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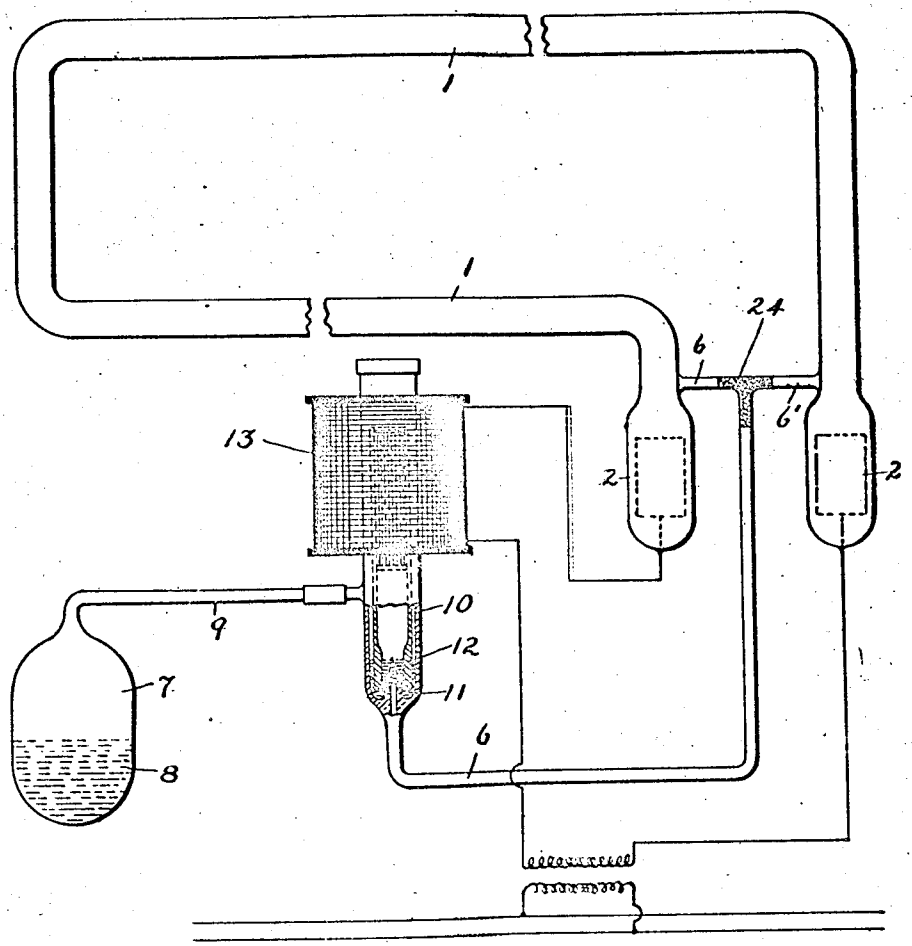
D. McF. MOORE.

VACUUM TUBE APPARATUS.

APPLICATION FILED APR. 2, 1908.



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VACUUM-TUBE APPARATUS.

No. 895,487. Specification of Letters Patent. Patented Aug. 11, 1908.

Application filed April 2, 1906. Serial No. 309,285.

To all whom it may concern:

Be it known that I, DANIEL McFARLAN MOORE, a citizen of the United States, and a resident of Newark, in the county of Essex and State of New Jersey, (with post-office address 52 Lawrence street,) have invented certain new and useful Improvements in Vacuum-Tube Apparatus, of which the following is a specification.

The present invention relates to vacuum tube or vapor electric lamps, vacuum or vapor rectifiers, X-ray tubes, vacuum oscillographs, wireless telegraph receivers and other devices which are provided with suitable electric terminals whereby electric energy may be passed through the gaseous contents of the tube for any purpose and which generally may be classified under the head of vacuum tubes.

My present invention relates to vacuum tube apparatus in which the desired gas or vapor tension is maintained automatically in stable or normal condition by feeding the gas from any suitable source into the tube whenever a reduction of tension occurs, the feeding devices being organized or combined with appliances which shall automatically respond to a reduction of tension.

In one of the plans heretofore employed by me, the feeding is governed by an electromagnet, which acts through a lowering of the resistance of the gas or vapor due to reduction of its tension, but other means of bringing about a feed of the air or gas upon reduction of tension and automatically responsive thereto may be used. The air or gas so fed is derived from a body of air or gas normally and constantly under a tension greater than that of the contents of the tube, so that on the opening of a port or passage momentarily, the said gas will flow into the tube and restore the tension of the contents to normal. Such supply of gas is, in some cases, the contents of a tank or receiver in which the supply is stored, and in other cases the atmosphere has been used as the source of supply. Where it is necessary, however, to use some particular character of gas, the same has heretofore been stored under pressure in a tank, which, obviously, will afford a comparatively limited supply unless tanks of cumbersome size or dimension be employed.

The object of my present invention is to simplify the apparatus, reduce its size and afford a means whereby the tube may be run for indefinitely long periods through the admission thereto, from time to time, of a gas which is controlled in its flow to the tube by a suitable valve or gas pressure regulator.

To this end the invention consists in the combination with the vacuum tube, of a tank or receiver containing a readily vaporizable liquid or one which will readily turn into a gas or vapor on reduction of its surface tension, pipes or passages connecting said receiver with the vacuum tube and an interposed regulator or governor of the gas flow.

My invention being especially useful in connection with vacuum tube lamps, I will describe the same specifically with reference to that class of vacuum tubes, from which its application to other vacuum tubes will be readily understood.

As an example only of the means for regulating or governing the flow of the gas to the tube, I will describe a valve whose action is controlled by an electromagnet operating in response to the changes of electrical resistance between the electrodes of the tube consequent upon a diminution of the gas or vapor tension.

In the accompanying drawings, Figure 1 shows in general side elevation and partial section a form of apparatus embodying my invention.

1 indicates the vacuum tube and 2 any form of electrode or terminal therefor connected with any suitable source of electric energy continuous or alternating, as for instance, the secondary of a transformer.

6 is a tube through which the gas or vapor is fed into the tube 2 at any desired point or points in amount sufficient to maintain a gas or vapor tension within said tube 1 practically constant. Said tube 6 may branch as shown into feeders 6′ connected to the tube 1 near its end and having a mass of sand 24 to prevent short-circuiting of the energy while allowing flow of the gas or vapor.

7 is a tank or receiver sealed and communicating through suitable pipes or passages 9 with the tube 6 and tube 1. In the tank or receiver S is some material, liquid or solid, which will readily vaporize or assume a gaseous condition on reduction of tension at its surface. Such material might be alcohol or ether or a solid even might be used.

Interposed in the passages leading to the tube 7 is a valve such as described in a prior application for patent filed by me and com-

prising a chamber 10 containing a body of mercury 11 which normally seals or partially seals the opening through which the gas or vapor derived from pipe 9 may pass from chamber 10 into pipe 6. In the liquid 11 is a plunger or displacer 12 sustained in part by the core of an electromagnet 13 to which said displacer is attached. The coils of the magnet 13 are connected to the circuit of the tube in such manner that on reduction of tension and change of resistance in the tube said coils will take more current, thereby lifting the displacer, lowering the level of the liquid, and permitting the gas or vapor to pass into tube 6 and thence to the vacuum tube. This passage of the gas or vapor will obviously take place owing to the fact that the gas or vapor tension will be higher than that normally maintained in tube 1 owing to the adjustment of the regulating appliances. A minute quantity only flows before the tension in 1 rises so as to cause the magnet to close the valve and stop the flow. A reduction of tension in the flask 7 and communicating spaces up to the regulating valve below that which is necessary to practically maintain the contents 8 in the liquid or solid condition will permit the evolution of more gas or vapor which will, therefore, be ready at hand and in a state of tension in the chamber 10 superior to the tension in tubes 1 and 6, so that a feed of gas will take place whenever the communication is opened by the gas regulating valve.

By the use of my invention, vacuum tubes may be run for very long periods without renewal of any portion of the apparatus.

What I claim as my invention is:

1. The combination of a vacuum tube, a receiver containing material adapted to release the gas or vapor on reduction of surface tension, pipes or passages connecting said receiver with the vacuum tube and means for regulating the flow of such gas or vapor to maintain a constant tension in the vacuum tube.

2. The combination of a vacuum tube, a tank or receiver containing a material capable of evolving a gas or vapor, pipes or passages connecting the same with the tube, an interposed valve controlling the flow of the gas or vapor, and means responsive to a change of gas or vapor tension in the tube for operating said valve.

3. The combination of a vacuum tube lamp, a closed receptacle containing a vaporizable material, a valve interposed in the passage between said receptacle and the lamp.

4. The combination of a vacuum tube lamp, a receptacle containing a vaporizable liquid and an automagnetic valve in the passage between said receptacle and the lamp.

Signed at New York in the county of New York and State of New York this 30th day of March A. D. 1906.

DANIEL McFARLAN MOORE.

Witnesses:
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