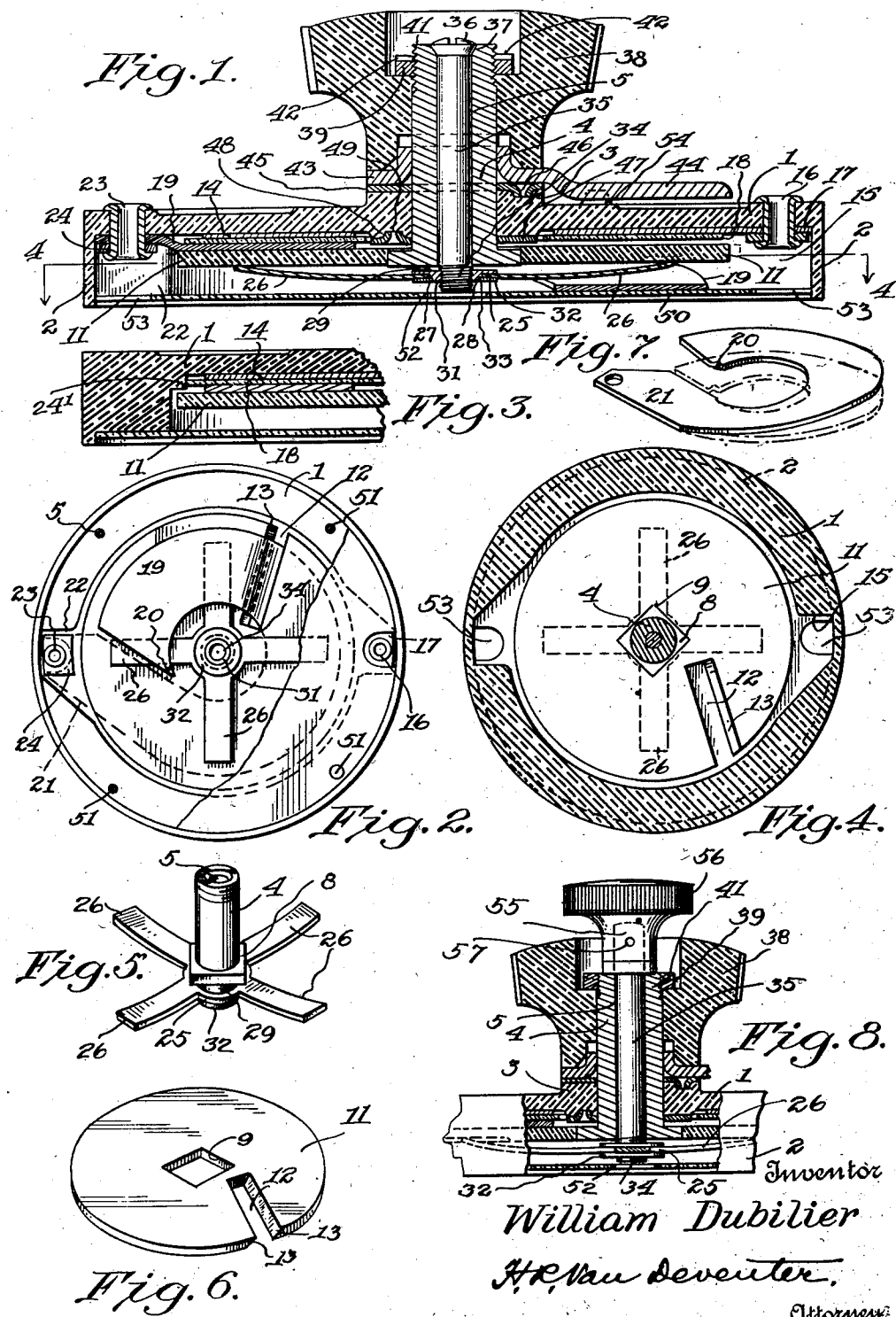


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W. DUBILIER
VARIABLE CONDENSER
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WILLIAM DUBILIER, OF NEW YORK, N. Y., ASSIGNOR TO DUBILIER CONDENSER CORPORATION, A CORPORATION OF DELAWARE

VARIABLE CONDENSER

Application filed January 16, 1924. Serial No. 686,547.

This invention relates to condensers, and more particularly to variable condensers capable of very accurate adjustment.

5 An object of my invention is to provide a variable condenser in which the initial setting may be accurately made.

Another object of my invention is to provide means for readily adjusting variable condensers to a certain standard.

10 A further object of my invention is to provide a supplemental means for adjusting the capacity of variable condensers, whereby very delicate and accurate adjustments of capacity may be made.

15 Other objects of my invention are to make a variable condenser that is sturdy in construction and easily repaired and replaced, and in which adjustments may be made with small friction of parts.

20 Heretofore, in the manufacture of condensers of the variable type, great difficulty has been experienced in getting the condensers of a certain type to conform to a standard. By reason of the fact that the 25 pressure between the elements of a condenser is one of the factors determining capacity, and further, because the pressure between the elements was not capable of accurate adjustment, there is often a wide variation in capacity between variable condensers of the 30 same size and type. Especially has this been true of variable condensers where there is actual contact between the fixed and movable elements that is maintained by spring pressure on one or both elements.

35 In adjustment of capacity, it is often necessary to accomplish minute variations in capacity values. This is particularly true in radio communication, where an almost infinitesimal adjustment may make a difference 40 between receiving the message correctly and not receiving it at all.

45 It is to solve these difficulties that this invention was conceived. With these and other objects in view, which may be incident to my improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements 50 comprising my invention, may be varied in

construction, proportions and arrangement, without departing from the spirit and scope of the appended claims.

In order to make my invention more clearly understood, I have shown in the accompanying 55 drawings means for carrying the same into practical effect without limiting the improvements in their useful applications to the particular constructions, which for the purpose of explanation, have been made the subject of illustration. 60

In the drawings:

Figure 1 is a view in longitudinal section of my device, taken on a plane passing 65 through the axis of the rotor shaft;

Fig. 2 is a bottom plan view of my variable condenser with part of the cover plate broken away to more clearly show the position of the parts;

Fig. 3 is a detail view in section showing 70 the position of the fixed condenser housed within the cavity bordered by the shoulder which prevents the rotor from contacting with the fixed element;

Fig. 4 is a cross section of my device taken 75 on the line 4—4 of Fig. 1, looking in the direction of the arrows;

Fig. 5 is a detail view in perspective showing the retaining spring and cooperating 80 parts;

Fig. 6 is a detail view in perspective of the rotor;

Fig. 7 is a detail view in perspective of the adjustable element of my condenser;

Fig. 8 is a detail view, partly in longitudinal 85 section, of a modification of my invention, wherein the tension of the pressure spring is regulated by an auxiliary knob.

My variable condenser comprises a fixed 90 element and a movable element. The movable element is adapted to be picked up from and laid down on the fixed element by means of a movable member that operates between 95 them. Means are provided for pressing the elements together. The spring is mounted upon a rotating shaft, which is rotated to vary the capacity. The spring is capable of adjustment in order to enable the device to have its capacity initially adjusted or re- 100

adjusted at any time to some desired standard.

In another form of my device, the knob for rotating the shaft to vary the capacity of the device has mounted above it another knob, that can be used to regulate the spring pressure that presses the elements of the condenser together. This enables a very fine adjustment to be made in capacity. A rough adjustment may be made in the usual way by varying the effective capacity area of the elements; a delicate adjustment may be made by rotating the knob that regulates the pressure holding one element against the other.

I have illustrated my invention as comprising a casing 1 of some suitable insulating material, such as hard rubber or bakelite. The casing 1 is provided with a downwardly extending annular flange 2 which forms one wall of the housing for the variable condenser. The casing 1 has an upwardly extending cylindrical portion 3 within which is journaled a metallic shaft 4. The metallic shaft 4 is formed with an aperture through its axis. As shown in the drawings, an aperture 5 extends the entire distance through the center of the shaft.

Formed on the shaft 4, and preferably integrally made therewith, is a shoulder 8, which I have shown as of square configuration, over which is adapted to fit an aperture 9 centrally formed in a rotor 11 of insulating material. The rotor 11 is provided with a slot 12 therein, which is set at an angle to the radii of the rotor. The slot 12 is provided with beveled edges 13. The fit between the aperture 9 and the shoulder 8 of the shaft 4 is not a tight fit, but the rotor is adapted to float on the shoulder 8 and be capable of ready movement in the direction of the axis of the shaft 4.

Mounted against the upper interior wall of the casing 1 is an annular fixed condenser plate 14, preferably formed of metallic foil. The condenser plate 14 fits into a recess 15 formed in the casing, and a metallic eyelet 16 is adapted to pass through the sheet or plate of metallic foil 14 and to make contact therewith, through a holding contact piece 17. The eyelet 16 is riveted in place to make the connection permanent. Covering the conducting sheet 14 is an insulating sheet of mica 18 which is in close relationship to the conducting foil 14, and is preferably fixed thereto by a suitable adhesive.

The flexible condenser element comprises a flexible strip of metal 19 of annular conformation, see Fig. 7. This metallic strip has a convolute intention which tends to spring it out, as shown in Fig. 7. One edge of the free end of the flexible element 19 is upturned, as indicated at 20. The flexible element 19 is provided with a relatively wide neck 21 extending into an aperture 22 formed in the casing 1. An eyelet 23 makes contact with

the flexible element 19 through a holding contact member 24. The eyelet 23 is riveted in place and makes permanent electrical connection with the flexible sheet 19.

Referring to Fig. 3, it is shown that the fixed element of the condenser, comprising the conducting sheet 14 and the insulating sheet of mica 18, is surrounded by a shoulder 24' that extends around the interior of the casing except directly opposite the eyelets 23 and 16. This shoulder 24' is of sufficient height to prevent the rotor from coming into contact with the insulating mica sheet 18 in any adjustment of the device, for the outer edge of the rotor will ride on the shoulder 24' and the rotor will be held away from the fixed element, which is preferably attached by adhesive to the wall of the casing and thus held from protruding beyond the line of the shoulder. This feature adds to the life of the device, for injury and abrasion of the mica sheet by rubbing contact is thus prevented.

In some types of condensers now in use, where there is abrasive contact on insulating mica sheets, mica dust is generated, and the mica dust gathering in the condenser quickly changes the effective capacity of the device. Such difficulty is avoided in the type of condenser I have devised.

The free end of the flexible element 19 is adapted to slide through the slot 12 in the rotor 11. The rotor 11 is spring pressed in the direction of the fixed element of the condenser comprising the metallic foil 14 and the mica sheet 18. The rotor 11 compresses that portion of the contacting surfaces of the fixed and adjustable elements which are adapted to be operative for a given capacity adjustment. In order to maintain the rotor 11 in this spring pressed relationship to the condenser elements, I have provided a spring member 25 having spring arms 26 which are upwardly intentioned, as indicated in Fig. 5.

The member 25 is provided with an aperture 27 which fits over an annular shoulder 28 formed on a nut member 29. The nut member 29 is provided with a lower shoulder 31 over which fits a holding washer 32, which is held in place by upwardly riveting the lower end of the shoulder 31, as indicated at 33. The nut member 29 is provided with internal screw-threads which engage with the external screw-threads 34 of a screw 35 that is adapted to rotatively fit within the aperture 5 of the shaft 4. The screw 35 is provided with a screw head 36 seated on conically sloping walls 37 formed at the upper end of the aperture 5. By rotating the screw 35, the nut member 29 can be drawn up towards the bottom of the shaft 4, or pushed away from it. This causes the extremities of the spring 26 to bear with greater or less force on the rotor 11.

This construction holds the spring member

25 firmly in place and permits the upper ends of the spring arms 26 to contact against the rotor 11 to urge it upwardly. The arms 26 are of such a length that the pressure is exerted on the rotor 11 at a point between the center of the rotor and its circumference, thereby insuring that the maximum degree of pressure shall be exerted on the annular fixed and flexible condenser elements. If pressure were exerted at the center or the periphery of the rotor, its effect would not be so readily transmitted as is the case where it is exerted directly adjacent to the main surface area of the condenser elements.

The feature of the adjustment through the screw 35 of the tension that the spring member exerts on the rotor provides a means for determining the pressure between the flexible movable and the fixed elements of the condenser in any and all adjustments. Since the capacity of the device is determined by several factors, one of which is the pressure existing between the elements of the condenser, this feature of adjusting the pressure provides a means for varying the capacity of the device and adjusting it to some desired standard. In the ordinary course of assembly, one device may be of lower capacity than the desired standard and another be of higher capacity. By regulating the screw, and hence the pressure between the elements of the condenser by either reducing or increasing such pressure, the condensers of a certain type may be made to conform to a standard set for that type.

To rotate the rotor and cause it to move with the shaft 4, a turning knob 38 is attached to the shaft by means of a nut 39, which fits over an external screw 41 on the upper end of the shaft. The nut 39 is provided with grooves 42 for use with a spanner wrench to rotate the nut. The nut 39 is tightened and compresses the turning knob 38 against a supporting member 43, which has a driving fit over the shaft 4, and which carries a pointer 44 cooperating with a scale (not shown) on the upper surface of the casing 1. The supporting member 43 is keyed to the turning knob 38, and a shim washer 45 is mounted on the upper surface of the upwardly projecting portion 3 of the casing 1. The shim washer 45 is depressed, as indicated at 46, into a depression formed in the portion 3 of the casing. Thereby, the shim washer 45 is prevented from rotation, yet the knob and pointer can easily turn. A shim washer 47 is provided on the interior face of the casing 1 and is depressed, as indicated at 48, into a depression 49 formed in the upper interior wall of the casing 1. These two shim washers have been found to add greatly to the sturdiness of the construction and the strength of the general shaft assembly, preventing undue play after long use.

Fitting over the lower surface of the casing is an insulating cover plate 50, held to the casing 1 by means of drive screws 51. An aperture 52 is provided in the cover plate opposite the shaft 4, and apertures 53 are formed opposite the eyelets 16 and 23. The cover plate 50 forms with the rotor 11 a recess within which the flexible member 19 may be housed when it is passed through the slot 12 of the rotor 11. A suitable stop 54 on the surface of the cover plate 1 prevents the pointer from completing more than one revolution, and consequently prevents injury to the device.

In operation, by turning the knob 38 in a clockwise direction, the rotor 11 is caused to move to pick up a portion of the flexible element 19 to vary the capacity of the condenser. By reason of the beveling of the edges 13, the picking up of the flexible element 19 is greatly facilitated, because the friction between the flexible element and the rotor is reduced to a minimum by reason of the sharp entering angle presented to the surface of the flexible element. Because the slot 12 is set at an angle to the radii of the rotor 11, the outer part of the rotor 11 has a slightly greater initial engagement with the flexible element 19, thus further facilitating the picking up of the flexible element. Since one edge 20 of the flexible element is upturned, and since the flexible element is given a convolute intention in its manufacture and retains this convolute intention in the assembled device, the flexible element has a tendency to engage with the rotor at the slot 12 and to easily pass out through that slot.

The flexible plate 19 is subjected to a "picking up" and "laying down" operation on the fixed element to vary the capacity of the condenser, which variation is indicated by the pointer 44 in cooperation with the scale on the casing of the device.

The initial capacity of the condenser, or the capacity for any adjustment can be regulated within certain limits by moving the screw 35 to increase or decrease the tension of the spring 25 on the rotor. As previously explained, condensers of a uniform size and type may be made to conform with a desired standard.

In Fig. 6 I have shown a type of my condenser in which the screw 35 is provided with an extension 55 over which fits an adjusting knob 56. A pin 57 holds the adjusting knob 56 firmly in place on the end of the screw 35.

In this form of condenser, the rough adjustment to a desired capacity may be effected by rotating the knob 38. Having once attained an approximate adjustment by rotating the knob 38, a fine adjustment may be accomplished by rotating the knob 56 which turns the screw 35 and varies the pressure

that the spring 25 exerts on the rotor 11. The adjustments accomplished through the change in pressure can be made very small and delicate. This is of peculiar advantage in radio communication where accurate tuning over small ranges is desirable.

The condenser disclosed in this application is similar to the condenser shown in my co-pending application Serial No. 686,548, filed January 16, 1924, in so far as the arrangement of the parts 14, 18, 19 and 11 are concerned. The arrangement of the parts mentioned however, is not recited in the claims herein, as the invention in the case resides primarily in the spring member 25 and the parts associated therewith for controlling the pressure exerted against the rotor 11 to hold the elements 14 and 19 in engagement; and the construction of the casing for mounting the shaft 4.

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 fixed element, a movable element, a shaft, means operated by the shaft for actuating the movable element, an operating knob for said shaft, a spring for pressing the movable element against the fixed element, a screw in the shaft for regulating the tension of the spring, and an operating knob for the screw.

2. A variable condenser comprising a fixed element, a movable element, a shaft, means operated by the shaft for actuating the movable element, a spring for pressing the movable element against the fixed element, and a screw in the shaft for regulating the tension of the spring.

3. A condenser comprising a casing, relatively movable elements in said casing, a shaft to control said elements, said casing having a bearing through which said shaft extends, and one or more shims secured to the casing adjacent the bearing and perforated to permit the passage of said shaft, each of said shims having a portion entering the surface of the casing.

In testimony whereof I affix my signature.

WILLIAM DUBILIER.