Dec. 18, 1923. 1,478,342

R. C. LEWIS

ELECTRICAL AIR CONDENSER

Filed Jan. 31. 1921 2 Sheets-Sheet 1

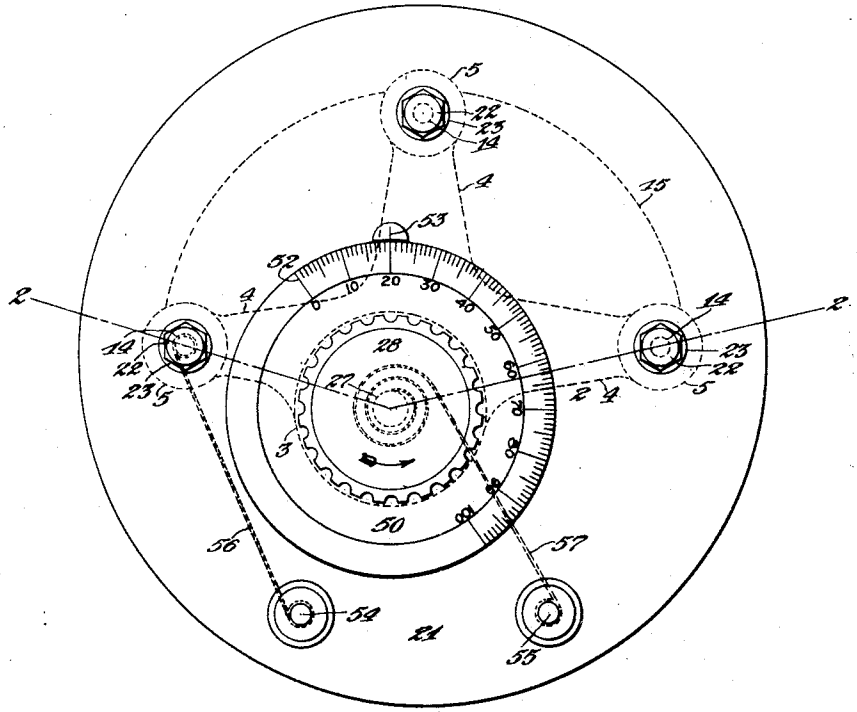

Fig. 1.

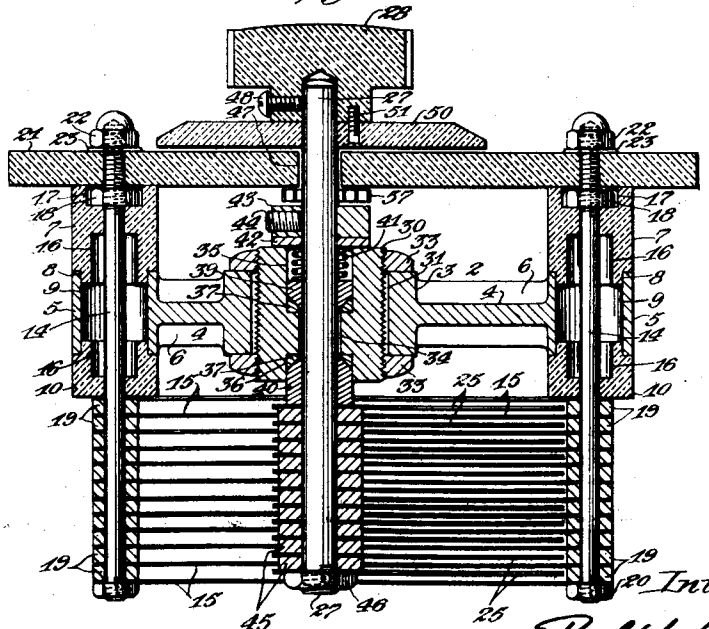

Fig. 2.

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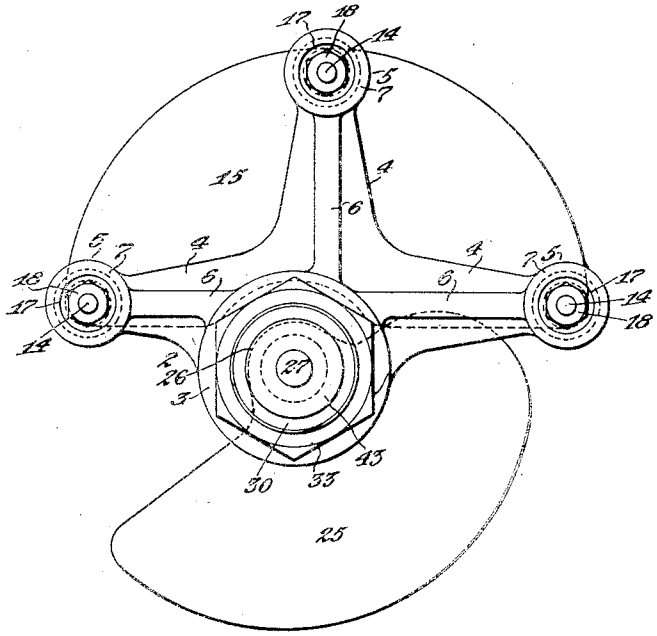


Fig. 3.

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# UNITED STATES PATENT OFFICE.

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## ELECTRICAL AIR CONDENSER.

Application filed January 31, 1921. Serial No. 441,115.

*To all whom it may concern:*

Be it known that I, RALPH C. LEWIS, a citizen of the United States, residing at Providence, in the county of Providence, State of Rhode Island, have invented certain new and useful Improvements in Electrical Air Condensers, of which the following is a specification.

My invention relates to electrical air-condensers of the variable type and consists in improvements in the mechanical design and construction of the same.

The principal object of the improvement is to simplify the structure and cheapen the cost of manufacture of the device while rendering it highly efficient for the purpose designed.

Further objects of the improvement are set forth in the following specification which describes a preferred embodiment of the invention as illustrated by the accompanying drawings, in which like reference-characters designate like parts. In the drawings:

Fig. 1 is a plan view of my improved air-condenser;

Fig. 2, a vertical sectional elevation of the same taken on the line 2—2 of Fig. 1; and

Fig. 3, a detail plan view showing the arrangement of the condenser plates.

My improved air-condenser is of a well-known type as used with radio apparatus and comprises in general a series of spaced-apart plates arranged in fixed relation, with a second set of movable plates adapted to be swung between the fixed plates, in alternate relation thereto, and with a variable degree of overlap to regulate the capacitive effect. As before stated, my invention relates particularly to the mechanical structure of the apparatus and consists in an improved mounting for the plates and a simplified method of assembling them thereon.

Referring to the drawings, the mounting for the condenser-plates consists essentially of a metal, spider-like member 2 comprising a hub or bearing 3 with arms 4 radiating from an axis in offset relation to the center of the hub. At the outer ends of the arms 4 are ring-like bosses 5 with ribs 6 extending longitudinally of the arms between the bosses and the hub 3 to reinforce the structure, see Figs. 2 and 3. On the top of the bosses 5 are cylindrical hubs 7 which are shouldered at 8 to adapt them to fit into the ends of the bores 9 of the bosses. Similar hubs 10 are fitted to the bottom of the bosses 5 and with the upper hubs 7 form a continuation or extension thereof. The hubs 7 and 10 are constructed of hard rubber, vulcanite, bakelite or similar dielectric material and are provided with axial bores for receiving rods 14 which hold the fixed condenser plates 15 on the spider or mounting 2. The hubs 7 and 10 are preferably counterbored at 16 and with the bores 9 of the bosses 5 provide air spaces surrounding the rods 14 to insulate them from the metal of the spider 2. At the upper ends of the hubs 7 are counterbores 17 adapted to receive nuts 18 screwed onto the threaded ends of the rods 14. The rods 14 project down through the lower hubs 10 to adapt them to be inserted through holes in the fixed condenser-plates 15 which are arranged in superimposed relation and held spaced-apart by a series of washers or collars 19.

As shown in Fig. 3, the fixed plates 15 are of substantially semicircular shape in outline and the three rods 14 pass through holes spaced equidistantly around their curved edges. Referring to Fig. 2, I have here shown twelve fixed plates but the number is arbitrary and may be varied at will. The plates 15 are held on the rods 14 by nuts 20 at their lower ends, which, with the upper nuts 18 also serve to clamp the hubs 7 and 10 in place against the bosses 5. The upper threaded ends of the rods 14 extend beyond the nuts 18 and are adapted to project through suitable holes in a circular plate 21 which is constructed of hard rubber or other suitable dielectric material and constitutes the cover or support for the condensers. In some cases the plate 21 forms the top or cover of a circular casing enclosing the complete apparatus and nuts 22 are screwed onto the upper ends of the rods 14 against washers 23 to bind the hubs 7 against the under side of the cover.

Referring to Fig. 3, the movable plates 25 are of substantially the same contour as the fixed plates 15 except that they are cut away or rounded off at one end and are provided with offset tabs 26 by which they are attached to a rotatable spindle 27, see Fig. 2, by means of which they may be swung to different positions in relation to the fixed plates 15. The spindle 27 is mount-

ed to turn in bearings in the hub 3 and carries a knurled knob 28 at its upper end for operating it. As shown in Fig. 2, the bearings for the spindle 27 are mounted in a bushing or thimble 30 adapted to be quickly and easily assembled in the hub 3 of the spider 2 and also providing for convenient adjustment of the spindle in the direction of its axis, whereby to allow for properly setting the movable plates 25 equidistantly between the fixed plates 15.

The thimble 30 is screw-threaded on its exterior and fits loosely within an enlarged bore 31 in the hub 3. Screwed onto its opposite ends are suitable nuts 33 which are tightened against the top and bottom faces of the hub 3 to secure the bushing 30 fixedly therewith. By loosening one nut and tightening the other the thimble 30 may be adjusted in either direction axially of the hub 3, whereby to accurately locate the spindle 27 with its plates 25 in proper relation with the fixed plates 15. The thimble 30 is provided with a bore 34 through which the spindle 27 passes with a clearance around its sides, and at its top and bottom are larger counterbores 35 and 36 adapted to receive bearing-rings 37. The rings 37 are formed with tapered bearing-faces fitted to the oppositely tapered faces of two bearing-cones 39 and 40 on the spindle 27. The lower bearing-cone 40 is forced or "sweated" onto the spindle 27 to hold it in fixed position, while the upper cone 39 is free to slide longitudinally thereof and is held against its bearing-ring 37 by means of a coiled compression-spring 41.

The spring 41 is coiled around the spindle 27 within the counterbore 35 and is held under compression by a washer 42 which bears against a collar 43 fastened to the spindle by a set-screw 44. The collar 43 is adjusted on the spindle 27 to cause the spring 41 to exert sufficient pressure on the bearings to provide a slight frictional resistance to the turning movement of the spindle 27, whereby when the latter is turned to swing the plates 25 into the desired position they will remain set without danger of being displaced by jar or shock. The plates 25 are held in spaced relation on the lower end of the spindle 27 by means of suitable washers 45 with a nut 46 screwed onto the end of the spindle to bind the whole series of plates against the fixed bearing-cone 40.

The spindle 27 projects upwardly through a hole 47 in the cover or top-plate 21 with the finger-knob 28 fastened to its upper end by means of a set-screw 48. Beneath the knob 28 is a circular disk or dial 50 secured to the hub of the knob by a screw 51 and provided with graduations 52 on its beveled edge. The graduations 52 are adapted to register with an index mark 53 on the fixed top-plate 21 to indicate the extent of adjustment of the swinging plates 25 under the turning action of the spindle 27.

On the top of the plate or cover 21 are two binding-posts 54 and 55 of usual arrangement, see Fig. 1, the post 54 being electrically connected with the fixed plates 15 by a wire 56 leading to one of the rods 14; while the other post 55 has a wire 57 leading to the spindle 27 which carries the movable plates 25. The wire 57 is preferably flat or ribbon-like and is coiled about the spindle 27 in a spiral so that the latter may be rotated freely without interference.

My improved condenser may be applied to use in the position shown in the drawings with a cylindrical casing enclosing its parts, or it may be set into a vertical plate or board if desired. The device is connected in circuit with the radio apparatus by means of the two binding-posts 54 and 55 and by turning the knob 28 the spindle 27 is rotated to swing the movable plates 25 between the fixed plates 15. The dial 50 is fixed on the spindle 27 in such position that when its zero mark registers with the index point 53 on the cover 21 the plates 25 will be set with their straight edges in parallel spaced relation with the opposite straight edges of the fixed plates 15 so that the capacitive effect between the plates will be nil. When, however, the knob 28 is turned in the direction indicated by the arrow in Fig. 1 the shorter curved ends of the plates 25 will be swung in between the fixed plates, as shown in Fig. 3. As the knob 28 is turned still farther in this direction the plates 25 will be swung around to enter them between the plates 15 with an increasing overlap until, when the "100" mark on the dial registers with the index point 53, the two sets of plates will have a complete overlap and the maximum capacitive effect will be secured.

It will be understood that the above described apparatus has the same principle of operation as that of similar devices well known in the art and, as before pointed out, the present improvement resides in the mechanical structure and arrangement of its parts. It will be noted that instead of employing the usual heavy and expensive composition plates or grids between which the two sets of condenser plates are supported I make use of a relatively light mounting for the plates comprising the skeleton spider-member 2. This part may be constructed very cheaply as an aluminum casting and the other metal parts are correspondingly light in weight and economical to manufacture by screw-machine processes. It is also to be observed that only one bearing is necessary for the operating-shaft or spindle which carries the movable condenser-plates, and this is arranged substantially central of the length of the spindle. A particular feature of my improvement consists in the ar-

rangement whereby the bearing may be assembled as a unit with the spindle and then applied to the mounting or spider-member 2 and readily adjusted to position to set the two series of condenser-plates in correct relation with very little labor and practically no fitting. Another feature of the improvement consists in the method of connecting the fixed plate supporting rods with the spider or mounting to provide an extended air-chamber or pocket surrounding the rods where they pass through the hollow bosses on the arms, whereby to secure a minimum capacitive effect between the metal rods and the metal mounting. It is also brought to attention that while the complete device is particularly staunch and rigid in structure its weight is reduced to the minimum and the heavy, expensive composition plates and insulators have been eliminated. Furthermore, such parts of insulating material as are necessary are designed for strength, and constructed to minimize the danger of cracking or splitting when assembled with the metal fastenings.

The above description and the accompanying drawings illustrate my improved device in its preferred form and slight variations in design and structure of the parts of the apparatus may be made without departing from the spirit or scope of the invention. Therefore, without limiting myself to the exact embodiment of the invention as herein set forth, I claim:

1. An electrical air-condenser comprising a single unitary mounting consisting in a spider-member having an extended bearing-hub and a skeleton structure supported therefrom, a series of superimposed spaced-apart condenser-plates suspended from said spider, a spindle journaled in the bearing-hub and projecting downwardly therefrom, and a second series of superimposed spaced-apart movable plates mounted on the projecting portion of the spindle below the hub to adapt them to be swung into position between the fixed plates.

2. An electrical air-condenser comprising a single unitary mounting having a bearing-hub with arms extending substantially radially therefrom, a series of fixed condenser-plates suspended from the ends of the arms in superimposed spaced-apart relation, a spindle journaled in a plurality of bearings in the hub and projecting downwardly therefrom, and a second series of movable condenser-plates mounted in superimposed spaced-apart relation on the projecting portion of the spindle to adapt them to be swung into position between the fixed plates.

3. An electrical air-condenser comprising a single unitary mounting, consisting in a spider-member having a hub with arms radiating therefrom, a series of fixed condenser-plates suspended below the spider in superimposed spaced-apart relation, rods extending through the plates and supported solely from their upper ends in the arms of the spider, means to secure said rods in the arms while insulating them therefrom, a spindle journaled in a plurality of bearings in the hub of the spider and projecting therebelow, and a second series of superimposed spaced-apart plates mounted on the spindle to adapt them to be swung into position between the fixed plates.

4. In a variable air-condenser, the combination of a unitary mounting having a bearing-hub with arms radiating therefrom, insulating hubs supported at the ends of the arms, rods secured in the insulating hubs on the arms and projecting therebelow without other support, a series of superimposed spaced-apart condenser-plates held in suspended relation by the rods below the mounting, a spindle journaled in the bearing-hub and projecting downwardly therefrom, and a second series of movable condenser-plates secured in superimposed spaced-apart relation on the lower projecting portion of the spindle.

5. In a variable air-condenser, the combination of a unitary mounting consisting of a spider-member having a hub and arms radiating therefrom with hollow bosses at their ends, insulating hubs fitted to the ends of the bosses on the arms, rods inserted through bores in the hubs, a series of fixed condenser-plates arranged in superimposed relation on the rods, means for holding said plates in spaced relation, nuts on the ends of the rods for securing the plates in position and fastening the rods in the hubs, a spindle journaled in the bearing-hub and projecting downwardly therefrom and a series of superimposed movable plates mounted in spaced-apart relation on the projecting portion of the spindle.

6. In a variable air-condenser, the combination of a mounting having a hub, a series of superimposed spaced-apart condenser-plates supported from the mounting, a bearing-thimble adjustable axially of the hub, a spindle journaled in bearings in the hub to adapt it for axial adjustment therewith, and a series of superimposed plates mounted in spaced-apart relation on the spindle to adapt them to be swung around into overlapping relation with the fixed plates.

7. In a variable air-condenser, the combination of a mounting having a bearing-hub, fixed condenser-plates attached to the mounting in superimposed spaced-apart relation, a thimble extending axially of the bearing-hub, nuts on the ends of the thimble for adjusting it in the hub, a spindle journaled in bearings in the thimble, and a series of superimposed spaced-apart plates carried by the spindle to adapt them to be swung into position between the fixed plates.

8. In a variable air-condenser, the combination of a mounting having a bearing-hub, fixed condenser-plates supported from the mounting in superimposed spaced-apart relation, a thimble adjustable axially of the bearing-hub, conical bearing-rings in the thimble, a spindle extending axially of the thimble, bearing-cones on the spindle seated against the bearing-rings in the thimble, means to exert a resilient pressure to force the cones and rings toward each other, and a series of superimposed spaced-apart condenser-plates carried by the spindle.

9. In a variable air-condenser, the combination of a mounting having a bearing-hub, fixed condenser-plates supported from the mounting in superimposed spaced-apart relation, a thimble in the hub, means for adjusting the thimble axially of the hub, conical bearing-rings in the thimble, a spindle extending axially of the thimble, a fixed bearing-cone on the spindle adapted to seat against one of the bearing-rings, a second bearing-cone slidable on the spindle to seat against the other ring, a spring for pressing the slidable cone toward the fixed cone, and a series of superimposed spaced-apart condenser-plates carried by the spindle.

10. In a variable air-condenser, the combination of a mounting having a bearing-hub and arms radiating therefrom with hollow bosses at their ends, insulating hubs fitted to said bosses, rods extending through bores in said hubs, a series of superimposed condenser-plates mounted in spaced-apart relation on the rods, a cover-plate fastened to the upper ends of the rods, bearings adjustable axially of the bearing-hub, a spindle journaled in said bearings and adjustable axially therewith, a series of superimposed condenser-plates mounted in spaced-apart relation on the lower part of the spindle, a knob on the upper end of the spindle, and a dial rotatable with the spindle and provided with graduations on its edge adapted to register with an index mark on the cover-plate.

11. In a variable air-condenser, the combination of a mounting having hollow bosses supported therefrom, insulating hubs mounted on the bosses and having counterbores forming extensions of the bores in the bosses to provide extended air-chambers, rods held in smaller bores at the outer ends of the hubs, a series of superimposed condenser-plates mounted on the rods in spaced-apart relation, a spindle journaled in bearings in the mounting, and a series of superimposed spaced-apart plates carried by the spindle to adapt them to be swung between the fixed plates.

In testimony whereof I affix my signature.

RALPH C. LEWIS.