Aug. 12, 1941. F. W. GODSEY, JR. 2,251,995

ELECTRICAL DEVICE

Filed Aug. 5, 1938 2 Sheets-Sheet 1

Fig. 1.

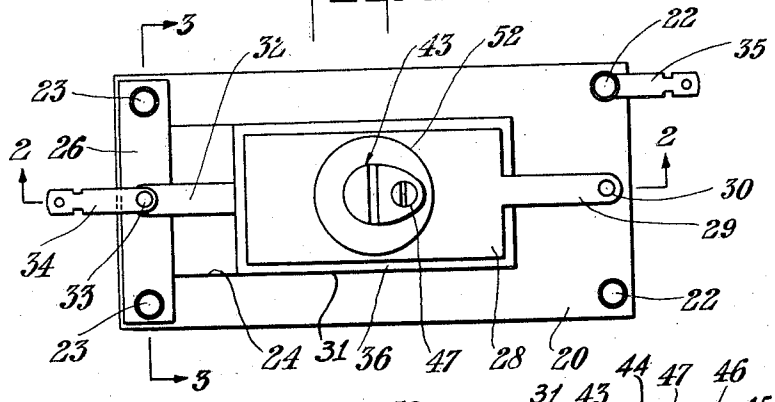


Fig. 2.

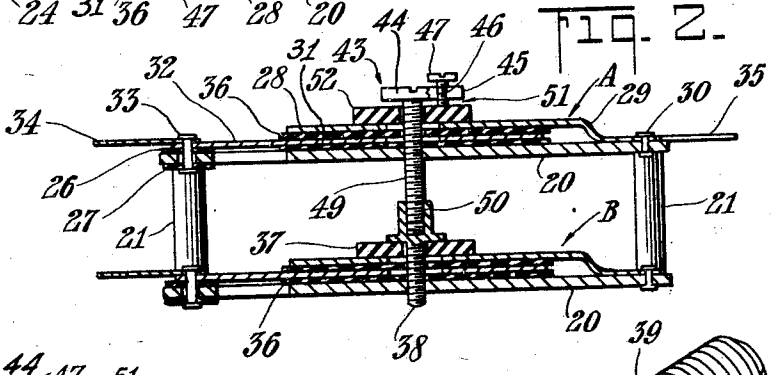


Fig. 3.

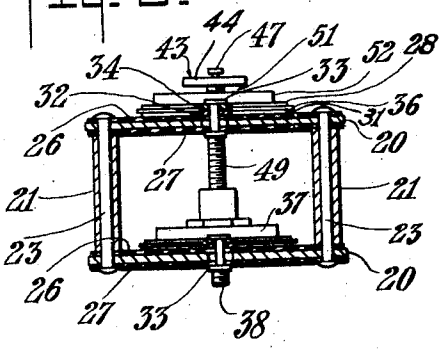


Fig. 4.

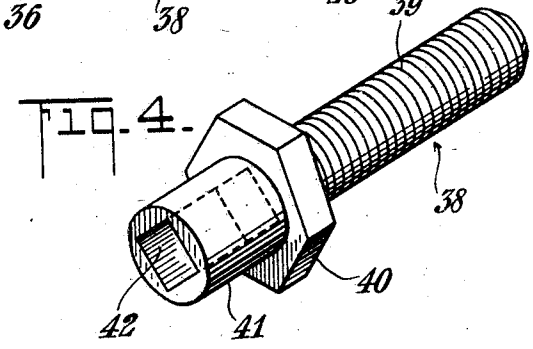


Fig. 5.

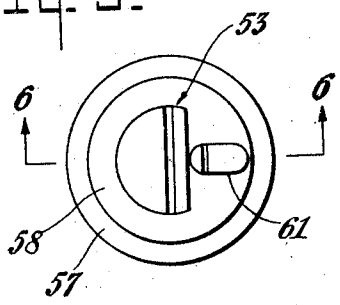
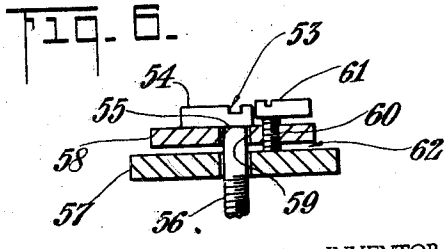


Fig. 6.



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Fig. 7.

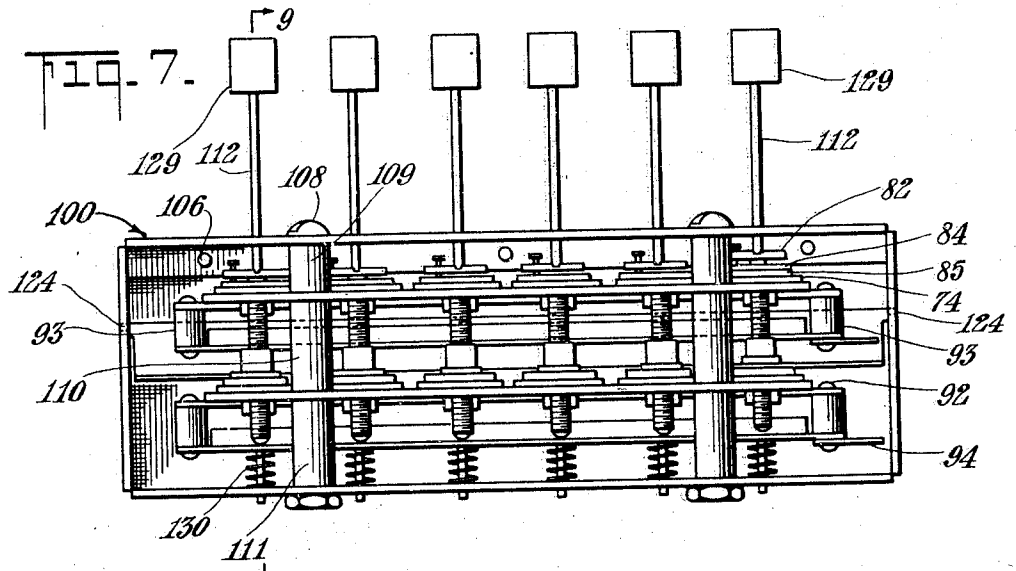
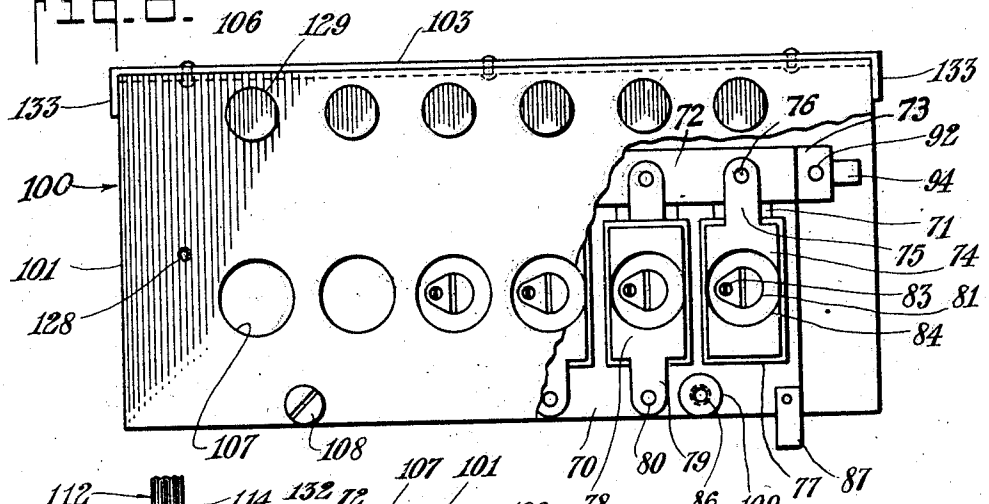


Fig. 8.



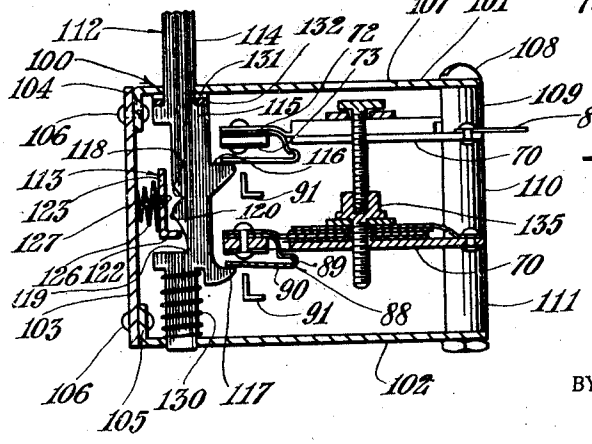


Fig. 9.

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UNITED STATES PATENT OFFICE

2,251,995

ELECTRICAL DEVICE

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Application August 5, 1938, Serial No. 223,299

5 Claims. (Cl. 175—41.5)

The present invention relates to electrical condensers and more particularly to a condenser assembly of two or more units, which are provided with a common adjustment means. Such condensers have many applications and will be illustrated in their use in radio receivers.

The condenser assembly of my invention is particularly adapted for use in the automatic tuning of radio receivers by the so-called condenser substitution method, and will be described in greater detail in this connection.

As is known, in this method of automatic tuning, the ganged variable tuning condenser assembly is substituted by semi-adjustable, so-called trimmer type condensers, which are pre-adjusted to the resonant frequency of the station selected.

As a rule, for this purpose a bank of individually independent semi-adjustable condensers were used, such bank consisting of a plurality of sets of condensers each set being adjusted to tune the radio receiver to one pre-selected frequency corresponding to the frequency of the station desired. The number of condensers in each set correspond to the number of circuits which are to be tuned, whereas the number of sets correspond to the number of frequencies or stations desired.

As the condensers of each set of such prior assemblies were independent and had to be individually adjusted, it was often necessary to make concurrent adjustments of the individual condensers of a set, a procedure which is both tedious and difficult. As this task has frequently to be done by the user of the radio receiver, unskilled in such work, the drawback of such prior devices is obvious.

The present invention obviates the above difficulty by replacing the individually adjusted condensers of a set, with assemblies of condensers which are provided with a common adjusting means for all of the condensers of the set.

It should be well understood that the invention is not limited to the above example, but has wide application wherever the capacities of a plurality of condensers have to be simultaneously adjusted.

It is therefore an object of this invention to provide a multiple unit semi-adjustable condenser assembly, the condensers of which are adjustable by means of a common adjustment means.

Another object of my invention is to provide a multiple unit semi-adjustable condenser assembly having a common adjustment means and in which furthermore the capacity of one or more of the condensers may be also separately adjusted without affecting the adjustment of the other condensers of the assembly.

A further object of my invention is to provide a trimmer condenser in which rough and fine capacity adjustment means are provided.

A further object of my invention is to provide an adjustable condenser with fine adjustment means of the vernier type.

A further object of my invention is to provide for adjusting means for a plurality of condensers which permit all adjustments to be made from one side of the condenser assembly.

Another object of my invention is to provide a novel multiple unit condenser assembly for the automatic tuning of radio receivers which is compact and simple to adjust.

These and further objects of my invention will be specifically pointed out in the specification and in the appended claims.

My invention will be further described with reference to the appended drawings in which:

Figure 1 is a top view of an embodiment of a trimmer condenser assembly made in accordance with my invention.

Fig. 2 is a section along the line 2—2 of Fig. 1 showing the two trimmer condensers of the assembly disposed one above the other in accordance with my invention.

Fig. 3 is a section along the line 3—3 of Fig. 1.

Fig. 4 is an enlarged perspective view of the adjustment screw for the lower condenser of Fig. 2.

Fig. 5 is a top view of a different embodiment of a vernier adjustment for the condenser assembly of my invention.

Fig. 6 is a section along the line 6—6 of Fig. 5.

Fig. 7 is a side view of an automatic tuning device embodying the condensers of my invention.

Fig. 8 is a top view with parts broken away of the device of Fig. 7.

Fig. 9 is a section along the line 9—9 of Fig. 7.

Referring to the drawings, in Figs. 1 and 2 there is shown a condenser assembly comprising an upper condenser unit A and a lower condenser unit B each disposed on a flat rectangular metal base 20, these bases being in parallel planes one above the other, and are preferably stamped from sheets of cold-rolled steel or other hard metal and as will be explained later may itself form part of the condenser unit. The bases 20—20 are spacedly fixed to each other by means of four hollow metal cylinders 21 through the whole length of

which pass rivets 22—22 and 23—23 to hold the assembly together as shown in Figs. 2 and 3.

Disposed above and below each of the bases, at one of their side edges are strips 26 and 27 of insulating material such as hard rubber, Bakelite or the like. The strips 26 and 27 are secured to their respective plates by means of the rivets 23—23 and the ends of the distancing cylinders 21.

Each of the condenser units as shown comprises as the electrode of one polarity each base 20 and a rectangular metal plate 28 having an integral extension lug 29 secured and electrically connected to the base by a rivet 30. The plate 28 is preferably of a highly resilient metal, for example, of phosphor bronze.

As the electrodes of the other polarity, I provide for each condenser individual rectangular plates 31 having integral extension lugs 32, secured to the insulating strip 26 by a rivet 33 passing through an enlarged hole of the base 20 and anchored in the lower insulating strip 27. The plates 31 are preferably of the same material as the plates 28, i. e., of phosphor bronze or other resilient metal.

Clamped between the head of the rivet 33 and the lug 32 is an outwardly extending terminal 34 for external electrical connection. A common terminal 35 of similar construction is shown to be provided on the other end of the top base 20 for the other electrical connection, whereby the metal cylinders 21 electrically interconnect the two condenser units.

Interposed between the base 20 and the plate 31 and the plate 31 and plate 28 respectively, are corresponding layers of dielectrical material, for example, mica plates 36. It is well understood that for larger capacity condensers additional electrodes and dielectric plates may be added in known manner.

The capacity of the condensers is adjustable by means of adjustment screws in accordance with the invention and later to be more fully described.

Suitable enlarged holes are provided in the plates 28 and 31 to provide non-contacting passage for the respective adjustment screws of the condensers whereas the holes provided in the mica plates 36, are preferably only slightly larger than the adjustment screws so as to serve as positioning means for these plates.

To prevent contact of the electrode plate 31 or the lug 32 with the base 20, the latter is provided with a rectangular perforation 24.

The adjustment means for the lower condenser unit comprises an adjustment bolt 38 and a washer 37.

The adjustment bolt 38 as shown in Fig. 4, comprises a threaded portion 39 adapted to engage corresponding threads provided in the lower base 20, and an enlarged hexangular head 40 which in turn, extends into a cylindrical shank portion 41. The shank 41 is provided with a rectangular bore 42 for the purpose later to be more fully described.

Interposed between the bolt head 40 and the electrode plate 28 is a washer 37. The washer 37 is preferably of steel or other conducting material if the topmost electrode plate is of the same polarity as the base, as herein illustrated. However, if the topmost plate is of the opposite polarity, i. e., a plate 31, the washer is of insulating material such as "Isolantite", hard rubber, "Bakelite," etc.

The capacity of the condenser is adjustable in known manner by rotations of the bolt 38.

The adjustment means for the upper condenser unit A comprises a bolt 43, having a head 44 provided with an extending offset portion 45. The portion 45 is provided with a tapped bore 46 for reasons later to be more fully explained.

Interposed between the bolt head 44 and the electrode plate 28 is a washer 52 similar to the washer 37 described in connection with condenser unit B.

The bolt 43 is provided with a threaded portion 49, which engages corresponding threads provided in the base 20, and with a rectangular shank portion 50 which engages the rectangular recess 42 of the bolt 38, so that any angular movement given to the bolt 43 produces a concurrent angular displacement of the lower bolt 38.

To obtain a vernier adjustment of the capacity of the upper condenser I provide in the tapped bore 46 of the offset head portion 45 a small adjustment screw 47 which passes through it to a sufficient extent to provide and maintain a gap 51 between the bolt head 44 and the washer 52.

The adjustment means for the condenser assembly of the invention operates in the following manner:

If an angular displacement is given to the bolt 43 it produces a similar rotation of the bolt 38 because of the engagement of its portion 50 in the recess 42 of the bolt 38 as has been already stated above. Thus to produce simultaneous changes of the capacities of both condenser units A and B, it is only necessary to rotate the bolt 43. The capacity of condenser A may be further adjusted independently and without disturbing the capacity of unit B, by means of the auxiliary screw 47, the rotation of which varies the gap 51 formed between the bolt head 44 and the washer 52.

In practice the fine adjustment means can serve several purposes. For example, if the two condensers are to be adjusted to identical capacities, but the same amount of adjustment does not quite achieve this purpose, a compensating adjustment of one by the fine adjustment of the invention makes possible the necessary correction and furthermore all of the adjustments are made from one side of the condenser assembly.

Another embodiment of the fine adjustment means is shown in Figs. 5 and 6. It comprises an adjustment bolt 53 provided with a chorded head 54, a rectangular shaft portion 55 and a threaded portion 56. Between the head 54 and a washer 57—which washer is similar to the washers shown as 37 and 52 in Fig. 2—there is disposed a second washer 58 provided with a rectangular slot 59 which fittingly engages the rectangular shaft portion 55 of the bolt 53. The washer 58 is further provided with an eccentrically disposed tapped bore 60 adapted to receive a small adjustment screw 61. Screw 61 is provided with an ovate head which abuts the chorded side of the head 54, whereby the rotation of the screw 61 is limited in its angular displacement.

The screw 61 is threaded through the washer 58 to a sufficient extent to provide between the washer 58 and the washer 57 a gap 62 which can be varied by the rotation of the screw 61 to produce a vernier adjustment of the capacity.

It should be well understood that my invention is applicable equally as well to assemblies comprising more than two condenser units. In such assemblies a simultaneous adjustment of the capacity of the units may be obtained by providing each of the adjustment bolts 38 with a rectangu-

lar shank portion similar to the portion 50 of the bolt 43, which shank portion then engages a corresponding recess 42 of the next bolt 38 of the next lower condenser.

Referring now to the automatic tuning device shown in Figs. 7, 8, and 9; this device comprises an assembly of a plurality of adjustable trimmer-type condensers and corresponding switching means to place these condensers in circuit.

The condenser assembly shown in the drawings comprises two rows of six condensers each. The number of condensers per row corresponds to the number of frequencies, i. e. broadcasting stations, for which automatic tuning can be obtained with a given setting of the condensers, whereas the number of rows corresponds to the number of tuned circuits in which these condensers are to be inserted, i. e. the number of gangs of an equivalent variable tuning condenser.

As will be later more fully explained, for any selected frequency two condensers arranged one above the other as in Figs. 7 and 9 are placed in circuit by a corresponding setting of the switch. The two condensers of each group have such capacity ranges that the circuits in which they are inserted can be tuned to their respective required frequency ranges, whereas the capacity ranges of the different sets are preferably in overlapping progression of such values that the entire tuning band is covered. However, except for differences in capacity ranges, the construction of all the condensers of each row is substantially the same.

For the sake of simplicity neither description nor illustration is given of the circuits of the radio receiver for which the device is used, such being well known to one skilled in the art.

The condensers of the assembly, shown in Figs. 7, 8 and 9 are disposed in two parallel rows one above the other, each row disposed on a common metal base 70, preferably stamped from a sheet of cold rolled steel or other hard metal. Disposed lengthwise over and beneath the base at one of its edges are two strips of insulating material 72 and 73 respectively, each of hard rubber, "Bakelite" or the like. The strip 73 is of such length that it extends from both sides of the base 70, for purposes later to be more fully described.

Each of the bases 70 forms a common armature plate or electrode for each of the condensers disposed thereon. As a second armature plate I provide for each condenser individual rectangular plates 74 having an integral extension lug 75 secured to the insulating strip 72 by a rivet 76 passing through a suitable enlarged hole in the base and anchored in the lower insulating strip 73. The plate 74 and its extension lug 75 is preferably of a highly resilient metal, for example, of phosphor bronze.

Interposed between the base 70 and the plate 74 is a layer of dielectric material 77, for example, a plate of mica.

For condensers of low minimum capacity each of the electrodes consists of a single armature plate, as is the case for the condensers just described, for example, that shown farthest to the right in Fig. 8. However, for condensers of higher capacity ranges additional interposed elements are used in known manner.

The latter condensers, in addition to the elements just described, have one or more intermediate armature plates 78 of the same polarity as the base 70 to which they are electrically connected and mechanically secured by means of integral lugs 79 and a rivet 80. Furthermore, instead of a single plate 74, the condenser may have also a plurality of such plates which are interconnected and secured to the strip 72 by means of their respective lugs 75 and the rivet 76. Instead of a single mica plate 77, there will be a plurality of same, as many as required to dielectrically separate adjacent plates of different polarities.

Each condenser disposed on the upper base 70 is adjustable by an adjustment screw 81, centrally located with respect to its plates and passing through corresponding holes in same. The holes of the armature plates are sufficiently large to permit non-contacting passage of the screw 81, whereas the holes in the dielectric layers 77 are smaller to provide a margin of insulation between the armature plates around their holes. The threaded portion of the screw 81 engages a corresponding tapped hole of the base 70.

The adjustment screw 81 is provided with an offset head 82 in which is provided a tapped hole adapted to receive a vernier adjustment screw 83 by means of which a vernier adjustment of the capacity of the condenser may be obtained as has been previously described.

Interposed between the top condenser plate and the screw head 82 there are provided one or two washers. If the top plate is a plate of the same polarity as the base 70, i. e., a plate 78, I may use a single metal washer. On the other hand, if the top plate is a plate 74, which is to be insulated from the base, I provide between the metal washer and the top plate a washer of insulating material, such being shown in Fig. 7 of the drawings, where interposed between the plate 74 and the screw head 82 there is provided an upper metal washer 84 and a lower insulating washer 85; the washer 85 may be of a low-loss ceramic material or of molded "Bakelite," mica or the like.

The adjustment bolts for varying the capacity of the condensers disposed on the lower base 70 are each similar to that described in connection with the condenser assembly shown in Figs. 1 and 2 and shown in detail in Fig. 4. The adjustment bolt shown as 135 in Figs. 7 and 9 comprises a threaded portion adapted to engage corresponding threads provided in the lower base 70, and an enlarged hexangular head which in turn extends into a cylindrical shank portion provided with a rectangular bore which serves in the same manner as has been previously described in connection with the condenser units of Figs. 1 and 2.

The base 70 is further provided with cut-outs 71 and holes 86. Of these, the cut-outs 71 are rectangular openings around the lugs 75 and serve to prevent contact of the lugs with base 70.

As a common outside terminal for all of the condensers of the assembly there is provided a terminal 87 soldered or otherwise secured to either of the bases 70, and which in radio receiver applications is as a rule, grounded to the chassis of the receiver.

The second or individual outside terminal of the condensers is provided as follows:

Disposed between the lug 75 and the insulating strip 72 and in direct contact with the former, and insulated from the base 70 by the cut-out 71, there is provided a resilient contact arm 88 of phosphor bronze or similar resilient conducting material (see Fig. 9). The arm 88 extends below the base into a U shaped bent portion 89 which in turn extends into an elongated contact strip 90 to be more fully referred to later.

Disposed under each of the lower insulating strips 73 is a contact bar 91 which together with the contact arm 88 combines to form the novel and simple switch for the tuning device of my invention. The bar 91 is secured in position by rivets 92—92 passing through extending portions of the insulating strip 73 and is spaced therefrom by insulating spacers 93—93 of "Bakelite," "Isolantite" or the like, provided on the rivets 92. A terminal 94 attached at one of the rivets 92 serves for outside electrical connection.

In the closed position of the switch the contact strip 90 of the arm 88 contacts the bar 91 and completes the electrical circuit between a selected condenser electrode 74 and the terminal 94. In the open position of the switch, the strip 90 is held away from the bar 91 by a latch mechanism later to be more fully described.

The condenser assembly above described and a latch mechanism for the selective operation of the switches, are enclosed and supported in a box-like metal housing 100 which comprises a top plate 101, a bottom plate 102 and wall or side plate 103, all preferably stamped from sheets of cold rolled steel or other hard metal. The top plate 101 and the bottom plate 102 are provided with angular extending lips 104 and 105 respectively, by means of which these plates are secured to the side plate 103 by suitable holding means, for example, by rivets 106, whereas the side plate 103 is provided with two extending lips 133—133 to be later more fully described.

The two bases 70 and their superimposed condenser units are held within the housing 100 by means of two supporting bolts 108 which pass through the holes 86 in the bases and are of sufficient length to pass through corresponding holes provided in the plates 101 and 102. To spacedly position the bases 70 in the housing 100, I provide on the bolts 108 metal spacers shown as 109, 110 and 111, the combined length of which is such that the distance between the plates 101 and 102 is bridged. As shown in Figs. 7 and 9 the spacer 109 is located between the topmost base 70 and the plate 101 whereas the spacers 110 and 111 are situated between the two bases 70, and the bottom base 70 and the plate 102 respectively. Spacer 109 is preferably shorter than the spacers 110 and 111 to permit a close mounting of the condenser assembly towards the plate 101.

To permit the adjustment of the capacity of the condensers the plate 101 is provided with circular openings 107 corresponding in number to the number of condenser sets in the assembly.

The latch mechanism for each set of condensers (shown in greater detail in Fig. 9 in which the switch is shown in its open position), comprises a latch 112 and a lock bar 113, both of which are preferably stampings of cold rolled steel or of a similar hard metal. The latch 112 comprises a stem 114 provided with an offset body portion 115 one side of which is provided with two projecting tips 116 and 117 the vertical distance between corresponding surfaces of which is equal to the distance separating the bases 70.

The body 115 is provided on its side opposite to the tips 116 and 117 with a projecting tip 120 formed by two notches 118 and 119. The tip 120 and the notches 118 and 119 serve as one portion of a locking mechanism for the latch 112.

As the complementary portion of the locking mechanism I provide a lock bar 113 having a bent lower portion 122 with regards to its upper portion 123. The lock bar 113 is supported in the housing 100 by means of extensions 124—124 which pivotally engage circular openings provided in the end portions 133 of the side plate 103; this support being such as to permit the lock bar 113 to swing through an arc.

A helical compression spring 126 disposed between the end plate 103 and the portion 123 and secured thereto by a rivet 127 serves to bias the lock bar to stay in contact with the latch body 115.

A helical spring 130 disposed on the stem 114 between the tip 117 and the bottom plate 102 serves to mechanically bias the latch 112 to return it to its switch open position.

For the mounting of the device the top plate 101 is provided with tapped holes 128—128, through which are inserted suitable mounting bolts (not shown).

The operation of the automatic tuning device is as follows: The device is connected in the circuit of the radio receiving set by means of its common terminal 87 and its two terminals 94—94. The adjustment of the condensers to their required capacity usually takes place after the device is connected in the circuit, and is accomplished as follows:

The adjustment screw 81 is rotated until the selected station desired is tuned to a maximum response in the loud-speaker of the receiver, after which time the vernier adjustment 83 is rotated clockwise or counterclockwise, as the case may require, until a point of further sensitivity is obtained. The receiver can now be considered as being adjusted for maximum response at the frequency selected. The remaining condenser sets are adjusted in similar manner to a capacity corresponding to the frequency of the other selected stations desired.

To tune the radio receiver to one of the six selected stations, one depresses the button 129 actuating the latch 112 which, by lowering the projecting tips 116 and 117 attached thereto, permits the contact strips 90—90 of the arms 88—88 to come in contact with the contact bars 91—91. This electrically connects the electrodes 74—74 of the two condenser units of the set selected to the respective terminals 94—94 and since the common electrodes of these condensers are permanently connected to the terminal 87, this set is now in circuit.

As the latch body 115 is depressed, its tip 120 presses against the portion 122 of the lock bar 113 and pushes it out of its path against the force of the spring 126. However, as soon as the portion 122 has cleared the tip 120, the spring 126 returns the lock bar to its normal position and causes it to engage the notch 118. This locks the latch and the switch in its closed position.

The release of a locked switch is achieved by partly depressing any one of the other buttons. This causes the tip 120 of the partly depressed latch body 115 to outwardly swing the lock bar 113 and disengage it from the notch 118 of the locked latch 112. The release of the latch 112 carries with it the two projecting tips 116 and 117 which in turn carry with them the contact strips 90 thereby raising these strips from the contact bars 91—91.

To tune in from one station to another station, the procedure just described is followed, the release being effected by the button corresponding to the second station selected; however, this button instead of being partly depressed is now fully depressed so that the lock bar 113 can lock its latch 112.

To cushion the impact of the latch against the plate 101, I provide on the latch stem 114 a soft cushion washer 131 and a metal backing washer 132.

I may also provide in the device additional latching members which instead of serving for the selective switching of condensers into the circuit, serve to actuate other switching means, for example, to change over from manual to automatic tuning, switch on or off the receiver, etc.

Whereas in the present invention a condenser assembly of six sets comprising two semi-adjustable condensers per set has been described, it should be well understood, that the principles of my invention and the novel features thereof are applicable equally as well, to a condenser assembly comprising any number of semi-adjustable condensers to the set and any number of sets to the assembly.

It should also be noted that many novel features of the invention are usable outside of the illustrated combination, and that various modifications of the devices described are possible without departing from the spirit of the invention.

Thus while I have described my invention in specific embodiments and by means of specific examples, I do not wish to be limited thereto, but desire the appended claims to be construed as broadly as permissible in view of the prior art.

What I claim is:

1. In a stacked condenser including an adjustable electrode and a base, adjusting means for rough and fine capacity adjustment of the condenser, said means comprising a bolt threadedly engaging said base and having a head provided with a chorded side, the electrode being disposed between said head and said base, two members interposed between said head and said electrode, a screw threadedly engaging and passing through one of said members and abutting against the other member, said screw having an ovate head asymmetrically disposed on its shaft and being confined in its rotation by said chorded side, rotation of said bolt providing for rough capacity adjustment and rotation of said screw providing for fine capacity adjustment.

2. In a stacked condenser including an adjustable electrode and a base, adjusting means for rough and fine capacity adjustments of the condenser, said means comprising a bolt threadedly engaging said base and having a head, the electrode being disposed between said head and said base, a screw threadedly engaging and passing through said bolt head and adapted to spacedly fix said head and said electrode, rotation of said bolt providing for a rough capacity adjustment and rotation of said screw providing for fine capacity adjustment.

3. In a stacked condenser including an adjustable electrode and a base, adjustment means for said condenser, said means comprising a bolt threadedly engaging said base and having a head, the electrode being disposed between said head and said base, a threaded member engaging said bolt head and adapted to spacedly fix said head and said electrode.

4. In a stacked condenser including an adjustable electrode and a base, adjustment means for said condenser comprising a bolt threadingly engaging said base and having a head, the electrode being disposed between said head and said base, a member interposed between said head and said electrode, a screw threadingly engaging and passing through said member and adapted to spacedly fix said head and said electrode.

5. In an adjustable condenser assembly comprising individual stacked condenser units disposed one above the other and each including an adjustable electrode and a base, a single main adjustment means for effecting incremental changes of the capacity of the condensers and additional adjustment means operative at all adjustments of the main adjustment means for individually varying the capacity of one condenser, said main adjustment comprising interconnected threaded members engaging each of said bases and each having a head portion, the electrode of each condenser interposed between the head portion of the corresponding threaded member and the corresponding base, said additional adjustment means comprising a screw threadedly engaging and passing through one of said head portions and adapted to spacedly fix said head portion and the corresponding electrode.

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