

Nov. 18, 1969

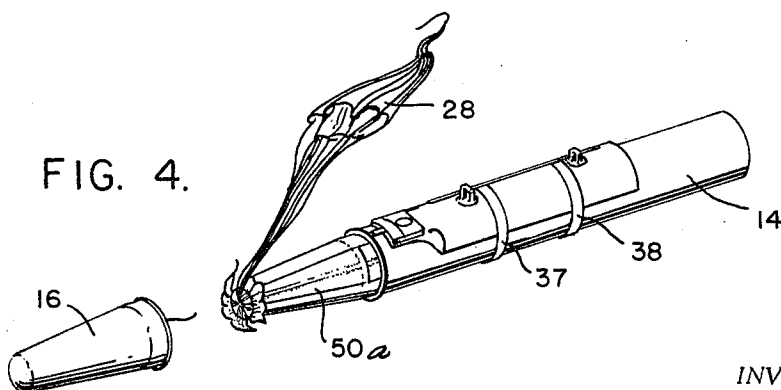
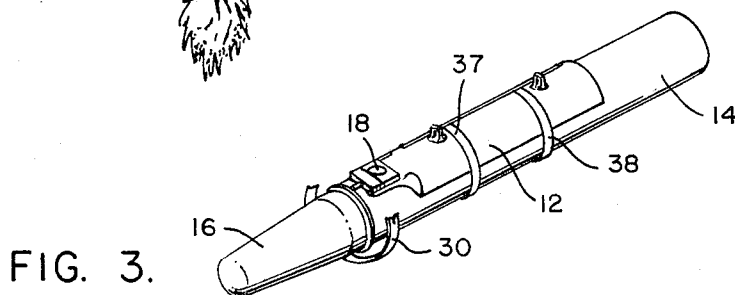
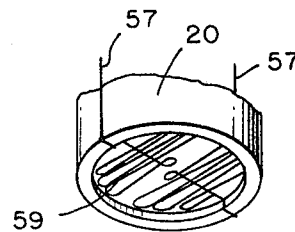
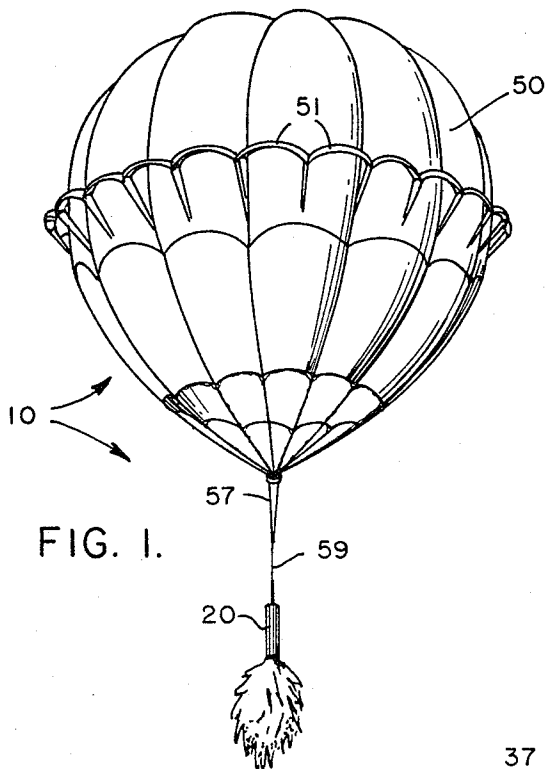
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3,478,687

VERY LOW DESCENT RATE, HIGH INTENSITY, ILLUMINATING FLARE

Filed Nov. 8, 1967

3 Sheets-Sheet 1



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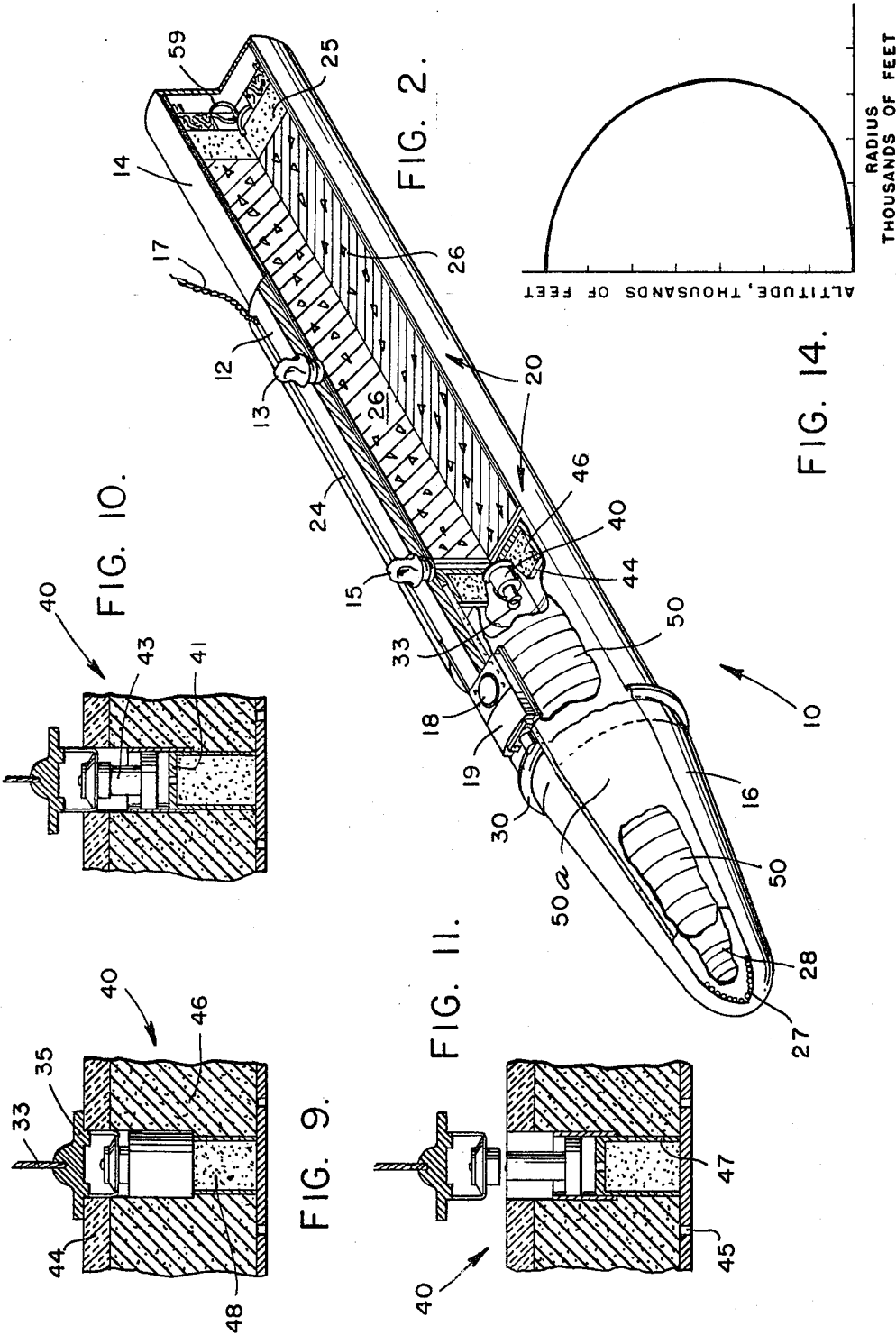
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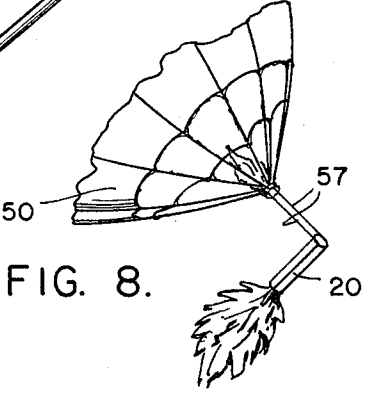
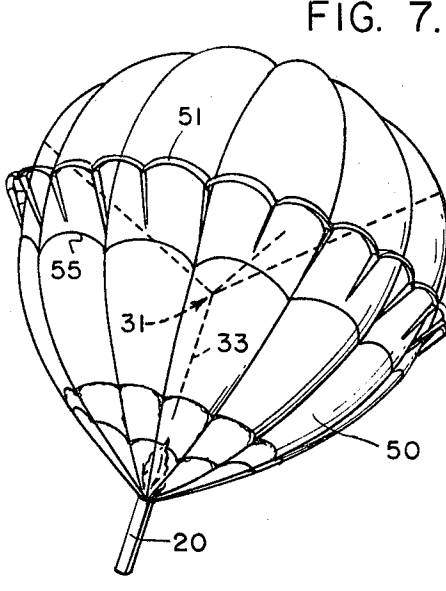
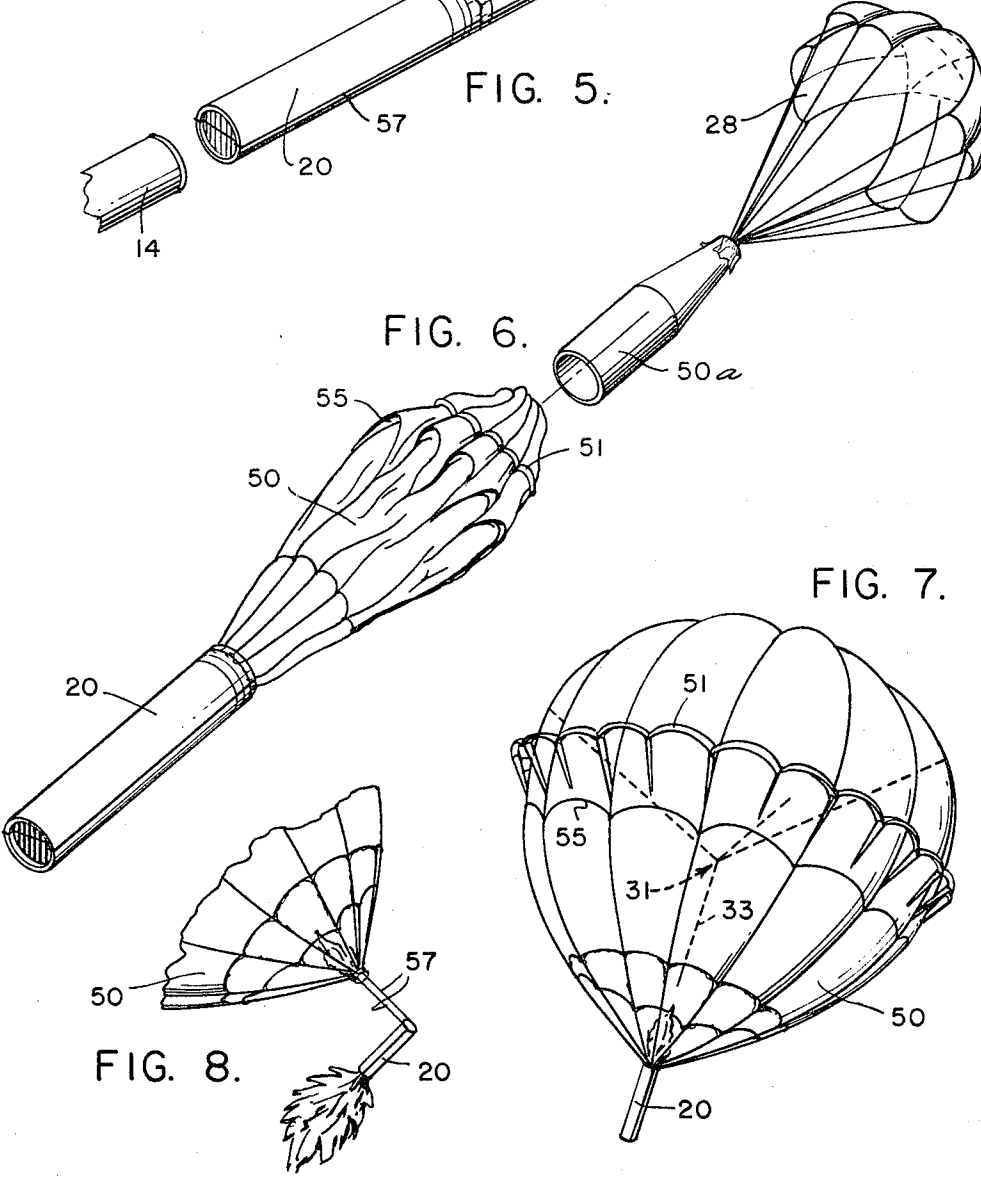
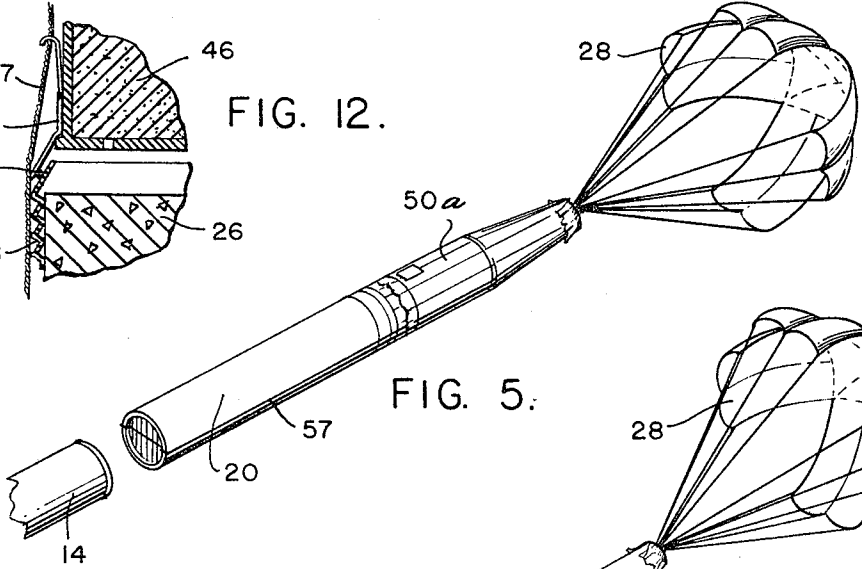
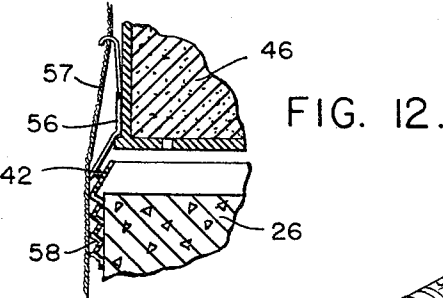
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3,478,687

VERY LOW DESCENT RATE, HIGH INTENSITY, ILLUMINATING FLARE

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Filed Nov. 8, 1967, Ser. No. 683,095

Int. Cl. F42b 25/04, 13/38

U.S. Cl. 102—35

2 Claims

ABSTRACT OF THE DISCLOSURE

A very low descent rate, high intensity, illuminating flare system comprising a flare assembly and a suspension balloon assembly is provided in a compact package for aerial delivery. The flare assembly consists of a flare candle, a flare candle igniter and a heat generator. The descent rate of the system is controlled by novel hot air balloon suspension means.

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.

BACKGROUND OF THE INVENTION

Previously developed aerial flares have been parachute suspended and have been known to have several disadvantages.

(1) Parachute flares in general oscillate during descent causing apparent flickering of the light.

(2) If descent is too fast the flare must be deployed at an altitude which is too high for most efficient lighting in order that it not arrive at the ground still burning.

(3) To achieve low descent rate, allowing more efficient altitude placement, a parachute for a heavy (100 lbs.) flare would require a very large parachute.

(4) Previous aircraft delivered flare systems have not incorporated safety features available in Briteye, for example:

- (a) Launch environment sensing (Y-bridle),
- (b) Out-of-line initiator (flare lighter),
- (c) First fire composition eliminated by flare lighter, fusible joint and tip over features.

SUMMARY OF THE INVENTION

The present invention combines a number of new and novel features to provide an aerial flare which may be delivered by the pilot of a single position aircraft with safety, reliability and efficiency. This system provides a slow rate of descent throughout the burning time of the candle and effectively illuminates a larger area for a longer period of time than was possible with any previous flare system.

The system in a preferred embodiment is packaged for aerial delivery in an aluminum tube with a conical forward fairing to lower the wind resistance when the system is attached to an aircraft. Assembled in the tube and fairing are the candle flare, igniter, heat generator and the aerostatic suspension system comprising a hot air balloon and a drogue parachute. When the system is launched from an aircraft the forward fairing drops away and the drogue chute deploys the balloon carrying the flare mechanism. Initial inflation of the balloon is augmented by ram-air entering through peripheral ports located on the balloon equator between the shroud lines. Inflation of the balloon causes an internally placed Y-bridle to actuate a flare lighter. The flare lighter ignites a pyro-

technic heat generator. The hot gas from the generator is directed into the inflated balloon to achieve system buoyancy and a small portion of the hot gas is allowed to jet downward to impinge on the face of the candle for ignition. When the candle is lighted, the high temperature melts a fusible joint in the flare housing. The candle then tips over to a burning face-down position. When the system is near the end of its useful life the flare color changes to indicate its impending burnout to the user so that another flare may be released. After burnout the flare is destroyed by a built-in destruct mechanism so that it will not present a safety hazard to aircraft in the area.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of the flare system fully deployed;

FIG. 2 is a perspective view partly in section and with portions broken away to show the internal configuration of the system packaged for delivery;

FIGS. 3 through 8 are perspective views of the system in various stages of deployment;

FIGS. 9 through 11 are cross sectional views of the ignition device, showing its operation;

FIGS. 12 and 13 are enlarged views of portions of the candle assembly showing the operation of the tip over mechanism; and

FIG. 14 is a graphic representation of the area illumination available with the disclosed system.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. 2 the flare system is shown in its delivery package ready for attachment to an aircraft. As shown, the assembled system 10 is surmounted by a strongback 12 having attachment lugs 13, 15 for fastening the assembly to an aircraft. The strongback is held in place by bands 37, 38 as illustrated in FIGS. 3 and 4. The forward end of the assembly is fitted with a nose fairing 16 shaped to reduce wind resistance on the assembly during aerial delivery. The nose fairing is ejected from the flare candle assembly after the system is launched. A timer 18 which may be set for from 2 to 20 seconds delay is started by the extraction of pull cord 17 as the system is launched. After the preset time has elapsed, the timer 18 mechanically initiates a band release device 19, which releases the clamp 30 (see FIG. 3) that seals the two sections of the outer case together. An internal compression spring 27 assists the forward nose cone 16 in separating from the inner flare assembly. As the nose cone 16 separates from the inner flare assembly, the drogue chute 28 is deployed (FIG. 4). The drag force on the drogue chute 28 stabilizes and decelerates the package in a candle-forward position (FIG. 5). The drogue chute 28, after a time delay, strips the cloth deployment case 50A off of the aerostat balloon 50, thus deploying the balloon (FIG. 6). The balloon 50 inflates from ram air entering the large peripheral ports 55 that are located on the balloon equator. These ports automatically close when the balloon is fully inflated (FIG. 7). Balloon inflation tensions the Y-bridle 31 that is attached to the inside of the balloon 50, thus mechanically initiating the flare lighter 40 of the pyrotechnic train. The flare lighter 40 ignites the ignition pellet 48 (FIG. 9), which directs an intense short-duration flame through ports 45 onto the surface of the pyrotechnic material 26 of flare candle 20 and also through ports 47 onto the heat generator 46, igniting both. The heat generator output is directed into the balloon 50, through an opening in heat shield 44, thus heating and lowering the density of the air in the balloon. The resultant buoyancy reduces the descent rate of the balloon to about five feet per second. This descent rate

is maintained by the residual heat and the burning flare candle.

After ignition, the hot flame of the candle face is directed against the fusible ring 42 (see FIG. 12) which melts, thus parting the candle from the heat generator section. As the candle falls away, the balloon suspension cables 57 (see FIGS. 12 and 13) which are joined to a single cable 59 fastened to and stored on the base of the candle (FIG. 13), cause the candle to tip over to a burning-face-down position. As the candle burns away, its weight loss tends to be compensated for by the loss of heat and, hence, loss of buoyancy of the balloon. The flare, therefore, has a fairly constant descent rate throughout its burn time.

Turning now to FIGS. 3 through 8, there is shown the sequence of events during deployment of the system. Thus, in FIG. 3, we see the ring 30 has released by timer 18 and in FIG. 4, the nose cone 16 has parted from the casing 14 releasing the drogue chute 28. In FIG. 5, the drogue chute 28 has aided in separating the outer case 14 from the candle assembly 20. The balloon shroud 50a is next stripped from the balloon 50 as shown in FIG. 6 and the balloon rapidly fills with ram air forced through peripheral ports 55 until it is fully opened as shown in FIG. 7. At this point the Y-bridle 31 has been tensioned sufficiently to actuate the firing mechanism and in FIG. 7, flame may be seen emanating from the top of candle assembly 20.

In FIG. 8 it may be seen that the candle has become lighted and has parted from the heat generator section causing the tip over to its fully deployed position.

Operation of the ignition device may be understood by reference to FIGS. 9 through 11 in which there is shown a lanyard plate 35 which is attached to a lanyard 33 of Y-bridle 31. Lanyard plate 35 is connected to a cap removably fastened to the firing pin device 43 of the igniter 40. During storage and delivery the igniter 40 is in a safe position wherein the firing pin blocks the ignition port and holds aside a pivoted primer slide in a well known manner. The primer slide is pivoted in such a way that, when the firing pin 43 is withdrawn from its safe position the primer will be positioned in line with the firing pin and the firing port. In this position the igniter is ready to be fired as shown in FIG. 10. The lanyard plate 35 is fastened to the cap by means of detent balls (not shown) which are designed to ride over a cam surface and fall away after a predetermined travel as shown in FIG. 11. When the cap separates from the firing pin assembly 43 the firing pin is free to travel downward against the primer and thus ignite the ignition pellet 48.

For a more complete and detailed description of the firing device and its operation, reference may be had to patent application Ser. No. 643,309, filed May 29, 1967, by Ronald C. Noles, entitled Mechanical Flare Lighter.

FIG. 12 shows the fusible joint 42, between metal rims 56, 58, which melts when the candle 26 is reliably ignited. This enables separation of the candle assembly 20 from the rim 56 so that the candle may tip over and be suspended by cables 57. After tipover, the candle is suspended further down by means of cable 59 playing out from the end of the candle assembly 20 as shown in FIG. 13.

With this system it is possible to deploy a relatively heavy flare having longer burn duration and greater il-

lumination and to maintain the system at an optimum altitude for the entire burn life of the candle.

Near the end of the candle 26 is a portion 25 which contains a compound which burns with a characteristic color to indicate that the burn time of the candle is near an end.

The system according to a preferred embodiment incorporates a destruct means such as a length of primer cord (not shown) across the balloon which cord is time actuated to cut the balloon after the normal burn time of the candle.

A time delay device is also used to allow the drogue chute 28 to slow the descent of the system to a tolerable speed before the shroud 50a is parted from the enclosed balloon 50.

What is claimed is:

1. An illuminating device comprising:

an incandescent pyrotechnic,
an aerostat,

means for supporting said pyrotechnic from said aerostat,

means for releasably attaching said device to an aircraft for delivery,

said pyrotechnic including heat generator means for heating the air in said aerostat and flare means for providing illumination during deployment of the device,

ignition means for igniting said flare means and said heat generator means, and

fusible link means retaining said flare means in close proximity to said heat generator means,

said fusible link means comprising means responsive to heat from said flare means to release said flare means for deployment remote from said heat generator means.

2. An illuminating device according to claim 1 wherein:

said aerostat comprises a generally globular balloon having a plurality of substantially equatorial inflation ports for initial inflation of said balloon;

bridle means fastened to at least three places equally spaced around a meridian internally of said balloon; and

said ignition means comprising actuating means attached to said bridle means so that said balloon must be initially inflated to about 90% of its fully deployed state before said ignition means is actuated.

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U.S. Cl. X.R.

102—37.7