Dec. 1, 1942. A. H. TOEPFER 2,303,514

VAPOR ELECTRIC DEVICE

Filed May 7, 1942

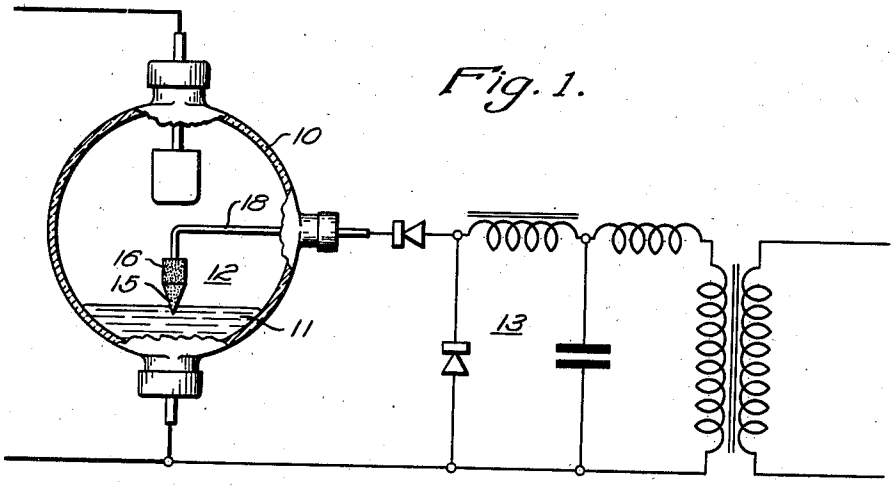


Fig. 1.

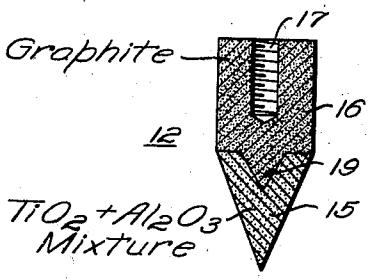


Fig. 2.

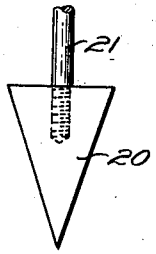


Fig. 3.

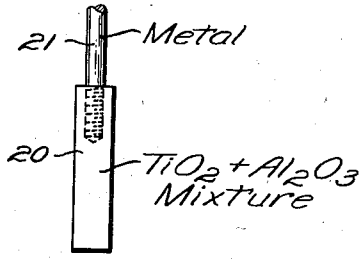


Fig. 4.

WITNESSES:

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VAPOR ELECTRIC DEVICE

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Application May 7, 1942, Serial No. 442,067

10 Claims. (Cl. 250—27.5)

My invention relates to a vapor electric device, and particularly to an improved make-alive electrode and means and methods of constructing such electrodes.

In the operation of vapor electric devices of the make-alive type, it is desirable to have make-alive electrodes of similar physical and electrical characteristics so that all of the parallel operating valves of a make-alive type converter may have substantially the same operating characteristics. The materials heretofore found suitable for make-alive electrodes are of a hard abrasive physical characteristic and it has heretofore been difficult to produce a plurality of substantially similar electrodes.

It has been found that materials having substantially identical physical dimensions and a homogeneous physical characteristic have produced substantially similar electrical characteristics.

I have found that titanium oxide combined with certain stable insulating materials such as aluminum oxide or silica can be worked to produce stable make-alive electrodes having substantially identical physical and electrical characteristics so that a large number of substantially similar make-alive electrodes may be practically constructed.

It is an object of my invention to provide a make-alive electrode which may be easily reproduced.

It is a further object of my invention to provide a method of constructing electrodes which will have substantially identical operating characteristics.

It is a further object of my invention to produce a low current reproducible make-alive electrode.

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

Figure 1 is a schematic illustration of a vapor electric device embodying my invention;

Fig. 2 is a sectional elevation of a preferred form of my improved electrode; and

Figs. 3 and 4 are front and side elevations of a modification according to my invention.

In the illustrative embodiment of my invention, a discharge device having a suitable container 10 and spaced main electrodes, one of which is preferably a vaporizable reconstructing cathode 11 such as mercury or gallium and is provided with a make-alive electrode 12 normally in contact with the cathode material. The make-alive electrode 12 is supplied with control potential from any suitable impulsing system herein illustrated as a wave distorter network 13 such as is disclosed in copending application Serial No. 404,888, filed July 31, 1941, and assigned to the same assignee as this application.

In constructing my improved make-alive electrode 12, a working tip 15 is provided by making a water paste of powdered titanium oxide and a stable insulating material such as aluminum oxide or silica. Preferably the insulating material is of the fineness of at least 120 mesh.

A satisfactory low current electrode was secured by combining titanium oxide and the insulating material in a ratio of the order of 24 parts of titanium oxide to 100 parts of the insulating material by weight. In order to mold the material into the desired shape, a water paste is made having a consistency of the nature of modelling clay or other easily worked mud.

In the preferred embodiment of my invention, the tip 15 is formed in a substantially conical shape and worked into intimate contact with a graphite head 16 which is preferably provided with a suitable aperture 17 for connection to a conductor 18 from the impulsing system 13.

In order to reduce the energy required to operate the make-alive electrode, I prefer to provide the graphite head 16 with a projection 19 or extension which extends downwardly into the active tip 15 to provide a conducting core for distributing the current evenly to various parts of the active material.

The assembled electrode 12 is heat treated in a non-oxidizing or reducing atmosphere such as carbon vapor or hydrogen at a temperature of the order of 1000 to 1500° C. for a time of the order of thirty minutes to two hours to reduce the tip to a homogeneous high resistance material. While the tip 15 may be molded in any suitable manner, I prefer to mold the tip in a relatively thin metallic mold which is removed by melting off during the heat treating process. Care must be taken, however, to control the temperature as the resistance material tends to fuse at a temperature but little above the melting point of common ferrous alloys.

Instead of molding the acting material into conical shape, as shown in the preferred embodiment, according to Fig. 2, the mud mixture may be rolled into a relatively thin sheet and cut into preferably tapering segments 20 as shown in Figs. 3 and 4, and a connection made by inserting a suitable metal conductor 21 into the segment. It is desirable to utilize a metal such as molyb-

denum which has a low thermal coefficient of expansion. The cutout segments **20** with their attached connecting wires **21** are heat treated in the same manner as the conical tips **15** to produce the high resistance homogeneous characteristic of the bonded electrode.

While for purposes of description I have shown and described preferred embodiments of my invention, it will be apparent to those skilled in the art that changes and modifications can be made therein without departing from the true spirit of my invention or the scope of the appended claims.

I claim as my invention:

1. A high resistant stable electrode for a make-alive type device comprising a tapering tip of a high resistant mixture of titanium oxide and a stable insulating material, a head of graphite bonded to the base of said tip, a projection on said head extending into said tip and providing a conducting core therein.

2. A make-alive electrode for an arc discharge device comprising a substantially conical electrode tip of high resistant material composed essentially of titanium oxide and aluminum oxide in the proportions of the order of twenty-four parts of titanium oxide to one hundred parts of aluminum oxide by weight.

3. A make-alive electrode for an arc discharge device comprising a substantially conical electrode tip of high resistant material composed essentially of titanium oxide and aluminum oxide in the proportions of the order of twenty-four parts of titanium oxide to one hundred parts of aluminum oxide by weight and a conducting connector having a portion extending into said tip.

4. In a make-alive type valve, a make-alive electrode comprising a graphite head, a composite tip secured to said head, said tip composed substantially of titanium oxide and aluminum oxide in the proportion of twenty-four parts of titanium oxide to one hundred parts of aluminum oxide by weight.

5. A make-alive electrode for an arc discharge device comprising a molded body composed of a mixture of titanium oxide and aluminum oxide which has been heat treated in a reducing atmosphere at a temperature of the order of 1000° C. and a conductor connected to said body.

6. A high resistant stable electrode comprising a body composed of particles of a stable insulating material and titanium oxide powder bonded at a temperature of the order of 1000° C. in the presence of a reducing atmosphere.

7. A high resistant stable electrode comprising a body composed of particles of a stable insulating material and titanium oxide powder bonded at a temperature of the order of 1000° C. in the presence of a reducing atmosphere and a conducting connector bonded to said body.

8. The method of constructing a high resistant stable electrode which comprises forming a water paste of titanium oxide and a stable insulating material, shaping said parts into an electrode body, pressing a graphite head into firm contact with said electrode body and heat treating said body in a hydrogen atmosphere.

9. The method of constructing a make-alive electrode which comprises constructing a graphite head, securing to the head a tip composed of a mixture of aluminum oxide and titanium oxide and heat treating in a reducing atmosphere.

10. The method of constructing a make-alive electrode which comprises making a wet mixture compound of approximately twenty-four parts of TiO_2 and one hundred parts of Al_2O_3 by weight, molding the mixture on a conducting body and firing the structure in a reducing atmosphere at a temperature of the order of 1000 to 1500° C.

ADOLPH H. TOEPFER.