

[54] X-RAY TUBE

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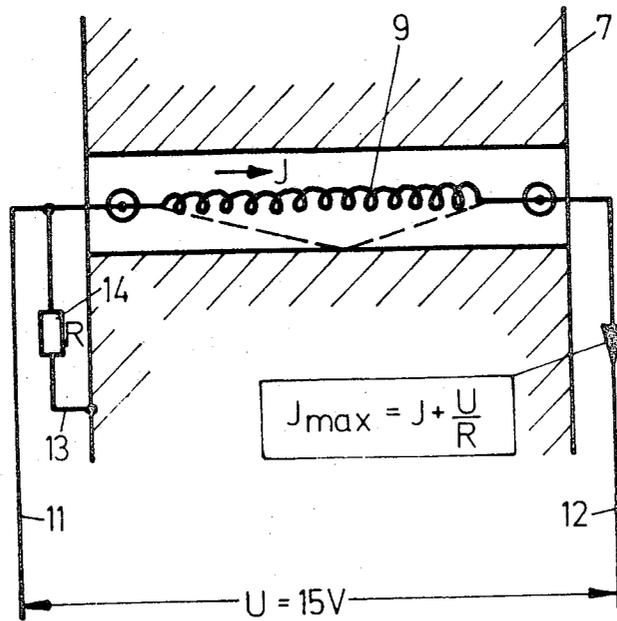
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[57] ABSTRACT

An X-ray tube has a glow cathode which is surrounded by a focussing device electrically connected therewith. The invention is particularly characterized in that the connection of the cathode with the Wehnelt cylinder serving as the focussing device includes a current limiting resistance.

3 Claims, 3 Drawing Figures



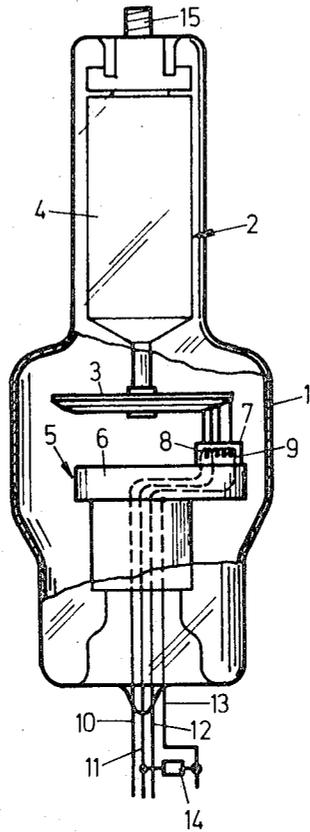


Fig. 1

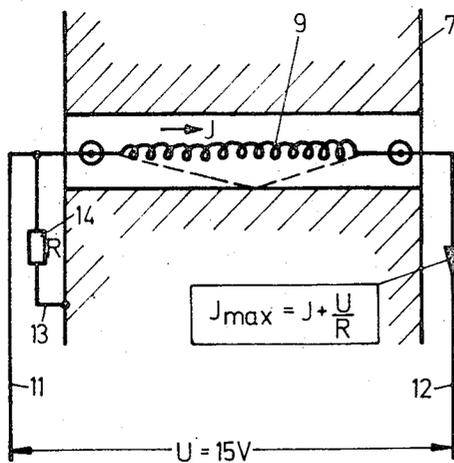


Fig. 2

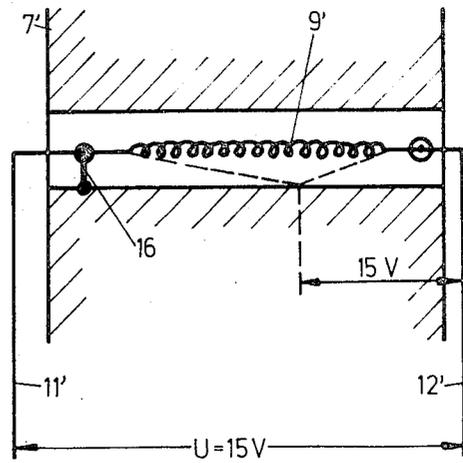


Fig. 3

## X-RAY TUBE

This invention relates to an X-ray tube with a glow cathode.

Most of the presently used X-ray tubes are operated by a glow cathode in order to provide rays which are sufficiently strong for the intended uses, particularly for medical diagnosis and therapy.

Glow cathodes of X-ray tubes are now made as winders and thus have the shape of a helical screw which can be of substantial length. When the rotary anodes are operated at high speeds a glow cathode winder of this type begins to swing and occasionally strikes the other cathode body connected with one end of the swing, particularly the body which is constructed as the so-called Wehnelt cylinder used for focussing the electrons upon the anode. In that case a conducting connection can arise through which a current will flow which can be so strong that the swing will be soldered on, since from a connection of the heating current to the place of contact constituting the other connection, only a part of the swing is effective. This produces a drop in the resistance so that the current flowing through the tube will be increased and the anode will become unuseable due to the overcharging of the diminished focal point.

An object of the present invention is to provide means which will remove this danger or at least eliminate its consequences to the greatest possible extent.

Other objects will become apparent in the course of the following specification.

In the accomplishment of the objectives of the present invention it was found desirable to include a current limiting resistance in the connection of the cathode with the Wehnelt cylinder serving as the focussing device. This resistance prevents a short circuit which would otherwise take place if the glow cathode would strike a part of the Wehnelt cylinder forming the cathode body. The flowing current is maintained so small that it is not sufficient to provide a soldering of the glow cathode to the anode body. As a rule, in the case of tubes now in use a resistance of 100 to 500 ohms is sufficient. However, the amount of the resistance is not critical, since the resistance only serves, on the one hand, to apply the potential to the part of the cathode serving as the Wehnelt cylinder and, on the other hand, to prevent the flow of a high current when the glow cathode swings to the body. In case of tubes having several, such as two, glow cathodes hanging upon each other, it is advantageous to add the resistance in connection with the mass, since then safety is provided for both glow cathodes.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawing showing by way of example only, a preferred embodiment of the inventive idea.

In the drawing:

FIG. 1 is a side view, partly in section, of a rotary anode X-ray tube having two cathodes and constructed in accordance with the present invention.

FIG. 2 is an enlarged diagrammatic view showing the

arrangement of the cathode according to the present invention.

FIG. 3 is a similar view but illustrates a prior art arrangement of the cathode.

FIG. 1 shows a vacuum glass container 1 which includes in the usual manner the anode device 2 consisting of an anode plate 3 of heavy meltable metal and a rotor 4 mounted on balls. The cathode device 5 is located at the opposite end of the container 1; it consists of a metal casing 6 upon which a Wehnelt cylinder 7 serving as the focussing device, is applied opposite the focal spot paths of the anode plate 3, the cylinder 7 containing the two glow cathodes 8 and 9. The heating voltage for the cathode 8 is supplied between the lines 10 and 11 and the heating voltage for the cathode 9 is supplied between the lines 11 and 12. The casing 6 lies through the line 13 at the mass. The resistance 14 of 200 ohms provided in accordance with the present invention is introduced between the lines 11 and 13.

In order to operate the X-ray tube a voltage, for example 75 kV, required for producing X-rays, is connected between the lines 11 and 13. A heating voltage of about 15 V is additionally inserted between the lines 11 and 12 to switch on the glow cathode 9 and to produce an intensity of rays sufficient for illumination. In addition the usual stator is applied from the outside at the container 1 opposite the rotor 4, which will start the rotation of the rotor 4 and thus of the anode 3. Then electrons leaving the glow cathode 9 are reproduced upon the anode 3 through the cylinder 7 which lies upon the cathode potential through the connection with the resistance 14. If as the result of swinging the winder of the glow cathode 9 strikes the focussing Wehnelt cylinder 7, then, as shown in FIG. 2, the heating current is transmitted through the remaining part of the winder of the cathode 9 and the resistance 14. Then the current is limited to such an extent that the winder 9 will not be soldered.

FIG. 3 shows that conditions are different in a prior art construction. There when the glow cathode 9' swings upon the Wehnelt cylinder 7', the line 11' will establish contact through the line 16 with the rest of the cathode 9' which remains for the line 12'. Then the entire heating voltage of 15 V lies upon the reduced resistance of the smaller cathode which will be heated to a greater extent. Due to the increased emission of electrons the anode will be overloaded, as has been described already.

I claim:

1. An X-ray tube, comprising a glow cathode, a focussing device consisting of a Wehnelt cylinder and means electrically connecting said cathode with said cylinder and comprising a current limiting resistance.

2. An X-ray tube in accordance with claim 1, wherein said resistance ranges between 100 and 500 ohms.

3. An X-ray tube in accordance with claim 1, comprising two glow cathodes constituting winders, said means having a point interconnecting the two winders, said resistance being located between said point and said cylinder.

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