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Naeseth et al.

[11] **3,781,536**

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[54] **ILLUMINATED DIVER'S SLATE**

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[73] Assignee: **The United States of America as represented by the Secretary of the Navy,** Washington, D.C.

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[52] **U.S. Cl.** ..... **240/2.25,** 240/6.4 B

[51] **Int. Cl.** **F21v 9/16**

[58] **Field of Search** ..... 240/2 LC, 2 E, 2.25, 240/6.4 R, 6.4 B

[56] **References Cited**

UNITED STATES PATENTS

3,215,453	11/1965	Malcom	240/6.4 B X
2,883,770	4/1959	Lieb	240/2.25 X
3,576,987	5/1971	Voight et al.	240/2.25

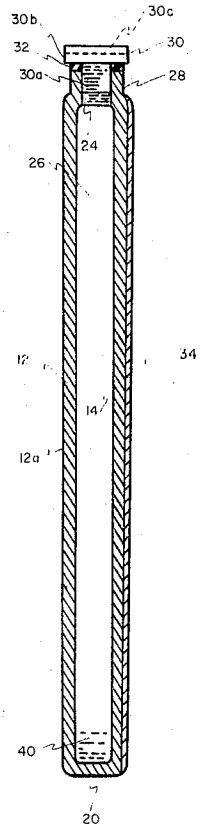
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[57] **ABSTRACT**

A reusable, illuminated diver's slate or writing tablet which utilizes a charge of chemiluminescent material. Light from the charge, preferably having wavelengths within a predetermined range, is directed through a light transmitting front wall, the surface of which is treated for writing. A mirrored rear wall increases efficiency of light use.

10 Claims, 3 Drawing Figures



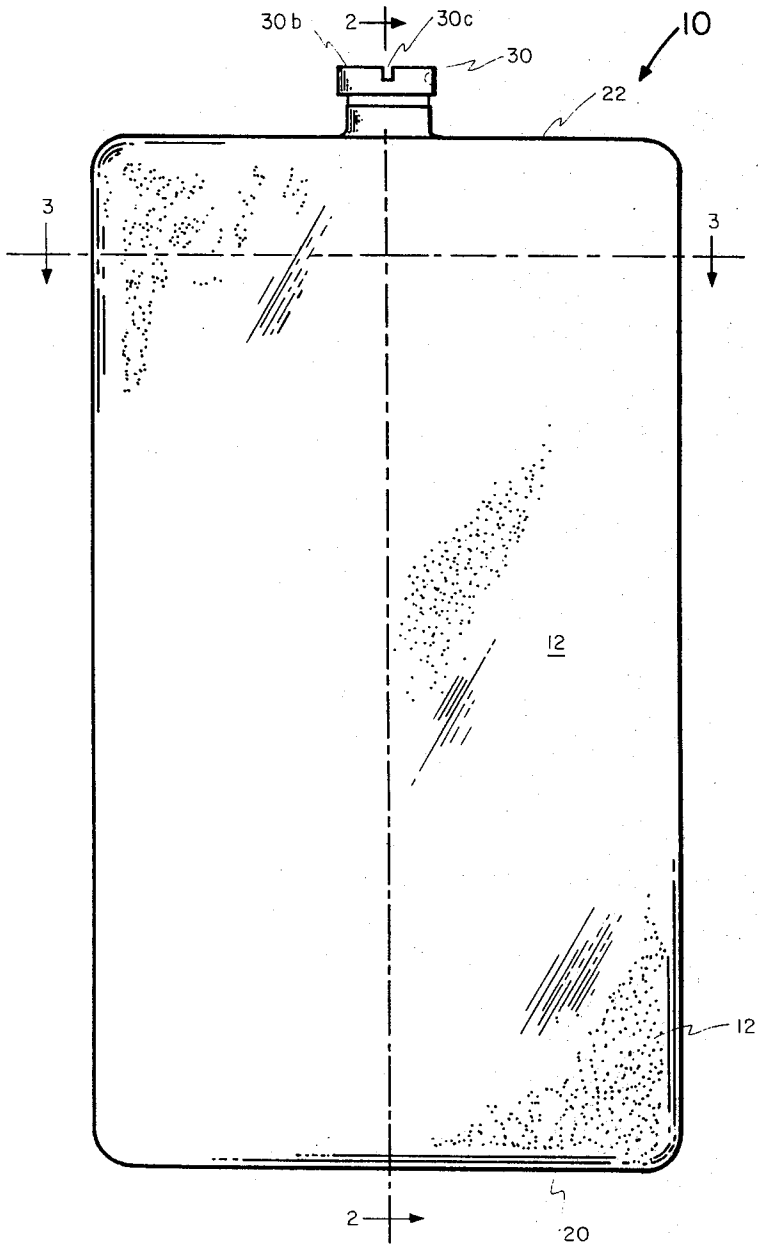


FIG. 1

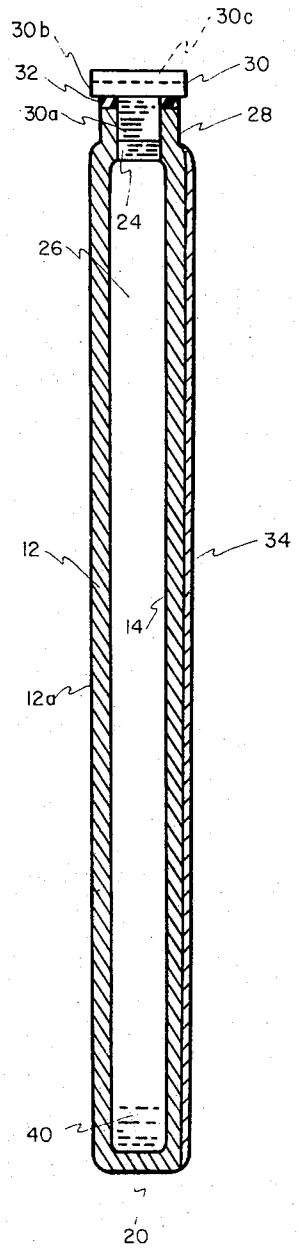


FIG. 2

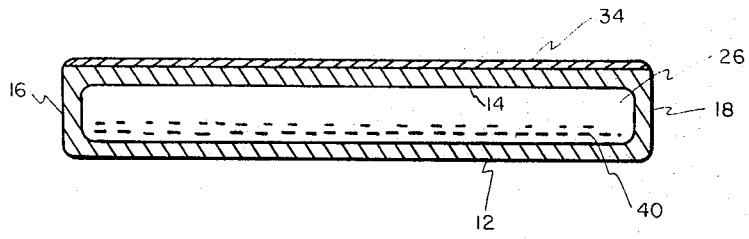


FIG. 3

ILLUMINATED DIVER'S SLATE

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

FIELD OF THE INVENTION

This invention relates to divers' writing plates used for communication between divers, recording data, and the like. More particularly, the invention is directed to an improved diver's slate which is illuminated by chemiluminescence.

DISCUSSION OF THE PRIOR ART

Diver's slates or writing tablets, used to pass information to or between divers, or used by divers to record information concerning their tasks, have been made in various forms. Among the most common forms presently in use are rigid plastic panels or "slates" which can be written upon with a grease pencil or crayon, or with common lead pencil if the panel surface is suitably roughened.

Self-illuminating plastic slates have been provided which comprise transparent or translucent plastic panels in combination with a layer or lamination of a phosphorescent or otherwise luminescent material or compound which gives off visible light for a period of time after being excited by other light, for example, from an incandescent lamp. An example of the latter type of writing slate or tablet is described in U. S. Pat. No. 2,883,770 issued to Harry C. Lieb on Apr. 28, 1959. Luminous compounds, such as zinc sulphide phosphors or the like, which can be excited to luminance by exposure to light from an incandescent source, have the disadvantage of rapid decay of brightness or luminescence after the excitation is terminated. Accordingly, the usefulness of divers' slates or tablets utilizing such materials is time limited. For example, typical slates using phosphorescent compounds and having been excited by a bright flashlight will provide only a low level of surface luminescence (on the order of 1.4×10^{-3} foot lamberts) after 30 minutes have passed. Since most diving operations where data is being collected require substantially longer diving times than 30 minutes, it will be appreciated that slates or tablets of that type are inadequate.

It has been proposed that a radioactive material, such as those which are β emitting, be included with the phosphorescent compound to effect continued excitation thereof. This expedient provides a generally higher level of surface luminance and one which remains relatively constant. However, it adds a potentially dangerous condition in that it subjects the user to an undesirable amount of radiation. Indeed, devices utilizing radioactive stimulated luminescence have been placed under governmental restrictions for the protection of the users.

SUMMARY OF THE INVENTION

The present invention aims to overcome most or all of the aforementioned shortcomings of the prior art through the provision of a novel diver's slate which makes use of chemiluminescent chemicals in liquid form as an illuminating agent.

In carrying out this invention, it is a principal object thereof to provide a diver's slate which affords a higher degree of surface illumination than has been safely possible heretofore, and to do so without danger of exposure to radioactivity.

It is another object of the invention to provide a novel diver's slate or tablet device which is self-illuminating, when charged with chemiluminescent liquid, to a useful degree of surface brightness for substantial periods of time, thereby affording a diver the convenience of being able to see the slate and any writing thereon throughout rather prolonged working periods.

As another object the invention aims to provide an improved self-illuminating diver's slate which avoids the inconvenience of having to subject a slate to a bright light for a period of time before use.

Yet another object is the provision of a diver's slate which realizes long term economy in that it can be reused repeatedly by merely refilling with a charge of chemiluminescent liquid. In this regard, the basic device has an unlimited shelf life as opposed to prior phosphorescent slates which, while re-excitable a number of times within a given period, have a useful life normally limited to several years, after which the entire slate is discarded.

Other objects and many of the attendant advantages will be readily appreciated as the subject invention becomes better understood by reference to the following detailed description, when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front elevational view of a diver's slate or writing tablet device embodying the invention;

FIG. 2 is a vertical sectional view of the device of FIG. 1, taken substantially along line 2—2 thereof; and

FIG. 3 is a sectional view taken substantially along line 3—3 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the form of the invention described hereinafter and illustrated in the drawings, there is provided a diver's slate or writing tablet device, generally depicted at **10**, which is particularly useful for conveying or recording information at an underwater location that does not have sufficient natural or artificial illumination to permit a diver to read markings on a conventional diver's slate. The device **10** comprises a generally rectangular, thin, flask having a front wall **12**, a rear wall **14**, side walls **16** and **18**, a bottom wall **20**, and a top wall **22**. The mentioned walls are preferably formed of a material having light transmitting properties, such as glass, acrylic plastic, or the like. It is preferable that the light transmitting qualities be those of transparency although, as will be made apparent as the description proceeds, some or all of the surfaces of the walls of device **10** are modified or treated to be otherwise than transparent. Also, as will presently appear, the light transmittance of the wall materials preferably favors certain wavelengths.

Located in one of the walls of device **10**, preferably in top wall **22** of the preferred embodiment being described, is an opening **24** through which a chemiluminescent material can be introduced into cavity **26** defined by the aforementioned walls. Opening **24** is conveniently surrounded by a neck portion **28** which is

adapted to receive a portion **30***a* of a stopper **30.** In this embodiment, the interior of neck portion **28** is advantageously threaded to cooperate with mating threads on stopper portion **30***a*. A suitable gasket or washer **32,** formed from rubber or a similar material, is provided between neck portion **28** and a head portion **30***d* of stopper **30.** Additionally, stopper **30** is conveniently provided with a slot **30***c* for receiving a suitable tool to provide increased leverage for tightening or loosening thereof.

The outer surface **12***a* of front wall portion **12** is provided with a rough or matte finish which improves the ability thereof to receive pencil markings. This rough or matte finish may be achieved either by grinding or chemical etching, or by suitable coatings known to provide a "frosting" effect. Irrespective of the manner in which surface **12***a* is treated, it must remain in at least a translucent condition.

The outer surface of rear wall **14** carries a coating **34** which serves as a reflecting layer in the nature of a mirror, so that light traveling outwardly through wall **14** is redirected inwardly toward wall **12.**

Cavity **26** is charged or filled with a light producing material **40,** which material is of the type commonly referred to as chemiluminescent. Any known chemiluminescent material or composition may be used in combination with device **10,** which will provide a satisfactory level of illumination for a useful time period, and such a time period may be considered to be on the order of one to several hours for use in diving operations. Suitable chemiluminescence materials, which retain as much as 65 ft. lamberts of illumination ability after 30 minutes, and a useful level for periods reaching 2 hours, are sold commercially under the trademark "CYALUME" of the American Cyanimide Company, Organic Chemicals Division, Boundbrook, New Jersey. Such materials are described in a number of patents, examples of which are U.S. Pat. Nos. 3,442,815 and 3,425,949. It will be understood, of course, that other chemiluminescent materials can be used in device **10.**

At this point it should be noted that satisfactory illumination at an underwater, particularly ocean water, location is a function not only of mere brightness at the writing surface **12***a* of device **10,** but also of the wavelength of the illuminating light. This is because ocean water absorbs and scatters light of some wavelengths more than others. Stated conversely, some wavelengths of light are more effective at penetrating ocean water. The better penetration is achieved principally by blue light on the order of 0.40 to 0.50 μ wavelength for offshore ocean water and by green to yellow light on the order of 0.50 to 0.58 μ wavelength for coastal waters.

The invention takes advantage of the foregoing by utilizing chemiluminescent materials having light emissions falling in the range of 0.40 to 0.58 μ, and by forming walls **12** and **14** of material such as glass or plastic which has good light transmitting properties in the just mentioned range. This combination results in a diver's slate device having optimum visibility characteristics due to minimization of scatter and absorption.

MODE OF OPERATION

When it is desired to conduct a diving operation, during which divers, such as scuba divers, will be used to gather information, or during which it will be desirable for divers to communicate with one another concerning their task, one or more of the devices **10** will be prepared by charging or filling with a chemiluminescent material through filler opening **24,** which is then closed and sealed through the agency of stopper **30.** The charges of chemiluminescent material, consisting of various compounds and agents, usually in the form of an oxalic component and a peroxide component are mixed just prior to use. Once mixed, the chemiluminescent material serves to emanate light energy which is normally directed outwardly in all directions therefrom. Some of such light energy travels directed through front wall **12,** while another portion of such energy travels through rear wall **14** where it is reflected by mirror surface **34** for return through rear wall **14,** chemiluminescent material **40,** and front wall **12.** The combined light energy emanating from the device through front wall **12** thereof serves to provide a good contrast with any markings placed on roughened surface **12***a* of the front wall by a diver. Moreover, device **10** serves as a convenient source of illumination for other purposes such as illuminating an area of work or inspection by the divers.

After a dive is completed, device **10** is emptied of its charge of chemiluminescent material **40,** rinsed, and then may be retained as a permanent record of the writings or markings thereon. Alternatively, such writings or markings may be erased, and device **10** recharged with fresh chemiluminescent material **40** just prior to a subsequent dive during which the device may be used.

Device **10** may be embellished with other refinements, such as the provision of lanyard means for attaching the device to the diver, and for attaching a writing instrument such as a pencil to the device.

It will be recognized that chemiluminescent material **40** is advantageously in the form of a substantially incompressible liquid so that device **10** can be used at substantial water depths and pressures without distortion or damage.

Obviously, other embodiments and modifications of the subject invention will readily come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing description and the drawings. It is, therefore, to be understood that this invention is not to be limited thereto and that said modifications and embodiments are intended to be included within the scope of the appended claims.

What is claimed is:

1. A device for use by divers, comprising:

flask means for containing a quantity of chemiluminescent material;

said flask means being characterized by a substantially plane, light transmitting first wall having a surface capable of being written upon by a pencil, and a substantially plane, light transmitting second wall disposed in spaced, parallel relation to said first wall;

mirror means, disposed on said second wall, for reflecting light from chemiluminescent material, when such is contained in said flask means, through said first wall; and

chemiluminescent material filling said flask means.

2. A device as defined in claim **1,** and wherein:

said first wall is substantially rectangular in plan and comprises a matte outer surface.

3. A device as defined in claim **2,** and wherein:

said flask means comprises a portion defining an opening to the interior thereof; and

closure means for closing said opening with said chemiluminescent material within said mask means, said closure means being removable to permit removal and replacement of said chemiluminescent material.

4. A device as defined in claim **3**, and wherein:

said light transmitting walls are formed of glass.

5. A device as defined in claim **4** and wherein:

said chemiluminescent material generates light energy having predominant wavelengths in a predetermined range; and

said light transmitting walls are characterized by ability to transmit light in said range.

6. A device as defined in claim **5**, and wherein:

said predetermined range includes those wavelengths of light most readily transmitted by sea water.

7. A device as defined in claim **3**, and wherein:

said light transmitting walls are formed of a rigid plastic material.

8. A device as defined in claim **7**, and wherein:

said chemiluminescent material generates light energy having predominant wavelengths in a predetermined range; and

said light transmitting walls are characterized by ability to transmit light in said range.

9. A device as defined in claim **8**, and wherein:

said predetermined range includes those wavelengths of light most readily transmitted by sea water.

10. A device for diver communication comprising in combination:

a flask including rectangular plane parallel front and rear walls interconnected by side, bottom, and top walls, so as to define a cavity therebetween;

at least said front wall being light transmitting for light having wavelengths in the range of 0.40 to 0.58μ;

a mirror surface associated with said rear wall and operative to reflect light toward said front wall;

said front wall presenting an outer surface which is characterized as being rough, so as to accept markings by a common lead pencil;

an opening through one of said walls for introducing material into, and removing material from, said cavity;

stopper means for closing said opening;

a quantity of light generating, chemiluminescent material filling said cavity; and

said chemiluminescent material being active to generate light having predominant wavelengths within said range.

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