

No. 726,044.

PATENTED APR. 21, 1903.

T. FRIEDLANDER.  
X-RAY TUBE.

APPLICATION FILED JULY 15, 1902.

NO MODEL.

Fig. 2.

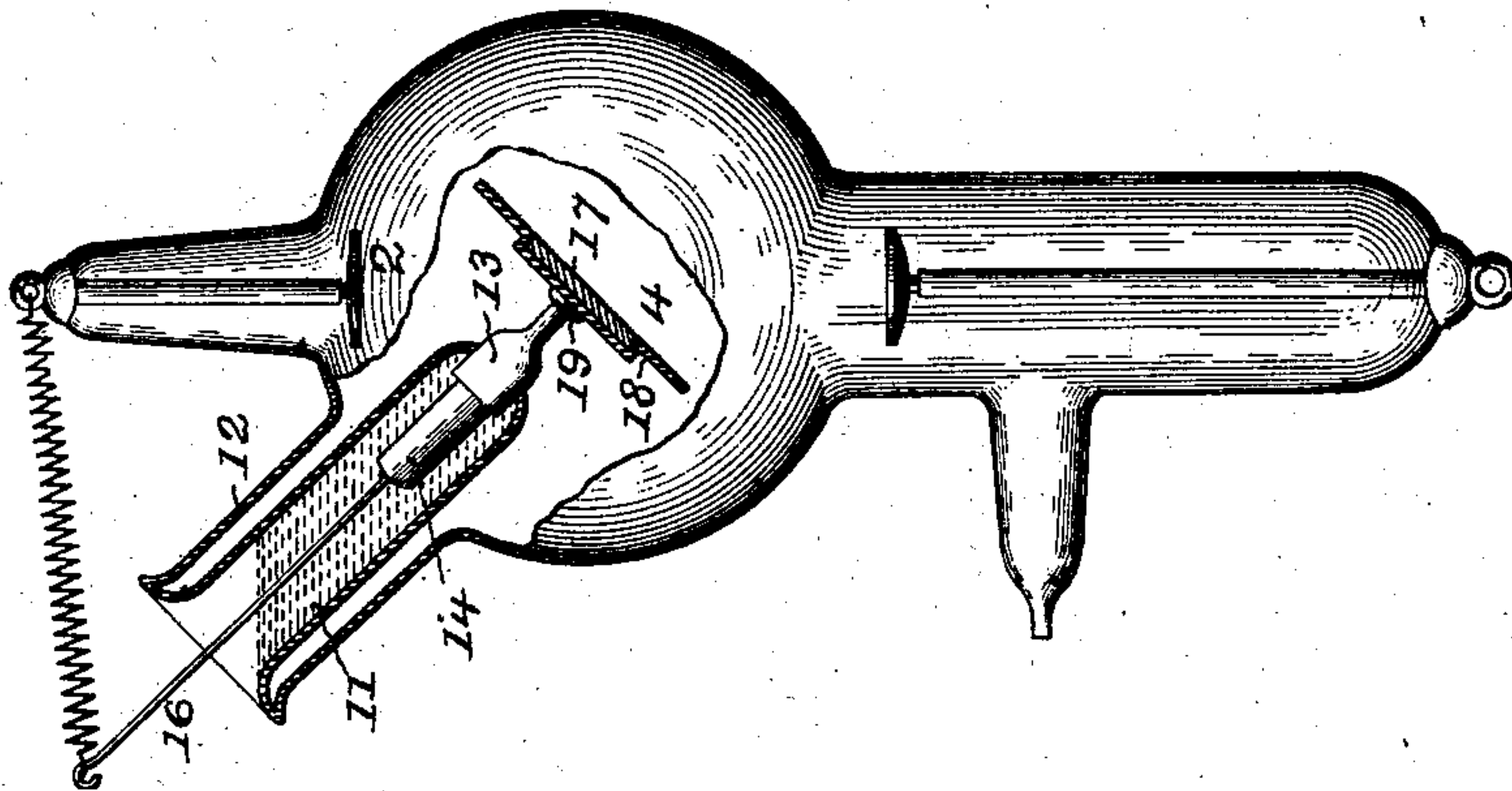
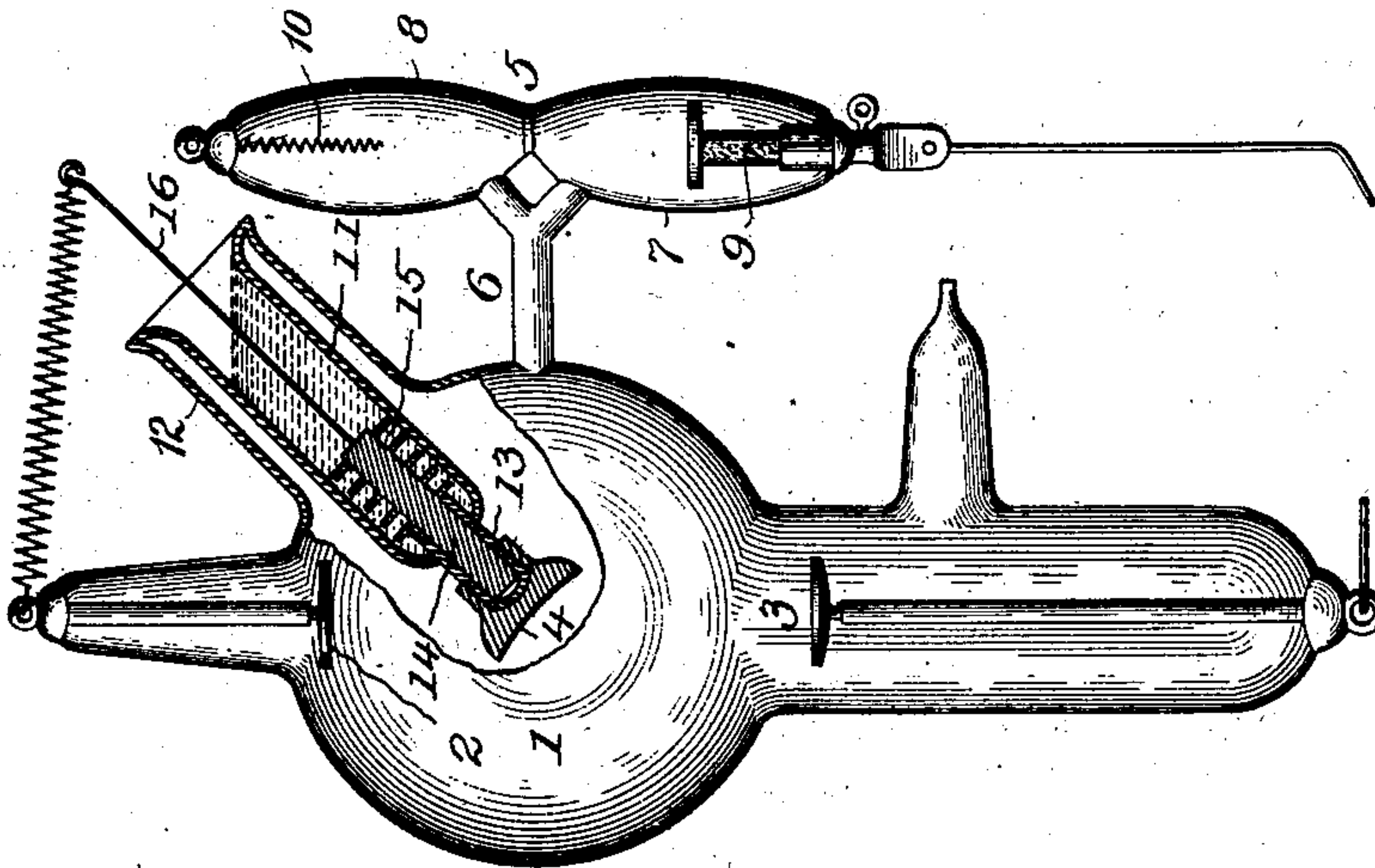


Fig. 1.



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# UNITED STATES PATENT OFFICE.

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## X-RAY TUBE.

SPECIFICATION forming part of Letters Patent No. 726,044, dated April 21, 1903.

Application filed July 15, 1902. Serial No. 115,641. (No model.)

*To all whom it may concern:*

Be it known that I, THEODOR FRIEDLANDER, a citizen of the United States of America, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in X-Ray Tubes, of which the following is a specification.

The present invention relates to vacuum-tubes employed for the generation of Roentgen and like rays or waves, and has for its object to provide a simple and efficient construction of such tubes and which involves, first, a light and efficient construction of the anticathode-mirror, by means of which the rays emanating from the cathode are very perfectly intercepted and reflected, and, second, a simple and effective construction of parts whereby a very efficient and vacuum-tight connection between the wall of the ray-tube and the carrying-stem of the anticathode-mirror is attained to prevent any subsequent leakage due to alternate heating, cooling, and the like changes of the anode during continued use of the ray-tube, all as will hereinafter more fully appear and be more particularly pointed out in the claims.

In the accompanying drawings, illustrative of the present invention, Figures 1 and 2 are elevations, partly sectionized, of Roentgen-ray tubes embodying the present invention and illustrating modifications in the details of construction of the same.

Similar numerals of reference indicate like parts in both views.

Referring to the drawings, 1 represents the main body or portion of a Roentgen-ray tube, which may be of any usual form and provided with the usual anode 2, the cathode 3, and the anticathode-mirror 4, arranged in any usual and approved manner. Such main body 1 is preferably provided with the supplementary vacuum tube or bulb 5, located at one side and connected thereto by the tubular connecting-neck 6, and such supplementary tube is in turn divided into two subchambers 7 and 8, having independent connections with the main body or portion 1 and containing, respectively, a supplementary cathode 9, on which is a coating of a gas-producing substance, such as potassic hydrate, and a sec-

ondary anode 10, formed of a metal adapted to absorb in a gradual manner under the influence of an electrical discharge portions of the attenuated gaseous atmosphere contained in the ray-tube in the manner and for the purpose set forth in my prior application for Letters Patent, Serial No. 112,734, filed June 23, 1902.

One part of the present invention involves a simple and efficient manner of connecting the attaching-stem of the anticathode-mirror to the glass wall of the ray-tube in a substantial and efficient manner that is adapted to maintain a vacuum-proof condition of the connection under the alternating heating, cooling, and like physical changes to which the same is exposed during repeated uses of the ray-tube. Such connection is attained by the following construction of parts:

11 is a water-chamber formed by a section of glass tubing open at its outer end and connected by fusion at such outer end with the outer end of the tubular extension 12 of the main ray-tube. The water-chamber 11 and its attaching extension 12 of the ray-tube are arranged in an oblique direction to the main axis of the ray-tube, as shown in Figs. 1 and 2, and as so arranged the chamber 11 is intended to receive and hold a body of water, the cooling effect of which upon the connections of the anticathode-mirror 4 is adapted to preserve the before-mentioned vacuum-proof condition of said connections in a very perfect manner.

In some special uses of the ray-tube it is impossible to employ the filling of water above described, in which case a circulation of atmospheric air in the open-ended chamber 11 can be depended upon for carrying away the heat during actual use of the ray-tube. The water filling is, however, preferred where it is possible to use the same on account of the very superior heat-dissipating properties thereof.

13 is a tube of platinum having a closed inner end, as shown, and which is sealed intermediate its length into the end of the glass tube 11 by fusion of the end of such glass tube or other equivalent means. The wall of such tube 13 is made as thin as may be consistent with the pressure to which the



same is exposed when the vacuum is formed within the ray-tube.

14 is a rod of suitable metal loosely fitting the bore of the platinum tube 13, so as to be readily removable therefrom. A perfect electrical contact between said rod and tube is insured by the water filling in the chamber 11, heretofore described.

15 represents fins formed on an outward extension of the rod 14 and intended to aid in dissipating the heat generated in the parts 13 and 14, due to the electrical discharges in the ray-tube.

16 is a wire terminal extension by means of which connection is had with the terminal of the anode 2.

Another part of the present invention involves a light, efficient, and economical construction of the anticathode-mirror 4 and which, as illustrated in Fig. 2, involves a construction as follows: 17 is a thin disk or plate of platinum of the required size to constitute the anticathode-mirror of the ray-tube. 18 is a disk-shaped holder for the mirror-disk 17 aforesaid. Such holder is of a larger diameter than said disk and in the present invention is recessed out, as shown, to receive said disk 17, so as to bring the faces of both parts on a common level and attain an extended and intimate surface contact of the parts. The resulting advantages of such construction are that the heat generated by the bombardment of the disk 17 by the cathode-rays of the ray-tube will be radiated or dissipated in a very effective manner, and in consequence effect with safety an extension of the time of active use of the ray-tube without an interruption to permit of a cooling down of the cathode-mirror. 19 is a stem or boss connecting the holder 18 with the inner and closed end of the platinum tube 13, heretofore described, and which constitutes a portion of the terminal of the anticathode-mirror of the ray-tube.

Having thus fully described my said invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of a ray-tube, an obliquely-arranged open-ended water-chamber located at one side of the ray-tube, an anti-

cathode-mirror, and a terminal for such mirror comprising a platinum tube having a closed inner end and sealed intermediate its length in the inner end of the water-chamber aforesaid, a metal plug fitting the bore of said platinum tube, and a terminal wire adapting the mirror for connection with the anode terminal of the ray-tube, substantially as set forth.

2. The combination of a ray-tube, an obliquely-arranged water-chamber formed by a glass tube sealed in a tubular extension of the wall of the ray-tube, and formed with an open outer end, an anticathode-mirror, and a terminal for such mirror comprising a platinum tube having a closed inner end and sealed intermediate its length in the inner end of the glass tube aforesaid, a metal plug fitting the bore of said platinum tube, and a terminal wire adapting the mirror for connection with the anode terminal of the ray-tube, substantially as set forth.

3. The combination of a ray-tube, a glass tube sealed in the wall of the ray-tube and formed with an open outer end, an anticathode-mirror, and a terminal for such mirror comprising a platinum tube having a closed inner end and sealed intermediate its length in the inner end of the glass tube aforesaid, a metal plug fitting the bore of said platinum tube and having an extension provided with heat-dissipating fins, and a terminal wire adapting the mirror for connection with the anode terminal of the ray-tube, substantially as set forth.

4. An anticathode-mirror for ray-tubes, comprising a thin disk of platinum or like metal, a holder for the same having a disk shape and provided with a receiving-cavity for said platinum disk adapted to effect an extended surface contact of the parts and bring the faces of both on substantially a common level, with a terminal sealed in the wall of a ray-tube, substantially as set forth.

Signed at Chicago, Illinois, this 7th day of July, 1902.

THEODOR FRIEDLANDER.

Witnesses:

ROBERT BURNS,  
HENRY A. NOTT.