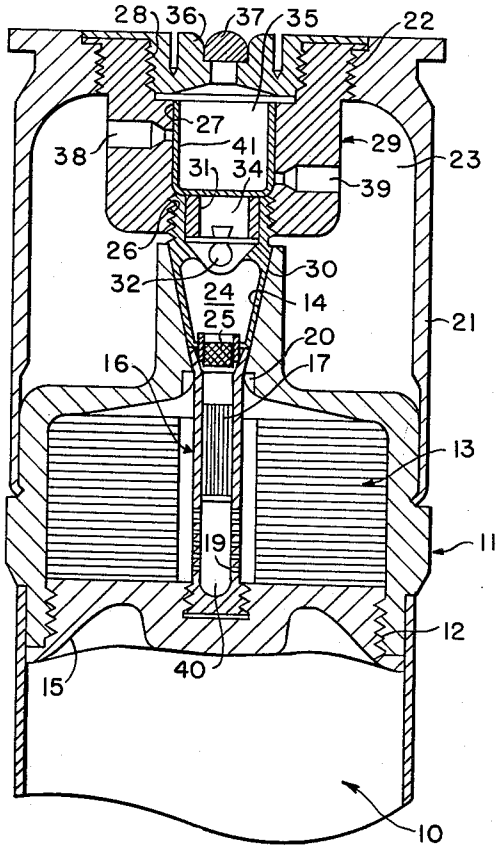
April 6, 1965 A. C. DE MATTHEW 3,176,615

GUN-PROPELLED ROCKET-BOOSTED MISSILE

Filed Dec. 31, 1962



INVENTOR.
ANTHONY C. DEMATTHEW
BY Alden D. Redfield
Charles M. Hogan.
ATTORNEYS.

United States Patent Office 3,176,615
Patented Apr. 6, 1965

3,176,615

GUN-PROPELLED ROCKET-BOOSTED MISSILE

Anthony C. De Matthew, Bloomington, Minn., assignor to Avco Corporation, Richmond, Ind., a corporation of Delaware

Filed Dec. 31, 1962, Ser. No. 248,644
2 Claims. (Cl. 102—49)

The present invention relates to rocket technology, and particularly to an improved gun-propelled, rocket-boosted missile. In the practice of the invention, a warhead is fitted to a rocket base, and the projectile comprising such base and warhead is fired from a gun after the manner of case ammunition. The base is formed with a posterior nozzle, and it contains a solid-fuel rocket propellant which is ignited in such a way that, at a predetermined time following the severance of the base from the case, which remains in the gun, the rocket becomes powered by thrust—i.e., by the discharge of its propellant gases from the nozzle.

An object of the invention is to provide a case-mounted rocket with an improved compound firing system.

A further object of the invention is to provide a firing system comprising components which are severally readily manufacturable in quantity, and, in combination, handled, armed, and disarmed with safety and reliability.

For a better understanding of the invention, together with other and further objects, advantages, and capabilities thereof, reference is made to the following description of the appended drawing, the single figure of which is an axial section through a rocket having a compound firing system in accordance with the invention.

The expression "compound firing system" is intended to designate the composite of those features pertinent to exterior operations performed at the gun to impel the rocket from the gun, and interior operations performed within the rocket so that its thrust "takes over" to complete its propulsion and maintain it through the desired predetermined trajectory.

In the preferred embodiment of the invention herein shown, I provide a rocket in which the usual warhead 10 is fitted to a metallic base 11. This base is generally cylindrical and is open and screw-threaded at its front 12. The rocket base is formed to define an interior chamber for a rocket propellant 13. It is further shaped to define a posterior nozzle 14.

Preceding the affixation of the warhead to the base, there is inserted into the base a subcombination comprising a screw-threaded metallic cap 15 and a flexible stem 16. The stem 16 is so formed as to be securely tightened in metallic cap 15. Sealing occurs between the surface 14 and the exterior diverging rear end of stem 16, the stem projecting rearwardly into the nozzle. The stem 16 is hollow to provide space for a delay charge 17 and an ignition mixture 40. Communication between this fuse train and the propellant 13 is established by a plurality of ports 19 in the wall of the flexible stem. A nozzle throat insert 20 is placed between the stem and an annular groove formed in the rocket base adjacent the nozzle, as shown.

The subcombination of elements so far described in detail is separately manufacturable and transportable. It is fitted to the warhead when desired. Also separately manufacturable and transportable are the cartridge case 21 and the elements carried on its rear.

Accordingly, there is disclosed a generally cylindrical metallic case member 21 having an open front formed and adapted to be crimped to the rocket base. The case has an open rear which is screw-threaded at 22, and the case is formed to define a generally cylindrical gas chamber 23.

A housing 30 is adapted to be placed within the nozzle 14. The housing converges in shape toward the front and is of generally hollow construction, exteriorly threaded at the rear. The housing is similar in shape, function, and content to the housing 13 illustrated in FIG. 2 of my copending United States patent application entitled "Simplified Rocket Propellant Charge Igniter," Serial No. 248,564, filed in the United States contemporaneously herewith on December 31, 1962, and assigned to the same assignee as the present application and invention. This housing carries a suitable rocket igniter 24 and mechanical ignition element 25, the latter being a shortened version of the stem 18 illustrated in FIG. 1 of my said copending United States patent application entitled "Simplified Rocket Propellant Charge Igniter." Before crimping of the case to the rocket base 11, the housing 30 is screwed into the cylindrical gun arbor 29, the latter being interiorly threaded at 26. Then the case is crimped to the rocket base.

Reference is now further made to the metallic, generally cylindrical gun arbor 29, which is adapted to be screwed into threads 22 and which is formed with a frontal screw-threaded bore 26, a central bore 27, and a rear screw threaded bore 28. Inserted into the frontal bore is the screw-threaded housing, which contains the hammer group. The hammer group is of metal and comprises a concentric sleeve 31 and a disc-mounted hammer 32, the latter being suitably arranged to ignite charge 24 by percussion in response to the development of pressures within chamber 34. As the missile is made ready for firing, there is screwed into threads 28 a percussion cap holder 36, to which is centrally secured a percussion charge 37.

On mechanical actuation of the percussion charge 37, a gun igniter 35, disposed in bore 27 and encased in a metallic liner 41, is ignited, generating gases which rupture liner 41 and flow through a large plurality of ports, such as 38 and 39, of the gun arbor into chamber 23, exerting forces against the rear of the rocket base 11. The pressures in chamber 34 actuate hammer 32 and ignite the rocket igniter 24 and therefore the element 25 and the train 17. The rocket is initially propelled by the gas forces exerted against the rear wall of base 11, which separate the rocket base from the case. Then, at a time dependent on the characteristics of the train 17, the rocket propellant 13 ignites, ultimately fracturing the stem 19 and/or decomposing it into a gas through the heat in the rocket chamber, so that the rocket propellant gases are in free and unrestrained communication with the rocket nozzle, whereupon normal rocket thrust takes over. On the severance of the rocket base from the rocket case, the rocket case and the elements secured thereto remain in the gun.

Thus it will be seen that the invention provides mechanical firing means for both the gun and the rocket charges. The primer group 36, 37 is a demountable element, and a dummy may be substituted for it to render the rocket safe in storage.

The timing of the train 17 is such that full rocket ignition and acceleration boost occur at some predetermined distance—say, fifty feet from the nozzle of the gun, this distance being mentioned by way of illustration and not limitation. A further advantage of this construction is its adaptability to high-speed tactical handling.

Additionally, this missile does not discharge materials hazardous to friendly personnel.

Having fully disclosed my invention, I claim:

1. In a rocket, the combination of:

a generally cylindrical non-jettisoned rocket base open at its front and formed to define an exterior rear sur-

face and an interior chamber for a rocket propellant and also to define a posterior nozzle;
a base cap screwed onto the front of said base;
a perforated stem projecting rearwardly from said base cap to said nozzle;
rocket igniter means projecting into said nozzle;
a generally cylindrical projectile case member having an open front secured to the exterior of said rocket base and an open rear, the interior of said case member and said rear surface being formed to define a gas chamber;
a generally cylindrical arbor centrally screwed onto the rear of said case member and formed with a succession of three bores;
said igniter means including an igniter housing secured in the fore one of said bores;
a percussion charge holder screwed onto the rear one of said bores;
a percussion charge in said holder;
a gun charge mounted in the central one of said bores, and hammer means mounted in communication with said igniter housing;
said arbor and igniter means and percussion charge holder being secured in fixed relation to said case member so that they do not fly with the rocket;
said arbor being formed with transversely extending channels between the second bore and the gas chamber so that gases from the gun charge flow transversely into the gas chamber and exert pressure directly against said rear surface as the percussion charge ignites the gun charge and the hammer ignites the rocket igniter means;
whereupon pressures against the rear of the rocket base propel the rocket forwardly, so that the rocket base becomes severed from said case by reason of the action of the gun charge, and the thrust of propellant gases thereafter takes over rocket propulsion when said stem collapses.

2. In a rocket, the combination of:
a generally cylindrical non-jettisoned rocket base open at its front and formed to define an exterior rear surface and an interior chamber for a rocket propellant and also to define a posterior nozzle;
rocket igniter means projecting into said nozzle;
a generally cylindrical projectile case member having an open front secured to the exterior of said rocket base and an open rear, the interior of said case member and said rear surface being formed to define a gas chamber;
a generally cylindrical arbor formed with a storage chamber and centrally screwed onto the rear of said case member;
gun firing means in said chamber;
said arbor and gun firing means being secured in fixed relation to said case member so that they do not fly with the rocket;
said arbor being formed with transversely extending channels between the gun firing means and the gas chamber so that gases from the gun firing means flow transversely into the gas chamber and exert pressure directly against said rear surface as the gun firing means ignites;
whereupon pressures against the rear of the rocket base propel the rocket forwardly, so that the rocket base becomes severed from said case by reason of the action of the gun charge, and the thrust of propellant gases thereafter takes over rocket propulsion when said stem collapses.

References Cited by the Examiner

UNITED STATES PATENTS

936,911	7/10	Loeble	102—45
1,240,859	9/17	Lallman	102—45
2,457,839	1/49	Skinner	102—49
2,657,630	11/53	Blacker	102—49
3,008,414	11/54	Jasse	102—49

FOREIGN PATENTS

662,429	12/51	Great Britain.

SAMUEL FEINBERG, *Primary Examiner.*