H. P. DONLE.

CONDENSER.

APPLICATION FILED JAN. 29, 1917.

1,240,958.

Patented Sept. 25, 1917.

2 SHEETS—SHEET 1.

Fig 1

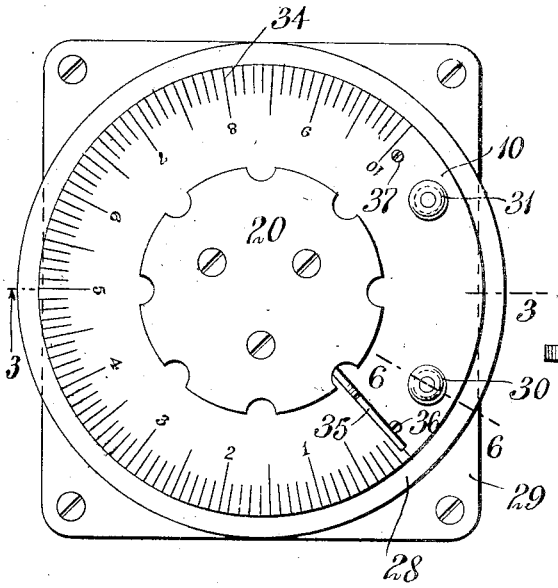


Fig 2

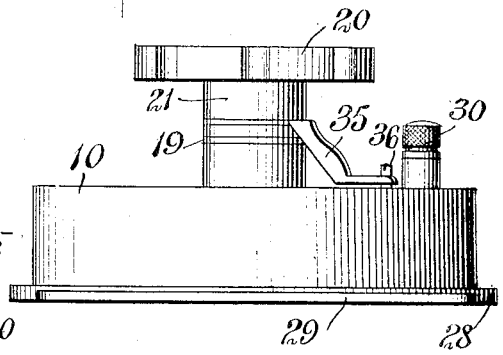


Fig 3

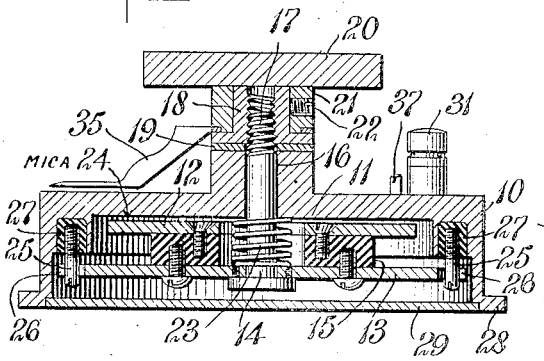
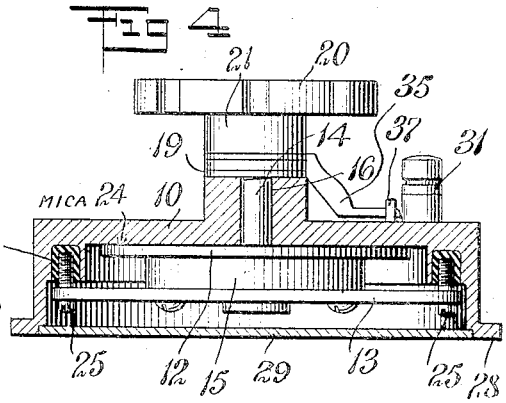


Fig 4



Inventor

Harold P. Donle

By Their Attorneys

Whittemore & Hulbert.

H. P. DONLE.

CONDENSER.

APPLICATION FILED JAN. 29, 1917.

1,240,958.

Patented Sept. 25, 1917.

2 SHEETS—SHEET 2.

Fig 5

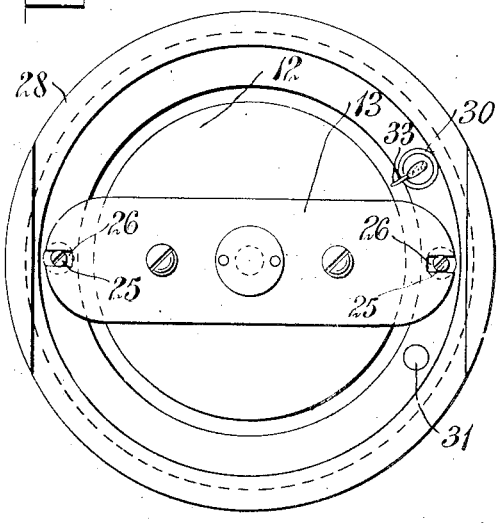


Fig 7

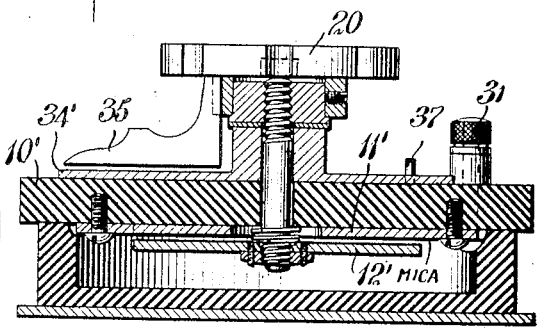


Fig 6

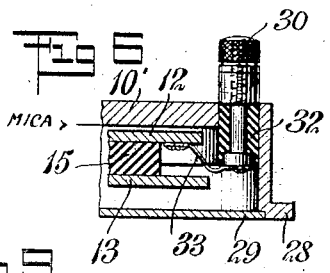


Fig 8

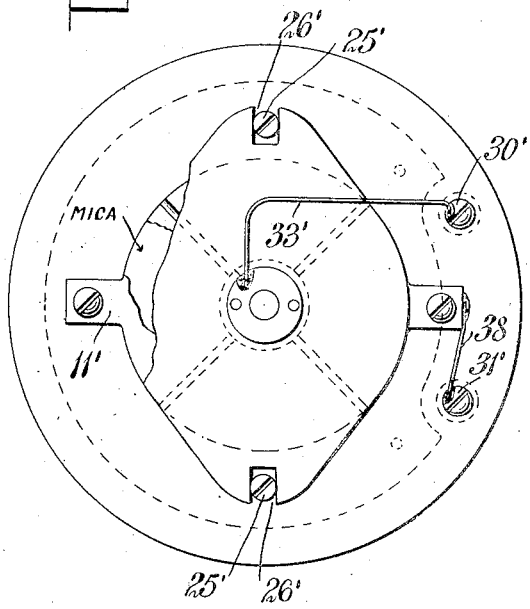
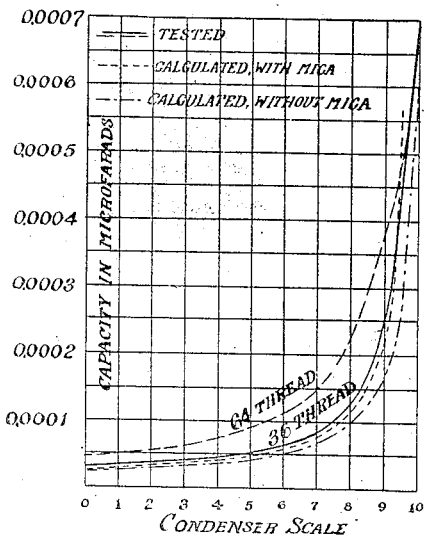


Fig 9



Inventor

Harold P. Donle

By Lee & Attorneys.

Whittemore & Hulbert.

UNITED STATES PATENT OFFICE.

HAROLD P. DONLE, OF BELMONT, MASSACHUSETTS, ASSIGNOR TO CONNECTICUT TELEPHONE & ELECTRIC COMPANY, OF MERIDEN, CONNECTICUT, A CORPORATION OF CONNECTICUT.

CONDENSER.

1,240,958. Specification of Letters Patent. Patented Sept. 25, 1917.

Application filed January 29, 1917. Serial No. 145,070.

To all whom it may concern:

Be it known that I, HAROLD P. DONLE, a citizen of the United States of America, residing at Belmont, Massachusetts, have invented a new and useful Condenser, of which the following is a specification.

My invention relates to condensers of variable capacity and aims to provide a condenser of this character which will be relatively small and compact, simple and inexpensive as to construction and which will be capable of relatively fine adjustment and therefore particularly adapted for radio telegraphy.

Another object of the invention is to provide a condenser which while compact in form will be of relatively great capacity and which when brought to the adjusted condition will remain in that condition until further adjustments are desired.

A further object is to so construct the device that its action will be constant and not subject to changes such as would result from the wearing down of the dielectric by frictional engagement of the condenser plates therewith.

In the progress of the art of radio telegraphy various types of condensers have been developed, they being an essential part of both the receiving and transmitting equipment.

The potentials in the transmitting circuit are usually high and condensers for this portion of the apparatus have therefore been developed mostly to avoid leakage and hysteresis losses.

Condensers for the receiving apparatus on the other hand have received less attention even though they are an important part of the equipment, as evidenced by the fact that in some systems five or more condensers are employed in each receiving set.

A type of variable capacity which has come into more or less general use is what is known as the "rotary condenser," consisting essentially of two sets of semicircular metal plates separated by washers, one set being mounted on a shaft which rotates through an angle of one hundred and eighty degrees so that the plates thereon will intermesh with the other relatively fixed set of plates. The capacity of this condenser is almost directly proportional to the movement of the rotary plates and the instrument while fairly satisfactory possesses certain serious defects. For one thing the percentage variation in capacity is small for it is impossible to adjust with any degree of accuracy below a certain point on the scale (fifteen degrees). Also as air is the usual dielectric in this instrument a small capacity occupies considerable space. Further the rotating plates tend to throw the shaft supporting them out of balance so that a slight jar or movement is sufficient ordinarily to destroy the adjustment, this becoming quite a serious defect on shipboard.

These and other disadvantages have been overcome and the objects set forth above have been accomplished in the present invention by employing a pair of condenser plates, one of which is covered with a thin layer of mica or like dielectric material, the capacity being varied by the adjustment of the plates with respect to each other. A special feature is the shifting of the plates in a direct or non-rotating path toward each other so as to avoid a rubbing engagement of the plates with the interposed mica or similar dielectric.

Other features of the invention are the mounting of the condenser plates within a hollow supporting base and the provision of indicating means for showing the approximate condition or relation of the condenser plates. Further features will become apparent as the specification proceeds.

In the accompanying drawings I have illustrated my invention embodied in practical and preferred forms but I would have it understood that changes and modifications may be resorted to without departure from the real spirit and scope of the invention.

In said drawings:

Figure 1 is a plan view of the invention embodied in a compact and practical form for radio work.

Fig. 2 is a view in side elevation.

Fig. 3 is a cross sectional view taken substantially on the plane of the line 3—3 of Fig. 1, showing the condenser plates in a partially separated condition.

Fig. 4 is a similar view with less parts appearing in section and showing the condenser plates brought together.

Fig. 5 is a bottom plan view of the device with the bottom cover removed.

Fig. 6 is a detail sectional view of one of the binding posts showing the flexible connection therefrom to the movable condenser plate, this view being taken substantially on the plane of the line 6—6 of Fig. 1.

Fig. 7 is a cross sectional view of a slightly modified form of the invention.

Fig. 8, is a bottom plan view of the main portions of this device.

Fig. 9 is a diagrammatic view showing curves plotted from some of the results obtained with the device.

In the first form illustrated a metallic supporting base 10 is provided, the same being generally hollow in form to constitute a casing for certain of the parts and being furthermore formed on the under surface of the top thereof as a plate or condenser element 11. The second condenser plate is designated 12 and is shown as housed within the hollow base opposite the first condenser surface 11 and supported on a movable head 13 carried by the stud 14, said second condenser plate being insulated from its support by a block of suitable insulating material 15 and having a central passage through which the stud 14 extends.

The stud 14 is guided for vertical movement in a passage 16 formed in the top of the supporting base and the upper end portion of the stud is screw threaded as indicated at 17 to receive an operating nut 18, a thrust resisting washer 19 being usually interposed between this nut and the top of the casing.

The nut 18 is operated by suitable means, in the present instance, by a finger hold or handhold 20, said operating finger hold having a collar portion 21 sleeved down over the nut and adjustably secured on the nut by a clamping screw 22. This construction enables a variable or adjustable connection of the operating member with the nut.

A spring is shown provided at 23 encircling the screw stud 14 and operating against the underside of the base at its upper end and against the supporting head 13 at its lower end, it thus exerts its tension to shift the lower plate away from the upper plate and thus separate the condenser plates when allowed to do so by the unscrewing of the control nut.

A layer of suitable dielectric material is interposed between the condenser plates, mica having been found a desirable material for this purpose and this dielectric which I have indicated at 24 may be secured directly to the face of one of the condenser plates, it being shown secured to the face of the upper condenser plate in the illustration. The mica may be held in place on the face of the condenser plate by suitable lacquer.

To prevent attrition or wearing down of the dielectric and consequent variation in the operation of the device I provide means for guiding the relatively movable condenser plate so as to prevent a rubbing engagement with the dielectric, said means comprising, in the illustration, outstanding guiding studs 25 dependent from the underside of the top of the base and fitting in slots 26 formed, in the first form of the invention illustrated, in the edge of the member 13 carrying the movable condenser plate.

The guide studs in this first form are shown set in the insulation 27, but this is unnecessary where, as in this case, the condenser plate 12 is insulated from the head 13 which supports it.

The supporting base may be formed with a suitable outstanding base flange 28 for securing the condenser in position and the open bottom of the base may be closed by a suitable bottom cover 29.

Suitable terminals are provided for the circuit wires, said terminals being here illustrated as binding posts 30 and 31, the first of these being suitably insulated from the metallic supporting base as by mounting it in an insulating block as indicated at 32 in Fig. 6 and the second binding post makes direct electrical contact with the condenser plate portion of the base as indicated in Fig. 3. Connection is made from the insulated binding post to the movable condenser plate by a suitable flexible connection such as a wire 33 as shown in Figs. 5 and 6.

From the foregoing it will be apparent that by means of the screw connection described the plates may be readily adjusted with respect to each other and with the interposed dielectric and it furthermore will be evident that by reason of the direct and non-rotating movement of one plate toward the other there will be no rubbing contact with the dielectric and consequently no wearing down or displacement of the dielectric. It will furthermore be evident that slow or rapid adjustments may be made at will and that the adjustments may be brought down to a very fine point. Another important feature of my invention is that the adjustments are permanent in that the device will remain in the condition in which it has been set, jarring and rolling motions having no disturbing effect upon the adjustments.

To aid in the attainment of the proper adjustments I have provided the device with indicating means taking the form of a scale 34 provided on the top of the supporting base and an index or pointer 35 carried by the operatitng member and registering on said scale. This scale may be calibrated in units of capacity or the like or may be simply marked off in arbitrary divisions as shown in the illustration. At opposite ends

of the scale stops 36—37 may be provided to prevent over-running the scale, said stops being engaged, in the present instance, by the outstanding pointer 35.

The detachable connection of the finger hold illustrated enables said finger hold being removed while making the preliminary adjustment of the condenser plates. Ordinarily this preliminary adjustment simply consists in turning the operating nut up far enough to bring the condenser plates into close engagement. The operating finger hold is then applied with the pointer thereof in position engaging the final stop 37 (the right hand stop in case of a right hand screw such as that indicated). The operating member may then be turned to separate the plates, the indicating pointer in such operation traveling back over the scale to the point of maximum separation of the plates. If the initial adjustment has been inaccurate or is unsatisfactory the handle may at any time be readily removed and new adjustment made.

The construction illustrated in Figs. 7 and 8 is similar in general respects to that already described, the main distinction being that in this latter form the hollow base 10′ is made of insulating material and it therefore becomes necessary to apply a separate metallic condenser plate 11′ to the underside of the base for coöperation with the movable condenser plate 12′, the second condenser plate, in this case, being shown secured directly to the operating screw without the intermediacy of any insulation. In this construction also the movable condenser plate is guided in a straight path into engagement with the other condenser plate by forming the guiding slots 26′ directly in the peripheral portion thereof to receive the guide studs 25′. Also in this construction the first binding post 30′ is connected with the movable condenser plate by flexible connection 33′ and the second binding post 31′ is connected with the stationary condenser plate by a conductor 38. Another feature of this construction is the provision of a separate scale 34′ secured on top of the insulating supporting base.

In Fig. 9 I have illustrated graphically some of the results obtained by means of my invention. In this view the horizontal graduations from "0" to "10" indicate figures on the condenser scale and the vertical graduations indicate capacity in microfarads. The solid black line indicates results of an actual test using an adjusting screw of thirty-six threads to the inch. The range of control and the ease of adjustment will be apparent from this curve. The dotted line indicates the calculated results using mica of approximately five ten thousandths inch thickness as the dielectric and the dot-and-dash line indicates calculated results without the mica. The dash line indicates results using an adjusting screw of sixty-four threads to the inch.

The capacity of the condenser without the mica, neglecting "edge effect", would be inversely proportional to the separation of the plates. With the one plate however covered with mica, which material has a dielectric constant of approximately six times that of air, (the capacity increasing directly with the dielectric constant), the capacity would be inversely proportional to $\frac{M}{K}+A$: where M equals thickness of the mica, K equals dielectric constant of mica and A equals the distance from the outer surface of the mica to the other plate.

From the shape of the curve of the actual test (the solid line) it will be apparent that this type of condenser is of special value for use in a wave-meter, in audion wing-circuits. Moreover the size of the device makes it particularly useful for small portable receiving sets.

What I claim is:

1. A condenser comprising a support having a condenser surface thereon and provided with a passage therethrough, a second condenser member for coöperation with the first condenser member provided with a screw stud extending freely through the passage in the first condenser member, an interposed dielectric between the condenser members, coöperating guides on the support and the second condenser member for guiding the second condenser member in a straight path toward and away from the first condenser member, a spring for separating the condenser members and a nut engaging the screw stud for drawing the second condenser member toward the first condenser member.

2. A condenser comprising a support having a condenser surface thereon, a second condenser member for coöperation with the first condenser member, a screw stud connected with said second condenser member, a nut engaged on said screw stud for operating the same to shift the second condenser member with respect to the first condenser member, an interposed dielectric between the condenser members, a finger hold engaging said nut for turning the same, and means for securing said finger hold in adjustable relation on the nut.

3. A condenser comprising a hollow supporting base having a condenser surface at the underside of the top thereof, a movable condenser member within the hollow base opposite said first relatively stationary condenser member, a dielectric between the condenser members, a spring interposed between the members for shifting the movable member away from the relatively stationary member, a screw for shifting the movable condenser member toward the stationary

condenser member in opposition to the spring, and means for guiding the movable condenser member non-rotatably in its movements toward and away from the first condenser member.

4. A condenser comprising a metallic base having an integral surface formed to constitute a condenser member, a second condenser member mounted on the base and insulated from the first condenser member, an interposed dielectric between the condenser members and means for shifting the second condenser member toward and away from the integral condenser surface of the metallic supporting base.

HAROLD P. DONLE.