

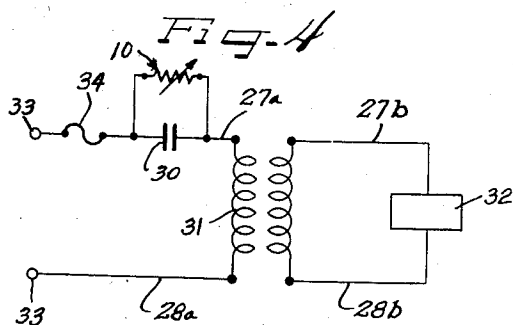
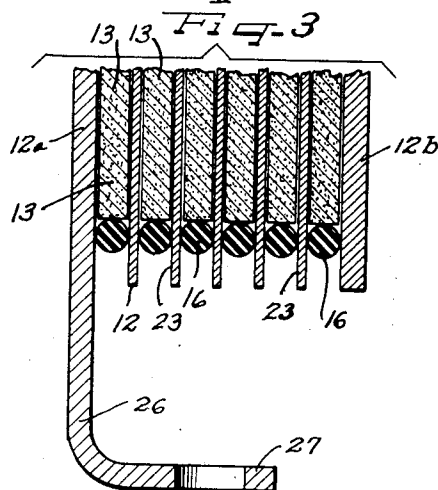
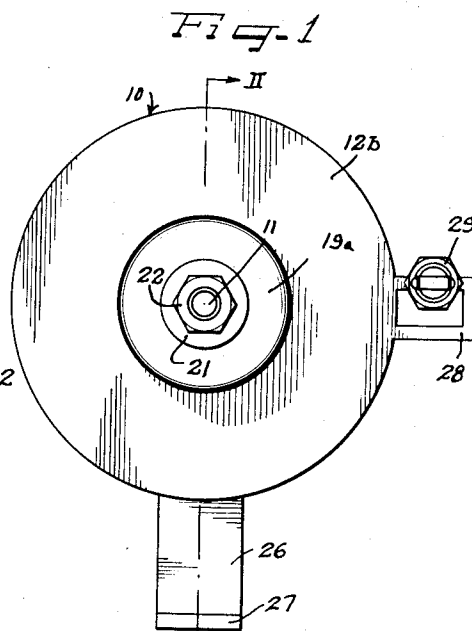
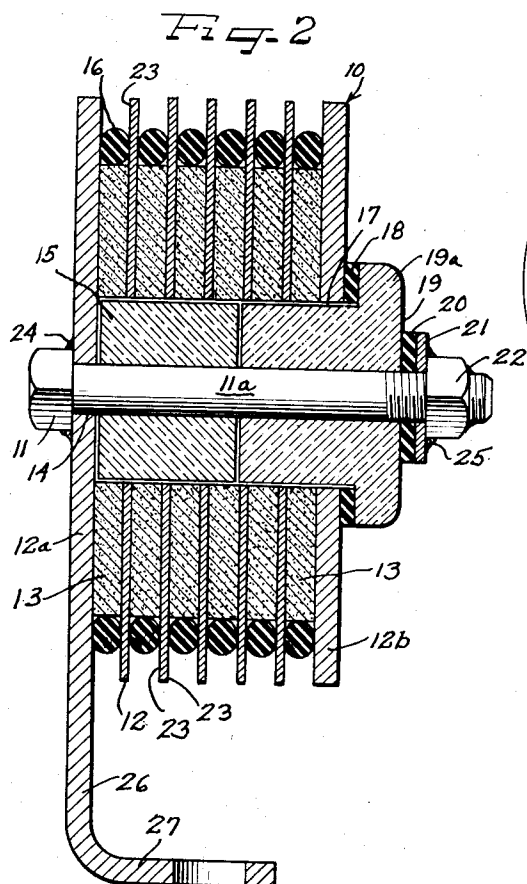
Jan. 20, 1959

A. R. MILLIKEN ET AL

2,870,307

WEATHERPROOF RESISTOR

Filed Sept. 4, 1957



Inventor  
ALVIN R. MILLIKEN  
MELVIN S. HOOK

64 *Still, Sherman, Meroni, Gross & Simpson*  
*Attys.*

1

2,870,307

## WEATHERPROOF RESISTOR

Alvin R. Milliken and Melvin S. Hook, La Salle, Ill.,  
assignors to Electrical Utilities Company, La Salle, Ill.,  
a corporation of Illinois

Application September 4, 1957, Serial No. 681,952

11 Claims. (Cl. 201—68)

This invention relates generally to a surge protector or a resistor for use with a capacitor or the like.

More particularly this invention relates to a new and improved surge protector or resistor which has means for sealing its peripheral areas preferably leaving cooling fins or plates exposed. The means herein contemplated to be used to prolong the useful life of the resistor preferably comprises elements or rings of non-conductive rubber-like material which may be displaced to attain a satisfactory seal between the fins at the outer periphery thereof and the electrical resistance spacers between the fins or plates. These elements or rings serve to protect the components of the resistor from the weather elements and the like so that the life and performance of the resistor will not be deleteriously affected.

In calling the resistant elements spacers, it is not intended to infer in any way that they are minor or lesser elements of the combination. Rather such term spacer was elected for the purpose of simplifying identification and claiming of same in the combination.

Accordingly, an object of this invention is to provide a new and improved surge protector or resistor construction.

Another object of the present invention is to provide a new and improved resistor which has means for weather sealing the peripheral areas thereof.

Still another object of this invention is to provide a surge protector or resistor construction which may be economically manufactured on a large production basis at a low cost.

According to the general features of this invention there is provided in a surge protector comprising a bolt including a bolt shank, a series of apertured stacked metal plates separated from one another by apertured electrical resistance spacers, both the plates and the spacers being stacked on the bolt with the plates extending outwardly beyond the spacers and with the spacers and the plates cooperating together and defining a series of longitudinally spaced annular grooves, non-conductive bushing structure between the bolt shank and the plates and the spacers, means comprising compressibly non-conductive weather protective structure with portions of the structure in each of the grooves, the portions normally having a dimension slightly in excess of the distance between opposing surfaces on adjacent plates when the plates are in abutting contact with the spacer therebetween, clamping means including the bolt maintaining the plates and the spacers in assembly compressing and displacing the portions into snug weather sealing engagement with the plates, and means cooperable with the plates at the opposite ends of the assembly providing connectors for connection with a capacitor and the like.

According to other features of the present invention, the depressible non-conductive weather protective structure above mentioned comprises an annular ring made from a suitable material such as a silicone rubber which resists cracking.

Other objects and features of the present invention will

2

more fully become apparent in view of the following detailed description taken in conjunction with the accompanying sheet of drawings illustrating therein a single embodiment in which:

5 Figure 1 is a plan view of a surge protector or resistor;

Figure 2 is an enlarged cross-sectional view taken substantially on the line II—II of Figure 1 looking in the direction indicated by the arrow;

10 Figure 3 is a fragmentary exploded view showing the rings having a diameter in excess of the width of the spacer; and

Figure 4 is a circuit diagram showing one application of the surge protector or resistor.

In the drawings:

15 The reference numeral 10 indicates generally a surge protector or resistor which may be used in conjunction with a capacitor or the like to compensate for an overload or a short-circuit in order to protect the elements which it is used in conjunction with such as a capacitor and a transformer. The present resistor 10 may be used in any suitable circuit which may be of the type shown in the Partington patent, entitled "Electric Circuit," Patent No. 2,202,716, issued May 28, 1940.

20 The resistor 10 comprises an electrical pile which includes a bolt 11 which may be made from brass or any suitable material. Stacked upon the bolt are a series of plates 12 and spacers 13 with the plates and the spacers being alternated with one another. The plates 12 include opposite end plates 12a and 12b which have a thicker cross-section than the plates 12 disposed therebetween. The opposite end plates 12a and 12b may be made from any suitable material such as brass and the like while the intermediate plates 12 may be made from aluminum, copper, and other suitable materials.

25 The spacers 13 may be preferably comprised of an electrical resistance material such as one containing carbonaceous material.

30 In the assembly of the resistor 10 the end plate 12a may be initially telescoped with respect to the bolt 11 by extending bolt shank 11a through opening 14 in the end plate 12a. Then an undersized porcelain bushing 15 may be centered and telescoped into assembly over the bolt shank 11a.

35 According to the features of the present invention a weather sealing and cushioning structure which is herein shown as annular rubber rings 16 are disposed about the outer periphery of the spacers 13. This cushioning and sealing ring may be made from any suitable material although it will be appreciated excellent results may be attained through manufacturing this ring from a silicone type of rubber to resist cracking when exposed to atmospheric conditions. Also, the rings 16 may have any suitable cross-sectional configuration although the rings are herein shown having an O-shaped cross sectional configuration.

40 In the assembly of the resistor 10, the plates 12 are alternated with the spacers 13 and the rings 16 with a suitable number of these elements stacked on top of one another and positioned radially of the bolt shank 11a. After the desired number of layers have been assembled with respect to the bolt 11, the end plate 12b is moved axially with respect to the bolt 11 and an opening 17 in the end plate 12b is telescoped over the bolt shank 11a with the plate 12b being placed in abutting contact with the adjacent ring 16.

45 As is illustrated in Figure 3, and before assembly is completed, the plates 12 and the spacers 13 are maintained in axially spaced relation with respect to one another. The reason for this is that the ring 16 is illustrated in the present instance as having an O-shaped cross-section which diameter exceeds the width of the spacer 13. Thus when the plates and the spacers and

3

the rings are in preliminary assembly the rings 16 operate to maintain the spacers 13 out of contact with at least one of the opposing surfaces on the adjacent plates 12.

To further complete the assembly of the resistor 10, a sealing gasket or ring 18 is telescoped over the bolt shank and engaged against the end plate 12b. Thereafter, a second bushing 19 is telescoped over the bolt shank 11a with the bushing 19 having an enlarged head portion 19a in abutting engagement with the annular rubber-like gasket or ring 18. After the bushing 19 has been moved into position a second rubber-like gasket 20 is engaged over the bolt along with a washer 21 and finally a nut 22 is threadingly engaged with respect to the threaded end of the bolt shank 11a. This construction prevents the bolt 11 from short circuiting the resistor between the end plates 12a and 12b.

Upon further tightening of the nut 22 on the bolt 11, the rubber-like rings 16 are displaced with each of the rings engaging against the adjacent opposed sides of the plates 12 and also against the outer peripheral surface of the spacers 13. The O-shaped rings 16 are displaced in such a manner their cross-sectional configuration is changed from a circular shape to an elliptical shape (Figure 2).

In order to facilitate cooling the resistor 10 the plates 12 and the spacers 13 are herein illustrated as discs having diameters at variance with one another with the spacer diameter being reduced with respect to the plate diameter. Thus when the plates and the spacers are in assembly with respect to one another annular grooves 23 are defined at the periphery of the spacers with the plates extending radially outwardly of the rings 16 which are disposed within the annular grooves 23. This construction permits air to freely circulate about the periphery of the plates 12 for cooling the same.

Where the rings 16 are manufactured having an O-shaped cross-section these rubber-like rings when pinched between the plates 12 are caused to be displaced out of round into elliptical cross-sectional shaped rings, as is illustrated in Figure 2. By manufacturing the bushing 15 slightly undersize in axially spaced relation to the plate 12a and the bushing 19, the nut and bolt may be drawn tight so that the rings 16 are displaced into cushioning and weather sealing assembly. It is in this manner that three point engagement between the ring 16 and the opposite surfaces of the plates 12 and the peripheral surface of the spacer 13 is attained so that the rings act as a cushion and as a seal to prevent sloughing and the like.

To further protect and weather seal the resistor 10, the bolt 11 and the nut 22 may be soldered. To this end, the head of the bolt is soldered at 24 to the end plate 12a and the nut 22 is soldered at 25 to the washer 21.

For connecting the resistor 10, the end plate 12a is provided with an integral L-shaped portion 26 having an apertured connector or terminal leg 27. In addition, the end plate 12b may be provided with an offset integral U-shaped extension 28 having a split-bolt 29 which extension 28 and bolt 29 comprises the other connector.

As was mentioned previously, the resistor may be used for any suitable purpose and may be connected in a circuit either in parallel or in series.

Figure 4 illustrates a circuit diagram showing the use of the resistor 10 for protection of a capacitor 30 in series with a step-down type transformer 31 wherein the load is indicated at 32. Lines 27a and 27b and lines 28a and 28b are connected to the transformer with the lines 27b and 28b connected to the load 32. The lines 27a and 28a have terminals 33 which may be connected to any suitable power supply. In the line 27a is located a transformer fuse 34 between the terminal

4

33 and the resistor 10 and the capacitor 30 for protecting the same against overloads above a predetermined amount.

Thus from the circuit it will be perceived that when there is a short circuit in the circuit or the circuit is subjected to an overload, a portion of the overload is by-passed through the resistor 10 thereby protecting the capacitor 30.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

We claim as our invention:

1. In an electrical resistance device for by-passing a capacitance in a power distribution line and the like, a plurality of spaced metal discs, a spacer of material such as carbon disposed between said discs in general axial alignment therewith, a resiliently elastic rubber-like sealing ring between said discs and encompassing the periphery of said spacer radially inwardly of the outer edges of said discs and means axially of said discs for tightly clamping the discs against said spacer and with said ring in cushioning contact with confronting sides of said discs to weather proof and protect said spacers from the elements.

2. In an electrical resistance device for by-passing a capacitance in a power distribution line and the like, a plurality of spaced metal discs, a spacer of material such as carbon disposed between said discs in general axial alignment therewith, a resiliently elastic rubber-like sealing ring between said discs and encompassing the periphery of said spacer radially inwardly of the outer edges of said discs and means axially of said discs for tightly clamping the discs against said spacer and with said ring in cushioning contact with confronting sides of said discs to weather proof and protect said spacers from the elements, said ring being of generally O cross section.

3. In combination, a plurality of spaced electrically conductive plates, a carbonaceous spacer disposed between said plates and of a smaller area than that of the plates so that said plates extend laterally beyond the spacer, and sealing means between the plates and about said spacer comprising a resilient ring encompassing at its inner periphery the spacer and having its side surfaces abutting confronting sides of the plates beyond the spacer.

4. In an electrical resistance structure, a series of axially spaced elements each with a peripheral surface to be confined from the surrounding atmosphere, and means including an elastic rubber-like ring sealingly encompassing said surface.

5. In an electrical resistance structure, a series of axially spaced elements each with a peripheral surface to be confined from the surrounding atmosphere, and means including an elastic rubber-like ring sealingly encompassing said surface, said ring comprising an O ring resiliently stressed and deformed about said surface and in cushioning contact therewith.

6. In an electrical resistance structure, a series of carbonaceous resistance elements each with a surface including a peripheral edge to be confined from the surrounding atmosphere, and means encompassing said surface including an elastic rubber-like ring sealingly engaged with said peripheral edge.

7. In an electrical resistance device for by-passing a capacitance in a power distribution line and the like, a bolt, a plurality of spaced metal discs stacked axially along said bolt with said bolt extending through an opening in each of said discs, a spacer of resistance material disposed between said discs in general axial alignment therewith with the bolt extended through an opening in the spacer, a resiliently elastic rubber-like sealing ring between said discs and encompassing the periphery of said spacer and means including a nut cooperable with said

5

bolt for tightly clamping said discs against said spacer and displacing said ring into cushioning contact with confronting sides of said discs to weather proof and protect said spacers from the elements.

8. In combination, a plurality of spaced electrically conductive plates, a carbonaceous spacer disposed between said plates and of a smaller area than that of the plates so that said plates extend laterally, clamping means maintaining said spacer between said plates, and sealing means between the plates and about said spacer comprising a resilient ring encompassing at its inner periphery the spacer cooperable with said clamping means and the said ring having its side surfaces abutting confronting sides of the plates beyond the spacer and with a peripheral edge of the spacer upon the ring being compressed and displaced by the clamping means when said spacer is clamped between said plates.

9. A surge protector comprising a series of stacked metal plates separated from one another by electrical resistance spacers with the plates extending outwardly beyond the spacers and with the spacers and the plates cooperating together and defining a series of longitudinally spaced annular grooves, a series of annular longitudinally spaced non-conductive weather protective elements with one of said elements in each of said grooves, each of said elements before assembly normally having a dimension slightly in excess of the distance between opposing surfaces on adjacent plates when the plates are in abutting contact with the spacer therebetween, clamping means maintaining the plates and the spacers in assembly compressing and displacing said elements into snug weather sealing engagement with said plates, and offset extensions emanating from the plates at the opposite ends of the assembly providing connectors for connection with a capacitor and the like.

6

10. A surge protector comprising a bolt including a bolt shank, a series of apertured stacked metal plates separated from one another by apertured electrical resistance spacers, both of the plates and the spacers being stacked on the bolt with the plates extending outwardly beyond the spacers and with the spacers and the plates cooperating together and defining a series of longitudinally spaced annular grooves, non-conductive bushing structure between the bolt shank and the plates and the spacers, means comprising compressible non-conductive weather protective structure with portions of said structure in each of said grooves, said portions normally having a dimension slightly in excess of the distance between opposing surfaces on adjacent plates when the plates are in abutting contact with the spacer therebetween, clamping means including the bolt maintaining the plates and the spacers in assembly compressing and displacing said portions into snug weather sealing engagement with said plates, and means cooperable with the plates at the opposite ends of the assembly providing connectors for connection with a capacitor and the like.

11. In a weatherproofed electrical structure, an electrical pile including a plurality of elements disposed radially around an axis, means for sealing said pile axially of the same against endwise ingress of moisture and ring means sealing said pile radially outwardly of said axis against radial ingress of moisture in said pile and with said ring means being in cushioned contact with elements of said pile.

#### References Cited in the file of this patent

#### UNITED STATES PATENTS

2,347,796 Podolsky May 2, 1944