June 2, 1931. R. G. BERTHOLD 1,808,517

METAL VAPOR RECTIFIER

Filed July 11, 1928

Fig. 1

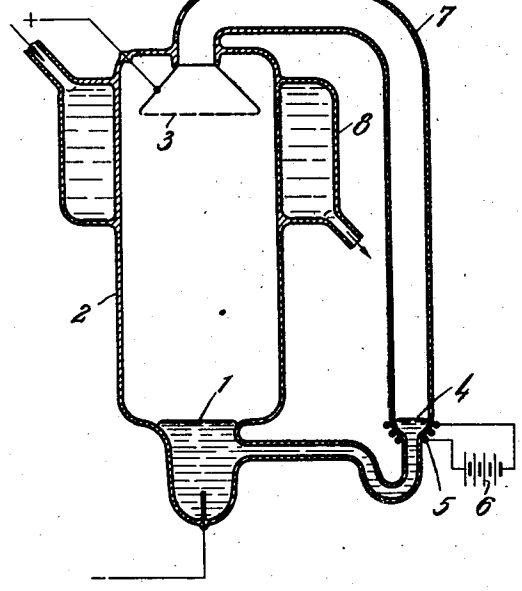
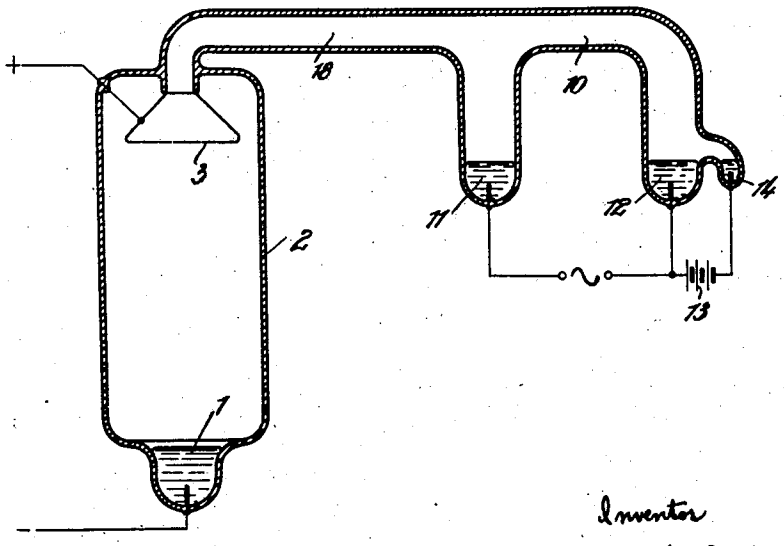


Fig. 2



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UNITED STATES PATENT OFFICE

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METAL VAPOR RECTIFIER

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My invention relates to improvements in metal vapor rectifiers, and more specifically to rectifiers for converting alternating current of high voltage into direct current. The use of metal vapor rectifier plants for converting alternating current of high voltage into direct current is limited by the comparatively low stopping voltage of such rectifiers. This stopping voltage is limited at the top by the following phenomenon: In the discharge space of the rectifier are contained large quantities of ionized gas, consisting of positive (heavy) mercury ions and negative (light) electrons, which are continuously supplied by the constantly burning ignition arc, and are thus available independent of a very short life of the ionization in all phases of the rectifying process.

If now in the stopping phase the rectifier anode becomes negative in relation to the rectifier cathode, the existing positive mercury ions originating from the ignition arc drop with a velocity corresponding with the great stopping voltage head on the rectifier anode and effect a vigorous emanation of electrons at the anode, since it possesses in the stopping phase negative potential in relation to the rectifier cathode. This bombardment with ions causes the very undesired back firing.

This bombardment with ions of the rectifier anode during the stopping period is in metal vapor rectifiers according to my invention prevented by producing at the anode a flow, current or stream of vapor starting at the active face of the anode and directed away from it. This current of vapor then also catches the ions streaming towards the anode due to the electric field and thus prevents the excessive heating of the anode. During the time the anode carries the working current, the positive ions are driven away from the anode due to its positive potential, in any case within the extent of the anode drop. The artificially produced flow of vapor thus acts during this half wave in the same direction as the positive anode potential. It appears, however, preferable not to let the stream of vapor extend itself in the direction of flow of the positive ions substantially beyond the sphere of the anode drop, because it will otherwise attempt to destroy the condition of the quasi-neutrality in the arc discharge and might thus cause a comparatively high voltage loss in the rectifier also in the direction of the flow. If it is thus impossible to produce an artificial stream of vapor within the range of the anode drop sphere only, a controlled stream of vapor directed away from the anode may also be used according to my invention, which streams from the anode towards the cathode during that half wave of the feeding alternating current only, during which the anode carries no current.

Mercury vapor rectifiers are already known in which in order to avoid backfiring the anode is housed in a chamber, which stands under a lower pressure than the remaining discharge chamber. To obtain this lower pressure the anode is enveloped by a shell open towards the cathode and the outer face of this shell is swept by a stream of vapor directed towards the cathode. This stream of vapor then exerts an exhausting action on the inside of the shell surrounding the anode. In contrast with this arrangement it is according to my invention not intended to prevent the backfiring by an increase of the vacuum at the active anode face, but by a current of vapor directed away from the anode face. While in the known arrangement the impinging of gas ions on the anode is to be reduced by increasing the vacuum, the positive gas ions flowing towards the anode are according to my invention blown away by a counter-current set up.

In the drawings affixed hereto and forming part of my specification two embodiments of my invention are illustrated by way of example.

Fig. 1 is a vertical section through one construction of my improved rectifier, in diagrammatic representation, and

Fig. 2, a vertical section through another construction of improved rectifier.

Like parts are indicated by like numerals of reference in both figures of the drawings.

Referring to Fig. 1, 1 is a mercury cathode of a glass rectifier 2, and 3 the anode. The anode is designed as a sieve, and mercury vapor is constantly supplied to it and trav-

erses the perforations of the sieve from back to front. To bring this about I provide a mercury cup 4 in communication with the cathode 1 and in which mercury vapor is constantly generated by means of an auxiliary heating arrangement. This heating arrangement consists in Fig. 1 of a heating spiral 5 and the feeding battery 6. The mercury vapor generated in the cup 4 is conveyed to the back of the sieve anode by means of the tube 7. For condensing the mercury vapor emanating from the cathode 1 as well as from the anode 3 the rectifier bulb 2 is in its upper part surrounded with a jacket 8 traversed by a cooling medium.

Referring to Fig. 2, it will be seen, that the mercury vapor stream or spray directed away from the anode face is generated during the half wave of the feeding alternating current, during which the anode carries no current. The anode is again designed as a sieve. The chamber at the back of the sieve communicates by the tube 18 with an auxiliary mercury vapor rectifier bulb 10. This auxiliary mercury vapor rectifier bulb is fed with alternating current and possesses two mercury electrodes 11 and 12, of which the electrode 12 acts as cathode.

For this purpose an auxiliary discharge is maintained at the electrode 12 by means of the source of direct current 13 and at the electrode 14. Through the auxiliary rectifier bulb 10 thus flow in phase with the, for instance, positive half wave of the feeding alternating current from the electrode 12 to the electrode 11 rushes of current, which also produce corresponding intermittent rushes of mercury vapor between the two electrodes. These pulsating streams of mercury vapor are then also supplied by the tube 18 to the anode 3 of the main mercury vapor rectifier and produce at it the desired flow of mercury vapor.

It will be understood that my improved metal vapor rectifier may be equipped with known apparatus for controlling the current between the anode and the cathode.

Various changes and modifications may be made without departing from the spirit of my invention and the following claims and I desire, therefore, that only such limitations should be placed thereon as are imposed by the prior art.

I claim as my invention:

1. In a metal vapor rectifier in combination, a sieve-like anode, and means for producing a stream of vapor passing through the perforations of the anode sieve and directed away from the active anode face.

2. In a metal vapor rectifier, means for generating a flow of vapor from the active anode face of the rectifier and directed away from it, said means creating the flow of vapor only during that half wave of the rectified alternating voltage during which the anode carries no current.

3. In a metal vapor rectifier, in combination, a sieve-like anode, and means for producing a stream of vapor passing through the perforations of the anode sieve and directed away from the active anode face, said means creating the flow of vapor only during that half wave of the rectified alternating voltage during which the anode carries no current.

4. In a metal vapor rectifier, in combination, a sieve-like anode, an auxiliary rectifier bulb fed with alternating current, a connecting tube between the auxiliary rectifier bulb and the metal vapor rectifier, said auxiliary rectifier adapted to generate a flow of vapor passing through the sieve-like anode of the metal vapor rectifier and directed away from the active anode face.

5. In a metal vapor rectifier, an anode designed as hollow body, sieve-like perforations in the active anode face, an auxiliary rectifier bulb fed with alternating current, a connecting tube between the auxiliary rectifier bulb and the metal vapor rectifier, said connecting tube opening into the cavity of said anode.

In testimony whereof I affix my signature.

RUDOLF G. BERTHOLD.