April 27, 1926. 1,582,519

C. H. HULBERT ET AL.

VARIABLE CONDENSER

Filed Jan. 10, 1923 2 Sheets-Sheet 1

Fig. 1.

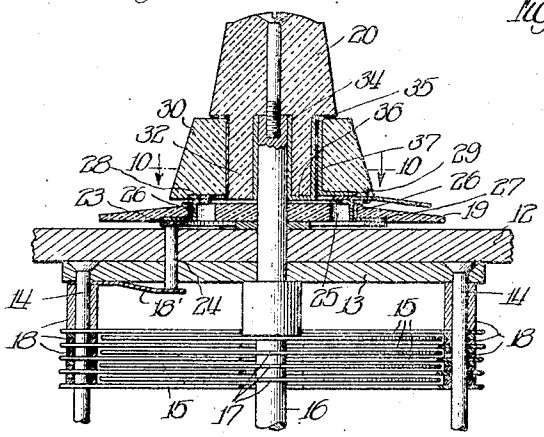

Fig. 3.

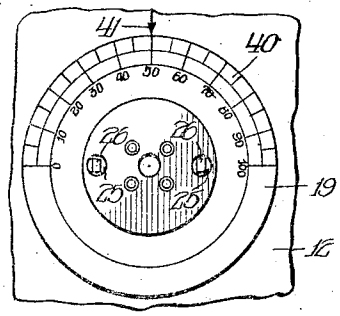

Fig. 4.

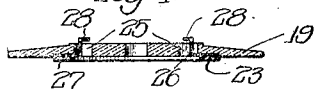

Fig. 5.

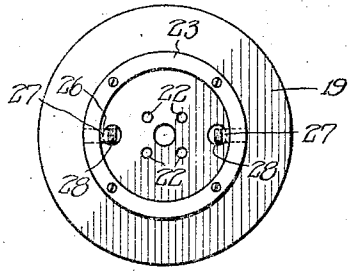

Fig. 2.

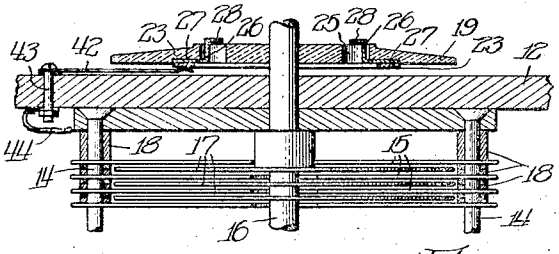

Fig. 10.

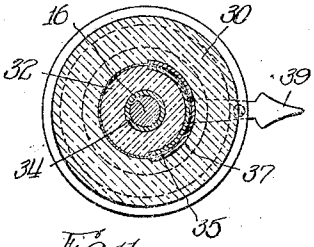

Fig. 7.

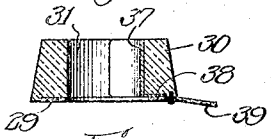

Fig. 6.

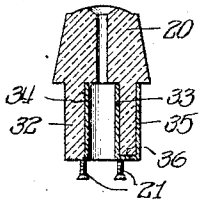

Fig. 9.

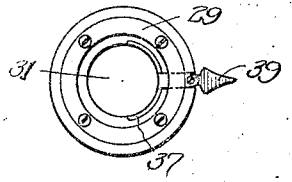

Fig. 8.

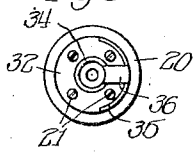

Fig. 11.

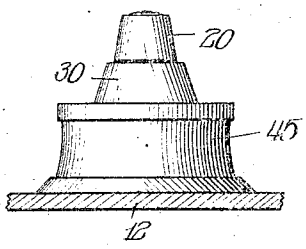

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Fig. 12.

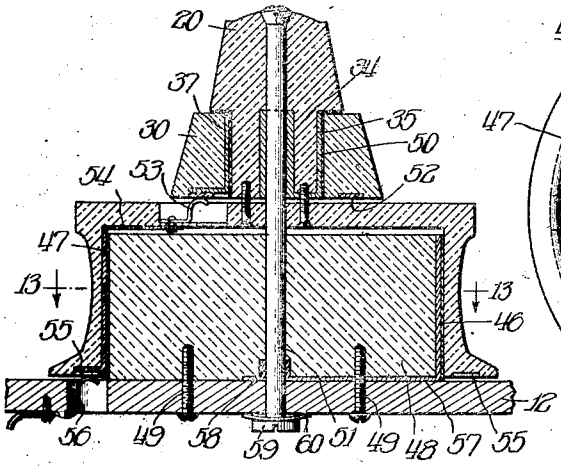


Fig. 13.

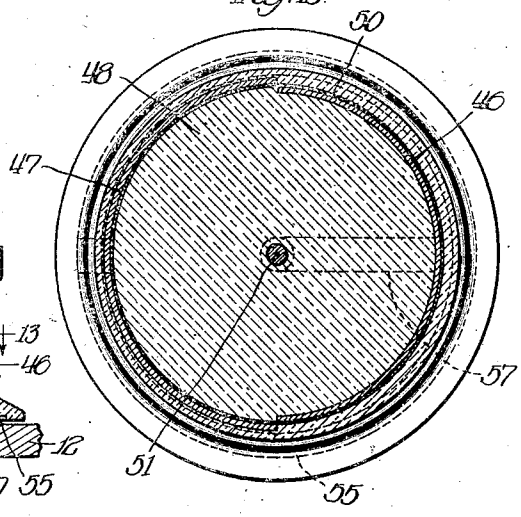


Fig. 15.

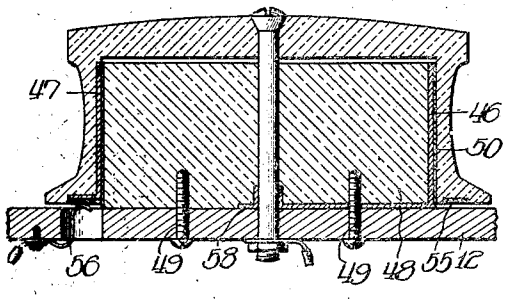


Fig. 11.

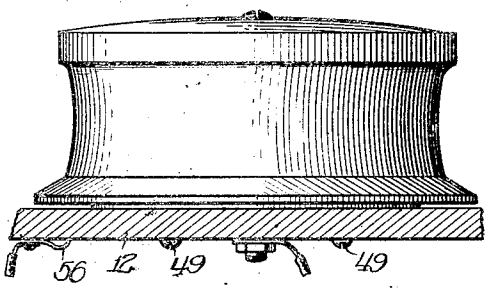
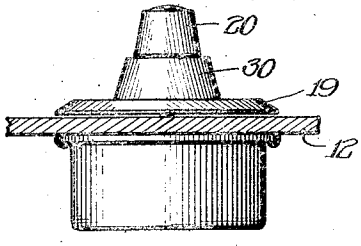


Fig. 16.



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Patented Apr. 27, 1926. 1,582,519

UNITED STATES PATENT OFFICE.

CLINTON H. HULBERT AND WILLIAM J. TIDEMAN, OF MENOMINEE, MICHIGAN, ASSIGNORS TO SIGNAL ELECTRIC MFG. CO., OF MENOMINEE, MICHIGAN, A CORPORATION OF MICHIGAN.

VARIABLE CONDENSER.

Application filed January 10, 1923. Serial No. 611,691.

To all whom it may concern:

Be it known that we, CLINTON H. HULBERT and WILLIAM J. TIDEMAN, citizens of the United States, residing, respectively, at Menominee, in the county of Menominee and State of Michigan, and at Menominee, in the county of Menominee and State of Michigan, have jointly invented certain new and useful Improvements in Variable Condensers, of which the following is a specification.

The present invention relates to variable condensers.

More particularly the present invention relates to variable condensers of the type for accomplishing fine adjustment and has for one of its objects the provision of a construction whereby the number of parts is reduced to a minimum.

A further object is to provide a variable condenser which is simple and sturdy, which is easy to manufacture and which permits a fine degree of adjustment.

A further object is to provide a variable condenser in which the operating mechanism is arranged in novel and improved structure.

A further object is to provide a fine adjustment construction applicable to ordinary variable condensers as they are now known and used.

A further object is to provide an improved variable condenser of the fine adjustment type in which the operating mechanism is of the usual knob and dial type.

A further object is to provide a variable condenser having a fine adjustment feature as a part thereof, which condenser may be mounted upon either side of the panel.

A further object is to provide an improved variable condenser in which the condenser elements are completely housed.

Further objects will appear as the description proceeds.

Referring to the drawings—

Figure 1 is a sectional view illustrating one embodiment of the present invention;

Figure 2 is a sectional view similar to Figure 1 but illustrating a slight modification.

Figures 3, 4 and 5 are top plan, sectional and bottom plan views respectively of a dial forming part of the structure illustrated in Figure 1;

Figure 6 is a sectional view illustrating a knob member forming part of the structure of Figure 1, said knob member being detached to better illustrate its structure;

Figure 7 is a sectional view of another operating member of the structure shown in Figure 1, said member being shown detached for the purpose of better illustration;

Figures 8 and 9 are bottom plan views respectively of the members shown in Figures 6 and 7.

Figure 10 is a sectional view taken along the plane indicated by the arrows 10—10 of Figure 1;

Figure 11 is a view in elevation of a variable condenser of the fine adjustment type according to the present invention, the operating mechanism and the condenser being both mounted upon the same side of a panel;

Figure 12 is a longitudinal sectional view illustrating a preferred construction of the structure illustrated in Figure 11;

Figure 13 is a sectional view taken along the plane marked by the arrows 13—13 of Figure 12;

Figure 14 and Figure 15 are, respectively, views in elevation and longitudinal section illustrating a further modification; and

Figure 16 illustrates a construction similar to that shown in Figure 1 but with the condenser element completely housed.

The numeral 12 indicates a panel or instrument board. According to the structure illustrated in Figure 1, the plates of a variable condenser, which may be of the ordinary type, are shown mounted upon the rear side of said panel 12, the operating mechanism of said variable condenser being mounted upon the front side of said panel. As will be pointed out hereinafter, the fine adjustment attachment of the condenser is closely associated with said operating mechanism.

The numeral 13 indicates part of the framework of a variable condenser, which framework may be attached to the panel 12 by screws, or by other preferred means. Said plate 13 supports studs 14—14, which form supports for the stationary plates 15—15.

The numeral 16 indicates a rotating shaft, upon which are mounted the plates 17—17, which are adapted to move relatively to the stationary plates 15—15 but are maintained out of electrical contact therewith. Bushings 18—18 hold the stationary plates 15—15 in proper relation to one another and provide electrical communication between said plates and conducting member 18′, which is represented in Figure 1 as a resilient contact member. The plates 15—15 and plates 17—17 and the holding and operating members therefor may be of the ordinary construction well known to those having any acquaintance with the electrical art. The movable plates 17—17 are held in proper spaced relation on the rotating shaft 16 and have electrical connection with said shaft. The shaft 16 projects through an aperture in the panel 12 and is adapted to carry the dial 19 and operating knob 20. Said dial 19 and knob member 20 are secured together non-rotatably by means of screws 21—21, which are adapted to project through the holes 22—22 in the dial 19. Said dial 19 carries on its under side the collector ring 23 adapted to be engaged by the pin 24, which affords an electrical connection between the terminal 18′ and collector ring 23. The dial 19 is provided with one or more holes 25, through which project one or more contact fingers 26. Said contact fingers 26—26 may be of substantially Z-formation having the flat portions 27 contacting with the collector ring 23 and the flat portions 28 adapted to engage the collector ring 29 secured to the under side of the rotating member 30, which member may be termed a twirler knob and which, as will be explained hereinafter, operates the fine adjustment attachment of the condenser. The member 30 has the bore 31 adapted to receive the shank 32 of the knob member 20 and is rotatably mounted relative to said knob member 20 though constrained against axial movement. As illustrated, the knob member 20 has an axial bore 33 provided with a bushing 34 adapted to form a good electrical contact with the shaft 16 of the condenser. Inset in the periphery of the shank 32 of knob member 20 is the fine adjustment condenser element 35, which may have a width substantially equal to the length of shank 32. The condenser plate 35 may encircle the shank 32 for a portion of its periphery, illustrated in Figure 8 as being slightly less than one-half of the periphery of said shank. The element 35 is connected electrically to the bushing 34 by means of the strip 36.

Inset in the inner periphery in the twirler knob 30 is the condenser plate 37, which may have a width substantially equal to the depth of said twirler knob 30 and which will extend through a fraction of the circumference of bore 31 of said twirler knob 30. As illustrated in Figures 7 and 9, said condenser plate 37 will extend around the bore 31 of twirler knob 30 a distance equal to slightly less than half of said circumference. Said condenser plate 37 of the twirler knob 30 has an offset lip 38 contacting with the collector ring 28. The twirler knob 30 may be provided with a pointer 39, which is adapted to overlie and co-operate with the scale 40 of the dial 19, which scale 40 may co-operate with a mark 41 on the face of the panel 12. A circlet, of mica or other dielectric, may be mounted between the shank 32 and the twirler knob 30, whereby the condenser plates 33 and 37 are kept out of electrical contact. It will be understood, of course, that the knob 20 and twirler knob 30 will ordinarily be made of insulating material. In any event, it will be understood that the electrical conducting parts are suitably insulated to prevent electrical communication between condenser elements of opposite polarity.

The mode of operation of the above described embodiment of the present invention will be clear without detailed description. The plates 17—17 may be moved relatively to the plates 15—15 by manipulation of the knob member 20. Inasmuch as the dial 19 is secured non-rotatably to the knob member 20, the position of the movable plates 17—17 may be indicated by the scale 40 of dial 19 co-operating with the mark 41 on the panel 12. The stationary plates 15—15 will be connected, by any suitable conductor (not shown), to one side of an electrical circuit, while the movable plates 17—17 will be connected by a suitable conductor (not shown) to the other side of said electrical circuit. Coarse adjustment of the condenser may be made by movement of plates 17—17 relative to stationary plates 15—15, said coarse adjustment being accomplished by the turning of knob member 20. After the coarse adjustment has been made by means of knob member 20, the twirler knob 30 may be adjusted to change the position of condenser plate 37 relative to condenser plate 35. It will be noted that the stationary plates 15—15 are connected to the condenser plate 37 of the twirler knob by way of terminal 18′, pin 24, collector ring 23, fingers 26—26 and collector ring 29. The movable plates 17—17 are connected to the fine adjustment condenser element 35 by way of shaft 16, bushing 34 and strip 36. The fine adjustment condenser element 35 is therefore in parallel relation with the main condenser plates 17—17 and the fine adjustment condenser element 37 is connected in parallel relation with the main condenser plates 15—15. The capacity between the two fine adjustment condenser plates is relatively small compared to the capacity of the main condenser plates 15 and 17, so that a nice adjustment may be

had by relative movement between the twirler knob 30 and the knob member 20.

The construction illustrated in Figure 2 differs slightly from that shown in Figure 1 in that a modified form of connection is provided between the stationary plates 15—15 of the main condenser and the collector ring 23 of the dial 19. According to the structure illustrated in Figure 2, a spring 42 is bolted on the front side of the panel 12, said spring 42 having a portion thereof contacting with the collector ring 23. The bolt 43 which holds the spring 42 also provides an electrical connection between said spring 42 and the conductor 44, which may engage one of the bushings 18 whereby to have electrical contact with the stationary condenser plates 15—15.

Figures 11, 12 and 13 illustrate a self-contained structure in which the main condenser and the fine adjustment attachment are both mounted upon the same side of the panel 12. According to the structure illustrated in these figures, the main condenser plates are mounted within the housing 45. As illustrated, the main condenser plates take the form of half cylinders, one of said plates being indicated by the numeral 46 and the other of said plates being indicated by the numeral 47. As shown in Figure 13, said plates 46 and 47 may each comprise substantially one-half of the periphery of a cylinder. The condenser plate 46 is inset in the block 48, which may be of a design such that with the condenser plate 46 applied thereto a complete cylindrical surface is provided. Said block 48 may be secured to the panel 12 by means of screws 49—49. The housing 45 has a substantially cylindrical bore for receiving the block 48 and condenser plate 46. Inset in the bore of housing 45 is the condenser plate 47. Said housing 45 will be so designed that with the condenser plate 47 in place a substantially cylindrical inner surface is provided. A cylindrical member 50, of mica or other dielectric, may be provided between the block 48 with its condenser plate 46 and the housing 45 with its condenser plate 47, whereby to prevent electrical contact between said condenser plates. Extending through an aperture in the block 48 is the shaft 51, which is rotatably mounted at its upper end in the bushing 34 of the knob 20. Said knob 20 may be provided with the condenser element 35 and may have associated therewith the twirler knob 30 with its condenser element 37, as described above in connection with Figure 1, the condenser elements 35 and 37 being insulated from one another by means of a circlet of mica or other dielectric. The bushing 34 will be electrically connected with the condenser element 35 and the condenser element 37 will be electrically connected with the collector ring 52. Said collector ring 52 may be electrically connected, by means of the spring contact member 53 and lead 54, with the condenser element 47 mounted within the housing 45. The condenser element 47 has electrical connection with the collector ring 55, which may have electrical connection with an outside circuit by way of the spring contact member 56. The condenser element 46 has electrical connection, by way of lead 57, with the bushing 58, which is adapted to engage with shaft 51. The shaft 51 may be secured in place in any preferred manner. As illustrated, said shaft has a head 59 which may engage the spring 60 to put said shaft under slight tension. The outer end of the shaft 51 may be provided with a nut or other preferred means for preventing the housing 45 and parts secured thereto from becoming released from said shaft 51. An electrical connection may conveniently be made between shaft 51 and an outside circuit.

A mode of operation of the embodiment of the present invention illustrated in Figures 11, 12 and 13 is substantially as follows: The condenser plates 46 and 47 will have a relatively large capacity compared to the capacity of the fine adjustment condenser plates 35 and 37. It will be noted that the main condenser and the fine adjustment condenser are connected in parallel. For a coarse adjustment, the housing 45 may be turned either by gripping the knob 20 or by gripping the housing 46 directly. For this purpose the upper portion of the housing 45 may be knurled. The bottom edge of housing 45 may be provided with a scale, which may co-operate with an indicating mark on the panel 12. For fine adjustment, the twirler knob 20 may be turned so that fine adjustment is had between the condenser elements 35 and 37.

The structure illustrated in Figures 11, 12 and 13 may be called a cascade formation of the fine adjustment elements and provides a structure which may be readily mounted upon the outside of the panel, all of the elements being completely housed.

The structure illustrated in Figures 14 and 15 omits the fine adjustment features but provides means whereby a completely housed condenser may be readily mounted upon the outside of the panel. The description of the operation of the structure shown in Figures 14 and 15 will be clear from the description of Figure 11, 12 and 13.

Figure 16, as indicated above, shows a structure very similar to that shown in Figure 1 but has all parts of the condenser completely housed whereby to protect the condenser against short circuit.

It will be noted that the fine adjustment features of the present invention may be applied very simply to the ordinary type of condenser, it being only necessary to provide

an electrical connection between the stationary plates of said ordinary condenser to a point on the front of the panel in a position to co-operate with the collector ring 23 on the under side of the dial 19.

The devices illustrated and described are very simple to install, are positive in their action, and are not likely to get out of order.

One embodiment of the present invention has been described in detail. Many modifications will occur to those skilled in the art. It is intended in this patent to cover all such modifications that fall within the scope of the invention as defined by the appended claims.

We claim:

1. An adjustable condenser comprising relatively stationary plates and plates of the opposite polarity movable relative thereto, an operating shaft for said movable plates electrically connected thereto, operating mechanism for said shaft having a cylindrical portion, a fine adjustment condenser element carried by said cylindrical portion, and a rotating member encircling said cylindrical portion carrying another fine adjustment condenser element, one of said fine adjustment condenser elements being electrically connected to said stationary plates, the other of said fine adjustment condenser elements being connected to said operating shaft.

2. A fine adjustment attachment for a variable condenser comprising a knob member having a cylindrical portion, said knob member being adapted to be attached to a condenser shaft, a fine adjustment condenser element carried by said cylindrical portion, a rotating member movable relatively to said knob member encircling said cylindrical portion, said rotating member carrying a fine adjustment condenser element co-operating with said first mentioned fine adjustment condenser.

3. A condenser comprising opposed condenser plates, an operating shaft for certain of said plates, a knob member non-rotatably secured to said shaft, a rotary member encircling said knob member, said knob member and rotary member each carrying a fine adjustment condenser element, the fine adjustment condenser element of said knob member having electrical communication with the plates having said shaft, and the fine adjustment condenser element of said rotary member having electrical communication with said other plates.

4. A condenser comprising opposed condenser plates, an operating shaft for certain of said plates, a knob member and dial non-rotatably secured to said shaft, a rotary member encircling said knob member, said knob member and rotary member each carrying a fine adjustment condenser element, the fine adjustment condenser element of said knob member having electrical communication through said dial with the plates having said shaft, and the fine adjustment condenser element of said rotary member having electrical communication through said dial with said other plates.

5. In combination, a condenser having a relatively stationary and a relatively movable plate, an operating shaft for said movable plates having electrical communication therewith, a knob member and dial non-rotatably secured to said shaft, a collector ring mounted upon one side of said dial and a wiping member providing electrical communication between said collector ring and said stationary plates, a rotary member encircling said knob member, said rotary member being provided with a collector ring, means for electrically connecting the collector ring of said dial with the collector ring of said rotary member, said knob member having a fine adjustment condenser element electrically connected with said shaft, said rotary member having a fine adjustment condenser element electrically connected with the collector ring of said rotary member.

6. A fine adjustment attachment for a variable condenser comprising a knob member adapted to be mounted upon the rotatable shaft of said condenser, said knob member being provided with a fine adjustment condenser element partly encircling said knob member, and a rotary member encircling part of said knob member, said rotary member being provided with a fine adjustment condenser element partly encircling the said knob member.

7. A fine adjustment attachment for variable condensers comprising a knob member adapted to be non-rotatably mounted upon the shaft of said variable condenser, a rotary member encircling a portion of said knob member and being held against axial movement relative thereto, said knob member and rotary member having co-operating fine adjustment condenser elements partly encircling said knob member.

8. In combination, opposed condenser plates, certain of which are relatively stationary and certain of which are relatively movable, a shaft for operating said movable plates and having electrical communication therewith, a knob member and dial mounted upon said shaft, and a rotary member encircling said knob member, said rotary member being held against axial movement relative to said knob member, said knob member and rotary member being provided with co-operating condenser elements, said elements comprising relatively thin pieces of metal and having their sides formed to provide portions of cylinders having said shaft as their axes.

9. A variable condenser comprising a relatively fixed plate and a relatively movable plate, said plates being of opposite polarity, supporting and operating means for said movable plate, said operating means having non-rotatably associated therewith a cylindrical portion, a fine adjustment condenser element carried by said cylindrical portion, and a rotating member encircling said cylindrical portion carrying another fine adjustment condenser element, one of said fine adjustment condenser elements being electrically connected to said stationary plate, the other of said fine adjustment condenser elements being connected to said stationary plate.

10. A vernier attachment for a variable condenser comprising a member having a cylindrical portion, said member being adapted to be attached to the rotatable element of a condenser, a fine adjustment condenser element carried by said cylindrical portion, a rotatable member movable relatively to said knob member and encircling said cylindrical portion, said rotating member carrying a fine adjustment condenser element co-operating with said first mentioned fine adjustment condenser element.

11. A condenser comprising opposed condenser plates, an operating member for one of said plates, a member non-rotatably secured to said operating member, a rotary member encircling said first mentioned member, said first mentioned member and said rotary member each carrying a fine adjustment condenser element, the fine adjustment condenser element of said first mentioned member having electrical communication with one of said plates and the fine adjustment condenser element of said rotary member having electrical communication with the other of said plates.

12. In combination, a condenser having a relatively stationary and a relatively movable plate, operating means for said movable plate, a member non-rotatably attached to said operating member, said member having a cylindrical portion, a rotary member encircling said first mentioned member, said cylindrical portion and said rotary member being provided with co-operating condenser elements, said rotary member being provided with a collector ring, means for connecting said collector ring with one of said condenser elements, sliding contact means for connecting said collector ring to one of said condenser plates, and means for connecting the other of said condenser elements with the other of said condenser plates.

13. A fine adjustment attachment for a variable condenser comprising a member adapted to be non-rotatably attached to the movable element of a variable condenser, said member being provided with a fine adjustment condenser element partly encircling said member and a rotary member encircling said first mentioned member, said rotary member being provided with a fine adjustment condenser element partly encircling said first mentioned member.

14. A condenser comprising a housing carrying a condenser plate therein, stationary means mounted within said housing carrying a condenser plate co-operating with the first mentioned condenser plate, a shaft, means forming an electrical connection between said shaft and the condenser plate on said stationary member, said means including a bushing for said shaft, and means including a sliding contact member for providing an electrical connection with the condenser plate on said movable housing and an outside circuit.

15. A condenser comprising two relatively rotatable elements, one of which encircles the other, one being substantially cylindrical in outline and the other having a cylindrical bore, the innermost of said elements being provided with a condenser element extending substantially throughout one-half of its outer periphery, the outer of said elements being provided with a condenser plate extending through substantially one-half of its inner periphery.

16. A condenser comprising a relatively stationary cylindrical member having a condenser element inset in its periphery throughout substantially one-half of said periphery, and a rotatable housing for said stationary member, said housing having a substantially cylindrical bore and being provided with a condenser element inset in its inner periphery and extending through substantially one-half of said periphery, supporting means for said housing whereby said housing may be rotated, wiping means providing electrical contact between the condenser plate of said housing and an outside circuit, and means including a bushing for said supporting means for providing an electrical connection from the condenser plate on said stationary cylindrical member to an outside circuit.

Signed at Menominee, Michigan this 3rd day of January, 1923.

CLINTON H. HULBERT.
WILLIAM J. TIDEMAN.