Jan. 9, 1940. E. G. BANGRATZ 2,186,189

VAPOR ELECTRIC DEVICE

Filed Jan. 31, 1935

Fig. 1.



Fig. 2.

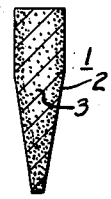


Fig. 3.

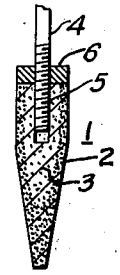
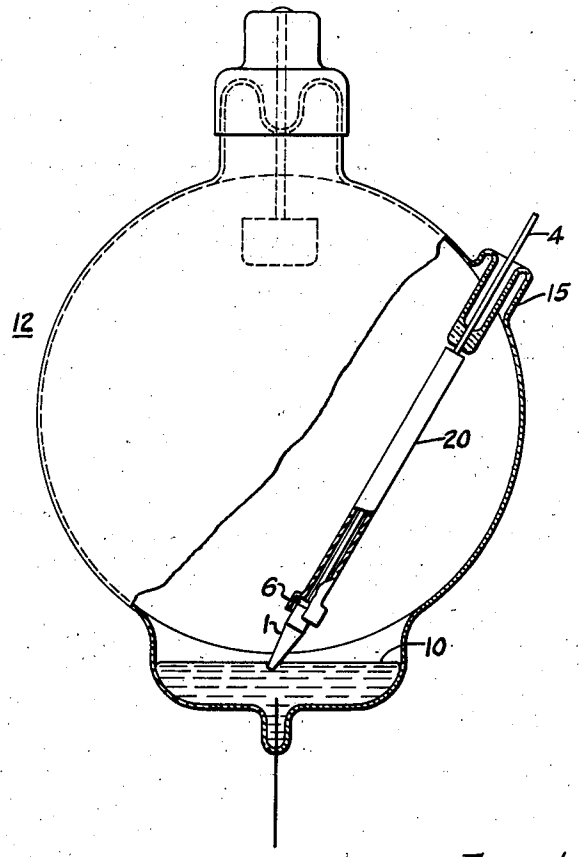


Fig. 4.



WITNESSES:

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VAPOR ELECTRIC DEVICE

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18 Claims. (Cl. 250—27.5)

My invention relates to a vapor electric converter and particularly to a make-alive electrode and method of mounting the same. The discovery of the make-alive system of control for vapor electric converters has greatly facilitated the use and application of such converters, but considerable difficulty still remains in providing suitable connections to the make-alive electrodes. The materials which have heretofore been found most suitable for make-alive electrodes, namely, carborundum and a composition of boron and carbon (probably boron carbide) are extremely hard, easily broken, non-machinable substances. As a result of the hard non-machinable nature of these materials great difficulty has been experienced in providing suitable mechanical support and electrical connection to such materials.

It is an object of my invention to provide a make-alive electrode having a make-alive surface of a boron carbon composition associated with a core of relatively soft machinable material such as molded graphite.

It is a further object of my invention to provide an improved mounting for such a make-alive electrode. The make-alive electrode according to my invention is preferably constructed by providing a molded graphite piece of a general shape of the finished electrode and then converting at least a portion of the exterior surface of the graphite piece by heating in the presence of an atmosphere of boron the conversion being stopped as soon as a suitable shell of make-alive material has been formed on the surface of the electrode, thus leaving a graphite core which may be suitably machined to provide a connection to a metallic electrode stem, which in turn is sealed into the wall of the vapor electric device in any suitable manner.

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 sectional elevation of a preformed graphite piece to be converted into an electrode,

Fig. 2 is a similar view of the electrode after conversion,

Fig. 3 is a sectional elevation of a finished electrode, and

Fig. 4 is a sectional elevation of a vapor electric converter showing the method of mounting my improved electrode.

In the construction of make-alive electrodes according to my invention, a piece of molded graphite is shaped roughly to the shape of the finished electrode, preferably substantially conical in shape. The graphite electrode form is then placed in a suitable crucible preferably a graphite crucible and heated to a high temperature in the presence of a boron atmosphere. This heating in the boron atmosphere converts a portion 2 of the electrode piece to a composition of boron and carbon. Preferably the converted boron carbon composition forms a shell which is integrally united with a relatively soft core of the electrode bed. The thickness of this shell 2 of make-alive material may be regulated by varying the interval during which the conversion takes place. The converted shell 2 has many of the characteristics of boron carbide, being very hard, fragile and non-machinable. However, the non-converted core portion 3 is still relatively soft and easily machinable. In order to connect the electrode stem 4 to the electrode head 1, the exposed non-converted portion of the core may be drilled and tapped or, if desired, a suitable opening 5 may be drilled therein and a threaded rod 4 screwed into the opening in such a manner that it will cut its own threads in the graphite material. In order to prevent loosening of the make-alive head 1 on the stem 4, a suitable metallic collar 6 is placed on the stem and screwed tightly against the head in the manner customary with lock nuts.

In mounting my make-alive electrode, the electrode head 1 is placed in contact with the cathode 10 of a suitable vapor-electric device 12 and the stem 4 sealed to the wall 15 of the container in such a manner that the make-alive electrode 1 will be maintained in constant contact with the cathode 10 of the device. Preferably the stem 4 of the make-alive electrode is provided with a suitable insulating cover such as a glass tube 20 to prevent any possibility of the attachment of the working arc of the device 12 to the electrode stem 4.

While, for purposes of illustration, I have shown and described a specific embodiment of my invention, it will be apparent to those skilled in the art that many changes and modifications can be made therein without departing from the true spirit of my invention by the scope of the appended claims.

I claim as my invention:

1. A make-alive electrode for a converter having a pool-type cathode comprising a body of graphite, said body having a very hard semi-conducting surface secured by treating the graphite with boron at high temperature, said semi-conducting surface being in contact with said pool-type cathode during normal operation of the converter, a stem secured to said graphite body, a collar on said stem adjacent the graphite body and an insulating covering on said stem.

2. A make-alive electrode assembly for a vapor electric converter having a vaporizable cathode comprising an electrode head, a core portion of said head comprising substantially pure graphite capable of being machined and having a high electrical conductivity, a coating of semi-

conducting material covering the major portion of said core, said coating being integrally united with said core, said coating being in contact with the cathode during normal operation of the device and a metallic conductor in threaded connection with said core.

3. In a vapor electric converter having a vaporizable cathode, a make-alive electrode comprising an outer shell of semi-conducting material, a core of conducting material integrally united to said shell, said shell being in permanent contact with the cathode, said core being exposed at a point remote from said cathode and a suitable stem in threaded connection with said core.

4. In a vapor electric converter having a vaporizable cathode, a make-alive electrode comprising an outer shell of semi-conducting material, a core of conducting material integrally united to said shell, said shell being in permanent contact with the cathode, said core being exposed at a point remote from said cathode and a suitable stem in threaded connection with said core, a metallic collar in threaded engagement with said stem and abutting the electrode head and an insulating member surrounding said stem.

5. An improved make-alive mounting for a vapor-electric converter comprising a make-alive head having a core of machinable conducting material and a surface of hard semi-conducting material, a stem secured to said conducting body and sealed into the converter container in such manner that the make-alive head is positioned with the semi-conducting surface in permanent contact with the cathode of said converter.

6. In an arc discharge device having a pair of main electrodes in a container, a make-alive electrode comprising an electrode head having a hard semi-conducting outer shell portion and a core of machinable conducting material, a stem of conducting material threadedly connected to said core, said electrode being so positioned that the semi-conducting shell is in permanent contact with one of said main electrodes and said stem extending through said container.

7. An improved make-alive electrode for a vapor-electric converter comprising an electrode head the outer surface of which is a boron-carbon compound in the nature of boron-carbide, said outer surface merging into a core of substantially pure carbon and a stem of conducting material connected to said core.

8. An improved make-alive electrode for an arc discharge device comprising an electrode head of unitary structure, the core of said head being substantially pure carbon, the major portion of the outer surface of said head being substantially boron-carbide said core and said surface merging into each other and a conducting stem mechanically and electrically connected to said core.

9. A make-alive electrode for a converter having an anode and a pool-type cathode comprising a body of graphite, a surface coating of hard semi-conducting material on at least a portion of said body, said semi-conducting material being in contact with the pool-type cathode during normal operation of the converter and a conductor connected to said graphite body.

10. An electrode assembly for a pool-type discharge device comprising a semi-conducting make-alive member which dips into the pool during normal operation of the device, a graphite coupling member, said coupling member projecting into said make-alive member, and a metallic conductor connected to said coupling member.

11. An electrode assembly for a pool-type discharge device comprising a semi-conducting, make-alive member which dips into the pool during normal operation of the device, a graphite coupling member, said coupling member projecting into said make-alive member and being integrally connected therewith and a metallic conductor connected to said coupling member.

12. A make-alive electrode assembly for a pool-type discharge device comprising a substantially conical make-alive electrode of semi-conducting material, a graphite coupling member connected to said electrode and a metallic conductor connected to said coupling member.

13. A make-alive electrode, for a vapor-electric device having a pool-type cathode, comprising a substantially conical electrode dipping into the pool-type cathode during normal operation of the device, a metal stem for supporting the electrode and a carbon coupling member interposed between the stem and the electrode.

14. An electron discharge device comprising an envelope containing a body of vaporizable liquid material, electrodes in said envelope including a molded semi-conducting member in contact with said liquid during starting and subsequent operation, said member having a configuration which approaches a point over that portion thereof which is in contact with the liquid material.

15. An electron discharge device comprising an envelope containing a body of vaporizable liquid material, electrodes in said envelope including a molded semi-conducting member immersed in said liquid during starting and subsequent operation, the cross-sectional area of said member being progressively smaller as the immersed end of the member is approached.

16. An electron discharge device comprising an envelope containing a pool of vaporizable liquid material, a plurality of electrodes in said envelope including a semi-conducting member of circular cross-section immersed in said pool, during starting and subsequent operation, said member having a circular configuration in which the diameter becomes progressively less as the immersed end of the member is approached.

17. An electron discharge device comprising an envelope containing a body of vaporizable liquid material, a plurality of electrodes in said envelope including a molded semi-conducting member in contact with said liquid during starting and subsequent operation, said member having a conically shaped configuration over that portion thereof which is in contact with the liquid material.

18. An electron discharge device comprising an envelope containing a pool of vaporizable material, electrodes in said envelope including a molded semi-conducting member having a straight portion and a convergent tip, said tip projecting partly above and partly below the level of the pool during normal operation of the device, said straight portion having a cross-sectional area which is sufficiently oversize to reduce the power loss in said portion to a minimum, said tip tapering down to a cross-sectional area at the point of contact with said pool which is sufficiently small to reduce the starting voltage applied to said tip to a minimum.

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