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REACTION-MOTOR MISSILE
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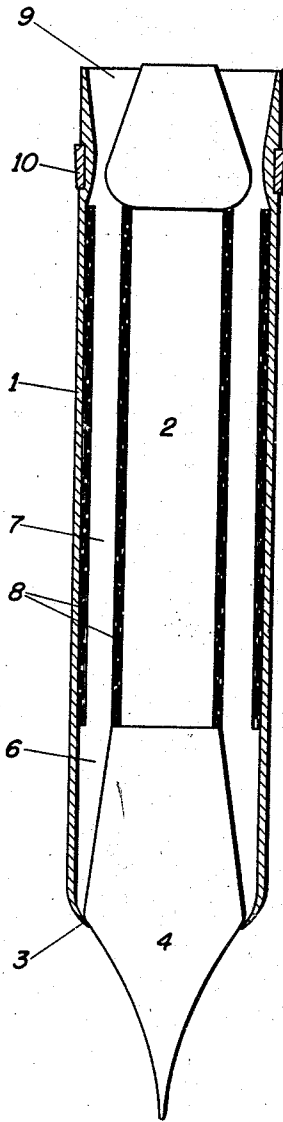


Fig. 1

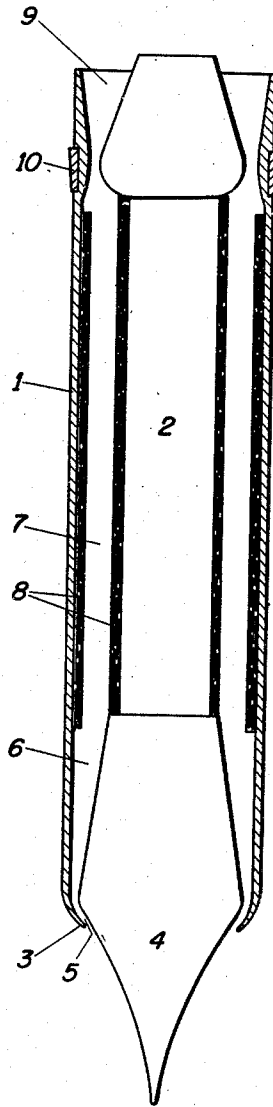


Fig. 2

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REACTION-MOTOR MISSILE

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4 Claims. (Cl. 102—49)

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This invention relates to projectiles and generally comparable missiles, and is particularly directed to a novel self propelled missile adapted to be discharged from a gun or the like and which having attained a suitable velocity on firing or launching thereafter by reaction obtained from combustion of fuel carried by the missile is propelled at the same or a greater velocity considerably beyond the range of projectiles depending for propulsion entirely upon high initial velocity imparted by the gun or other launching device, a further improvement over the present invention being disclosed in my application Serial No. 166,594 for U. S. Letters Patent entitled Rocket-Engine and Reaction-Motor Missile executed and filed in the United States Patent Office concurrently herewith.

Efforts have heretofore been made to produce rotation-symmetric projectiles comprising so called "jet" or "reaction" motor propulsive means but as the gases generated in the gun by the propellant charge during firing must be confined by the projectile while the latter is in the gun barrel the making of provision for adequate passage of air into and through the combustion chamber and discharge of exhaust gases at the rear during jet propulsion has presented difficulties.

One projectile suggested for cooperation by or with the aid of a jet propulsion comprises coaxial outer cylindrical casing and inner body elements defining between their adjacent surfaces an annular compression zone, a diffuser zone, a combustion zone and an exhaust nozzle, the outer shell and inner body being fixed relatively to each other, with movable means such as a close fitting ring within the exhaust nozzle intended for preventing escape of gases through the said nozzle and zones when the gun is being fired and permitting passage of air and combustion products in the opposite direction during jet operation but attainment of said objectives by such movable means has thus far been unsatisfactory.

It is therefore an object of the present invention to provide a missile or the like embodying reaction propulsive means, which may be fired from a gun or other suitable launching apparatus and after having attained an appropriate velocity is automatically conditioned to admit air under pressure to said propulsive means for sustaining combustion of a fuel supply therein, although effectively sealed against escape of gases from the launching means through the projectile at the initiation of its flight.

A further object is to provide a missile primarily for military purposes comprising relatively movable parts which when acted upon by the air through which the missile is traveling automatically supplies air under pressure to a self-contained jet or reaction motor for maintaining or increasing the velocity of the missile as a whole

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whereby the range of the missile may be substantially increased over that attainable when the entire propulsive force is applied at the beginning of its flight as by the charge in a gun or the like.

Other objects, purposes and advantages of the invention will hereafter more fully appear or will be understood from the following more particular description of a preferred embodiment of it diagrammatically illustrating in the accompanying drawing in which:

Fig. 1 is an axial section partly in elevation of a missile or the like as it appears at rest prior to firing, and

Fig. 2 is a corresponding view showing the relative positions of the parts as they appear after the missile has attained a predetermined speed in flight and just as the operation of its contained jet or reaction propulsive means is about to be initiated.

More particularly the missile illustrated comprises an outer casing or shell 1 which is preferably substantially cylindrical in general contour, and an inner body 2 which may carry a charge of explosive similar to that of an artillery shell or a bomb.

At its leading end the outer shell is inwardly curved and feathered as at 3 to conform substantially to an adjacent zone of the generally conoidal nose 4 of body 2, these parts when in contact constituting an effective gas seal against the escape through the missile of the gases generated by the propulsive charge of the gun during firing. After the missile has attained a sufficient velocity however, the pressure of the air on the front surface of the nose 4 of the inner body restrains the travel of the latter relatively to the outer casing to a degree sufficient to separate the front edge 3 of the latter from the body nose 4 and thus provide an annular inlet port 5 for the air required for operation of the reaction motor contained in the missile. In order to effectively bring about this operation the inner body is tapered inwardly rearwardly of its nose 4 to provide between its outer surface and the adjacent inner surface of the outer shell a diffusion zone 6 through which air admitted by port 5 passes to a combustion chamber 7 the walls of which may be supplied with layers of solid fuel 8 applied to the corresponding surfaces of the outer casing and inner body.

Combustion products are discharged from the rear end of the missile through an annular exhaust nozzle 9 formed by the body and casing in such way as to cause their discharge to impel the missile as a whole forward by reaction of the exhaust gases.

The casing 1 is desirably provided with a packing ring 10 at a suitable point on its outer surface for cooperation with the bore of the gun or other launching device employed, the latter, if

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rified, by co-action with the said packing ring inducing rotative motion of the missile as a whole about its axis during its forward motion. Of course it is obvious means may be provided for holding the front and rear portions of the inner body 2 in coaxial relation with the outer shell and limiting the extent of their relative axial movement.

When the missile is loaded the forward inlet port 5 is closed and the gases produced by the gun charge thus react against the entire missile to impel it forward, being prevented from escape either through the missile itself or through the barrel about the latter; it is thus discharged from the gun at relatively high initial velocity but with its relatively movable parts in the relation shown in Fig. 1. Upon its discharge however the air pressure acting on the nose 4 of the inner body somewhat retards the latter relatively to the outer casing and this allows the port 5 to open whereupon air under considerable pressure is admitted through the said port to the diffuser zone 6, the rapid compression of the air causing it to attain a temperature sufficient to initiate and support combustion of the fuel 3 in the combustion chamber 7. Combustion products thereafter continuously issue at extremely high velocity through the exhaust nozzle 9 the form of which is designed to afford maximum reaction to propel the projectile forward at constant or increasing velocity, the forces of the excess pressure in the several zones of the missile cooperating with the external atmospheric flow resistance to maintain the relative positions of the outer casing and inner body substantially as shown in Fig. 2 until the fuel supply has been consumed.

While reference has herein been made to the employment of solid fuel for the reaction material embodied in the missile it will be appreciated that any other suitable fuel may be supplied and released to the combustion chamber by appropriate mechanism (not shown) and the invention is consequently not dependent on the reaction motor fuel being furnished in solid, fluid or gaseous state or any particular combination thereof it being essential only that an appropriate provision be made for combustion in the combustion chamber of a fuel suitable for providing a stream of exhaust gases which may be ejected through the exhaust nozzle at sufficient velocity and in such manner as to provide reaction for propelling the missile forward in its flight.

Moreover it will be obvious that the missile may be provided with stabilizing devices if desired and may be rotationally asymmetric and designed to rotate about its axis or not during flight as desired.

It will therefore be appreciated that while I have herein described with considerable particularity one embodiment of the invention and have suggested certain modifications thereof, I do not desire or intend thereby to be limited or confined thereto in any way as other changes in the form, construction and relationship of the several parts and instrumentalities employed will readily occur to those skilled in the art and may be made if desired without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

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1. A missile of the character described comprising a hollow outer casing having a constricted forward edge, an inner body coaxial therewith and movable axially relatively thereto, said casing and body having cooperative surfaces at adjacent ends thereof forming an annular inlet port, the maximum diameter of the body surface being within the casing and greater than the diameter of the forward edge of said casing surface, cooperative surfaces adjacent the opposite ends respectively of the casing and body forming an annular exhaust nozzle and cooperative surfaces intermediate said ends forming a combustion chamber, and a supply of fuel for combustion in said chamber said casing and inner body having cooperative contours adapted to maintain said port closed while the missile is traveling in a forward direction at a predetermined velocity and to open said port through relative axial movement of the casing and inner body when the missile is traveling at a lower velocity and thereby automatically change the contour of said exhaust nozzle.

2. A missile as defined in claim 1 in which said casing and shell are provided with surfaces forming a diffusion chamber between said inlet port and said combustion chamber wherein air admitted through said port during rapid travel of the missile is diffused prior to its passage into the combustion chamber.

3. A missile as defined in claim 1 in which the forward end of the inner body is substantially conoidal and the forward end of the outer casing of lesser diameter than the major part of the casing conforms substantially to said conoidal body end adjacent the zone of maximum diameter of the latter.

4. In a missile a substantially cylindrical hollow casing having at its leading end a zone of lesser diameter than the adjacent zone, a body movable relatively to the casing disposed axially therein and having a substantially conoidal coaxial nose projecting forwardly from the interior of the casing through said zone of lesser diameter, said nose having a surface complementary to said last mentioned zone of greater maximum diameter within the casing than the minimum diameter of said zone and cooperative therewith to inhibit passage of air between said nose and zone into the casing when in mutual engagement and to form an inlet port for air when disengaged, the casing in rear of said zone defining a combustion chamber about the body, and a supply of fuel for combustion in said chamber during passage of air thereinto through said port for ejection adjacent the rear end of the casing of combustion products of the fuel from said chamber at velocity sufficient to impel the missile in the direction of said leading end during combustion of said fuel.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,540,594	Price	Feb. 6, 1951

FOREIGN PATENTS

Number	Country	Date
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50,033	France	Aug. 1, 1939

(Addition to No. 779,655)