Dec. 2, 1941. F. B. JOHNSON ET AL 2,264,699

LIGHTNING ARRESTER BLOCK

Filed Nov. 16, 1938

Fig. 1.

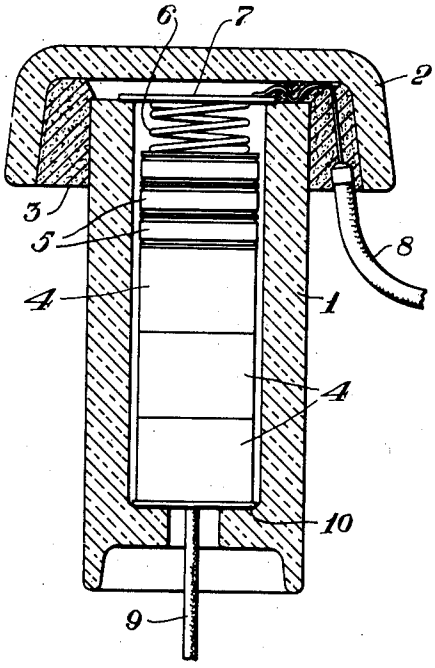


Fig. 2.

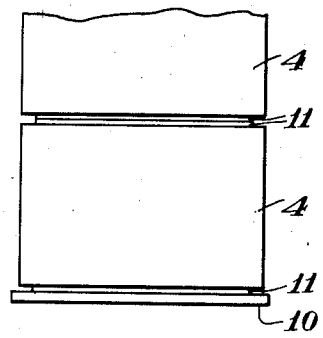


Fig. 3.

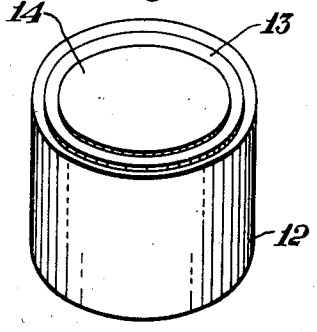
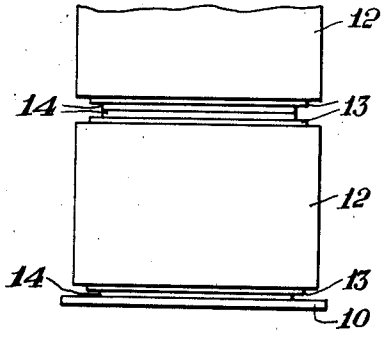


Fig. 4.



WITNESSES:
Edward Michaels
T. P. Lyle

INVENTORS
Frederick B. Johnson &
Edward F. W. Beck.
BY
O. B. Buchanan
ATTORNEY

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LIGHTNING ARRESTER BLOCK

Frederick B. Johnson, Murrysville, and Edward F. W. Beck, Pittsburgh, Pa., assignors to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

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4 Claims. (Cl. 175—30)

The present invention relates to lightning arresters, and more particularly to means for improving the contact conditions between adjacent arrester blocks or other arrester elements.

A well-known type of lightning arrester consists essentially of a spark gap element, which is adapted to insulate the arrester from the line under normal conditions but to break down and permit the passage of current when a surge voltage is applied to it, and a resistance or valve element in series with the gap. The resistance element is made of a material having valve characteristics, that is, a material which is capable of discharging high currents when a high surge voltage is applied to it, but which will reduce the current to a very low value which can be readily interrupted by the gap when the voltage falls to approximately the normal line voltage or the rated voltage of the arrester. The valve element is usually made up of a plurality of blocks of some suitable material, such as granular silicon carbide molded with a suitable binder and baked or fired to form a porous block, a sufficient number of blocks being used in series to obtain the desired voltage rating. Electrical contact between adjacent blocks or other elements of the arrester is obtained by means of contact plates secured to the blocks and other elements and contacting each other. In the case of the blocks, the contact plate is usually in the form of a coating of metal, such as copper, applied to each end of the block. This coating is usually applied by spraying in order to obtain intimate contact with the block material, and when the coating is applied in this way, it is necessary to make the diameter of the coating somewhat less than that of the block, so that an uncoated portion is left around the periphery of the block.

It has been found that the contact conditions between adjacent blocks or between the blocks and other arrester elements have a very important influence on the life of the blocks. When a heavy surge current passes through an arrester block, the contact coating and the contact plate or coating of the adjacent block or other element are at the same potential because of their high conductivity and close contact. The uncoated peripheral portion of the block, however, may be at a different potential from the coating because the current flowing through the relatively high resistance material of the block causes a potential gradient in a radial direction between the edge of the coating and the edge of the block. If this uncoated portion is accidentally in contact with the adjacent element, or even if it is very close to the adjacent element, sparking may occur between them because of this difference in potential which may exist, and this sparking readily induces flashover of the block, resulting in failure of the unit.

The object of the present invention, therefore, is to improve the contact conditions between adjacent lightning arrester blocks or other elements by keeping those parts which may be at different potentials spaced far enough apart to prevent accidental contact or sparking between them.

More specifically, the object is to provide a lightning arrester valve block having means for spacing it far enough from an adjacent block or other arrester element to prevent contact or sparking between those parts which may be at different potentials. This spacing means may be a conducting flat disc or washer placed between the block and the adjacent element in contact with their contact plates only, but is preferably a second coating applied to the contact coating on the block but of less diameter than the first coating and of sufficient thickness to space the adjacent elements a safe distance apart.

Other objects and advantages of the invention will be apparent from the following detailed description, taken in connection with the accompanying drawing, in which:

Figure 1 is a vertical sectional view of a typical lightning arrester assembly,

Fig. 2 is a diagrammatic view illustrating the contact conditions between adjacent arrester blocks,

Fig. 3 is a perspective view of a lightning arrester block embodying the present invention, and

Fig. 4 is a diagrammatic view showing the improved contact conditions obtained by the present invention.

The lightning arrester shown in Fig. 1 has a generally cylindrical porcelain casing 1 with a porcelain cap 2 secured to the casing 1 by a suitable cement 3. The arrester assembly consists of one or more valve blocks 4 of suitable resistance or valve material, and one or more gap elements 5 of any suitable type. A sufficient number of gaps and blocks is provided in series to obtain the desired voltage rating for the arrester, and a helical spring 6 is placed between the topmost gap element and a conducting plate 7 to hold the various elements of the arrester in

intimate contact and to maintain them in position in the casing. A lead 8 for connection to a transmission line or other device to be protected is secured to the plate 7, and a ground lead 9 is secured to a conducting plate 10 on which the lowermost block rests.

Fig. 2 shows diagrammatically the contact conditions between adjacent blocks and other elements of the arrester, the spacing between the elements being greatly exaggerated for the sake of clearness. As explained above, the usual method of providing contact between the blocks and adjacent elements is by a metallic contact coating which is applied to each end of each block and is indicated at 11. It will be seen from this figure that, in the usual arrangement, the contact coatings of the blocks do not extend to the edge of the block and that there is a narrow, uncoated peripheral portion. As explained above, this portion may be at a different potential from that of the coatings 11 and, since these coatings are usually very thin, the uncoated portion of the block is very close to the adjacent block or other element and may accidentally be in contact with it or may be close enough to it so that the difference in potential causes sparking to occur, which may lead to flashover of the block, especially with a surge of relatively long duration.

This danger of block failure resulting from flashover may be avoided by improving the contact conditions so as to prevent the possibility of sparking between the adjacent blocks or other conducting elements. This may be most readily accomplished by spacing the blocks far enough apart to prevent accidental contact or sparking between those portions which may be at different potentials. This can be done in a number of ways, such as by providing mechanical spacers of sufficient thickness between the adjacent elements to space them far enough apart to prevent sparking. The spacer should be of conducting material and, in order to prevent difficulty and danger of misalignment during assembly, it should preferably be secured to the block. This can be done by providing thin discs or washers of copper or lead of smaller diameter than the coating on the end of the block and soldering them to the coating concentrically with the block.

A more desirable way of obtaining this spacing is shown in Fig. 3, which is a perspective view of a single block. The block 12 itself may be of any usual type and is preferably made of granular silicon carbide molded with a suitable binder and either baked or fired to form a porous block having the desired valve characteristics. A copper coating 13 is applied to each end of the block in the usual manner, preferably by spraying, and it will be seen that a narrow uncoated portion is left at the periphery of the block. This coating is, of course, extremely thin, being of the order of 2 or 3 mils, although its thickness is exaggerated in the drawing. The spacing means consists of a second coating 14 applied on top of the first coating and made of less diameter than the first coating but of greater thickness, preferably from 8 to 15 mils. This second coating may also be of copper, or if desired, it might be of some more ductile metal such as lead or a lead alloy. It will be seen that this second coating acts as a spacing means which, when the block is assembled in contact with another block or other arrester element, will maintain the uncoated portions of the block which may be at a different potential a sufficient distance from the adjacent element to prevent accidental contact or sparking between them. It is desirable to apply this spacing means as a second coating over a thin first coating, since if a thin coating is applied to the block first, more intimate contact can be obtained with the block material, which may be rough.

Fig. 4 shows diagrammatically the effect of the spacing means 14 on the contact conditions between adjacent blocks or other arrester elements. The thickness of the coatings 13 and 14 is greatly exaggerated in this figure for the sake of clearness but it will be seen by comparison with Fig. 2 that all possibility of accidental contact between uncoated parts of a block and the adjacent block or other element is eliminated and that they are spaced far enough apart to prevent the occurrence of any sparking between them. This is particularly advantageous when the blocks are not perfectly aligned so that the contact coating of one block overlaps the uncoated portion of an adjacent block. Even with the worst condition of this kind that can occur practically in the assembly of a lightning arrester, the spacing means of the present invention prevents any sparking between the blocks.

It will be seen, therefore, that a lightning arrester block has been provided in which the contact conditions between the block and adjacent blocks or other elements are greatly improved by preventing the possibility of contact or sparking between those parts of the block and adjacent element which may be at different potentials, so that this source of danger of flashover and resulting failure of the block is entirely eliminated.

It is to be understood that although a specific embodiment of the invention has been illustrated and described, it is not limited to the exact arrangement shown, but that the desired spacing between adjacent elements may be obtained in various other ways, such as by the use of metallic spacers or washers placed between the adjacent elements, or other means, without departing from the spirit of the invention. It is to be understood, therefore, that the invention is not limited to the specific constructional form described above but that in its broadest aspects it includes all equivalent modifications and embodiments which fall within the scope of the appended claims.

We claim as our invention:

1. A lightning arrester valve element comprising a cylindrical block of resistance material, said block having a conducting coating on each end thereof, the diameter of said coating being less than that of the block, and a second conducting coating applied to said first coating to space the block from an adjacent block, the diameter of said second coating being less and its thickness greater than that of the first coating.

2. In a lightning arrester, a plurality of blocks of resistance material disposed in series relation, each of said blocks having a conducting coating on each end surface thereof, and a conducting spacing member united to said coating at each end of the block, said spacing member covering only a limited area of the coating and being thicker than the coating to space adjacent blocks apart.

3. In a lightning arrester, a plurality of cylindrical blocks of resistance material disposed in series relation, each of said blocks having a conducting coating on each end surface thereof, the diameter of said coatings being slightly less than that of the block, and a conducting spacing member united to said coating at each end of

the block, the diameter of the spacing member being less than that of the coating and its thickness greater to space adjacent blocks apart.

4. In a lightning arrester, a plurality of blocks of resistance material disposed in series relation, each of said blocks having a conducting coating on each end surface thereof, the diameter of said coatings being slightly less than that of the block, and a second conducting coating on each end of the block, said second coating being of less diameter than the first coating and of greater thickness to space adjacent blocks apart.

FREDERICK B. JOHNSON.
EDWARD F. W. BECK.