United States Patent

Howison et al.

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[54] **DISPOSABLE ROCKET MOTOR NOZZLE**

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[51] **Int. Cl.** **B64d 33/04**

[58] **Field of Search** 239/265.15, 265.11; 102/49.5

[56] **References Cited**

UNITED STATES PATENTS

3,331,324	7/1967	Oss et al.	102/49.5
3,427,698	2/1969	Guzewicz	239/265.15 X
2,937,595	5/1960	Margulis et al.	102/49.5
3,447,465	6/1969	White	102/49.5
3,351,691	11/1967	Wilford	239/265.15 X

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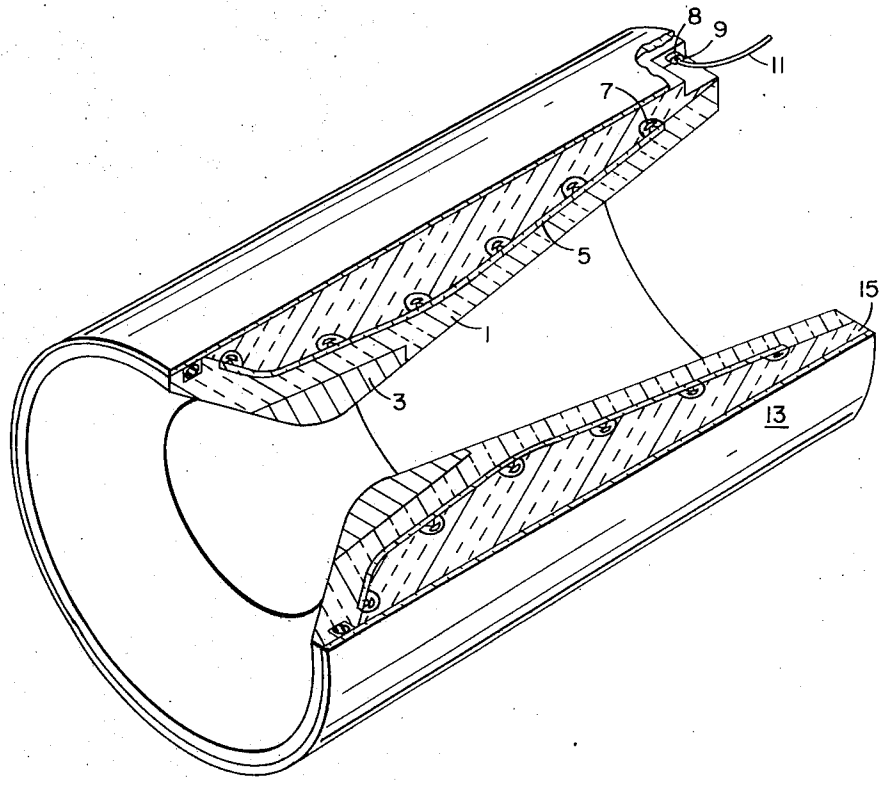
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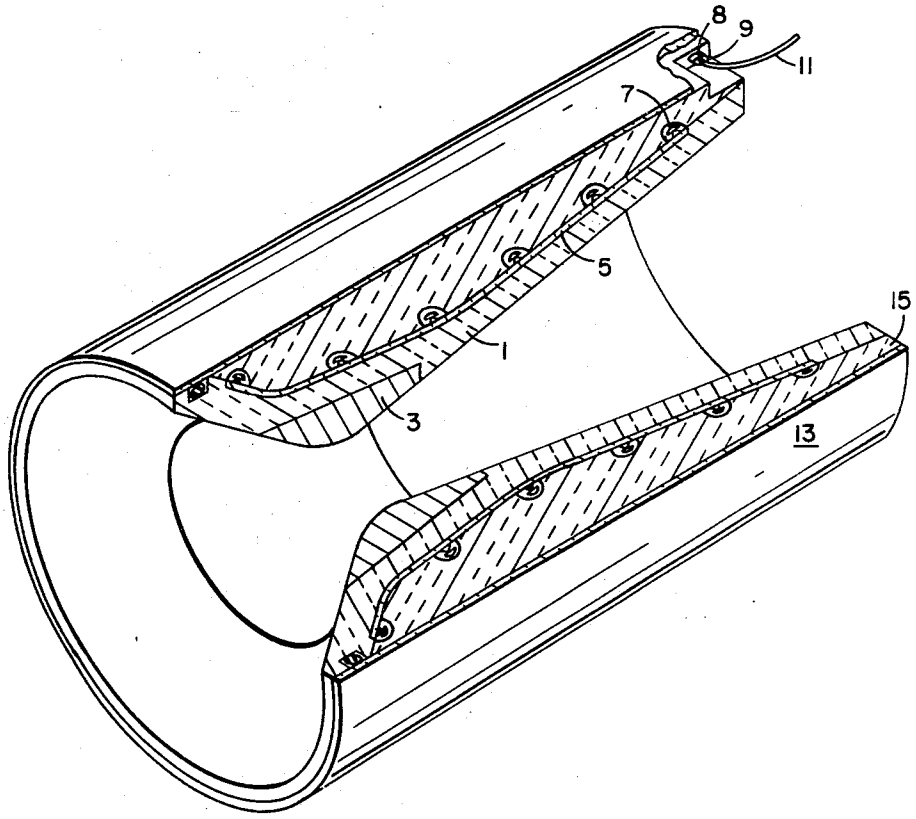
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[57] **ABSTRACT**

A disposable rocket motor nozzle that has a converging diverging throat portion with a shaped charge wound about the throat portion to be ignited by conventional igniter means to cause the throat portion to be broken up into small pieces when it is desired to destroy the nozzle.

8 Claims, 1 Drawing Figure





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DISPOSABLE ROCKET MOTOR NOZZLE

BACKGROUND OF THE INVENTION

Since the advent of high altitude sounding rockets, users have been plagued with prediction of impact points for expended rocket components. The unguided rocket has been known to provide its user with bad moments when an erratic flight made the eventual impact locale somewhat questionable. Because of these falling mass hazards, the use of sounding rockets for obtaining high altitude meteorological data for research, development, tests, and evaluation has been restricted to missile ranges where the air lanes are controlled and large tracts of land or water are available for impact areas. Firings in populated locales of the globe, where such data are most often needed, have not been possible. Therefore there is a need for rocket components that can either be destroyed or burned up so that they can be used in populated locales without adversely effecting property or personnel of these locales.

In accordance with the need, it is an object of this invention to provide a rocket motor nozzle that can be disposed of in a safe manner.

Another object of this invention is to provide a disposable rocket motor nozzle that can be safely handled by personnel.

A further object of this invention is to completely fragment a nozzle section and contain the explosive section entirely within a rocket motor case and restrict the hazardous area to a small area immediately behind the rocket.

Still another object of this invention is to provide a disposable rocket motor nozzle that can be mounted on a rocket such as to enable one to safely handle the rocket without danger of blast in the event of accidental detonation of the explosive around the nozzle.

A still further object of this invention is to provide means to explosively fragment a nozzle section and decrease the safety hazard to a degree which makes the design practical for use in meteorological systems.

SUMMARY OF THE INVENTION

In accordance with this invention, a disposable rocket motor nozzle is provided that includes a converging diverging nozzle body with a throat insert therein. A thermal barrier such as asbestos paper is placed around the outer periphery of the nozzle body portion and a shaped charge is helically wound about the periphery of the nozzle body portion and the thermal barrier. With the shaped charge in place, a housing is placed around the nozzle body portion to define a void between the nozzle body portion and the housing. A cushioning filler material is used to back up the shaped charge and provide shock absorber and thermal barrier protection to the housing. A conventional igniter cap is placed at one end of the shaped charge to ignite the charge at the appropriate time.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE of the drawing is a perspective view in section of the disposable rocket motor nozzle.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawing, converging diverging nozzle body portion 1 has a throat insert 3 mounted

therein in a conventional manner. That is, throat insert 3 is secured in nozzle body portion 1 by conventional securing means. Nozzle body portion 1 has a thermal barrier layer 5 about the outer periphery thereof, and over the thermal barrier 5 is helically wound a shaped charge in the form of a flexible linear shaped charge 7. Shaped charge 7 is helically wound about the outer periphery by first making one complete turn at one end of the nozzle body portion of the helical shaped charge and thereafter helically winding the shaped charge about the remainder of the nozzle body portion so as to terminate the helical wound charge in one complete turn at the opposite end of the nozzle body portion. The shaped charge is bound by adhesives such as dental adhesive to the thermal barrier to initially hold the shaped charge in place. The ends of shaped charge 7 are coated with a lacquer to seal the ends. The shaped charge at the aft end of the rocket nozzle has a plastic tube 8 placed thereover and a conventional igniter cap 9 is placed in the tube. An electrical lead 11 is connected to cap 9 to cause detonation of the cap and shaped charge. A rocket motor housing 13 in the form of a fiberglass sheath is placed around the outer periphery of the nozzle body portion and cushioning filler material 15 is placed between the outer housing and the shaped charge to form a backup for the shaped charge and provide shock absorber and thermal barrier protection for the motor housing. The nozzle may be connected to the rocket motor structure in any conventional manner.

Nozzle body portion 1 is perferably made of a material such as asbestos-phenolic, paper-phenolic, glass-phenolic or ceramic such as Pyroceram, and throat insert 3 is made of graphite. Shaped charge 7 is preferably a flexible linear shaped charge but may be other explosive cord such as Primacord. The amount of shaped charge to be used to dispose of the nozzle body portion and throat will depend upon the type material used in the nozzle body portion. That is, if an asbestos-phenolic is used, more shaped charge will be needed than if a ceramic is used. This is true since it takes a greater force to break up the nozzle body portion if it is made of a material other than the ceramic. Thermal barrier sheath 5 is made of asbestos, and filler material 15 which acts as a shock absorber and thermal barrier may be selected from the materials including expanded, cellular polystyrene (Styrofoam), epoxy foam and phenolic microballoon. The phenolic microballoon filler material is composed of a plurality of synthetic resins and glass. This combination of synthetic resins and glass materials make finely divided, whole free, low density particles.

In operation, the disposable rocket motor nozzle acts as an aft motor closure of a solid fuel rocket motor and limits the hot gas motor flow during motor burning. At some selected time after motor burn out, either by pyrotechnic delay or electrical time delay, the shaped charge is detonated by initiator 9 and nozzle body portion 1 and throat insert 3 are fragmented into small particles of .1 pound or less. These particles will then float back to the ground harmlessly.

We claim:

1. A disposable rocket motor nozzle comprising a converging diverging nozzle body portion, a shaped charge wound about the outer periphery of said nozzle

body portion for directing its explosive force toward said nozzle body portion, a thermal barrier of asbestos mounted on the outer periphery of said nozzle body portion to separate said shaped charge from said nozzle body portion, a housing about said nozzle body portion so as to inclose said shaped charge relative to said nozzle body portion, and a filler material between said shaped charge and said housing to act as shock absorber and thermal barrier to protect the housing when the shaped charge is detonated.

2. A disposable rocket motor nozzle as set forth in claim 1 wherein, said nozzle body portion is made of a material selected from the group consisting of an asbestos-phenolic, a paper-phenolic, a glass-phenolic, and ceramic, and wherein said nozzle body portion has a throat insert secured therein and said throat insert is made of graphite.

3. A disposable rocket motor nozzle as set forth in claim 2 wherein, said shaped charge is a flexible linear shaped charge and said shaped charge is wound about said nozzle body portion by being wound one complete revolution near each end of said nozzle body portion, the remainder of said shaped charge being wound about said nozzle body portion in the form of a helix.

4. A disposable rocket motor nozzle as set forth in claim 3 wherein, said filler material is selected from the group consisting of expanded polystyrene epoxy foam, and phenolic microballoon.

5. A disposable rocket motor nozzle as set forth in claim 3 wherein, said nozzle body portion is made of asbestos-phenolic.

6. A disposable rocket motor nozzle as set forth in claim 3 wherein, said nozzle body portion is made of a glass-phenolic.

7. A disposable rocket motor nozzle as set forth in claim 1 wherein, said nozzle body portion is made of ceramic material.

8. A disposable rocket motor nozzle as set forth in claim 1 wherein, said nozzle body portion outer periphery converges radially inwardly from one end of said nozzle body portion and then diverges radially outwardly to the other end of said nozzle body portion, and said shaped charge is a flexible linear shaped charge with said shaped charge being wound about said nozzle body portion by being wound one complete revolution near each end of said nozzle body portion, the remainder of said shaped charge being wound about said nozzle body portion in the form of a helix.

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