Sept. 9, 1930. W. M. BAILEY 1,775,266

APPARATUS UNIT

Original Filed Oct. 1, 1924

Fig. 1.

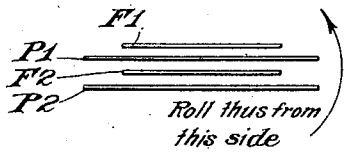


Fig. 2.

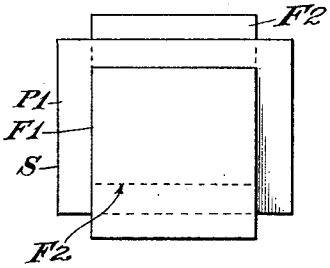


Fig. 3.

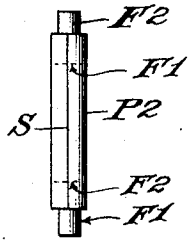


Fig. 6.

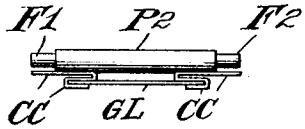


Fig. 4.

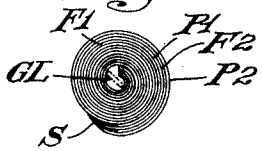


Fig. 5.

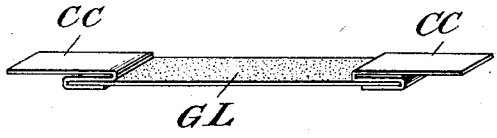


Fig. 7.

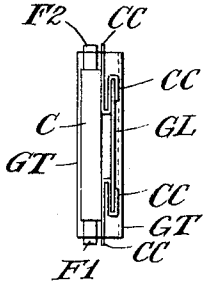


Fig. 8.

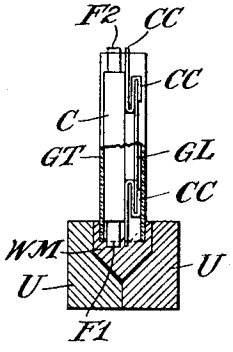


Fig. 9.

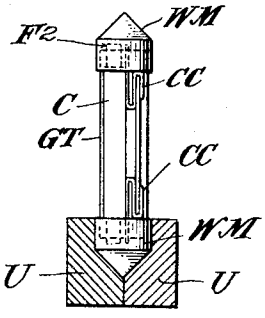
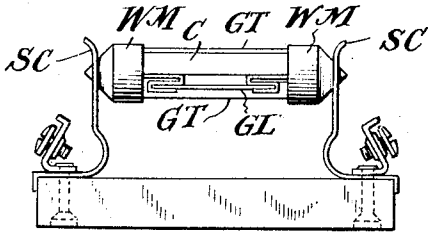


Fig. 10.



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By his Attorney
Philip Farnsworth

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1,775,266

UNITED STATES PATENT OFFICE

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APPARATUS UNIT

Original application filed October 1, 1924, Serial No. 740,925. Divided and this application filed June 14, 1926. Serial No. 115,823.

This application is a division of my application, Serial No. 740,925, filed Oct. 1, 1924.

This invention relates to apparatus unit.

The object of the invention is to produce an improved device of the above nature.

The invention consists of the improvements in construction disclosed herein and illustrated in the drawings, of which

Fig. 1 is a diagrammatic view of certain electrical condenser sheets;

Fig. 2 is a plan of such condenser at a stage in the process of manufacture for use in accordance with the invention;

Fig. 3 is a plan of the sheet condenser as completed for embodiment in the invention;

Fig. 4 is an end view, enlarged, of the condenser of Fig. 3;

Fig. 5 is a perspective of an electrical resistance completed for embodiment as an element of a complete form of the invention;

Fig. 6 is an elevation of the temporary assembly of the condenser and electrical resistance, in a part of the process of manufacture previous to permanent assembly;

Fig. 7 is another incomplete assembly, showing as located inside a glass tube, the assembly in Fig. 6 of condenser and resistance;

Fig. 8 is a view similar to Fig. 7 showing the process of completing the assembly as to one end of the device;

Fig. 9 is a view similar to Figs. 7 and 8, wherein the partially assembled device of Fig. 8 has been inverted, to complete assembly at the lower end of the device in Fig. 9; and

Fig. 10 is an elevation showing the completed invention as it may be used in practice.

The condenser first will be considered in connection with Figs. 1–4. While the condenser may be of any desired construction, suitable for use as an element of the invention, yet the one here disclosed is suitable and at present preferred. The condenser is a sheet condenser consisting of sheets of dielectric and conductors alternately placed in a stack. The dielectric sheets may be of paper, oil saturated preferred to increase the dielectric strength. The conducting sheets may be of tinfoil. The condenser consists of four sheets, two of oil paper and two of the tinfoil, assembled alternately in the stack (Fig. 1). On the bottom is a paper sheet P^2; above that is a foil sheet F^2; above that is a second paper sheet P^1; and on top is a foil sheet F^1. These sheets preferably are offset endwise in the manner shown in Fig. 2. The sheets are shown separated, for clearness. When the sheets are laid on top of one another in the stack, they are to be rolled together in a cylinder as indicated in Fig. 1, the top of the stack being inside of the roll condenser, and the bottom (the paper sheet) being the outside of the roll. The condenser stack is shown in plan in Fig. 2, which shows that the two foil sheets F^1, F^2 project from opposite ends of the stack. Three edges of each foil sheet lie, as shown, a substantial distance inside of the edges of the adjacent paper sheet. As indicated in Fig. 1, this stack is to be rolled into a cylinder, beginning at the right-hand side of the figure and rolling toward the left. The rolled condenser is shown in Fig. 3. The left-hand edge S of paper sheet P^1, as shown in Fig. 2, is shown in Fig. 3; in fact, the line S indicates the left-hand edges of both paper sheets P^1, P^2, (Figs. 1 and 2); and these edges of both paper sheets preferably are secured as by sealing-wax at S, to the adjacent surface of paper sheet P^2 as wound into the roll, but partially exposed on the outside thereof. As shown in Fig. 3, the foil sheets F^1, F^2 extend as tabs at the two ends of the condenser beyond the paper sheets, these foils respectively being now wound in cylindrical shape as contrasted with Fig. 2 before rolling. Fig. 4 is an end view of the condenser of Fig. 3; but as a modified form of the invention it includes a centrally-disposed electrical resistance GL to be described now.

The preferred form of electrical resistance for combination with the above condenser in tube GT is shown in perspective in Fig. 5. Said resistance GL may be adapted in value as a high resistance for use as the grid leak of a radio receiving apparatus; and in such case the condenser of Figs. 1–3 may be adapted as to capacity value as the grid condenser of such radio apparatus. In such case, the condenser may have a capacity of .0003 mfd.; the paper sheets P^1, P^2 being

approximately four inches long by an inch and a quarter wide; and the foil sheets F^1, F^2 being about three inches long by one inch wide. In such case also the electrical resistance of Fig. 5 may have a high value such as about 2,000,000 ohms, or, say, between 1,500,000 to 4,000,000 ohms. Such a resistance is shown in Fig. 5 as consisting of a narrow strip of ordinary heavy drawing paper GL, about one-eighth inch wide and one inch long and painted with india ink. This paper sheet may be of a cardboard like Bristol board or thick paper. Either one or both sides of this paper sheet may be painted with the fluid ink. In practice, the paper is painted in a large sheet by means of a brush, the ink being applied as a heavy coat and permitted to dry. After drying, the paper should not be bent or wrinkled. It is cut into strips as shown in Fig. 5, being carefully handled to prevent bending or wrinkling, which is liable to alter the resistance which has been reached by proper painting or dipping in the ink. A suitable ink is Higgins's Eternal Carbon ink. Preferably the ends of the paper sheet resistance GL are clamped in copper clips CC (Fig. 5). These clamps CC are preferably tinplated, to aid in the process step of Fig. 8. But clamps need not be used; and instead the ends of paper sheet GL may be painted with a rather thick mixture of water glass and powdered graphite, as a means of facilitating the effectiveness of the step of the process shown in Fig. 8; and this graphite paint may be employed in considerable thickness with bulges or irregularities, for the same object.

As preliminary to the final assembly, the electrical resistance of Fig. 5 and the condenser of Figs. 1–3 are placed alongside one another as shown in Fig. 6; both devices being of substantially the same length so that their ends lie alongside of one another in the same general vicinity.

Fig. 7 shows the next step in the manufacture, wherein the temporary assembly of Fig. 6 is shown as being inserted in a glass tube GT. The condenser C of this assembly (and Fig. 3) is cylindrical, and if employed alone without the resistance GL. In Fig. 7, the glass tube has sufficient internal diameter to provide space for the condenser C and resistance GL alongside one another. The ends F^1, F^2 of condenser C and the ends CC of resistance GL, in Fig. 7, are located in the vicinity of the ends of glass tube GT, both ends of which are open. As shown in Fig. 7, the ends of both devices project beyond the ends of the tube, and this is preferred. The next step is to make permanent the assembly of Fig. 7. This step is shown in Fig. 8 where the assembly of the three parts,—i. e., the tube, and the condenser and the resistance inside the tube,—is placed so that one set of ends of the three assembled parts (including one metal end, i. e., F^1, of the condenser), enters the depression shown in steel mold U, the depression being shaped in accord with the desired configuration of the ultimate ends of the completed device. This depression is filled with a molten soft metal such as Wood's metal, which may be of composition resulting in melting at about the boiling point of water. Metals of higher melting point may be used, such as solder; but alloys such as the well-known Wood's metal are preferred because their lower boiling point avoids cracking of glass tube GT or charring of the ends of resistance sheet GL. Wood's metal is preferred for use herein which has a composition resulting in its melting at about 80° C., 20° below the boiling point of water. Tubular condenser-casing GT always, in accordance with the invention, is a strong structural element existing as a unit before condenser C is inserted in it, as distinguished from a mere glaze which is applied to the outer surfaces of the condenser itself. The material of which the tube is made, preferably glass, may be any other vitreous or vitrified material possessing the advantage here wherein the glazing at least at the surface, constitutes means of excluding moisture from the enclosed condenser in addition to the electrical insulating property of the material of the tube in respect of the enclosed condenser, and the terminals thereof of opposite polarity and of conducting bodies outside the tube. As shown in the section of Fig. 8 the wall of the tubular casing is of substantial thickness relative to the size of the enclosed condenser, so as to compensate by way of thickness for the fragility of the vitreous or vitrified material as compared with metal, the result being a structure which is sufficiently strong for its purpose altho of comparatively fragile material. Such thickness is co-operative with the methods shown, or equivalent methods, of securing the metal end structures WM with the ends of the wall of the tubular casing, so as to reenforce the tube GL by the combination with the relatively thick wall itself and so that notwithstanding the structural fragility of the material of which the casing is composed, nevertheless the combination of WM with the sufficiently thick casing wall not only does not injure the latter, but on the other hand reenforces it, while the result is a permanent union of said parts. Such a union as described seals the open ends of the tube against ingress of moisture, just as the glaze or vitrified character of the casing-material seals the sides of the structure against access of moisture to the contained condenser. An important advantage of this class of materials for casing GT, in addition to its protection of the enclosed condenser, is that the

vitrifaction of at least the external surface of the casing protects the casing itself from deterioration by atmospheric conditions, so that altho the tube itself is not of metal yet without any extra protection it can withstand any service which does not subject the fragile material to severe mechanical impacts. The inherent strains of the assembled structure are made harmless to the material of casing GL by the means and methods disclosed. Furthermore the metal ends WM or their equivalents engage the condenser itself so as to mechanically support it in position inside the casing, the ultimate support of course being the casing itself on which members WM are supported; but the whole arrangement being such that casing GL, altho of fragile material, can and does support both the metal end structures and the condenser itself without any injury to the casing. Also the casing as a whole is made structurally strong, irrespective of the weakness of the vitrified material and irrespective of the supporting of the condenser by the metal terminals WM, by reason of the substantially thick wall of the vitrified casing portion, in combination with the metal of terminals WM which terminals are secured to and supported by (and thereby in turn reenforce and strengthen as a whole) the vitrified casing-portion GL.

The temporary assembly of Fig. 7 has one end inserted in the molten metal WM as shown in Fig. 8, where it is held briefly until the soft metal cools and solidifies. The mold U may be surrounded with cold water to hasten the operation. Thereupon the assembly of Fig. 7 is removed from the position of Fig. 8, the soft metal then being incorporated as shown at the top of Fig. 9, as a permanent end terminal. In Fig. 9 the entire apparatus unit is inverted from the position shown in Fig. 8, so that the top end of Fig. 8 is inserted in mold U, the depression of which is again filled with the readily fusible metal WM, to duplicate at the bottom of the device in Fig. 9, the end construction shown at the top of Fig. 9. Any suitable materials may be used for the molds, and in practice two-part molds indicated in Figs. 8 and 9 are preferred, so that the parts of the mold can be removed laterally from the solidified soft metal terminals, instead of removing the enclosed condenser from the mold.

The Wood's alloy or equivalent soft metal possesses the property of expanding upon cooling and solidifying. The result therefore of the operations of Figs. 8 and 9 is that the soft metal end members contract tightly around and grip the exterior of vitrified tube GT and seal the interior of the tube from the external atmosphere, (the tube itself being of moisture-proof insulating material), thereby preventing access of moisture to the paper resistance GL and the paper condenser C, preserving them of uniform humidity and constant electrical properties, as to resistance and capacity respectively. The projection of the metal ends F^1, F^2 of the condenser C and the end CC of resistance GL beyond the open ends of glass tube GT assists the action of the metal WM in effecting good mechanical and electrical contact with said elements; but the molten metal WM will enter up into the inside of vitrified tube GT and surround the ends of the condenser and resistance, (if there is sufficient space around the condenser and resistance and between them and tube GT), so as to adequately grip and make contact with said members at points inside the tube GT, irrespective of their gripping by the metal on their parts which extend beyond the open ends of the tube. The soft metal by its expansion upon solidification thereby is contracted around the projecting condenser foil tabs F^1, F^2 thereby tightly gripping them and making good electrical contact therewith, constituting the soft metal as a terminal of the condenser, and holding the condenser and the glass tube mechanically in permanent assembly. The soft metal when solidified also tightly grips the ends of resistance GL, making good electrical contact with it and holding the condenser and resistance in assembly with one another and holding each and both in permanent assembly with the vitrified tube. The soft metal end members WM also reinforce the ends of the vitrified tube; and by virtue of their good electrical connections with the condenser terminals and the resistance terminals, constitute common terminals for both the condenser and the resistance.

When as here both the condenser and resistance are located together in vitreous tube GT, the same permits dispensing with two pairs of spring holders, one pair for each of the condenser and resistance. (See Fig. 10). The manner of combining the condenser and resistance which is shown in Figs. 6–10 is preferred, i. e., where said members are ranged alongside one another, as a matter of manufacturing; but, if desired, the resistance (of Fig. 5 or its equivalent within the invention) may be combined with the condenser in the manner shown in Fig. 4, where the resistance GL shown in dotted lines is located at the center of the condenser cylinder, the sheets of the condenser being wound around the electrical resistance. This temporary assembly of Fig. 4, however, is less desirable than that of Fig. 6, because it involves more time in wrapping the condenser sheets around the electrical resistance; and in the form of Fig. 4 it is desirable to employ a third sheet of paper on top of the showing of Fig. 1, for the purpose of insulating the resistance GL (Fig. 4) from foil sheet F^1 (the inside foil sheet) of the rolled condenser. In either case, Fig. 4 or Fig. 6, the condenser and resistance are located in parallel with one another, and their ends also are

located in parallel with one another; and both have a length proportionate to that of the vitrified tube GT of Figs. 7–8, such that the ends of said elements lie in the vicinity of the open ends of said tube.

In Fig. 10 the reactance C of this invention is shown in service in a circuit between spring clips SC forming part of the stand shown; the pointed ends WM of the device being suitable for engagement in the holes in spring clips SC. Only one of those standards of Fig. 10, including the spring clips SC, is needed for a given radio receiving set when the condenser C and resistance GL are included in vitrified tube GT and held in the assembly by the metal end pieces WM, the latter being preferably of soft metal as described but permissively of other conducting material as terminals of the device and as means for retaining the elements of the device in assembly.

I particularly point out and distinctly claim the part, improvement, or combination which I claim as my invention or discovery, as follows:—

1. A capacity-resistance device comprising a glass tube open at both ends; a sheet condenser rolled and located inside said glass tube with its opposite potential conducting sheets projecting as tabs from the opposite ends of the rolled condenser and located in the vicinity of the open ends of the glass tube; a paper sheet resistance inside said tube having an over-all length substantially the same as that of the condenser, its terminals being located in parallel with the projecting condenser tabs in the vicinity of the open ends of the glass tube; and two soft metal terminals contracted around the outside of the respective ends of the glass tube, and contracted around and making good electrical contact with the foil tabs and resistance terminals, closing the ends of the glass tube and moisture-sealing the contained condenser and paper resistance from the external atmosphere, tightly gripping the tube, the condenser tabs and the resistance, and thereby holding all three in the assembly, reinforcing the ends of the glass tube, and constituting common terminals for the condenser and resistance.

2. A capacity-resistance device comprising a tube of insulating material having openings at both ends, a foil and paper sheet condenser rolled and located inside said tube, the opposite potential foils projecting as tabs from opposite ends of the rolled condenser and located in the vicinity of the open ends of said insulator tube; a paper sheet resistance located in parallel with said condenser inside said tube and having terminals located in parallel with the projecting foils of the condenser; and two soft metal terminals contracted around the outside of the respective ends of the insulating tube, and contracted around and making good electrical contact with the foil tabs and resistance terminals, closing the ends of the insulating tube and moisture-sealing the contained condenser and paper resistance from the external atmosphere, tightly gripping the tube, the condenser tabs and the resistance, and thereby holding all three in the assembly, reinforcing the ends of the insulating tube, and constituting common terminals for the condenser resistance.

3. A capacity-resistance device comprising a tube of insulating material open at both ends, a sheet condenser rolled and located inside said insulating tube with its opposite potential conducting sheets projecting as tabs from the opposite ends of the rolled condenser and located in the vicinity of said open tube-ends; an electrical resistance having an over-all length substantially the same as that of the condenser, its ends being located in parallel with the condenser tabs in the vicinity of the open ends of the insulating tube; and two soft metal terminals contracted around the outside of the respective ends of the insulating tube, and contracted around and making good electrical contact with the foil tabs and resistance terminals, closing the ends of the insulating tube and moisture-sealing the contained condenser and paper resistance from the external atmosphere, tightly gripping the tube, the condenser tabs and the resistance, and thereby holding all three in the assembly, reinforcing the ends of the insulating tube, and constituting common terminals for the condenser and resistance.

4. A capacity-resistance device comprising a tube of insulating material open at both ends; a sheet condenser rolled and located inside said insulating tube with its opposite potential conducting elements projecting as tabs from the opposite ends of the rolled condenser and located in the vicinity of said open tube ends; an electrical resistance having an over-all length substantially the same as that of the condenser, its ends being located in parallel with the condenser tabs in the vicinity of the open ends of the insulating tube; and two metal end members extending around the outside of the respective ends of the insulating tube and electrically and mechanically connected with the condenser tabs and resistance ends, said end members closing the ends of the tube and holding in assembly the tube, condenser and resistance, reinforcing the ends of the tube and constituting common circuit terminals for the condenser and resistance.

In testimony whereof I hereunto affix my signature.

WILLIAM M. BAILEY.