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VARIABLE CONDENSER

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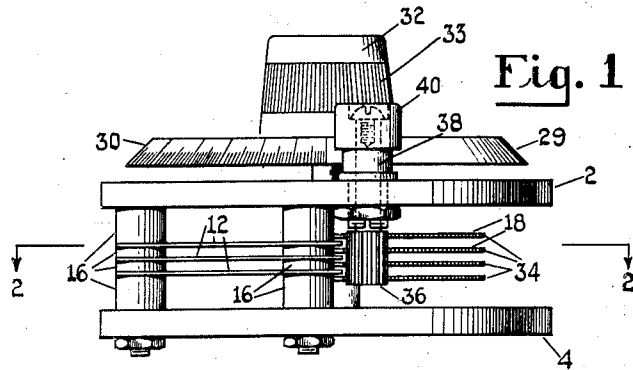


Fig. 2

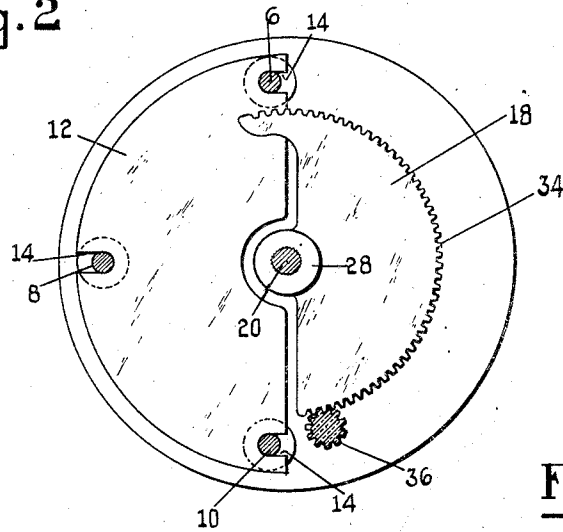


Fig. 4

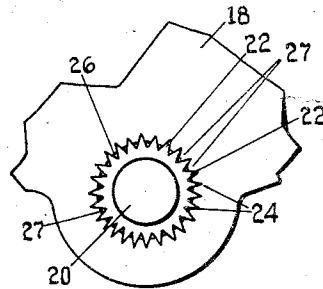
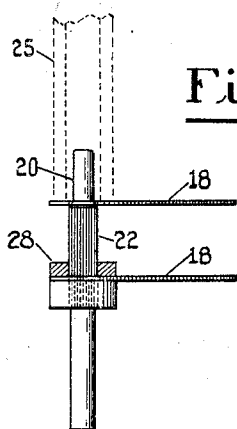


Fig. 3



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VARIABLE CONDENSER

Application filed January 9, 1923. Serial No. 611,667.

This invention relates to variable condensers such as are employed in wireless telegraphy and telephony.

As is well known, wireless transmitters and receivers comprise circuits which may be tuned to the length of the waves which it is desired to transmit or receive. As is also well known, the tuning of a circuit depends on the inductive and capacitive effects of the circuit. In such circuits it is customary to maintain the inductive effect substantially constant and to vary the tuning or wave length of the circuit by regulating the capacity. The capacity effect is obtained by the use of condensers, and the length of the wave transmitted or the length of the wave to which a receiver is tuned is usually varied by adjusting certain elements of a condenser relatively to certain other elements.

It has heretofore been proposed to provide a variable condenser, particularly for use in receivers, with means for adjusting the condenser approximately to the wave length which it is desired to receive and auxiliary means for effecting minute adjustments of the condenser to tune the receiver exactly to the length of the incoming waves. Such condensers have also been provided with scales for indicating the capacity to which the condenser is set by actuation of the primary adjusting means. The arrangement of such condensers has, however, generally been such that the reading of the scale has not been affected by the auxiliary means for making the minute adjustments, and that the capacity of the condenser might be varied by operation of the auxiliary adjusting means through a range corresponding to a number of graduations on the scale, with the result that when the condenser was first set to the approximate wave length by the primary adjusting means and was then adjusted by the auxiliary adjusting means, as nearly as the construction of the condenser would permit, to the exact length of the incoming waves, the indicating means no longer showed the precise capacity to which the condenser had been set.

It is an object of this invention to provide a variable condenser which can be

quickly set by primary adjusting means approximately to the incoming wave length, and which may then be adjusted by auxiliary adjusting means exactly to the incoming wave length with appropriate movement of the indicating means so as to cause such means to invariably show the precise capacity to which the condenser is set, or in other words, assuming that the inductive effect of the receiver is constant, the wave length to which the circuit, of which the condenser is a part, is tuned.

It is frequently important in the design of radio receiving sets, particularly for the reception of broadcasted speech or music, to employ a condenser occupying a minimum amount of space in proportion to its capacity. Such a condenser is, for example, of great advantage in the construction of a sound reproducing machine, such as that shown in the co-pending application of Alfred N. Goldsmith, Serial No. 587,067, filed Sept. 9, 1922, which comprises a combined phonograph and radio receiver in which the radio receiving apparatus is mounted in the cover of the machine casing. The space available in the cover of such a machine is limited, particularly in its vertical dimensions, and it is accordingly necessary that the condensers employed in the radio receiving apparatus shall be small, particularly in thickness.

A further object of this invention is to provide a condenser which will afford maximum capacity in proportion to the amount of space occupied by it.

An important feature of the invention resides in the provision of a condenser, including indicating means and relatively movable plates and having connections between one of the plates and the indicating means and operating means separate from such connections for effecting minute relative adjustments of the plates to regulate the capacity of the condenser.

To the end that the above-mentioned objects of the invention may be carried out, a further important feature of the invention resides in the combination with a set of one or more stationary plates, and a set of one or

more movable plates mounted on a shaft and having curved outer edges, of indicating means connected with the movable plates and means for positively engaging the outer edges of the movable plates to effect minute adjustments of said plates relatively to the stationary plates. In the preferred form of the invention, the movable plates are mounted rigidly on a shaft having a dial constructed for manipulation by the hand, and the curved outer edges of the movable plates are toothed for engagement with a gear, so that the approximate setting of the condenser can be quickly effected by rotation of the dial and the capacity of the condenser can be regulated and the dial simultaneously rotated by actuation of the gear to adjust the condenser exactly to the wave length, which it is desired to receive, the result being that the scale on the dial at the point of best reception invariably indicates both the exact capacity of the condenser and the precise length of the incoming wave.

A still further feature of the invention contemplates the provision of a condenser including a shaft having longitudinal ridges thereon and plates mounted on the shaft and having portions cooperating with the ridges to maintain the plates and the shaft rigidly together.

Other objects and features of the invention will appear as the description proceeds and will be pointed out in the appended claims.

In the drawings, in which like reference numerals indicate like parts throughout the various views,

Fig. 1 is a view in elevation of a variable condenser embodying the invention;

Fig. 2 is a view in horizontal section taken along the line 2—2 of Fig. 1;

Fig. 3 is a view showing the manner in which the plates of the condenser are assembled upon the shaft; and

Fig. 4 is a sectional detail taken along the line 4—4 of Fig. 3.

The frame of the illustrated device comprises a circular top 2 and bottom 4 composed of insulating material and connected by upright rods 6, 8 and 10, Fig. 2. Stationarily mounted on the frame is a set of plates 12 of generally semi-circular form provided with slots or notches 14 to receive the rods. The plates 12 are supported and spaced from each other by suitable washers 16 sleeved upon the rods, and arranged in interdigital relation with the stationary plates 12 is a set of movable plates 18. As shown, the plates 18 are of somewhat smaller size than the plates 12, but are also generally of semi-circular form. The plates 18 are carried by a shaft 20 journaled in the top 2 and bottom 4 of the frame of the device.

The movable plates 18 are connected rigidly to the shaft 20 for rotation therewith in both directions. The preferred means for

thus connecting the plates 18 and the shaft is shown in Figs. 3 and 4 and comprises ridges 22 extending longitudinally of the shaft 20 and provided with sharp outer edges 24 which will hereinafter, for the sake of convenience, be referred to as knife edges. In the assembly of the plates 18 and shaft 20, the plates may be driven upon the shaft by a suitable tool indicated by dotted lines 25 in Fig. 3, thereby causing the knife edges of the ridges 22 to enter the material of the plates 18 around the central openings 26 therein, so as to cause portions 27 of the plates 18 in the assembled construction to interlock with the ridges 22 of the shaft. The interlocking of the portions 27 of the plates 18 with the ridges 22 of the shaft 20 causes the plates 18 to be rigidly joined to the shaft 20, so as to move therewith without lost motion, even after extended use of the condenser. Preferably, and as indicated in Fig. 4, the openings 26 in the plates 18 are made of slightly greater diameter than that of the shaft 20 exclusive of the ridges 22, thereby enabling the plates 18 to be readily driven upon the shaft without warping them. The plates 18 are spaced from each other by suitable washers 28, Fig. 2, on the shaft 20.

Mounted on the upper end of the shaft 20 is a dial 29 provided with a peripheral scale 30, and preferably constructed so that it may be readily manipulated by the hand. To this end, the dial may, for example, be provided with a knob 32 having its periphery knurled as indicated at 33. With this construction, it is apparent that upon rotation of the knob 32 or plates 18 in either direction, such rotation will be communicated to the entire assembly consisting of the set of plates 18, dial 29 and knob 32. In other words, it will be clear not only that the set of movable plates 18 may be adjusted relatively to the stationary plates 12 by rotation of the dial 29 in either direction but also that rotary movement of the set of plates 18 however effected, will be communicated to the dial 29 and scale 30.

The knob 32 constitutes primary adjusting means for rotating the movable plates 18 relatively to the stationary plates 12. In the use of the condenser, such means may conveniently be employed for quickly setting the condenser so as to tune the receiver containing the condenser approximately to the wave length of the signals which it is desired to receive. It is found, however, that such adjusting means is not sufficiently delicate in its manipulation to enable the exact tuning necessary for the best possible reception to be readily attained. In order to enable a receiver to be tuned to the precise wave length which it is desired to receive, I provide auxiliary means for effecting minute relative adjustments of the sets of movable plates 18 and stationary plates 12. Such means is preferably constructed so as

to positively engage and operate the plates 18, and as shown comprises gear teeth 34 formed on the outer curved edges of each of the plates 18 and meshing with a gear 36 composed of insulating material and carried by a shaft or spindle 38 journaled in the top 2 of the condenser frame. In order to facilitate rotation of the gear 36, the spindle 38 is preferably provided adjacent to the dial 29 with a knob 40 or the like. The condenser may be provided in a known manner with means for making electrical connections to the set of stationary plates 12 and the set of movable plates 18.

It will be apparent from the foregoing that very minute adjustments of the set of movable plates 18 relative to the set of stationary plates 12 may be effected by operation of the gear 36, and that movement of the plates 18 by the gear 36 produce simultaneous movements of the dial 29 and scale 30 so as to cause the dial to indicate the true capacity of the condenser, both when the condenser is set solely by movement of the knob 32 and when the setting of the condenser involves the use of the peripheral gear 36. It will also be understood that, assuming that the inductive effect of a circuit in which the condenser is to be employed, is maintained constant, the scale 30 of the dial 29 may be calibrated in wave lengths so that at the point of best reception, the scale 30 will indicate directly the length of the incoming wave.

It is recognized that the broad principles of the invention may be embodied in a condenser in which one or other number less than all of the movable plates 18 are engaged at their outer edges with the gear 36 or other operating means separate from the shaft 20. It is preferred, however, that the gear 36 be caused to operatively engage the peripheries of all of the movable plates 18.

In the use of condensers, as heretofore constructed, it frequently occurs that the joints between the movable plates and the shaft on which they are mounted become loosened, so that lost motion is developed between some or all of the plates and the shaft. The plates, consequently, become displaced to a greater or less degree with respect to each other and to the shaft. Such displacement obviously affects the capacity of the condenser so that the indicating means which is commonly operated from the shaft of the condenser no longer shows its real capacity. As heretofore pointed out, the occurrence of such lost motion between the movable plates and the shaft is largely prevented by the special connecting means illustrated in the accompanying drawing. If however, any looseness should develop between any of the plates 18 and the shaft 20, the gear 36, in the event that it is operatively

engaged with all of the movable plates 18, will prevent such looseness from resulting in any error in the capacity of the condenser as indicated by the scale 30 of the dial 29. This follows from the fact that when the plates 18 are rotated by the gear 36, the gear manifestly effects equal movements of the plates regardless of whether they are or are not rigidly fixed to the shaft 20. On the other hand, if the plates 18 are rotated by the shaft 20, those which are rigidly fixed on the shaft will, of course, effect rotation of the gear 36, and the gear 36 will in turn rotate any plate, which may be loose on the shaft 20, to exactly the same extent as that to which the first-mentioned plates are rotated. From these considerations, it will be seen that the gear 36 not only constitutes auxiliary adjusting means for effecting minute relative adjustments of the sets of movable and stationary plates, but that such gear also constitutes means for positively maintaining the movable plates 18 in proper relation to each other and to the shaft 20, so that the capacity of the condenser cannot be changed by displacement of the plates relatively to each other or the shaft, thereby eliminating all possibility of errors arising from such displacement in the indicated capacity of the condenser.

The provision of the means hereinbefore described for effecting minute relative adjustments of the sets of movable and stationary plates enables a condenser to be made of small dimensions, particularly in regard to height or thickness, in proportion to its capacity because it avoids the necessity of the provision of driving gears or the like separate from the movable plates for operating them and because it simplifies generally the construction of the condenser, diminishing the number of parts required and consequently reducing the space requirements of the parts.

Although the condenser is herein described as being of the type comprising generally semi-circular plates, certain of which are carried by a shaft, it is recognized that the principles of the invention may be embodied in condensers of other types. Accordingly, it is intended that the scope of the appended claims shall not be limited, except as required by the prior art.

In the appended claims the term "set of plates" as applied to either the movable or stationary plates of the condenser is intended to embrace a single plate as well as a plurality of plates, in the event that the context of a claim is consistent with the interpretation of the term as including a single plate only.

Having fully described my invention what I claim is:

1. A variable condenser comprising a shaft

having ridges extending longitudinally thereof and a plate mounted on the shaft, said ridges being embedded in a portion of the plate to cause the plate to be held rigidly upon the shaft for rotary movement therewith without lost motion.

2. A variable condenser comprising a shaft provided with integral ridges extending longitudinally of the shaft and having sharp outer edges, and plates mounted upon the shaft, the ridges being embedded in a portion of each plate to hold the plates and shaft rigidly together.

3. A variable condenser comprising stationary plates, a rotatable shaft having serrations formed thereon, and movable plates mounted on said shaft, said serrations being embedded in a portion of each plate, whereby said movable plates may be moved relatively to said fixed plates, without backlash between the said movable plates and the rotatable shaft.

4. A variable condenser comprising a shaft having longitudinal ridges, a series of plates mounted upon said shaft, said ridges being embedded in a portion of each plate in order to provide a firm union between said plates and shaft, means carried by said shaft to rotate the plates, and separate means spaced from said first mentioned means to provide a vernier adjustment of said plates.

5. In a condenser, a rotatable shaft provided with a plurality of sharp-edged, wedge-shaped projections, one or more rotor plates mounted on said shaft, said projections being embedded in a portion of each plate.

6. In a condenser, a shaft provided with a plurality of sharp-edged projections, one or more plates mounted on said shaft, said projections being embedded in a portion of each plate.

7. In a condenser, a rotatable shaft provided with a plurality of gripping members, one or more rotor plates mounted on said shaft, said gripping members being embedded in a portion of each plate.

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