Sept. 3, 1963 F. R. BARNET 3,102,390

JETEVATOR SYSTEM DESIGN

Filed March 9, 1960

FIG.3.

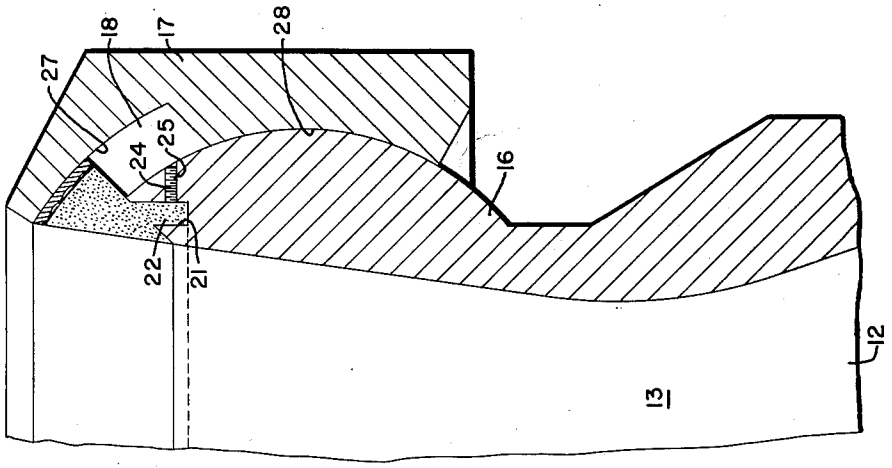


FIG.2.

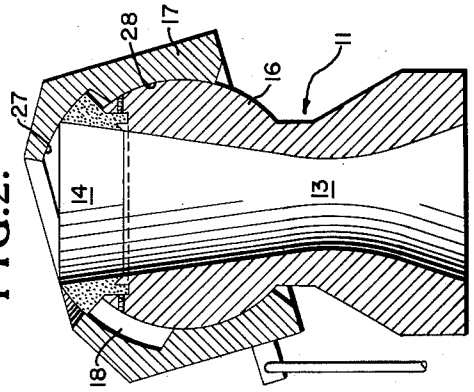
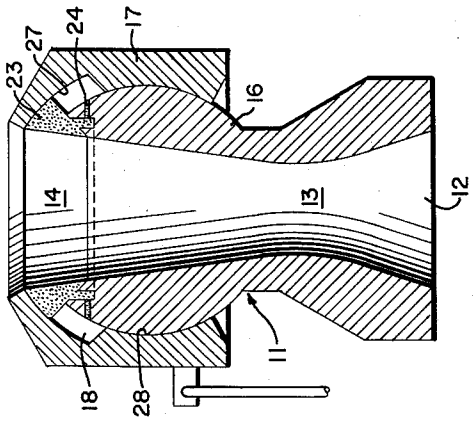


FIG.1.



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JETEVATOR SYSTEM DESIGN

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(Granted under Title 35, U.S. Code (1952), sec. 266)

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 a sealing ring for application between an exhaust nozzle and a jetevator.

Vector control on missiles may be obtained by the deflection of the exhaust gases at the nozzle termination by a jetevator which is affixed to the nozzle. The present high energy propellants contain large quantities of aluminum. This is present in the exhaust gases either as vapor or a highly dispersed liquid, and many times is deposited on the inner surface of the jetevator so as to interfere with its operation. This depositing occurs because the jetevator acts as a heat sink and the alumina is condensed and adheres to the inner surface of the jetevator. This adherence is sometimes sufficient to interfere with the operation and render the jetevator inoperative.

It is an object of the present invention to provide a seal attached to the nozzle and in contact with the jetevator to prevent the deposition of alumina in sufficient amounts so as to interfere with the operation.

It is another object to provide a graphite ring seal at the end of the nozzle and in contact with the inner surface of the jetevator to wipe the inner surface of the jetevator and coat said surface with a film of graphite to prevent the adherence of the particles of alumina in the exhaust gases to the inner surface of the jetevator.

It is a further object of the invention to provide a graphite annular seal at the exhaust end of the nozzle and to secure the seal to the nozzle by an adhesive and by mechanical means.

It is a still further object of the invention to provide a seal between the nozzle and the jetevator which would lubricate the inner surface of the jetevator during its operation and in case of alumina deposits on the inner surface of the jetevator the graphite seal would not provide a stop to prevent the operation of the jetevator but would receive the alumina particles into its comparative softer surface.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

FIG. 1 is a longitudinal section of a nozzle with attached seal and jetevator;

FIG. 2 is a similar view with the jetevator in a different position; and

FIG. 3 is a similar view showing how the alumina particles score the graphite seal to permit lubrication.

Referring to the drawing wherein like numerals designate like parts in the several figures, a nozzle **11** for a missile is illustrated having a bore **12** restricted at **13** and gradually enlarged to the exhaust end **14**. The nozzle has its exterior surface spherical shaped at **16** to receive the jetevator **17**. A pair of pins (not shown) extend from diametrical opposite points of the spherical portion and support the jetevator for limited oscillatory movement controlled by levers or gears (also not shown).

The jetevator at its outer opening is recessed at **18**.

Ordinarily the outer portion is spaced from the nozzle by approximately ⅛ inch and the alumina deposits sometimes fill this space.

The exhaust end of the nozzle is recessed at **21** to receive the annular base **22** of a graphite sealing ring **23**. The sealing ring is secured to the nozzle by adhesive between the metal surface of the nozzle and the graphite surface of the ring. Screws **24** threaded into holes **25** also hold the ring in position. The sealing ring extends into the recess **18** and is in sealing contact with the jetevator. The inner surface of the sealing ring is an extension of the inner surface of the nozzle and presents no obstruction to the flow of exhaust gases. The graphite ring serves as a seal, a bearing and a lubricant for the jetevator. It extends beyond the nozzle and into close contact with the jetevator thus preventing turbulence of exhaust gases formerly caused by the clearance between the nozzle and the jetevator.

FIG. 2 illustrates the position of the jetevator when it is used to change the direction of flight of the missile, the exhaust gases being deflected by the inner surface **27** of the jetevator. The movement of the jetevator in moving from the position shown in FIG. 1 to that shown in FIG. 2 causes the inner surface **27** of the jetevator to wipe the graphite surface of the seal resulting in a deposit of graphite on the inner face **27**. This deposit of graphite will inhibit the deposition of alumina on the inner surface **27** and the closely spaced relationship of the jetevator and the graphite seal insures against the accumulation of alumina particles between the nozzle and the jetevator.

Should the coating of graphite on the inner surface **27** be not complete and some particles of alumina are deposited, the soft surface of the graphite seal will be scored, as seen in FIG. 3 to permit the jetevator to function.

The close adherence of the seal to the jetevator also keeps the exhaust gases out of contact with the inner surface of the jetevator where they were formerly directed by the inner surface **27** by reason of the clearance between the jetevator and the nozzle and prevents the overheating of the jetevator in those bearing surfaces **28** which contact the spherical surface **16** of the nozzle. This assists in maintaining the jetevator in operative condition as uneven expansion of these bearing surfaces can cause binding.

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.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. An exhaust nozzle for a missile comprising a body portion having a tapered bore terminating in a nozzle opening, an exterior spherical bearing surface formed at the end of the body portion, a jetevator mounted on said bearing surface for limited movement, means for moving said jetevator relative to the body portion, a graphite seal mounted on the body portion and forming the nozzle opening, said seal being in contact with the inner surface of the jetevator whereby movement of the jetevator to operative position coats the inner face of the jetevator, which after movement is exposed to the exhaust gases with a coating of graphite.

2. An exhaust nozzle for a missile comprising a body portion having a tapered bore terminating in a nozzle opening, said body portion having an exterior spherical surface adjacent said opening, an annular graphite seal secured to the end of the body portion, the inner surface of said seal conforming to and forming part of the tapered

bore, the outer surface of said seal being concentric with the spherical surface of said body portion, a jetevator mounted for universal movement on the spherical surfaces of said body portion and said seal, movement of said jetevator on said spherical surfaces coating a portion of the inner surface of said jetevator with graphite.

3. A nozzle according to claim 2 wherein the spherical surface of the graphite seal is of greater diameter than the spherical surface of the body portion, to shield the bearing surface of the body portion from the exhaust gases.

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