

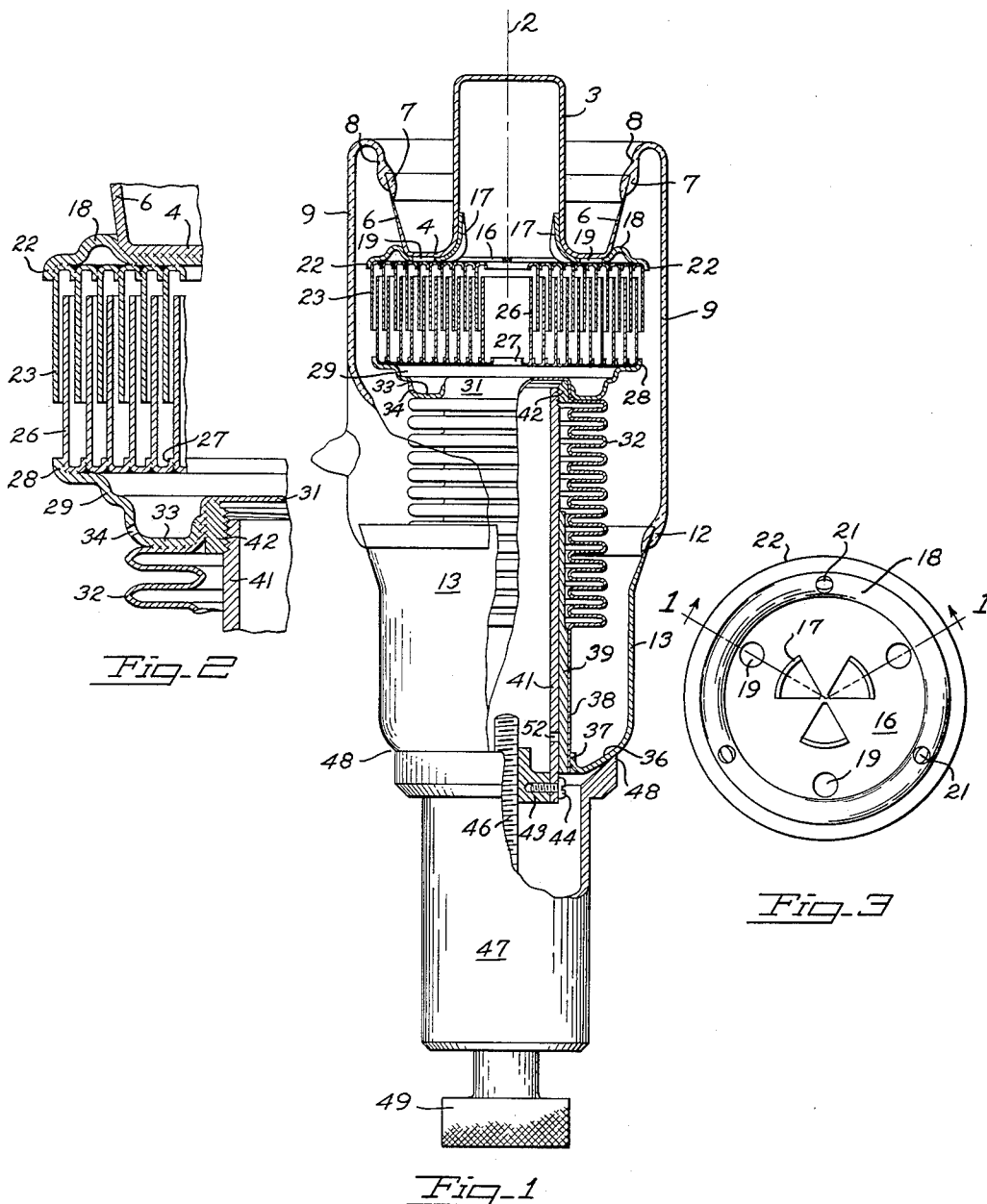
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J. E. JENNINGS ET AL

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VACUUM VARIABLE CONDENSER

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INVENTOR
 JO EMMETT JENNINGS
 LEWIS B. STEWARD
 BY *Charles S. Evans*
 their ATTORNEY

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VACUUM VARIABLE CONDENSER

Jo Emmett Jennings and Lewis B. Steward, San Jose, Calif., assignors, by mesne assignments, to Jennings Radio Manufacturing Corporation, San Jose, Calif., a corporation of California

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Our invention relates to vacuum variable condensers; and one of the objects of the invention is the provision of an improved mounting for the condenser plates characterized by a very high degree of rigidity and strength.

Another object is the provision of a shorter and more compact condenser structure, and one in which the stresses imposed by temperature changes and expansion differentials, is less severe where metal and glass parts are united, as in the seals.

Another object is the provision of a condenser in which each set of the plates and its mounting structure are in immediate or very intimate mechanical and electrical contact, so that inductance in these portions of the condenser is materially reduced.

Still another object of the invention is the provision of a vacuum condenser having a glass envelope characterized by a fold-over section adjacent one of the metal terminals, so that the increased insulation thus afforded, together with the electrostatic field produced at the outwardly extending feathered edge of the terminal sealed in the glass, enforces a higher surface flash-over voltage.

In addition to the above, our vacuum variable condenser has many other objects, some of which with the foregoing will be set forth at length in the following description where that form of the invention which has been selected for illustration in the drawing accompanying and forming a part of the present specification is explained. In said drawings, one form of the invention is shown, but it is to be understood that it is not limited to that form, since the invention as set forth in the claims may be embodied in a plurality of forms.

Referring to the drawings:

Fig. 1 is an elevation of our vacuum variable condenser, partly in vertical compound section. The planes of section are indicated by the radial lines 1—1 of Fig. 3.

Fig. 2 is a fragmentary view in vertical half section, showing the mounting of the plates. The scale is twice that of Fig. 1.

Fig. 3 is a plan view of the mounting plate for the fixed condenser plates.

Referring first to Fig. 1, the vacuumized shell or envelope of our condenser includes an end cap or terminal made of suitable gauge copper and comprising three main portions, concentrically arranged about the main long axis 2 of the condenser. The central or stud portion 3 of the terminal is an inwardly opening cup, very slightly tapered toward the outer end. This stud is engaged by a mounting clip or bracket when the condenser is placed in a circuit. At its inner end the stud flares sharply into a radially extending flange 4, which turns backwardly, along but divergently from the center stud in the flange 6.

The outer edge of the flange 6 is feathered and united in a vacuum tight metal-to-glass seal 7 with the folded over end 8 of the glass cylinder 9, which forms a major part of the vacuumized envelope of our condenser structure. At its opposite end, a similar metal-to-glass seal 12 joins the cylinder to the copper end cap 13.

Integrally united to the terminal cap by brazing along

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the inner face of the radial flange portion 4, is a mounting plate 16, Fig. 3, from the center of which tongues 17 are struck upwardly to fit snugly into the flaring open end of the stud. The mounting plate is also provided with a concentric annular bead 18 snugly enclosing the annular corner from which the flange 6 turns upwardly. This bead also plays an important part in stiffening the mounting plate.

In order to facilitate the application of brazing solder between the mounting plate and the radial stud flange 4, the former is provided with holes 19; and in order to avoid an orphaned air pocket, the mounting plate is also formed with holes 21 in the annular bead 18.

In addition to the bead 18, the mounting plate is further stiffened against distortion and vibration by the inwardly turned peripheral flange 22, which also forms a secure and concentric seat for mounting the unit assembly of fixed plates 23 of the condenser.

The condenser plates 23 are cylindrical shells arranged concentrically, each shell at one end being substantially U-shaped in axial section, and being sized to fit snugly around each successively smaller shell. This unit of assembled shells is brazed together and to the mounting plate within the peripheral flange, forming an exceedingly rigid structure with a high degree of accuracy of concentric spacing about the long axis of the condenser.

The importance of concentric accuracy and of structural stability is very great, since the interleaved movable plates 26 of the condenser, each with its reentrant flange 27, are also similarly concentrically disposed and brazed together and within the raised flanged seat 28, formed on the periphery of the mounting plate 29, by which the movable plates 26 are mounted on the mobile end 31 of the bellows 32.

The plate 29 is formed with a concentric bead 33 on the side opposite the peripheral seat; and this bead provides an accurate setting for the end of the bellows which is brazed to the plate. The flanged and beaded construction of the mounting plate not only provides an accurate mounting for the unit assembly of movable condenser plates, but by spacing the plate assembly close to the end of the bellows with support on the peripheral flange, vibration and distortion are prevented, while at the same time preserving a compact and rigid structure.

One or more holes 34 are made in the bead 33 to permit easy cleaning and prevent the trapping of reaction products and air in pockets that would prevent complete evacuation of the envelope.

Because of physical limitations in the drawing, the plates of the condenser are necessarily shown with a degree of thickness and are spaced apart a considerable distance. Actually they are very thin and very close together for reasons relating to the capacity of the condenser; and unless great rigidity and a high degree of accuracy in mounting and in movement are attained, objectionable changes in electrical characteristics and capacity of the instrument or even shorting across the plates is inevitable.

The fixed end of the bellows is connected to the cap 13 to complete the vacuumized chamber in which the plates lie. This is done by extending the conical end 36 of the cap inwardly to a flange 37 in tight engagement with the end of the bellows sleeve extension 38, which snugly surrounds the thickened end of the bearing tube 39. The three parts 37, 38 and 39 are then brazed together at their juncture, as shown in Fig. 1, thus providing a wide and vibration-free bearing or slideway for the cylindrical thick walled hollow stem 41, by which the movable plates 26 are given their axial movement. The bearing tube and stem are preferably of a copper alloy such as brass or bronze and are of substantial thickness as shown. These qualities and a stem diameter of about two-fifths

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the diameter of the largest condenser plate 26, provides the lateral breadth of mounting needed to insure rigid stability and freedom from vibration.

The stem 41 is rigidly attached at its inner end to the mobile end 31 of the bellows, preferably by threading it into the annular flange 42 concentrically disposed on the inside of the bellows end and brazed thereto. Closing the outer end of the cylindrical stem is the head 43, held in place by screws 44, the heads of which form stops to limit the inward travel of the stem and connected plates 26. The center of the head is bored and threaded to receive in snug engagement the threaded operating shaft 46, journaled for rotary but not axial movement in the end of the terminal 47, which has a peripheral edge 48 bearing against the conical end of the cap 13; and forms a hood around the exposed outer ends of the stem 41 and bearing tube 39.

A knob 49 is fixed on the outer end of the operating shaft so that it can be turned to adjust the movable plates 26. Atmospheric pressure is of course always exerted against the stem to force it inwardly, moving the plates 26 into interieaved relation with the fixed plates. This pressure is carried by a ball thrust bearing interposed between the shaft 46 and the terminal hood. Our condenser is connected in the circuit in which it is to be used by clips or other suitable means arranged to engage the cap 3 at one end and cap 13 at the opposite end.

An aperture 52 is made in the side of the hollow stem to permit insertion of a stop pin, in the event it is necessary to renew the head 43. With the pin in place, the bellows is prevented from uncontrolled expansion into the envelope with a resultant crushing together of the shells.

We claim:

1. In a vacuum condenser, an evacuated envelope having a metallic end wall comprising a central inwardly opening cup forming a terminal electrode of the condenser, said cup having its peripheral edge folded outwardly and back to form a concentric return flange spaced outwardly from the cup, a flat mounting plate integrally united to the folded over edge of the cup and having integral tongues extending into and integrally united with the cup and having a concentric peripheral flange on the face opposite the cup, a cylindrical condenser plate brazed to the mounting plate within the flange, a plurality of successively smaller cylindrical condenser plates brazed to each other and to the mounting plate, a glass shell forming part of the envelope and at one end folded inwardly and back in a concentric return flange spaced inwardly from the shell, and a metal-to-glass sealed joint uniting the peripheral edges of the return flanges.

2. In a vacuum condenser, an evacuated envelope having a metallic end wall comprising a central inwardly opening cup forming a terminal electrode of the condenser, said cup having its peripheral edge folded outwardly and back to form a concentric return flange spaced outwardly from the cup, a flat mounting plate integrally united to the folded over edge of the cup and

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having a concentric bead embracing the return flange and a peripheral concentric flange on the side opposite the bead, an assembly of concentric cylindrical condenser plates integrally united to the mounting plate within the flange, a glass shell forming part of the envelope and at one end folded inwardly and back in a concentric return flange spaced inwardly from the shell, and a metal-to-glass sealed joint uniting the peripheral edges of the return flanges.

3. In a vacuum condenser, an evacuated envelope having a cylindrical metallic end wall forming a terminal electrode of the condenser, a metallic bellows having a closed inner end extending into the envelope and with the cylindrical end wall closing the end of the envelope, a flat mounting plate having an outwardly extending concentric, annular bead within which the closed end of the bellows is integrally united to the mounting plate, an annular flanged seat concentrically formed around the periphery of the mounting plate on the side opposite the bead, a bearing tube extending into the envelope and continuous with the cylindrical end wall, a stem slidably mounted in the bearing tube and fixed at its inner end to the closed end of the bellows, an assembly of concentric cylindrical condenser plates immediately adjacent the mounting plate and integrally united thereto within the annular seat, and means for moving the stem in the bearing tube to vary the axial position of the mounting plate within the envelope.

4. In a vacuum condenser, an evacuated envelope having a cylindrical metallic end wall forming a terminal electrode of the condenser, a metallic bellows having a closed cylindrical inner end extending into the envelope and with said cylindrical metallic end wall closing the end of the envelope, an annular mounting plate having an outer peripheral flanged seat and a central circular aperture within which aperture the closed cylindrical end of the bellows is integrally united, an assembly of concentric cylindrical condenser plates fixed in said flanged seat, and means for varying the axial position of said annular mounting plate within the envelope.

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