July 1, 1930. W. F. HENDRY 1,769,024

ELECTRICAL DISCHARGE DEVICE

Filed March 9, 1927

Fig. 1.

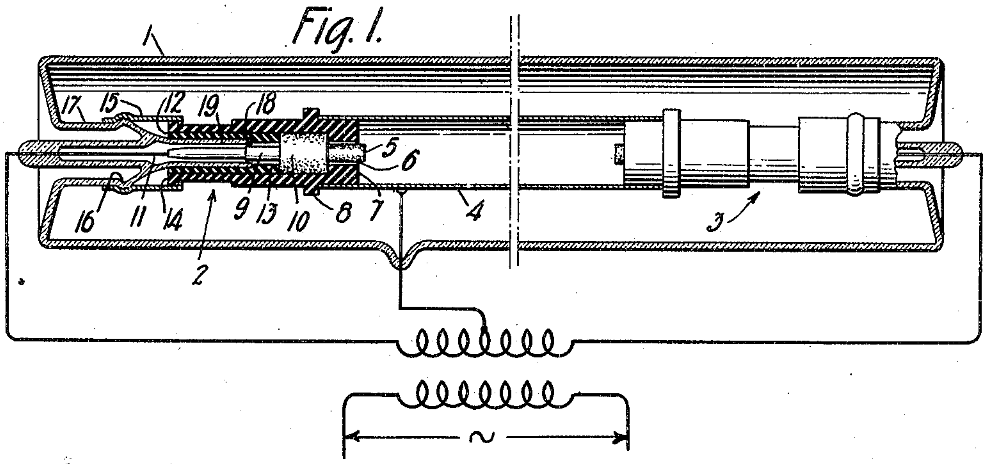
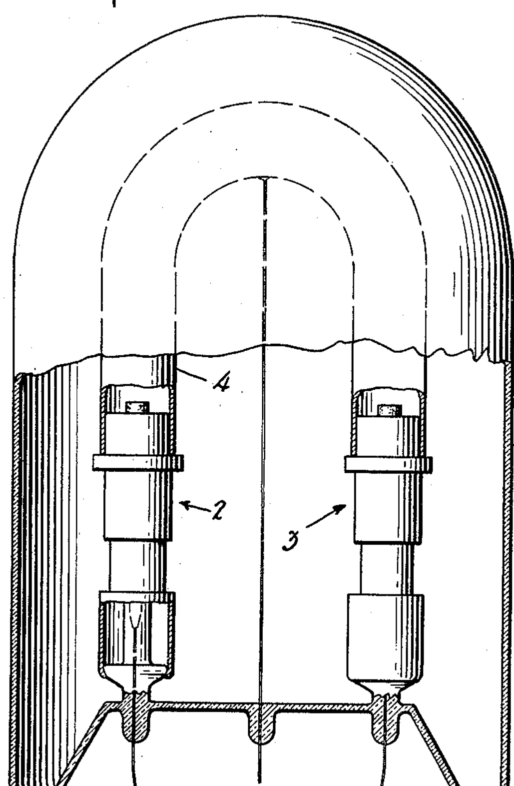


Fig. 2.



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Patented July 1, 1930 1,769,024

UNITED STATES PATENT OFFICE

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ELECTRICAL-DISCHARGE DEVICE

Application filed March 9, 1927. Serial No. 173,910.

This invention relates to electrical discharge devices and more especially to gaseous rectifiers.

Rectifiers are now known wherein rectification is obtained by utilization of two electrodes of different sizes placed in an atmosphere of rare gas under low pressure. Methods and means for insulating the electrodes used in such rectifiers, whereby moderately high voltages may be utilized without breakdown of the rectifier, are also known.

Full wave rectifiers, even when equipped with the best insulating means heretofore available, have not been able to function continuously under extremely high voltage without electrical breakdown and disintegration of the insulation of the electrodes.

The object of the present invention is to provide a full wave rectifier tube capable of operation at very high voltages.

This invention and the further objects, features and advantages thereof will be made clear in the following description and the appended claims forming a part hereof.

Referring to the drawings, Fig. 1 represents a full wave rectifier constructed in accordance with my invention and Fig. 2 represents a modification of the rectifier shown in Fig. 1.

In Fig. 1, reference numeral 1 indicates an envelope of glass or other material which encloses two electrodes of small surface area, 2, 3, of the type disclosed in my Patent #1,628,045, placed at opposite ends of the envelopes and a tubular electrode 4, of aluminum positioned between the two first mentioned electrodes.

Electrodes 2 and 3 each comprise a carbon body having an enlarged base portion 10 and a point 5.

The base portion 10 is fitted within the bore 12 of an insulating cylinder 7 and the point 5 is positioned within a perforation 6 which is an extension of bore 12. The point 5 fits closely in perforation 6 but does not touch the walls thereof. Attached to the base portion 10 is an aluminum rod 9 which serves to conduct electricity to the point. A leading-in wire 11 is attached to the end of the rod 9 and extends through the wall of the glass envelope 1. Cylinder 7 has two collars 8 and 14 upon it. Collar 8 serves to position the electrode 4 relative to electrodes 2 and 3. The collar 14 is engaged by a ferrule 15 which serves to interconnect cylinder 7 with enlargement 16 of the glass portion 17 of envelope 1. Fitted within the bore 12 of cylinder 7 is a sleeve 13 which holds the carbon button in position in the bore of the cylinder. This sleeve 13 is secured against longitudinal movement by a shoulder 18 which abuts upon an extension 19 of the glass portion 17.

The cylinder 7 and the sleeve 13 may be made of lava, porcelain or the like.

The rectifier shown in Fig. 2 is exactly similar to that shown in Fig. 1 except that the two electrodes 2, 3, are placed at the same end of the tube and the electrode 4 is bent back on itself in order to engage with the electrodes 2, 3 in the proper relation. With this particular modification of the rectifier no special base or holder for the tube is necessary as all of the terminals of the electrodes, can be brought out through the same end of the envelope into a standard base.

These rectifiers are of the full wave type and are to be connected in circuit in the manner shown in Figure 1 wherein the two anodes are connnected to the ends of the secondary winding of the power transformer while the cathode is connected to the midpoint of the said winding.

I have found that by constructing and positioning the three electrodes of the rectifier in the manner described that it is possible to operate the device at extremely high voltages for long periods of time without harmful disintegration of the elements of the device. It is possible, by varying the diameter and length of the tubular electrode to adapt the rectifier to different operating voltages and conditions. The higher the impressed voltage is, the longer the tubular electrode should be.

Referring to Fig. 1 of the drawing it will be noted that there is double the voltage across the two small electrodes that there is between one small electrode and the tubular electrode, but on the other hand there is a much greater distance between the two small electrodes than there is between one small electrode and the tubular electrode. Now, by referring to the theory advanced tentatively on pages 4, 5 and 6 of my said Patent No. 1,628,045, it will be noted that a screen or shroud of positive particles is postulated as blanketing the small electrode or point when it is negative thus preventing the migration of electrons from it to the other point which would at that instant be positive.

With a particular rectifier constructed in accordance with my above mentioned co-pending application actual tests show that the leakage of current (migration of electrons) in this direction under a potential of 800 volts direct current is about 1½ milliamperes, showing that a multitude of electrons succeed in finding passages through the screen of positive particles. As the voltage is increased to 1,000 volts this current increases to about 2 milliamperes and so on, therefore it is reasonable to suppose that at a sufficiently high voltage the screen is punctured in so many places that it is entirely disrupted and the alternating current flows directly from point to point in the form of an arc. If this be the correct theory, then it should be possible to offer an inducement to the electrons which break through the screen to go to the tubular electrode rather than the positive point. The rectifier of this application has been constructed in accordance with this idea.

Referring to Fig. 1 it is evident that the distance from point to point can be made as great as desired while the distance from either point to plate may be as small as desired. If the alternating line potential is 1,000 volts there will be 1,000 volts impressed between the two point electrodes and 500 volts between either point electrode and the plate. It is evident, therefore, that the electrons must travel a relatively long journey to reach the opposite point while they are continually being attracted by the wall of the tube electrode, or plate, which is at a potential of 500 volts positive and only a relatively short distance away. It is apparent for these reasons that a tube of such construction is capable of operation at extremely high potentials.

I have found that a tube 6½ inches long constructed in this manner will successfully rectify alternating currents at a potential of 2,200 volts, and deliver 900 volts direct current.

While I have shown and described for the purpose of illustration, a specific embodiment of my invention as applied to a rectifier I do not intend to be limited thereby as many variations in the mode of construction of the device and application of the principle involved will suggest themselves to one skilled in the art. For example, other materials such as nickel may be used for the point electrode while the tube electrode may be constructed of copper, iron or other material instead of aluminum.

I wish to be limited only by the scope of the appended claims.

What I claim is:

1. A full wave rectifier comprising a sealed glass envelope containing an elongated tubular cathode having an insulating plug in each end thereof, a separate anode supported by each of the said plugs, and means for supporting said plugs from said envelope.

2. A full wave electrical discharge device comprising a tubular cathode having a perforated insulating plug in each end thereof and a separate anode positioned within the perforation of each of the said plugs, a hermetically sealed envelope housing said electrodes, and means for attaching said insulating plugs to the inside of the envelope.

3. A high voltage rectifier comprising in combination two anodes, insulation surrounding the two anodes and a tubular cathode extending between the two anodes and surrounding a section of the insulation of each of the anodes.

4. A rectifier comprising an elongated envelope having a filling of rare gas, an insulating post at each end of the envelope, a small carbon electrode supported by each post and surrounded by an insulating sleeve, a tubular aluminum electrode extending between the first mentioned electrodes and surrounding the ends of the insulating sleeves.

5. A high voltage rectifier comprising a tubular cathode bent into semicircular form, a perforated insulating bushing in each end of the cathode and an anode positioned within the perforation of each of the said bushings.

6. A high voltage rectifier comprising an envelope, a tubular cathode bent into semicircular form, a perforated insulating bushing in each end of the cathode, a point electrode extending within the perforation of each bushing, a leading-in wire attached to each point electrode and surrounded by an insulating post supported by the envelope.

In testimony whereof, I have signed my name to this specification, this 2nd day of March, 1927.

WILLIAM F. HENDRY.