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TUNING CONDENSER ARRANGEMENT

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Fig. 1

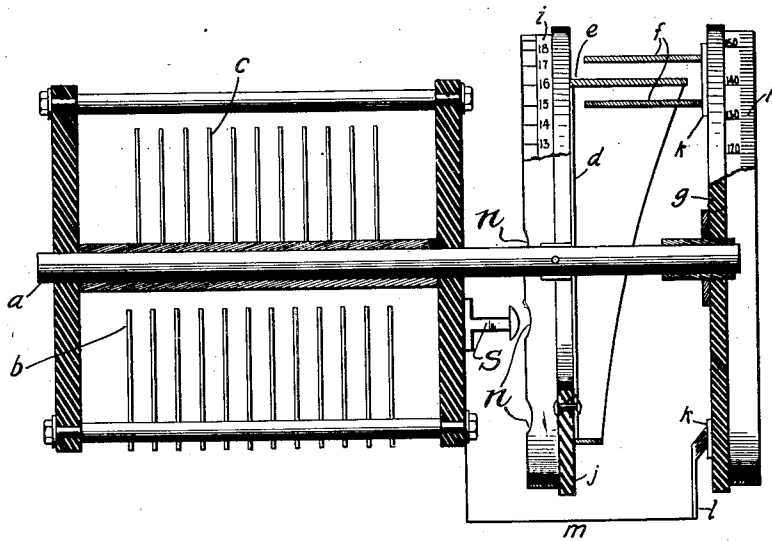


Fig. 2

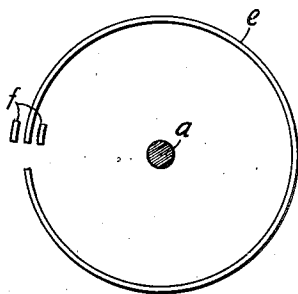


Fig. 2a

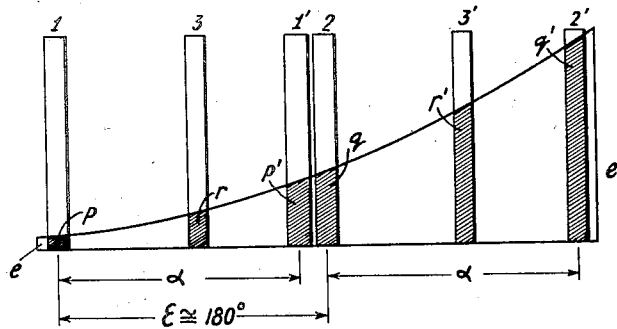


Fig. 3

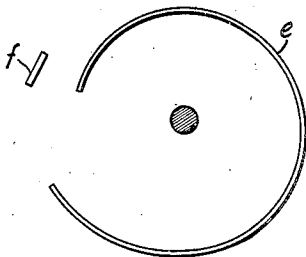
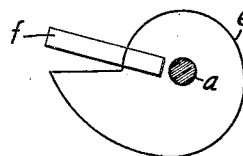


Fig. 4



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TUNING CONDENSER ARRANGEMENT

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The present invention relates to condenser assemblies and more particularly to such assemblies wherein use is made of vernier controls.

The forms of construction known in the prior art for delicate adjustment of rotary condensers in which for the purpose of insuring more convenient reading, the vernier knob does not drive the part of the condenser controlled thereby directly, but rather by the intermediary of gearing means such as tooth-wheels, worms, cams and the like, fail to secure the desired degree of accuracy inasmuch as the mechanical tolerance limits which are inevitable no matter what gearing methods may be resorted to, and which manifest themselves in back-lash and spindle distortion, are inacceptably great.

In the construction here disclosed the use of mechanical gearing means has been dispensed with, so that the defects and error source inherent therein are obviated, with the further result that the reading accuracy is high. According to this invention a coarse-adjustment condenser is so assembled constructionally with an electrically paralleled vernier condenser that in the latter the part which is not actuated by the vernier knob is coupled with the coarse-adjustment condenser. In the vernier condenser the sizes of the surfaces of the two members are substantially different so that, no matter what the position of setting, one thereof will not completely come to coincide with the other. Hence, they are so shaped and disposed that the capacity is able to vary in dependence upon the fine-regulation knob or vernier in accordance with the desired law.

More particularly speaking, it is possible to design the vernier so as to insure a linear frequency change in such a way that for each coarse step the entire possible fine-adjustment range practically furnishes linear and invariably equal frequency differences.

In the drawing;

Figure 1 is a schematic diagram partly in section showing a preferred form of the invention,

Figure 2 is a detail plan of the vernier condenser shown in Figure 3.

Figure 2a is a diagrammatic showing of the shape of one of the condenser plates,

Figure 3 shows schematically another form of vernier condenser in accordance with the present invention, and

Figure 4 is a diagrammatic showing of still another form of the invention.

Fig. 1 by way of example illustrates a rotary condenser according to this invention. The same

comprises a coarse-adjustment condenser with a stator *b* and a rotor *c*, and a vernier condenser one member of which is seated, as indicated at *e*, upon the rotor spindle *a* of the main condenser, being secured thereon, for instance, by the aid of a metallic circular disk *d*, while the other member thereof, *f* is associated with a vernier knob for fine adjustment. The said knob consists here, for instance, of an insulation disk *g* with a fine-setting scale *h*.

The coarse-setting dial, *i*, if desired is attached to the rotor spindle *a* by means of an insulating disk *j* screwed together with the plate *d* or in some other suitable manner. The electrical parallel connection between the coarse and fine condenser for both parts *c* and *e* consists of the spindle *a* and for the parts *b* and *f* by the lead *m*, spring contact *l* and the slip ring *k* associated with *f*.

Free mobility of the part *h*, *g*, may be slightly impeded by the friction of the contact spring *l* upon the slip ring *k* or some other retarding or braking means.

The coarse-setting condenser, in the usual way, may be so designed that upon turning the rotor through an angle ϵ equal to 180 degrees, its capacity will be caused to change from minimum to maximum. In this scheme it is recommendable to provide a number of rest (notch) positions, *n*, *n*, 30 such positions about 3 degrees apart may be utilized although only three are shown in order to simplify the drawing so that the change from one thereof to the next will be effected by the twisting of the rotor into the next notch position. The regulation ranges between the coarse steps may then be bridged by the fine adjustment of the scale or dial *h* corresponding to the auxiliary condenser element that may take the form of a spring finger the end of which is adapted to cooperate with the notches *n*, *n* formation in the plate. The finger acts to hold the condenser in any one of the desired notched positions.

The plate *e* of the auxiliary condenser, in the embodiment illustrated by way of example, consists of a circular cylinder collar having a circumference less than 360 degrees, say, only 340 degrees (see Fig. 2 where a top view of the coats *e* and *f* is shown drawn to a reduced scale). The height of the shell line (directrix) is variable, see Fig. 2a.

The coat *f* consists of one or more strips extending parallel to the spindle *a* and is adapted to be twisted conjointly with the vernier scale *h* through an angle which is slightly less than 180 degrees, say, 160 degrees.

If the main condenser occupies, for instance, its initial notch position corresponding to minimum capacity, then, in the case of the auxiliary condenser inside its entire adjustment angle the strip *f* is able to occupy all possible relative positions to the plate *e* comprised between the two liminal positions 1 and 1' (Fig. 2a). Its capacity surface thus changes continuously from *p* to *p'*. But if the main condenser occupies its last notch position corresponding to maximum capacity, with its rotor having incidentally been moved out of its initial position by an angle ϵ equal to 180 degrees, it will be seen that then upon fine adjustment the relative positions of the plate *f* to the plate *e* are comprised between two liminal positions 2 and 2' and the active (capacitive) area of the vernier condenser passes through all values between *q* and *q'*, it being understood that the positions 1' and 2 may also overlap partially. At some definite median notch position of the main condenser the relative positions of the plates of the fine or vernier condenser are changed between the liminal positions 3 and 3', and its capacitive surface varies between the limiting values *r* and *r'*.

It is recommendable to so shape the surfaces of the condensers that in all steps of adjustment not only the coarse regulation, but also the fine adjustment will result in a frequency alteration being uniform and equal for all steps so that practically always the same frequency difference corresponds to the entire angle of rotation of the vernier dial at all notch positions of the coarse condenser.

The desired trend in the change of the capacity may be insured not only by the differences in the height of the shell of a cylinder having a circular directrix, but also for instance, by variation of the distance between the two plates in that the plate *e* as indicated in Fig. 3, has the form of a cylinder of like or unlike height with a spiral directrix.

The two plates furthermore could consist each of one or more flat plates extending at right angles to the spindle *a* as shown in Fig. 4.

Of course, nothing is changed fundamentally in the construction as described if the two plates *e* and *f* were to change their parts in such a way that the plate *e* is actuated by the vernier knob

and the plate *f* by the spindle *a* and the coarse-condenser knob, respectively.

I claim:—

1. A vernier for a rotatable condenser provided with a rotor shaft comprising a carrier fixedly mounted on said shaft, said carrier having mounted thereon in substantially concentric relationship with said shaft a cylindrical condenser plate of varying depth, a second carrier movably disposed on said shaft said second carrier having fixedly mounted thereon a condenser plate adapted to cooperate with said first named condenser plate so as to form a variable condenser assembly.

2. The system described in the next preceding claim wherein the first carrier acts as the main adjusting means for the rotatable condenser.

3. A vernier for a rotatable condenser provided with a stator and a rotor said rotor being mounted on a shaft, comprising a carrier fixedly mounted on said shaft said carrier having mounted thereon in substantially concentric relationship with said shaft a cylindrical condenser plate, a second carrier movably disposed on said shaft said second carrier having fixedly mounted thereon a condenser plate, said two carriers being disposed with respect to each other so that the respective condenser plates mounted thereon cooperate with each other, one of said plates being arranged so as to produce variable capacity effects with respect to the other of said plates when said carriers are rotated one with respect to the other, and means for connecting the vernier condenser plates with said stator and rotor.

4. A variable condenser for radio apparatus and the like comprising a group of substantially semi-circular, flat condenser plates, a second group of similar condenser plates, means for mounting the second group of plates for movement relative to the first group of plates to interleave the first group of plates, a cylindrical condenser element electrically connected to one of said group of plates, a second condenser element capacitively associated with said cylindrical condenser element and electrically connected with the other group of said plates, means for moving one of said condenser elements with the group of movable condenser plates and means for moving the other condenser element relative thereto.

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