Jan. 16, 1951 S. D. VIGREN ET AL 2,538,177

EXCESS-VOLTAGE ARRESTER

Filed Sept. 7, 1945

Fig. 1

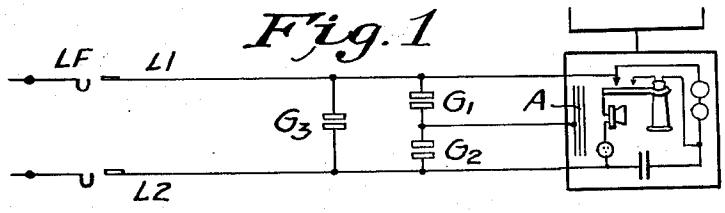


Fig. 2

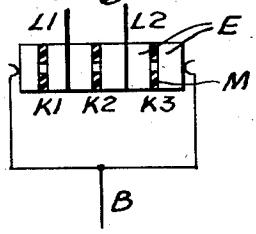
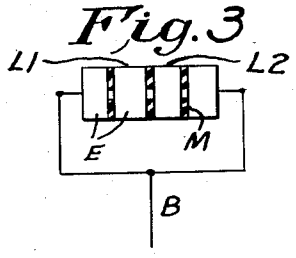


Fig. 3



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Patented Jan. 16, 1951 2,538,177

UNITED STATES PATENT OFFICE

2,538,177

EXCESS-VOLTAGE ARRESTER

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Application September 7, 1945, Serial No. 615,036
In Sweden April 3, 1944

Section 1, Public Law 690, August 8, 1946
Patent expires April 3, 1964

1 Claim. (Cl. 179—78)

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The invention relates to a modification of excess-voltage arresters, especially with regard to such ones, as are used in large quantities in low tension devices such as in telephone plants and in other low voltage devices. An excess-voltage arrester which is very common in telephone devices is made of a spark gap with two electrodes, usually of carbon, said electrodes being held at a short mutual distance, for instance by washers of insulating material, usually mica. That type of excess-voltage arrester is described in the Swedish Patent No. 74,667, according to which electrodes and washers have received a suitable shape for the function of the arrester, electrodes and washers having furthermore been assembled into a single unit by means of insulating binding means.

Of late it has been proposed to use, instead of the described excess-voltage arrester, voltage-dependent resistances (siliceous carbide, ocelit, etc.), which at normal operating voltages possess a high resistance, but under high voltages show a very low resistance and thereby can dissipate the high-tension voltages.

Said arresters are mounted close to the part of the device which is to be protected, and are connected between the branches of an aerial line and earth. The latest researchers have however proved, that in thunderstorms the currents in an aerial line (telephone line) can come up to 1500 amperes or still more. That fact places especially great demands on a good earth connection for the arresters. If the earth connection resistance comes up to 2 ohms, there will be, for said current, a tension of 3000 volts on the earth electrode, said tension being hardly supportable by the insulation in a telephone apparatus or a telephone wire of normal construction. The earth connection resistance ought thus preferably to be below 2 ohms. However, such a low earth connection resistance cannot be obtained otherwise than at special places, at any rate not without exceedingly heavy costs. Even an earth connection resistance of 10 ohms is difficult to obtain.

The inventors have introduced a new way for connection of said excess voltage arresters, which differs from hitherto known ways, the arresters, instead of being connected between line branches and earth, are according to the invention connected between the branches and the metallic body of the apparatus, which supports the inner details of the apparatus. Said body may as a result of lightning obtain a high potential and the arresters are so provided, that the potential difference between the line branches and the body does not exceed the dielectric strength of the insulation.

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The high potential of the body will soon disappear owing to leakage.

In certain cases it may be convenient to connect the body of the apparatus in series with a special arrester or a resistance (voltage-dependent resistance) to some earthed object or object having a great capacity to earth (water pipe, central heating).

It is to be observed that with said arrangement the arresters will be less damaged by lightning than if they were directly connected to earth.

From another point of view it is obvious that it is not desirable to touch the body of the apparatus during thunderstorms—it seems to be of minor importance, as the subscribers are ordered not to use the telephone during thunderstorms—it is however to be observed, that the same voltage conditions must arise, if a break down occurs on the body, which during lightning is a normal defect of said apparatus. The invention is moreover intended for telephone instruments with insulating casing, for instance of molded plastic material, which surrounds the body of the apparatus and the inner details it supports, so that the body is thus not normally accessible from outside.

We think of the origin of atmospherical excess-tension voltages, irrespective of direct down-strokes, more or less in the following way: In a static thunderfield, there arise charges on an aerial line (e. g. a telephone line with two branches). On changes of the thunderfield these charges are released and give birth to a tension wave on both sides along the telephone line. When said tension wave meets the parts of the device connected with the telephone line, break-downs or flash-overs may take place on earthed parts or on apparatus metallic details, which have great earthing capacities or not very good insulation against earth, respectively. The beforementioned way of connecting an excess-voltage arrester, for instance a carbon lightning arrester, between each of the branches and earth depends for its effectiveness on the supposition that the high-tension wave runs parallel to both branches, and that therefore no potential difference worth mentioning exists between the branches. In reality, however, the attenuation of the wave may often be different with regard to the two branches, and the charge of one of the branches may even

for some reason be discharged in a larger or smaller degree.

With regard thereto the inventors have found another modification, wherein, besides said two arresters, there is also an arrester intended to be connected between the branches. Said latter arrester is then supposed to come into action should, for some reason, a potential difference arise between the branches. Recent researchers have also proved that such a triple arrester obtains a higher protecting efficiency compared with previously known devices having only two protecting elements.

The described modifications will be more clearly illustrated by means of the figures in the accompanying drawing. Said figures refer more particularly to open spark gaps (carbon lightning arresters), but it is obvious that the principles of the invention may be applied with other forms of excess-voltage arresters.

Fig. 1 shows the connection in principle. Two spark- or discharge gaps G_1 and G_2 are connected in series to a telephone branch L_1 and L_2, and the point of contact between G_1 and G_2 is connected to the body A in a telephone apparatus. G_3 is a spark gap connected right across the branches, which in turn are connected to usual selecting equipment LF.

Fig. 2 shows a unit made of three interconnected carbon lightning arresters K_1, K_2 and K_3. The line branches are indicated by L_1 and L_2 and the connection with the body of the telephone apparatus by B. The electrode blocks of the carbon lightning arresters are indicated at E and the insulating washers at M.

Fig. 3 shows a unit made of only four electrode blocks (E), out of which two (the central ones) have been provided with electrode surfaces on both their sides.

The embodiments may vary in still other ways. The assembling into one single unit may be effected in different manners, by means of screens, springs or, most conveniently, by means of insulating binding means.

The arresters thus described may, when they are to be combined with telephone devices, be placed in a suitable socket, eventually provided with a cover, close to the telephone apparatus. An additional conductor must then be carried from the apparatus case to said socket.

A new way, by which said conductor may be dispensed with, is to mount the arresters directly in the apparatus. Both ways may have their advantages, and the way of mounting may vary according to different circumstances and with regard to different practical considerations.

The invenventors have introduced one more novelty, i. e. that the unit, with regard to its outer shape, is so composed, that it cannot be installed otherwise than in the correct connecting way. This is an advantage if the arrester is to be exchanged by a person unfamiliar with its construction.

We claim:

An excess voltage arrestor unit for equalizing the potentials in telephone apparatus components due to excessive voltages on line wires connected to said apparatus, comprising a plurality of more than two excess-voltage conducting layers, conductive electrode layers alternating with said excess-voltage conducting layers and supported in contact therewith to provide end and intermediate connection points for said unit, means for connecting intermediate electrode layers to respective wires of a telephone line, and means for connecting said end electrode layers by a common connection to a metallic portion supporting at least one of said components.

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