

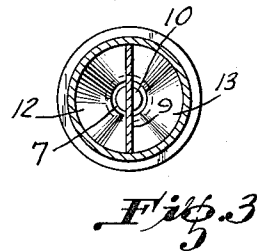
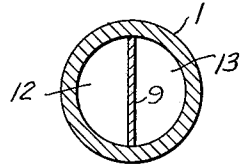
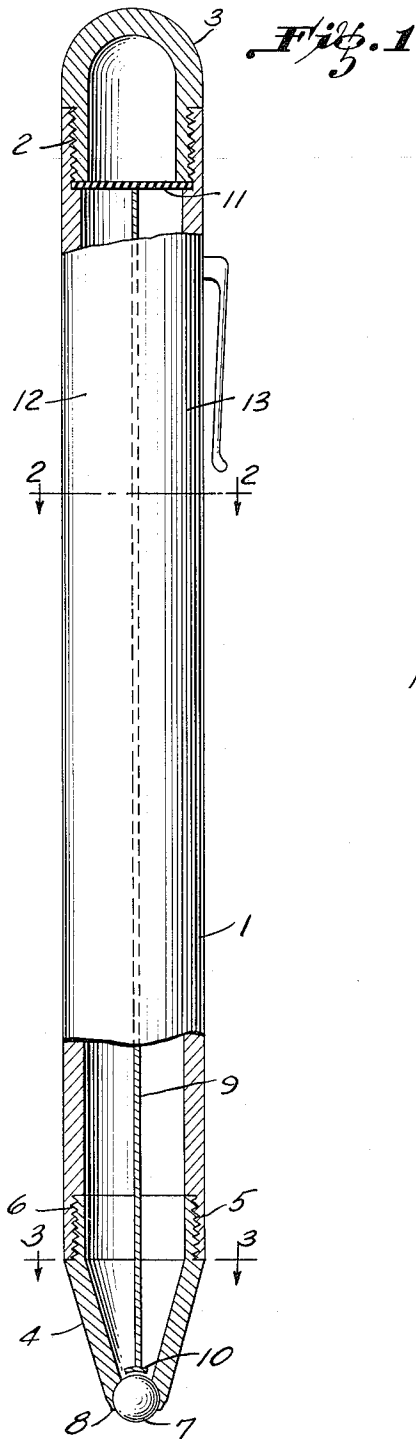
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L. T. JENKINS

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LUMINOUS WRITING

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LUMINOUS WRITING

Lloyd T. Jenkins, Decatur, Ala.
(P.O. Box 297, Cary, N.C.)

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5 Claims. (Cl. 252—301.3)

The present invention relates to a composition and method for writing in the dark. More particularly, the invention relates to compositions, which when mixed, are capable of generating visible light to provide illumination of a writing outline on a writing surface, or to provide a luminous writing fluid.

The invention also relates to a device for containing and feeding at least one such composition in fluid form into contact with the other to provide continuous visible radiation on a writing surface, which coincides with the writing characters being formed. In addition, the invention is directed to a writing device of the fountain pen type for feeding and bringing into contact the reactive compositions to provide a self-luminous writing outline.

In many instances, it is either desirable or necessary to write in the dark, such as taking notes in conjunction with slide or film presentations in darkened lecture rooms. Also, writing under blackout conditions may be necessitated in many circumstances involving military or civilian defensive operations, or military offensive operations. In such cases, only sufficient illumination to permit following the writing characters is desired to avoid any projection of light.

In the past, there have been many devices suggested for such purpose, all of which require a source of artificial illumination, such as battery operated incandescent lamps, or fluorescent materials which must be irradiated by ultra violet or other invisible radiation. Battery operated lights are not suitable since they emit too much light, and require dry cell batteries for portability, which are, of course, of limited life. Moreover, in such devices, it is necessary to provide beam-shielding or beam-diffusing elements, and in operations involving blackouts, these devices require extreme precaution in handling due to the danger of position exposure.

In the fluorescent devices, activating sources of ultra violet light are required, or in phosphorescent devices previous visible light illumination of the phosphorescent substance involved is necessary in order that the substance will generate visible light in the dark.

There exists a distinct need for means for writing in the dark which will provide only limited illumination, and particularly diffuse visible light on a limited portion of a writing surface sufficient to enable one to form writing characters rapidly and legibly in the dark without the aid of any of the foregoing artificial light producing devices.

It is a primary purpose and object of this invention to provide compositions which upon mixing will cause light radiation, known as chemiluminescence, to provide illumination of the writing outline on a writing surface, or to provide a luminous writing fluid thus enabling one to write in the dark by following the projected light radiation produced by the chemical reaction.

It is a further object of the invention to provide a method of writing in the dark utilizing such chemiluminescent materials to provide illumination of the writing surface and to form luminous writing characters

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which are visible in the dark. It is a further object of the invention to provide such chemiluminescent materials in combination with conventional ink formulations so that permanent writing characters are formed which are visible in daylight or under ordinary illumination.

A still further object of the invention is to provide a device for storing, feeding and mixing of the reactive components of such compositions to provide the visible radiation or chemiluminescence at a location on the writing surface coincident with the writing characters being formed. A more specific object of the invention is the provision of a fountain pen type device especially adapted for use with the compositions and method for containing at least one of the reactive components and feeding it into contact or mixing it with a second reactive component to provide chemiluminescence or "cold light" for writing in the dark. These and other objects and advantages of the invention will be apparent from the following detailed description thereof.

According to the invention a source of limited illumination in the form of visible light sufficient to enable one to write legibly and rapidly in the dark is provided by utilizing a chemical reaction known as chemiluminescence in which certain organic chemical components react with a second chemical component, usually one or more oxidizing agents, to cause light radiation or glowing. These chemicals are reactive in solution with the oxidizing agent, and the resultant reaction temporarily produces a so-called "cold" or chemiluminescent light. The reactive components are contained separately until the desired time for effecting illumination or providing the luminous writing fluid, and upon bringing the reactive components into contact, the visible light is generated on the writing surface to permit writing in the dark with facility.

The invention contemplates that the reactive components may be contained in a separated condition in a device which feeds the solutions to a common point to provide a continuous light radiation upon contact of the chemicals at the common point. The mixing point is adjacent to or coincident with the writing surface thereby enabling one to write in the dark by following the projected light radiation produced by the chemical reaction. When utilizing the reactive components in separate solution form, a suitable writing device containing two fluid reservoirs may be provided with the reservoirs feeding to a common writing point, so that the components are simultaneously fed and mixed to the writing surface providing a writing fluid for forming writing characters which are self-luminous.

In an alternative embodiment, one of the reactive components, for example, the oxidizing agent, may be incorporated in the material of which the writing surface is composed. The other reactive component is in solution, or other liquid form, suitable for contact with the material of the writing surface containing the oxidizing agent to generate visible light and render the writing characters luminous.

The compositions of the present invention may incorporate any of the several materials which generate visible radiation by chemiluminescence under the influence of an oxidizing agent. Compounds which may be mentioned by way of illustration, and which are particularly adapted for this purpose are 3- and 4-aminophthalhydrazide. Various derivatives of these compounds such as hydroxy and nitro substituted compounds and the acetylated amino compounds may also be employed. Various other condensed ring compounds having the chemiluminescent property, such as benzhydrazides, N,N'-dimethyl-biacridylum dinitrate, and the like are also suitable. The aminophthalhydrazides above-men-

tioned are preferred on the basis of their easier preparation and more ready availability, although the invention is in no way limited to these specific compounds.

The other reactive component is an oxidizing agent or mixture of oxidizing agents which is capable of reacting with the hydrazides or other chemiluminescent material when contacted or admixed therewith in solution form. The oxidizing agents of the present invention are for the most part those which decompose to generate nascent oxygen among which may be mentioned hydrogen peroxide, perborates, persulfates, perchlorates and hypochlorites. In conjunction with such decomposable oxidizing agents, there may be utilized other mild oxidizing agents which promote the release of free oxygen, such as potassium or sodium ferricyanides and other soluble ferricyanides, soluble copper and cupric ammonium complex salts and the like. The preferred oxidizing agent is hydrogen peroxide used in conjunction with sodium or potassium ferricyanide to accelerate its decomposition upon mixing with the hydrazides or other chemiluminescent substances.

The reaction to provide the cold or chemiluminescent light is generally carried out in an alkaline medium, although certain types of the reactive compounds may involve reaction mechanisms which are not pH sensitive. When utilizing the preferred aminophthalhydrazides of the invention, an alkaline medium is preferably provided for the reaction by forming an alkaline solution of the hydrazide. The reactive oxidizing component is separately prepared, for example, a hydrogen peroxide solution containing potassium ferricyanide. These two solutions constitute the separate reactive components in the two-solution embodiment of the invention, which are stored in separate containers or reservoirs of a suitable writing device and fed to a common point at the writing surface to provide the luminous writing characters or illumination.

In that alternative of the invention where one reactive component is supplied in fluid form from a writing device and the other component is incorporated as a layer on the writing surface, such as paper or other suitable material, the writing fluid is preferably a solution of the hydrazide and hydrogen peroxide in dilute alkali solution. The accelerator or other oxidizing agent, such as potassium ferricyanide, or other hydrogen peroxide-decomposing agent, may be applied to the writing surface as an impregnant or coating. When the liquid writing fluid containing the hydrazide and hydrogen peroxide is brought into contact with the paper surface, the reaction generates desired light radiation.

The intensity of the visible radiation and the duration thereof may be controlled by varying the concentration of the reactive components over a wide range from dilute to saturated solutions. In general, the intensity of the radiation is increased with increasing alkalinity of the solution, and the intensity as well as the duration of the visible glow produced by the reaction is decreased with decreasing concentrations of the hydrazide or other chemiluminescent material and the oxidizing agent.

In either the two-liquid or one liquid-writing surface coating embodiments of the invention, the liquid reactive component may be used with or actually combined with any conventional ink formulation to provide permanent writing visible in daylight or under ordinary illumination. At the same time the necessary visible radiation is generated by the reaction to permit writing in the dark.

The alkalinity of the reaction medium may be provided by any number of compounds with normally satisfactory results, including caustic soda, sodium carbonate, and hydrolyzable salts providing an alkaline pH, such as trisodium phosphate, and other alkali metal phosphates, or alkali metal metasilicates and the like. In some instances, with suitable accelerators, the reaction medium may be at a relatively lower pH. For this purpose, organic ferric chloride complexes may be utilized.

The following serves to illustrate specific formulations that may be utilized according to the invention, although they are not intended as a limitation thereof. Percentages are by weight.

Example I: Two-liquid formulation—

(1) 0.5–1.0% 3-aminophthalhydrazide in 5–10% sodium hydroxide solution.

(2) 0.5–1.0% hydrogen peroxide in aqueous solution with 0.5–1.0% potassium ferricyanide.

Example II: One liquid-paper coating formulation—

Liquid: 0.5–1.0% 3-aminophthalhydrazide, 0.5–1.0% hydrogen peroxide in 5–10% sodium hydroxide solution.

Paper: Paper coated by dipping in 1–2% potassium ferricyanide solution.

A suitable writing device for feeding and mixing of the reactive components to provide the requisite illumination on the writing surface, i. e. luminous writing characters, may be any writing pen of the reservoir type. For the two-liquid form of the invention the pen is provided with separate reservoirs or chambers, which contain and feed the separated reactive components in solution form to the writing tip of the device. In the one liquid-writing material coating form of the invention, the writing device may be any conventional type of pen equipped with a reservoir for the single liquid containing one of the reactive components in solution form with or without ink added.

One specific embodiment of a suitable writing device for purposes of the invention is shown in the accompanying drawings, in which

Figure 1 is a schematic view of the writing device with its associated parts,

Figure 2 is a sectional view taken on line 2–2 of Figure 1, and

Figure 3 is a sectional view taken on line 3–3 of Figure 1.

Referring to the drawings, a hollow cylindrical pen barrel 1 is provided at its upper end with screw threads 2 to which a screw threaded cap 3 is attached. A conical tip 4 is provided at the lower end of the pen barrel 1 with a cylindrical threaded extension 5 which is attached to the threaded end 6 of pen barrel 1. The conical tip is provided with a ball point 7 seated in aperture 8. This ball point 7 also functions as a ball check for permitting free flow of fluid when the ball is rolled upon contact with a writing surface, and which upon cessation of the rolling pressure shuts off the flow of writing fluid. As shown in all of the figures, the pen barrel 1 is provided with a diaphragm or separator 9 vertically disposed on a diameter of the cylindrical barrel 1 and dividing the interior of the barrel into two chambers. The separator 9 extends into and divides the conical screw tip 4 to the ball point 7. A suitable seal 10 is provided between the end of the separator 9 and the ball point 7. A flat disc type seal 11 is provided between the screw cap 3 and the reservoirs 12 and 13 formed in the pen barrel by separator 9.

Reservoirs 12 and 13 are filled separately by unscrewing the screw cap 3 and adding the solutions of the reactive components into their respective chambers with a medicine dropper or any other suitable filling device. The screw cap is replaced and the seal 11 contained therein seals off the reservoirs. Writing is accomplished by rolling the ball point which causes a flow of the two solutions and a mixing thereof at aperture 8 onto the paper to form the writing characters with the reaction occurring to render the writing characters visible by generation of cold or chemiluminescent light. To provide a description of a complete specific embodiment of the invention, it may be mentioned that chamber 12 in operation of the device, as above described, is filled with an alkaline solution of 1% by weight 3-aminophthalhydrazide containing 5% by weight sodium hydroxide.

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Chamber 13 is filled with an aqueous solution containing 1% by weight hydrogen peroxide and 0.5% by weight potassium ferricyanide. Upon feeding and mixing of the reactive solutions in forming writing characters with the ball point pen, a visible light of greenish blue color is generated, permitting one to write by following the projected radiation coinciding with the writing outline.

It may be seen from the above description of the invention that a composition and method for writing in the dark is provided which is not dependent upon artificial light producing devices such as incandescent bulbs, or fluorescent materials which require an activating ultra violet radiation. The simple provision of a two component reactive chemical composition, which components when brought into contact on the writing surface produce cold or chemiluminescent light, facilitates writing in the dark. Thus, legible and rapid writing in the dark is made possible by means of the present invention. In addition, the invention provides a suitable writing device, which is utilized to separately store solutions of the reactive components, and which is adapted to feed the solutions to the writing point of the device to admix the reactive solutions and permit their even and simultaneous flow onto the writing surface to provide the luminous or visible light emanating writing characters. The invention also provides a single liquid containing one of the reactive components with a coating on the writing material surface containing the other reactive component, so that the two are brought into contact to generate the visible light at the point on the writing surface where the writing characters are being formed.

Various modifications and alterations of these specific embodiments above-described may be made without departing from the spirit of the invention, the scope of which is defined by the appended claims. For instance, in utilizing the one liquid-writing surface coating embodiment of the invention, the two chambered writing device may be utilized to contain a single solution of a reactive component in one reservoir and a conventional ink formula in the other reservoir for providing permanency of the writing produced to render the writing characters visible in daylight or under ordinary illumination. Still another modification would be to provide a triple chambered device which may separately contain an ordinary ink formulation, and in the other two chambers the separated solutions containing one each of the reactive components. Alternatively, the ink may be admixed with either of the solutions containing the reactive components provided,

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of course, it does not cause decomposition of the reactive components in either of the two solutions.

What I claim is:

1. A method of writing in the dark which comprises, supplying a liquid containing a reactive component which when oxidized produces chemiluminescent light to a writing surface formed on an object from a source dissociated with said object in such manner as to form writing characters on said surface, and contacting said liquid with an oxidizing agent, whereby said liquid and said agent react together to produce visible light coincident with said writing characters.
2. The method according to claim 1 in which the oxidizing agent is contained as a coating on the writing surface and reacts upon contact of the liquid therewith.
3. The method according to claim 1 in which said liquid consists essentially of an alkaline solution of an aminophthalhydrazide, and said oxidizing agent consists essentially of a solution of hydrogen peroxide containing potassium ferricyanide.
4. The method according to claim 1 in which both said liquid and said agent are simultaneously supplied to said surface from separate sources dissociated with said object.
5. The method according to claim 2 in which said liquid consists essentially of a solution of an aminophthalhydrazide, and said oxidizing agent coated on said writing surface consists essentially of an alkali metal ferricyanide.

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