Jan. 9, 1940. H. KALLMANN ET AL 2,186,757

PHOTOGRAPHIC DETECTION OF SLOWLY MOVING NEUTRONS

Filed March 24, 1938

Fig. 1

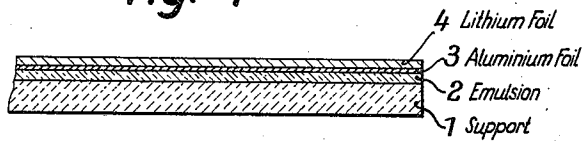


Fig. 2

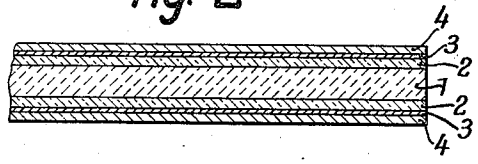


Fig. 3

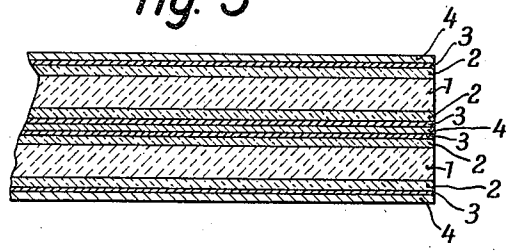
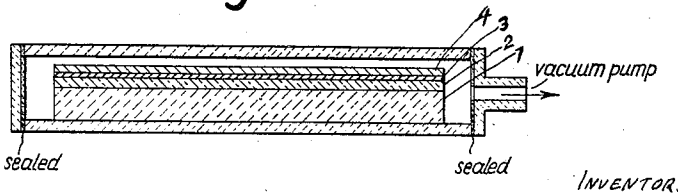


Fig. 4



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PHOTOGRAPHIC DETECTION OF SLOWLY MOVING NEUTRONS

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13 Claims. (Cl. 250—83)

This invention relates to a method for the detection of slowly moving neutrons, and has for its principal object the provision of a method by which slowly moving neutrons may be detected photographically.

Slowly moving neutrons are only slightly absorbed by lead, but are strongly absorbed by water- or hydrogen-containing substances, such as wood or the like. They behave, in this respect, exactly opposite to X-rays. If, therefore, a body composed of different substances is transilluminated by a beam of slowly moving neutrons the intensity distribution of the neutron beam leaving the body is different from the intensity distribution in an X-ray beam after it has penetrated the same body. If the beam of slowly moving neutrons could be made visible by means of a luminous screen or a photosensitive material a different image would be obtained in the transillumination with slowly moving neutrons than with X-rays. The investigation of substances by means of slowly moving neutrons would be important, therefore, not only for medical purposes but also for technical investigations. It would be possible, for example, to investigate materials contained in metallic receptacles if the materials were such as to absorb the neutrons more strongly than they are absorbed by the metallic walls of the vessel, for example, if the materials comprise hydrogen-containing substances.

Slowly moving neutrons are almost entirely unable to affect photosensitive coatings. If slow neutrons are to be detected, therefore, an intermediate reaction must be introduced which results in the production of particles capable of blackening the photographic plate.

The invention comprises the photographic detection of slowly moving neutrons by utilizing an interposed reaction that results in the production of heavily charged particles which have a greatly increased effect on photosensitive coatings. This is accomplished by using plates or films including a lithium foil. The slowly moving neutrons react with the nuclei of lithium in such a way that heavy charged particles such as H_3 or He are produced. In order that the lithium will not attack the photographic coating, it is desirable to interpose an intermediate layer between it and the coating. The intermediate layer should, however, be very easily penetrable by the H_3 or He particles produced in the intermediate reaction, for example, a thin aluminium foil may be used; or plates or films can be used on which a gelatine protective layer free from emulsion has already been applied.

The invention is illustrated by the accompanying drawing in which:

Fig. 1 is a diagrammatic section of an illustrative embodiment of the invention; and

Figs. 2, 3 and 4 are diagrammatic sections of modified embodiments of the invention.

In the drawing, 1 is a support, 2 is a layer of photosensitive material, for example, silver halide gelatine emulsion, 3 is a protective layer comprising a thin aluminum foil, and 4 is a layer of lithium foil.

The thickness of the aluminum foil may be about 0.0005 mm., the thickness of the layer of lithium may be about 0.1 mm.

For increasing the effect, it is advisable to use double-coated films or plates, as shown in Figure 2, or to place a plurality of films or plates one behind the other, as shown in Fig. 3, lithium foil with a protective coating being associated with each of the sensitive coatings. Since the lithium foil oxidizes easily in air and thereby becomes less effective, it is advisable to enclose it in an airtight manner. Airtight receptacles that are either exhausted, as shown in Figure 4, or filled with an inert gas are preferably used for this purpose.

Instead of the lithium foil, layers of a lithium compound may be used. The effect of such compounds is less, however, since in the effective layer (equal to the width of the H_3 field) fewer lithium atoms are present.

We claim:

1. A device for forming a photographic image of a beam of slowly moving neutrons comprising a layer of photosensitive material associated with a layer containing lithium atoms.

2. A device for forming a photographic image of a beam of slowly moving neutrons comprising a layer of photosensitive material covered with lithium foil.

3. A device for forming a photographic image of a beam of slowly moving neutrons comprising a layer of photosensitive material covered with lithium foil and having interposed between the lithium foil and the photosensitive material a protective layer.

4. A device for forming a photographic image of a beam of slowly moving neutrons comprising a layer of photosensitive material covered with lithium foil and having interposed between the lithium foil and the photosensitive material a thin aluminium foil passable by the particles produced by the interaction of the slowly moving neutrons with the lithium atoms.

5. A device for forming a photographic image

of a beam of slowly moving neutrons comprising a layer of photosensitive material associated with a layer containing lithium atoms, a gastight receptacle surrounding said layers, the interior of said receptacle being substantially free from air.

6. A device for forming a photographic image of a beam of slowly moving neutrons comprising a layer of photosensitive material associated with a layer containing lithium atoms, a gastight receptacle surrounding said layers, the interior of said receptacle being evacuated.

7. A device for forming a photographic image of a beam of slowly moving neutrons comprising a layer of photosensitive material associated with a layer containing lithium atoms, a gastight receptacle surrounding said layers, the interior of said receptacle being filled with an inert gas.

8. A device for forming a photographic image of a beam of slowly moving neutrons comprising a supporting layer, a layer of photosensitive material on each surface of said supporting layer, lithium foil associated with each layer of photosensitive material and a protective layer between each photosensitive layer and the lithium foil.

9. A device for forming a photographic image of a beam of slowly moving neutrons comprising a plurality of supporting layers, a layer of photosensitive material on each surface of said supporting layers, lithium foil associated with each layer of photosensitive material and a protective layer between each photosensitive layer and the lithium foil.

10. A method of forming a photographic image by means of slowly moving neutrons which comprises applying a layer of a substance containing lithium atoms to a layer of photosensitive material and exposing the associated layers to the action of a beam of slowly moving neutrons.

11. A method of forming a photographic image by means of slowly moving neutrons which comprises applying a lithium foil to a layer of photosensitive material and exposing the associated layers to the action of a beam of slowly moving neutrons.

12. A method of forming a photographic image by means of slowly moving neutrons which comprises applying a protective layer to a layer of photosensitive material, applying a layer of lithium foil upon said protective layer, and exposing the associated layers to the action of a beam of slowly moving neutrons.

13. A method of forming a photographic image by means of slowly moving neutrons which comprises applying a thin aluminum foil to a layer of photosensitive material, applying a layer of lithium foil upon said aluminum foil, and exposing the associated layers to the action of a beam of slowly moving neutrons.

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