Patented Apr. 19, 1927. 1,625,426

UNITED STATES PATENT OFFICE.

HARVEY C. RENTSCHLER AND JOHN W. MARDEN, OF EAST ORANGE, NEW JERSEY, ASSIGNORS TO WESTINGHOUSE LAMP COMPANY, A CORPORATION OF PENNSYLVANIA.

TARGET FOR X-RAY TUBES.

No Drawing. Application filed December 21, 1920. Serial No. 432,326.

This invention relates to anti-cathodes or targets for Röntgen or X-ray tubes, more especially to rare metals which are peculiarly adapted for such purpose.

It has been recognized for a long time that the intensity of the X-rays generated in devices of this character is dependent upon the atomic weight of the anti-cathode or target. It is well known that the greater the atomic weight of the target, the greater is the intensity of the X-rays emanating from the target. Kaye has arranged the metals having high atomic weights and which are suitable for X-ray targets on the basis of 100 for platinum as follows, the values for uranium and thorium being calculated:

Uranium	125
Thorium	120
Gold	101
Platinum	100
Iridium	98
Osmium	97
Tungsten	91
Tantalum	90

Of these metals, gold is unsuitable owing to its low melting point. Platinum, iridium and osmium are practically eliminated on account of the scarcity of these metals. Uranium and thorium have not been used heretofore because it has been impossible to prepare them in a form suitable for anti-cathodes.

Many attempts have been made to produce the heavier rare metals, such as thorium and uranium, in pure, coherent, metallic form suitable for targets and for other purposes, but such efforts have uniformly been unsuccessful. So far as we are aware, no one hitherto has succeeded in producing these metals in pure, coherent, metallic form, although the powders of such metals are well known. It is especially difficult to obtain metallic uranium in its pure, coherent form since it oxidizes very readily in the air and interacts with gases, such as oxygen, hydrogen, water vapor, and the like, with great ease.

We have recently discovered that various refractory metals, such as uranium and thorium, may be readily obtained by sintering the substantially pure metal powders in a furnace of special construction, under suitable conditions. We have also found that, under suitable conditions, these metals may be produced in this furnace by heating the hydrides in a high vacuum and at a high temperature in such manner as to cause complete dissociation and ultimate sintering to solid, coherent metal with or without the metal passing through the molten condition. The furnace is described and claimed in Rentschler Patent 1,480,301, granted Jan. 8, 1924, on furnaces, and assigned to the Westinghouse Lamp Company. The method employed in the production of such coherent metals and the products obtained thereby are described and claimed in our copending application, Serial No. 432,325, filed December 21, 1920, on a method of sintering metals, and assigned to the Westinghouse Lamp Company.

In accordance with the method set forth, we generally prefer to mold or compress a disk or pellet of metal powder, such as uranium or thorium, and place the same in a crucible or on a sheet of molybdenum or tungsten which is inserted within a closely wound coil in an evacuated chamber. High-frequency current is passed through the coil which acts as a primary, inducing secondary currents in the crucible or sheet and the pressed disk of metal powder, sintering the same and forming pure, coherent, metallic uranium or thorium.

Thorium has a melting point in the neighborhood of 2020° to 2030° C. Uranium and thorium have the highest atomic weights known, namely 232 and 238.5, respectively. The intensity of emission of X-rays from these metals is in the neighborhood of 20% to 25% greater than the intensity of emission of rays from platinum. We believe that we are the first to have obtained satisfactory X-ray targets which have atomic weights above 200.

X-ray targets of thorium and uranium are eminently suitable for ray emission since their melting points are comparatively high and their atomic weights are among the highest known. They are far superior to the metal tungsten previously in common use.

We do not wish to restrict ourselves to the use of the pure metals alone as X-ray targets, but we may use alloys or mixtures of uranium with thorium or either of these

metals with other metals. If desired, the X-ray tube may be filled with an inert gas, such as argon, helium, and the like.

We claim as our invention:

1. In an X-ray tube, a target of coherent metal having an atomic weight between 230 and 240.

2. In an X-ray tube, a target of dense coherent metallic thorium.

3. In an X-ray tube, a target of substantially pure coherent metallic thorium.

4. An anticathode comprising a coherent metal having an atomic weight between 230 and 240.

5. An anticathode comprising coherent, metallic thorium.

6. An anticathode comprising substantially pure, coherent, metallic thorium.

7. A target for X-ray tubes and the like consisting partly of a substantially pure, coherent metal having an atomic weight above 230.

8. A target for X-ray tubes and the like consisting of a substantially pure, coherent metal having an atomic weight above 230.

9. A target for X-ray tubes and the like consisting partly of substantially pure, coherent thorium.

10. A target for X-ray tubes and the like consisting of substantially pure, coherent thorium.

In testimony whereof, we have hereunto subscribed our names this 15th day of December, 1920.

HARVEY C. RENTSCHLER.
JOHN W. MARDEN.