March 20, 1951 F. SHORT 2,545,496

ROCKET PROJECTILE

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Fig. 1.

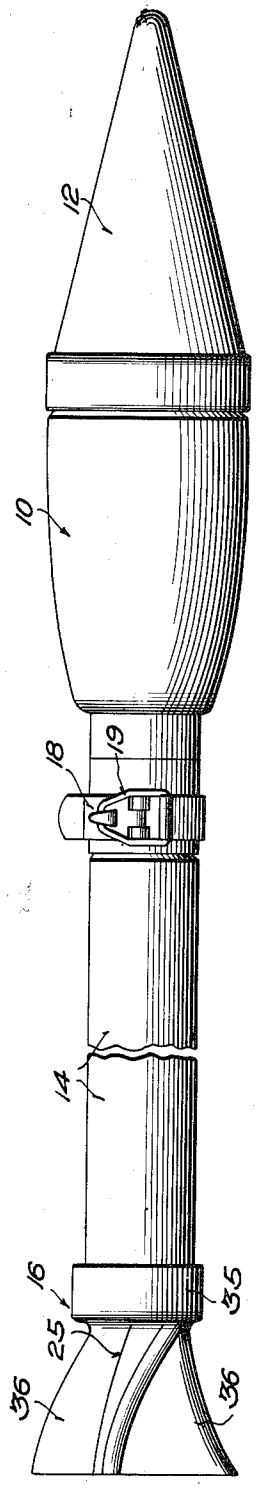
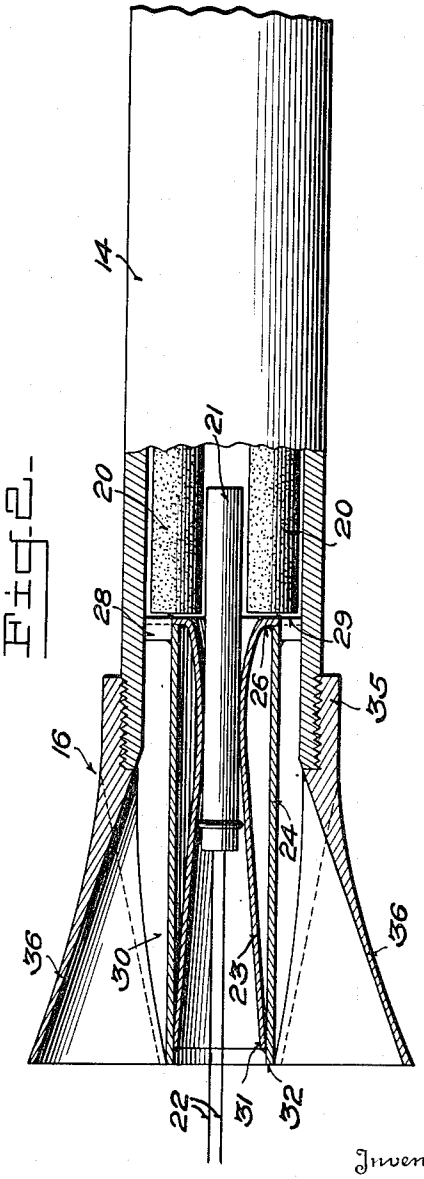


Fig. 2.



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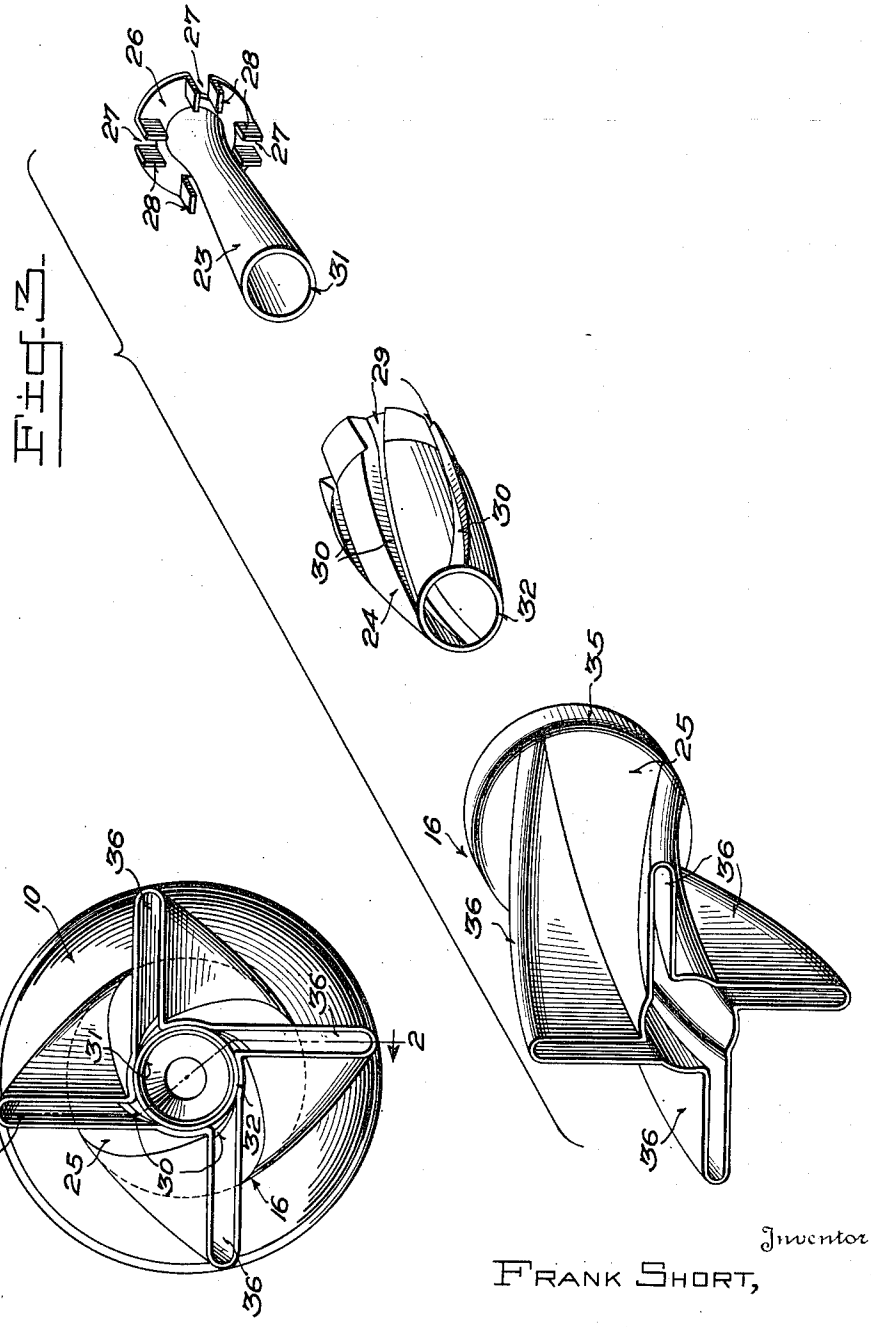
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ROCKET PROJECTILE

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5 Claims. (Cl. 102—51)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

The present invention relates generally to a self-propelled rocket projectile.

More particularly it pertains to a novel propulsion unit of general utility adapted to be employed in conjunction with various types of rocket projectiles for propelling the same.

In the case of conventional self-propelled rockets the greater portion of the rocket flight, in some cases more than 99%, takes place after the propellant has been completely burned. Furthermore, in such rocket projectiles it is usual to provide a blunt ended nozzle at the rear of the projectile together with some form of guiding structure for controlling the direction of initial movement imparted to the projectile in the launcher tube. Such structure at the rear end of the projectile has been generally unsatisfactory due primarily to the air resistance occasioned thereby during flight.

It is accordingly an important object of the present invention to reduce the flight resistance of a rocket projectile by improving the aerodynamic structure of the rear end thereof.

Another object of the invention is to provide an improved rocket projectile having a plurality of hollow, helical vanes adjacent its rear end for imparting both thrust and rotational moments thereto.

Another object of the invention resides in the provision of an improved propulsion unit permitting a high jet efficiency through the increased expansion of the propulsive gases.

A still further object of the invention resides in the provision of a novel rocket propulsion unit having a central Venturi nozzle adapted to receive a majority of the propulsion gases together with a plurality of inclined expansion vanes adapted to receive a smaller proportion of the gases for imparting rotation to the projectile.

Yet another object of the invention resides in a novel interior construction of a rocket propulsion unit wherein the forward edge of the central Venturi nozzle surface is formed as a powder trap to prevent the propulsion material from being expelled rearwardly prior to combustion.

The above as well as other and further objects and advantages of the invention will become more readily apparent to one skilled in the art from a consideration of the following detailed specification taken in conjunction with the accompanying

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drawings illustrating a preferred embodiment thereof wherein:

Figure 1 is a side elevational view of a complete rocket projectile according to my invention;

Figure 2 is a longitudinal cross sectional view of the improved propulsion unit and a portion of the projectile taken along the line 2—2 of Figure 4;

Figure 3 is an exploded perspective view showing the separate components of the propulsion unit; and

Figure 4 is a rear end view of the projectile illustrated in Figure 1.

Referring now particularly to Figure 1 of the drawings a complete rocket projectile according to my invention is seen to comprise generally a main body portion 10, a wind shield or nose piece 12 secured to the forward end of said main body portion, a propellent tube assembly 14 secured to the rear end of said main body, and a propulsion unit 16 secured to the rear end of the propellant tube 14. The projectile selected for purposes of illustration is of the general type and proportions best adapted for use with the standard 2.36 inch rocket launcher, the combined unit being generally known as the "bazooka." For the purposes of the present invention it is immaterial whether the main body 10 is of the type adapted to contain a high explosive charge or a dummy charge for training purposes, the invention being equally applicable in either case. It is likewise immaterial to the purposes of the present invention whether or not a so-called shaped charge or hollow charge head is employed although in general my invention is best applied to other types of explosive charges since shaped charges have been observed to show little improvement as a result of spinning the projectile.

A safety device 18 is provided on the propellent tube 14 and includes a quick release fastener 19 secured to a safety wire (not shown) which is released prior to placing the projectile in its launcher. Since the details of the specific type of safety mechanism provided form no part of the present invention they have not been illustrated in further detail.

Referring now particularly to Figures 2 and 3 of the drawings the propellent tube 14 is provided interiorly thereof with a plurality of propellent charges 20 together with a squib or igniting element 21 located centrally thereof having an igniting wire or similar suitable ignition device generally designated by reference numeral 22. The propulsion unit 16 is of three part construction

as will be readily apparent from the exploded perspective view of Figure 3, and includes a central Venturi nozzle 23, a concentric intermediate throat member 24, and a fin member or vane assembly 25. The three elements 23, 24 and 25 are nested together in concentric manner to provide a series of expanding orifices through which the propulsion gases generated by the burning of the charges 20 may be ejected to the rear of the projectile.

The Venturi nozzle 23 is provided at its forward end with a flange 26 having a plurality of notches or apertures 27, in the present case four in number, formed therein. The depending sides 28 of the notches 27 are adapted to seat in corresponding notches 29 cut in the open forward ends of a plurality of grooves 30 which are helically tapered about the outer periphery of the intermediate throat member 24. It will be noted that the Venturi member 23 expands rearwardly and the rearward rim 31 thereof is adapted to be secured adjacent the rearward rim 32 of the intermediate throat member in any convenient manner as by brazing or the like. The Venturi nozzle and throat member are adapted to be similarly secured by brazing or other suitable means inside the fin member 25.

The fin member 25 is provided with an interiorly threaded attaching portion 35 secured to similar threads provided exteriorly at the rear end of the tube 14. A plurality of hollow vanes 36 are formed on the outer surface of the fin member 25 having their longitudinal axes inclined or tapered in a helical manner about the outer periphery of said member. The inner open faces or sides of the hollow vanes 36 are in registry with the grooves 30 formed in the outer periphery of the throat member 24.

When the projectile is fired by energizing the firing circuit or similar device 22 to ignite the squib 21 and hence the propellent charges 20, the squib 21 itself is expelled to the rear through the Venturi nozzle 23. The unburned propellent materials of the charges 20, however, are retained within the propellent tube 14 by the flange 26 and associated structure. As the charges 20 burn the propulsion gases produced thereby expand rearwardly, the larger portion thereof passing out through the central Venturi nozzle 23 to effect forward translation of the projectile by their reaction. A portion of these gases, and preferably a smaller portion thereof, passes through the apertures 27 and grooves 30 into the helical vanes 36 when they expand in a rearwardly inclined direction and by their reaction impart rotational moments to the projectile. It will be noted that the exterior shape of the vanes 36 is such as to tend to continue the rotation of the projectile during its trajectory through the air in the same direction as that initially imparted to it by the rearward expansion of the propulsion gases therethrough.

Obviously, numerous other modifications, alterations and deviations from the specific structure herein set forth for purposes of illustration will occur to one skilled in the art without departing from the spirit or scope of the invention as set forth in the claims appended hereto.

I claim:

1. A rocket projectile comprising, a generally cylindrical main body portion adapted to contain a propelling charge therein, a propulsion jet assembly secured to the rear end of said body portion including a central Venturi nozzle having an apertured flange secured thereto adjacent its forward end, a concentric intermediate throat member surrounding said nozzle having a plurality of helical grooves therein the forward ends of which are in registry with the apertures in said flange, and a concentrically mounted fin member surrounding said nozzle and said throat member having a plurality of hollow, helical vanes thereon the inner open sides of which are in registry with said grooves whereby a portion of the propelling gases are diverted through said apertures and said vanes to impart rotation to said projectile in flight.

2. A rocket projectile comprising, a generally cylindrical main body portion adapted to contain a propelling charge therein, a propulsion jet assembly secured to the rear end of said body portion including a central Venturi nozzle having an apertured flange integrally secured thereto adjacent its forward end, a concentric intermediate throat member surrounding said nozzle having a plurality of helical grooves therein the forward ends of which are in registry with the apertures in said flange, and a concentrically mounted fin member surrounding said nozzle and said throat member having a plurality of hollow, helical vanes thereon the inner open sides of which are in registry with said grooves whereby a portion of the propelling gases are diverted through said apertures and said vanes to impart rotation to said projectile in flight.

3. A rocket projectile comprising, a main body adapted to contain a propelling charge therein, a generally ogival head mounted adjacent the front portion of said main body and adapted to contain an explosive charge, and a propulsion assembly secured to the rear portion of said main body including a central Venturi nozzle having an apertured flange integrally formed on the forward end thereof, an intermediate throat member surrounding said nozzle having a plurality of helical grooves therein the forward ends of which are in registry with the apertures in said flange, and a fin member surrounding said nozzle and throat member having a plurality of hollow, helical vanes thereon the inner open sides of which are in registry with said grooves whereby a portion of the propelling gases are diverted through said apertures and said vanes to impart reactive rotational moments to said projectile.

4. A propulsion unit for a rocket projectile comprising, a central Venturi nozzle having an apertured flange integrally secured thereto adjacent its forward end, a concentric intermediate throat member surrounding said nozzle having a plurality of tapered, helical grooves formed along its outer periphery the forward open ends of which are in substantial registry with the apertures in said flange, and a concentrically mounted fin member surrounding said nozzle and said throat member having a plurality of hollow, helical vanes formed externally thereon the inner, open sides of which are in substantial registry with said grooves, said unit being constructed and arranged whereby said nozzle is adapted to transmit a larger portion of the propulsion gases fed thereto and said apertures and said vanes are adapted to transmit a smaller portion of such gases to produce a reactive, rotational moment on said unit.

5. A propulsion unit for a rocket projectile or the like comprising, a central Venturi nozzle having an apertured flange secured thereto, an intermediate throat member surrounding said nozzle having a plurality of grooves formed along its

outer periphery the forward open ends of which are in substantial registry with the apertures in said flange, and a fin member surrounding said nozzle and said throat member having a plurality of hollow vanes thereon the axes of which are inclined relative to the longitudinal axis of said unit and the inner, open sides of which are in substantial registry with said grooves, said unit being constructed and arranged whereby said nozzle is adapted to transmit a portion of the propulsion gases fed thereto and said vanes are adapted to transmit a portion of such gases to

produce a reactive, rotational moment on said unit.

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