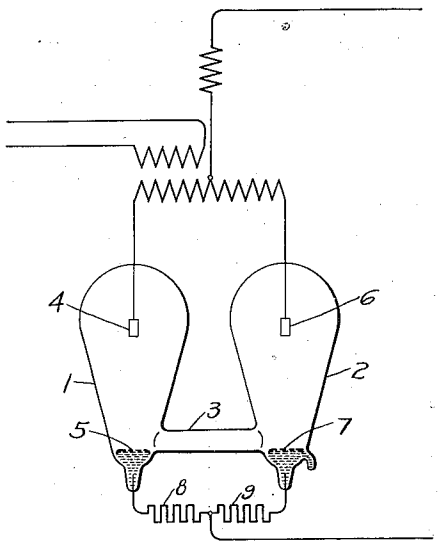
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MERCURY ARC RECTIFIER

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MERCURY ARC RECTIFIER

Application filed December 31, 1924. Serial No. 759,214.

This invention relates to vapor electric devices, and more particularly to such devices as are employed in the rectification of alternating current.

The object of the present invention is to provide means whereby the efficiency of operation of a high voltage rectifier of the type mentioned may be materially improved.

The novel features characteristic of my invention are pointed out with particularity in the appended claims. The invention itself, however, may be better understood by reference to the following specification taken in connection with the accompanying drawing in which the figure represents diagrammatically an arrangement whereby the invention may be carried into effect.

In order that a vapor rectifier may operate at high efficiency it is necessary to have the anodes close to the cathodes. Such an arrangement will not ordinarily operate at high voltage, since arcing will occur between the anodes. If the anodes are placed at the ends of long tubes, the rectifier will operate at high voltage, but will also have high drop and therefore high losses.

According to my invention I have devised a rectifier which comprises two evacuated vessels or branches 1, 2. Each vessel has an anode 4 or 6 and a mercury cathode pool 5 or 7. A tube 3 of relatively small diameter connects the two vessels at a point adjacent their lower ends and at about the level of the cathode pools.

When an alternating electromotive force is impressed upon the tube, the cathode spot will alternately pass from one cathode to the other. If the cathode spot is at 5, positive potential on anode 6 will cause the arc stream to pass through the small connecting tube 3, and if the cathode 7 is negative the arc stream will render the cathode 7 active and a new spot will be formed at that point.

The operation of the device will be more clearly understood from a consideration of the fact that in an inductive circuit such as that to which the anodes 4 and 6 are connected the current will persist for a definite time after the voltage attains a zero value. Thus assuming current to be flowing through the anode 4 and cathode 5, this current must necessarily continue for an appreciable time after the potential of the anode 4 becomes negative and that of the anode 6 becomes positive. When the anode 6 becomes positive, however, current starts between the cathode 5 and the anode 6 and for a definite interval of time current is transmitted from both anodes to the cathode 5. This interval of time is of course very short but I have found that it is sufficiently long to permit the transfer, by the action of the arc stream passing between cathode 5 and anode 6 through tube 3, of the hot-cathode spot from the cathode 5 to the cathode 7. As soon as the cathode spot is transferred to cathode 7 current flows only through the anode 6 and cathode 7. This current continues to flow during the remainder of the half cycle of positive polarity of anode 6.

At the end of the half-cycle of positive polarity of anode 6 the flow of current is transferred back to cathode 5 in the same manner as above described for the transfer of current flow from anode 4 to anode 6 and for the transfer of the cathode spot from cathode 5 to cathode 7. These cycles of current flow through anodes 4 and 6 and their corresponding cathodes 5 and 7 and the accompanying transfer of the cathode spot from one to another of the cathodes continue as long as the alternating electromotive force is impressed on the anodes.

In order to effect transfer of the cathode spot consideration must be given to the size and location of the connecting tube 3. I have found that with a tube of fifteen amperes capacity, a connecting tube one inch in diameter and four inches long will give satisfactory results. If tube 3 is so proportioned that the arc stream will be fairly dense in passing through it, and is located so that the arc stream will pass close to the cathode pool, the transfer of the cathode spot may be made without difficulty.

With my arrangement the cathode spot is transferred from one pool to another, so as always to be in a pool adjacent an active anode. The cathode pools are so arranged that each one is close to its associated anode

so that a minimum loss will occur. At the same time the passage between cathode pools is sufficiently circuitous so that an arc back between anodes is prevented.

Resistance elements 8 and 9 may be inserted in the connection between the cathodes to provide a difference in potential between them and therefore facilitate the transfer of the cathode spot. The resistance elements, however, might be omitted if desired. The wiring diagram shown is the usual standard diagram used in connection with mercury vapor rectifiers and a description thereof is not believed to be necessary.

While I have shown only one form of my invention, it will be obvious to those skilled in the art that it is susceptible of various changes and modifications without departing from the scope of the invention as set forth in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. The combination of a vapor electric device comprising an envelope having a plurality of main branches, a source of alternating current, a connecting tube communicating with the branches, vaporizable cathodes located at one end of said branches adjacent the connecting tube, anodes located in said branches remote from said cathodes, and means including said tube and said source for transferring the cathode spot from one to another of said cathodes.

2. The combination of a vapor electric device comprising an envelope having a plurality of main branches, a source of alternating current, a connecting tube of relatively small diameter communicating with the branches, vaporizable cathodes located at the end of said branches adjacent the connecting tube anodes located in said branches remote from said cathodes, and means including said tube and said source for transferring the cathode spot from one to another of said cathodes.

3. The combination of a vapor electric rectifier comprising a plurality of evacuated vessels, each vessel having an anode near one end and a cathode pool at the opposite end, a tube of relatively small diameter connecting said vessels near the level of the cathode pools, and means including said tube and a source of alternating current for transferring the cathode spot alternately from one pool to another of said pools.

4. The combination of vapor electric device comprising an envelope having a plurality of main branches, a source of alternating current, a connecting tube communicating with the branches, vaporizable cathodes located at one end of said branches and adjacent the connecting tube, anodes located in said branches remote from said cathodes a resistance element connecting said cathodes, and means including said tube said source and said resistance element for transferring the cathode spot from one to another of said cathodes.

5. The combination of a vapor electric device comprising an envelope having a plurality of main branches, means providing a path for the arc in said device between said branches, a plurality of anodes near one end of said envelope, each of said anodes being mounted in a different one of said branches, a plurality of cathode pools at the opposite end of said envelope, each of said cathode pools being arranged in a different one of said branches, a source of alternating current, and means including said first-named means and said source for transferring the cathode spot from one to another of said pools at regular intervals.

6. The combination of a vapor electric device comprising a plurality of main branches, means providing a path for the arc in said device between said branches, a plurality of anodes near one end of said envelope, each of said anodes being mounted in a different one of said branches, a plurality of cathode pools at the opposite end of said envelope, each of said cathode pools being arranged in a different one of said branches, a source of alternating current, and means including said first-named means and said source for transferring the cathode spot alternately from one to another of said pools at a frequency determined by said source of current.

7. The combination of a vapor electric device comprising an envelope having a plurality of main branches, means providing a path for the arc in said device between said branches, a plurality of anodes near one end of said envelope, each of said anodes being mounted in a different one of said branches, a plurality of cathode pools at the opposite end of said envelope, each of said cathode pools being arranged in a different one of said branches, a resistance element associated with said pools, a source of alternating current, means including said first-named means and said source of transferring the cathode spot at regular intervals from one to another of said pools, and means including said resistance element for facilitating the transfer of the cathode spot.

8. The combination of a vapor electric device comprising an envelope having a plurality of main branches, means providing a path for the arc in said device between said branches, a plurality of anodes near one end of said envelope, each of said anodes being mounted in a different one of said branches, a plurality of cathode pools at the opposite end of said envelope, each of said cathode pools being arranged in a different one of said branches, a resistance element connected between said cathode pools, a source of alternating current, means including said first-named means and said source for transfer-

ring the cathode spot at regular intervals from one to another of said pools, and means including said resistance element to facilitate the transfer of the cathode spot.

9. The method of rectifying alternating current which comprises energizing one anode and its associated cathode to cause the flow of an arc stream therebetween, energizing a second anode to change thereby the direction of said arc stream to cause said arc stream to flow between said cathode and said second anode, passing the arc stream in close relation to a second cathode to cause thereby ionization of said second cathode, initiating the flow of an arc stream between said second cathode and said second anode, and extinguishing the flow of the arc stream from said first-named cathode.

10. The combination of a vapor electric apparatus comprising a plurality of main branches, a plurality of anodes, each of said anodes being mounted in a different one of said branches, a plurality of cathodes, each of said cathodes being arranged in a different one of said branches, each of said anodes being mounted in close arcing relation to a different one of said cathodes, means providing a path for the arc in said apparatus between said branches, a source of alternating current, and means including said first-named means and said source for causing the arc in said apparatus to be transferred from one to another of said cathodes at regular intervals.

In witness whereof, I have hereunto set my hand this 30th day of December, 1924.

DAVID C. PRINCE.