Dec. 17, 1929. W. DUBILIER 1,740,159

VARIABLE CONDENSER

Filed Jan. 16, 1924 2 Sheets-Sheet 1

Fig. 1.

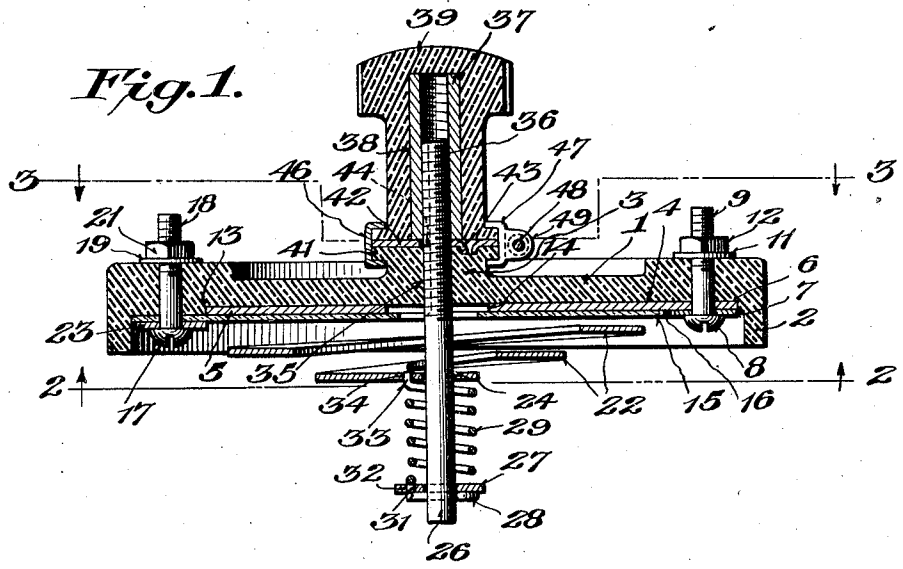
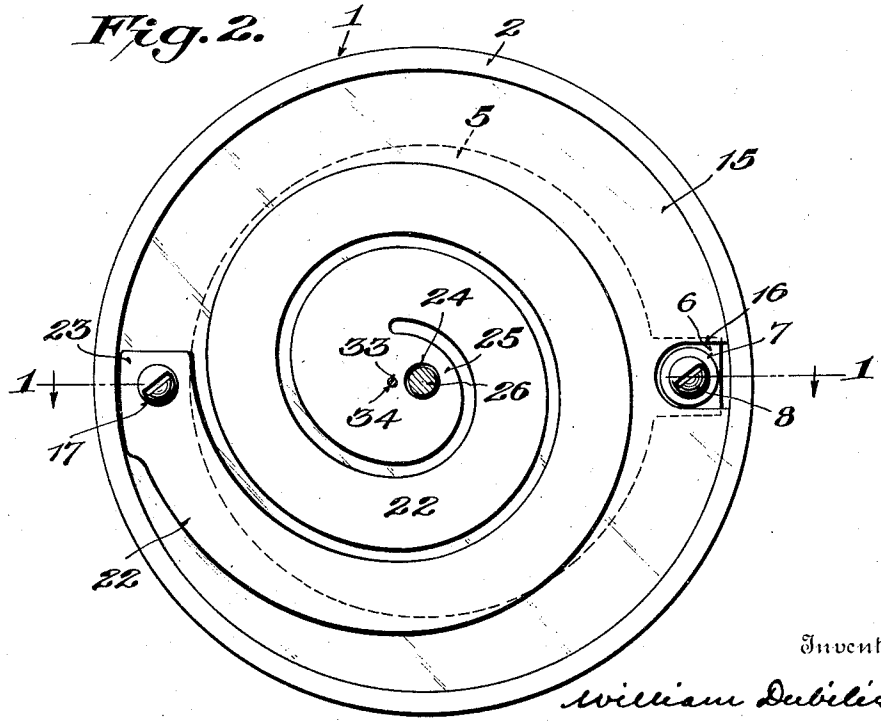


Fig. 2.



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Fig. 3.

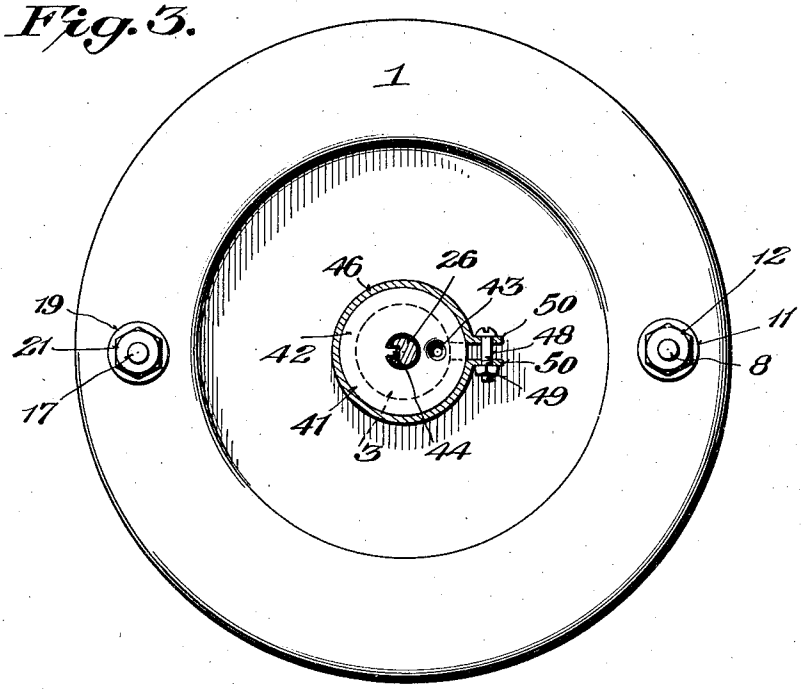
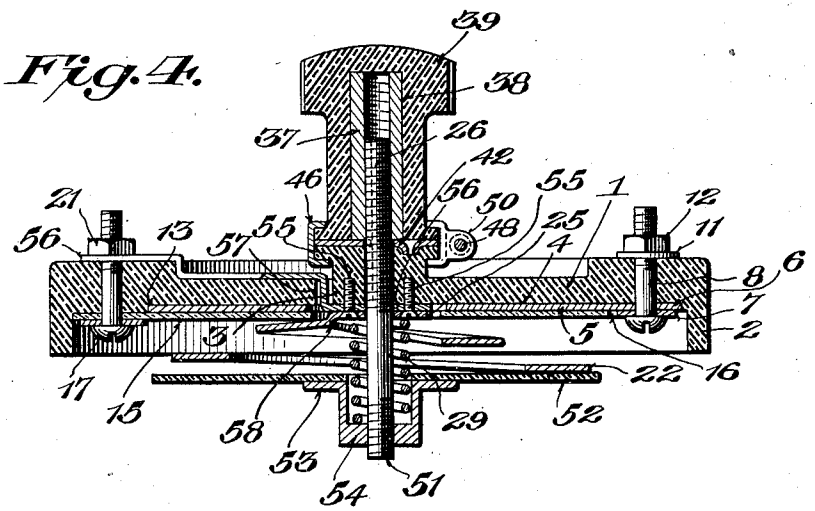


Fig. 4.



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UNITED STATES PATENT OFFICE

WILLIAM DUBILIER, OF NEW YORK, N. Y., ASSIGNOR TO DUBILIER CONDENSER CORPORATION, A CORPORATION OF DELAWARE

VARIABLE CONDENSER

Application filed January 16, 1924. Serial No. 686,546.

My invention relates to condensers, and more particularly to variable condensers.

An object of my invention is to provide a condenser in which the variations in setting may be exceedingly minute.

Another object of my invention is to provide a condenser in which the parts are so supported that the danger of injury through careless usage is almost entirely obviated.

A further object of my invention is to provide a condenser which is neat and compact in appearance, and in which there are few parts to get out of order, and moreover in which the parts can be easily repaired and replaced.

In the type of condenser in common use by amateurs in radio communication, capacity adjustment is difficult where sharp tuning is necessary. This has been true for the reason that condensers of large enough capacity to be practical, register a large change in capacity for a small change in setting. Moreover, through careless handling, the parts of variable condensers now in common use are subject to derangement or displacement, and consequently to injury.

In my apparatus herein disclosed, I have provided condenser elements, one of which is flexible and of spiral shape. The spiral shaped element is deformed to cause it to be progressively laid on the other element of the condenser. A relatively great length of resilient element can be progressively moved into and out of engagement with the fixed condenser element, with small change of capacity, since the spiral shape permits a great length of movable element to be comprised in a small condenser. The great length of the flexible movable element permits minute variations to be made; change in capacity of the device for any given length of movable element brought in contact with the fixed element can be made small. The flexible spiral element of the condenser is spring supported, thus obviating to a large degree possibility of injury to the condenser elements through attempts to adjust the condenser beyond its maximum and minimum capacity values.

In the drawings:—

Figure 1 is a longitudinal sectional view taken through the axis of the operating shaft on the line 1—1 of Fig. 2, looking in the direction of the arrows;

Fig. 2 is a bottom plan view of the condenser, partly in section, taken on the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is a top plan view of my condenser, partly in section, taken on the line 3—3 of Fig. 1, looking in the direction of the arrows;

Fig. 4 is a longitudinal sectional view of a modification of my condenser, such view corresponding to the view of my preferred form of condenser shown in Fig. 1.

Referring to the drawings for a detailed description, I have shown a condenser casing or support 1 of bakelite, or some other suitable insulating material, having a downwardly depending annular lip 2, and provided with an upstanding centrally located protuberance 3. Against the upper inner wall 4 of the casing 1 is placed an annular strip of metal foil 5, which comprises the metallic portion of a fixed condenser element. The foil 5 is provided with a tab 6 which extends beyond the periphery of the foil. Fitting over the tab 6 is a metallic holding washer 7, and passing through the metallic holding washer 7 and the casing 1 is a binding post 8. A screw-threaded portion 9 of the binding post extending above the casing 1 has fitted thereover a washer 11, and over the washer 11 a bolt 12. The binding post 8 comprises one of the terminals of the condenser, and connection to that terminal may be made by placing a wire between the washer 11 and the nut 12 and tightening the nut 12. The foil 5 is preferably fastened within a slight depression 13 in the upper wall 4 of the casing 1, and the center of the foil 5 is cut away to leave a round aperture therein, as indicated at 14.

Fastened over the foil 5 is an insulating sheet 15, preferably of mica, which is attached to the foil 5 by some suitable adhesive. The mica strip 15 is cut away, as indicated at 16, to permit the holding washer 7 to make electrical contact with the foil 5.

On the opposite side of the condenser from the binding post 8, is located a binding post 17. The binding post 17 pas es through the insulating sheet 15 of the fixed element of the condenser, and through the casing 1, and its upper end 18 is provided with screw-threads. A washer 19 is placed over the binding post and is held in place by means of a nut 21. The binding post 17 for establishing electrical connection with the movable element of the condenser, does not have electrical connection with the foil 5 of the fixed element.

On the interior of the casing there is affixed at one end a spiral resilient metallic element 22. The end 23 at the outer diameter of this spiral element 22 is held in position by the binding post 17, and the spiral element 22 is intentioned away from the fixed element. Passing through an aperture 24 formed in the center of the spiral, approximately at the inner end 25, is a reciprocable shaft 26. The shaft 26 has fitted over it a supporting washer 27 prevented from downward movement on the shaft by means of a cotter pin 28. A helical spring 29 is mounted over the shaft 26, and has its lower end 31 keyed into an aperture 32 in the holding washer 27.

The upper end 33 of the spring 29 is keyed in a hole 34 provided in the end 25 of the resilient metallic movable element 22. The reciprocable shaft 26 passes upward through the protruding portion 3 of the casing 1, through an aperture 35 formed in that portion of the casing. Screw-threads 36 are formed on shaft 26, which are adapted to engage with an internally screw-threaded collar 37, keyed and firmly held within an interior aperture 38, formed in an operating knob 39 of bakelite, or some other insulating material.

The upper side of the protruding member 3 formed on the casing 1 is formed with a horizontally extending annular flange 41. Resting on the upper surface of the member 3 is a friction washer 42 which is downwardly depressed, as indicated at 43, into a pocket formed on the upper surface of the protruding member 3. This prevents the friction washer 42 from rotating. The friction washer 42 is provided with a tab 44 which projects into a longitudinal slot 45 formed in the reciprocable shaft 26. The friction washer 42, through the tab 44, prevents rotation of the reciprocable shaft 26.

To hold the operating knob 39 in position, there is provided a U-shaped holding collar 46 which surrounds the annular flange 47 formed on the bottom of the operating knob 39. The collar is a split collar, and is deformed to fit over the flanges, after which the spring of the metal draws it in place, where it is held by a bolt 48 and nut 49 that pass through the ends 50. The holding collar 46 does not fit so tightly as to prevent free rotation of the operating knob 39, whose rotation carries with it the internally threaded member 37, adapted to turn with the operating knob 39.

Rotation of the operating knob 39 causes the reciprocable shaft 26 either to be drawn up into the knob, or pushed downwardly, depending on the direction of rotation. The shaft 26 is prevented from rotation by means of the tab 44 formed on the friction washer 42.

The movement of the shaft carries with it the spring 29 and consequently the free end of the spiral member 22. The spiral member 22 is subjected to a picking up and laying down action, on the fixed element of the condenser, comprising the foil 5 covered by the insulating mica sheet 15.

The capacity of the condenser may be subjected to minute changes, by reason of the fact that the entire length of the spiral has to be brought in close proximity to the fixed member of the condenser to give the maximum capacity, and, therefore, any given short length of the spiral brought into contact with the fixed element of the condenser will produce a relatively minute change in capacity value. This feature of the invention permitting of delicate adjustment is of peculiar advantage in radio communication. Moreover, by reason of the spring connections between the reciprocable shaft 26, and the movable member of the condenser, attempts to adjust the condenser beyond its maximum and minimum values will accomplish no harm, since the spring connections prevent injury to the delicate parts.

Referring to Fig. 4, I have shown a different modification of my invention embodying the same principle of operation. In the form shown in Fig. 4, the spiral member 22 is in inverse position, and is adapted to be laid down upon the fixed member beginning at its small diameter and progressing to its larger diameter. In this form of device, the reciprocable shaft 26 is provided at its lower end with a screw-threaded portion 51. Threaded over the shaft 26 is a supporting plate 52, preferably of bakelite, or some other suitable insulating material. The plate 52 rests on an annular flange 53 formed on a hollowed bolt member 54, whose interior threads engage with the threads 51 of the reciprocable shaft 26. In the position of maximum capacity, when the plate 52 compresses all of the spiral 22 against the fixed element of the condenser, the compressed spring 29 is housed in the hollowed bolt member 54. The end 25 of the spiral resilient movable member 22 is fastened by means of screws 55 against a conductor strip 56 positioned against the center of the upper wall 4 of the casing 1. The conductor strip 56 passes upwardly and outwardly through the aperture 57 formed in the casing 1, and then along the casing. The binding post 17 passes through the conductor strip 56. Connection with the inner resilient

movable member may be made through binding post 17 by loosening the nut 21 and clamping a wire terminal between the nut 21 and the conductor strip 56.

The spring 29 merely rests at its lower end against the supporting plate 52, and at its top contacts with the end 25 of the spiral resilient element 22. The spiral resilient element is given a slight offset, as indicated at 58, to prevent injury to the mica or the foil of the fixed condenser element in the operation of the condenser. This offset insures that the mica and foil will not be subjected to a pinching action at their edges. If such pinching action should take place, however, there would be slight danger of short-circuiting, by reason of the fact that in all of these forms of condenser, the fixed element is composed of a strip of foil whose inner and outer edges are overlapped by the insulating mica sheet.

The operation of the form of condenser shown in Fig. 4 is quite similar to my preferred form illustrated in Figs. 1 to 3 inclusive. In the form of condenser shown in Fig. 4, "the laying down operation" begins at the small diameter of the spiral, in other words, near the center, and is progressively continued to the larger or outer diameter of the spiral.

While I have shown and described the preferred embodiment of my invention, I wish it to be understood that I do not confine myself to the precise details of construction herein set forth, by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

I claim:—

1. A variable condenser comprising, a support, a fixed element carried by the support, a rotatable screw-threaded member, a spiral movable element, a screw-threaded shaft with a channel therein whose threads engage the threads of the screw-threaded member, a washer fixed to the support between the screw-threaded member and the support, a lug on the washer fitting into the channel of the shaft, and means operated by the reciprocation of the shaft to progressively press the spiral element against the fixed element.

2. A variable condenser comprising a fixed element and a movable element separated by insulation, the movable element having the form of a flat spiral, and means for deforming said spiral element to vary the capacity of the condenser.

3. A variable condenser comprising a support, a fixed element attached thereto, a resilient element in the form of a flat spiral fastened at one end to said support and having its free end spaced from the fixed element, dielectric material between said elements, and means engaging the free end of the spiral element to cause the same to approach and recede from said fixed element in order to vary the capacity of the condenser.

4. A variable condenser comprising a fixed element, a movable flexible element in the form of a spiral having a plurality of convolutions, said spiral having a fixed end and a free end, dielectric material between said elements, and means including a spring engaging the free end of said spiral for causing its surface to progressively approach and recede from the fixed element.

5. A variable condenser comprising a fixed element, a resilient element in the form of a spiral having a plurality of convolutions, insulation between said elements, and a screw cooperating with the spiral element to cause it to approach and recede from the fixed element in order to vary the capacity of the condenser.

6. A variable condenser comprising a support, a fixed element attached thereto, a resilient element in the form of a flat spiral fastened at its larger end to said support and having its smaller end spaced from the fixed element, dielectric material between said elements, and means engaging the smaller end of said spiral to cause its surface to progressively approach and recede from the fixed element.

In testimony whereof I affix my signature.

WILLIAM DUBILIER.