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H. COHN

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ELECTRIC VALVE

Filed Oct. 27, 1923

FIG. 1.

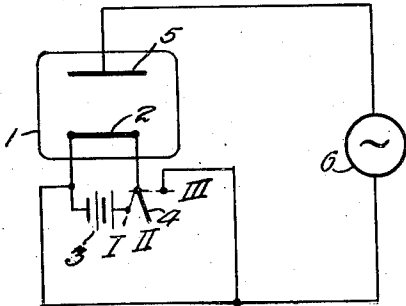


FIG. 2.

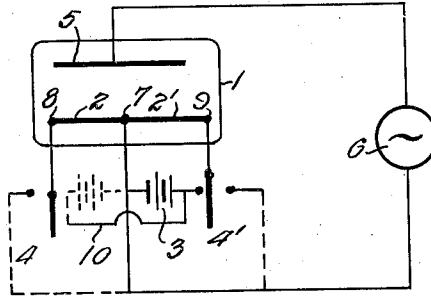


FIG. 3.

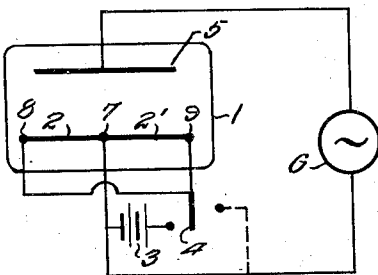
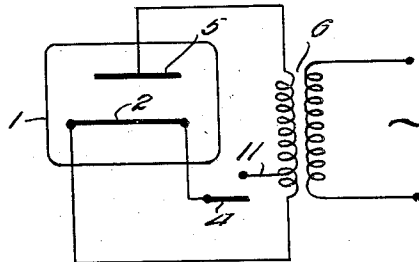


FIG. 4.



Inventor
Henry Cohn

By N. R. Van Derenter,

Attorney

UNITED STATES PATENT OFFICE

HENNY COHN, OF CHARLOTTENBURG, NEAR BERLIN, GERMANY, ASSIGNOR TO THE
FIRM DR. ERICH F. HUTH GES. M. B. H., OF BERLIN, GERMANY

ELECTRIC VALVE

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This invention relates to electric valves that may be used as current rectifiers, amplifiers, detectors or the like.

As well known, such tubes or valves operate with a hot cathode consisting of a metallic filament e. g. of tungsten or the like, or of a suitable core entirely or partially covered with an oxid layer. These cathodes are usually heated by means of a heating battery which is continuously connected in circuit during the operation of the device. For this reason such heating batteries must be of fairly large size and, because of this and the necessity of looking after their charging, etc., they are inconvenient.

In accordance with the present invention, means are provided whereby the necessity of providing such heating battery is eliminated. This is accomplished in such a manner that during the operation of the valve the cathode is heated by the current which flows therefrom towards an anode whereby the capacity of the cathode to emit electrons is maintained. It is not necessary to connect the heating battery into the cathode circuit during the actual operation of the tube. Such battery or any other heat source is connected in circuit for a very short time, possibly only for a fraction of a second for the purpose of causing the cathode to glow and is then again disconnected from the circuit upon the starting of the anode current or emission of electrons. As a result of this a very small heating battery may be provided. If the hot cathode is fed from a power line or a current source which serves also for any other purpose (e. g. the anode current source) then, in determining the point at which this source should be tapped only these short circuit closures need be taken into consideration.

As above stated such self heating of the cathode by means of the electron emission current may be practised with filament or plate cathodes of tungsten, wolfram or other materials. However, the arrangement is particularly applicable if an oxid layer of earth alkalis or of other suitable compositions and constructions are used. This oxid layer has the property of offering a higher resistance to the passage of the current than is the case

with naked electrical conductors. The electrons i. e. the anode current traversing this covering must therefore overcome a higher resistance and the resulting Joule effect will cause the heating of the cathode in the required manner.

The use of a covering layer which as compared with the usual metallic conductors increases the resistance to the emission of electrons, has also a further advantage. As well known, when the load is increased and the valve is more efficiently operated, the anode will also be caused to glow by the electrons and will become therefore a source of electronic emission. If only the cathode and not the anode is provided with a covering layer which aids in the emission of electrons then, even in case both the anode and the cathode are caused to glow, the quantity of the electrons emitted by the hot cathode will be excessive with respect to the quantity emitted by the anode. In this manner in rectifiers or other valves in which it is required to send only uni-directional current, the passage of such current is maintained because of the excessive emission of electrons by one of the two glowing electrodes.

In order to insure the above mentioned excessive electron emission by the cathode with respect to the heated anode, it is advisable to use an oxid covered cathode in which the cathode is covered with mixtures of combinations of earth alkali metals, inclusive or exclusive of oxids, hydroxids and salts of nitrogen containing acids, which are applied as a jelly on a carrier or are powdered and then molded into forms and heated.

The invention is not limited to subjecting the anode to the effect of heat. The effect of light on the anode may also be utilized in which case the cathode is covered with a layer which under the action of light rays will emit electrons (electric photocell). By using valves provided with such cathodes, during the operation of the device after the stream of electrons has been started, the glowing anode itself may be used as a source of light.

The invention will be described more in detail by means of the drawings in which Figs. 1-4 schematically illustrate various

embodiments of which the present invention is capable.

Fig. 1 shows a container 1 for the valve provided with a cathode 2, for instance an oxid covered cathode which may be heated by means of a small battery 3 controlled through the agency of a switch 4. A suitable alternating current source such as a low, medium or high frequency machine is provided between the cathode 2 and the anode 5 which may be connected in circuit directly or through the agency of a transformer. It is desired to rectify the alternating current supplied from this source. As soon as the switch 4 is moved into position I the cathode is brought to a glow and the condition is reached in which it will be maintained glowing due to the electronic emission. Then the switch 4 is moved into position II disconnecting the heating battery. If desired, the switch may be moved into position III in which the cathode is bi-polarly connected to the alternating current source and therefore into the anode circuit.

As shown in Fig. 2 the same circuit arrangement may be used also with a multiple cathode and more particularly with a cathode divided into two sections 2 and 2'. The sections of the cathode connected in parallel may be unipolarly connected at 7 with the heating battery 3 whereas the other poles 8 and 9 are separately connected with switches 4 and 4' and may be connected through these switches with the battery 3 or separately through the conductors indicated in dotted lines with the anode circuit.

Obviously, as shown in Fig. 3 the sections 2 and 2' of the cathode may be permanently connected in parallel and then connected with the heating battery through a single switch 4 or disconnected from this battery and connected to the anode circuit.

In the circuit arrangement shown in Fig. 2 a separate heating source may be provided for each section of the cathode. This is indicated in dotted lines at 3'. Of course in this case the connection 10 is left out.

Fig. 4 shows an arrangement in which the use of a heating current source is entirely avoided. The cathode 2 is heated from an alternating current source 6 which in the present case is a transformer provided with a tap 11 with which the cathode may be connected by means of the switch 4 at the beginning of an operation and disconnected after a few seconds or a fraction of a second when the electronic emission begins. Obviously, this arrangement can be used also with other alternating current sources than a transformer. If an alternating current machine is used then one of the windings is tapped.

What is claimed is:

An electron discharge tube comprising a heatable cathode and an anode therein, said

cathode when heated to an electron emitting temperature being adapted to emit electrons and having resistance sufficient to generate heat solely by means of the normal space current-flow therethrough to maintain the cathode at an electron emitting temperature independently of any auxiliary external heating means.

In testimony whereof I affix my signature.

HENNY COHN.