June 28, 1927.

E. F. POTTER

1,633,870

CONDENSER

Filed Jan. 26, 1923

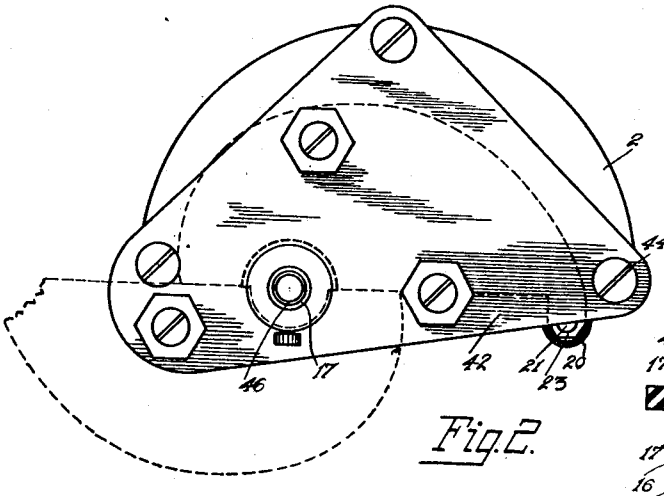


Fig. 2.

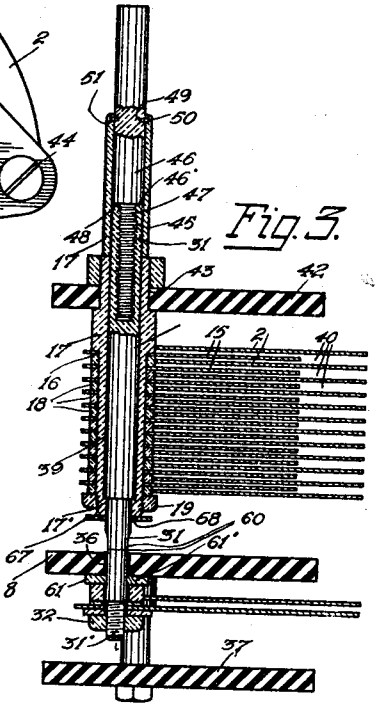


Fig. 3.

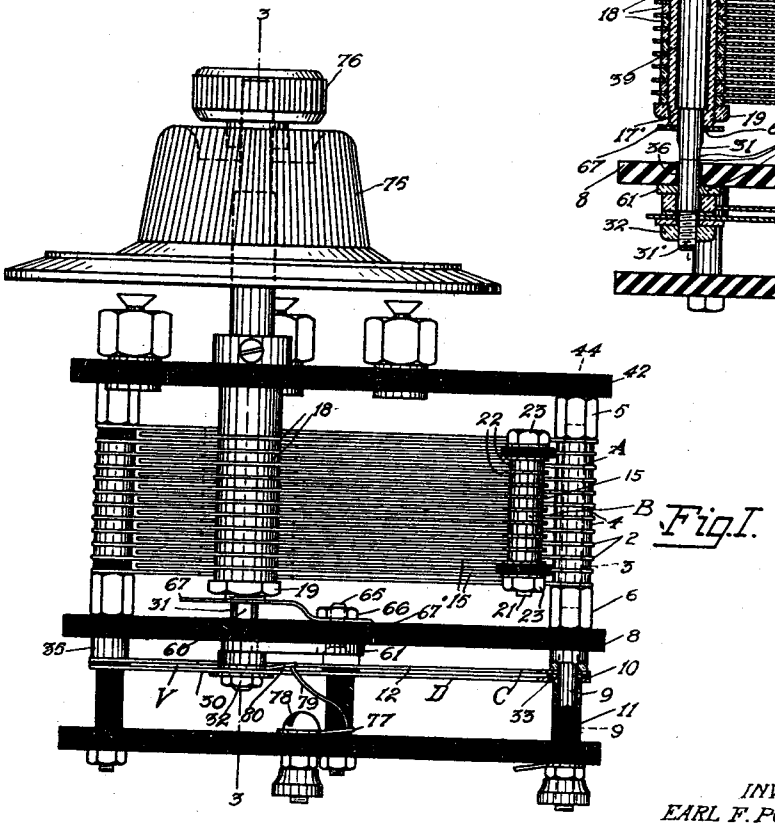


Fig. 1.

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UNITED STATES PATENT OFFICE.

EARL F. POTTER, OF GLENCOE, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CONDENSER.

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My invention relates to condensers and has to do more particularly with variable condenser with an air dielectric, such as are now in general use in wireless sets, and an object of my invention is the provision of an improved condenser of the variable type, which is provided with structural features in combination with novel assembly features, which combination produces an improved condenser of the above type.

The condenser of my invention is of the decremeter type, in which a rotating plate element and its supporting shaft, as a whole, is eccentrically located in relation to the circular fixed plates so that the capacity of the condenser may be made to vary as the square of the angle of rotation of the rotatable element, which, of course, is well known in the art.

A feature of my invention is the association of a fine adjustment element with the variable condenser element for finer tuning purposes, and its association with the variable condenser rotary movable element.

Another feature of my invention is the provision of a novel fine adjustment element which comprises a stationary plate and a movable plate, which is controlled by means of a longitudinally movable shaft which, in association with a knob when rotated to the right or left, to decrease or increase the capacity of the said fine adjustment element, as the case may be, causes the shaft to which the movable plate is secured to move endwise or laterally in relation to the rotatable variable condenser shaft to decrease or increase the space between the stationary and movable plate of the vernier element of the condenser. The above feature of my invention as well as others will be more apparent by a reading of the specification.

For a more complete understanding of my invention, reference may be had to the accompanying drawing, in which like reference characters in the several views denote like parts, and in which:

Fig. 1 is a front elevation of the condenser of my invention;

Fig. 2 is a plan view of Fig. 1; and

Fig. 3 is a sectional view along the line 3—3 of Fig. 1 to clearly illustrate the rotary plate shaft assembly and the actuating means of the fine adjustment element in association with the rotatable plate element.

Referring now more in detail to my invention as illustrated in the accompanying drawing, the condenser comprises a fixed plate element A, a rotatable plate element B, operatively associated with the fixed plate element A. I also provide a fixed plate element C independent of the element A and which has associated therewith a movable plate element D, which may be moved independently of the rotatable element B.

The fixed plate element A comprises a plurality of semi-circular plates 2, of suitable metal, such as aluminum, each being provided with orifices of a size to receive rods 3. The rods 3 are inserted alternately through the orifices of the plates 2, and spacer washers 4, and their ends which are threaded, have a screw-threaded engagement with the studs 5 and 6, which are provided with suitable tapped orifices to clamp the plates 2 in position upon the rods 3. The element C also comprises a circular plate 12, which is also provided with orifices, and an intermediate base 8 of suitable insulation material, such as bakelite, is provided, and orifices in the base 8 in alignment with the orifices of the plate 12, are adapted to receive rods 9 which pass through the openings in the intermediate base 8, their threaded ends having screw-threaded engagement with the tapped orifices in the studs 6. Insulation washers 10 are also provided which slip over the rods 9 and rest against the bottom face of the plate 12, and insulation sleeves 11 are also provided which slip over the rods 9 and are for purposes as will presently be described.

The rotatable plate element B comprises a plurality of suitably formed plates 15, designed according to the decremeter equation for developing the boundary curve of the rotatable element of this type. The plates 15 are provided with openings 16 of a size to permit the passage of the shaft 17 of the rotatable element B associated with the fixed plate portion A of the condenser. The shaft 17 passes alternately through the openings 16 of the plates 15 and the spacer washers 18, and when the requisite number are slipped upon the shaft 17, its end 17', which is threaded, receives a nut 19 which tightly clamps them upon the shaft 17. The plates 15 are also provided with ears 20 integrally formed therewith, and provided with openings of a size to receive a rod 21 which

passes alternately through the openings in said ears 20 and spacer washers 22. The ends of the rods 21 are threaded to receive nuts 23 which clamp the free ends of the plates 15 in proper spaced relation with each other and, at the same time, hold the plates 20 in alignment with each upon the shaft 17.

The movable plate element D of the fine adjustment portion V of the condenser, comprises a semi-circular shaped plate 30 and a shaft 31 upon which the plate 30 is secured. The shaft 31 has its one end 31′ threaded and a nut 32, having screw-threaded engagement with the threaded end 31′ of the shaft 31, clamps the plate 30 upon the shaft 31. The movable plate 30 is provided with orifices 33 in alignment with the rods 9 and are of a size to slip over the sleeves of insulation 11, which are supported on the rods 9. When the movable plate 30 is in position as illustrated in Fig. 1, the rods 9 and the supported insulation sleeves 11 serve as guides for the movable plate 30 as it is moved laterally with relation to its associated stationary plate 12, as will be more fully, hereinafter, described.

The construction and assembly of the fixed plate elements A and C and the rotatable plate element B and the movable plate D having been described, I will now describe the assembly of the elements A, B, C, and D, as a whole, to form the completed condenser of my invention. The fixed plate element A of the variable condenser is placed upon the intermediate base 8, and the orifices in the base are made to register with the tapped orifices in the studs 6. Now, when the element A is in this position, the rods 9 are inserted into the orifices in the base 8, and their threaded ends are threaded into the tapped orifices of the studs 6. The plate 12 of the fixed element C of the fine adjustment portion V of the condenser which is provided with suitable orifices which register with the rods 9, is now slipped on the rods 9 and spacer washers 35 are placed between the base and the plate 12 to keep the said plate 12 properly spaced from the bottom face of the base 8. Insulation washers 10 are provided which are now slipped over the rods 9 as are also the sleeves of insulation 11 for purposes as will presently be described. The movable plate 30 of the movable element D of the portion V of the condenser, is secured to one end of the shaft 31 as already described and is provided with orifices which are adapted to register with the rods 9 and are of a size to permit it to be slipped over the insulation sleeves 11 which surround the rods 9. The intermediate base 8 is provided with an orifice 36 of a size to permit the insertion of the shaft 31, and when the shaft 31 and its associated plate 30 are in position, as illustrated in the drawing, a base plate 37 provided with orifices which register with the rods 9 is slipped on the said rods 9 and the protruding ends of the said rods 9 which are threaded, receive nuts 38 which, when tightened, hold the fixed plate 12 of the portion V of the condenser between the intermediate base 8 and the base plate 37. The shaft 17 of the rotatable element B of the condenser, is provided with a central orifice 39 extending its length and is of a size to permit its being slipped over the shaft 31 of the movable plate element C of the portion V of the condenser and when in the position as shown dotted in Fig. 2, the said rotatable element B is slipped over the shaft 31. When the plates 15 of the rotatable element B, register with their respective spaces 40 between the plates 2 of the fixed plate element A, a top plate 42, having an orifice 43, permits the shaft 17 to extend therethrough and screws 44 pass through suitable orifices in the plate 42 and have screw-threaded engagement with the studs 5. The end of the shaft 31 is provided with a tapped orifice 45 and the stem 46 of the control button or knob 76 having a threaded portion 47, is adapted to have a screw-threaded engagement with the tapped orifice 45 in the shaft 31 and which, when in position in operative relation with the shaft 31, has its shoulder 46′ engaging the end face 48 of the shaft 31. This stem 46 of the control knob 76 forms a connecting link between the movable plate 30 of the vernier portion V of the condenser and its rotary movement in relation to the longitudinal movement of the shaft 31, will presently be described.

The stem 46 of the knob 76 is provided with an annular groove 49 which is adapted to receive a U-shaped retaining member 50 and which rests in the enlarged opening 51 in the end of the shaft 17. The wall of the shaft 17 protrudes slightly above the face of the member 50 and this portion is spun over to retain the stem 46 of the knob 76 in position against lateral movement, but permits the same to be rotated. When the stem 46 of the knob 76 and shaft 31 are connected and the end face of the shaft 31 engages the shoulder 46′ of the stem 46, the movable plate 30 of the element C of the vernier portion V of the condenser rests against the insulation spacer washers 10 which keep the movable plate 30 and stationary plate 12 of the portion V of the condenser in proper spaced relation and in the position as illustrated, the fine adjustment portion V of the condenser is at its greatest capacity. When the stem 46 of the knob and shaft 31 are connected by means of the threaded connection and secured in position as described, the rotation of the knob 76 in a clock-wise or counter-clockwise direction causes the shaft 31 associated with the portion V of the con-

denser to be moved longitudinally in relation to the rotary motion of the stem 46 of the knob 76, due to the well known screw principle, and which operation will be more fully, hereinafter, described.

A portion of the stem 46 extending into the orifice 39 of the shaft 17, forms a bearing for the same when rotated and the said orifice 39 also forms a bearing for the longitudinally movable shaft 31. To prevent rotation of the shaft 31 when the knob 76 is rotated, I have provided the portion of the shaft 31 which extends through the shaft 17, with two flattened faces 60; and a retaining plate member 61 provided with a bifurcated end 61', straddles the shaft 31 to engage the flattened faces 60 on the shaft 31 thus preventing rotary movement of the shaft 31. The plate 61 is secured to the bottom face of the base 8 by means of a screw 65 and nut 66.

A combined thrust and frictional leaf spring 67 is provided for the rotatable plate element B which is provided with an orifice 68 through which the shaft 31 extends. The spring 67 is secured to the base 8 by means of the screw 65 and nut 66, its one end being provided with an angular extending tongue 67' which rests in a suitable orifice in the base 8 and prevents rotation of the said spring 67. The tension of the spring 67 is such as to bear against the bottom face of the shaft 17 to place its face in frictional engagement with the bottom face of said shaft so that as the rotatable element B is rotated for tuning purposes, it will remain in any position it is set due to this frictional engagement. The spring 67 also acts as a thrust means as the tension of the spring 67 is such as to force the shaft 17 and its parts as a whole upward in relation to Fig. 1 and if any downward pressure is exerted upon the shaft 17, the tension of the spring 67 is such as to prevent the shaft from being forced downward and cause the rotatable plates 15 to engage the fixed plates 2 to discharge the condenser when in use.

A suitable dial 75 is secured to the shaft 17 by suitable means to permit the ready manipulation of the rotatable element B and the knob 76, and its stem 46 permits the ready manipulation of the movable element D of the portion V of the condenser. A terminal 77 is secured to the base 37 by means of a screw 78 and is connected by means of a flexible lead 79 to the terminal 80 of the movable plate 30 of the fine adjustment portion V of the condenser, forming connection means for the external circuit.

Having described the apparatus which comprised my invention, I will now describe the method of manipulating the condenser of my invention for tuning purposes. When the dial 75 is turned, the rotatable element B is rotated independent of the shaft of the movable element D of the fine adjustment portion V and when proper tuning is accomplished through the medium of the rotatable element B in association with the fixed element A, the said element B is held in position by means of the spring 67. If a finer tuning is desired to clarify, the knob 76, associated with the portion V, is rotated in a counter-clockwise direction for the purpose of description. The stem 46 is also rotated in a counter-clockwise direction and, due to the screw-connection 47—45 between the stem 46 and the shaft 31, the said shaft 31 is moved longitudinally in a downward direction and, as the movable plate 30 of the portion V of the condenser is also secured to the shaft 31, the plate 30 is moved away from its associated stationary plate 12. The rods 9 form guiding means for the movable plate 30 to permit free movement of the shaft 31 in a longitudinal direction. The shaft 31, when moved in a downward direction, carries the plate 30 away from its associated stationary plate 12 to decrease the capacity of the portion V of the condenser and, to again increase the capacity, the knob 76 is turned in a clockwise direction causing its associated stem 46 to rotate in the same direction and, due to the screw connection 47—45 between the stem 46 and shaft 31, this rotary motion of the stem 46 transmits longitudinal motion to the shaft 31 and causes the shaft 31 to be moved up to carry the plate 30 closer to its associated stationary plate 12 to increase the capacity of the adjustable portion V of the condenser.

While I have described the variable condenser of my invention in its preferred form, it is to be understood that changes and modifications will readily suggest themselves by those skilled in the art, and I desire to cover all such changes and modifications as come within the spirit and scope of the appended claims.

Having described my invention what I claim as new and desire to secure by United States Letters Patent is:

1. In a device of the character described including a fixed element and a rotatable element, a shaft for said rotatable element, a second fixed element, a movable element associated with said second fixed element, a shaft for said movable element extending through the shaft of said rotatable element, and means rotatably secured in said first shaft for moving the shaft of said movable element longitudinally in the first said shaft.

2. In a device of the character described, including a fixed element and a rotatable element, a shaft for said rotatable element, a second fixed element, a movable element associated with said second fixed element, means for rotating said first shaft, a shaft for said

movable element extending through the shaft of said rotatable element and slidable longitudinally therein, and means rotatably secured in said first shaft for moving the shaft of said movable element longitudinally independent of the rotary movement of said first shaft.

3. In a device of the character described including a fixed element and a rotatable element, a shaft for said rotatable element, a second fixed element, a movable element associated with said second fixed element, a shaft for said movable element extending through the shaft of said rotatable element, a knob provided with a stem which has screw-threaded engagement with said shaft, rotatable to impart longitudinal movement to said shaft of said movable element.

4. A condenser comprising a fixed element and a rotatable element, a second fixed element, a movable element associated with said second fixed element, concentric shafts for said rotatable element and said movable element for controlling the same, means for turning the shaft of said rotatable element, and means rotatably secured to the shaft of said rotatable element for moving the shaft of said movable element longitudinally.

5. A condenser comprising two sets of stationary plates, a set of rotatable plates associated with one of said sets of stationary plates, a movable plate associated with said other stationary plate, concentric shafts for said rotatable element and said movable element for controlling the same, means for turning the shaft of said rotatable element, and means associated with the shaft of said movable element for longitudinally moving said shaft independent of the rotary movement of the shaft of said rotary element.

6. In a device of the character described including a set of stationary plates and a set of rotatable plates associated therewith, a stationary plate and a movable element associated therewith, concentric shafts for said rotatable element and said movable element, means for rotating the shaft of said rotatable element, a knob provided with a stem, which stem extends into the shaft of said rotatable element, means for rotatably securing said stem in said shaft, a screw connection link between said stem and the shaft of said movable element having threaded engagement with shaft of said movable element to impart longitudinal movement to the shaft of said movable element when said knob and said stem as a whole is turned.

7. In a device of the character described including a rotary element and a fixed element, a second fixed element and a movable element associated therewith, concentric shafts for said rotary element and said movable element, rotatable means for the shaft of said rotary element, a stem rotatably secured in the shaft of said rotary element and rotatable independent of the shaft of said rotary element, a threaded extension of said stem engaging a threaded orifice in the shaft of said movable element to impart longitudinal movement to the shaft of said movable element when the stem is rotated.

Signed by me at Chicago in the county of Cook and State of Illinois this 24th day of January 1923.

EARL F. POTTER.