Nov. 26, 1957 T. W. BRENNAN ET AL 2,814,249

FLARE

Filed April 30, 1956

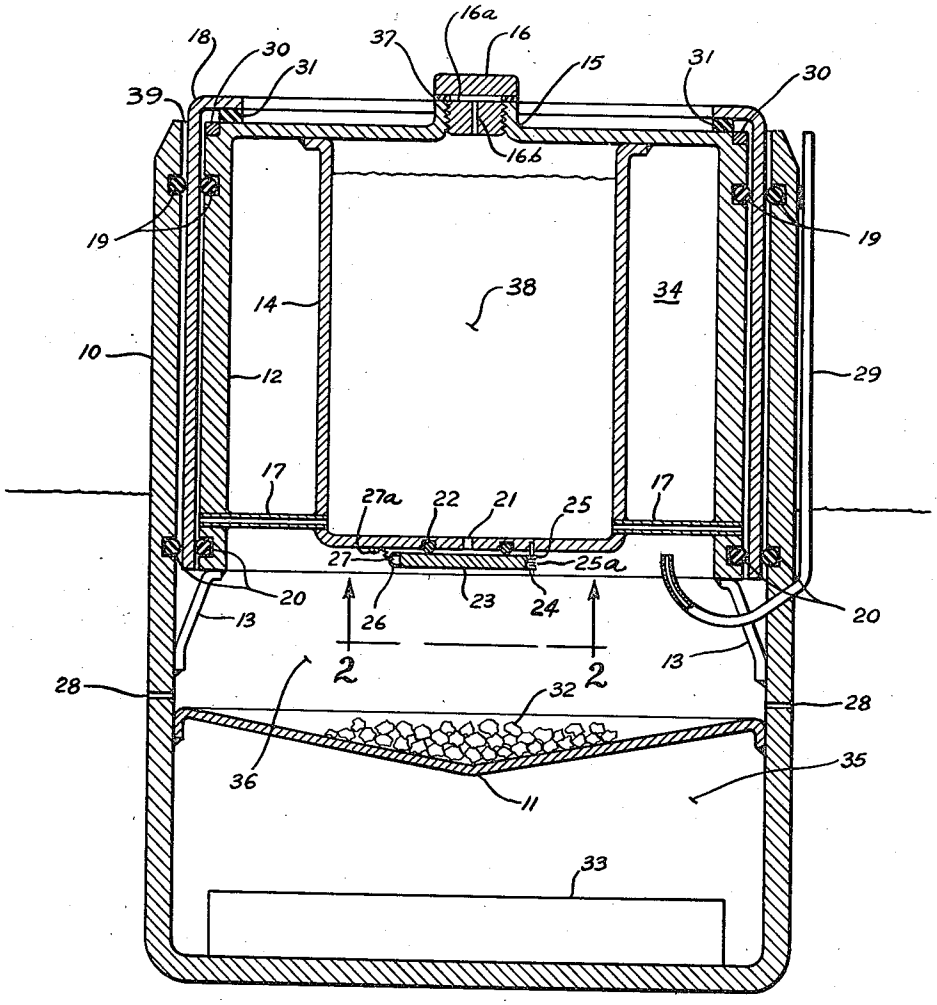


Fig. 1

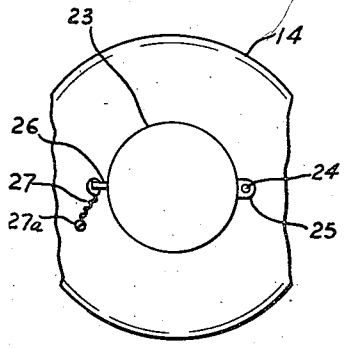


Fig. 2

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FLARE

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1 Claim. (Cl. 102—7)

The present invention relates to signalling devices of the type generally known as flares. It relates more particularly, to flares which burn a substance to produce a bright light of high visibility.

The present invention is principally useful as a life-saving flare for marine use. It is adapted to be placed in the water adjacent to a life boat or life raft by an occupant thereof, after which the flare will operate automatically to produce a brilliant green flame visible for a great distance. The device will float upright in the water with its lower portion submerged and the flame will emanate from its top. The flare must be placed in the water before operation can occur and there is, therefore, no danger of operation of the flare inadvertently. It can be stored for long periods of time with little or no attention and yet is always ready for instant use when needed.

It is, therefore, an object of the present invention to provide a signalling flare which will float in water and is capable of automatic operation soon after its placement in the water.

It is also an object of the present invention to provide a signalling flare which will, after contact with water, operate automatically to produce a brilliant green flame of exceptional visibility by burning the chemical compounds monobromopentaborane, formula $B_rB_5H_8$, described in a co-pending patent application filed on even date herewith April 30, 1956, and bearing Serial Number 581,808, the inventors being Murray S. Cohen and Carl E. Pearl.

It is also an object of the present invention to provide a process for producing a signal light by burning monobromopentaborane in a novel manner.

Other objects and advantages will be apparent from the drawings and from the descriptions which follows.

In the drawings:

Figure 1 is a cross-sectional view showing the interior arrangement of the flare.

Figure 2 is a view of the cover and bottom of the liquid tank looking upward from beneath the tank.

In the preferred embodiment of the present invention, use is made of the compound monobromopentaborane for the production of a brilliant green flame upon its burning. Monobromopentaborane is a combustible, low-melting solid and is utilized in the present invention dissolved in an inert solvent which is miscible in water. Solvents found to be suitable for the purpose of the present invention are anhydrous diethylene glycol, dimethyl ether and dioxane.

Monobromopentaborane is especially well suited for use in the present invention because it:

(*a*) Reacts rapidly with water
(*b*) Ignites easily
(*c*) Burns with a brilliant green flame
(*d*) Does not burn spontaneously when contacted with air and
(*e*) Because it is soluble in a wide range of solvents.

With reference to Figure 1, an annular container or

canister **10** having its top open and its lower end closed, is provided with a shelf or pan **11** preferably of shallow inverted conical form as shown. Pan **11** is circular in shape and is attached at its periphery to canister **10** to define a relatively air tight chamber **35** in which is a metal weight or other ballast weight **33** attached to the interior of the bottom of canister **10**. Immediately above pan **11**, and passing completely through the walls of canister **10** are orifices **28**. These are of very small diameter for reasons explained later in the specification.

In the upper portion of Figure 1, will be seen annular cup **12** having its open end toward pan **11**. Cup **12** has struts **13** attached to its lower periphery and to canister **10** to make canister **10** and cup **12** a unitary structure. Inside of cup **12** is liquid tank **14** which has its open end periphery fixedly attached to the underside of the top of cup **12** and has filler neck **15** which is in turn closed by vented filler plug **16** threaded into filler neck **15**. Filler plug **16** has a passage **16***a* clear through its shank and a passage **16***b* communicating therewith and open to the interior of tank **14**. A gasket **37** of resilient material is provided between filler neck **15** and plug **16** to prevent leakage of liquid from tank **14** during normal storage and handling. Plug **16** has a knurled outer surface so that it may be rotated conveniently by hand. It will be seen from Figure 1, that as plug **16** is rotated so as to unscrew it from filler neck **15**, passage **16***a* will be uncovered to allow air to pass through passages **16***a* and **16***b* into tank **14** to act as a vent.

In the bottom of liquid tank **14**, is a small diameter orifice **21**. This is closed by cover **23** which bears against resilient sealing ring **22** to provide a seal. Cover **23** is hinged to the bottom of tank **14** by means of pin **24** through hinge **25**, and a helical spring **25***a* is provided about pin **24** to urge cover **23** to swing away from seal **22** in the plane of the bottom of tank **14**. Cover **23** is provided with a hasp **26** through which is looped a slender restraining wire **27** of zinc or other acid corrosive material having its ends attached to tank **14** by means of a screw **27***a* or other suitable attachment. It will be seen that if restraining wire **27** is removed or parted, cover **23** is urged to swing aside about hinge pin **24** to uncover tank orifice **21**.

Between the inner walls of container or canister **10** and cup **12** is an annular pressure-removable sleeve **18**. This extends downward from the top of the device to the full depth of cup **12** and is in bearing with seals **19** near its top and seals **20** near its lower periphery. Small diameter pipes **17** are located near the bottom of liquid tank **14** and communicate with its interior and pass through the wall of cup **12** to communicate with the annular space defined by sleeve **18** cup **12** and seals **19** and **20**. A vent pipe **29** of very small diameter is provided on the exterior of container **10** and extends into chamber **36** above pan **11** from its top above the surface of the water.

Crystals, pellets or the like of ammonium chloride **32** are supported by pan **11** in chamber **36**.

In operation, the present invention is placed in water after which it will submerge to the approximate liquid level shown in Figure 1, thus allowing water to enter chamber **36** through orifices **28**. As the water reaches the ammonium chloride a dilute solution of hydrochloric acid is formed, and as water continues to enter orifices **28** and to contact the ammonium chloride **32**, the level of the acid solution rises as the trapped air is forced out through vent **29** to the atmosphere. When the level reaches slender zinc restraining wire **27** it will attack the zinc and eat it away. When the wire parts, spring-loaded cover **23** is released and is then urged by spring **25** to swing about hinge **25** and pin **24** away from its seat upon seal **22** to thereby uncover orifice **21** and thus allow the solution of

monobromopentaborane to pass through orifices **21** in small but steady quantity and to drop into the acid solution. As the monobromopentaborane solution comes in contact with the acid, large quantities of hydrogen gas are released. The hydrogen gas is produced in much greater quantity than can easily flow through orifices **28** or through vent tube **29**, and as a result, pressure is built up within chamber **36** to a considerable degree, this pressure acting upon the face of edge **38** at the lower periphery of annular sleeve **18**. Since sleeve **18** is held in place only by the friction of the O ring type seals **19** and **20**, and since this friction is relatively small, the resultant upward force created upon sleeve **18** will force it upward and cause it to be ejected from the top of the device. The hydrogen gas will then follow it up through the vacated narrow annulus or passage **39** and will pass over catalytic material **30** set in the upper end or periphery of cup **12** as a ring or band with its face exposed to the gas. This material is such that it will catalyze the reaction of hydrogen with air and cause it to ignite. Among such catalytic materials are metals of the platinum, palladium and nickel groups. As the hydrogen gas flows upward through passage **39** with considerable velocity, it will entrain monobromopentaborane solution which enters passage **39** from tank **14** through pipes **17** under a static pressure head and because of the aspirating effect of the high velocity hydrogen gas. As the entrained monobromopentaborane is carried upward to the point where the hydrogen is burning, it too will ignite and in burning will produce a brilliant green flame and intense light. The flare will continue to operate until all of the monobromopentaborane solution has been used up.

Before the device is placed in the water, filler plug **16** is loosened with the fingers to allow passage **16*a*** to become uncovered in order that air may pass through it and passage **16*b*** into tank **14** to fill the space evacuated by the liquid as it passes from the tank **14**.

Suitable flotation material such as cork is provided in annular space **34**. Flotation material is also located in chamber **35** below pan **11** and about weight **33**. The purpose of ballast weight **33** is to provide a low center of gravity for the device so that it will at all times float in an upright position, even in disturbed water, and will float to a depth sufficient to allow the water level in canister **20** to reach the zinc wire **27**.

Orifices **28** can be kept in a closed, sealed condition to prevent moisture from entering chamber **36** and thus coming in contact with ammonium chloride **32**, by means of a pressure-sensitive tape applied to the outside of canister **10**. This tape can be easily removed before the flare is placed in the water for operation.

In addition to the mechanical device described in the foregoing paragraphs, a novel process for producing a signalling light is present. This process includes the steps of forming hydrogen gas, increasing its velocity by passing it through narrow annulus **39**, entraining monobromopentaborane solution in the moving hydrogen gas, and then igniting the hydrogen and its entrained monobromopentaborane by passing the hydrogen over a material catalytic for the reaction of hydrogen in air. Because of the monobromopentaborane present, a brilliant green flame useful as a signal light is produced. Earlier steps which can be included in the process include forming a dilute acid solution by adding water to ammonium chloride and then forming the hydrogen gas by adding a solution of monobromopentaborane to the acid solution.

While there have been shown and described and pointed out the fundamental novel features of this invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is:

A signalling flare comprising, an open-topped annular canister, means for closing all of its top except a narrow annulus about the inner periphery of said canister, a vented tank containing a solution of monobromopentaborane, conduit means connecting the tank with the annulus, an orifice in the bottom of the tank, a spring-loaded cover for said orifice, sealing means between said cover and tank, an acid-corrosive restraining wire attached to said cover and to a fixed portion of the flare, means for forming an acid solution in said canister in the vicinity of the wire upon the entry of water to the canister, orifice means for allowing entry of water thereto and for venting air trapped therein, pressure removable closure means for said annulus, and material at the upper periphery of said annulus catalytic for the reaction of hydrogen with air, whereby the acid in the acid solution will eat through the restraining wire to cause uncovering of the orifice in the monobromopentaborane tank with resultant flow of monobromopentaborane solution into the acid solution to produce hydrogen gas, the hydrogen gas pressure thereupon causing removal of the annulus closing means with resultant flow of hydrogen gas through the vacated annulus and entrainment of monobromopentaborane, and ignition of the hydrogen gas and entrained monobromopentaborane at the upper periphery of the annulus by virtue of the contact of the hydrogen with the catalytic material.

References Cited in the file of this patent

UNITED STATES PATENTS

2,110,061	Gentzel	Mar. 1, 1938
2,334,182	Farrow	Nov. 16, 1943