March 21, 1933. A. UNGELENK ET AL 1,902,474

PROTECTIVE COVER FOR X-RAY TUBES

Filed April 11, 1930

Fig. 1.

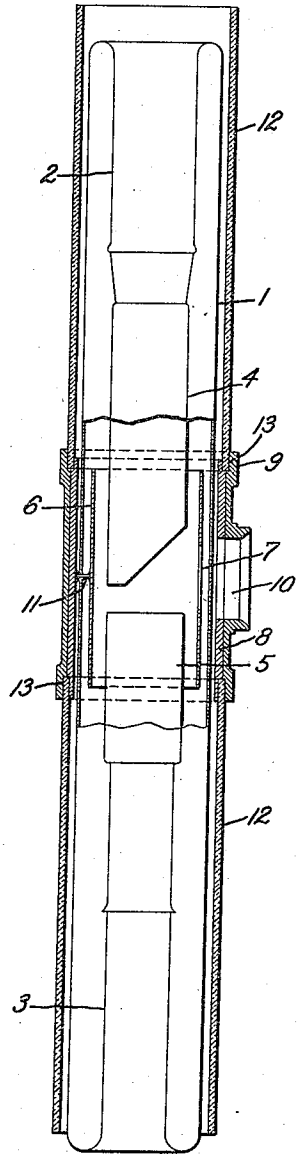
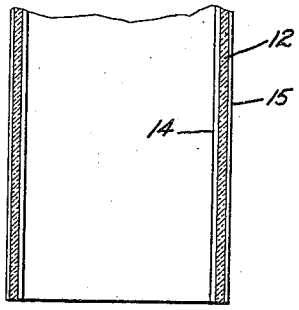


Fig. 2.



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Their Attorney.

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UNITED STATES PATENT OFFICE

ALFRED UNGELENK AND WALTER HOFMANN, OF THURINGIA, GERMANY, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

PROTECTIVE COVER FOR X-RAY TUBES

Application filed April 11, 1930, Serial No. 443,588, and in Germany April 19, 1929.

The present invention relates to X-ray apparatus, more particularly to the tube covering which serves as a protection against X-rays.

Notwithstanding the fact that the anode of an X-ray tube is designed to constrain the rays to a predetermined direction, there are usually present stray rays, which, unless absorbed, may cause burns and other harmful effects to the operator. In order to absorb those undesired rays which are propagated radially of the tube, it is customary to position a metallic cylinder which is opaque to X-rays as near as possible to the discharge zone, i. e. closely surrounding the space between the anode and cathode, the cylinder having an opening through which the desired rays may pass. Along the exterior surface of the tube there may also be arranged one or more metallic sleeves, ordinarily concentric and in longitudinal alignment with the inner cylinder and provided with a window which registers with the opening in the inner cylinder. The rays emitted in other directions than the desired one may be absorbed by a cover which extends substantially the entire remaining length of the tube and is held in position preferably by the metal sleeve. The present invention is directed to an improved construction of this covering member.

In view of the fact that high voltages are applied between the anode and cathode of an X-ray tube, it is evident that the insulation properties of the covering member must meet high requirements under all conditions of temperature and must also be able to withstand concentrated electrical stresses. It has been proposed heretofore to employ for the covering material a phenolic condensation product, but this material has not been found to be suitable in all climates, particularly in tropical climates.

In accordance with our invention, we propose to substitute for the phenolic condensation material a vitreous or vitrifiable substance such as porcelain which has been found to be a reliable insulator even under the most adverse conditions. In order to give the porcelain body a sufficient X-ray absorbing effect, we propose to apply to the inner or outer surfaces thereof or both, a tenaciously adherent layer of high atomic material preferably in the form of a glaze or enamel. The invention will be better understood when reference is made to the following specification and the accompanying drawing in which Fig. 1 shows partly in section and partly in diagram an X-ray tube improved in accordance with the principles of the invention, while Fig. 2 is an enlarged fragmentary view.

In the drawing, numeral 1 designates the glass envelope of an X-ray tube terminating in reentrant stems 2, 3, which constitute a support for the anode 4 and cathode 5 of usual and well known design. The discharge zone between the electrodes is surrounded by a cylinder 6 of a suitable refractory metal which is provided with an opening 7 through which the X-rays emerge. On the exterior of the tube and in opposed relation to the cylinder 6 there is an apertured jacket 8 of lead or equivalent metal for absorbing the radially directed rays which may pass through the cylinder 6 and the glass wall of the envelope. The jacket is fitted within a metallic casing 9 of brass or the like which may serve as a support for the apparatus in the well understood manner. The casing is provided with an opening 10 which registers with the opening in the jacket 8 and in the cylinder 6. In order to maintain the latter substantially at ground or other desired potential there may be provided one or more conductors 11 sealed in the envelope and connecting the cylinder 6 to the outer metal members. These conductors, if sufficiently stiff, may serve to support the cylinder.

The covering which constitutes the subject of our invention may take the form of elongated cylinders or sleeves 12, having sufficient thickness to offer rigidity of shape and secured at their inner edges in any suitable manner within a circular slot 13 formed between the lead jacket and the brass casing 9, as shown. The covering preferably is somewhat larger in diameter than the envelope and is so mounted as to present an annular air space between the members along their

entire length for ventilation purposes. In accordance with our invention, the cover 12 is made of porcelain and is coated on the interior, i. e. the surface adjacent the envelope, with a substance designed to absorb X-rays. This substance may be lead oxide or uranium oxide conveniently applied as a glaze. The exterior surface of each porcelain cylinder may also be treated with a lead oxide or uranium oxide preparation but it is found sufficient and preferable to apply simply a high voltage glaze of suitable and well known material such as is ordinarily employed in the manufacture of high voltage insulators. The interior and exterior glazes or coatings are designated in Fig. 2 by reference characters 14 and 15 respectively.

What we claim as new and desire to secure by Letters Patent of the United States is:—

1. X-ray apparatus comprising an evacuated envelope containing an anode and cathode, a metallic cylinder within the envelope surrounding the discharge zone, a metallic cylinder arranged on the exterior of the envelope and substantially in alignment with the inner cylinder, and a plurality of porcelain sleeves surrounding the envelope and secured to the exterior cylinder, said sleeves being coated with uranium oxide.

2. X-ray apparatus comprising an evacuated envelope containing an anode and a cathode, a metallic cylinder within the envelope surrounding the discharge zone, a metallic cylinder arranged on the exterior of the envelope and substantially in alignment with the inner cylinder, and a plurality of porcelain sleeves surrounding the envelope and secured to the exterior cylinder, said sleeves being coated with an X-ray absorbing material.

3. X-ray apparatus comprising an evacuated envelope containing an anode and a cathode, a metallic cylinder within the envelope surrounding the discharge zone, a metallic cylinder arranged on the exterior of the envelope and substantially in alignment with the inner cylinder, and a plurality of porcelain sleeves surrounding the envelope and secured to the exterior cylinder, said sleeves being coated on the interior with an X-ray absorbing material and on the exterior with an insulating material.

In witness whereof, we have hereunto set our hands this 31st day of March, 1930.

ALFRED UNGELENK.
WALTER HOFMANN.