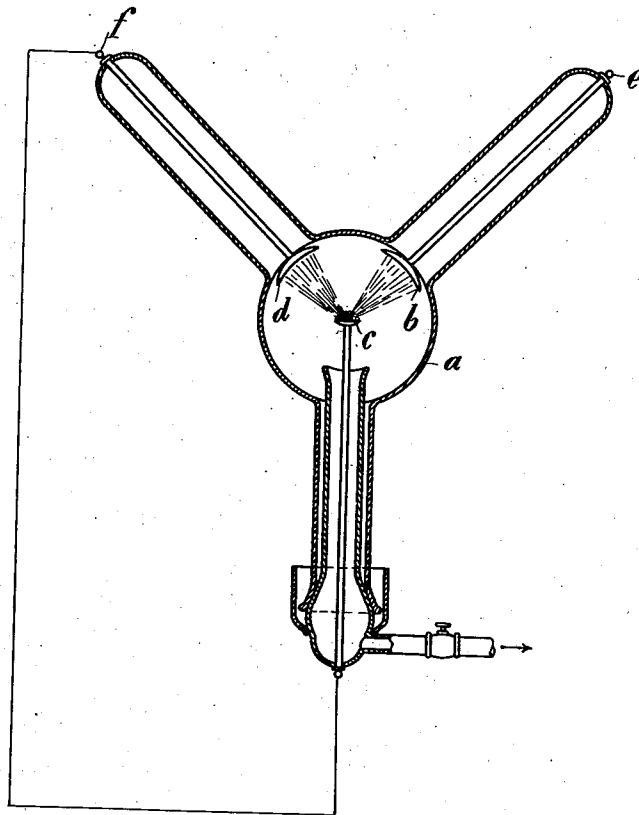


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PROCESS FOR OBTAINING RADIO ACTIVE BODIES FROM URANIUM OR THORIUM, &c.
APPLICATION FILED JAN. 28, 1908.

917,191.

Patented Apr. 6, 1909.



Witnesses:
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Inventor:
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UNITED STATES PATENT OFFICE.

ADRIAAN P. H. TRIVELLI, OF SCHEVENINGEN, NETHERLANDS.

PROCESS FOR OBTAINING RADIO-ACTIVE BODIES FROM URANIUM OR THORIUM, &c.

No. 917,191.

Specification of Letters Patent.

Patented April 6, 1909.

Application filed January 28, 1908. Serial No. 413,035.

To all whom it may concern:

Be it known that I, ADRIAAN P. H. TRIVELLI, gentleman, and a subject of the Queen of Netherlands, a resident of 8 Leuvensestraat, in the city of Scheveningen, Netherlands, have invented a certain new and useful Process for Obtaining Radio-Active Bodies from Uranium or Thorium or from the Compounds of the Same, of which the following is a specification.

By the researches of Crookes it has become known, that uranium as it occurs in nature consists of two bodies, one of which, the pure uranium, emits alpha-rays only, while the other body which has been called by Crookes uranium-X emits also beta-rays and gamma-rays and is distinguished from uranium as regards both its chemical as well as its physical properties. Furthermore, it has been shown by Soddy and others, that uranium-X is formed by itself from pure uranium after extremely long periods of time, and that this conversion continues, inasmuch as from uranium-X other new bodies are formed which do not emit any rays originally, but after some time radio-activity is noticed again all forms of which produce the phenomenon of the radium or of the radium emanation. However, while the conversion of uranium particularly to uranium-X, takes place in very long periods of time only, I have found that this conversion can also be brought about by artificial means in a considerably shorter period of time. This acceleration of the conversion is effected by the action of beta-rays and gamma-rays of radio-active substances, or of Roentgen-rays for instance, the quickest way being the direct action of cathode-radiation in a tube in which a high vacuum is produced. The action is the more rapid and intense, the more the velocity of the cathode rays increases. For it has been found, that when uranium metal or uranium compounds are submitted for some time in a tube in which as perfect a vacuum as possible has been produced, to the action of cathode rays either on an anti-cathode or an anode, or to the action of Roentgen-rays at any point of the tube, a considerable liberation of gas takes place for some time, after the gases which have been occluded by the uranium, have escaped. When these gases are evolved, they are mostly accompanied by luminous phenomena, so that they agree with the well known alpha-rays of radio-active bodies.

The nature of these gases has thus far not yet been determined with certainty. At any rate they yield in the electric discharge in a Geissler-tube very characteristic colors 60 and probably consist of helium.

With the duration of the radiation and the continued evolution of gases, the electric properties of the tube as regards behavior in the electric discharge are gradually 65 changed both as far as intensity as well as the appearance of the phenomenon is concerned. This is due to the fact, that the uranium has changed its physical and chemical properties. The new substance is distinguished from the 70 original product by emitting beta-rays and gamma-rays and as regards its radio-active properties it agrees in all respects with the uranium-X separated from uranium and from its compounds. When the new prod- 75 uct is exposed to the action of the air for a short time, it becomes very quickly oxidized as distinguished from pure uranium. Being then brought back into the vacuum, it emits a magnificent, very powerful, bluish- 80 green fluorescence, visible in daylight. In the same manner as uranium-X the new body is transformed both by itself without any reagent and, still more quickly by repeating the radiation, into the radio-inactive 85 forms described and finally it is changed again to form new radio-active bodies the qualities of which correspond to those of radium. The same effects are produced, even without the employment of cathode 90 rays and Roentgen-rays by acting upon uranium or uranium compounds with the rays of radio-active substances, the conversion however in this case taking place slower than by means of the cathode rays. The 95 most rapid conversion was produced with the arrangement hereinafter described and illustrated by the accompanying drawing. In a tube *a* in which a very good vacuum has been produced by a mercury pump, an anti- 100 cathode *c* is arranged in the focus of the cathode *b*; the said anti-cathode consisting of platinum, nickel, tantalum or the like. This anti-cathode is short-circuited with the anode *d*. On the anti-cathode *c* uranium or 105 uranium compounds are placed, so as to present a large acting surface, preferably in very fine distribution, and the terminal *e* is connected to the negative and the terminal *f* to the positive pole of a strong inducing 110 apparatus. After allowing the radiation to go on for some days, while the gases evolved

are at the same time removed by pumping, the surface of the uranium is found to be transformed into uranium-X. By a renewed radiation of longer duration, the uranium-X is found to be transformed first into radio-inactive and finally into radio-active bodies again. When working in this manner, the action of the cathode rays can be increased by radio-active bodies, arranged above the anti-cathode, so as to produce a rapid transformation.

Similar to uranium and uranium-compounds is the behavior of thorium and of thorium compounds. With these substances an evolution of gas is also produced upon radiation, the thorium and the thorium compounds being transformed in this manner into a radio-active substance which by a radiation of longer duration is transformed again into radio-active substances with other qualities.

The uranium-X and the other radio-active substances which can be obtained according to this process are intended to be employed for medicinal purposes and for carrying out

reactions for which heretofore the expensive radium preparations obtained from the natural product, have been employed.

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

1. The process for producing radio-active bodies from uranium, thorium or from their compounds, which consists in exposing uranium, thorium or their compounds *in vacuo* to action of the cathode-rays, substantially as specified.

2. The process for producing radio-active bodies from uranium, thorium or from their compounds, which consists in simultaneously exposing uranium, thorium or their compounds, *in vacuo*, to the action of cathode-rays and of radio-active bodies, substantially as specified.

Signed by me this thirteenth day of January, 1908.

ADRIAAN P. H. TRIVELLI.

Witnesses:

L. Koot,

AUG. F. W. MAUCK.