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UNDERWATER FLARE

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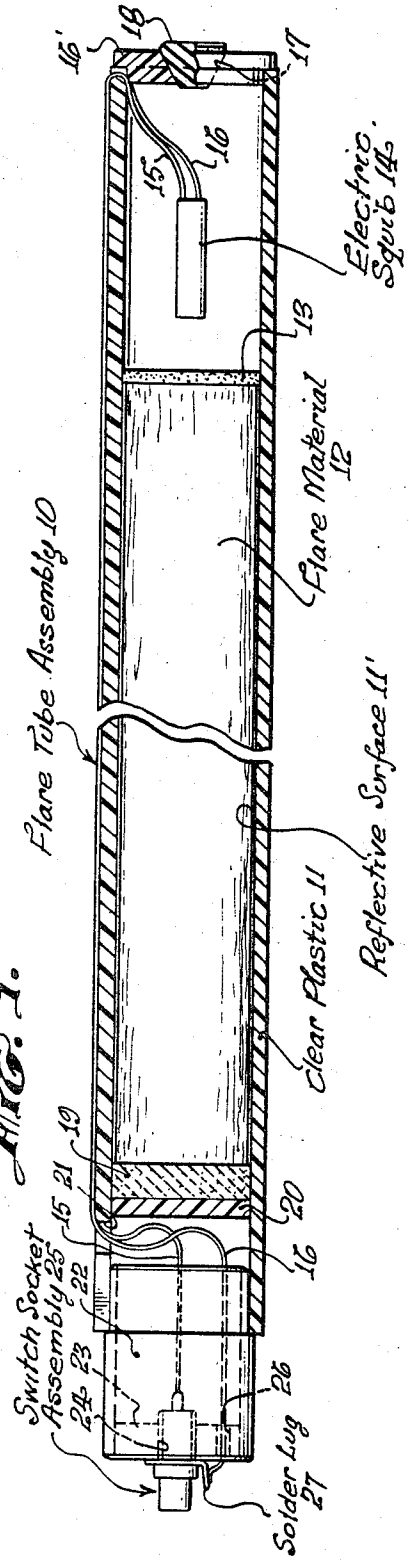


FIG. 1.

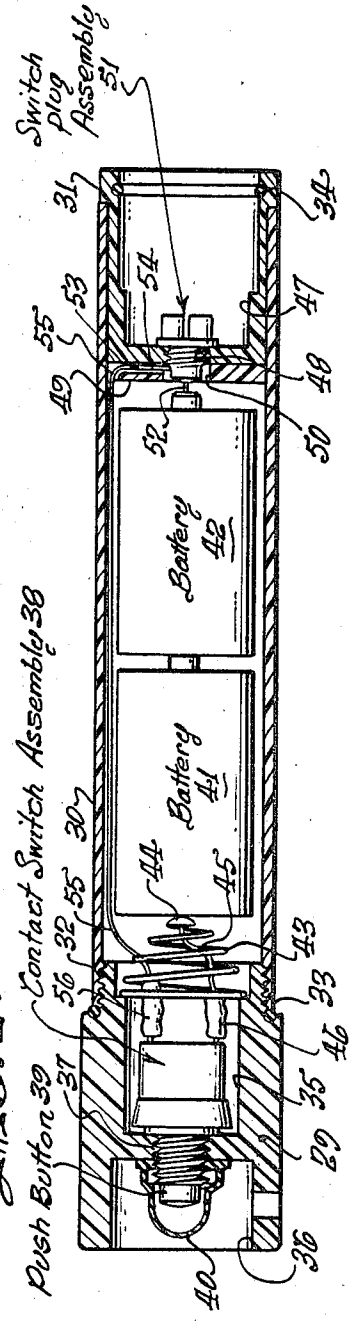


FIG. 2.

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UNDERWATER FLARE

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ABSTRACT OF THE DISCLOSURE

An underwater flare which is electrically ignited and utilizes a transparent plastic casing within which the burning takes place, thus reducing the flame size while increasing the brilliance of the light produced. The transparent plastic flare casing is readily attached to an all plastic, re-usable ignitor handle and can be ignited near the water surface or several hundred feet underwater by simply pressing the firing button. In addition, one of the areas of the clear plastic casing can be provided with a reflective means.

Background of the invention

This invention relates to the pyrotechnic flare art, particularly to underwater pyrotechnic flares, and more particularly to the utilization of a clear or transparent plastic casing within which the flame burns, thus substantially reducing the size while increasing the brilliance of the light produced.

Much prior effort has been directed to producing more effective underwater flares for applications such as photography, fish hunting, scuba diving, and the like, as well as a protective means against sharks or the like. However, while the prior efforts have greatly increased the effectiveness of underwater flares, there are certain disadvantages which have not been overcome, prior to this invention; namely, weight, size, brilliance, water depth, and expense. The weight and water depth have been improved by the use of plastic casings and sealing arrangements as exemplified by U.S. Patent 3,064,576. One of the primary problems with the prior known underwater flares is the size required to generate sufficient gas to maintain the flame burning in the open water. It is well known that in order to ignite and maintain a flame in water that sufficient excess gas must be generated to keep the flame from being extinguished, thus requiring a generation means far larger than that required to produce the flame itself. Therefore, in the past, the flares have been large and thus more inconvenient to handle as well as being more expensive. The flare of this invention has solved this primary prior problem by the utilization of a clear plastic casing within which the flame burns and through which the light comes. Therefore, while the light or flame in the prior flares was produced in open water at the end of the flare casing, the light or flame in the inventive flare is produced with a clear plastic casing and shines through same, the casing burning away but is maintained clear or transparent by the temperature of the flame therein.

Summary of the invention

The underwater flare of this invention provides users, such as scuba divers, with a low cost, intense illumination source, which is hand held and electrically ignited and exceeds in brilliance by one to several orders of magnitude all competitive lighting systems or devices. It is utilized with an all plastic, re-usable ignitor handle which uses standard flashlight batteries and is capable of lighting several thousand flares in the range of depth from the surface to several hundred feet underwater. The embodiment of the flare tested is one and a quarter inches in diameter and twenty three inches long, thus illustrating

the smallness in size compared to the prior known flares. The flare can be readily inserted into the handle prior to entering the water or inserted underwater at the time illumination is desired. Spare flares can be carried in a back pouch for insertion after the burnout of the first flare which burns for about ten minutes, depending on depth and ambient temperature. In addition the utilization of a reflective surface for directing the light increases the applications therefor.

Therefore, it is an object of this invention to provide an underwater flare.

A further object of this invention is to provide an underwater flare which utilizes a clear plastic casing within which the flame burns and through which illumination is achieved.

Another object of the invention is to provide a clear plastic underwater flare in combination with a plastic, re-usable ignitor handle.

Another object of the invention is to provide an underwater flare having a transparent casing and which increases the illumination while decreasing the size and expense thereof.

Another object of the invention is to provide an electrically ignited underwater flare which can be easily attached to an ignitor handle and which burns with high brilliance for about ten minutes with a minimum of noise and bubbles.

Another object of the invention is to provide an underwater flare which utilizes a clear plastic casing having a reflective surface to channel light in a desired direction.

Other objects of the invention will become readily apparent from the following description and accompanying drawings wherein:

Brief description of drawings

FIG. 1 is a view partially in cross section of an embodiment of the novel clear plastic casing underwater flare assembly; and

FIG. 2 is a view partially in cross section of the ignitor handle assembly for the FIG. 1 flare.

Description of the invention

As illustrated in the FIG. 1 embodiment, the inventive underwater flare indicated generally at **10** comprises a casing or tube **11** which is of a clear or transparent plastic, such as clear acrylic, having pressed or otherwise positioned therein flare material indicated at **12**, which may, for example, be finely divided magnesium with appropriate oxidizing material, or other such material as known in the pyrotechnic art. At the forward end of the flare material **12** is a ring or plug **13** of suitable ignitor material which is activated by an electric squib **14** positioned within the forward end of tube or casing **11**. The forward end of tube **11** is provided with one or two cuts through which squib wires **15** and **16** extend. Also, the forward end of tube **11** is provided with an end cap **16** of clear plastic material, such as clear acrylic, the end cap **16** being sealed to the tube **11** by suitable adhesive or sealant. End cap **16** is provided with a tapered aperture **17** within which is a pressure responsive plug **18** of suitable adhesive sealant, the purpose for which will be described hereinafter. If desired the end cap **16** and plug **18** may be combined into a single unit which will blow outwardly or disintegrate when sufficient pressure has been generated by burning of the flare material **12** to overcome the pressure of the water thereabout. Also, the closure may be burned away when sufficient temperature of the burning material has been reached.

Positioned at the rearward end of flare material **12** is a plug **19** of fire clay or other suitable material, and adjacent the plug **19** is secured a disc or ring **20** of material such as clear plastic, the disc **20** being glued to tube **11**

by acrylic plastic cement or other suitable material to provide a seal thereabout. Adjacent the disc or ring **20**, the tube or casing **11** is provided with an aperture **21** through which squib wires **15** and **16** extend, wires **15** and **16** being secured to the outer surface of tube **11** by clear plastic tape, for example. An actuator assembly housing **22** of suitable plastic, such as PVC plastic, is secured in the aft end of tube or casing **11** by suitable bonding material. A plate **23** of PVC plastic, for example, is secured in the open end of housing **22** by PVC plastic glue or other means. Plate **23** is provided with a central aperture **24** within which a switch socket assembly **25** is mounted, socket assembly **25** being attached to squib wire **15**. Also, plate **23** is provided with an aperture **26** through which squib wire **16** extends for connection with a solder lug **27** which is secured to housing **22** via switch socket assembly **25**.

If desired, a reflective surface indicated at **11'** may be secured to a portion of the tube or casing **11** to direct or channel the light in a desired direction. While the reflective surface **11'** has been shown extending 180° about casing **11**, it may extend a greater or a lesser distance depending on the specific requirements. Thus, utilization of the reflective surface **11'** will not only direct the light in a specific direction but will serve to prevent the light from affecting the seeing capability of the user. The specific materials used for the reflective surface **11'** will depend on the various applications and needs as known in the art. The reflective surface **11'** may be positioned within the casing **11**, as shown, or secured to the outer surface of the casing by suitable bonding material. Also, the reflective surface may be painted on or otherwise applied directly to the casing or tube **11**.

The ignitor handle assembly generally indicated at **28**, as shown in FIG. 2, is adapted to cooperate with the flare assembly **10** of FIG. 1 as will be described herein below. As shown in FIG. 2, the ignitor handle assembly **28** comprises three sub-assemblies and the housings thereof consist of a switch holder assembly housing **29**, a handle or battery holder assembly housing **30**, and a tube connector assembly housing **31**. Each of housings **29**, **30** and **31** are constructed of plastic, such as PVC, with housings **29** and **30** being secured together by a threaded connection indicated at **32**; while housings **30** and **31** are secured together by suitable bonding material, such as PVC plastic glue. An O-ring **33** is positioned intermediate housings **29** and **30** to insure a water tight connection; while an O-ring **34** is positioned in a groove in the end portion of housing **31** to provide a frictional fit between housing **31** and housing **22** of flare assembly **10**, such that flare assembly **10** is frictionally held in the ignitor handle assembly **28**.

Switch assembly housing **29** includes a pair of counter-bores or chambers **35** and **36** which are interconnected by a threaded aperture **37**. Positioned within counter-bore **35** is a contact switch assembly **38** which is threadedly secured in aperture **37** such that the push button actuator **39** thereof is located in counter-bore **36**. A flexible water proof seal assembly **40** is positioned in counter-bore **36** and around push button **39**.

Positioned within housing **30** is a pair of standard batteries **41** and **42** such as the Eveready flashlight batteries. Positioned intermediate battery **41** and housing **29** is a compression spring **43** with a plug button or contact **44** secured thereto and in abutment with battery **41**. A lead wire **45** interconnects plug button **44** with a terminal **46** of contact switch assembly **38**.

Housing **31** defines a counter-bore or chamber **47** which is in communication with housing **30** via a threaded aperture **48**. Secured to the end of housing **31** on the side adjacent the battery **42** is a plug bridge or plate **49** having an aperture **50** therein which aligns with the threaded aperture **48** of housing **31**. A switch plug assembly **51** is threadedly secured within counter-bore **47** via threaded aperture **48**, and includes a portion which extends into the aperture **50** of plug bridge **49**, which supports an escutcheon pin **52** which contacts the battery **42**. Plug bridge **49** is provided with a cut-out **53** into which a solder lug **54** extends, lug **54** being operatively connected with switch plug **51** at one end while being secured, such as by soldering, to a lead **55** which in turn is operatively secured to a second terminal **56** of contact switch assembly **38**. Lead **55** extends through housing **30**. While not shown, housings **30** and **31** may be provided with an aperture which extends outwardly through the sidewall of counter-bore **47** of housing **31** and through housing **30** to allow water within counter-bore **47** to escape when housing **22** of flare assembly **10** is inserted into housing **31** during underwater operation.

In operation, the flare assembly **10** is inserted into the ignitor handle assembly **28** by inserting actuator housing **22** of flare assembly **10** into the tube connector assembly housing **31** of handle assembly **28** such that the switch socket assembly **25** is inserted into the switch plug assembly **51** and the solder lug **27** is in contact with the plug assembly **51**, with the O-ring **34** functioning to frictionally secure assemblies **10** and **28** together. With the flare thus assembled, activation is accomplished by pressing push buttom **39** which closes the electrical circuit and activates the electric squib **14** which ignites the material **13**, which in turn lights the forward end of flare material **12**. The initial lighting takes place within the space at the forward end of tube or casing **11** and allows the flare material to be ignited without contact with water. As initial burning continues, pressure is generated within this space sufficient to blow out the plug or sealant **18**, thereby allowing continued burning of the flare material **12**. Due to the temperature of the flame within tube **11** the plastic thereof, while being burned does not blacken due to carbon and thus allows the light to be directed out through the wall surface of the clear plastic tube **11**. Although the tube is consumed by the flame therein, sufficient length of the tube is maintained to provide a nozzle-like end within which sufficient pressure from the burning material is mtaintained for preventing the water from affecting the burning operation.

Due to the novel use of a clear or transparent plastic casing and the pressure responsive end cap arrangement for initial igniting of the flare material, the size of the flare and thus the cost thereof is substantially reduced. Also, since less gas needs to be generated to maintain the burning, which is accomplished within the casing or tube, the material utilized functions primarily to produce light which shines through the clear plastic tube.

With a flare assembly of the type described above, having a diameter of 1¼ inches and a length of 23 inches, tests have shown that it exceeds in brilliance by one to several orders of magnitude over all competitive lighting systems or devices, the brilliance being primarily determined by the depth of the water. Also, tests have shown that this novel flare will light immediately and burn with a minimum of noise and bubbles for an average of ten minutes, depending on depth and ambient temperatures. Also, as pointed out above, the flare assembly can be inserted into the ignitor handle assembly prior to required ignition, or inserted underwater at the time the illumination is desired. After insertion it is only necessary to press the firing button, located in a recess on the end of the ignitor handle, to ignite the flare.

Also, as pointed out above, the ignitor handle assembly is of the all plastic, re-usable type which utilizes two standard flashlight batteries and is capable of lighting flares in the range of depth from the surface to several hundred feet underwater. Also, due to the small size of the flare assembly, spare flares can be carried in a convenient leg or back pouch for insertion after the first flare burnout. These additional units can be inserted and lighted one after another, underwater, with no further preparation.

If desired, the housing **22** of flare assembly **10** and the

ignitor handle assembly **28** may be constructed from the transparent acrylic plastic or other suitable materials.

Therefore, it has been shown that the inventive flare has produced a long needed low cost, intense illumination source, thereby greatly advancing the state of the underwater flare art. In addition to its reduced size with increased illumination, the flare is entirely safe for those utilizing it, since the plastic handle assembly remains cool, thus enabling it to be easily handled.

Although a particular embodiment of the flare assembly and ignitor handle assembly have been described and illustrated for purpose of explaining the invention, modifications and changes will become apparent to those skilled in the art, and it is intended to cover in the appended claims all such modifications and changes as come within the spirit and scope of the invention.

What I claim is:

1. In an underwater flare, a casing of transparent plastic material, burnable light producing material mounted in a portion of said casing, ignitor means mounted in one end portion of said transparent plastic casing, pressure responsive plug means closing said one end portion of said casing, actuator means mounted in the opposite end portion of said transparent plastic casing, and means interconnecting said ignitor means with said actuator means, whereby activation of said activator means ignites said ignitor means which causes burning of said material to be initiated, thus producing illumination by the light produced from the burnable material shining through the transparent plastic casing and generating sufficient pressure to activate said pressure responsive plug means wherein continued burning of the material is sustained.

2. The underwater flare assembly defined in claim **1**, additionally including a reflective surface extending over a portion of said transparent plastic casing for channelling the light produced therein in a desired direction through said casing.

3. The underwater flare assembly defined in claim **1**, wherein said pressure responsive plug means comprises an end cap sealed to said transparent plastic casing and having an aperture therethrough, and a plug member constructed of suitable material removably mounted in said end cap aperture.

4. The underwater flare assembly defined in claim **1**, wherein said ignitor means includes an electrically activated squib means operatively connected to said interconnecting means.

5. The underwater flare assembly defined in claim **1**, wherein said burnable light producing material is of the magnesium base type.

6. The underwater flare assembly defined in claim **1**, wherein said actuator means includes a housing operatively secured to said transparent plastic casing, a switch socket assembly operatively mounted in said housing, and a lug means secured to said housing, said switch socket assembly and said lug means being operatively connected to said interconnecting means.

7. The underwater flare assembly defined in claim **1**, wherein said transparent plastic casing is constructed of clear acrylic plastic.

8. The underwater flare assembly defined in claim **1**, in combination with an ignitor handle assembly; said ignitor handle assembly including an electrical power source, and switch means operatively connected to said power source; said switch means being removably attached to said activator means of said flare assembly, whereby actuation of said switch means causes activation of said activator means which ignites said ignitor means.

9. The combination defined in claim **8**, wherein said switch means includes a push button type contact switch assembly and a switch plug assembly, said switch plug assembly being adapted to cooperate with said actuator means of said flare assembly.

10. The combination defined in claim **8**, wherein said ignitor handle assembly includes a housing; said housing having a switch holder portion, a battery holder portion and a tube connector portion, a push button type contact switch assembly being operatively mounted in said switch holder housing portion; said battery holder housing portion being adapted to contain at least one electrical storage type battery means; means adapted for operatively interconnecting said contact switch assembly with an associated battery means; a switch plug assembly operatively mounted in said tube connector housing portion; means operatively interconnecting said contact switch assembly with said switch plug assembly; means adapted for operatively connecting said switch plug assembly with an associated battery means adapted to be contained in said battery holder housing portion; said switch plug assembly being constructed to cooperate with said activator means of said flare assembly; and means mounted in said tube connector housing portion for frictionally securing said flare assembly thereto.

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