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CASE FOR NUCLEAR LIGHT SOURCE MATERIAL

Filed Oct. 29, 1957

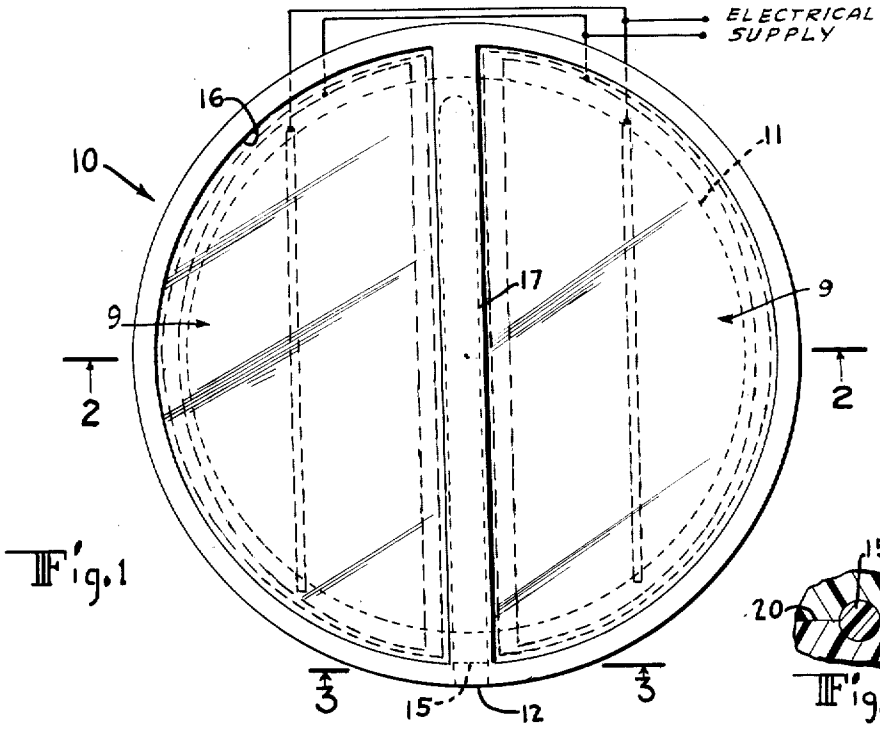


Fig. 1

Fig. 3

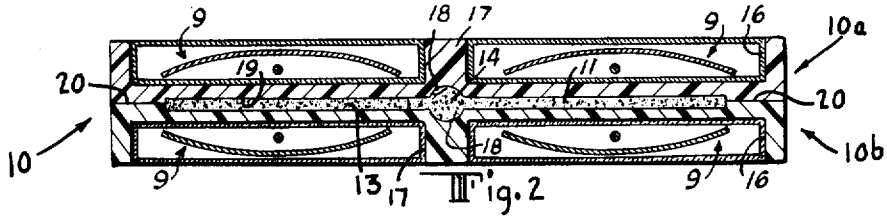


Fig. 2

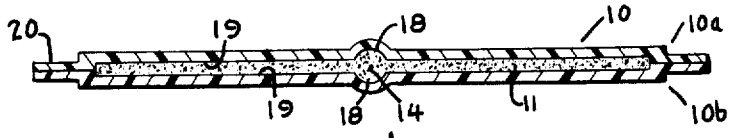


Fig. 4

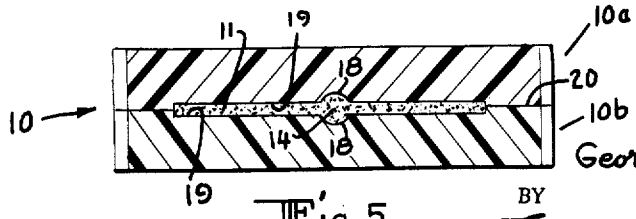


Fig. 5

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CASE FOR NUCLEAR LIGHT SOURCE MATERIAL

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The present invention relates to an energy source device of the type wherein nuclear energy first is converted to light and the light is then converted to electrical energy, and, more particularly, to an improved case for nuclear light source material of such a device.

In such devices, a radioactive material, a phosphor and a photoelectric cell are arranged so that light is emitted by the phosphor in response to disintegration of the radioactive material and the light is converted to electrical energy by the cell. This may be accomplished by confining thin layers of phosphor and radioactive material or a single layer of a mixture of such materials in a relatively shallow chamber of about five-thousandths of an inch. The primary requirement has been to provide an entirely enclosed, uniform layer of such materials.

The method presently employed in producing nuclear light source devices comprises placing a quantity of material into a shallow cup-shaped container, levelling off the material, putting a cover in place, and sealing the contacting edges of the cover and the container with cement. Because these operations are presently performed with gloved hands in a shielded confined area, the operations are very difficult to carry out and the finished product is far from satisfactory.

Accordingly, an object of the present invention is to provide a case for nuclear light source material which is not subject to the foregoing difficulties and disadvantages.

Another object is to provide such a case wherein the chamber is dimensioned to provide a layer of uniform thickness upon introducing therein a given quantity of material.

Another object is to provide such a case which can be sealed in a manner to reduce the leakage hazard to a minimum and can be tested for leakage prior to filling the same.

Another object is to provide such a case, which facilitates mounting photoelectric cells thereon.

Another object is to provide such a case which is adapted for automatic loading.

Another object is to provide such a case which can be produced in various sizes and shapes.

A further object is to accomplish the foregoing in a simple, practical and economical manner.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will appear to one skilled in the art upon employment of the invention in practice.

In the drawing:

FIG. 1 is an enlarged plan view of a case in accordance with the present invention.

FIG. 2 is a sectional view taken along the line 2—2 on FIG. 1.

FIG. 3 is a sectional view taken along the line 3—3 on FIG. 1.

FIGS. 4 and 5 are sectional views similar to FIG. 2 illustrating modified embodiments of the present invention.

Referring to the drawing in detail, there is shown a light source device which includes a case **10** having a shallow internal chamber **11** provided with an opening **12** extending to the exterior of the case for introducing light source material **13** into the chamber. Preferably,

the case has internal recess means **14** which extends diametrically from the opening to within the chamber to facilitate even distribution of the light source material in the chamber. After the chamber has been filled, the opening **12** is sealed by means of a plug **15**.

As illustrated herein, the case preferably comprises a pair of circular disc-like members **10***a* and **10***b* which have cooperating formations to provide the chamber **11**, the opening **12** and the recess means **14**.

In order to simplify the construction of the case and reduce its cost to a minimum, the case members are identical in construction and have complementary formations which provide the internal structure thereof.

The case members are constructed of transparent material through which light radiations ranging from the near infra-red to the ultra-violet in the spectrum can be transmitted, for example, polystyrene or polymerized methyl methacrylate type resins.

Such materials enable the case members to be arranged, as shown, and heat sealed at the periphery thereof to provide a leak-proof chamber. The effectiveness of the seal so provided can be tested prior to filling the chamber, whereby defective cases can be rejected and reprocessed to make an effective heat seal. The plug **15** is constructed of the same material as the case members and can be heat sealed into the opening **12** to confine the light source material in a leak-proof manner. If desired, the case members and the plug can be adhesively secured, but heat sealing is preferred because it provides an autogenous indestructible bond between these parts.

The light source material **13** with which the chamber is filled may be a mixture of nuclear source or radioactive material and a phosphor, for example, $Pm_2{}^{147}O_3$ and zinc sulphide in admixture as a finely divided powder.

The case shown in FIGS. 1, 2 and 3 is further provided with a pair of semi-circular recesses **16** on the outer faces of the case members adapted to have photoelectric cells **9** fitted and secured therein to overlie the chamber (FIG. 2). A rib **17** divides each pair of these recesses and provides structure in which arcuate diametrically extending recesses **18** can be formed at the inner faces of the case members, whereby the recess means **14** is, in effect, a circular bore which extends from the opening **12** and through the chamber.

This bore enables the light source powder to be evenly distributed within the chamber. As can be seen, the chamber is provided by circular recesses **19** on the inner faces of the case members, and an annular flat zone **20** surrounds each circular recess which facilitates heat sealing.

Since the case is shown in FIGS. 1, 2 and 3 as enlarged ten times, reference to its approximate dimensions will enable a better understanding of its actual size.

Case member diameter	inch	0.540
Case member overall thickness	do	.050
Recess **16** radius	do	.255
Recess **16** depth	do	.037
Bore **14** and opening **12** diameter	do	.020
Plug **15** diameter	do	.021
Recess **19** diameter	do	.045
Recess **19** depth	do	.003
Wall thickness between recesses **16** and **19**	do	.010
Chamber thickness	do	.006
Chamber capacity	cu. in.	.001

In FIG. 4, another form of case is shown which comprises a pair of members **10***a* and **10***b* which have a substantially uniform wall thickness throughout and are formed with chamber providing recesses **19** and recesses **18** on their inner faces. Flat annular peripheral zones **20**

are heat sealed to each other. This case has the following dimensions:

Case member diameter	inch	0.530
Case member wall thickness	do	.005
Bore **14** and opening **12** diameter	do	.023
Recess **19** diameter	do	.450
Recess **19** depth	do	.003
Chamber thickness	do	.006
Chamber capacity	cu. in	.001

In FIG. 5, a somewhat larger and more rugged case is shown wherein the case members **10***a* and **10***b* are flat discs formed with internal recesses **18** and **19**. This case has the following dimensions:

Case member diameter	inch	1.750
Case member thickness	do	.130
Bore **14** and opening **12** diameter	do	.024
Recess **19** diameter	do	1.260
Recess **19** depth	do	.003
Chamber thickness	do	.006
Chamber capacity	cu. in	.007

An important advantage of the cases just described is that they can be filled in a more simple, rapid and economical manner with minimum health hazards. This is accomplished by placing the empty case with the opening **12** up, in a holding fixture having an open-bottom seat for the cup of a hypodermic needle which is arranged so that the lower end of the needle extends into the opening **12**. The holding fixture is placed on a vibrator within a shielded zone, and a measured quantity of light source powder is placed into the needle cup. The holding fixture and the case are vibrated to cause the material to leave the cup and flow into the chamber of the case. Visual observation indicates the completion of the filling operation. The case is then removed from the fixture, and the opening **12** is sealed off by applying a plug of heat softened resin, which upon cooling is heat-seal bonded within the opening. The sealed case containing the light source material can then be safely removed from the shielded zone.

The case shown in FIGS. 1 and 2 is primarily adapted to be used in a nuclear battery because semi-circular cells **9**, such as silicon photocells shown in broken lines herein, can be sealed in the recesses **16** with their light sensitive side facing the transparent upper and lower walls of the chamber **11** and with their terminals at the opposite side exposed exteriorly of the recesses **16** for connection in a parallel or series circuit (not shown).

The cases shown in FIGS. 4 and 5 also can be used in a nuclear battery by mounting photocells (not shown) on the transparent upper and lower walls of the chamber **11**, but their simplified form enables the same to be used solely as a light source for "flash light" or warning light having a long life.

From the foregoing description, it will be seen that the present invention provides an improved case for a light source device or a nuclear battery having fully controllable external and internal physical dimensions, having adaptability for automatic or semi-automatic filling. All these advantages are attained with maximum economy.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and

without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

I claim:

1. A case for nuclear light source material constructed, at least in part, of material through which light radiations ranging from the near infra-red to the ultra-violet in the spectrum can be transmitted, said case comprising a shallow internal chamber of substantially equal depth throughout most of the chamber, an opening extending from the side of said chamber to the exterior of the case, and an internal channel of greater depth than the chamber, said channel being in communication with said opening and extending into the chamber a substantial distance to facilitate loading thereof.

2. A case according to claim 1, having an external recess overlying said chamber for receiving a photoelectric cell.

3. A case according to claim 1, wherein said internal channel extends from said opening substantially the full distance of the chamber to a wall thereof diametrically opposed to said opening.

4. A case according to claim 1 wherein the case is constructed of a material through which light radiations ranging from the visible to the ultra-violet in the spectrum can be transmitted.

5. In a nuclear battery, a case constructed of two disc-like members sealed together and being formed of material through which light radiations ranging from the near infra-red to the ultra-violet in the spectrum can be transmitted, said case members providing a shallow internal chamber being of substantially equal depth throughout most of the chamber formed with an opening at the peripheral edge thereof extending to the exterior of said case, photoelectric cell means mounted on and secured to said case members to overlie said chamber, a mass of nuclear light source material in said chamber, and sealing means for said opening to confine said material.

6. In a nuclear battery, a case constructed of two disc-like members sealed together and being formed of material through which light radiations ranging from the near infra-red to the ultra-violet in the spectrum can be transmitted, said case members providing a shallow internal chamber formed with an opening at the peripheral edge thereof extending to the exterior of said case and said case members having external recess means overlying said chamber, photoelectric cell means fitted and secured in said recess means, a mass of nuclear light source material in said chamber, and sealing means for said opening.

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