May 17, 1949. N. M. HOPKINS 2,470,489

RIFLE ROCKET MISSILE

Filed June 12, 1944

FIG 1

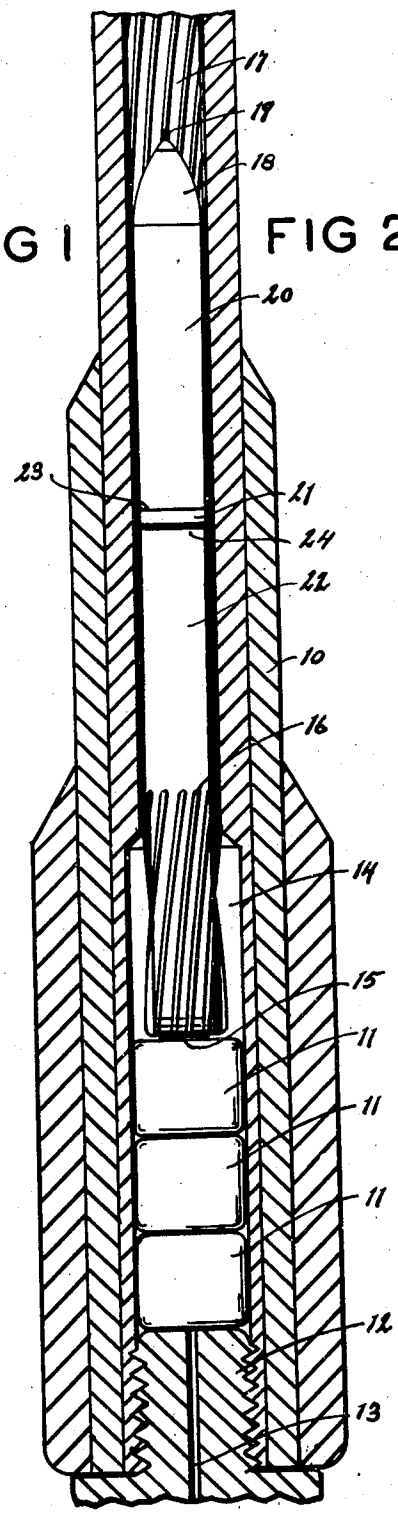


FIG 2

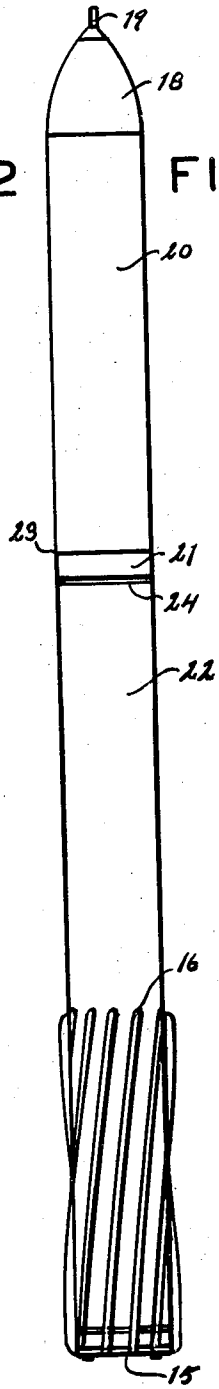
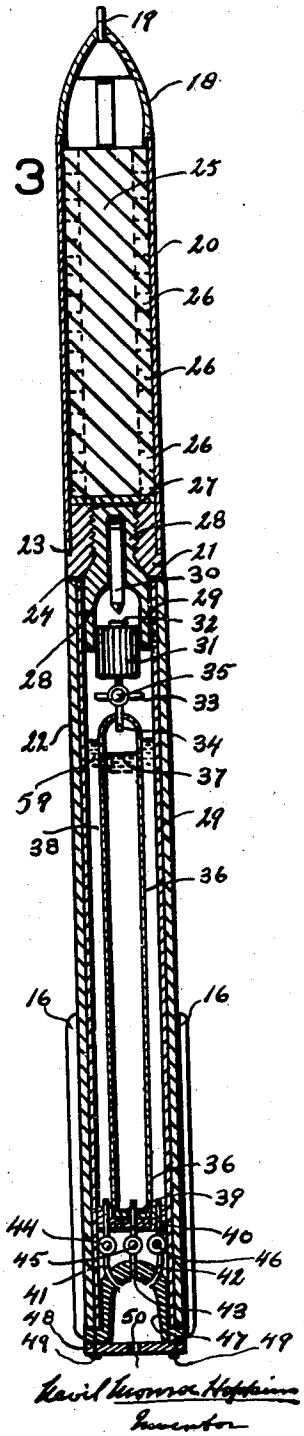


FIG 3



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2,470,489

RIFLE ROCKET MISSILE

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6 Claims. (Cl. 102—49)

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This invention pertains to rocket torpedo missiles fashioned to be fired at any angle of fire from a rifled howitzer or gun, and to attain greater range, and greater accuracy in marksmanship over rockets and rocket missiles heretofore developed.

It is a special object of this invention to fashion a rocket torpedo missile for battleship wrecking, when fired at low angles of departure from a rifled gun, carrying a maximum mass of high explosive in the most economic and accurate flight through the air, and after striking the water of the sea, to either "skip-shoot" over the surface, or to proceed in an under water "scurry" and to produce the "torpedo effect," or in the larger calibres, the "mine effect" in proximity to the ship's under water plating.

It is also a special object of this invention to fashion a rocket missile capable of easily receiving a thick walled liner to be broken up into missile fragments, the rocket missile fashioned for the most economic and accurate flight through the air when fired at high angles of departure from a rifled gun, for shore, personnel and fort bombardment, as well as air-craft attack.

It is also an important object of this invention to bring about a revolutionizing action upon the submarine by not only giving her a more accurate and destructive torpedo for use against battleships, but a more devastating high explosive missile for use against air-craft.

This new rifle rocket missile for submarines may be of sixteen, eighteen, or even twenty one inch calibre for a howitzer or gun of this size and be mounted and served upon a super submarine, as illustrated and described in United States Patent Number 2,349,728 issued to the present applicant under date of May 23, 1944 with title War vessel with high power, long range gun.

It is also a special object of this invention to produce a rifle rocket missile of the highest destructive power, to be discharged at any angle of fire, including the vertical, from a rifled howitzer or gun, with the least possible strain upon the light casing of the body of the rocket missile when it contains the maximum mass of high explosive, as well as the least possible strain upon the howitzer or gun.

Other objects of the invention will appear as the description of the missile and its operating rifled gun is disclosed hereinafter.

With all objects of the invention in view, the invention resides in the novel principles and

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parts as will be disclosed hereinafter and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification and in which like numerals designate like parts in all the views,

Fig. 1 is a fragmentary longitudinal sectional view of a rifled howitzer or long range rifled gun, showing one of these rocket missiles positioned therein for firing by a reduced charge of powder;

Fig. 2 is an elevational view of this rocket missile; and

Fig. 3 is a longitudinal sectional view of this rocket missile.

Referring particularly to Figs. 1 and 2, the numeral 10 indicates generally a howitzer or gun having the reduced charge powder bags 11 therein, each bag containing standard slow-burning propellant, said bags positioned immediately forward of and retained by the breech-block 12 having therethrough the duct or passage 13 for the firing primer, leaving a cushioning air space 14 between the foremost powder bag and the rear end of the bore for the rocket missile, which missile at its rear end is provided with external fins, lugs or ribs 16 adapted to engage the grooves of the rifling 17 of the gun barrel. The numeral 18 designates the war-head of the missile, equipped with the firing device 19 which may comprise a contact or an inertia firing pin, a time-fuse, a super-sensitive fuse, or a water-depth actuated fuse, or a combination of two or more such devices. I may elect to have a so-called magnetic firing device, or an electrical firing device, or even a radio or super-sonic firing device, depending upon the nature of the target. The outer shell of the body of the torpedo is indicated at 20, said shell containing the explosive charge, the thickness of this outer shell depending also upon the nature of the target. At 21 is shown a machined steel base member fashioned to receive the rear end of the faced-off shell 20, and attached thereto by screw threads (not shown), or by welding, for example.

The rear portion of the missile comprises a heavy walled steel casing 22 having sufficient mass to store considerable kinetic energy when rapidly rotating about its major axis, as well as when shot forward by a powder charge. Whereas this steel casing may not weigh as much as an armor-piercing shell, or a standard high explosive shell of like diameter, it is desired to point out that all of its mass is remote from its center, and therefore said mass acts at high gyro-action efficiency, when spun by its fins 16 through the agency of their engagement with the rifling

17 of the gun barrel. The line 23 represents the faced-off rear end of the shell 20 where it joins the machined steel base member 21, and the line 24 represents the faced-off forward end of the heavy walled casing 22, which forward end does not unite integrally with the machined steel base member, since it merely gives thrust to said member and rotates the member with a friction drive upon departure from the gun.

The interior construction of the missile is shown in Fig. 3 where 25 indicates the charge of explosive which in this case comprises a solid explosive such as TNT, but it is to be understood that a twenty per cent lighter by weight, and a forty per cent more powerful by volume, explosive may be substituted, for example a liquid high explosive comprising a liquid hydrocarbon and liquid nitrogen tetra-oxide as the component parts thereof as disclosed in U. S. Letters Patent No. 2,298,255 granted October 6, 1942 to the present applicant. In the present illustration the shell 20 is of comparatively thin wall construction in order to contain not only a maximum mass of high explosive, but to avoid the loss of a considerable portion of the kinetic energy of the explosive in disrupting the walls of the shell upon detonation. This missile, with its comparatively thin-walled shell, is primarily designed for battle-ship wrecking, where maximum under water "torpedo effect" (or, as in the case of the larger missiles, under water "mine effect") is desired. It is by using the reduced charge of powder, and by the friction drive in rotating this comparatively thin walled shell, that such a maximum mass of high explosive may be projected in a practical manner at long ranges and with superior accuracy.

For shore, and fort bombardment, as well as for use against personnel or air craft attack, the wall thickness of the shell 20 is increased inherently, or this thickened effect may be attained by using a plurality of metallic rings 26 as a lining of the shell, which rings will be disrupted and/or broken by the detonation of the high explosive and their parts will serve as shrapnel fragments. The shell is provided with a rear closure plate member 27 for retention of the explosive.

The base member 21 is threaded internally, as illustrated, to receive the stout machined steel plug member 28 which is suitably and firmly secured in the forward open end of the steel tube 29 which extends substantially the full length of the casing 22. This machined steel plug member 28 is bored out centrally to receive an inertia firing pin 30 fashioned to strike a percussion primer 32 carried by the cartridge 31, and thus fire a potassium-nitrate charcoal mixture, for example, disposed in said cartridge. The gases of combustion resulting from the firing of such mixture, will pass from the cartridge through the two ducts 33 and 34, the such passage being controlled by the valve 35, which valve may be of the impact opening, or centrifugally operated, type. The centrally disposed tubular chamber 36 may contain one component part 37 of a liquid fuel, and the surrounding space 38 may contain another component part 59 of a liquid fuel.

One of these component parts may comprise one or more liquid hydrocarbons. such as benzene or gasoline for example, or it may contain one of the many alcohols. In any of these combustibles some liquid gas may be dissolved for pressure producing purposes, some normal or iso-butane for example.

The other component part may comprise liquid nitrogen tetra-oxide for example, where it is desired to close hermetically, and seal for storage, a suitable fluid supporter of combustion for the liquid fuel. The fluid supporter of combustion however, may be liquid oxygen, or liquid ozone, where it is not desired, or it is not necessary, to hermetically close the chamber and store the fluid for any length of time. When liquid oxygen, or liquid ozone, is employed as the supporter of combustion, a safety valve must of course be provided to blow off gas and relieve pressure; for this purpose one or more of the valves 44, 45, or 46, presently to be described, may comprise a spring venting release.

The lower ends of the tubular chamber 36, and the surrounding space 38, are closed respectively by the plug members 39 and 40, and the ducts 41, 43 and 42 are kept closed when the missile is in a static state, but are opened respectively by the impact or centrifugally operated valves 44, 45 and 46 when the missile is launched rotating from the rifled barrel of the howitzer or gun, thereby allowing said ducts to discharge the liquid fuel components 29 and 37, as well as the liquid supporter of combustion, into the heavy walled combustion chamber 47 where the mixture (i. e. propelling "rocket fuel") will become ignited by the gunpowder propellant of the howitzer or gun admitted through the opening 50 in the heavy closure plate 48 secured upon the rear end of the casing 22 as by the easily drawn pins 49. The combustion chamber 47 or the opening 50 may contain a time fuse for delaying the ignition of the rocket fuel in said chamber, or it may contain cotton wool, for example, for prompt ignition of the rocket fuel. With a time fuse, the rocket missile may have its propelling fuel go into action at any desired point in its trajectory. Its trajectory may be a simple aerial one as in high angle fire, or it may be a compound trajectory in low angle fire, part aerial, and part "skip-shooting" over the surface of water, or part aerial, and part under water "scurry" depending upon conditions. In any event, it is pointed out that the heat of combustion is well taken care of in the heavy walled combustion chamber, because the thermal units not used in the rocket action pass through the heavy walls of said chamber to the walls of the embracing and surrounding steel tubes 29 and 22 respectively, and to the air-cooling fins 16.

Having described the various parts of this rifle rocket torpedo missile, I will now describe its operation, and set forth the scientific principles upon which it is based, some of which are more subtle than others.

In applicant's missile, it will be appreciated from the following that he may use a thin walled shell and/or a properly proportioned or reinforced shell for maximum shrapnel effect, and still secure adequate range for all purposes in hand—"torpedo effect" or "mine effect" under water, or maximum execution in shelling land bases or air craft.

But a thin-walled shell for maximum torpedo or mine effect, cannot be fired in contact with full charge powder bags at high muzzle velocity from a rifled gun with engagement of the grooves of the rifling. It would be broken up by the combined sudden thrust and twist of departure from the barrel of the gun.

Therefore applicant's scientific design of his new rifle rocket missile and ballistic plan. The

thin-walled body of the rocket torpedo when containing the heaviest possible charge of high explosive for torpedo or mine effect, is not fired suddenly in contact with full charge powder bags at high muzzle velocity, and is furthermore not forced to spin suddenly.

By virtue of his rocket drive after departure from the gun, adequate ranges are nevertheless easily attained. These results are major features of the invention. The recommended muzzle velocity for the new missiles is something under the velocity of sound—900 feet per second, for example.

In loading the smooth body of the rocket torpedo, it is caused to slide freely into the rifled gun. It may be loaded as a unit, but when space is limited the component parts 20 and 22 may be loaded serially since they are attachable, as heretofore described.

The entire missile may be pushed within the rifled portion of the gun or only a portion thereof, as illustrated in Figure 1. In either case there would be a cushion of air, first to be compressed before the modified shock and twist of departure is brought to bear.

In applicant's copending U. S. patent application, Serial No. 526,782 filed March 16, 1944 and entitled Aerial torpedoes, a revolvable and comparatively short gas-check member is illustrated and described to serve the triple purpose of a gas-check, a friction rotation drive for the body of the torpedo, and direct air rotation drive in flight.

In the present design therefor, the multiple shallow lug and fin members 16 at the rear end of a stout tubular member, serve the triple purpose of gas-check, sliding friction rotation drive, and later static friction drive for the body of the torpedo. The present fins therefore not only act as a gas-check in preventing the passage of hot gases between the body of the torpedo and the rifling of the gun, which even with the comparatively low muzzle velocity of the reduced charge of powder would be conductive to erosion, but make possible the full propelling action of the powder gases to be exerted upon the missile, and moreover track in the grooves of the rifling with less wear and strain upon them than if forced therein according to heretofore known copper band constructions. With applicant's shallow spirally disposed lug fin members properly lubricated, the strain upon the rifling and gun would be at the minimum.

As previously stated the tube member 22 is of heavy construction, and because it is a hollow structure with its mass of metal remote from its center, it stores a maximum of kinetic energy when rotated at high speed about its major axis, and is well qualified therefore to build up, by a friction drive, the inner and lighter weight rocket fuel chamber as well as the warhead of the missile.

The rocket fuel here may, of course, be a solid slow-burning rocket powder as well as the component part liquid fuel as described, and this rocket fuel is only brought into propelling action after the reduced charge of propellent in the gun has imparted at least 900 feet per second velocity, as well as an efficient gyro-spin, to the missile.

The jet propulsion, or rocket action in this new missile and its system of use, does not come into play until the rocket body is already at high speed. This results in great efficiency, for when the speed of the rocket body is closest to the

speed of its gas jet particles, the efficiency of the rocket is at its maximum. In other words the new rocket missile does not wastefully use up valuable rocket fuel in accelerating the missile from a state of rest, as do previously fired rockets from the so-called rocket guns. It is initially propelled by a charge of powder in a true rocket gun.

Furthermore, unlike previously fired rockets, it is made to build up a high velocity spin, which is conducive to higher accuracy in marksmanship. Applicant is, of course, aware of the fact that in some of the previously fired rockets from smooth bore guns, the rotation is also gradually built up by making the rocket blast produce rotation as well as propulsion. But this jet produced rotation is not as rapid as could be desired. Applicant may, of course, fashion his jet exhaust to aid in rotation as well as to give propulsion, and thereby secure all the speed of gyro-rotation desired.

Because the diameter of the rocket tail end is substantially as great as the rocket war-head end, there is but small clearance space for the spirally disposed fin members, but unlike the spirally disposed fin members in applicant's copending patent application Serial No. 526,782, they are less steep in twist and more numerous. They consequently present to a cross wind a certain percentage of substantially flat surface to the curved tubular surface upon which they are machine cut or mounted, and therefor they may be adjusted as to lengths and number to give the missile a "yaw" into a cross wind, the yaw being determined by calculation or experiment to have a corrective action to lateral displacement in aerial flight. No common projectile is capable of such an adjustment.

The present new missile may contain 800, 1000, or 1,500 pounds of high explosive and because of its unusual relationship of great length to diameter has very high momentum plus its rocket fuel propulsion on striking water either for "skip-shooting" with a minimum of ricochet, or "under water scurry," or the target in the direct hit as will be presently described.

It is obvious that those skilled in the various arts and sciences involved in such a development as herein set forth, may easily vary the details of design and construction, arrangement of parts, as well as the methods, ways and means of use, which would enable them to produce the foregoing accomplishments as well as other accomplishments, without departing from the spirit of this invention, and therefore it is not desired to be limited to the precise description, except as may be required by the claims.

Having described my invention, I claim:

1. A rocket missile fashioned to be fired from a rifled gun, said rocket missile comprising an outer tubular member with rifle-engaging fins, an inner tubular member having a surface drive fit within said outer tubular member and rotated by virtue of such drive fit by said outer tubular member, a centralized plug member rigidly attached to the interior of said inner tubular member, a war-head member rigidly attached to said centralized plug member, a charge of explosive and a firing device therefor disposed in said war-head member, a rocket fuel in said inner tubular member, and a combustion chamber at the end of said inner tubular member, said chamber having a driving nozzle for the escape of the products of combustion of said rocket fuel.

2. A rocket missile fashioned to be fired from

a rifled gun, said rocket missile comprising a comparatively heavy-walled outer tubular member, with rifle-engaging fins thereon, a comparatively light-walled inner tubular member having a surface drive fit within said outer tubular member and rotated by virtue of such drive fit by said comparatively heavy-walled outer tubular member, a centralized plug member rigidly attached to the interior of said comparatively light-walled inner tubular member, a war-head member rigidly attached to said centralized plug member, a charge of explosive and a firing device therefor disposed in said war-head member, a rocket fuel and a combustion chamber therefor in said inner comparatively light-walled inner tubular member, and pressure generating means carried by said plug member for forcing said fuel into said combustion chamber.

3. A rifled rocket missile comprising a war head containing an explosive charge and a firing device therefor, a base member therefor centrally apertured and threaded to receive a threaded plug member, a threaded plug member therefor, a comparatively light-walled tubular member rigidly attached to said threaded plug member, a rocket fuel and a combustion chamber therefor within said comparatively light-walled tubular member, said chamber having a driving nozzle for the escape of the products of combustion of said rocket fuel, and a comparatively heavy-walled outer tubular member embracing said comparatively light-walled tubular member with a friction fit, spirally disposed fin members upon said comparatively heavy walled outer tubular member, said fin members fashioned to enter the rifling of a gun, and delayed action means for igniting the said rocket fuel upon discharge of the rifled rocket missile.

4. A rocket missile fashioned to be launched from a rifled gun, said rocket missile comprising a comparatively heavy-walled outer tubular member, with rifle-engaging fins thereon, a comparatively light-walled inner tubular member embraced by said outer tubular member with a friction fit for rotation therewith, a combustion chamber at the end of said inner tubular member, said chamber having a driving nozzle for the escape of the products of combustion of a propellant liquid fuel, a centralized plug member rigidly attached to the interior of said comparatively light-walled inner tubular member, a war-head member rigidly attached to said centralized plug member and containing a charge of explosive and a firing device therefor, a centrally disposed container within the inner tubular member and a component part of a propellant liquid fuel therein, a pipe leading from said container to said combustion chamber, and a valve disposed in said pipe and responsive to movement imparted to said missile incident to the launching thereof.

5. A rocket missile fashioned to be launched from a rifled gun, said rocket missile comprising a comparatively heavy-walled outer tubular member, with rifle-engaging fins thereon, a comparatively light-walled inner tubular member embraced by said outer tubular member with a friction fit for rotation by said outer tubular member, a combustion chamber at the end of said inner tubular member, said chamber having a driving nozzle for the escape of the products of combustion of a propellant liquid fuel, a centralized plug member rigidly attached to the interior of said comparatively light-walled inner tubular member, a war-head member rigidly attached to said centralized plug member and containing a charge of explosive and a firing device therefor, a centrally disposed container within the inner tubular member and a component part of a propellant liquid fuel therein, a pipe leading from said container to said combustion chamber, and a normally closed valve disposed in said pipe, said valve opened in response to the launching movement of said missile.

6. A rocket missile fashioned to be launched from a rifled gun, said rocket missile comprising an outer tubular member with rifle-engaging fins thereon, an inner tubular member embraced by said outer tubular member with a friction fit for rotation by said outer tubular member, a combustion chamber at the end of said inner tubular member, said chamber having a driving nozzle for the escape of the products of combustion of a propellant liquid fuel, a centralized plug member rigidly attached to the interior of said inner tubular member, a war-head member rigidly attached to said centralized plug member and containing a charge of explosive and a firing device therefor, a centrally disposed container within the inner tubular member and a propellant liquid fuel therein, a valved connection between said container and said combustion chamber, said connection operatively responsive to movement imparted to said missile by the launching thereof, and pressure generating means carried by said plug member for forcing said fuel into said combustion chamber.

NEVIL MONROE HOPKINS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,360,602	VanDeuren	Nov. 30, 1920
1,994,490	Skinner	Mar. 19, 1935
2,145,508	Denoix	Jan. 31, 1939
2,397,114	Anzalone	Mar. 26, 1946

FOREIGN PATENTS

Number	Country	Date
41,147	France	Aug. 9, 1932
	(Addition to No. 714,676)	
618,668	Germany	Sept. 13, 1935
625,104	France	Apr. 19, 1927
831,496	France	June 7, 1938