

No. 895,486

PATENTED AUG. 11, 1908.

D. McF. MOORE.  
VACUUM TUBE APPARATUS.  
APPLICATION FILED APR. 3, 1906.

Fig. 1.

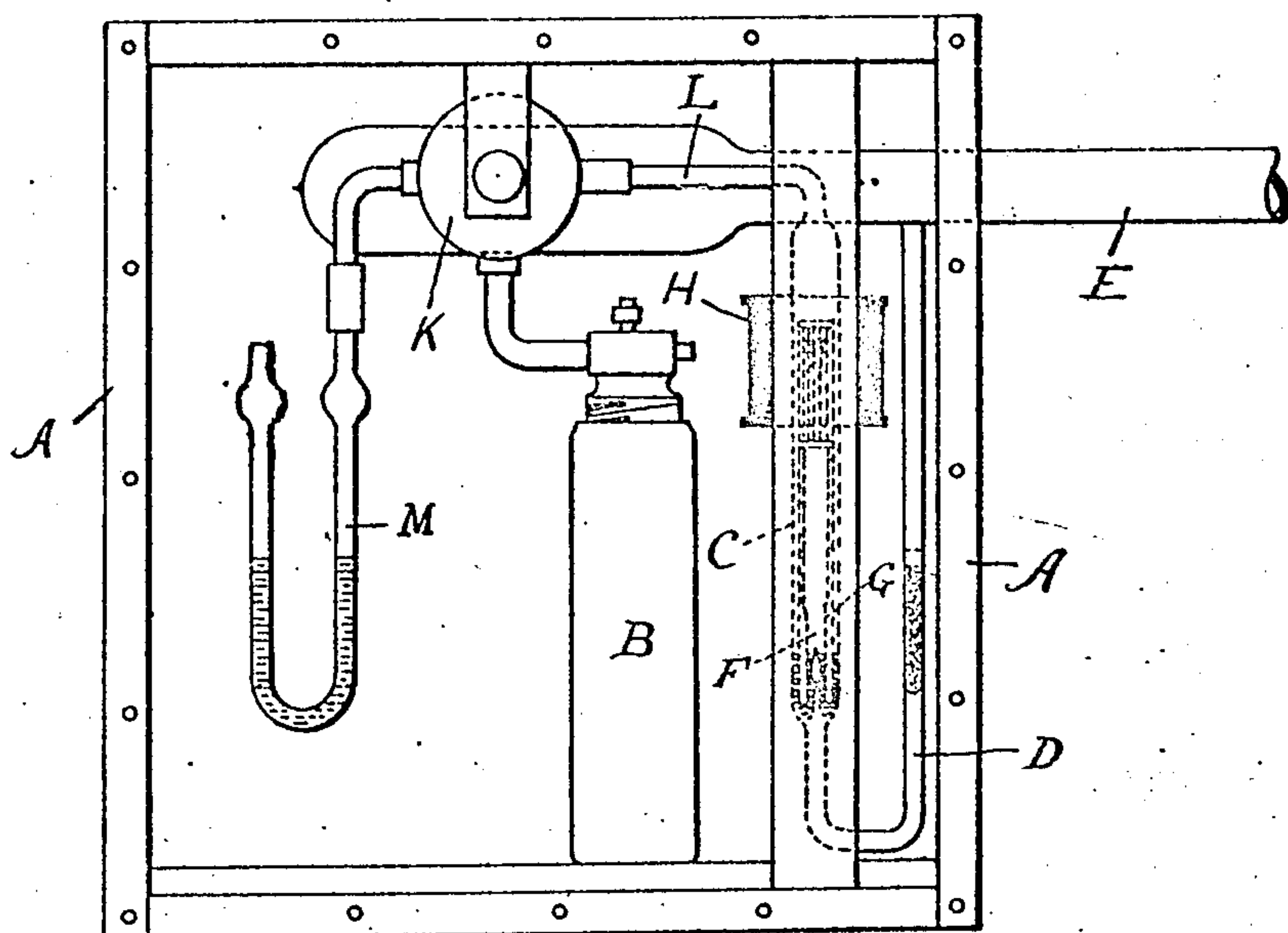
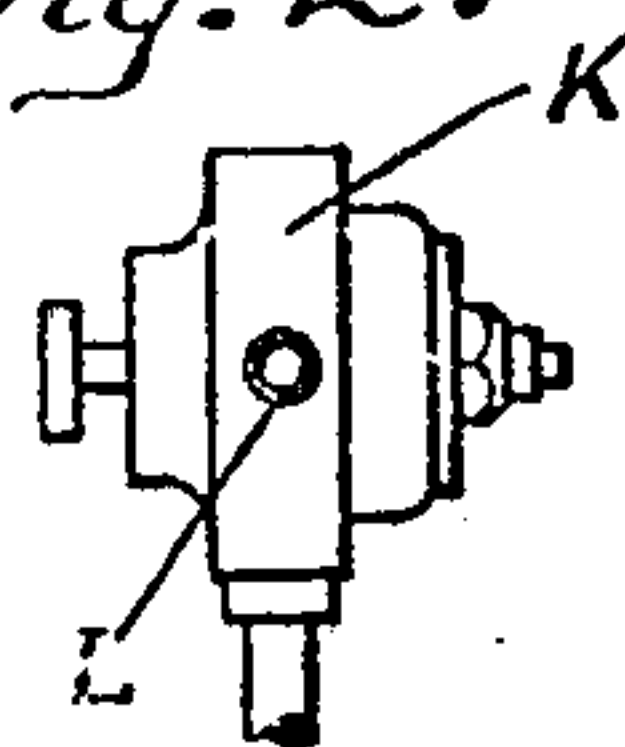


Fig. 2.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

DANIEL McFARLAN MOORE, OF NEWARK, NEW JERSEY, ASSIGNOR TO MOORE ELECTRICAL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

## VACUUM-TUBE APPARATUS.

No. 895,486.

Specification of Letters Patent.

Patented Aug. 11, 1908.

Application filed April 2, 1906. Serial No. 309,283.

*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.

10 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 generally may be classified under the head of vacuum tubes and which are provided with suitable electric terminals whereby electric energy may be applied to the gaseous contents of the tube for any purpose.

20 My present invention is an improvement upon my prior invention set forth in my prior application S. N. 275,003, filed Aug. 21, 1905, wherein I have described the application to a vacuum tube, of a valve which admits minute quantities of the gas into the tube in regulated amounts sufficient to keep the tension of the gas within the tube at normal state, said valve responding automatically to changes in the gaseous tension in said tube.

30 The object of my present invention is to permit the use of a tank carrying the desired gas at high pressure so that the tube may be run for very great lengths of time without renewal of the source of supply.

35 In the operation of the apparatus described in my prior application, it is desirable that the tension of the gas in the valve chamber should be but little above the tension of the gas in the tube, the object being to prevent sudden in-rush of a large quantity of gas when the valve opens.

40 My present invention consists in the combination broadly of a vacuum tube, a gas tank carrying a charge of the compressed gas, a valve for admitting the gas to the tube, said valve being responsive automatically to changes of tension in the tube and a pressure reducing valve interposed between the tank and the regulating valve.

50 My invention consists further in the combination with the apparatus above described, of a pressure gage, which is open to the atmosphere and which is adjusted to permit entrance of air when the supply of gas from

the tank fails and the tension of the gas in the valve chamber becomes so small that the feeding of the gas to the tube ceases.

My invention consists further in the special combinations of devices hereinafter more particularly described and then specified in the claims.

In the accompanying drawings, Figure 1 is a side elevation of apparatus embodying my invention, the operative parts being shown assembled in a suitable casing. Fig. 2 is a view taken at right angles to that of Fig. 1 and shows the connections of the tank and pressure reducing valve.

Referring to the drawings, A indicates the casing and B a tank holding a compressed charge of the desired gas, as for instance, nitrogen.

C is a valve through which the air or gas is admitted to a pipe D leading to the vacuum tube, a section of which is indicated at E. The valve C may be of the character described in my prior application or of any other desired form. The form shown comprises a conical plug of porous material like compressed carbon which is inserted in the mouth of the tube D and stands in a bath of mercury contained in a valve chamber F. By raising and lowering the height of the mercury, the tip of the plug is more or less exposed to admit gas from the chamber F to the pipe D. The action of the valve is brought about by means of a plunger or displacer G which dips into the mercury and is connected by a rod with the core of an electromagnet H. Said electromagnet is connected to some electric circuit through which energy is furnished to the tube E and in such manner that when the tension of the gas falls in the tube, or in other words, when the vacuum becomes higher than the desired adjusted vacuum, the magnet will respond and by raising the plunger or displacer G, will cause air or gas to be admitted to the pipe D and tube E to bring the vacuum back to normal, which action of the magnet H is the result of the decrease of the resistance offered to the passage of the energy from one electrode to the other through the gas when the tension thereof falls.

Tank B is connected by a suitable pipe with a pressure reducing valve of any desired character, as for instance, a diaphragm or disk pressure reducing valve K, the high pressure side of which is connected to the



tank and the low pressure side to the pipe L joined with valve chamber F. This pressure reducing valve is adjusted to maintain in the valve chamber a reduced pressure of the gas such, however, as to be slightly above the pressure or tension which it is desired to maintain in the tube E. This difference of pressure is small in order to prevent unsettling or sudden changes of tension in E, but is sufficient to cause a positive flow of gas from valve chamber F when the valve is opened. In the tank any desired pressure or volume of gas may be compressed and said gas may be of any desired kind according to the effects which it is desired to produce in the tube E.

One of the chief uses of my invention is for supplying gas to the vacuum tubes used for lighting, since, by its means, a light may be maintained for indefinite periods by the use of tanks B of comparatively small size, which need be renewed only at long intervals.

Connected to the low pressure side of the valve is a vacuum gage M. Said gage indicates the condition in the connections to the tube, but also may be adjusted so as to prevent the light in the tube E from becoming extinguished in case the supply of gas from the tank B should fail. For this purpose, the mercury in the pressure gage M is made of such amount, that on reduction of the pressure on the low pressure side of the reducing valve below the desired or normal pressure, the level of the mercury in the side of the pressure gage exposed to air pressure, will fall into the bend of the U or even be carried up on to the low pressure side to such extent to allow bubbles of air to find ingress through the mercury column and into the connection leading to the valve chamber. If, therefore, at any time the supply from the tank B should give out, air will be supplied and fed to the tube to permit the same to continue its operation in a manner not very different from its operation when supplied with nitrogen compressed in the tank B. It is to be understood, however, that this part of my invention is useful no matter what the character of the gas supplied from tank B for the purpose of keeping the tube E in operation as a light-giving tube.

My invention is not confined to any particular kind of reducing valve K nor to any particular means for automatically operating the admission valve through which the supply of gas to the tube E is admitted.

While I have shown and described my invention as carried out in connection with a tank containing a supply of the gas, it being especially useful in that connection, it is to be understood that I claim, broadly, the ap-

plication of the pressure reducing valve in a position between any source of air or gas under pressure, whether the same be a tank or whatnot, and the automatic valve which, by its automatic regulating action, controls the supply of gas to a vacuum tube in a manner to preserve a constant tension of the gas within said tube.

What I claim as my invention is:

1. The combination of a vacuum tube containing a gas in rarefied condition, a tank containing a supply of gas of the desired kind under compression, a valve through which the gas is admitted to the tube automatically in response to changes of gas tension therein and a pressure reducing valve between said valve and the tank.

2. The combination of a vacuum tube lamp, a source of gas under pressure, an automatic valve admitting gas to the tube from said source, and a pressure reducing valve between said valve and source.

3. The combination of a vacuum tube lamp, a gas holder containing gas under pressure and a pressure reducing valve between the lamp and gas holder.

4. The combination with a vacuum tube, of an automatic valve governing the flow of gas to said tube, and a pressure reducing valve between the automatic valve and the source of supply.

5. The combination with a vacuum tube and an automatic valve, of a pressure reducing valve, a tank containing gas under pressure and a vacuum gage open on one side to the air and connected on the other to the low pressure side of the pressure reducing valve.

6. The combination of a vacuum tube, an automatic magnetic feed device through which gas may be admitted to the tube and a pressure reducer interposed between the feed device and the source of gas.

7. The combination of a vacuum tube lamp, an automatic magnetic feed device through which gas may be admitted to the tube and a pressure reducing valve connected to the high pressure side of the magnetic feed device.

8. The combination of a vacuum tube lamp, an automatic magnetic feed valve and a pressure reducing valve connected to the high pressure side of the valve.

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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LILLIAN BLOND.