

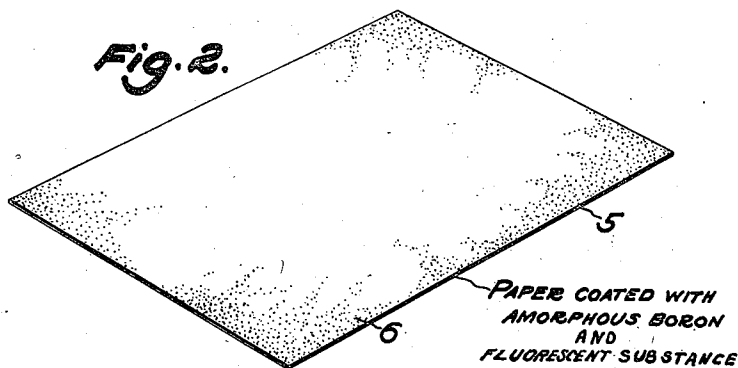
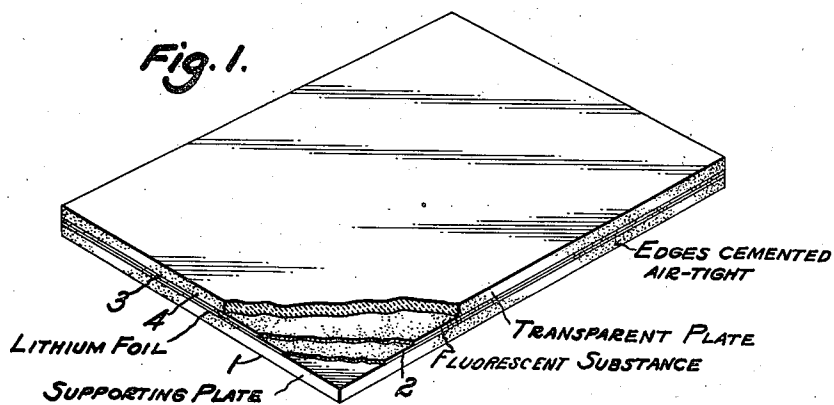
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INVESTIGATION OF MATERIALS WITH NEUTRONS

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INVESTIGATION OF MATERIALS WITH
NEUTRONS

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The present invention relates to a method and means for investigating materials by means of slowly moving neutrons, and is particularly directed to a method and means for producing a visible image of a beam of neutrons which has passed through the material to be investigated.

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 electrons, however, do not perceptibly excite fluorescent substances, so that in order to obtain a visible image on a fluorescent screen, for example, of zinc sulfide, it is necessary to interpose an intermediate reaction giving rise to particles capable of exciting the fluorescent materials.

It has been found that the production of heavy particles, such as H_2 or He particles, which excite fluorescent material much more strongly than neutrons can be effected by associating with the luminous material lithium or boron, or a substance containing atoms of lithium or boron or both.

For example, the fluorescent substance, such as zinc sulfide, is coated in a thin layer on lithium foil. The slowly moving neutrons generate in the lithium fast H_2 particles which cause the fluorescent substance to scintillate. In order to render such a fluorescent screen durable, it is advantageously enclosed between two plates, one of which is transparent and cemented in an air-tight manner between the plates.

Instead of the lithium foil, a layer of boron, or a mixture of boron and lithium, or a substance containing boron or lithium atoms or a mixture

thereof, may be used, and paper coated with amorphous boron to which the fluorescent substance is applied may be utilized.

Embodiments of the invention are illustrated in the accompanying drawing in which

Fig. 1 is a perspective view, with parts broken away, of a luminous screen assembly, and

Fig. 2 is a perspective view of a modified form of the invention.

In Fig. 1, 1 is a supporting film or plate, 2 is a lithium foil, 3 is a layer of luminous substance and 4 is a transparent plate. The edges of the structure are coated with a cement sealing the lithium foil and the luminous substance in an air tight manner between the external plates.

In Fig. 2, 5 is a sheet of paper and 6 is a coating of amorphous boron and luminous substance.

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

1. Method of forming a visible image of a beam of slowly moving neutrons which comprises causing the beam to impinge on a layer of a fluorescent substance having associated therewith a thin layer of a material selected from the group consisting of lithium, boron and substances containing atoms of at least one of these elements.

2. Method of forming a visible image of a beam of slowly moving neutrons which comprises causing the beam to impinge on a layer of a fluorescent substance coated on a lithium foil.

3. Method of forming a visible image of a beam of slowly moving neutrons which comprises causing the beam to impinge on a layer of a fluorescent substance associated with a layer of amorphous boron.

4. A device for forming a visible image of a beam of slowly moving neutrons comprising a layer of a fluorescent substance associated with a thin layer of a material selected from the group consisting of lithium, boron and substances containing atoms of at least one of these elements.

5. A device for forming a visible image of a beam of slowly moving neutrons comprising a layer of a fluorescent substance coated upon a lithium foil.

6. A device for forming a visible image of a beam of slowly moving neutrons comprising a layer of a fluorescent substance coated upon a lithium foil, the coated foil being enclosed in an air-tight manner between two plates one of which is transparent.

7. A device for forming a visible image of a beam of slowly moving neutrons comprising a layer of a fluorescent substance and a layer of amorphous boron coated upon a sheet of paper.

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