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L. DE FOREST

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LUMINOUS DISCHARGE DEVICE

Original Filed Dec. 19, 1925

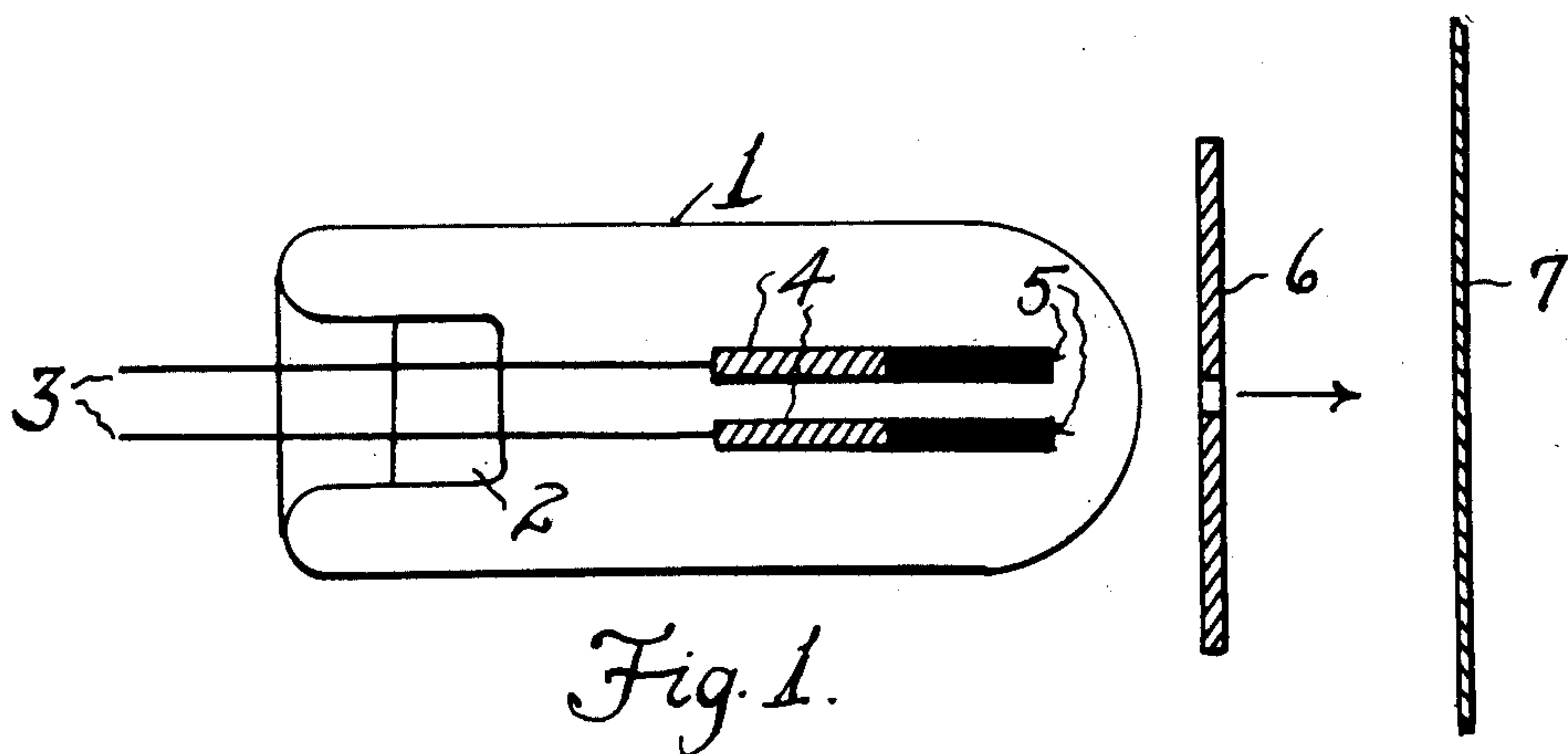


Fig. 1.

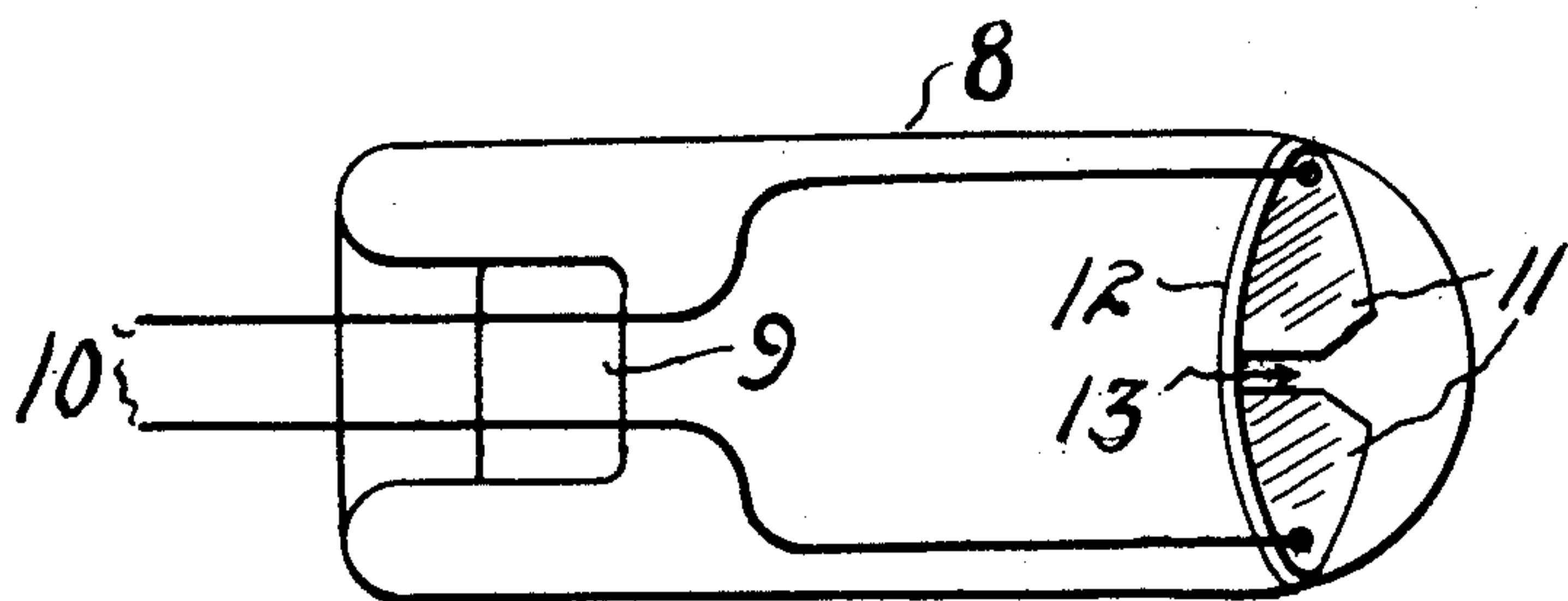


Fig. 2.

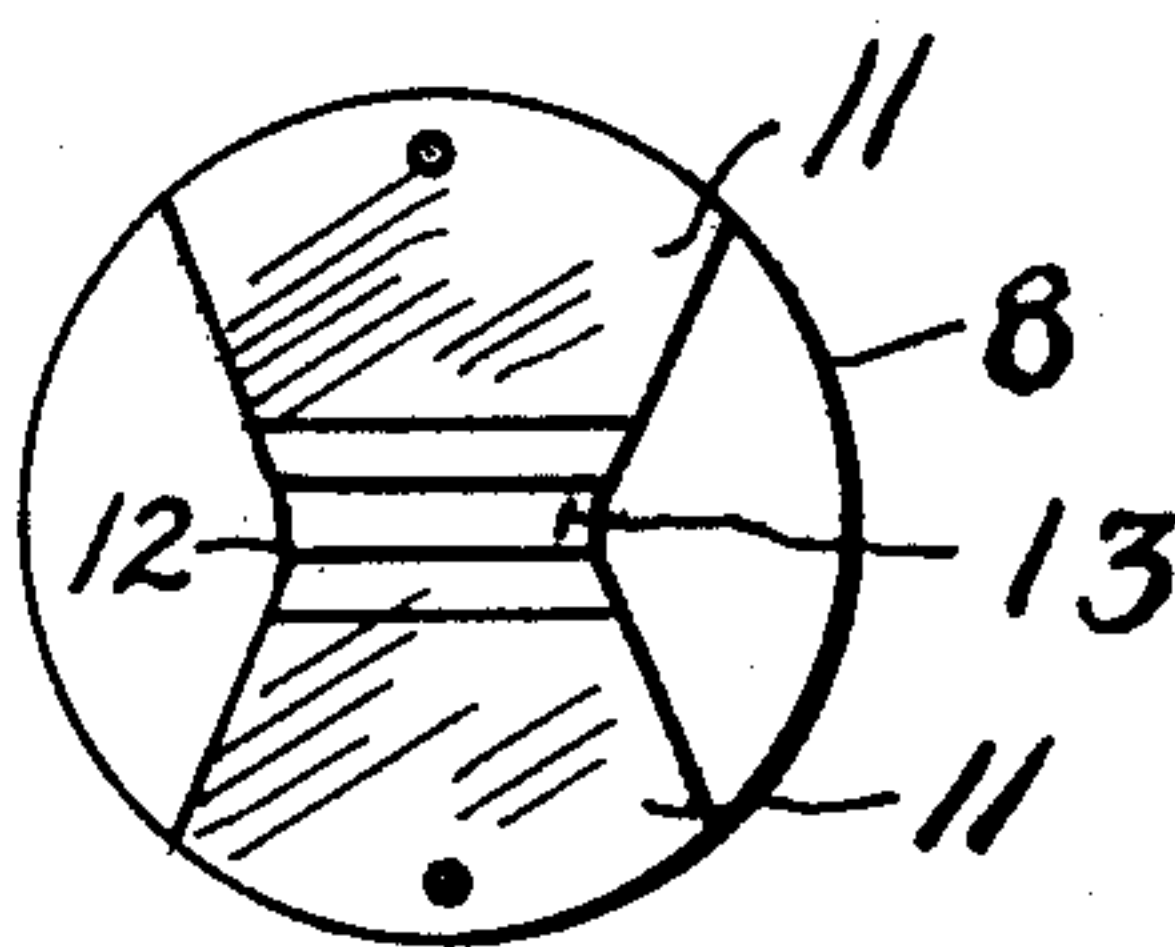


Fig. 3.

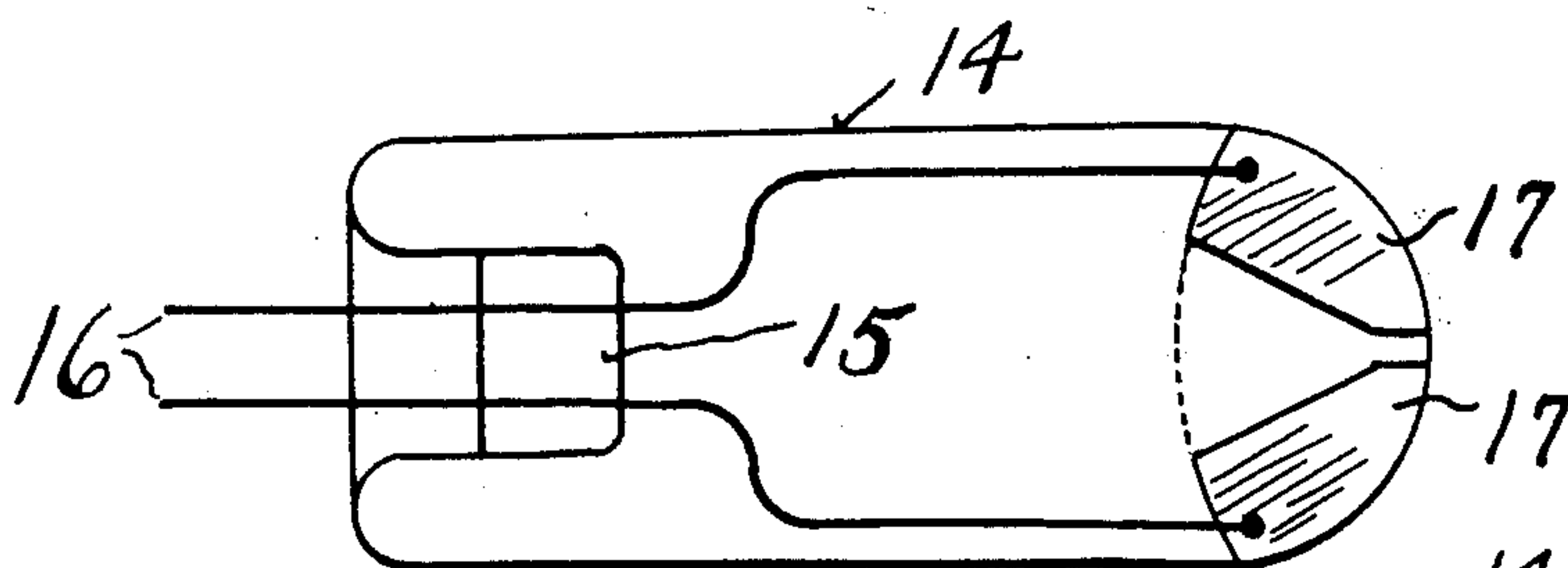


Fig. 4.

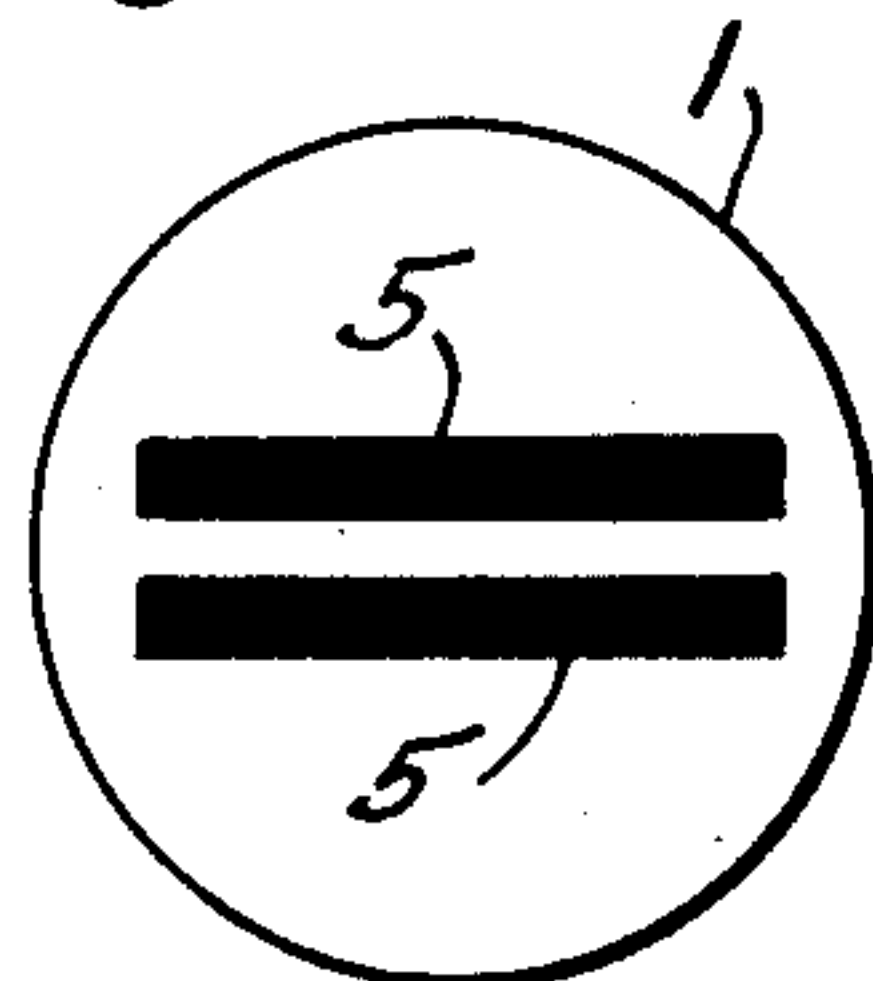


Fig. 1a.

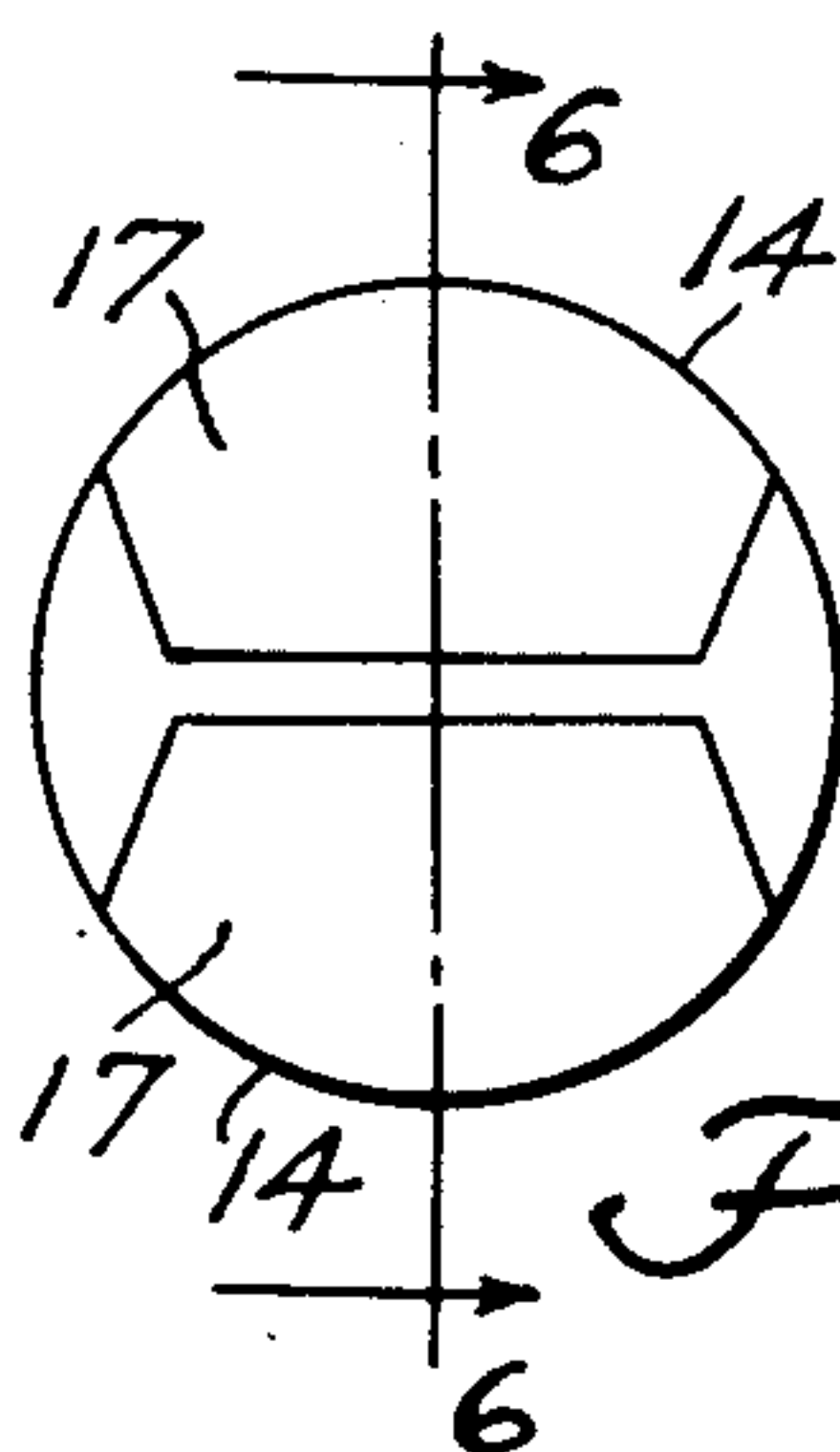


Fig. 5.

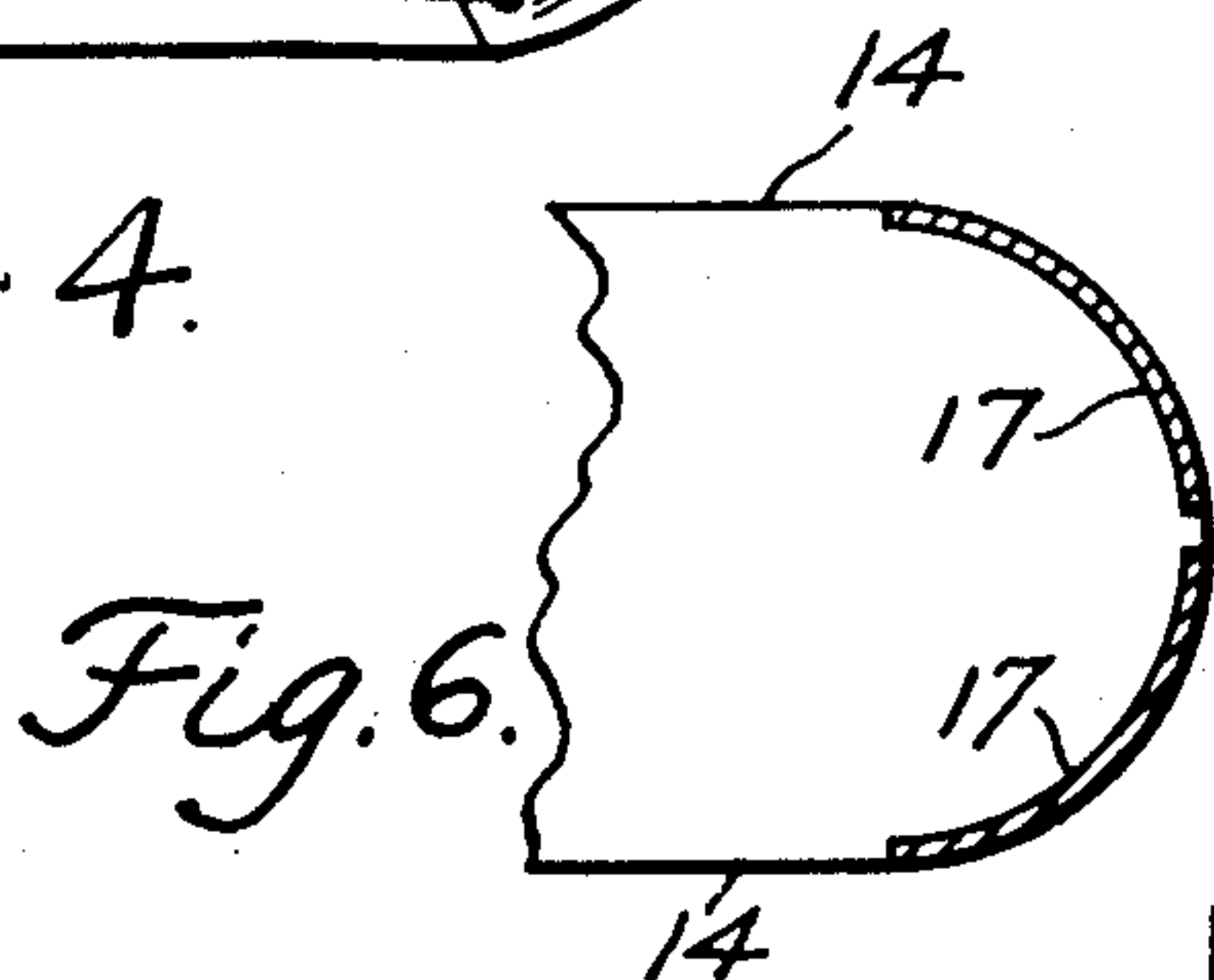


Fig. 6.

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# UNITED STATES PATENT OFFICE

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## LUMINOUS DISCHARGE DEVICE

Continuation of application Serial No. 76,470, filed December 19, 1925. This application filed July 20, 1928. Serial No. 294,196.

This invention relates in general to luminous discharge devices of the type used for the photographic recordation of sound.

One of the objects of this invention is the provision of a luminous discharge device comprising an evacuated vessel having electrodes constructed and arranged to produce illumination in a thin band under electrical excitation.

A further object of this invention is the employment of rare gases and mixture thereof in the discharge devices of the above type.

A still further object of this invention is the provision of a luminous discharge device of the above type which efficiently and faithfully varies in illumination by and in accordance with sound waves when employed in a suitable system for that purpose.

These and other objects as will appear from the following disclosure are secured by means of a device of this invention.

This invention resides substantially in the combination, construction, location and relative arrangement of parts, all as will be more fully described hereinafter.

This invention is a continuation of my co-pending application, Serial No. 76,470, filed December 19, 1925 for sound recording apparatus.

Referring to the drawing,

Figure 1 is a side elevational view of the device of this invention;

Fig. 1a is an end view of the device shown in Fig. 1.

Figs. 2 and 3 are side and end elevational views respectively of a modified form of the device; and,

Fig. 4 is a side elevational view of a still further modification.

Fig. 5 is an end view of the modified form shown in Fig. 4.

Fig. 6 is a sectional view taken along the line 6—6 in Fig. 5.

The general purpose of this invention is the production of a luminous discharge device for use in recording sounds photographically on films so constructed that it produces illumination in a thin band.

Referring to the drawing one form of the device is shown comprising an evacuated ves-

sel 1, having a re-entrant stem 2. Lead wires 3 are shown passing into the vessel through the stem 2 and are attached to two electrodes 15 which are welded or cemented to two opaque members 16 which will be made of any suitable material such as black glass. The leads 14 are to be connected to the output of the sound recording device or microphone in any well known manner.

It has been found that when highly polished electrodes are placed close together free in space in the manner shown in Fig. 1, that a gaseous discharge takes place not only over the entire opposing surfaces, but, in addition, extends outward and runs somewhat over the edges giving a "fringing" effect thereat. It is the main purpose of this invention to restrict the luminous discharge to a narrow plane so that its image can be thrown directly upon the film in the form of a very fine line without diffusion and without necessarily passing it through a narrow slit such as is usually employed in this art. In order to avoid this flaring out of the discharge or fringing, non-conducting members 5 are welded or cemented on to the forward edges of the electrodes 4, the discharge is then maintained in its plane form so far as the side towards the film 7 is involved. The flaring out of the discharge along the sides and rear edges of the plate electrodes 4 produces no harmful effect inasmuch as the light in those regions is cut off by a suitable screen 6 and does not reach the film.

In the modification shown in Figs. 2 and 3, the evacuated vessel is shown at 8 having the re-entrant stem 9 through which the lead wires 10 extend. These lead wires are attached to two electrodes 11 which are separated by a short distance indicated at 13. The one surface of the electrodes 11 is covered by means of any thin non-conducting material 12 suitable for the purpose.

A still further modification is shown in Fig. 4 comprising the evacuated vessel 14 having the re-entrant stem 15 through which the lead wires 16 pass. The wires 16 are attached to two electrodes 17 of such shape as to lie within the rounded end of the vessel 14. These electrodes are as before, separated by



a short distance and in one form of the device may consist of thin deposits of metal directly on the glass. The electrodes may be coated, except on the thin opposing edges  
5 with an insulating material such as mica or lacquer.

It is understood that in each form of the device the electrodes are so shaped as to provide relatively thin, adjacent edges of considerable extent with respect to their width  
10 and separated by a short distance.

If fluctuating direct current be employed as distinguished from high frequency alternating currents, the useful glow will reside  
15 on the cathode surface or edges, and not on the anode. Best results will be secured if such gases as neon, argon, nitrogen or helium either alone or in any desired mixture thereof be employed within the vessel. The average gaseous pressure which gives the best results and the most useful actinic discharge at the least voltage lies between 7 and 8 millimeters. I, of course, realize that useful discharges can be secured with other gases and  
20 at other pressures and I do not therefore desire to be limited to these specifically set forth.

The separation between the electrodes may be of the order of 0.001 or 0.0005 in width.  
30 With a space of this size between the electrodes a relatively moderate voltage of the order of 100 to 400 volts is required to cause a luminous discharge to pass between the electrodes. For the best results the opposing edges of the electrodes disposed parallel to each other should be highly polished.

When the precautions above set forth are followed out, an illuminous discharge in the form of a thin band which in cross section  
40 gives a fine line is produced.

I am of course aware that many changes in the details of construction and arrangement of parts readily suggest themselves to those skilled in the art and I do not therefore  
45 desire to be limited to the specific illustrated showings that I have made in the drawing and described in the specification but rather to the spirit and scope of my invention as I define it in the appended claims.

50 Having described my invention, what I claim and seek to secure by United States Letters Patent is:

1. In a luminous discharge device, the combination comprising an evacuated vessel containing rarified gas, electrodes in said vessel having physically opposed polished surfaces and leads extending into said vessel and connected to said electrodes, said electrodes being so constructed as to produce illumination  
55 in a thin band.

2. In a luminous discharge device, the combination comprising an evacuated vessel containing rarified gas, said vessel having a rounded end, an insulating member within  
60 said vessel and separated from said end and

electrodes supported upon said insulating member and separated a short distance, said electrodes having physically opposed polished edges, of considerable length with respect to their width, said device being adapted to produce illumination in the form of a narrow band of light. 70

3. In a luminous discharge device of the type described, the combination comprising an evacuated vessel, a pair of physically opposed parallel polished electrodes therein and leads connecting to said electrodes and extending exteriorly of the vessel, said electrodes producing illumination in the form of a narrow band of light. 75

4. In a luminous discharge device the combination comprising an evacuated vessel containing rarified gas, a plurality of electrodes disposed in said vessel having physically opposed polished operating surfaces separated by a short distance. 80

5. In a luminous discharge device the combination comprising an evacuated vessel containing rarified gas, a plurality of electrodes disposed in said vessel having opposed parallel polished operating surfaces separated by a short distance, and means secured to said electrodes to prevent fringing therebetween. 85

6. In a luminous discharge device the combination comprising an evacuated vessel containing rarified gas, a plurality of electrodes disposed in said vessel having opposed parallel operating surfaces, each of said electrodes having secured thereto at the ends thereof means to confine the luminous discharge within the plane of the edges of such electrodes to prevent fringing. 90

7. In a luminous discharge device the combination comprising an evacuated vessel containing rarified gas, two parallel electrodes disposed in such vessel, one over the other and separated by a short gap, and means disposed at the operative end of such electrodes to confine discharge at that end to within the edges thereof to prevent fringing. 95

8. In a luminous discharge device the combination comprising an evacuated vessel having a rounded end containing rarified gas, two irregularly shaped electrodes disposed in said rounded end and having opposed parallel operating surface portions and opposed non-parallel portions for preventing fringing, and a transparent supporting member disposed in said rounded end for holding said electrodes in spaced apart relation. 100

9. The structure as recited in claim 8 characterized in that the electrodes are separated by a small gaseous gap. 105

10. In a luminous discharge device the combination comprising an evacuated vessel having a rounded end containing rarified gas, electrodes disposed within said vessel on the inner surface of the rounded end thereof and having opposed parallel operating edges separated by a short gaseous gap. 110



11. In a luminous discharge device the combination comprising an evacuated vessel containing rarified gas, and a plurality of electrodes disposed in said vessel having opposed  
5 parallel operating surfaces separated one from the other by a distance of the order of 0.001 to 0.0005 inches.

In testimony whereof I have hereunto set  
my hand on this 17th day of July A. D., 1928.  
10 LEE DE FOREST.

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