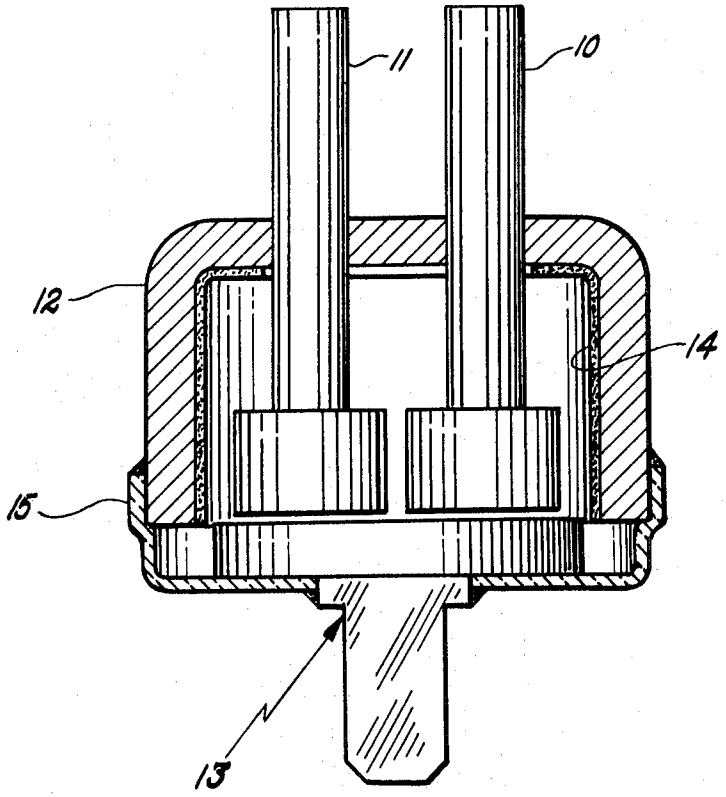
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HIGH-POWER SURGE ARRESTER

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INVENTORS
MURRAY E. HALE
ROBERT D. WRIGHT
BY Harry A. Herbert Jr. and George Fine
ATTORNEYS

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HIGH-POWER SURGE ARRESTER

Murray Everett Hale, Atkinson, N.H., and Robert David Wright, Canton, Mass., assignors to the United States of America as represented by the Secretary of the Air Force

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ABSTRACT OF THE DISCLOSURE

A high-power surge arrester designed to breakdown with minimal time lapse at a predetermined voltage surge level. An avalanche type of breakdown is initiated by the drift velocity of emitted electrons issuing from gaps in the adjacent TiO_2 coating located on the inner walls of the surge arrester.

This invention relates to surge arresters and more particularly to a high-power electrical surge arrester stabilizing the breakdown conditions thereof.

The present invention effectively stabilizes the breakdown conditions of a high-power electrical surge arrester, i.e. if the typical 60 cycle or DC breakdown has a nominal value of 400 volts, the arrester always breaks down at 400 volts regardless of the time elapsed since the last breakdown or the rise time of the applied voltage.

The prior art methods have included the use of Ni–63 or Krypton 85 within the gap of the surge arrester as radioactive keep alive agents; i.e., they maintain a certain level of ionization at all times within the unit to provide initial electrons for fast breakdown of the gap when its breakdown is exceeded. Another method uses a titania (TiO_2) between an auxiliary set of electrodes to provide UV irradiation of the main gap of the surge arrester on application of an impulse to make the breakdown of the main gap faster.

In the radioactive case the level of radiation that must be maintained to provide a significant advantage is so high as to constitute a hazard, at least psychologically. No unit using this method has been observed to depart drastically from the normal behavior without trace elements. In the case of the present invention, the present use depends on a separate TiO_2 structure within the gap envelope and depends on "magic" properties of TiO_2.

Operation of the device of the present invention depends on the electron emissive properties of various agents which may be used to coat the inner wall of the ceramic shell of the surge arrester gap. Breakdown of the gap is initiated by the fact that due to the small gap spacings (or vacancies in the case of TiO_2) in the coating, many areas of the coating become electron emissive immediately on application of a rising voltage at the electrodes.

An object of the present invention is to provide a high-power surge arrester designed to breakdown with minimal time lapse at a predetermined voltage level.

Another object of the present invention is to provide a high-power surge arrester wherein an avalanche type of breakdown is initiated therein.

Yet another object of the present invention is to provide a high-power surge arrester wherein breakdown occurs therein at a predetermined voltage level regardless

of the time elapsed since the last breakdown or rise time of the applied voltage.

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention itself, however, together with further objects and advantages thereof may best be understood by reference to the following description when taken in conjunction with the accompanying drawing illustrating one embodiment of the present invention.

Now referring to the single figure of the present invention, there are shown electrodes **10** and **11** which are pressure fitted and sealed into ceramic shell **12**. Electrodes **10** and **11** are separated a predetermined distance for breakdown at a predetermined voltage, for example, 400 volts. Electrodes **10** and **11** receive input surging voltages. Supporting metal structure **13** is also provided for ceramic shell **12**. Annular glass ring **15** clamps onto and seals shell **12** to form a vacuum tight fitting. Supporting structure **13** and ring **15** are integrated. Shell **12**, supporting structure **13** and ring **15** provide a housing for electrodes **10** and **11**. This housing may also be referred to as the gap housing or envelope. Up to this point, the surge arrester is of conventional structure.

The inner wall of ceramic shell has applied thereto coating **14**. The coating may be deposited by conventional methods such as spraying and baking, etc., and can be composed of carbon particles TiO_2 as an N type semiconductor or can be composed of metallic particles. Such a coating can be DC or AC coupled to the electrodes. In the present instance, it is AC coupled. Since the impedance of the coating is so high, AC coupling is effective to fairly low frequencies even if no effort is made to purposely introduce it, the stray capacitance being adequate. It is to be noted the electrodes and the intervening space therebetween is referred to as the main gap.

With a 60 cycle or DC breakdown value of 400 volts, for example, the arrester always breaks down at 400 volts regardless of the time elapsed since the last breakdown or the rise time of the applied voltage.

Breakdown of the gap is initiated by the fact that due to the small gap spacings (or vacancies in the TiO_2) in the coating, many areas of the coating become electron emissive immediately upon the application of a rising voltage at the electrodes. Without introducing acceleration effects, the drift velocity of a few of the electrons is fast enough for them to be in the area of the main gap in some tens of nanoseconds. These provide the initial electrons needed to start an avalanche breakdown in the main gap. The whole process requires less than 100 nanoseconds under reasonably fast impulse conditions and also is very fast for incoming rise times comparable to 60 cycles AC. With the above process, it is possible to specify a surge arrester that has a DC to impulse breakdown ratio of unity.

In the alternative the whole gap shell could be made out of TiO_2 suitably treated to become a very high impedance semiconductor.

While a particular embodiment of the invention has been shown and described, modifications may be made. It is intended in the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A high-power surge arrester having a stabilized predetermined breakdown voltage level comprising a pair of

electrodes receiving surging and rising voltages and being spaced a predetermined distance in accordance with said breakdown voltage level, an envelope surrounding said pair of electrodes, said envelope having an inner wall, and a coating of TiO_2 on said inner wall, said coating operating as an N type semiconductor and becoming electron emissive immediately on application of a rising voltage at said electrodes.

2. A high-power surge arrester as described in claim 1 wherein said envelope is comprised of a ceramic shell.

3. A high-power surge arrester as described in claim 2 wherein said coating is AC coupled to said electrodes.

4. A high-power surge arrester as described in claim 2 wherein said coating is DC coupled to said electrodes.

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JOHN W. HUCKERT, *Primary Examiner.*

R. F. POLISSACK, *Assistant Examiner.*

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