IMPINGEMENT AND COMPOSITION ENHANCED INFRARED FLARE

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IMPELLMENT AND COMPOSITION ENHANCED INFRARED FLARE

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5 Claims

ABSTRACT OF THE DISCLOSURE

An infrared flare including a hybrid combustor having the characteristics of restartability and throttleability. The rear portion of the flare includes an impingement block of the suitable chemical composition. The flame generated in the impingement section of the flare strikes the block as it flows from the nozzle. The impingement enhances the radiation effects of the flame because of ablation of the impingement block and increased density and temperature of the flame.

BACKGROUND OF THE INVENTION

This invention relates generally to infrared flares and, more particularly to an impingement and composition enhanced infrared flare.

There has been a recent tendency to supplement radar detection and guidance systems with infrared or "IR" systems. Sources of radiation in the infrared spectrum are useful as target devices in testing equipment and training personnel in weapons having infrared sensitive homing mechanisms.

For the purpose of training personnel and development of new equipment, infrared flares, which can simulate the IR output from various thermal engines, are required. The infrared flares may be attached to the wings of target drones which are remotely controlled, or the flare may be propelled by rocket to high altitudes and suspended at the peak of its ascent by parachute. The flare may be balloon-dropped from aircraft or carried by a manned plane to trained detection equipment operators.

Initially, infrared flares were of pyrotechnic compositions which were towed in appropriate targets by high performance aircraft. This type of flare, however, left much to be desired, the two principal drawbacks being their inability to be started and restarted and their inflexibility to adjusting the characteristics of the flare. Therefore, the application of a hybrid combustor for the purpose of circumventing the two problems was introduced. Although the hybrid combustor flare appeared to satisfy past requirements, it has become desirable to produce greater enhancement in the radiation of present day infrared flares, while maintaining the restartability and throttleability characteristics of the hybrid combustor.

SUMMARY OF THE INVENTION

The present invention is an infrared flare which incorporates into a single compact package radiation enhancement by impingement and compositional effects, and also restart and throttling capabilities.

The present invention uses a hybrid combustor. Therefore, restartability, throttleability and other capabilities unique to hybrids apply. The high temperature combustion products generated in the mixer-nozzle section of the hybrid combustor flame flow out of an annular nozzle and stagnate at the axis of the abovementioned section. The rear side of the stagnated flame impinges on an impingement block located adjacent the nozzle. At a steady state, the heated impingement block will add to the continuum in the flame spectrum. In addition, the high temperature flame will also ablate the block, thus enhancing the flame by altering its composition. Thus, this new flare enhances the radiation of the flame by (1) impingement effects which may be separated into that due to stagnation of the flow and that due to heating of the impingement block, and (2) by compositional effect arising primarily from ablation of the impingement block.

The chemical composition of the impingement block can be chosen to enhance various regions of the spectrum.

It is therefore an object of this invention to provide an infrared flare which has radiation enhancement by impingement.

It is a further object of this invention to provide an infrared flare which has radiation enhancement by composition.

It is another object of this invention to provide an infrared flare which has all the unique features of a hybrid combustor, such as restart and throttling capabilities.

It is still a further object of this invention to provide an infrared flare which has a large radiating area.

It is still another object of this invention to provide an infrared flare which is made in removable sections so that most of the hardware is reusable.

It is yet another object of this invention to provide an infrared flare which is economical to produce and which utilizes conventional, currently available components that lend themselves to standard mass production manufacturing techniques.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

DESCRIPTION OF THE DRAWING

The figure of the drawing represents a fragmentary side elevational view of the infrared flare of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the figure, the infrared flare 10 is made up of a hybrid combustor 12, having the characteristics of restartability and throttleability. The combustor 12 is made up of an oxidizer section 14 and a mixer-nozzle section 16.

The mixer-nozzle section 16 has a cylindrical compartment therein which contains a solid fuel 20. Although only one compartment is shown in the drawing any suitable number may be used. The solid fuel 20 is composed of any suitable base such as castable rubber or methylmethacrylate or the like. The mixer-nozzle section 16 is further defined by a plurality of ports 22 located adjacent the solid fuel 20 and terminating in a nozzle 24.

Although only two such ports 22 are shown, any suitable number may be used, or the plurality of ports may be replaced by a single cylindrical port. The entire inner portion of the mixer-nozzle section 16 is lined with a suitable insulatory material, such as ceramic-coated material 25.

Adjacent the solid fuel 20 and proximate the nozzle 24 is an impingement block 26. The impingement block 26 in an adjustable mounted by any suitable means, such as mounts 28 on an insulated support member 27 in the flame portion of the mixer-nozzle section 16. The block 26 is composed of any suitable material, such as poly methylmethacrylate and potassium nitrate. In order to further enhance the emissivity the following additives may be used in the block 26: aluminum, magnesium, silicon, carbon, camphor, polyethylene, Teflon or polyurethane, depending upon the desired IR spectrum of the flame emanating from the nozzle 24. The ports 22 continue past the sides of the impingement block 26 before exiting through nozzle 24.
The oxidizer section 14 contains therein any suitable oxidizer, such as gaseous oxygen which is under constant pressure. The oxidizer section 14 further includes a plurality of valves 30, equal to the number of ports 22, or a single valve in the case of a single cylindrical port. Alternatively, a plurality of valves may be spaced around the cylindrical port.

The mixer-nozzle section 16 and the oxidizer section 14 are removably mounted to each other by any suitable fastening means, such as clamps 32 and sealing means 34. In this manner, either the oxidizer section 14 or the mixer-nozzle section 16 may be readily interchanged with another such section. The oxidizer, such as gaseous oxygen, flows under pressure through valves 30 and into the ports 22 in the mixer-nozzle section 16. The high temperature combustion products generated in the mixer-nozzle section 16 flow out of the annular nozzle 24 and stagnate at the axis of the mixer-nozzle section 16. The upstream side of a stagnated flame 36 impinges upon the downstream side of the impingement block 26.

At steady state the heated impingement block 26 will add to the continuum in the flame spectrum. In addition, the high temperature flame 36 will also ablate the block 26, thus enhancing the flame by altering its composition. Thus, the flame 10 of the instant invention enhances the radiation of the flame by (1) impingement effects, and (2) compositional effect arising from ablation of the impingement block.

MODE OF OPERATION

Referring again to the figure, the infrared flare 10 of this invention utilizes the restarktability and portability of the hybrid combustor 12 which is designed to supply an oxidizer, such as gaseous oxygen to a solid fuel. The gaseous oxygen is under constant pressure whereby it is injected into ports 22 of the mixer-nozzle section 16.

Operation of the infrared flare 10 is initiated in an injector section (not shown) wherein an oxidizer rich mixture of the oxidizer and a gaseous fuel, such as propane, is ignited by a spark to generate a hot gas which produces the initial vaporization of the fuel 20. The starting device is then terminated after which time combustion of the solid fuel 20 is sustained by the gaseous oxidizer. Additional oxidizer may be introduced into the hot combustion gases in the mixer-nozzle section 16 by regulating valves 30, accordingly, thus further controlling the applicable burning parameters. A coolant, such as water, (not shown) is continuously circulated in a conventional manner through the mixer-nozzle section 16 to provide cooling protection for the systems hardware. In accordance with the instant invention the radiant intensity of the exhaust flame 36 of the infrared flare 10 is enhanced by the judicious adjustment of the motor parameters, which include propellant composition and jet impingement.

The infrared flare exhaust flame 36 will thermally degrade and mechanically erode, that is ablate the impinge-

I claim:

1. An infrared flare having the characteristics of restarktability and portability comprising a combustor, said combustor including an oxidizer section and a mixer-nozzle section, said mixer-nozzle section having a compartment therein containing a solid fuel, a port located in said compartment and adjacent said solid fuel and terminating in a nozzle, said oxidizer section having therein a suitable oxidizer under constant pressure and a value means, whereby the oxidizer flows through said valve into said port in said mixer-nozzle section generating high temperature combustion products which flow out the nozzle in the form of an exhaust flame, and an impingement block of suitable composition which includes an additive means for enhancing the emissivity of said flame mounted in the rear portion of said mixer-nozzle section adjacent said solid fuel and proximate said nozzle. whereby the upstream side of said flame impinging upon the downstream side of said impingement block thereby enhances the emissivity of said flame.

2. An infrared flare as defined in claim 1 wherein said composition comprises polymethylmethacrylate and potassium nitrate.

3. An infrared flare as defined in claim 2 wherein said additive means includes aluminum for enhancing the emissivity of said flame.

4. An infrared flare as defined in claim 2 wherein said additive means composition further includes a magnesium additive for enhancing the emissivity of said flame.

5. An infrared flare as defined in claim 1 wherein said oxidizer section and said mixer-nozzle section are removably mounted to one another.

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