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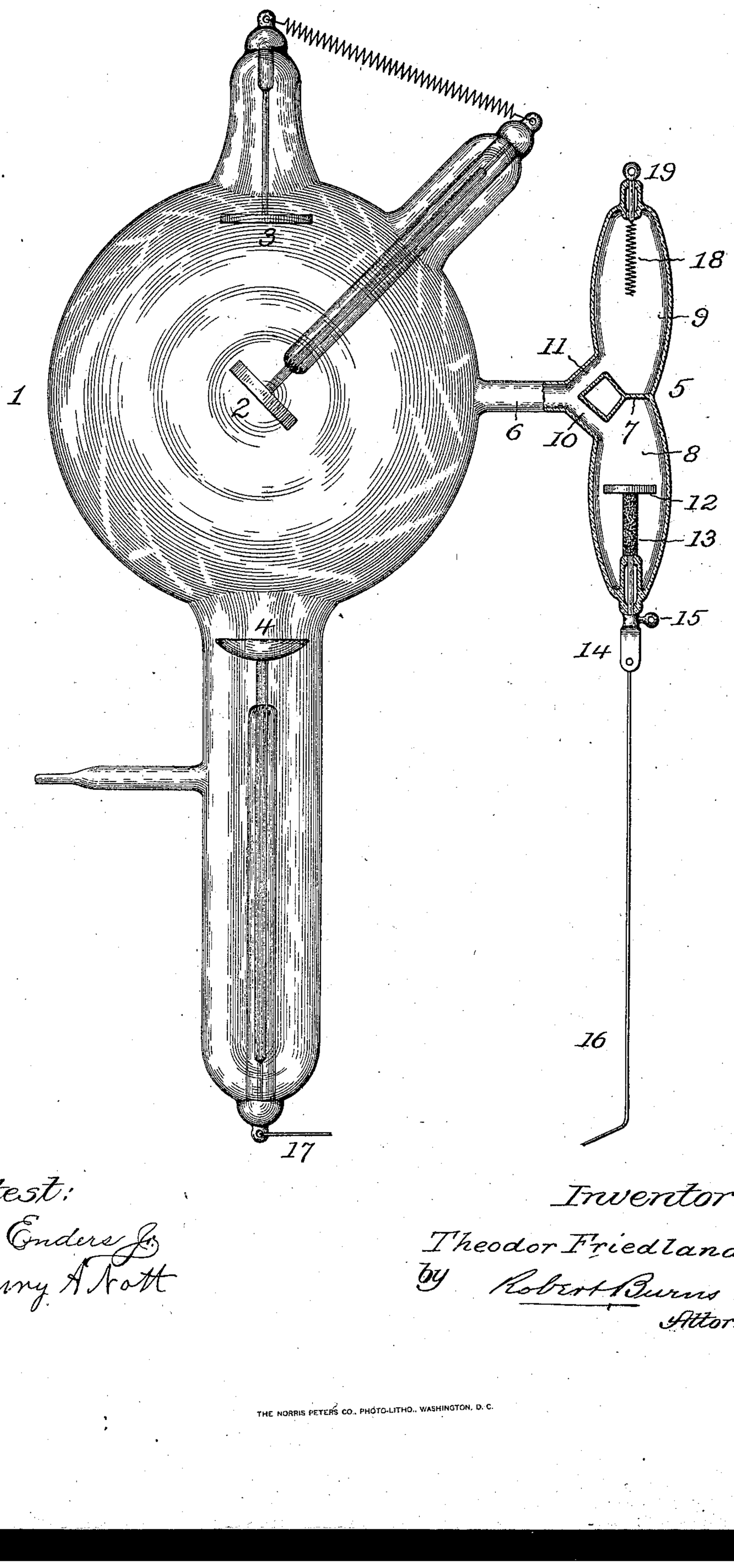
T. FRIEDLANDER.

X-RAY TUBE.

APPLICATION FILED JUNE 23, 1902.

NO MODEL.



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X-RAY TUBE.

SPECIFICATION forming part of Letters Patent No. 725,331, dated April 14, 1903.

Application filed June 23, 1902. Serial No. 112,734. (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 vaccuum-tubes used in the generation of X or Roentgen rays, and has for its object to provide a simple and efficient construction of such tubes whereby the degree of exhaustion or attenuation of the air or gas within the same can be either increased or diminished to suit the particular operations in which the tube is employed. I attain such object by the construction and arrangement of parts illustrated in the accompanying drawing, which represents, partly in elevation and partly in section, a Roentgen-ray tube embodying the present invention.

Referring to the drawing, 1 represents the main body or portion of a Roentgen-ray tube, which may be of any usual form, and provided with the usual main and supplementary anodes 2 and 3 and with the usual cathode 4, arranged in the manner shown or in any other usual and approved manner.

5 is an auxiliary vacuum tube or bulb located at one side of the main ray-tube 1, and connected thereto by a tubular connecting-neck 6. In my preferred construction, as shown in the drawing, the auxiliary tube 5 is subdivided by a partition 7 into two subchambers 8 and 9, which preferably communicate with the tubular connecting-neck 6 in a separate manner by individual passages 10 and 11; but which may, if so desired, connect in common with said connecting-neck.

12 is an auxiliary cathode arranged within the subchamber 8, and which is preferably provided with a coating 13 of potassic hydrate or other analogous gas-producing substance surrounding the body of such cathode, as shown in the drawing. Such substance, however, may be arranged in a separate holder having adjacent relation to the cathode 12 when so desired.

14 is the external terminal of the cathode 12. In the construction shown in the drawing such terminal is provided with a connecting-eye 15, by which direct connection may be had with the negative pole of the inductorium and with a pivotally-connected finger 16, the free end of which is adapted to be adjusted to and from the terminal 17 of the main cathode 4 to form an adjustable spark-gap.

The feature of an auxiliary cathode in connection with a gas-producing substance is common to a number of prior ray-tubes, the object being to prevent too great an attenuation of the gas within such ray-tubes during continued use by automatically supplying gas from such gas-producing substance to compensate for an undue increase in the stage of attenuation.

In practical use a regulation of the degree of attenuation within the ray-tube to meet any particular condition or requirement in the use to which the ray-tube is applied is effected by a manual adjustment on the part of the operator of the spark-gap between the finger 16 and the cathode-terminal 17, heretofore described.

When through long continued use, prolonged inactivity, and the like the atmosphere in the ray-tube becomes overattenuated, such overattenuation can be overcome with the present arrangement in a rapid and convenient manner by connecting the negative pole of the inductorium directly to the connecting-eye 15 of the secondary cathode 12 until such overattenuation is reduced to the desired condition.

In the simpler and preferred form of the present invention the pivoted finger 16, which forms, in connection with the terminal 17, the ordinary adjustable spark-gap, may be entirely dispensed with and dependence placed wholly upon a momentary connection of the negative pole of the inductorium with the connecting eye or terminal 15, as above described.

18 is an auxiliary anode arranged within the subchamber 9 and provided with an external terminal 19, by which connection is had in a manual manner with the positive pole of the inductorium when so desired by the operator. In the present invention such

anode 18 is formed of a metal, such as platinum or other equivalent substance, which is adapted to absorb in a gradual manner under the influence of an electrical discharge portions of the attenuated gaseous atmosphere contained within the ray-tube to gradually increase the attenuation of such atmosphere to the required degree under the control and judgment of the operator who is enabled to stop such absorption by interrupting the electrical connection of the secondary anode 18 with the positive pole of the inductorium.

The described means for attenuating the atmosphere within the ray-tube is of advantage during continued use of the ray-tube—such as, for instance, in cases where from inattention and the like an overreduction of the gaseous attenuation has taken place under the use of the auxiliary cathode 12, heretofore described. In such cases the present provision affords a ready, rapid, and efficient means for increasing the attenuation of the atmosphere in the ray-tube to the required degree. In like manner a like rapid and convenient change can be made in the condition of the ray-tube in the different uses of the same in making successive examinations of the hand, the pelvis, &c.

With the active use of the described means for effecting an attenuation of the atmosphere of the ray-tube it is material to the rapid and proper operation of the same that the pivotal finger 16 of the secondary cathode 12 be swung back into a dormant position, so that no spark-gap can form between the point of such finger and the terminal 17 of the main cathode 4.

The operation of the present invention is as follows: When it is desired to reduce the attenuation of the gas within the ray-tube in a rapid and effective manner, connection is made in a direct manner between the negative pole of the inductorium and the auxiliary cathode 12 13 by means of the connecting-eye 15, and at the same time the positive pole of the inductorium is connected with the external terminals of the main and secondary anodes 2 and 3. Connected in the manner described, the auxiliary anode 18 is entirely out of circuit and in a dormant condition, the main and secondary anodes 2 and 3 act simply as a conductor for the positive flow of electricity, and the auxiliary cathode 12 13 acts as a conductor for the negative flow of electricity and under such flow will give forth a portion of its contained or occluded gas in a gradual manner until the proper reduction in the attenuation of the gas within the ray-tube has been attained and involving a period of time ranging from one-half a second to two or more seconds. Where a very gradual reduction is desired, the same may be attained by means of the well-known spark-gap herein shown and described, and in which case the direct connection above described between the positive pole of the inductorium and the eye or external terminal of the auxiliary cathode 12 13 will not be used. On the other hand, when it is desired to increase the attenuation of the gas within the ray-tube connection is made in a direct manner between the positive pole of the inductorium and the outside terminal of the auxiliary anode 18, and at the same time the negative pole of the inductorium is connected with the external terminal 17 of the main cathode 4. Connected in the manner described, the auxiliary cathode 12 13 is entirely out of circuit and in a dormant condition, the main cathode 4 acts simply as a conductor for the negative flow of electricity, and the auxiliary anode 18 acts as a conductor for the positive flow of electricity and under such flow will absorb gas from the interior of the ray-tube to attain the desired increased attenuation and involving a period of time from one to five or more minutes.

During the normal operation of the ray-tube both the auxiliary anode 12 13 and cathode 18 will be out of circuit and in a dormant condition.

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

1. In a ray-tube of the character described, a main tube provided with anode and cathode terminals, an auxiliary tube provided with an auxiliary anode-terminal adapted to absorb the gaseous atmosphere of the ray-tube, substantially as set forth.

2. In a ray-tube of the character described, a main tube provided with anode and cathode terminals, an auxiliary tube, an auxiliary anode-terminal arranged in the auxiliary tube, and adapted to absorb the gaseous atmosphere of the ray-tube, an auxiliary cathode arranged within the auxiliary tube, a body adapted to emit gaseous products arranged within the influence of such auxiliary cathode, and means for controlling the discharge through such auxiliary anode and cathode, substantially as set forth.

3. In a ray-tube of the character described, a main tube provided with anode and cathode terminals, an auxiliary tube, an auxiliary anode-terminal arranged in the auxiliary tube, and adapted tc absorb the gaseous atmosphere of the ray-tube, an auxiliary cathode arranged within the auxiliary tube, a body adapted to emit gaseous products arranged within the influence of such auxiliary cathode, and a spark-gap arranged between the auxiliary cathode and the terminal of the main cathode, substantially as set forth.

4. In a ray-tube of the character described, a main tube provided with anode and cathode terminals, an auxiliary tube provided with a cross-partition, an auxiliary anode-terminal arranged in the auxiliary tube and adapted to absorb the gaseous atmosphere of the ray-tube, an auxiliary cathode arranged within the auxiliary tube, a body adapted to emit gaseous products arranged within the influ-

ence of such auxiliary cathode, and means for controlling the discharge through such auxiliary anode and cathode, substantially as set forth.

5. In a ray-tube of the character described, a main tube provided with anode and cathode terminals, an auxiliary tube provided with a cross-partition, an auxiliary anode-terminal arranged in the auxiliary tube and adapted to absorb the gaseous atmosphere of the ray-tube, an auxiliary cathode arranged within the auxiliary tube, a body adapted to emit gaseous products arranged within the influence of such auxiliary cathode, and a spark-gap arranged between the auxiliary cathode and the terminal of the main cathode, substantially as set forth.

6. In a ray-tube of the character described, a main tube provided with anode and cathode terminals, an auxiliary tube provided with a cross-partition and individual passages from either side of said partition, an auxiliary anode-terminal arranged in the auxiliary tube and adapted to absorb the gaseous atmosphere of the ray-tube, an auxiliary cathode arranged within the auxiliary tube, a body adapted to emit gaseous products arranged within the influence of such auxiliary cathode, and means for controlling the discharge through such auxiliary anode and cathode, substantially as set forth.

7. In a ray-tube of the character described, a main tube provided with anode and cathode terminals, an auxiliary tube provided with a cross-partition and individual passages from either side of said partition, an auxiliary anode-terminal arranged in the auxiliary tube and adapted to absorb the gaseous atmosphere of the ray-tube, an auxiliary cathode arranged within the auxiliary tube, a body adapted to emit gaseous products arranged within the influence of such auxiliary cathode, and a spark-gap arranged between the auxiliary cathode and the terminal of the main cathode, substantially as set forth.

Signed at Chicago, Illinois, this 20th day of June, 1902.

THEODOR FRIEDLANDER.

Witnesses:
HENRY A. NOTT,
ROBERT BURNS.