May 6, 1930. R. W. SORENSEN ET AL 1,757,397

HIGH VOLTAGE FUSE

Filed April 1, 1925

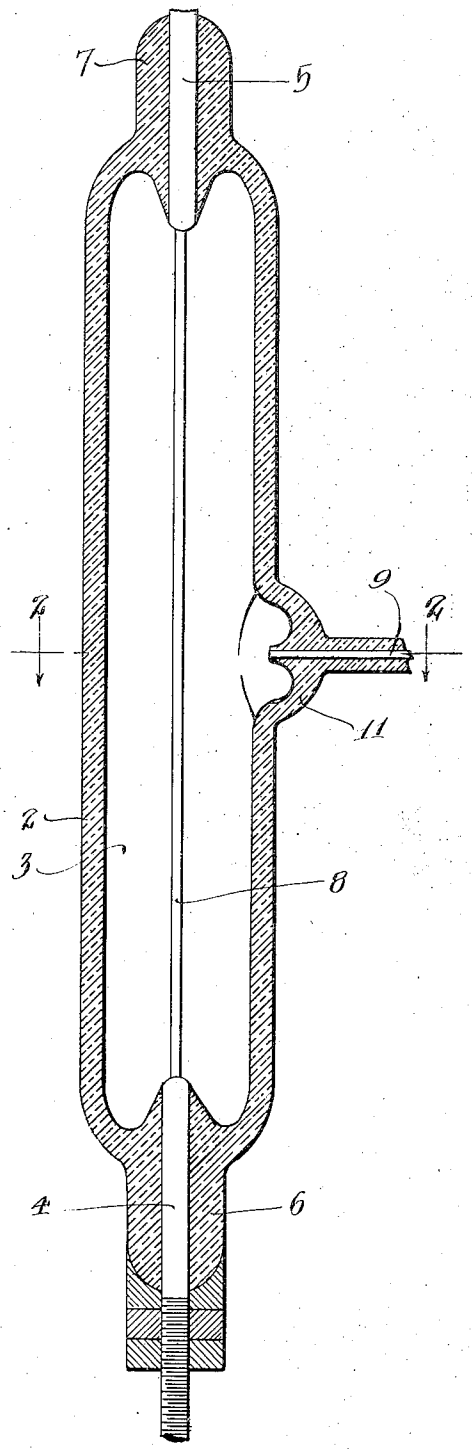
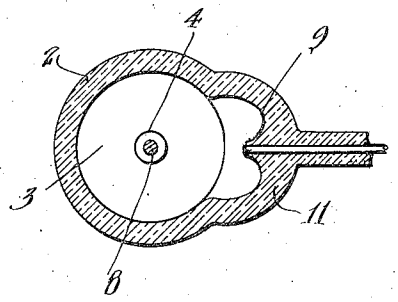


Fig. 1

Fig. 2



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UNITED STATES PATENT OFFICE

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HIGH-VOLTAGE FUSE

Application filed April 1, 1925. Serial No. 19,840.

This invention relates to fuses adapted to be employed upon high-tension lines and is adapted for operation on lines of electrical potential of 100,000 or 200,000 volts or more, although it may be used at any lower voltage if desired.

Hitherto, considerable difficulty has been encountered with fuses of the type above referred to. Whenever a fuse burns out, there is a break in the current through the line at the fuse, and if the surrounding insulating material does not possess the proper dielectric properties, excessive arcing will occur, which is extremely dangerous at the high voltages mentioned.

Hitherto, the art has not been able to discover any material of the proper dielectric strength to be employed as an insulating material around fuses of this character without danger of excessive arcing taking place when the fuse burns out.

It is an object of the present invention to provide a simple form of fuse for such high-voltage lines which is adapted to overcome the above mentioned difficulties and is simple and economical in construction and safe in operation.

This invention comprehends that in place of surrounding the fuse wire of the fuse with insulating material, or other material and attempting, by the provision of a large amount of this material of correct dielectric properties, to permit the operation of the fuse wire on high-tension lines, that the danger of arcing when the fuse wire is burned out is best overcome through surrounding the fuse wire with a space which is substantially completely evacuated; that is to say, that fuses of the present invention are provided with fuse wires disposed within a space or chamber which is evacuated to substantially a complete vacuum, and by the use of such substantially completely evacuated space, arcing upon burning out of the fuse can be to such a large extent overcome as to permit of successful and safe operation of the fuses on voltages of 200,000 volts or higher. It is not intended, however, to limit the invention to fuses for any particular voltage.

For the purpose of provision of a fuse safely operable at such high tensions, it has been found that the higher the space around the fuse wire is evacuated, the safer will be the operation of such a fuse.

As the chamber is progressively evacuated, the rarified gases within the chamber first pass through the point where they become conductive of electrical currents. By further evacuation of the space, this property of the rarified gas is eliminated and a point of evacuation is reached where the evacuated space provides the best known insulation for electric currents. This degree of evacuation is in the neighborhood of a gas pressure corresponding to a column of mercury of the height of 10^{-5} millimeters, although it is not intended to limit the invention to such a degree of vacuum, as higher vacuums are better adapted, and lower vacuums may be employed on relatively low-tension lines. The vacuum in any case, however, must be well in excess of that at which the rarified gases are conductive to electric currents.

For safety in the use of such a fuse, it is necessary that provision be made for testing the evacuation of the space surrounding the fuse wire and to determine whether or not the leads to the fuse wire are completely sealed against air and liquid. For this reason this invention is also directed to the construction of fuses which are also provided with means for testing the vacuum therein to determine at all times whether the desired vacuum is still maintained around the fuse wire.

Various other objects and advantages of the present invention will be apparent from a description of a preferred form or example of a fuse embodying the invention. For this purpose reference is made to the accompanying drawings illustrating a fuse embodying the invention.

In the drawings:

Fig. 1 is an elevation, mainly in section, of a fuse.

Fig. 2 is a transverse section on the line 2—2 of Fig. 1.

In the drawings, the fuse comprises a casing 2 or other means providing an elongated chamber 3 entirely enclosed. The casing 2,

of course, may be of any material which is both adapted to provide a chamber maintained at a nearly complete vacuum, and is also an insulating material so that it does not conduct electric current, glass being particularly suitable for this purpose.

The length of the casing 2 and the elongated chamber provided thereby will be dependent upon the electric potential of the line to which the fuse is to be placed, it being necessary to provide a chamber of such length that the lead wires thereto will not arc outside of the fuse. The ends of the casing 2 receive electrical leads 4 and 5 respectively, and the walls of the casing 2 are thickened as indicated at 6 and 7 and sealed air-tight to the leads 4 and 5. The leads 4 and 5 are connected inside the chamber 3 of the casing by a fuse wire 8 extending preferably axially through the center of the chamber 3. This wire may be of various materials, depending upon the sizes of the current to be carried by the fuse, copper wire being suitable for some sizes of fuses.

At a suitable point along the side walls of the casing 2, the walls of the casing 2 form a boss 11 through which a lead 9 is passed. The lead 9 is sealed air-tight in the boss 11.

In the construction of the electrical fuse described, the chamber 3 of the housing is, after the leads 4, 5 and 9 are sealed therein, highly evacuated. As above stated, this evacuation must be beyond that point at which rarified gas is conductive to electrical currents and preferably to a point equivalent to a column of mercury of 10^{-5} millimeters or less. The connection for exhausting the chamber 3 is not shown, as after exhaustion this connection may be closed up and removed from the fuse. As an alternative the connection may be left connected to the pump and the pump continually run during use.

Before the fuse is placed in operation, the vacuum within the vessel should be tested. This is done by connecting the fuse to two points having a high potential drop therebetween, one of the points being connected to one of the leads 4 or 5 and the other point being connected to the lead 9. If arcing takes place between the lead 9 and the fuse wire 8, the vacuum within the vessel is not of the proper degree.

While the invention is described in some detail, various modifications may be made without departing from the principles of the invention, and hence it is not desired to limit the invention to the specific details of construction, but the invention includes all such modifications as come within the scope of the appended claim.

We claim:

A high-voltage fuse comprising means providing a chamber evacuated beyond the conducting point, leads connected to a fuse wire disposed within said chamber, and a test lead extending into the said chamber.

Signed at Los Angeles, California, this 12th day of March, 1925.

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