of contacts for shunting portions of said inductance elements when said rotary actuator is shifted to a position of minimum capacity value.

6. Tuning apparatus comprising a plurality of independent inductances, a variable condenser normally rotatable through only 180° arranged in circuit with each of said inductances, an actuator for simultaneously controlling all of said variable condensers, a switch member connected with each of said inductances, a reciprocating member arranged to control each of said switch members and a lost motion connection between said actuator and said reciprocatory member for imparting movement to said reciprocatory member at the limits of travel of said actuator.

7. Tuning apparatus including a plurality of independent tuning circuits each constituted by inductance and capacity elements, said capacity elements being normally rotatable through only 180° and variable between maximum and minimum limits, tapped connections leading from said inductance elements to sets of switch contacts, a reciprocatory member, switch blades carried by said reciprocatory member in cooperative relation to said switch contacts, means for shifting said member when said variable capacity elements are moved to the maximum and minimum limits for connecting or disconnecting said switch blades from said contacts.

8. Tuning apparatus comprising a plurality of tuning circuits each including inductance and capacity elements, said capacity elements being normally rotatable through only 180°, a pair of independent actuators, one of said actuators carrying a plurality of switch blades and the other of said actuators connected with each of said capacity elements for simultaneously varying the capacity thereof between maximum and minimum limits, contacts connected to taps on portions of said inductance elements, selected ones of said contacts being connected by said switch blades when the actuator carrying said blades is shifted to either one of two limiting positions, and means connecting said actuators for effecting a shift in the position of said switch blades when said capacity elements are adjusted to positions of maximum and minimum limits.

9. Circuit tuning means comprising an inductance variable to two values, a variable capacity normally rotatable through only 180°,

and means for automatically varying the inductance when the capacity reaches minimum and maximum values so as to render the variable capacity effective throughout its entire range with each value of the inductance.

10. Circuit tuning means comprising an inductance variable to two values, and a variable capacity normally rotatable through only 180°, a switch for varying the inductance, a control member for varying the capacity, and a connection between the switch and capacity control member, which operates to change the value of the inductance only at the minimum and maximum capacity positions of the control member, whereby the variable capacity is rendered effective throughout its entire range with either value of the inductance.

11. In a radio receiver, tuning means comprising an inductance in series with a variable condenser normally rotatable through only 180°, means for giving the inductance either of two values, and means operated from the variable condenser to control the first said means so as to change the inductance to its higher value at the maximum adjustment of the condenser and to change the inductance to its lower value at the minimum adjustment of the condenser.

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