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EXTERNALLY MOUNTED, JET-IGNITED TRACKING FLARE

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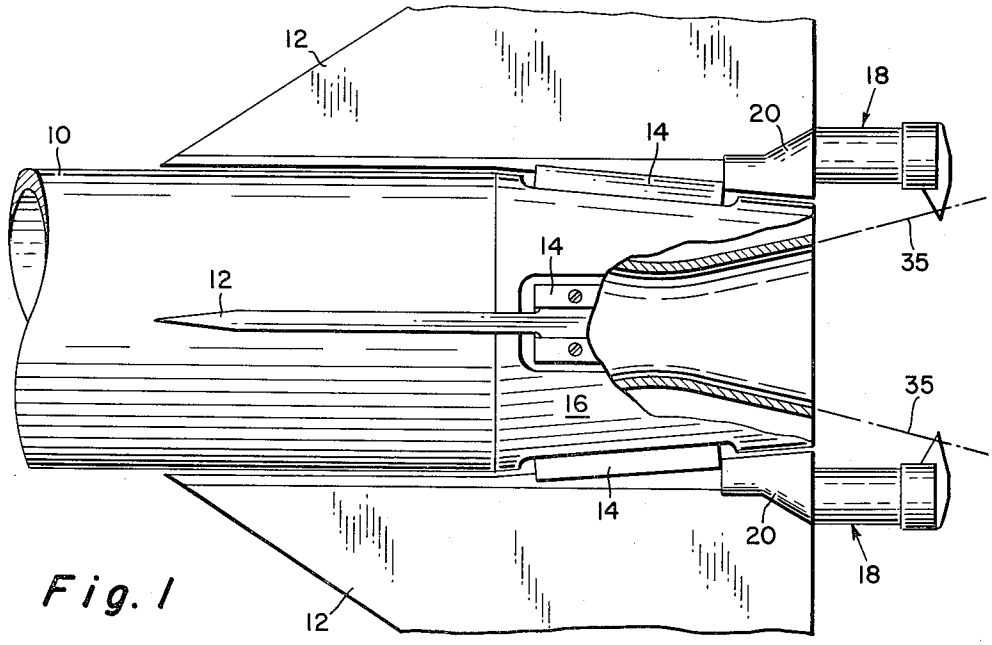


Fig. 1

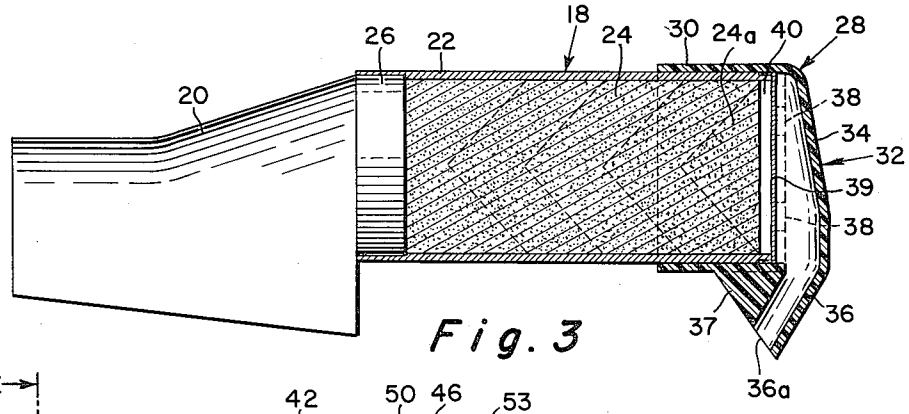


Fig. 3

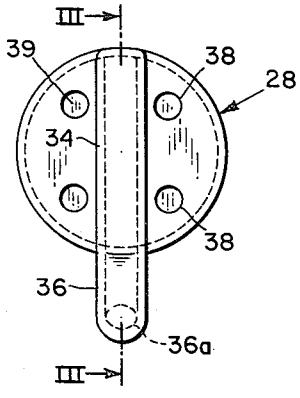


Fig. 2

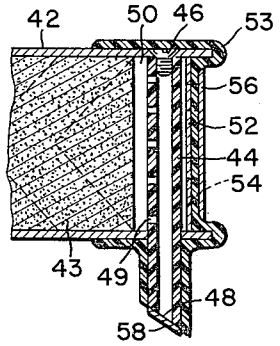


Fig. 4

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EXTERNALLY MOUNTED, JET-IGNITED TRACKING FLARE

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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.

This invention relates to flares and more particularly to a parasitic tracking flare capable of being externally mounted adjacent the nozzle of an aircraft's jet motor and ignited by the hot motor exhaust gases emitting therefrom.

In the test and evaluation of guided missiles, one of the methods for determining the operating flight characteristics is by observation through visual or photographic tracking means. To accomplish this result over maximum distances from the sighting stations it has been found necessary to provide the missile with an intense light source to facilitate the tracking operation. The most common light source employed is a pyrotechnic type flare ignited by an electrical squib. The flare is attached to some external appendage of the missile by a suitable mount to avoid a missile design change that might otherwise be necessary to accommodate such a test device. While such flares have been found satisfactory for the most part, there are several disadvantages. For example, an electrical wiring circuit is required having a suitable source of power in the missile. Furthermore, electrical squibs provide only a limited amount of heat for ignition, and are therefore not very reliable, especially at low ambient temperatures.

These disadvantages are overcome, and other advantages obtained, by utilizing the hot jet exhaust gases of a reaction motor, i.e., rocket motor to ignite the flare. This result can be accomplished by providing the flare with a mount for external support adjacent the jet nozzle, preferable on the boattail or to a fin structure, if the latter is available. The flare casing containing the combustible material is provided with a diverting means, such as a flame tube, which extends toward the longitudinal axis of the missile nozzle and into the jet exhaust stream. This tube diverts a portion of the hot gases into the flare to ignite the combustible material. Such a construction eliminates the need for an electrical circuit including a current source, ignition switch and squibs, thus, materially reducing the cost and weight of the flare while achieving improved reliability and greater safety.

A principal object of this invention is to provide a tracking flare which can be externally mounted to a jet powered aircraft and be ignited by the exhaust gases from the nozzle.

A further object is to provide a flare capable of being mounted and adapted to a variety of different types of missiles, quickly and without modifying the missile.

Other objects are to provide a simple, inexpensive, and more reliable flare.

FIG. 1 is a plan view of an aft end of a typical jet powered guided missile with a portion of the boattail broken away to show the nozzle, and with two flares of this invention being mounted on two oppositely-disposed missile fins in balanced relation;

FIG. 2 is an aft end elevation view of one of the novel flares;

FIG. 3 is a longitudinal section of the flare and mount taken along line III—III of FIG. 2; and

FIG. 4 is a longitudinal section of a modified flare construction.

Referring to the drawing where like reference numerals refer to similar parts throughout the figures, there is shown in FIG. 1 the aft portion of a typical guided missile 10 of the type having a plurality of tail fins 12 supported by guide members 14 secured to the missile boattail 16. A pair of flares 18, constructed according to this invention, are each detachably secured by a respective mount 20 to oppositely disposed fins to balance the forces on the missile, and while such a disposition is desirable it is obvious that one or more flares could be employed depending on the missile and the particular operational requirements.

Flare mount 20 is of a type described in a U.S. patent application, Serial No. 694,898 now Patent No. 2,967,484 and is particularly suitable for supporting the flare to a fin-type missile. Other type mounts can be employed depending on missile configuration.

As flares 18 are identical in construction a description of one flare should suffice for both. Referring to FIGS. 2 and 3, the flare comprises an open-ended, preferably cylindrical, metal sleeve or casing 22 packed or otherwise filled with any suitable combustible pyrotechnical mixture 24. As has been found most suitable in practice, the mixture is packed in conical shaped increments, indicated by broken lines, using a correspondingly shaped ram, the first increment 24*a* being an ignition mixture to accelerate initial flare ignition. The pyrotechnic material is recessed at the supported end of the casing to accommodate a shoulder 26 of the specific mount 20, although it is apparent that any other suitable attaching means may be employed.

The ignition end of the casing is closed by a cap 28, preferably constructed of a thermally destructible, moldable material such as a suitable polyester compound, for a purpose later to be described. The cap is provided with a peripheral lip 30 capable of being press-fitted over and sealed to the casing. Cap 28 is fabricated with a hollow flame tube 32 which can be integrally formed in the molding process. A semicylindrical portion 34 of the tube extends diametrically across the cap and is open to the cap interior. The tube terminates in a projecting portion 36, having a bevelled entrance opening 36*a* facing toward the nozzle and in the path of the hot gases indiacted by broken lines 35 in FIG. 1. It should be noted that tube projection 36 is also canted upstream of the exhaust flow to produce a positive diversion of the hot gases through the tube into the flare interior, the tube passageways being configured to direct the induced gases back against the entire surface of mixture 24. A web portion 37 joins tube portion 36 and the cap to enable the tube to withstand the blast force.

The flat portion of the cap on each side of tube 32 is provided with a pair of spaced openings 38 for venting to atmosphere a combustion chamber 40 of the flare casing. Pyrotechnic mixture 24 is sealed from atmospheric openings 38 and tube 34 by a disc 39 of thin combustible material, such as aluminum foil, which covers the open end of casing 22 and is clamped and sealed about the periphery thereof by cap 28 to provide a moisture barrier. In an air-launched missile it is preferred that disc 39 be not sealed to the inside face surface of the cap to permit an airflow through the tube and cap out to atmosphere through openings 38 prior to rocket ignition to avoid a frosting condition in the cap and to prevent a build-up of pressure immediately before rocket ignition. As will be noted in FIG. 3, the entire exposed surface of ignition increment 24*a* is spaced from the inner face of cap 28 providing the combustion cham-

ber 40 through which the hot exhaust gases can be distributed, thus ensuring more stable and uniform burning characteristics. It is obvious that the combustion chamber could be formed in a suitable recess in the cap.

When the missile jet motor is ignited, a portion of the hot gases emitting from the nozzle enter the flare cap through entrance 36*a* and the tube passageways, and the impact either ruptures and melts disc 39 adjacent the cap openings to admit the flame within the casing to ignite the pyrotechnic charge. The pressure build-up due to combustion is vented to the atmosphere through openings 38. As the flare commences to burn, the cap being of combustible material is eventually destroyed by both gradual enlargening of openings 38 and by the jet exhaust, and the flare burns unrestricted through the uncaped end of casing 22.

A modified flare is shown in FIG. 4 having an open-ended flare casing 42 filled with a conventional pyrotechnic material 43. Adjacent one end of the casing is provided a drilled opening to receive a flame tube 44, the inner end of the tube being secured by a screw 46 to the opposite side of the casing. The other end of the tube projects beyond the casing and terminates in a beveled end having an entrance opening 48. The portion of the tube within the casing is provided with a plurality of openings 49 leading from within the tube to a combustion chamber 50 provided between the first increment of the pyrotechnic charge and the tube. The open end of the casing is closed by a cap end 52 made of a combustible material, such as cardboard, being sealed in position. The end of the assembled casing is dipped into a plastic sealing compound 53. Thereafter a plurality of holes 54, similar to 38 in cap 28 of the prior embodiment, are drilled through the sealing coating and cap 52 and the openings are thereafter sealed by a disc of aluminum foil 56, similar to disc 39. Final sealing of the flare is accomplished by adhering a disc 58 of aluminum foil over the entrance opening 48. Tube 44 and mixture 53 are made of a consumable material similar to cap 28 of FIG. 3. The operation of the flare in FIG. 4 is substantially the same as described with reference to the modification of FIGS. 2 and 3, with the exception that there is no ram air flow through the cap prior to rocket ignition.

This invention provides a parasitic flare that is simple, inexpensive, and self-sufficient. By utilizing the hot exhaust gases of a jet motor, the flare does not depend on a current source and electrical circuitry which simplifies, and at the same time, ensures a more dependable flare. The flame tube can be formed separate, as in FIG. 4 or integrally casted with the cap as in FIGS. 2 and 3, the latter being simpler and easier to manufacture, and is more positive in inducing exhaust flow into the flare. If desired the flame tube in both embodiments can be filled with a conventional combustible material, such as quick match, to facilitate ignition of the flare charge. A flare embodying the invention is easily adaptable for test purposes on various types of missiles as it requires no modification of the missile to support the flare.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

We claim:

1. A jet-powered missile having a nozzle from which is emitted an exhaust flow of hot gases, a tracking flare comprising a longitudinal housing containing a combustible charge, a mount for supporting said housing to the missile laterally outside the nozzle exhaust flow and aft of the nozzle, said housing having a transverse open-ended hollow extension projecting into the exhaust flow and forming a passageway leading to the interior of the housing adjacent the charge, said extension inducing a portion of the hot gases laterally from said flow through the passageway into the housing to ignite the charge.

2. The jet-powered missile of claim 1 wherein said housing has two ends, means are provided at one end of the housing for attachment to the mount, and the extension is a tube which projects transversely from the other end of the housing.

3. The jet-powered missile of claim 2 wherein a cap is provided to close the end of the housing having the extension, said cap being made of thermally destructible material and being provided with at least one aperture venting the interior of the housing to atmosphere, said tube terminating between the charge and the cap.

4. The jet-powered missile of claim 3 wherein the opening in the tube and the opening in the cap are sealed with a thin, thermally destructible, moisture-proof barrier.

5. The jet-powered missile of claim 3 wherein said cap and tube are an integrally-molded member.

6. The jet-powered missile of claim 3 wherein a mouth of the tube extension is inclined upstream the exhaust flow.

7. A tracking flare comprising longitudinal housing containing a combustible charge, a cap closing one end of the housing and spaced from the charge to form a combustion chamber, an open-ended tube extending transversely across said housing adjacent the combustible charge and having a portion projecting laterally beyond said housing, said cap and tube being made of thermally destructible material, said cap being provided with at least one aperture venting the combustion chamber to atmosphere.

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