Sept. 6, 1927. 1,641,945

H. J. MURRAY

ELECTRICAL INSTRUMENT

Filed Nov. 6, 1923

Fig. 1.

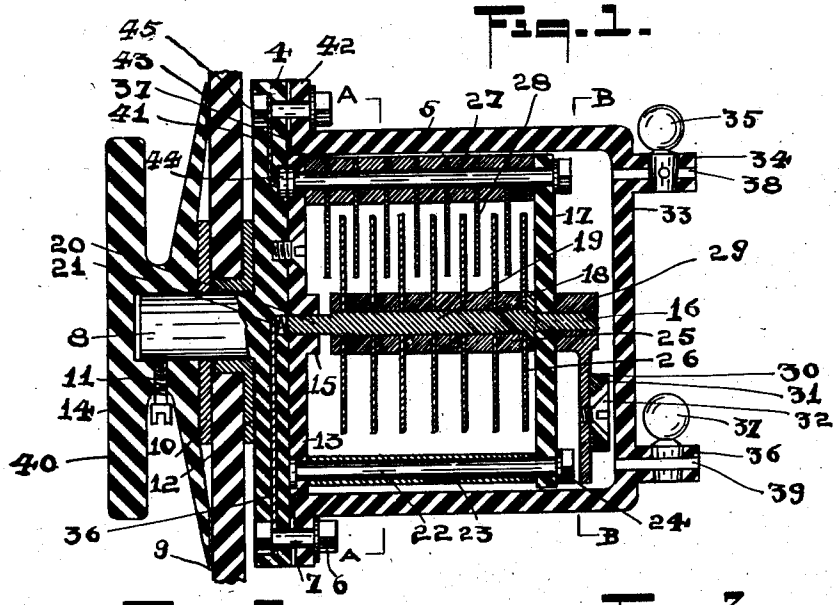



Fig. 2.

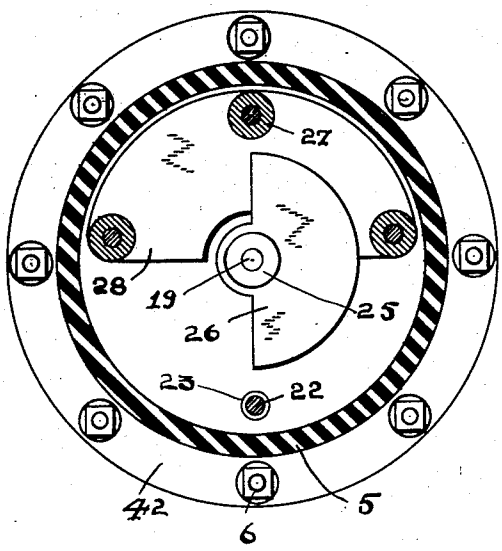
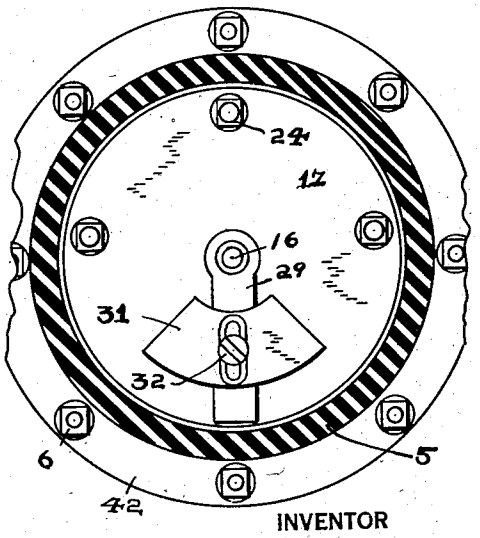



Fig. 3.




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# UNITED STATES PATENT OFFICE.

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## ELECTRICAL INSTRUMENT.

Application filed November 6, 1923. Serial No. 673,066.

The invention relates in general to variable electric devices which are provided with relatively movable elements designed to affect the status of the electric circuit of which they form a part, and the invention especially relates to variable condensers for use in connection with wireless or similar work where refinement in adjustment is required.

The primary object of the invention is to provide a simple form of circuit controlling instrumentality by means of which greater refinement in the adjustment of the variable factor may be attained than is possible with similar devices now known, and at the same time to provide an instrument of this type which will be substantially free of certain external influences, such for instance as would be caused by variations in the atmospheric pressures.

Broadly I attain this object by attenuating the density of the gaseous dielectric between the coacting and relatively movable elements of the device. In its relation to an electric condenser the oppositely charged plates are contained in a casing which is exhausted as far as practicable to obtain a vacuum.

It has been suggested heretofore in the art of variable electric condensers to go to the other extreme and to enclose the relatively movable plates in an air tight casing containing air and other gases under pressure. By thus increasing the density of the dielectric there results an increase in dialectric hysteresis which becomes especially prevalent at high frequencies and results in a lowering of resonance particularly at high potential.

This acts to weaken the condenser dielectrically, necessitating a greater spacing of the plates and a consequent increase in bulk of the instrument in order to maintain the desired capacity. Any increase is objectionable not only on economical grounds but also due to necessity of using larger parts which increases the possibility of plate warpage and possibility of breakdown and incidentally tends to increase self-induction, all of which acts to reduce the efficiency of such condensers.

Accordingly another object of the invention is to provide variable electric condensers which will be of smaller all-over size, with smaller size plates and with the plates spaced closer together than is the case with known forms of condensers of equal capacity.

The invention features a simple, easily constructed device in which the necessary electric connections may be made with the contained elements in the vacuum chamber and the elements varied at will from the outside of the chamber in such way that leakage along the connections is avoided and the chamber maintained in a hermetically sealed condition.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one form of mechanism embodying my invention, and the invention also consists in certain new and novel features of construction and parts hereinafter set forth and claimed.

The form of the invention herein illustrated was designed particularly for experimental purposes to permit variations in the pressure of the contents but in its commercial form the plate containing chamber will be permanently sealed after it has been exhausted following conventional practices in forming electric light bulbs.

In the drawings:

Fig. 1 is a vertical sectional view taken axially through one physical embodiment of the invention.

Fig. 2 is a vertical sectional view taken on the line A—A of Figure 1 looking in the direction indicated by the arrows. and

Fig. 3 is a vertical sectional view taken on the line B—B of Figure 1 looking in the direction indicated by the arrows.

As the invention may be admirably embodied in a variable condenser for electric circuits, it will be described in connection with such a device but it will be readily appreciated that the invention is not so limited but may be utilized wherever a variable electrical instrument is utilized to affect the status of an electric circuit.

In the following description and in the claims, parts will be identified by specific names for convenience of expression but they are intended to be as generic in their application to similar parts as the art will permit.

Referring to Fig. 1 of the drawings, there is shown a rotatably mounted end member 4 having a hub 8 and preferably consisting of transparent insulating material able to

resist pressure. The hub 8 is designed to be rigidly supported by and rotate in a flanged bearing 12 of bronze material and designed to position the member 4 a desired distance from a supporting wall 9.

A knob 14 of insulating material is fastened to the hub 8 by means of a set screw 11 and is spaced from the wall 9 by a washer 10 which also serves as a thrust bearing. The knob 8 includes a projection 43 which is suitably graduated and serves to indicate the angular displacement of the knob 14 with respect to the wall 9.

A mechanism containing casing of suitable material preferably the same as the material of member 4 includes a base 13 which is securely fastened to the member 4 to rotate therewith. Mounted upon base 13 is a variable condenser which resembles a type of variable condenser now used in the art.

Plate elements 26 of the condenser are mounted upon a rotatable axle 19 and are spaced apart by suitable rings 26 which may be designed to fit securely to the axle or shaft 19. A flange portion 18 positions the axle 19 with respect to an end piece 17 and the opposite end of axle 19 is arranged to fit into an opening in a hub extension 15 of the base 13 and presses against a contact spring 21 which rests against a conductor 36 contained in the end member 4. A pendulum 29 is fitted on an extended portion 16 of the axle 19 and is provided with an adjustable weight 31 fixed in adjusted position by means of a screw 32.

Coacting plate elements 28 are spaced by rings. 27 fitted on rods 22 the forward ends of which are imbedded in the base 13. When nuts 24 are in place the end piece 17 as well as the parts 16, 28, 27 are fixed relative to each other in the plane including the axis of axle 19. A spacer 23 is mounted on one of the rods 22 as shown by Fig. 2.

A flanged cover 5 preferably made of transparent insulating material is securely fastened to the end member 4 by bolts 7 and nuts 6. This cover is provided with openings 38 and 39 which may be closed as desired by cocks 35 and 37 and it is assumed that proper connection to sources of pressure or vacuum may be made through the extensions 34 and 36.

The electrical connections with an external circuit may be made by means of the conductor 36 imbedded in the end member 4, and the bolt 7 with which it is caused to contact when nut 6 is in proper place. Another similar connection may be made by means of element 44, conductor 41 and one of the bolts 7.

It is assumed when the nuts 6 are tightened the cover 5 will be drawn against member 4 and thereby cause gasket 37 to form an air tight connection.

In operation it may be assumed that the supporting wall 9 is fixed against all movement. Hence, when the knob 14 is rotated the unit formed of member 4, base 13 and cover 5 will rotate with it. Washer 10 may turn with knob 14 and thus serve as a bearing against the face of the wall 9, but bearing 12 may be tightly fitted in the opening of wall 9 so that hub 8 may rotate within same and be maintained about a desired axis. This action will cause the shaft portion 16 to rotate also on the same or on a parallel axis as the knob 14 is rotated due to the action of gravity on the pendulum 29.

It is evident that if the weight 31 is of sufficient mass and the pendulum 29 sufficiently long to provide the necessary force the elements 26 will be held approximately stationary in space as the knob is turned.

As the elements 28 are fixed to the rods 22 they turn with wall 4 and hence the angular relation of elements 26 and 28 are varied as desired by the rotation of the knob 14. By means of conductors 36 and 41 this variation may be caused to affect an external circuit.

By means of the cocks 35 and 37 the air may be removed from the space outlined by base 13 and cover 5 or pressure may be added and maintained.

It should also be evident that the elements 26 and 28 may constitute portions of variable electrical instruments or machines such as variometers, vario-couplers, rectifiers, etc.

While I have shown and described, and have pointed out in the annexed claims, certain novel features of my invention, it will be understood that various omissions, substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. In an electric condenser, a pressure resisting casing having an internal insulating wall and rotatable as an entirety about a substantially horizontal axis, means to rotate said casing; a removable condenser assembly comprising a frame with a first plurality of capacitative plates fixed thereto and a shaft freely rotatable in said frame and having a second plurality of capacitative plates secured to it and interleavable with the said first plate, a relative gravitational means on said shaft to cause movement of said plates during rotation of said casing, and separate insulated contacts on said frame electrically connected to said respective plates; cooperating contacts on and conductors in said insulating wall, means to fasten said assembly in said casing whereby said contacts are brought into and se-

cured in conductive relation, means to close and seal said casing, and means whereby to vary the gaseous pressure in said casing.

2. In an electric condenser, a pressure resisting insulating casing rotatable about a substantially horizontal axis, means to rotate said casing, a removable condenser assembly comprising insulating end plates and a first plurality of capacitative plates and metallic clamping means to hold said first plates in fixed relation to said end plates, said end plates having alined apertures therein, a conductive shaft free to rotate in said apertures, a second plurality of capacitative plates fixed to said shaft, means on said shaft to hold the same and said second plates from bodily movement in a direction toward and from said second plates, and permitting a relative rotational movement of said plates into and out of interleaving relationship, means insulated from said plates to secure said assembly in said casing whereby said first plates move with the same during rotation, and means within said casing and external to said end plates to gravitationally hold said second plates from movement with said first plates whereby to vary the capacity of the condenser, and conductors within the walls of said casing to contact the said clamping means and said shaft so that said plates are brought into an external circuit connected to said clamping means and shaft by operation of said securing means.

Signed at New York, in the county of New York and State of New York, this 24th day of April, A. D. 1923.

HOWARD J. MURRAY.