Sept. 4, 1934. J. ANTONIETTA 1,972,510

VARIABLE TUNING CONDENSER

Filed March 28, 1933

Fig. 1

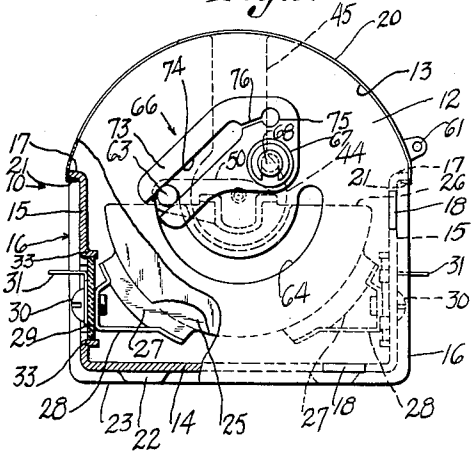


Fig. 2

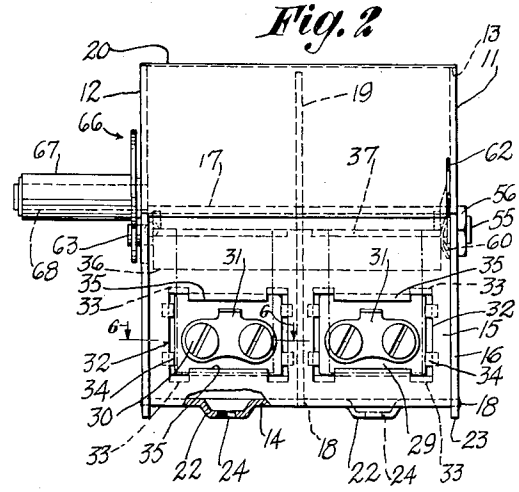


Fig. 3

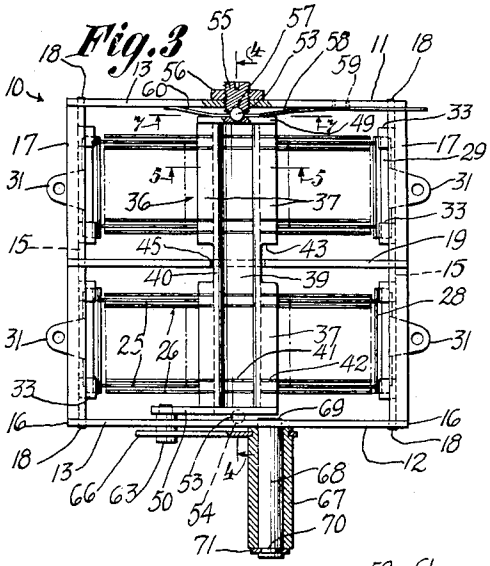


Fig. 6

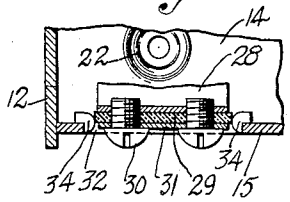


Fig. 4

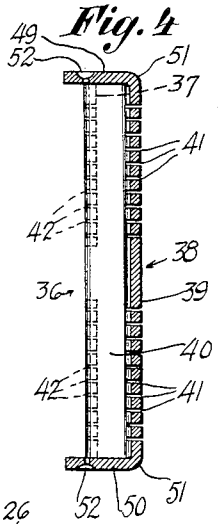


Fig. 5

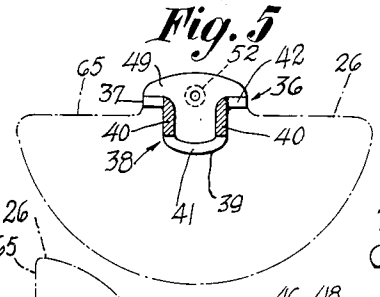


Fig. 7

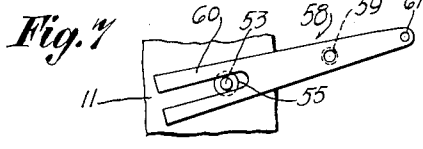


Fig. 10

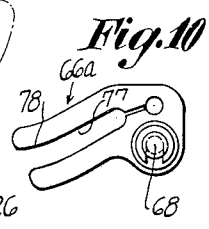


Fig. 9

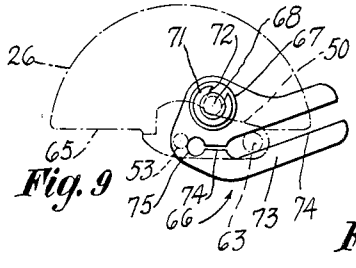


Fig. 8

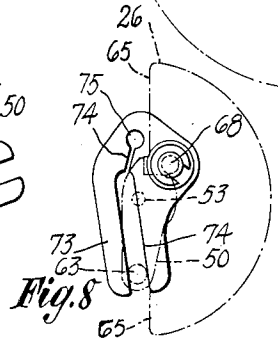
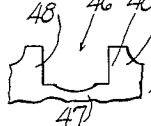


Fig. 11



INVENTOR
Joseph Antonietta
BY
Mis Schumacher
ATTORNEY

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VARIABLE TUNING CONDENSER

Joseph Antonietta, Port Richmond, N. Y.

Application March 28, 1933, Serial No. 663,120

16 Claims. (Cl. 74—10)

This invention relates to variable condensers, and particularly to devices of this character used for tuning as in radio apparatus.

One object of the invention is to provide a device of the character described having improved means for causing a variable rate of change in the capacity of the condenser, and so as to eliminate the necessity for using specially shaped or eccentric condenser plates.

Another object of the invention is the provision of a device of the nature set forth having interchangeable actuator means for modifying the variable rate of change in capacity of the condenser, whereby different condenser characteristics can be produced even though standard condenser plates are used, unlike the practice heretofore followed of changing the shape of the rotor plates for the purpose mentioned.

Another object of the invention is to devise a variable condenser having an improved mounting or shaft construction for the rotor plates, whereby the rigidity of the rotor plate is increased, lightness in the weight of the shaft maintained, or rendered less than the weight of the usual round or solid shaft, and which shaft can be formed from sheet material, if desired.

Another object of the invention is to construct a variable condenser having improved similar means for mounting the shaft at opposite ends thereof; improved means for mounting and insulating the stator plates; improved means for reenforcing the frame of the condenser; and improved closure means for the condenser; the above features being adapted for utilization in any desired arrangement or combination.

A further object of the invention is to furnish an improved condenser having few and simple parts, and which is compact and inexpensive in construction, convenient to make and use, and durable, reliable, and efficient in operation.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated on the annexed drawing, wherein like parts are designated by the same reference characters throughout the several views.

In the drawing:

Figure 1 is a view in front elevation of a device embodying the invention with parts removed to show the internal construction.

Fig. 2 is a view in side elevation thereof.

Fig. 3 is a top plan view thereof, with parts removed, and other parts being in section.

Fig. 4 is a longitudinal sectional view of the shaft taken on line 4—4 of Fig. 3.

Fig. 5 is a transverse sectional view of the shaft taken on line 5—5 of Fig. 3 and showing a condenser rotor plate in dot-dash lines.

Fig. 6 is a horizontal sectional view taken on line 6—6 of Fig. 2.

Fig. 7 is a fragmentary sectional view taken on line 7—7 of Fig. 3.

Figs. 8 and 9 are diagrammatic fragmentary views showing different positions of the device.

Fig. 10 is a plan view of an interchangeable cam means.

Fig. 11 is a fragmentary plan view of a rotor condenser plate.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in one and the same structure, but useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which this invention appertains, that the same may be incorporated in several different constructions. The accompanying drawing, therefore, is submitted merely as showing the preferred exemplification of the invention.

Referring in detail to the drawing, 10 denotes a device embodying the invention. The same may include a frame having a plurality of parallel end plates 11, 12 of similar form, and whose upper edges 13 may be arc shaped to conform to the shape of the rotor plates of the condenser. Interconnecting said end plates there may be a one piece frame member of generally U-shaped form, and having a bottom plate section 14 and upright side plate sections 15 that may be exactly alike. The frame member may be spaced somewhat inward of the adjacent side edges 16 of the end plates, and the side sections 15 may have marginal outwardly bent flanges 17 extending therealong to the edges 16. The frame members 14, 15 may lie in abutment between the end plates, and may be secured thereto as by the usual lugs 18 passed through suitable openings in the end plates and deformed or headed to form a strong interconnection. If the condenser is of a double section type, a plate 19 may be provided intermediate of and parallel to the end plates and of generally similar shape therewith. Said intermediate plate may be secured in place in any suitable manner as by lugs 18 engaging frame section 14, and it may be undercut to lie between frame sections 15 and

conform to the flanges 17, as will be obvious. To provide a closure for the condenser frame or housing, a cover 20 may be utilized, and which may consist of an arcuate resilient or flexible sheet of metal adapted to seat on the curved edges 13 of the end plates 11, 12, and having longitudinal parallel lips 21 adapted to be snapped under the flanges 17 for retaining the cover in place.

For mounting the device on the chassis of a radio apparatus, the frame section 14 may have bosses 22 downwardly struck to the plane of the lower edges 23 of the end plates, and threaded as at 24 for receiving screws. Should there be any irregularity in the chassis or frame, the latter would be sprung by the tension of the screws at 24 and hence the frame would become distorted and the spacing between the condenser plates affected, as hereinafter more particularly described. Such distortion, however, is prevented by the flanges 17 which afford a strong and simple reenforcement where it is most needed.

The variable condenser includes a stator having one or more plates 25 and a rotor having one or more plates 26, suitably arranged in alternating and spaced relation, and being each in the form of a sector or semicircle, and disposed in parallel planes, whereby, on angularly moving the rotor, the capacity of the condenser is varied. It will be particularly noted that the stator and rotor plates are concentrically symmetrically arranged, whereby a high degree of compactness is afforded, the rotor requiring a minimum of space for its path of travel, so that the cover 20 becomes practical to apply. Heretofore, condensers arranged to change the capacity thereof at variable rates have been arranged with the condenser plates disposed according to an eccentric principle, so that the rotor requires a higher path of travel and therefore more space in a radio apparatus, and hence such condensers were not provided with a cover.

For mounting the stator plates, the same may be formed with arcuate segments 27 which may be suitably secured to the angular plates 28. In order to insulate the stator from the frame, the plates 28 may be engaged with plates of insulation 29, as by screws 30, and terminal contacts 31 may also be affixed to said screws. In the opposed side frame sections 15, openings 32 may be provided. Along the upper and lower edges of said openings, lugs 33 may be pressed inward, and along the side edges of said openings, lugs 34 may be pressed inward and curved to afford an entrance. In providing lugs 33, flanges 35 may be formed along the upper and lower edges of said openings. The plates 29 are snugly fitted in seating engagement between the several lugs 33, 34 and so as to rest against the flanges 35, being so maintained by reason of the abutment action of the stator and plates 28 between the opposite insulating plates 29. The plates 28 may be slightly resilient if desired to afford a snug wedging fit. Heretofore the plates 29 have been riveted to the frame. This required the use of nonbrittle materials of low insulating qualities. By my invention, the expense of riveting is avoided, and plates 29 of high insulating character may be employed, which are reliably and quickly secured in place.

For mounting the rotor plates 26, a means 36 may be provided which may in certain respects be denominated a shaft, and in other respects a frame or plate. The same may have rib or flange means 37, and is desirably made of channel form in cross section, and is preferably made of a sheet of material such as metal. Thus a sheet of plane material may be bent and slotted in a single operation to produce the means 36. One possible embodiment of the invention, preferably includes the flange and channel features, the latter being designated by 38, and including a back 39 and side walls or flanges 40 from which one or more of the marginal lips or flanges 37 extend radially, as along a plane passing through the axis of rotation of the shaft. The back 39 may be transversely slotted as at 41, and the flanges 37 may have slots 42 alined with different slots 41, the slots 42 extending preferably to the side walls of the channel. Intermediate of the ends of the shaft, the flanges 37 may be cut away as at 43, if desired to afford clearance for the intermediate plate at an opening 44 thereof which may form a part of a slot 45 that clears the shaft so that the rotor unit can be dropped into the frame to be assembled therein.

For fixing the rotor plates to the shaft, each rotor plate may have an opening 46 adapted to receive the shaft and having edge portions 47 and 48 at said opening fitted in the respective slots 41, 42 of the shaft and bearing against the side walls of the channel shaft section. For strongly securing the rotor plates in the slots, a force may be exerted on the outside of the back of the channel between the different rotor plates, and if desired, the flanges 37 may be deformed slightly, whereby the metal between the different slots 41, 42 is caused to tightly pinch and permanently hold the rotor plates.

For mounting the shaft 36, any suitable means may be employed, and preferably said shaft is provided with integral tongues 49, 50 at opposite ends thereof, and which may extend from the back of the channel structure. Said tongues may be bent as at 51 so as to lie in square abutment with the ends of the side walls or flanges 40 of the channel structure. To afford frictionless bearing means for the shaft, the elements 49, 50 may be formed with alined openings or recesses 52 that open outwardly in opposite directions to afford seats for bearing members such as anti-friction balls 53, the end walls 11, 12 having means affording corresponding alined seats for the balls. Thus the end wall 12 may have a similar seating recess 54, and, in order to provide for adjustment in the bearing, the end wall 11 may have a set screw 55 threaded therein and secured by a locknut 56, the set screw having a seating recess 57 for the adjacent ball 53.

For electrical connection with the rotor condenser plates 26, a means such as a contact member 58 that may be in the nature of a leaf spring is utilized. The same may have an eye 59 pressed therefrom and fitted in a corresponding hole in the end plate 11. One end portion of the spring may have a fork 60 taking about an adjacent ball 53 and bent laterally so that the end of the fork presses against the end plate 11, and another part of the fork presses against the end wall 49 of the shaft 36. The other end of the leaf spring is formed with a terminal hole 61 and projects beyond the end wall 11, the cover 20 having an open ended slot 62 for receiving the same. The spring 58 also serves to reduce any possible axial movement of the rotor, and facilitates the adjustment setting of the device at the screw 55.

It will be appreciated that according to my invention both bearings for the shaft are simple, compact, and similar in construction.

To provide a simplified means for causing angular movement of the shaft 36, the tongue 50

may be sufficiently elongated to constitute a crank arm. The latter may have a crank pin 63 extending through an opening or arcuate slot 64 in the front plate 12. The slot 64 is so arranged that the ends thereof afford stops for the pin 63 in the position of maximum capacity of the condenser shown in Fig. 1, and in the position of zero capacity of the condenser shown in Fig. 9. Hence the stop engagement heretofore used for the condenser rotor plates directly is eliminated, and any strain taken up solely by the shaft. It will be noted that the crank 50 may extend in parallelism with the straight edges 65 of the rotor plates.

To actuate the pin 63, a cam means 66 is preferably provided. The same may for compactness consist of a sheet of plane material parallel to the wall 12, and may desirably be fixed upon a sleeve 67, which may be journaled upon a bar or stub shaft 68 secured to the wall 12, as at 69, in spaced relation to the axis of the shaft 36. To the sleeve 67, a conventional manual control knob and a dial with uniform graduations, not shown, may be removably fitted in any well known manner. To provide for removability and interchangeability of the cam 66, the outer end of the stub shaft 68 may have an annular groove 70, and a washer 71, slotted at 72, may be removably snugly engaged therein to slidingly abut the end of the sleeve 67.

The cam means 66 may include an open ended fork 73 for slidingly receiving the pin 63. This fork may have any desired cam slope 74. To avoid backlash in the cam engagement, an opening 75 may be formed spaced from the closed end of the fork and connected therewith by a narrow opening 76, whereby the prongs of the fork are resiliently movable toward each other for snugly engaging the pin 63.

In attempting to provide a variable condenser, such that an actuator movable at a uniform rate or according to uniform graduations shall cause a different variable change or non uniform rate of change in the capacity of the condenser, the condenser plates have been eccentrically arranged, resulting in various drawbacks. Thus the condenser required more space, and required reenforcement for the large wings of the rotor plates to assure parallelism and uniform spacing. Moreover, if a condenser of different variable characteristics was desired, it was necessary to produce rotor plate of a different shape or eccentricity, or even to redesign the entire condenser. By my invention, these defects are overcome, and if a condenser of different variable characteristics is required, the cam means 66 alone need be changed. Thus, as shown in Fig. 10, the modified cam means may have a straight and a curved cam surface 77, 78. To apply it even to an already assembled condenser, the washer 71 is taken off, then the cam and sleeve unit 66, 67 is removed, the cam and sleeve unit 66*a*, 67 mounted in position as shown in Fig. 1, and the washer 71 replaced.

For the purpose of illustrating one possible mode of using the invention, Figs. 1 and 8 show a counterclockwise movement of about 90 degrees of the cam means 66, with a uniform rate of movement of the rotor plates, since the pin 63 is in each figure at the same position relative to the cam means. In moving a further 90 degrees from the position of Fig. 8 to that of Fig. 9, the pin 63 moves rapidly inwardly of the cam means, and hence a constantly diminishing rate of angular movement of the rotor occurs, though the cam may move at a uniform rate. This occurs because the pin 63 approaches the axis of the cam means. It is as though the rotor were movable according to its own independent scale formed with uniform graduations for the first 90 degrees and with graduations of diminishing size for the last 90 degrees. Obviously the above principle may be utilized in various or opposite ways.

It will be appreciated that various changes and modifications may be made in the device as shown in the drawing, and that the same is submitted in an illustrative and not in a limiting sense, the scope of the invention being defined in the following claims.

I claim:

1. A variable condenser, including a stator, and a rotor movable angularly relatively to each other for varying the capacity of the condenser, operating means, and an actuator therefor, said actuator and operating means being angularly movable at different rates, so that a uniform rate of movement of the actuator causes a variable rate of change in capacity of the condenser, said actuator being removable and having internally journaled sleeve means for direct connection of a finger piece knob thereto.

2. A variable condenser, including a stator and a rotor each having condenser plates movable relatively to each other along planes parallel thereto, and means angularly movable at a uniform rate of motion and being so connected with the rotor as to cause the same to move at a non uniform rate of motion relatively to the stator, said condenser having a fixed shaft, and the said means having a sleeve removably journaled thereon and adapted to be inserted into an actuator knob.

3. A variable condenser including a stator and a rotor having condenser plates, the rotor being mounted for angular movement about its geometric center to vary the capacity of the condenser, and cam means for actuating the rotor to cause movement thereof at a varying rate of speed, the cam means including a cam slot and a pin therein movable relatively to each other, the cam slot and pin having continuous resilient interengagement to avoid backlash.

4. A condenser including a stator plate, a rotor plate, a frame for mounting the stator plate, a shaft journaled in the frame for mounting the rotor plate, said frame having an opening, a follower fixed to said shaft and extending through said opening, a cam mounted on said frame at a point spaced from the axis of the shaft and engaging said follower, and an actuator for causing angular movement of the cam, whereby motion of said actuator at a uniform rate causes a non-uniform rate of motion of the rotor plate, the opening having stop engagement with the follower to limit the range of motion thereof by the cam.

5. A condenser including a rotor plate, a stator plate, a frame for mounting the stator plate, said frame including a front plate, a shaft for the rotor mounted on said frame and journaled in the front plate, a crank arm connected to said shaft, said front plate having an opening, said crank arm having a pin passing through said opening, a cam mounted on said front plate for angular movement about a point offset from the axis of the shaft, said cam engaging said pin, and means for actuating said cam, and said cam and crank arm being on opposite sides of said front plate.

6. A condenser including a stator plate, a rotor plate, a frame for mounting the stator plate and rotor plate, operating means including a cam

mounted on said frame at a point spaced from the axis of the rotor plate, and a follower element controlled by said cam and engaged with the rotor plate for causing angular movement thereof, and said frame having stop means to limit the motion of the operating means.

7. A condenser including a stator plate, a rotor plate, a cam, a frame for mounting said plates and said cam, said frame including a front plate, the latter, the stator plate, rotor plate, and cam lying in planes parallel to each other, the cam being movable along its plane and about an axis offset from the axis of the rotor plate, the front plate having an opening means interengaging said cam and rotor plate through said opening with the latter acting as a stop for said means, and actuating means for the cam.

8. A condenser including a rotor plate, a stator plate, a frame for mounting the stator plate, said frame including a front plate, a shaft for the rotor mounted on said frame and journaled in the front plate, a crank arm integrally connected to said shaft, said front plate having an opening, said crank arm having a pin passing through said opening, a cam mounted on said front plate for angular movement about a point offset from the axis of the shaft, said pin having stop engagement with an end of said opening, said cam engaging said pin, and means connected to said cam for actuating the same.

9. A variable condenser including a stator plate, a rotor plate, and means for causing angular movement of the rotor plate, including a pin eccentrically engaged with the latter, and a cam mounted for angular movement at a point spaced from the axis of the rotor, said cam having a fork for receiving the pin for sliding movement therealong, means for resiliently pressing the prongs of the fork toward each other for snug engagement with the pin, and means for actuating the cam.

10. A variable condenser adapted to have a knob connected thereto at the front thereof, including a stator plate, a rotor plate, a cam mounted for variably causing angular movement of the rotor plate, and means for removably interchangeably mounting cams for causing a variable angular movement of the rotor plate in any required different predetermined manner, said means including a fixed stub shaft at the front of the condenser, and one of said cams mounted on said shaft and having a forward extending sleeve hub for connection with the knob.

11. A variable condenser including a stator plate, a rotor plate, a frame for mounting said plates, a cam, a sleeve to the inner end of which the cam is fixed, a bar connected to the frame, at a point spaced from the axis of the rotor, said sleeve being rotationally journaled on said bar, means for releasably mounting said sleeve on said bar, and a follower connected to the rotor plate and engaged by said cam for angular movement thereof and the rotor plate at a variable rate upon angular movement at a uniform rate of said cam.

12. A variable condenser including a stator, a rotor, and a frame for mounting the same, said rotor having a shaft, said frame having a front plate at right angles to said shaft for rotatably supporting the latter, said front plate having an opening, said shaft having a crank extending along the inside of the front plate and having a pin projecting through said opening, a cam pivotally mounted on the front plate at the outside thereof and movably engaging said pin, said front plate having a frontward projecting stub shaft, the cam having a frontward projecting sleeve fixed thereto and removably journaled on said stub shaft, whereby a knob can be connected to said sleeve for actuating the shaft.

13. A variable condenser including a frame, a stator mounted thereon, a rotor having a shaft, said frame having a front plate and a back plate, said shaft being journaled in said plates, the front plate having an opening, the shaft having a crank arm provided with an end pin extending through said opening for movement therealong, the front plate having a stub shaft mounted thereon, a cam at the outside of the front plate engaged with said pin, said cam having a frontward projecting sleeve removably journaled on said shaft, said pin having stop engagement with the ends of said opening, and the sleeve being adapted for engagement by a knob.

14. A variable condenser including a stator, a rotor, a frame therefor, and actuator means for the rotor including a cam, the stator having a frontward extending stub shaft mounted thereon, the cam having an elongated knob receiving sleeve fixed thereto and removably journaled on the stub shaft, whereby different cams can be readily interchangeably positioned on the stub shaft.

15. A variable condenser including a frame, a stator mounted thereon, a rotor having a shaft journaled on the frame, said frame having a front plate, said shaft having a crank arm movable along said front plate, the latter having an opening, the crank arm having stop engagement with the ends of said opening, and a cam mounted on the front plate for actuating said crank arm.

16. A variable condenser including a frame having an opening, a stator mounted thereon, a rotor having a shaft journaled on said frame, said frame having a front plate, said shaft having a crank element and a cam element mounted on said front plate for actuating said crank, one of said elements having stop engagement with said front plate opening.

JOSEPH ANTONIETTA.