1,643,453

Sept. 27, 1927.

G. HOLST

X-RAY TUBE

Filed Aug. 25. 1925

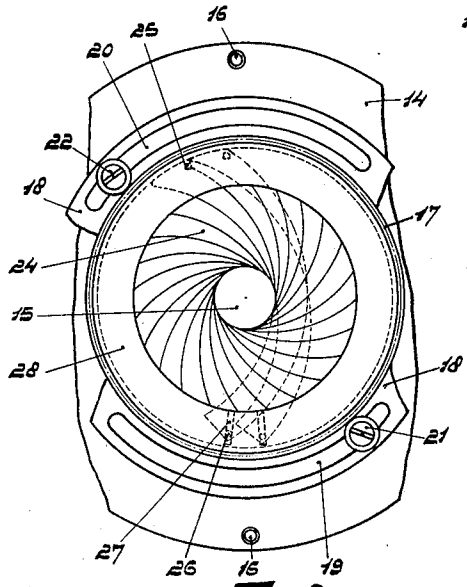


Fig. 2.

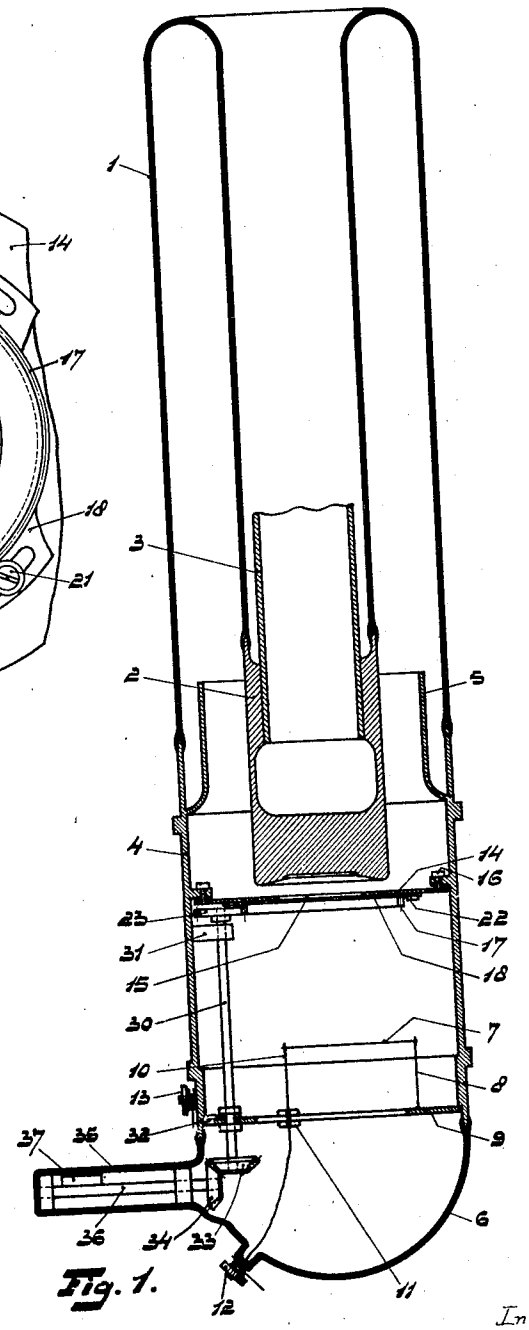


Fig. 1.

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UNITED STATES PATENT OFFICE.

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X-RAY TUBE.

Application filed August 25, 1925, Serial No. 52,399, and in the Netherlands November 20, 1924.

This invention relates to an improvement in or modification of that described in specification No. 1,626,465 issued April 26, 1927, and is concerned with incandescent cathode X-ray tubes, more particularly with such as described in the above-mentioned United States Letters Patent.

In X-ray tubes according to the prior specification the incandescent cathode is arranged within a metal vessel the wall of which forms wholly or partly part of the outer wall of the tube and from which the auticathode is separated by an insulation capable of resisting the operating voltage to be supplied between the incandescent cathode and the anticathode, the metal vessel and the anticathode being so shaped and so arranged relatively to each other that the cathode rays can strike the anticathode only on a limited surface.

According to the prior specification, in order to realize the latter object the metal vessel may be narrowed on the side of the anticathode to an aperture for the passage of the cathode rays, that part of the surface of the anticathode which is struck by the cathode rays, being located in or near said aperture.

According to the present invention, the aperture of the metal vessel is made regulable. By changing the size of the aperture, the size of the focus, that is to say the size of that part of the surface of the anticathode which is struck by the cathode rays, is also modified.

X-ray tubes according to this invention offer therefore the advantage that they can be used for different purposes. The same tube can be used, for example, for taking radiographs (small focus) and for irridiation (large focus).

For making the aperture of the metal vessel for the passage of the cathode rays regulable, many different constructions may be used. According to this invention a rotary member provided with means for regulating the aperture, may be arranged against the wall of the metal vessel on the side of the incandescent cathode. For moving the said rotary member, a movable member may be provided which can be moved by magnetic influence from outside the tube.

The accompanying drawing illustrates, by way of example, a construction of an X-ray tube according to the present invention, in which drawing

Figure 1 is a section through the axis of the tube and

Figure 2 represents on an enlarged scale part of the device for regulating the aperture in the metal vessel.

The X-ray tube illustrated consists of a double-walled glass tube 1 to the ends of which an anticathode 2 and a metal vessel 4 are hermetically sealed. The anticathode 2 is provided with a metal tube 3 which serves to supply a cooling liquid. The metal vessel 4 carries a cylindrical wall 5 which protects the seal between the glass vessel 1 and the metal vessel 4.

To the other end of the metal vessel 4 is sealed a glass closing piece 6, an incandescent cathode 7 being mounted within the metal vessel 4 on pole wires 8 and 10 which rest on a metal table 9. The pole wire 8 is electrically connected to the metal table whereas the pole wire 10 is insulated therefrom by a bead 11 of quartz or similar insulating material. Terminals 12 and 13 serve to supply current to the incandescent cathode. To the metal vessel 4 is further connected a metal disc 14 which has an aperture 15 and is so arranged that the mirror of the anticathode 2 is located near the said aperture. For regulating the size of the aperture 15 an iris diaphragm has been provided.

Against the bottom surface of the metal disc 14 is provided a metal ring 18 held by screws 21 and 22 (see Figure 2) which are secured in the disc 14. The ring 18 to which lamellæ 24 are secured by means of pins 26 can be turned backwards and forwards through a certain distance and is provided for this purpose with circular slots 19 and 20 through which pass the screws 21 and 22. The ring 18 is provided with a gear 17 with which meshes a gear wheel 23, mounted on one end of a spindle 30 which can turn in bearings 31 and 32 and in the metal table 9. At its other end the said spindle is provided with a conical gear wheel 33 which meshes with a conical gear wheel 34, mounted on a spindle 36 which can turn in a glass tube 35. The spindle 36 has an iron projecting part 37 so that from the exterior by magnetic influence the spindle can be turned backwards and forwards. The rotation of

the spindle 36 causes the metal ring 18 to rotate owing to which the size of the aperture 15 increases or decreases. The metal disc 14 is provided for this purpose with metal pins 25 on which can pivot semicircular lamellæ 24. At the other end these lamellæ are provided with small pins 26 which can turn and can slide to and fro in grooves 27 provided in the ring 18. When the ring 18 turns, the lamellæ 24 are consequently carried along, owing to which the size of the aperture 15 either increases or decreases.

An X-ray tube according to the present invention may be highly evacuated in any known manner or may have a gaseous filling consisting of hydrogen or helium at such a pressure that any detrimental ionization does not occur. In the case of hydrogen this pressure may be, for example, 0,01 mm. of mercury.

When operating an X-ray tube as illustrated a high tension is supplied between the metal vessel 4 and the anticathode 2. The electrons emanating from the incandescent cathode, are drawn by the electric field towards the anticathode. The shape of the vessel 4 with the disc 14 and the aperture 15, and the arrangement of the anticathode mirror near said aperture cause the cathode rays to strike only a limited surface of the anticathode. The size of this surface is regulated by modifying the size of the aperture 15. The X-rays generated pass through the aperture 15, through the aperture in the table 9 and leave the tube through the glass closing piece 6. Undesired X-rays are absorbed by the wall of the metal vessel 4 which, preferably, consists of chrome-iron.

What I claim is:—

1. An incandescent cathode X-ray tube in which the incandescent cathode is arranged within a metal vessel the wall of which wholly or partly forms the outer wall of the tube and from which the anticathode is separated by an insulation capable of resisting the operating voltage to be supplied between the incandescent cathode and the anticathode and in which the metal vessel adjacent the anticathode is narrowed to an aperture for the passage of the cathode rays, that part of the surface of the anticathode which is struck by the cathode rays being located in or near the said aperture characterized in that the aperture in the metal vessel for the passage of the cathode rays is regulable.

2. An X-ray tube according to claim 1, characterized by a rotary member arranged against the wall of the metal vessel adjacent the incandescent cathode and provided with means for regulating the size of the aperture for the passage of the cathode rays.

3. An X-ray tube according to claim 1, characterized by a rotary member arranged against the wall of the metal vessel adjacent the incandescent cathode and provided with means for regulating the size of the aperture for the passage of the cathode rays, said rotary member being moved by a member which in its turn can be moved by magnetic influence from outside the tube.

In testimony whereof I affix my signature, at the city of Eindhoven, this 10th day of August, 1925.

GILLES HOLST.