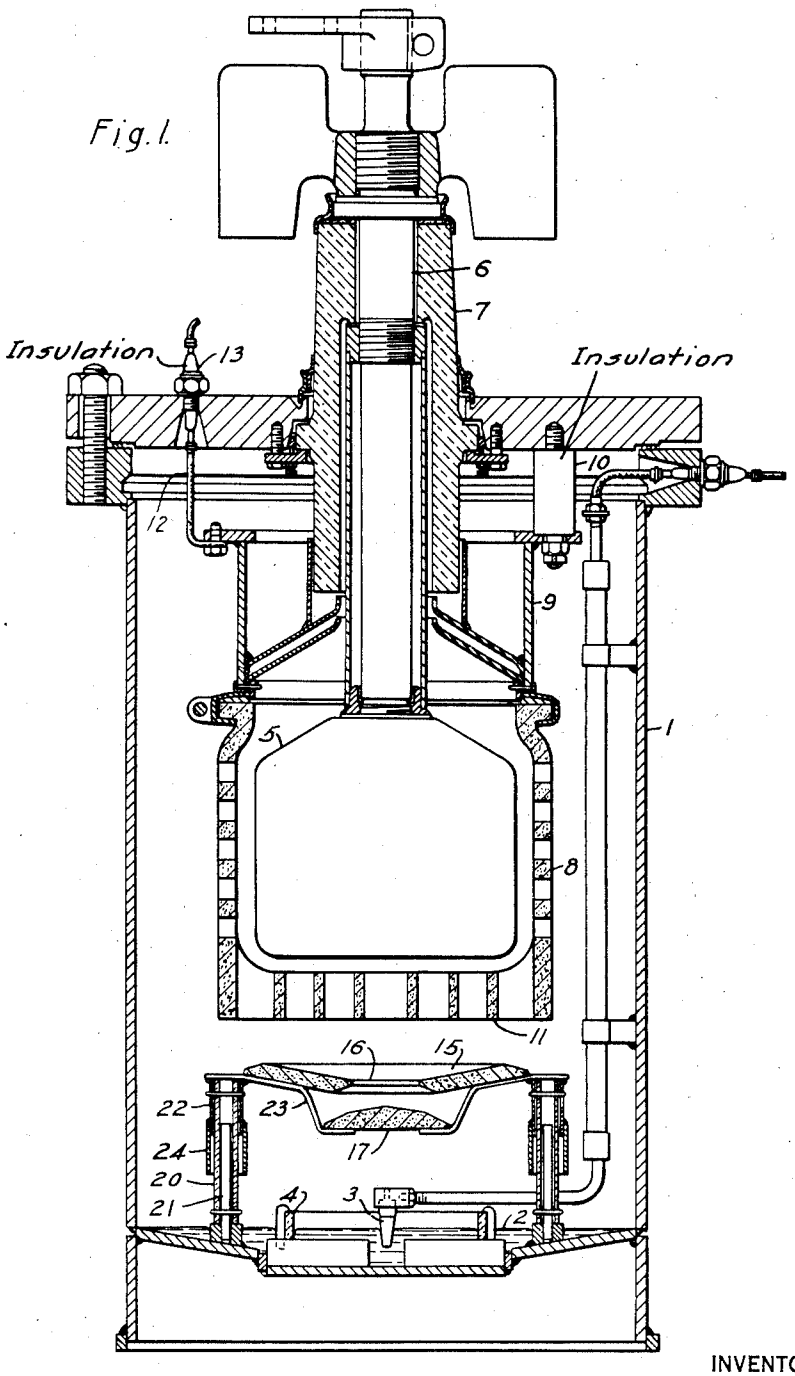
Aug. 4, 1942. J. H. COX 2,292,057

VAPOR-ELECTRIC DEVICE

Filed Sept. 4, 1941 3 Sheets-Sheet 1

Fig. 1.



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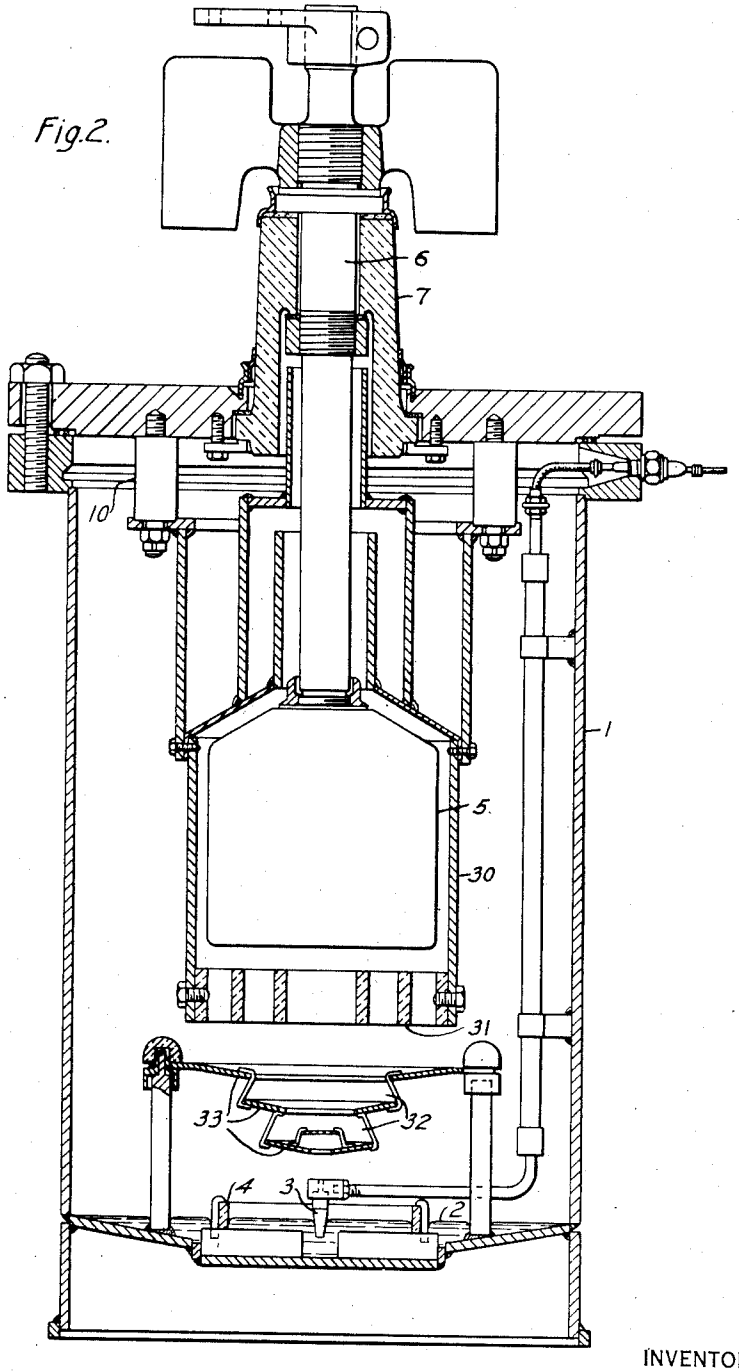
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VAPOR-ELECTRIC DEVICE

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Fig.2.



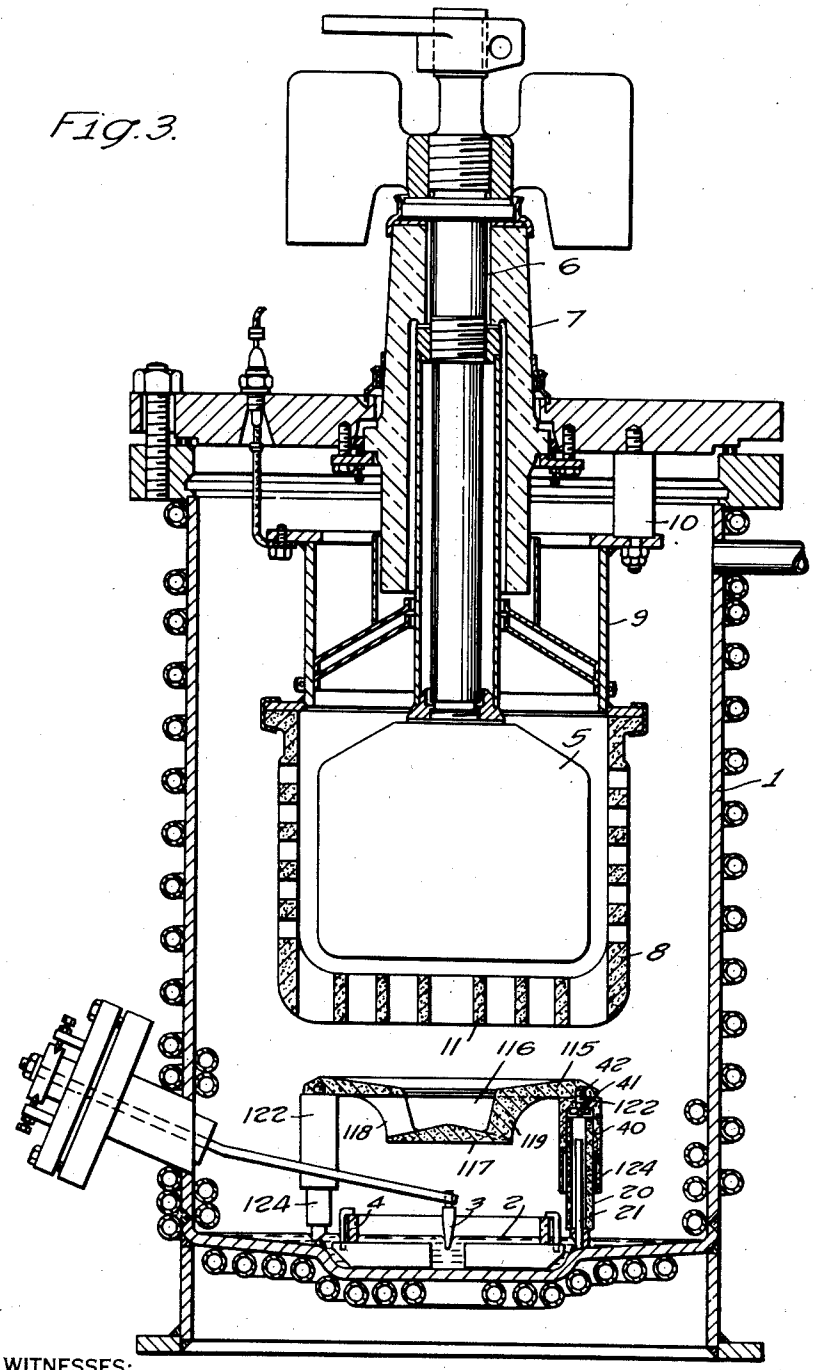
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Fig. 3.



WITNESSES:

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Patented Aug. 4, 1942

2,292,057

UNITED STATES PATENT OFFICE

2,292,057

VAPOR-ELECTRIC DEVICE

Joseph H. Cox, Forest Hills, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application September 4, 1941, Serial No. 409,503

3 Claims. (Cl. 250—27.5)

My invention relates to a vapor-electric device and particularly to a shielding and baffling system for increasing the current carrying characteristic and decreasing the arc back rate in a vapor electric device.

This application is a continuation-in-part of my application Serial No. 345,082, filed July 12, 1940.

In the operation of vapor-electric devices such as ignitron valves, it is found desirable to enclose the anode in a shield which is spaced a relatively short distance from the sides of the anode and which encloses the back portion of the anode from the general arc space. In order to prevent arc back or other faulty operation, it has been found desirable to provide a deionizing shield close to the active anode face. In order to prevent the dense jets of high speed, highly ionized mercury vapor evolved from the cathode from entering into the anode space, I have found it desirable to provide a suitable baffle between the active cathode surface and the grid to optically obscure the anode from the cathode.

In order to prevent attachment of the current carrying arc to the baffle member, I have found it desirable to insulate the baffle from the cathode.

It is, therefore, an object of my invention to provide a vapor-electric valve having suitable deionizing shield and baffling members to control the entry of mercury vapor into the anode space.

It is a further object of my invention to provide a cathode baffle which is substantially unaffected by long exposure to the operating conditions in a vapor-electric device.

It is a further object of my invention to provide a shield and baffle structure having no metal parts exposed to the major arc stream.

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

Figure 1 is a sectional elevation of a vapor-electric device according to my invention,

Fig. 2 is a similar view of a modification according to my invention, and

Fig. 3 is a similar view of a preferred modification according to my invention.

In the exemplary embodiment according to Fig. 1, a vapor-electric valve of the ignitron type comprises a metallic container 1 in the bottom of which is a suitable pool 2 of a vaporizable reconstructing cathode material such as mercury. In contact with the mercury pool 2 is a suitable make-alive electrode 3 for initiating the cathode spot on the mercury pool 2. In order to restrict the cathode spot to a predetermined area of the cathode surface, a suitable barrier, such as the quartz ring 4, is anchored in position, preferably concentric with the make-alive electrode 3.

Cooperating with and spaced from the cathode 2 is a suitable anode 5 suspended on a suitable anode stem 6 which passes through the wall of the container 1 by means of a suitable insulating bushing 7.

The anode 5 is contained in a suitable shield member herein illustrated as a perforated graphite cylinder 8 which is suspended from suitable metallic supports 9 which close in the back part of the anode 5, the whole shield structure being supported from a suitable portion of the metallic container 1 by means of suitable insulating bushings 10 so that the interior of the shield is sufficiently open to be readily evacuated.

In order to improve the arc back characteristic of the device, the anode shield 8 is closed by a suitable deionizing shield herein illustrated as a perforated graphite disc 11 integral with the graphite cylinder forming the side shield 8 for the anode 5.

Because of the deionizing shield, it is sometimes necessary or desirable to excite the shield 8 in order to assist in the pick-up of the current carrying arc to the anode 5. For this purpose, I have shown a connection 12 from the shield carried in insulated relation through a suitable bushing 13 and which may be connected to any desired exciting source.

In order to prevent the entrance of undesirable quantities of highly ionized high velocity mercury vapor into the anode shield 8, I have provided a multi-part baffle between the deionizing grid 11 and the active cathode surface. The baffle may be constructed of a plurality of parts at least one of which is an annular member 15 constructed of graphite or other suitable material and of such a diameter that no portion of the shield 11 is exposed to any portion of the active cathode area. The central opening 16 in the annular member 15 is likewise protected by a suitable baffle 17 so that no portion of the grid 11 is exposed to the active cathode area through the central opening 16 of the annular baffle 15.

In order to support the baffle in insulated relation to the cathode surface, I have provided an improved insulating member which consists of an insulating tubular element 20, preferably of quartz or porcelain, one end of the tubular member 20 being slipped over an upright pin 21 secured in fixed relation to a portion of the container 1. The pin 21 extends sufficiently far into

the tubular member to rigidly support the same and terminate in spaced relation to the opposite end of the insulating tube 20. A suitable bracket preferably in the form of a short tubular member 22 is then extended over the opposite end of the insulating tubular member 20 and welded or otherwise securely attached to a suitable framework 23 for supporting the baffle elements 15 and 17.

To prevent bridging of the insulating surface by metal or other particles which will be sputtered thereon during the operation of the vapor-electric device, I have provided a suitable shading tube or shadowing element 24 in the form of a short tubular element which may be integral with or welded to the bracket support 22 and extending in spaced relation to the tubular insulator 20.

Since the cathode baffle parts 15 and 16 are in contact with the current carrying arc, they operate at a high temperature, of the order of 1000° C., and as ordinary steel or iron has the property of dissolving in carbon at a temperature of the order of 1000° C., it is necessary to use a metal other than steel to form the framework 23 in contact with the graphite baffles 15 and 17. While the refractory metals such as platinum or tungsten are suited for constructing the farmework 23, I have found that nickel may also be used with satisfactory results in some instances, particularly in installations having intermittent load characteristics.

In the operation of the vapor-electric device, the make-alive electrode 3 initiates the cathode spot at any desired time and suitable potential is applied to the shield 8 in order to facilitate pick-up of the main arc from the anode 5 to the cathode 2. The baffling member then diverts a substantial portion of the highly ionized cathode vapor away from the shield 8 into proximity with the side wall 1 of the device which may be cooled in any suitable manner to provide a condensing surface. However, it is desirable that a portion of the vapor should pass into the anode area and the offset baffle opening 16 provides sufficient space for this desirable vapor flow.

In the modification of my invention according to Fig. 2, I have provided a suitable metallic shield 30 which is provided with a deionizing grid 31 of suitable material such as quartz or graphite. In order to increase the vapor flow into the anode area to facilitate pickup, I have provided a baffling member with a plurality of annular openings 32 so that a substantially greater vapor flow occurs between the cathode surface and the active anode face. These annular spaces 32 are preferably provided by supplying a plurality of annular baffling plates 33 each of which shields the opening in the next succeeding plate.

The plates 33 may be made of any suitable material which will maintain its shape when subjected to the operating temperature and which is substantially unaffected by mercury.

In some instances, particularly in converters operating at high load factors for long periods of time such as encountered in the supply of power to electrochemical plants, it is undersirable to have metal parts, particularly nickel in the high temperature regions of the converter, that is, between the anode and cathode, as the arc tends to sputter off particles of the metal which eventually interfere with the proper operation of the device.

In the modification according to Fig. 3, I have shown a baffle and support so arranged that no metal is exposed to the arc stream.

The baffle interposed between the anode shield 8 and the cathode 2 is constructed of a graphite block machined or otherwise shaped to provide an upper baffle part 115 and an auxiliary part 117. A central recess 116 is bored or machined to provide a vapor space and lateral openings 118 made between the baffle surfaces 115 and 117 leaving webs 119 to support the part 117 in spaced relation to part 115 so that a regulated quantity of vapor can pass through the offset passage made by openings 118 and recess 116 into the vicinity of the anode shield 8.

It is frequently desired to apply various potentials to the shield 8. Therefore, I prefer to support the baffle in insulated relation to the shield 8. Also to prevent attachment of the arc to the baffle, it is desirable to insulate the baffle from the cathode 2.

I prefer to mount the baffle on the bottom of the container 1 so that the baffle may be mounted and adjusted prior to the insertion of the anode 5 and the closing of the container 1, also bottom mounting reduces the suspended shield load, thus reducing the hazard of injury during shipping or other movement.

The insulating support comprise metal pins 21 secured to the bottom of container 1, and suitable insulating cylinders 20 preferably of quartz. The cylinders 20 are longer than the pins 21 so that the end of the pins 21 is spaced from the end of the cylinder 20. A bracket consisting of a graphite cylinder or block 122 having a bore or recess 40 to receive the top of the insulating cylinder 20. The block 122 is counterbored adjacent the exposed end to provide a shading sleeve 124 to preserve the insulation against bridging by the deposit of conducting material on the insulating surface. While the blocks 122 may be integral with the baffle structure, I prefer for convenience to construct the blocks 122 as separate pieces and secure them to the baffle structure. I secure the blocks 122 to the baffle structure by hidden metal screws 41 inserted into the bore 40 and screwing into a recess 42 the baffle, care being taken that the recess 42 does not extend through the baffle structure. The screws 41 can be made of any suitable metal, such as nickel or copper, which does not dissolve in carbon at a high operating temperature.

While, for purposes of illustration, I have shown and described specific embodiments of my invention, it is apparent that modifications and changes 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 vapor-electric device comprising a metallic container, a mercury pool in the bottom of said container, an insulating barrier for defining an active cathode area on said pool, means for initiating a cathode spot on said active cathode area, an anode spaced from the cathode, a conducting shield substantially enclosing the back and sides of the anode, a grid spaced from the front of the anode and substantially closing said shield, insulating means for supporting the shield in spaced insulated relation to the anode and the container, an annular baffle between the grid and the cathode, a supplementary baffle between said annular baffle and the cathode and insulating means for supporting said annular baffle in insulated relation to the shield and the cathode, said insulating means including a tubular insulator, a pin secured to the container and extended into one end of said tubular insulator,

a tubular cap around a portion of the tubular insulator, a baffle support secured to said cap and a shading tube in spaced relation to a portion of said tubular insulator adjacent said cap.

2. A vapor-electric device comprising a container, a mercury pool in the bottom of said container, an insulating barrier for defining an active cathode spot on said active cathode area, an anode spaced from the cathode, a conducting shield substantially enclosing the back and side of said anode, that portion of the shield adjacent the sides of the anode being of graphite, a graphite grid spaced from the front of the anode and substantially closing said shield, insulating means for supporting the shield in spaced insulated relation to the anode and the container, a substantially annular graphite baffle between said grid and said cathode, offset vapor passages through said baffle, insulating means for supporting said baffle in insulated relation to the shield and the cathode, said insulating means including a substantially tubular insulator, a pin secured to the container and extended into one end of said insulator, a graphite block secured to the baffle and having a recess engaging a portion of said tubular insulator and a skirt on said block providing a shading tube in spaced relation to said insulator adjacent the recess engaging said insulator.

3. A vapor-electric device comprising a container a vaporizable-reconstructing cathode in said container, an anode cooperating with said cathode, a shield substantially enclosing said anode, a baffle interposed between the cathode and the shield, said baffle having offset vapor passages therethrough, a plurality of insulating supports for supporting said baffle in insulated relation to said anode and cathode, each of said insulating supports including a substantially tubular insulating member, a pin secured to the container, said pin extending into one end of the insulating member and terminating in spaced relation to the other end thereof, a graphite block having a bore engaging the end of the insulating member and a shading tube in spaced relation to the insulating member at its point of junction with the graphite block.

JOSEPH H. COX.