Dec. 22, 1936. L. G. BURLINGAME 2,064,819

CONDENSER

Filed March 30, 1933

Fig. 1.

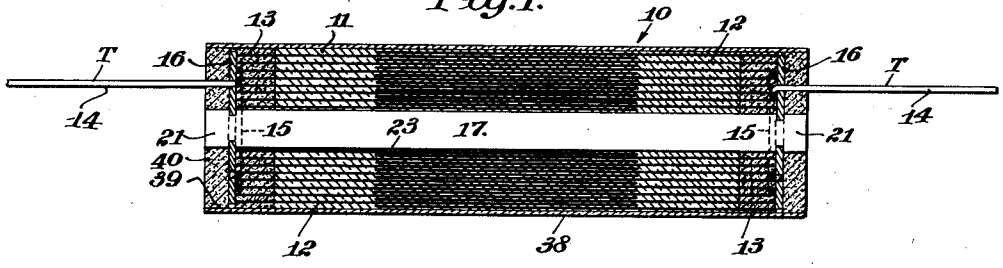


Fig. 2.

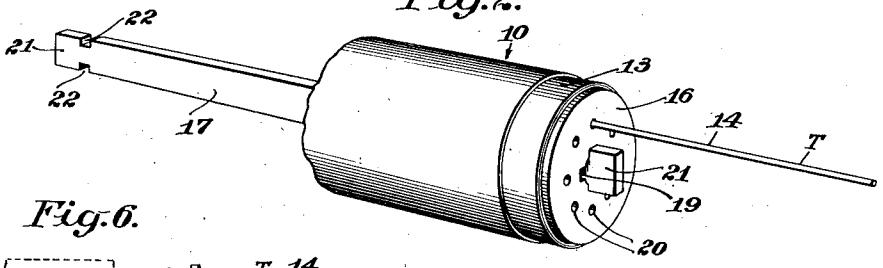


Fig. 6.

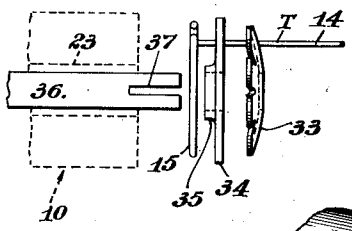


Fig. 3.

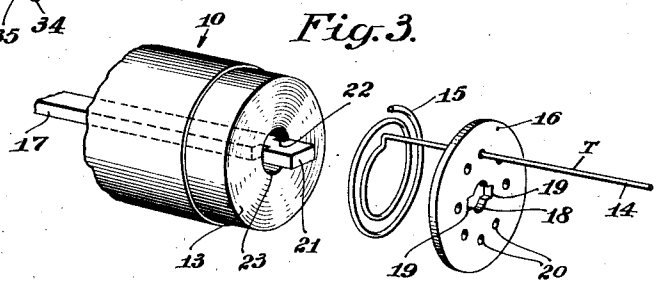


Fig. 4.

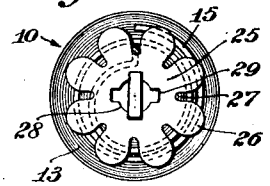
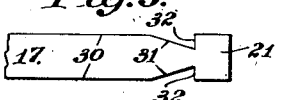


Fig. 5.



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2,064,819

CONDENSER

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Application March 30, 1933, Serial No. 663,433

10 Claims. (Cl. 175—41)

The present invention relates to electrical condensers and, more particularly, to electrical condensers having metal foil electrodes and terminal means therefor.

Electrical condensers of the type above referred to usually comprise electrodes of metal foil wound with insulating sheets into a body in the ends of which the marginal edges of the electrodes are presented for connection, at one or more points, with a terminal lead or leads. The terminal means of certain known prior art devices of this character include terminal leads in the form of short lengths of conducting wire, secured mechanically or by fusion, such as by soldering, with the marginal edges of the foil electrodes. Such terminal means are often not sufficiently flexible to withstand repeated flexing in use without breaking away at the joint or tearing out from the foil edges.

Various expedients have been employed heretofore to overcome the above and other weaknesses in the terminal constructions of foil condensers and like electrical devices, but have not been of practical use because of increased cost, limited flexibility, increased size, lack of adaptability to common forms of apparatus and lack of ability to withstand ordinary handling in production and use.

It is, accordingly, an object of my invention to provide an electrical condenser having an improved terminal construction whereby the above-noted and other disadvantages inherent in known constructions are obviated.

A further object of my invention is to provide an improved condenser having a plurality of terminal connections whereby the condenser body may effectively be supported without impairing the union between the condenser and the terminal connections.

A further object of my invention is to provide an improved, flexible terminal construction for electrical foil condensers and the like which provides for easy attachment or removal of the terminal means, thereby facilitating manufacture and repair, and prevents damage to the elements of the device by accidental breakage or removal of the terminal means.

Another object of my invention is to provide improved, flexible terminal members for condensers of the character specified which are attached thereto without the aid of solder.

A still further object of my invention is to provide an improved electrical condenser of the metal foil type having detachable terminal means providing a relatively large contact area with the electrode elements thereof and means for positively establishing and maintaining an electrical connection between said elements and said terminal means.

With the above and other objects in view, the invention resides in the novel construction, combination, and arrangement of parts, the novel features of which are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment, when taken in connection with the accompanying drawing, in which

Fig. 1 is an enlarged sectional view of a metal foil condenser and terminal means therefor embodying my invention;

Fig. 2 is a fragmentary perspective view, on the same scale, of the condenser of Fig. 1, illustrating a step in the assembly operation wherein a terminal member is connected to one end thereof;

Fig. 3 is a similar view illustrating the parts of Fig. 2 in detached, but assembled, relation with respect to one end of the condenser;

Fig. 4 is an end view, on the same scale, of a condenser illustrating a modification of a terminal attaching end plate shown in Figs. 1, 2, and 3;

Fig. 5 is a fragmentary view, in elevation, and also on the same scale, illustrating a modification of a locking bar shown in Figs. 1, 2, and 3; and

Fig. 6 is a view, in elevation and on the same scale, of certain parts in detached, but assembled, relation to each other, illustrating a further modification of my invention.

Referring more particularly to the drawing, wherein similar reference characters indicate corresponding parts throughout, a condenser, generally indicated at 10, comprises a plurality of suitable paper strips 11 which are wound on a mandrel or arbor, (not shown), with a plurality of strips of suitable metal foil 12 therebetween, the foil strips 12 forming the electrode elements and being spaced edgewise to extend the marginal edge portions 13 thereof beyond the marginal edges of the paper strips 11 or body of the condenser to provide exposed terminal ends for the electrodes.

In accordance with my invention, the condenser 10 is provided at each end with terminal means T which is preferably constituted by a single length of suitable conducting wire 14 hav-

ing one of its free end portions convoluted, as indicated at 15, in a plane at right angle to the remaining or terminal lead portion thereof and to a diameter less than the diameter of the free ends of the condenser 10, as clearly shown in Figs. 1, 3, and 4.

The terminal leads 14 are secured to the ends of the condenser 10, in contacting relation with the exposed convoluted edge 13 of each foil strip 12, by means of a pair of discs or washers 16 and a locking bar 17. The washers 16, preferably of metal and of a diameter substantially equal to the diameter of the free ends of the condenser 10, are each provided with a central opening 18 having diametrically opposite rectangular recesses or slots 19 cut inwardly from the edge defining the opening 18 to form a key-hole. The washers 16 are further provided with a plurality of equally spaced minor openings 20 which are concentrically arranged about the opening 18.

The locking bar 17 consists preferably of a suitable length of hard fibre or the like, preferably rectangular in cross section, which is provided adjacent each of its free ends 21 with a plurality of rectangular slots, notches, or recesses 22 which are cut inwardly from its opposite sides to form a key as clearly shown in Figs. 2 and 3.

In the attachment of the terminal leads 14 to the condenser 10, the straight portion of each of the members 14 is passed through one of the openings 20 in the washer 16 until the convoluted portion 15 abuts one face thereof. With the terminal leads 14 and the washers so assembled, the locking bar 17 is subsequently inserted in the central opening 23, extending lengthwise through the condenser 10, until the free ends 21 thereof project an equal distance beyond the ends of the condenser. An assembled terminal lead 14 and washer 16 are then placed on each of the projecting ends 21 with the convoluted portions 15 of each member 14 in contacting engagement with the respective ends of the condenser 10.

The condenser 10, with the locking bar 17 and the terminal leads 14 and washers 16 as a unit, is now inserted in a suitable press or other pressure exerting means to compress the convoluted portions 15 of the terminal leads 14 into firm contact with the exposed foil edges of the condenser and the washers 16 into alignment with the slots 22 in the locking bar 17.

After the washers 16 have been compressed into alignment with the slots 22, the locking bar 17 is given a quarter turn to cause the slots 22 to lock the washers 16, in the position to which they have been compressed, by the cooperation of the slots 22 with the diametrically opposite edge portions of the openings 18 at points removed 90° from the slots 19. After the terminal leads 14 have been so secured, the condenser is ready to be impregnated in a suitable dielectric compound, the minor openings 20, not occupied by the terminal leads 14, assisting the slots 19 in permitting ingress of the impregnating compound into the ends of the condenser under the washers 16 and into the central opening 23 occupied by the locking bar 17 whereby the said bar is also impregnated.

Among other things, impregnation of the locking bar 17 causes the said bar to shrink. This is highly desirable since shrinkage of the fibre locking bar 17, after the washers 16 have been locked in place thereby, causes the said bar 17 to maintain the washers 16 under constant pressure contact with the convoluted portions 15 of the terminal leads 14 and the convoluted portions with the ends of the condenser 10.

In Fig. 4, there is illustrated a modified form of washer 25 having its peripheral edge scalloped to provide a series of circular segments 26 joined at their extremities by a series of radially arranged, inwardly extending slots 27, said slots being adapted to assist the central opening 28 therein and the rectangular slots 29 associated with the opening 28 in permitting ingress of an impregnating dielectric compound into the condenser structure, and also to provide an outlet passage for the free end portion of a terminal lead 14 similar to the openings 20 shown in connection with the washer 16 in Figs. 2 and 3.

Fig. 5 illustrates one end of a modified form of locking bar 17 wherein a portion of the opposite side edges 30 is tapered or undercut, as indicated at 31, to provide shoulders 32 adapted for cooperative locking engagement with either form of washer illustrated, in a manner similar to that hereinbefore described. From a consideration of the above, it will readily be apparent that, in the attachment of the terminal leads 14 to the condenser 10 by means of the washers 16 and a locking bar, as exemplified in Fig. 5, the application of pressure to the washers 16 need not be so regulated as to insure the exact alignment of the washers 16 with the rectangular slots 22, since the absence of shoulders opposite to the shoulders 32, shown in Fig. 5, obviates the necessity for exact alignment and thereby facilitates the attachment of the terminal leads 14 to the condenser 10.

While I have described the locking bar 17 as being formed preferably of hard fibre or the like, and the washers 16 as of metal, it is to be expressly understood that I consider it within the scope of my invention to employ a metallic locking bar and a washer of bakelite or other form of hard insulating material in lieu of the materials aforesaid. Moreover, I may also utilize a metallic, dished, spring washer 33 having a scalloped peripheral edge, similar to the washer 25 shown in Fig. 4, in conjunction with a locking bar of suitable insulating material or with a metallic locking bar. In the latter case, as shown in Fig. 6, an additional washer 34, of insulating material such as hard sheet fibre, having a short, annular flange 35 projecting centrally from one side thereof, is preferably interposed between the metallic spring washer 33 and the convoluted portion 15 of the terminal leads 14 with the annular flange of the said additional washer projecting into the central opening 23 in the condenser 10 to insulate the end portion of the metallic locking bar from the convoluted marginal edge of the foil layers, adjacent the axial center of the condenser.

Also, as shown in Fig. 6, in lieu of the form of locking bar shown in Figs. 1, 2, 3, and 5, I may utilize a metallic bar 36, either rectangular or cylindrical, solid or tubular in cross section, having a slot 37 cut inwardly axially of its free ends, to divide each free end portion of the bar whereby a terminal lead 14, the intermediate flanged fibre washer 34, and the dished spring washer 33 may all be attached to each end of the condenser 10 by separating the divided end portions 37 of the bar over the outer surface of the spring washer 33 in a well known manner or, alternatively, the slots 37 may be dispensed with and the free ends of the bar may be simply upset or peened over.

After the terminal leads 14 have been secured to the respective ends of the condenser 10 in the

manner herein set forth, the condenser **10** is preferably inserted in a tubular container **38** (Fig. 1) of suitable insulating material or, alternatively, in a wrapper of similar material. The container or wrapper is preferably of a length substantially greater than the length of the condenser **10** to provide an opening **39** at each end of the condenser adapted for the reception of a suitable sealing compound as indicated at **40**, whereby the said condenser, with the attached ends of the terminal members **14**, is effectively sealed within the container.

I claim as my invention:

1. In a fixed condenser having marginal foil edges projecting from each end thereof and a central opening extending throughout its length, a pair of flexible terminal members each having an end portion thereof contacting one of said foil edges, clamping elements for said terminal members, provided, each, with an aperture in the form of a key-hole, a locking bar extending through said central opening and the aperture of each clamping element, and a key carried by the end portions of said bar for locking each of said apertured elements to its associated terminal member upon partial rotation of said locking bar whereby said terminal members are secured in abutting relation to the terminal means of said condenser.

2. In a fixed condenser of the rolled foil type having an axial opening throughout its length and presenting exposed foil-edges at the ends thereof, a terminal member for each foil edge, the said members each having a free end and an end angularly disposed thereto, the angularly disposed end of one member being in contacting engagement with one foil edge and the angularly disposed end of the other member being in contacting engagement with the remaining foil edge, a pair of locks each constituted by a multi-perforated disc associated, respectively, with the angularly disposed ends of the several terminal members and through each of which the free end of the respectively associated terminal member extends, a clamping member having oppositely located key-shaped ends extending through said axial opening and through said discs, the ends of the clamping member and the perforations in the discs which accommodate them having such configuration that rotation of the said member with respect to the said discs gives rise to a locking action, a container for said condenser, and means for sealing said condenser within said container.

3. The combination with an electrical condenser having a spiral electrode and an insulating body in which an edge of said electrode is exposed as a terminal element therefor, of a flexible terminal member for said electrode comprising a convoluted wire portion arranged to lie in contact with the edge of said electrode, said convoluted portion having a terminal lead extending therefrom, a disc for engaging and holding said convoluted wire portion in direct contact with said exposed electrode edge, said disc having an orifice therein to accommodate said terminal lead and a second orifice in the form of a key-hole, a locking bar having a key portion extending beyond the body of said condenser and through said key-hole and movable into locking engagement with said disc, and means for anchoring said bar with respect to the body of said condenser whereby said bar and disc frictionally and conductively engage said flexible terminal member with the edge of said spiral electrode.

4. In a condenser presenting an exposed marginal foil edge lying in the end of the body thereof, a terminal member adapted to contact said foil edge, a disc for clamping said terminal member against said foil edge, said disc having a slot therein, a locking bar extending through the body of said condenser and having a recessed end adapted to be passed through said slot in said disc and, by relative movement of said rod and disc adapted to lock said terminal member against said foil edge.

5. The invention as set forth in claim 4 further characterized in this, that said locking bar is composed of fibrous material treated to ensure shrinkage whereby it exerts continuous pressure against said clamping disc.

6. In an electrical device having an opening therethrough, terminal members contacting said device, a clamping rod extending through said opening and engaging said terminal members, said clamping rod having a permanent shrinkage factor whereby said terminal members are maintained under pressure contact with said device.

7. In an impregnated electrical device having a central opening throughout its length, terminal members contacting the ends of said device, an impregnated clamping rod extending through said central opening and engaging said terminal members, said clamping rod having a permanent shrinkage factor whereby said terminal members are maintained under continuous pressure contact with said ends of said device.

8. The invention as set forth in claim 7 further characterized in this, that said terminal members are orificed to permit impregnation of the interior of said condenser after assembly.

9. In a condenser having a plurality of metallic foils separated by insulating material and rolled into substantially cylindrical form with one marginal foil edge projecting from each end of said condenser, a pair of terminal members adapted to be secured in abutting relation with the projecting marginal foil edges and each having a terminal lead extending from one end thereof, a disc cooperatively associated with each terminal member, said discs each having an orifice to accommodate said terminal leads, and a rod of impregnated fibre having a permanent shrinkage factor extending axially of said condenser and connecting said discs for maintaining said terminal members in contacting relation with the projecting foil edges of said condensers.

10. The combination with an impregnated electrical apparatus having a body portion and electrode terminals at each end, a detachable terminal means therefor comprising a convoluted terminal member engaging said electrode terminals, said members each having a terminal lead extending from one end thereof, and clamping means extending in part through said body portion and mechanically connecting said convoluted terminal members, the part of said clamping means extending through said body portion being composed of impregnated fibre and having a permanent shrinkage factor whereby said convoluted terminal members are maintained under constant pressure with said electrode terminals.

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