Ce 128

Published May 11, 1943

Serial No. 395,760

ALIEN PROPERTY CUSTODIAN

TREATMENT OF TISSUE WITH THERAPEUTICALLY ACTIVE RAYS

Erwin Schopper, Dessau, and John Eggert, Leipzig, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 29, 1941

Our present invention relates to an improved method for treating tissue and the like particularly of the human body with therapeutically active rays.

It is known in therapeutics to use material rays such as α-rays and protons besides the X- and γ-rays. The therapeutical effect of those particles is very intensive owing to the short ranges of the radiations in the tissues of the body. As the particles have a low penetrating power, they are generally employed only for treating surfaces. It has, therefore, already been proposed to use neutrons in the penetrating therapy since these corpuscular rays when having a suitable speed are capable of penetrating the tissue and producing protons therein especially due to a reciprocal action on hydrogen atoms or effecting conversions in the nucleus with other atoms whereby therapeutically active α-particles, protons and/or γ-rays are emitted.

It is often necessary in the radiation therapy to impart topical effects to parts in the interior of the body to be treated with rays, for instance crossed fields are used, i. e. there is carried out a radiation with several thin bundles of rays emanating from different sides and meeting at the place to be affected. In using γ-rays it is often possible to bring the preparation producing γ-rays in the form of so-called needles or small tubings to the place to be exposed to rays of the tissue and thus to obtain an intensive topical effect of the rays.

The neutrons have properties somewhat different from those of the γ-rays as to absorption and scattering. Rapidly moving neutrons (energy>0.1 *e*MV) obtained by disruption or bombardment with ions or radioactice radiation of beryllium or boron, for instance, have a very great penetrating power. In addition to a slight absorption the neutrons are scattered in the tissues of the body, the scattering being effected to a relatively large extent in substances having atoms of low weight, especially hydrogen atoms. A bundle of neutrons penetrating the body, therefore, becomes strongly diffuse. Accordingly the known method using crossed fields does not produce the desired effect in this case.

Due to the scattering the neutrons undergo loss of energy, i. e. the velocity thereof is decreased. Slowly moving neutrons, however, have only a relatively low penetrating power. As is known, such neutrons when having certain velocities are extremely strongly absorbed by certain substances such as lithium, boron, gadolinium, cadmium, dysprosium, indium, rhodium, iridium, gold, silver, mercury or rhenium. By this absorption there is attained a conversion of the atom nuclei, lithium emitting α-particles, boron emitting α-particles and protons and the other substances mentioned above forming in addition to a γ-radiation radioactive disintegration products which emit electrons.

In accordance with our present invention a way for obtaining a higher topical neutron effect is as follows:

The velocity of the neutrons emanating from a source of neutrons as, for instance, a mixture of 10 g of beryllium and 0.5 mg of radium on a neutron tube is decreased by a layer containing hydrogen as, for instance, paraffin or water and having a suitable thickness (paraffin: 8 to 10 cm; water: a correspondingly thicker layer) determined on account of the co-agency of the penetrated tissue. Thus a great percentage of neutrons with a suitable low velocity (for instance 3 to 7 *e*MV; 25,000 neutrons/second) is obtained. These slow moving neutrons, especially adapted to act upon the substances mentioned above such as boron, cadmium or silver are caused to be absorbed by one of these substances, if desired, in the form of a chemical compound or by a mixture of alloy thereof in order to produce therapeutically active particles and γ-rays. The substances are brought in needles or small tubings into contact with the tissue to be exposed to the rays. Sometimes it is to be preferred to employ the absorbing substance in the form of an aqueous solution. An innoxious, if desired, colloidal solution of a boron or lithium salt may, for instance, be used for exposing to rays the inner coat of the stomach. The effect thus obtained is especially insensitive since the particles produced by the neutrons are capable of penetrating the tissue only few thousandths of a mm.

ERWIN SCHOPPER.
JOHN EGGERT.