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G. A. YANOWCHOWSKI

1,633,915

CONDENSER

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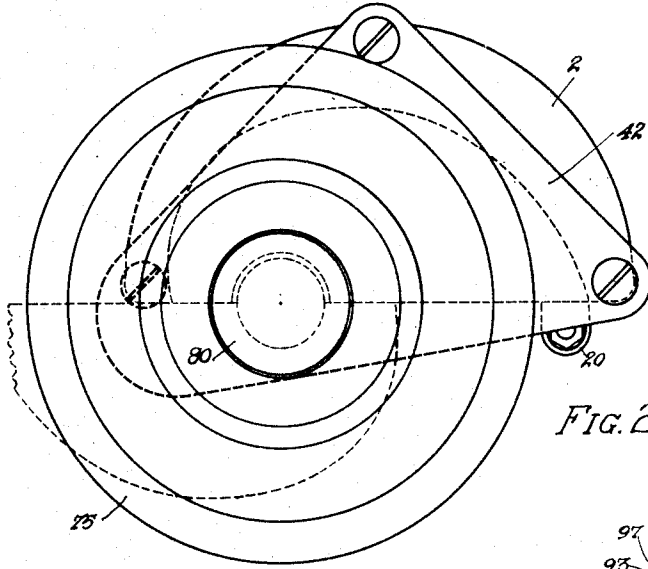


FIG. 2.

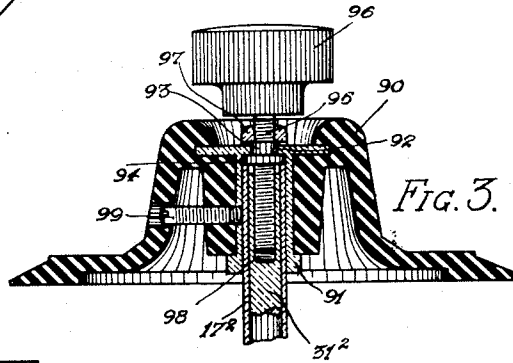
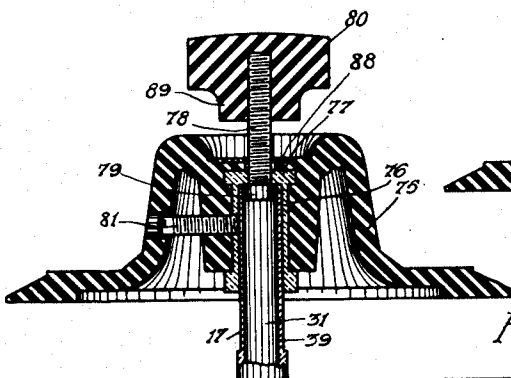
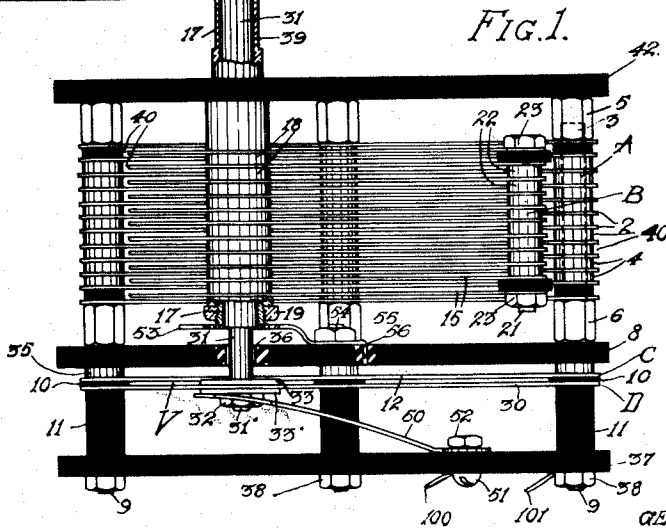


FIG. 3.



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GEORGE A. YANOCHOWSKI, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCH-BOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CONDENSER.

Application filed January 25, 1923. Serial No. 614,752.

My invention relates to condensers and has to do more particularly with variable condensers 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 decimeter 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 element having a fine adjustment which element comprises a stationary plate and a longitudinally movable plate, which latter plate is controlled by means of a longitudinally movable shaft. A knob is provided which, when rotated to the right or left, moves the shaft longitudinally to decrease or increase the capacity of the said element, as the case may be, by decreasing or increasing the space between the stationary plate and the movable plate. The longitudinal position of the knob indicates the position of the endwise movable plate relative to the stationary plate.

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:

Figure 1 is a front elevation of the condenser of my invention showing certain parts thereof in section:

Figure 2 is a plan view of Figure 1: and Figure 3 is a sectional view showing a modified form of my invention.

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 vernier 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 plate 2 and spacer washers 4, and their ends, which are threaded, have screw-threaded engagement with the studs 5 and 6 which are provided with suitably tapped orifices to clamp the plates 2 in position upon the rods 3. The fine adjustment element C also comprises a circular plate 12 which is provided with suitable orifices and an intermediate base 8 of suitable insulation material, such as bakelite, is provided and has suitable openings in alignment with the orifices in the plate 12 and are adapted to receive rods 9 which pass through the orifices 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 decimeter equation for developing the boundry curve of the rotatable element of this type. The plates 15 are provided with suitable openings 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 in 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 properly spaced relation with each other and, at the same time, hold plates 20 in alignment with each other upon the shaft 17.

The movable plate element D of the adjustable 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' reduced and threaded and a nut 32, having a screw-threaded engagement with the threaded end 31' of the shaft 31, clamps the plate 30 upon the shaft 31 and washers 33 and 33' are also clamped between the shoulder of the reduced end portion of shaft 31 and nut 32 and in engagement with the plate 30. The movable plate 30 is provided with suitable orifices which are 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 Figure 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 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 vernier 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 8 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 vernier 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 in-

section 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 adjustable 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 adjustable portion V of the condenser and to assume the position as shown in Figure 1 when in its assembled position. When the plates 15 of the rotatable element B are in position and register with their respective spaces 40 between the plates 2 of the fixed plate element A, a top plate 42, having suitable orifices, permits the shaft 17 to extend through one of said orifices and suitable screws, not shown on the drawing, pass through the other suitable orifices in the plate 42 and have screw-threaded engagement with the studs 5. A combined thrust and frictional leaf spring 50 is provided, which has its one end secured to the plate 37 by means of a screw 51 and nut 52, and the other end of said spring 50 is provided with an opening of a size to permit the protrusion of the end of the shaft 31' and nut 32, so that the end of the spring 50 has its upper end face portion engaging the face of the washer 33' for purposes which will be pointed out in the ensuing specification.

A combined thrust and frictional leaf spring 53 is also provided for the rotatable plate element B which is provided with an orifice through which the shaft 31 extends. The spring 53 is secured to the base 8 by means of the screw 54 and nut 55, its one end being provided with an angular extending tongue 56 which rests in a suitable orifice in the base 8 and prevents rotation of the said spring 53. The tension of the spring 53 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 17 so that as the rotated element B is rotated for tuning purposes, it will remain in any position it is set, due to this frictional engagement. The spring 53 also acts as a thrust means as the tension of the spring 53 is such as to force the shaft 17 and its parts as a whole upward, and if any ordinary and reasonably downward pressure is exerted upon the shaft 17, the tension of the spring 53 is such as to prevent the shaft from being forced downward and causes the rotatable plates 15 to engage the fixed plates 2 to short-circuit the condenser when in use.

A suitable dial 75 of non-conducting material is provided and which has a cylindrical insert 76 of suitable metal secured and molded in the central portion of the dial 75 when the dial 75 is formed. The closed end 77 of the insert 76 is provided with a threaded opening through which a screw-threaded member 78 extends and has screw-threaded engagement with the said opening, said screw-threaded member 78 having a head 79 for purposes to be presently described. To the free end of the screw-threaded member 78, is suitably secured a knob 80 so that when the knob 80 is rotated, the member 78 will rotate with the said knob 80. The cylindrical insert 76 is provided with a central opening of a size to permit the insertion of the end of the shaft 17 whereby the end of the shaft 31 is brought into operative engagement with the head 79 of the screw member 78. The dial 75 and insert 76 are secured on the shaft 17 by means of a set screw 81 which extends through a suitable orifice in the dial 75 and a suitably tapped orifice in the side of the insert 76 and which screw 81 has frictional engagement with the shaft 17 to prevent rotation of said insert 76 and dial 75 on the shaft 17 and to prevent the displacement of said dial 75 from said shaft 17.

Having described the apparatus which comprises my invention, I will now describe the method of manipulating the condenser of my invention for tuning purposes with reference to the dial shown in Figure 1. When the dial 75 is turned, the rotatable element B is rotated, independent of the shaft of the movable element D of the adjustable portion V and when the 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 53. If a finer tuning is desired, the knob 80, associated with the fine adjustment portion V, is rotated in either a clockwise or a counter clockwise direction. The screw-threaded member 78, being secured to the knob 80, will also be caused to rotate with the knob 80 in a clockwise or the same direction and, due to the rotation of said member 78 which has screw-threaded engagement with the opening in the end of the insert 77, the said member 78 will move longitudinally in a downward direction and its head 79, engaging the end of the shaft 31, will cause said shaft 31 to also move longitudinally in a downward direction against the tension of the leaf spring 50 and since the movable plate 30 of the adjustable portion V is secured to the shaft 31, said plate 30 will move 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 adjustable portion V of the condenser and, to again increase the capacity, the knob 80 is turned in a counter-clockwise direction whereby the head 79 of the screw-threaded member 78, moves longitudinally upward and tends to move away from the end of the shaft 31, but, due to the spring tension of the spring 50 in operative engagement with the other end of the shaft 31, the said shaft 31 will move upward to carry the plate 30 closer to its associated stationary plate 12 to increase the capacity of the adjustable portion V of the condenser. The head 79 of the member 78, when in the position shown in Figure 1, will engage the end of the insert 76 which will prevent the further movement of the said member 78 in a counter-clockwise direction, which will, in turn, prevent any further movement of the shaft 31 in an upward direction, and the leaf spring 50 being of sufficient strength to hold the shaft 31 in this position, the plate 30 and shaft 31 will be maintained in this position until the member 78 is again operated.

The dial 75 is provided with a central depression 88 of a size to receive the reduced portion 89 of the knob 80 so that when the knob 80 is turned in a clockwise direction, its reduced portion 89 will move toward the depression 88 and engage the same when the said knob 80 is rotated far enough. When the knob 80 and screw member 78 are in the position as shown above in Figure 1, the minimum space between the movable plate 30 and its associated stationary plate 12 will be present; or, in other words, the maximum capacity of the adjustable portion V of the condenser will exist. Now as the knob 80 is rotated and moves toward the depression 88 in the dial 75, the movable plate 30 will move away from the stationary plate 12, thereby decreasing the capacity of the vernier portion V of the condenser, as described above. The operator, by observing the space between the button 80 and dial 75, will know approximately the position of the movable plate 30 relative to its stationary plate 12 and, from this knowledge, the operator will know approximately at what capacity the vernier portion V of the condenser is set.

Having described the construction and operation of my invention as illustrated in Figures 1 and 2, I will now describe the construction and operation of the modified form of my invention as shown in Figure 3.

The dial 90 is molded out of some suitable non-conducting material and has a cylindrical insert 91 of suitable metal secured therein during the process of molding said dial 90. The insert 91 is provided with a central opening of a size to receive one end

of the shaft 17². An opening 92 is provided in the closed end of the insert 91 through which a rotatable bearing member 93 extends, said bearing member having a collar 5 94 which rests between the lower face of the closed end of said insert 91 and the end of the shaft 17², which shaft 17² corresponds to shaft 17 in Figure 1, in such a manner as to permit rotation of said bearing member 93. 10 A screw-threaded member 95 having a knob 96 suitably secured thereto, is provided and which member 95 extends through and has screw-threaded engagement with the bearing member 93 and also has screw-threaded engagement with a suitably tapped central orifice 98 in the end of the shaft 31² which corresponds to shaft 31 in Figure 1. A nut 97 is provided, which has screw-threaded engagement with the member 95 and is screwed 20 down against the end of the bearing member 93, said end extending slightly above the face of the end of the insert 91 to prevent frictional engagement of the nut 97 and end of the insert 91. The collar 93 and nut 97 25 thus form a unitary grooved collar securely fastened to member 95 and which rotates with the rotation of the knob 96.

The dial 90 is secured on the shaft 17² against rotation and longitudinal movement, 30 by means of a set screw 99 which extends through suitable orifices in the dial 90 and wall of the insert 91 and has frictional engagement with the shaft 17². When the dial 90 is rotated, the shaft 17² rotates in the 35 same direction with the dial 90 and independently of the shaft 31², said shaft 31² remaining stationary as will be understood from the description of Figures 1 and 2. When the knob 96 secured to the screw-threaded member 95, is rotated, the member 40 95 and bearing member 93 and nut 97 will all rotate therewith as a unit and in the same direction and since the shaft 31² has screw-threaded engagement with the member 95, said shaft 31² will move longitudinally in an upward or downward direction, depending on the direction in which the knob 96 is turned, to increase or decrease the capacity of the adjustable portion V of the 50 condenser, as explained in describing the operation of Figure 1. The knob 96 and screw-threaded member 95, do not move in a longitudinal movement as is the case in Figure 1, due to the bearing member 93 and nut 97 55 engaging the end of the insert 91 and secured to the member 95, as is obvious from the drawing, but the shaft 31² will move in a longitudinal direction on the screw-threaded member 95. By loosening the nut 97 and 60 turning the screw-threaded member 95 to cause the same to travel inwardly or outwardly in the opening 98 in the insert 91, as the case may be, and then by tightening the nut 97 down against the member 93, the 65 member 95 will be retained in this position

relative to the shaft 31². Thus it will be seen that the operative relation of the screw-threaded member 95 and shaft 31² may be adjusted.

Referring to Figure 1, 100 and 101 are the 70 electrical terminals to which are attached the circuit conductors. The stationary plates of both the upper and the lower condenser are electrically connected to the mounting posts while the movable elements 75 of the upper and lower condenser are connected thru the shafts and spring 50 to terminal 100.

While I have described the variable condenser of my invention in its preferred form, 80 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 85 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, 90 including a fixed element and a rotatable element, a shaft for said rotatable element having a central opening, a second fixed element, a movable element associated with said 95 second fixed element, a second shaft extending into the opening in said first shaft, means secured on said first shaft for effecting rotation of said first shaft, and means secured in said first means for causing endwise movement of said second shaft independently of said first shaft to regulate the 100 operative relation of said second fixed element and said second movable element.

2. In a device of the character described, 105 including a rotatable shaft, provided with an opening, a non-rotatable shaft for engaging the opening in said first shaft, a member secured to said rotatable shaft for rotating the same, a screw-threaded member secured 110 in said first member and in operative engagement with said second shaft for causing longitudinal movement of said second shaft independent of said rotatable shaft.

3. In a device of the character described, 115 including a rotatable shaft and a non-rotatable shaft, a member having a central opening for receiving said shafts, means for securing said member on said rotatable shaft for effecting rotation of said shaft when said 120 member is rotated, a driving member rotatably secured in said first member for effecting longitudinal movement of said non-rotatable shaft independent of said rotatable shaft.

4. A device of the character described, 125 including a rotatable shaft having a central orifice, a non-rotatable shaft positioned in said orifice, a stationary condenser element, a rotatable condenser element and means for 130 rotating said rotatable element relative to

said stationary element, a second stationary element, a movable element adapted to be adjusted longitudinally relative to said second stationary condenser element, a control member adapted to engage said non-rotatable shaft and move the same in a longitudinal direction for causing such movement of said movable element, said control member in association with said means of said rotatable element adapted to indicate the position of said movable condenser element relative to said second stationary condenser element.

5. In a device of the class described, including a rotatable shaft having a central orifice, a second shaft for engaging said orifice, a member for rotating said rotatable shaft and secured on said rotatable shaft, means rotatably secured in said member and in engagement with said second shaft for causing said second shaft to move longitudinally in one direction, and a spring member for moving said second shaft in the opposite longitudinal direction.

6. In a device of the class described, including a rotatable shaft having a central orifice, a second shaft for engaging said orifice, a member for rotating said rotatable shaft and secured on said rotatable shaft, means secured in said member and in engagement with said second shaft for causing said second shaft to move longitudinally in one direction, a spring member for co-operating with said means to move said second shaft in the opposite longitudinal direction.

7. In a device of the character described, including a fixed element, a rotatable element associated therewith, a shaft having a central opening for said rotatable element, a second shaft engaging said opening, a second fixed element, a movable element operatively associated with said second fixed element and secured to said second shaft, a member having a central opening for receiving said shafts, said member secured to said rotatable shaft for rotating the same, a member rotatably secured in said member and in engagement with said second shaft for effecting longitudinal movement of said second shaft to adjust the operative relation of said second fixed element and said second movable element, and indicating means for indicating the operative relation of said second elements.

8. In a device of the character described, including a rotatable element, a shaft for said element having an opening extending therethrough, another shaft for engaging the opening in said first shaft, a stationary element, a movable element secured to said second shaft and operatively associated with said stationary element, a dial member secured to said first shaft for rotating the same, means rotatably secured in said dial member and in operative relation with said

second shaft for varying the operative relation of said stationary element and said movable element, and means including a portion of said dial member for indicating to the operator the operative relation of said stationary element and said movable element.

9. A variable condenser of the class described, including a stationary element and a rotatable element and means for rotating said rotatable element relative to said stationary element, a second stationary element, a movable element longitudinally adjustable relative to the said second stationary member, and a control member for causing such movement, said control member indicating by its position relative to said means of said rotatable element the relation of said movable element to said second stationary element.

10. A device of the character described, including a rotatable shaft, a non-rotatable shaft, a plurality of stationary plates, movable plates supported on said rotatable shaft rotatable relative to said stationary plates, an indicating member for moving said rotatable plates, another movable plate adapted to be adjusted longitudinally relative to said stationary plates, and an indicating member rotatably secured in said first indicating member adapted to move said non-rotatable shaft in a longitudinal direction for causing movement of said other movable plate, the position of said second indicating member relative to said first member indicating the relative position of said second movable plate and said stationary plates.

11. A condenser comprising a set of fixed plates and a set of rotatable plates, a rotatable shaft supporting said rotatable plates, said rotatable plates adapted to be rotatably interleaved with said fixed plates, a control member secured to said rotatable shaft for rotating the same in combination with a pair of supplemental plates, a second control member rotatably secured in said first control member, and means for causing said supplemental plates to approach and recede from each other in a longitudinal direction, the relative position of said control members serving as means for indicating the relative position of said supplemental plates.

12. A condenser comprising a set of fixed plates and a set of movable plates, a rotatable shaft supporting said rotatable plates, said rotatable plates adapted to be rotatably interleaved with said fixed plates by means of a control member secured to said rotatable shaft, in combination with a pair of supplemental plates one of which is fixed and the other movable, and means having a control member rotatably secured in said first control member for causing said movable plate to approach and recede in a straight line direction from said fixed plate, the relative

position of said control members serving as means for indicating the relative position of said supplemental plates.

13. A condenser comprising a set of fixed plates and a set of movable plates, a rotatable shaft supporting said rotatable plate, said rotatable plates adapted to be rotatably interleaved with said fixed plates by means of a control member secured to said rotatable shaft, in combination with a pair of parallel non-rotatable conductor plates electrically insulated from each other with means having a control member rotatably secured in said first control member for causing said plates to approach and recede in a straight line direction from each other, the position of said second control member relative to said first control member serving as means for indicating the relative position of said non-rotatable plates to each other.

14. A condenser comprising a set of fixed plates and a set of movable plates, a rotatable shaft supporting said rotatable plates, said rotatable plates adapted to be rotatably interleaved with said fixed plates, by means of a control member secured to said rotatable shaft, in combination with a condenser unit comprising a pair of juxtaposed non-rotatable conductor plates separated by an air gap, and means having a control member

rotatably secured in said first control member for moving one of said plates toward and away from the other plate to longitudinally vary the thickness of said air gap, the position of said second control member relative to said first control member serving as means for indicating the thickness of said air gap between said non-rotatable plates.

15. A condenser unit comprising a pair of fixed parallel plates and a set of movable parallel plates, a rotatable shaft supporting said movable plates, said movable plates adapted to be rotatably interleaved with said fixed plates by means of a control member secured to said rotatable shaft in combination with a condenser unit comprising a pair of conductor plates arranged parallel to each other and having a common axis and means having a control member rotatably secured in said first member for moving one of said plates toward and away from the other plate in the direction of their common axis, the position of said second control member relative to said first control member serving as means for indicating the relative position of said pair of parallel plates.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 23 day of January, 1923.

GEORGE A. YANOCHOWSKI.