July 14, 1936. R. A. OGG 2,047,796

RESISTANCE DEVICE

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FIG. 1

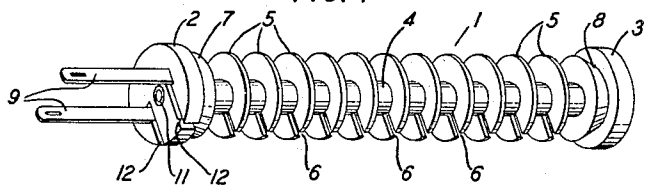

FIG. 2

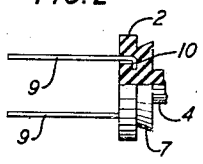

FIG. 3

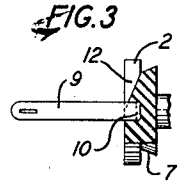

FIG. 4

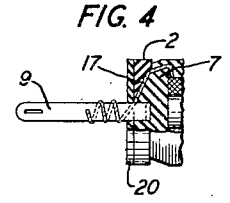

FIG. 5

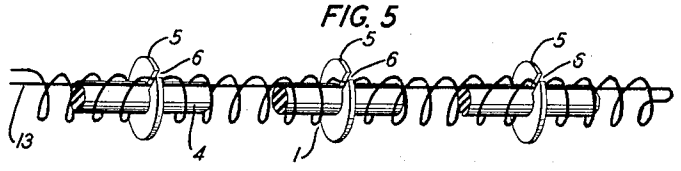

FIG. 6

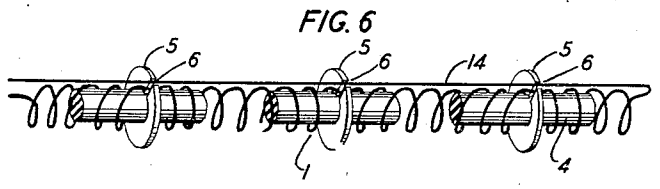

FIG. 7

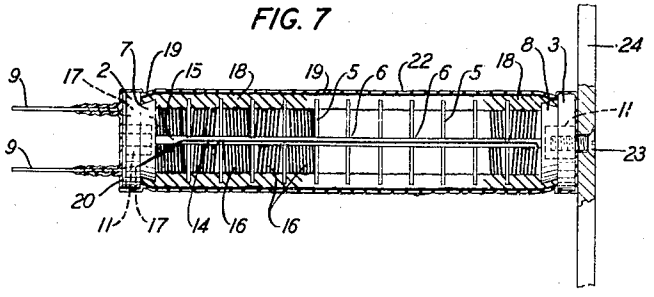

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FIG. 8

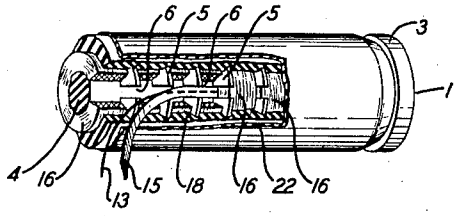


FIG. 9

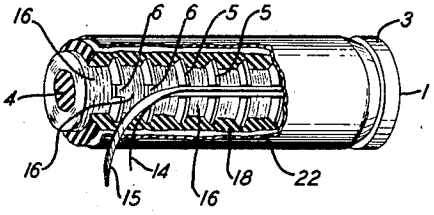


FIG. 10

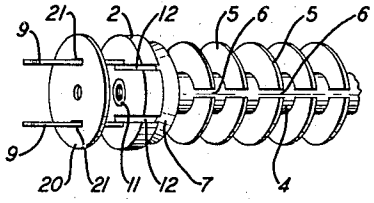
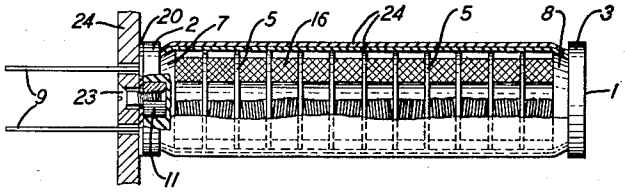


FIG. 11



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UNITED STATES PATENT OFFICE

2,047,796

RESISTANCE DEVICE

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Application October 6, 1934, Serial No. 747,165

6 Claims. (Cl. 201—67)

This invention relates to resistance devices and more particularly to wire wound resistance devices.

Its object is to provide an improved means for protecting the resistance winding from moisture.

In accordance with this invention the resistance support is provided with tapered ledges to receive the ends of a tubular covering, for the wire winding, consisting of cellulose acetate, which covering is partially dissolved at its ends and in drying shrinks in length and in diameter and thus makes intimate contact with the tapered ledges.

To seal the point of emergence of terminals on the unit and points of connection between a wire winding and the terminals a washer of sheet cellulose acetate is applied to the outer face of an end flange of the support.

Other features of the invention are pointed out in the detailed description.

In the drawings, Fig. 1 is a view in perspective of a support for a wire winding;

Fig. 2 is a side elevational view, partly in section, of an end of the support;

Fig. 3 is a side elevational view of an end of the support taken at a ninety degree angle from the view shown in Fig. 2;

Fig. 4 is a side view partly in section of an end of a completely wound resistance unit;

Fig. 5 is a plan view of one method of winding a resistance wire on the support;

Fig. 6 is a plan view of another method of winding a resistance wire on the support;

Fig. 7 is a side elevational view, partly in section, of a complete resistance unit attached to a frame or panel;

Fig. 8 is a view in perspective and partly in section of a portion of the resistance shown in Fig. 7 wound as shown in Fig. 5;

Fig. 9 is a view in perspective and partly in section of a portion of the resistance shown in Fig. 7 and wound as shown in Fig. 6;

Fig. 10 is a view in perspective of a portion of the support shown in Fig. 1 with a washer to be applied to a terminal end of the support; and

Fig. 11 is a side elevational view partly in section of a modification of the invention.

In wire wound resistance devices it is quite often found important to provide a moisture-proof covering over the wire winding and to have the moisture-proof covering make intimate contact with portions of the support for the winding.

In some instances the protective covering over a winding of wire on a support comprises a winding of cellulose acetate silk thread which is wound over the wire winding on the support until the wire winding is completely covered. In this invention a protective covering is built up in the form of a tube over a wire winding on a support and ends of the covering are shrunk into intimate contact with tapered ledges on ends of the support.

To further described this invention reference will now be had to the drawings in which like parts bear like numerals and in which 1 in Fig. 1 is a support for a wire winding. The support 1 is made in the form of a spool having end flanges 2 and 3 and a central cylindrical portion 4, on the respective ends of which are the end flanges 2 and 3. Spaced flanges 5 may be included in the structure as shown in Fig. 1 where a sectionalized support is required. The spaced flanges 5 are attached at intervals along the cylindrical portion 4 between the end flanges 2 and 3 and project radially of the cylindrical portion 4. Each flange 5 is radially slotted at 6 to permit the passage of the resistance winding from one section of the support 1 to another and the slots at 6 are in alignment so that an unobstructed passage is provided through the flanges 5 from one end of the group of flanges 5 to the other.

Between the end flange 2 and the adjacent end of the cylindrical portion 4 is an annular ledge 7. The annular ledge 7 is frusto-conical in shape and tapers toward the end flange 2. Between the end flange 3 and the adjacent end of the cylindrical portion 4 is an annular ledge 8. The annular ledge 8 is frusto-conical in shape and tapers toward the end flange 3. Each spaced flange 5 is the same diameter as the others. The inner end of the tapered ledge 8 is the same diameter as a spaced flange 5 and the inner end of the tapered ledge 7 is the same diameter as a spaced flange 5. The diameter of each of the end flanges 2 and 3 is slightly greater than the diameter of a spaced flange 5. Terminals 9 are provided in the end flange 2 and project longitudinally of the support 1.

In making the support 1, I preferably mold it all in one piece so that the spaced flanges 5 are integral with the cylindrical portion 4, the tapered ledges 7 and 8 are integral with the cylindrical portion 4 and the end flanges 2 and 3 are integral with the respective tapered ledges 7 and 8. I preferably make the support 1 of cellulose acetate or some like resinous material and mold the terminals 9 into the end flange 2. The terminals 9 as shown in Fig. 2 have inwardly bent ends 10 which are embedded in the end flange 2. I also mold into each end flange 2 and 3 an internally

threaded and externally knurled short brass tube 11 to provide means for securing the resistance device to a panel or frame. In molding the support 1, I also provide spaced slots 12 in the outer face of the end flange 2 for a purpose to be later explained. The spaced slots 12 extend from the periphery of the end flange 2 inward to the terminals 9 and each slot 12 as shown in Fig. 3 progressively decreases in depth from its outer extremity to the corresponding terminal 9 so that at the terminal 9 the bent end 10 of the terminal is below the base of the slot 12.

After the support 1, shown in Fig. 1, has been made a predetermined length of resistance wire is wound on the support 1. The resistance wire may have an insulating coating of enamel or silk or have any other insulating coating required. The winding may be started from one of the terminals 9 then wound progressively along the support 1 and back again to the other terminal 9.

To minimize inductance and capacitance in the resistance device, however, I prefer to apply the winding in either of the two following ways. First, as shown in Fig. 5, by first running a straight length 13 of the resistance wire along the support 1 through the aligned slots 6 in the spaced flanges 5 to the far end of the cylindrical portion 4 and then progressively winding back to the point of beginning through the various sections of the support 1 and in each section reversing the direction of the winding over the direction taken in the preceding section; and, secondly, as shown in Fig. 6, to apply the various turns of the resistance winding in each section of the support 1 progressively along the support from the point of beginning to the far end of the cylindrical portion 4 and reversing the direction of winding in each section over the direction taken in the preceding section and then bringing back through the aligned slots 6 in the flanges 5 a straight portion 14 of the resistance winding to the point of beginning. In either case a long narrow strip 15 of insulating material as shown in Figs. 8 and 9 is placed between the straight portion of the resistance wire and the wound portions. The strip 15 of insulating material may be a strip of sheet cellulose acetate equal in length to about the space between the inner faces of the tapered ledges 7 and 8 and of about the same width as the width of the slots 6 in the flanges 5. In Fig. 7, the resistance wire is shown as applied to the support 1 in the manner shown in Fig. 6 with the long straight portion 14 of the resistance wire coming back through the slots 6 in the flanges 5 and over the narrow strip of insulating material 15 which overlies the various wound portions 16 in the various sections of the unit. Fig. 9 shows the insulating strip 15 taking position in the slots 6 of the flanges 5 and over the wound portions 16 of the resistance wire and the long straight strip of resistance wire 14 taking position over the insulating strip 15 to form the structure shown in Fig. 7. Fig. 8 shows the long straight portion 13 of the resistance wire passing through the slots 6 in the flanges 5, the long narrow strip 15 of insulating material taking position over the long straight portion 13 of the resistance wire and the wound portion 16 of the resistance wire passing over the strip 15 of insulating material as it would appear if the resistance shown in Fig. 7 were wound in the manner shown in Fig. 5. The ends of the resistance wire pass over tapered ledge 7 as shown in Fig. 7 and through the slots 12 in the end flange 2 and are attached to the terminals 9. If a comparatively fine gauge wire is used for the resistance wire, I find it advisable to attach stranded leads 17, as shown in Figs. 4 and 7, to the ends of the resistance wire and bring the stranded leads 17 over the tapered ledge 7 and attach them to the terminals 9. Connecting of the stranded leads 17 to the resistance wire and to the terminals 9 may be done by twisting and soldering the stranded leads 17 to the resistance wire and to the terminals 9. Use of the stranded leads 17 as connecting means between the resistance wire and the terminals 9 prevents breakage at the points where the wire passes over the tapered ledge 7 and also at the points of connection with the terminals 9.

After the resistance wire has been applied to the support 1 in either of the manners above described, a moisture-proof covering 18 is applied over the wound portion of the unit and over the tapered ledges 7 and 8 as shown in Fig. 7. The moisture-proof covering 18 may be a serving of cellulose acetate silk thread wound sufficiently deep over the various sections of the resistance device as to fill up the sections between the flanges 5 not occupied by the various portions of the resistance wire and also sufficiently deep to increase the diameter of the unit beyond the diameter of the tapered ledges 7 and 8. The serving of cellulose acetate silk thread is continued over the tapered ledges 7 and 8 and into engagement with the inner wall surfaces of the end flanges 2 and 3 and forms a tubular covering of wound silk thread over the wire winding and over the tapered ledges 7 and 8. After the serving 18 of cellulose acetate silk thread has been applied over the wound portions of the unit and over the tapered ledges 7 and 8 the outer strands of the cellulose acetate silk serving are partially dissolved by the application of a solvent such, for instance, as acetone. Application of the acetone to the serving 18 of cellulose acetate silk, partially dissolves the outer turns of the serving and permits the outer turns to coalesce and form an impervious coating 19 over the outer portions of the wound unit and over the tapered ledges 7 and 8. When the acetone treated serving 18 of cellulose acetate silk thread dries, it shrinks in length and in diameter and makes intimate contact with the tapered ledges 7 and 8 of the support 1 and creates a seal between the serving 18 of cellulose acetate silk and the tapered ledges 7 and 8 thereby sealing up the ends of the resistance device against the entrance of moisture at these points. Since the tapered ledges 7 and 8 taper toward the respective end flanges 2 and 3, the greater the shrinkage of the tube, comprising the serving 18 of cellulose acetate silk, in length and in diameter, the tighter will be the seal at the ends of the tubular covering of cellulose acetate silk thread and around the tapered ledges 7 and 8 of the resistance device.

To prevent moisture from entering the resistance device at the points where the terminals 9 emerge from the end flange 2, a washer 20 of sheet cellulose acetate material, and as shown in Figs. 4, 7, 10, and 11, is applied to the outer face of the end flange 2. The washer 20 is apertured at 21—21 to register with the terminals 9 to permit the terminals 9 to pass therethrough and has its central aperture in register with the internally threaded tube 11 in the end flange 2. To secure the washer 20 to the end flange 2 and to seal the point of emergence of the terminals 9 from the end flange 2 and to further seal the slots 12 in the

end flange 2, a generous supply of acetone is applied to the outer face of the end flange 2 and to the inner surface of the washer 20. The application of acetone to these parts partially dissolves the outer face of the end flange 2 and the inner surface of the washer 20. The partially dissolved material flows around the inner ends of the terminals 9 and seals these points against the entrance of moisture. The partially dissolved material also flows down into the slots 12 in the end flange 2 and, as shown in Fig. 4, seals up these slots and fills up the spaces in these slots not occupied by the stranded leads 17 or ends of the resistance wire. After the moisture-proof coating comprising the cellulose acetate silk serving 18 has been applied to the unit, the unit may be further moisture-proofed by the application of a suitable paint or other moisture-proofing compound 22 over the cellulose acetate silk serving and over the end flanges 2 and 3.

To attach the resistance device to a panel or frame a machine screw 23 is passed through an aperture in the panel or frame 24, as shown in Fig. 7, and is threaded into the internally threaded tube 11 which is molded into the end flange 3. If it is required that the terminals 9 be brought through the panel 24, spaced apertures are provided in the panel 24 to receive the terminals 9. In this case the machine screw 23 is threaded into the internally threaded tube 11 in the end flange 2.

In the modification of the invention shown in Fig. 11, the resistance device is formed in the same manner as above described with the exception that the serving 18 of cellulose acetate silk thread and the outer coating of paint 22 are not required. Instead of using the serving 18 of cellulose acetate silk thread and the outer coating of paint 22, a moisture-proof covering formed of sheet cellulose acetate material 24 is applied over the wound portion of the unit and over the tapered ledges 7 and 8. The cellulose acetate sheet 24 is preferably a laminated sheet having two plies or more of extremely thin sheet cellulose acetate material. The width of the sheet is slightly more than the distance between the inner surface of the end flange 2 and the inner surface of the end flange 3. The length of the sheet 24 is slightly more than is required to encircle the support 1. Before applying the laminated sheet 24 of sheet cellulose acetate to the unit, the tapered ledges 7 and 8 are treated with a solution of acetone to partially dissolve them. The edges of the laminated sheet 24 are also treated with a solution of acetone. The laminated sheet 24 is then wrapped around the wound resistance unit and is pressed down at its ends against the tapered ledges 7 and 8. The edges of the laminated sheet 24 which have been treated with the acetone, in drying, shrink against the partially dissolved tapered ledges 7 and 8 of the support 1 and become firmly united with the tapered ledges 7 and 8. Acetone is also applied to the outer ends of the laminated sheet 24 of cellulose acetate to permit the outer ends of the laminated sheet of cellulose acetate 24 to become united with the underlying portion. By using a laminated sheet 24 of cellulose acetate material instead of a thicker solid sheet of the same material, I find that the sheet 24 of cellulose acetate may be more readily applied to the wound resistance unit, because of greater flexibility, and that if there are any pinholes or other slight imperfections in the material in one layer, they are compensated by the overlapping layer. The sheet 24 of cellulose acetate may be transparent so that the wound portions 16 of the unit and the flanges 5 are visible therethrough as shown in Fig. 11 or the cellulose acetate sheet may be opaque.

While the invention has been described as applying to wire wound resistance devices it is obvious that the same structure may be included in other electrical devices without departing from the spirit of the invention.

What is claimed is:

1. A resistance device comprising a support, end flanges on the support, a wire winding on the support, a tubular covering of thread for the wire winding, and tapered ledges, on said end flanges, against which ends of said tubular covering are shrunk.

2. A resistance device comprising a support of resinous material, end flanges on the support, a wire winding on the support, a tubular covering of resinous material for said winding, and tapered ledges on said end flanges engaged by ends of said covering, the ends of said covering being shrunk against and united to said tapered ledges.

3. A resistance device comprising a support, end flanges on the support, a wire winding on the support, a tubular protective covering for said wire winding, and tapered ledges, on said support, against which ends of said covering are shrunk, each of said tapered ledges being frustoconical in shape and terminating at the smaller end in one of said end flanges.

4. A wire wound device comprising a support of cellulose acetate material, end flanges on said support, tapered ledges on the inner faces of said end flanges, a winding of wire on said support, terminals on said support for said winding of wire, and a sheet of cellulose acetate forming a tubular covering over said winding of wire and over said tapered ledges and having ends in engagement with and shrunk against said tapered ledges.

5. A wire wound device comprising a support of cellulose acetate material, end flanges on said support, tapered ledges on the inner faces of said end flanges, spaced inner flanges between said end flanges, a series of compartments along said support defined by said spaced inner flanges and said end flanges, a winding of wire on said support, said wire winding being wound in the compartments along said support, slots in said inner flanges, said wire winding passing through said slots from one of said compartments to an adjacent compartment, the direction of winding of said wire winding being reversed in each compartment over the direction taken in the adjacent compartment, a sheet of cellulose acetate forming a tubular covering over said wire winding and said tapered ledges and having ends engaging and shrunk against said tapered ledges, and terminals on said support for said wire winding.

6. A wire wound device comprising a support of cellulose acetate material, end flanges on said support, tapered ledges on the inner faces of said end flanges, said tapered ledges being frustoconically shaped and tapering toward an adjacent end flange, a wire winding on said support, and a tube of cellulose acetate covering said wire winding and said tapered ledges, the ends of said tube being shrunk into said tapered ledges.

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