

G. S. MEIKLE.
 INCANDESCENT CATHODE DEVICE.
 APPLICATION FILED SEPT. 18, 1915.

1,230,004.

Patented June 12, 1917.

Fig. 1.

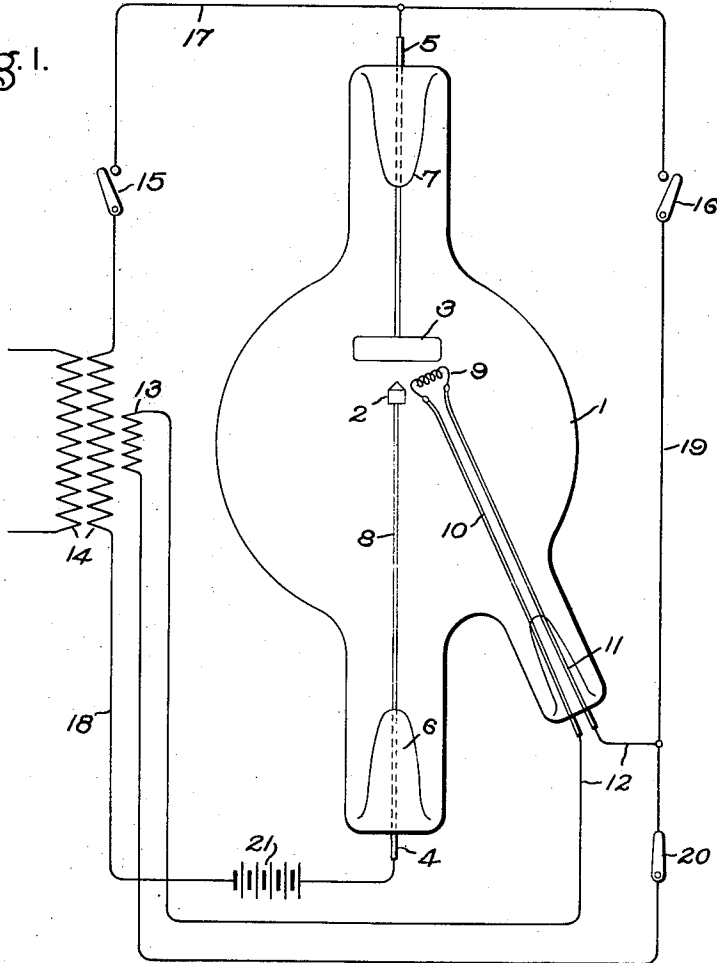


Fig. 2.

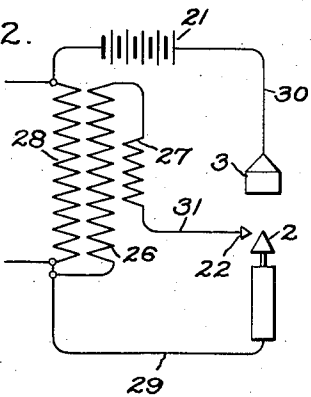
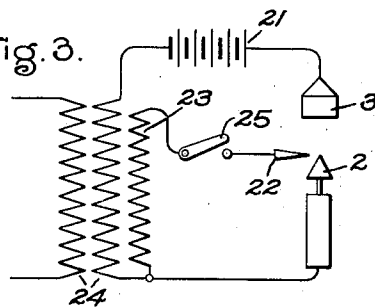


Fig. 3.



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UNITED STATES PATENT OFFICE.

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INCANDESCENT CATHODE DEVICE.

1,230,004.

Specification of Letters Patent. Patented June 12, 1917.

Application filed September 18, 1915. Serial No. 51,470.

To all whom it may concern:

Be it known that I, GEORGE S. MEIKLE, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Incandescent Cathode Devices, of which the following is a specification.

The present invention relates to electrical discharge devices of the gas-filled incandescent cathode type, and its object is to provide a rugged device having a commercially long life and which may be promptly and conveniently started.

In Patent 1,182,290 I have described and claimed a rectifier having a filamentary cathode which may be rendered incandescent by passage of current to start an arc. This construction while convenient and operative will sometimes result in a shortened life of the device by reason of the breaking of the conductor due to localized electrical erosion.

In accordance with my present invention I have provided a rugged main cathode and a separate or auxiliary electrode which operates in conjunction with said cathode to spring a starting arc which heats the cathode to incandescence preliminary to starting the main arc.

The accompanying drawings illustrate my invention, somewhat diagrammatically, applied to the rectification of alternating current, Figure 1 showing a device having an auxiliary electrode heated by passage of current and Figs. 2 and 3 arcing auxiliary electrodes.

Referring to Fig. 1, the device here shown comprises a sealed envelop 1 consisting of glass, quartz or the like, the cathode 2 which is adapted to operate at incandescence, and an anode 3 having a heat-dissipating capacity large enough to enable it to operate below about 700° C. The current supply conductors 4, 5 are sealed into glass stems 6, 7 in the usual manner. The cathode 2 is shown as being substantially rod-shaped terminated by an arcing tip of greater diameter than the supporting conductor 8.

The auxiliary cathode 9 as diagrammatically indicated may consist of a short coiled filament supported by stiff current supply conductors 10 sealed into the stem 11.

The main cathode 2 may be pointed in order to facilitate starting and to steady the

arc during operation. The cathode tip preferably consists of tungsten and should be so proportioned as to have a heat-dissipating capacity adjusted with respect to the energy normally carried by the device so that it will operate at bright incandescence. The anode 3 may also consist of tungsten but other conductive materials, such, for example, as carbon, iron, mercury and the like, may be used.

In the preparation of the device the space within the envelop should be carefully evacuated of all gases and vapors, particular care being taken to remove electro-negative gases, such as oxygen or chlorine or substances which at high temperature will yield electro-negative gases, for example, water vapor. The envelop is then filled with inert gas, for example, such as nitrogen, argon, crypton, neon or hydrogen this being carefully purified to exclude electro-negative gases. When a mercury anode is used, the gas filling may be omitted as the mercury will volatilize and supply the desired ionizable atmosphere. In some cases a small amount of gas, for example, a few millimeters of argon may be used in a tube having a mercury anode to facilitate the starting of the arc.

The pressure of the gaseous atmosphere will vary widely in accordance with the voltage and other electrical operating conditions, but as one of its functions is to protect the cathode from destructive electrical erosion the pressure of the gas ordinarily should not be below several millimeters. For low voltage rectifiers, a pressure of about 5 to 12 centimeters of mercury is desirable.

When the device is to be started a suitable heating current is conveyed to the starting electrode 9 by conductors 12, 12. The current may be furnished by any convenient means, for example, by a transformer secondary 13 wound on the core of the main supply transformer 14. Switches 15, 16, are then closed thereby connecting the main electrodes 2, 3, to the secondary of the main supply transformer through conductors 17, 18, and connecting the auxiliary electrode to the main anode through the conductor 19. A discharge will occur between the auxiliary electrode 9 and the main cathode 2. The cathode tip because of its small heat capacity will be heated to incandescence,

and will operate to pass current to the main anode. When the switches 20 and 16 are opened cutting off the heating current from the auxiliary electrode, current will continue to pass between the main electrodes 2 and 3. Due to the unidirectional conductivity of the device only half waves of current negative with respect to the cathode 2 will then be conducted. This rectified current may be used for any desired purpose, such for example, as charging a storage battery 21.

As the main electrode 2 consists of a rugged conductor a small amount of electrical erosion will not shorten the life of the device. The starting electrode 9 is used only for short periods and, therefore, is substantially unaffected by erosion.

In the devices diagrammatically illustrated in Figs. 2 and 3, (a bulb or globe being understood to be present in each case) the auxiliary arc is started by a high potential discharge. For example, as shown in Fig. 3, a high potential discharge may be caused to pass from the pointed auxiliary electrode 22 to the main cathode 2, current being taken conveniently from a high potential winding 23 wound on the core of the main supply transformer 24. When the switch 25 is closed a high potential discharge will occur from the pointed electrode 22 as cathode and the electrode 2 as anode. This discharge heats the electrode 2 to incandescence whereupon the main arc starts between the electrode 2 as cathode and the electrode 3 as anode and rectified current is furnished. The switch 25 may then be opened.

In the device shown in Fig. 2 an auto-transformer connection is shown, the winding 26 being connected in series with a reactance or resistance 27 permanently in circuit with the winding 28, so that a small arc operates continuously between the electrodes 22 and 2, the starting being otherwise the same as already described in connection with Fig. 3. When the main cathode 2 has become sufficiently heated full load current will flow during one-half cycle through the circuit conductor 29, electrodes 2 and 3, and conductor 30. During the other half cycle a small current will flow through the conductor 29, electrodes 2 and 22, and conductor 31 to the terminal of the transformer winding 26.

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

1. The combination of a source of alternating current, a rectifier comprising a sealed envelop, a gas filling therein, a main

cathode adapted to operate at incandescence, a main anode, connections between said main electrodes and said source, an auxiliary incandescent electrode spaced away from said main electrodes, and means for starting and operating an arc between the auxiliary electrode and the main cathode.

2. A rectifier comprising a sealed container, main electrodes therein of materially different heat-dissipating capacities, the electrode of smaller heat-dissipating capacity being substantially rod-shaped and consisting of refractory material, a filamentary electrode adapted to be independently heated spaced away from said main electrodes, a filling of inert gas for said container having a pressure great enough to suppress electrical disintegration of a cathode when operating at incandescence, means for heating the filamentary electrode to incandescence and connections for operating an arc between said filamentary electrode and the main cathode.

3. The combination of a sealed container, a filling of inert gas therein, a main anode of large heat-dissipating capacity, a main cathode having a tip of materially smaller heat dissipating capacity than said anode, an auxiliary electrode spaced away from said main electrodes, independent electrical connections for operating an arc between said auxiliary electrode and the main cathode, and means for simultaneously supplying said main electrodes with current alternating in potential.

4. The combination of an envelop, a filling of ionizable gas therein, a main cathode of highly refractory material, a main anode, a source of alternating current, connections between said main electrodes and said source, an auxiliary electrode, means for heating the same, and means for connecting said auxiliary electrode to the terminal of said alternating current source which is connected to the anode whereby an electric discharge will occur between the auxiliary electrode and the main cathode.

5. The combination of an envelop, a main cathode, an anode, a source of alternating current, connections between said main electrodes and said source, an auxiliary electrode, means for producing a discharge between the auxiliary electrode and the main cathode whereby said cathode may be heated and an arc automatically started between said main electrodes.

In witness whereof, I have hereunto set my hand this 17th day of September 1915.

GEORGE S. MEIKLE.