Dec. 14, 1926. 1,610,863

G. C. KUCHER

X-RAY TUBE

Filed Feb. 9, 1924

Fig. 1.

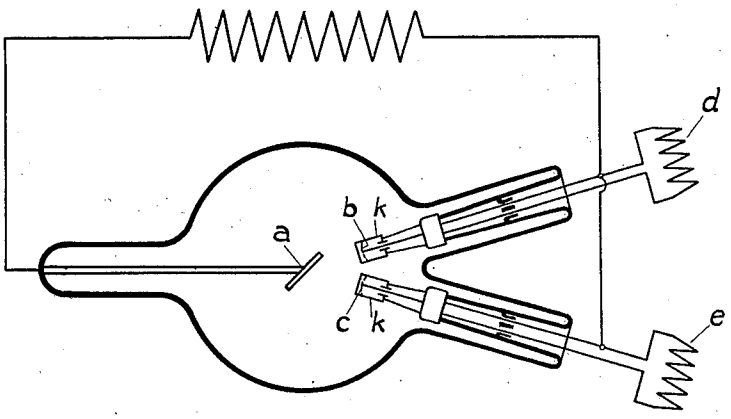


Fig. 2.

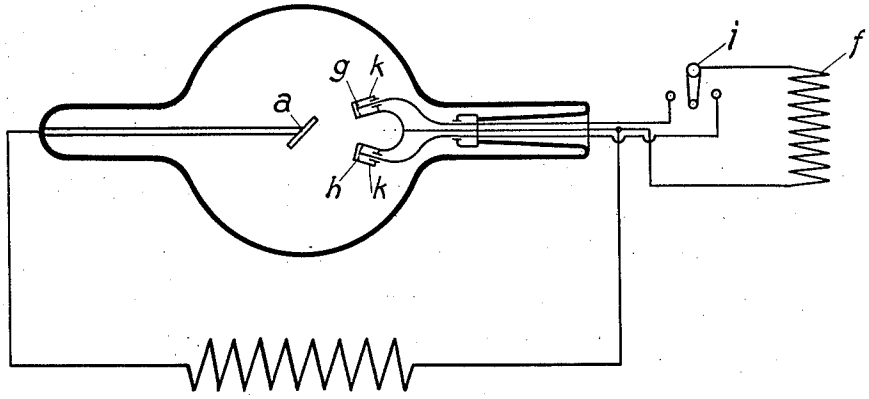


Fig. 3.

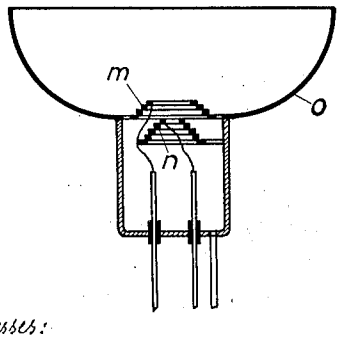


Fig. 4.

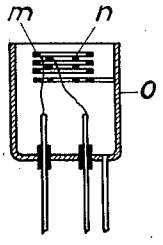
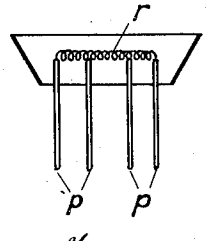


Fig. 5.



Witnesses:

E. Thalley

A. Wolfenbarger

Inventor:

George Kucher

Patented Dec. 14, 1926. 1,610,863

UNITED STATES PATENT OFFICE.

GEORG CONRAD KUCHER, OF VIENNA, AUSTRIA, ASSIGNOR TO THE FIRM PHÖNIX RÖNTGENRÖHREN-FABRIKEN, OF RUDOLSTADT, GERMANY.

X-RAY TUBE.

Application filed February 9, 1924, Serial No. 691,844, and in Germany February 16, 1923.

In order to obtain sharp X-ray projections revealing as much detail as possible, for instance in screen examinations, the X-ray apparatus is so arranged that the focus or source of X-rays, i. e. that portion of the surface of the anticathode upon which the cathode rays impinge, is of small area, say only one and a half to three millimetres in diameter. Such precision focussing is possible in screen examinations since for this purpose the current strength of the electric discharge through the X-ray tube need not exceed three to eight milli-amperes.

But if it were attempted to make X-ray photographs with such a precision tube the comparatively large discharge current necessary for this purpose would overload the small focal spot on the target and the tube would be destroyed. There is a hitherto unsatisfied demand for X-ray tubes which can be used either for exact screen examinations or for making photographic exposures with a discharge current of up to one hundred milli-amperes.

The present invention relates to an incandescent cathode X-ray tube designed to fill this need.

Certain forms of construction of Röntgen tubes embodying the invention, in some cases with a diagram of their connections, are illustrated diagrammatically in the accompanying drawings wherein Figure 1 is a diagrammatic view of one form of the invention; Figure 2 is a similar view of a slightly different form; and Figures 3, 4 and 5 are views of different forms of concentrating devices employed.

Figure 1 shows a highly evacuated bulb containing an anti-cathode *a* and two incandescent cathodes *b* and *c* each of which is supplied with heating current from a transformer *d* or *e* and can be regulated independently of the other. One of these incandescent cathodes, say *b*, is constructed for precision purposes, i. e. it is so formed that the rays directed by it upon the anticathode *a* are focussed upon a small area. The other incandescent cathode *c*, the heavy load cathode, on the contrary focusses its projected rays upon an area of the anti-cathode markedly larger than the first-named area so that the anode is not unduly overloaded even by the maximum discharge current. Either cathode *b* or cathode *c* is supplied with heating current according to the purpose for which the X-ray tube is to be used and so is rendered active.

To make one source of heating current serve for both cathodes *g* and *h* a switch *i* may be provided, as shown in Figure 2, by which either of the cathodes may be connected with a source *f* of heating current.

It is not necessary that each incandescent cathode should have its own concentrating device *k*. Instead two or more spiral incandescent wires *m* and *n* may be arranged within a single concentrating device *o* (Figure 3) in such fashion that the cathode rays from one or more incandescent wires pass beside one or more other incandescent wires; an alternative construction with helical incandescent wires is shown in Figure 4.

Further, parts of one and the same incandescent wire may be used as the two or more cathodes, the current connections *p* for the several cathodes being connected to different parts of one and the same incandescent wire *r* as shown in Figure 5.

The high vacuum which only permits passage of current on account of the cathode being made incandescent causes the cathode ray emission to be confined to the filament which is for the time being incandescent.

What I claim is:

1. In an X-ray device, a highly evacuated envelope, an anode therein, two or more cathodes adapted to be heated to incandescence independently from one another, and means for focusing a discharge from the said cathodes respectively on areas of markedly different size on the surface of the anode.

2. In an X-ray device, a highly evacuated envelope, an anode therein, two or more cathodes adapted to be heated to incandescence independently from one another, and means for focusing a discharge from each cathode to the exclusion of the other on areas of markedly different sizes on the surface of said anode.

3. An X-ray device comprising the combination of an envelope the space within which is highly evacuated, an anode, two or more cathodes adapted to be heated to incandescence, means for focusing a discharge from the said cathodes respectively on areas of markedly different size on the surface of the anode, and means for supplying each of the cathodes from a separate source of heating current respectively.

4. An X-ray device comprising the com-

bination of an envelope the space within which is highly evacuated, an anode, two or more cathodes adapted to be heated to incandescence, means for focusing a discharge from the said cathodes respectively on areas of markedly different size on the surface of the anode, a common source of heating current, and means for connecting the same alternately to any one or the other of the said cathodes.

5. In an X-ray device, an envelope the space within which is highly evacuated, an anode, two or more cathodes adapted to be heated to incandescence independently from one another, a cathode including one or more cathode filaments, the conductors of the heating current supply joining one and the same cathode at different points, thus dividing the cathode filament in a number of portions each of which may be heated independently from the others.

In witness whereof I have hereunto set my hand this 15th day of January, 1924.

GEORG CONRAD KUCHER.