Sept. 2, 1947. N. M. HOPKINS 2,426,610

ROCKET LAUNCHING GUN

Filed Nov. 21, 1944

FIG. 1

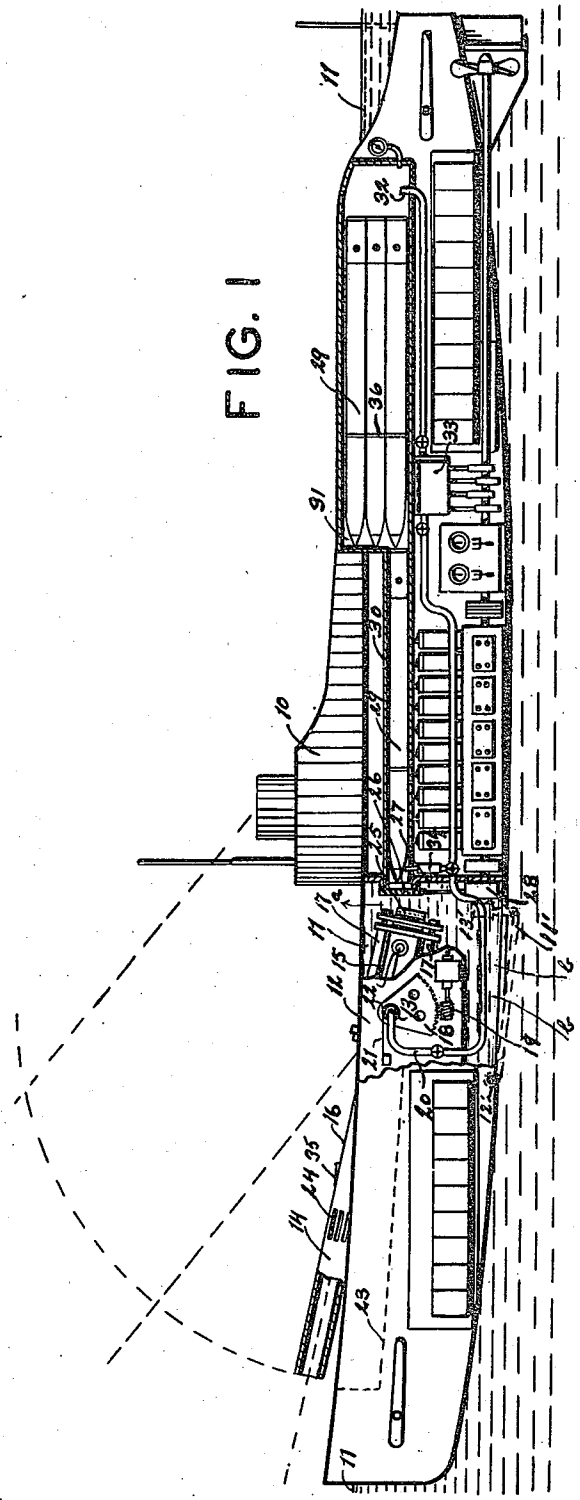


FIG. 2

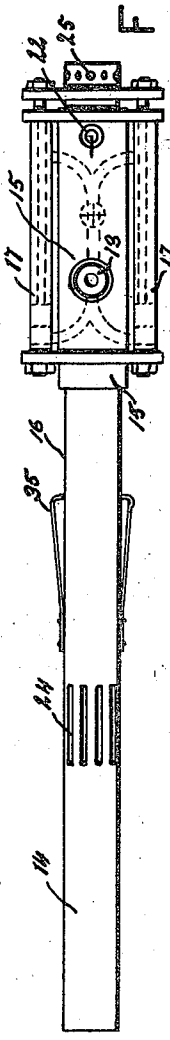


FIG. 3

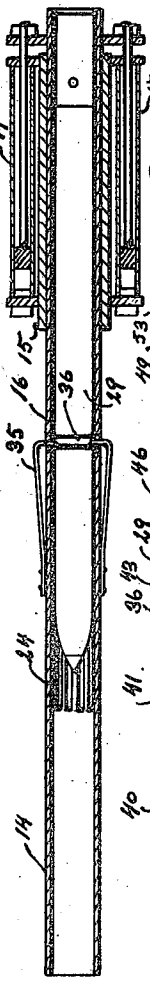
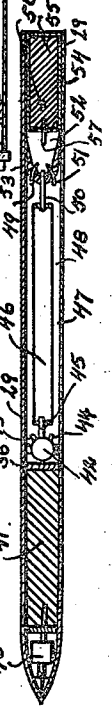


FIG. 4



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ROCKET LAUNCHING GUN

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1 Claim. (Cl. 89—1.7)

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This invention pertains to the carrying, servicing and firing of large rockets on land or at sea. It deals with the handling of rockets of large diameter and great length, particularly aboard either a surface vessel or a submarine vessel. It necessarily embraces highly cooperative features between vessel, rocket-gun, and rocket-missile, for both low and high angle fire.

It is an object of this invention to present new scientific ways and means, as well as method of using the most powerful of long range rockets with the most destructive explosive war-heads. It is also an object of this invention to carry, serve, and discharge such powerful rocket missiles with the maximum of safety to a vessel and its crew.

It is also an object of this invention particularly when applied to submarines because of their element of surprise, to produce a battleship wrecking rocket-missile, at low angle fire, and a flying fortress wrecking rocket-missile at high angle fire.

It is also an object of this invention, when the rocket-gun and well-way are applied to the forward position of a surface vessel, a destroyer, for example, because of her high speed, among other favorable features, to provide an automatic or manually controlled variable angle aquaplane at or adjacent to the bottom of the well-way, for giving temporary auxiliary buoyancy forward, due to the weight of the rocket gun located there and the loss of buoyancy due to the water-filled well-way.

With these and certain other important objects in view which will become apparent as the description proceeds, the invention consists in the novel parts and combination of parts, principles and methods of operation, all as will be more fully described and particularly pointed out in the claim. In a recently issued United States patent to applicant—Number 2,349,728, War vessel with high power long range gun, some of the general principles are dealt with, but the difference in fundamentals of the present invention will become apparent upon a study of the two respective developments.

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

Fig. 1 is a view in partial longitudinal section of a boat adapted to carry, serve, and fire a rocket according to this invention;

Fig. 2 is an elevational view of a rocket gun made in accordance with this invention;

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Fig. 3 is a central longitudinal sectional view of the parts shown in Fig. 2; and

Fig. 4 is a longitudinal sectional view through one of the rocket-missiles.

In the drawings, the numeral 10 represents the superstructure of a small vessel, floating upon the surface of the water of the sea 11, and 12 is the port side of a heavy lateral bulkhead of a narrow well-way, substantially equal in width to the diameter of the largest breech-end part of the rocket-gun presently to be described. This well-way is open to the sea at its top, and may or may not be open to the sea at its bottom, but for the purpose of illustration it is shown open at the top as indicated by the small arrow *a*, and is shown open at its bottom as indicated by the small arrows *bb*. When the bottom of the well-way is open to the water of the sea, it is preferably provided with a hydraulically operated closure member to prevent retarding drag. For fast surface vessels, such as a destroyer, I may provide a manually or automatically operated combination closure and aquaplane member 11', hinged at 12' and operated by a hydraulic cylinder and piston 13', all as shown in dotted lines.

The numeral 13 indicates the hollow port trunnion of the rocket-gun generally identified by the numeral 14, supported in a water-tight bearing (details not shown) in the side of the bulkhead 12. The hollow trunnions 13 (one for port and one for starboard) support the heavy tubular forging 15 through which the rocket-gun barrel 16 slides, restrained and controlled in its sliding movement by the pneumatic cylinders such as shown at 17, 17. Each hollow trunnion is rotated by a geared segmental member, worm-gear driven by an electric motor, the port equipment comprising the geared segment 18 and the worm-gear drive 19. There is also, of course, a graduated segment (not shown) for indicating the angle of elevation of the rocket-gun.

A conduit 20 is provided with suitable valves for supplying compressed air through the trunnions for operating the pistons in the cylinders 17, and 21 is one of a pair of electrical contactors for supplying electric current to the firing device 22 at the breech end of the rocket-gun. This firing device may be electrical, electro-magnetic, or electromechanically fashioned to strike a mechanical blow in response to the flow of an electric current.

Since the barrel of the rocket-gun is immersed in the water of the sea, it fills with water whenever it is lowered and stowed in the trough-like extension 23 of the well-way. This filling of the

rocket-gun with water would take place regardless of the type of vessel of moderate size. On a very large vessel, a cruiser, for example, the rocket gun could be carried comparatively high. In a submarine, it is of course obvious that the gun would be water-filled generally, and occasionally in a destroyer, for example, because of heavy seas which may break over her bows. To render the rocket-gun automatically serviceable, I provide the novel water-drainage slots, **24**, relying upon the rocket-missile, which is introduced into the barrel by compressed air, to displace the sea water in the after part of the rocket-gun barrel, all as will be presently described.

The breech end of the present design of rocket-gun has no breech-block nor conventional closure member. It may be left wholly open to the water of the sea, in which case the light charge of powder provided in the new rocket-missile acts directly upon the water of the sea, which as described and illustrated completely fills the vessel's well-way.

I may, however, provide for a partial closure of the breech end of the rocket-gun by furnishing a plurality of heavy bolt-like members radially introduced through radially bored holes **25**. This would be a simple and practical construction when, as, and if it is desired to impart a portion of the blast from the light charge of powder and rocket-fuel blast to the gun trunnions. But it is not believed that any breech closure at all will be necessary or desirable, especially in view of the light charge of propellent, the swiftly expanding gases therefrom acting directly upon the solid water of the sea. Such a sudden push as provided by the explosion of a light charge of powder, would meet with exceedingly high hydraulic resistance, a far higher resistance than would be presented to the comparatively slow applied force of the unaided rocket-fuel blast.

Applicant believes that this open end or breechless rocket-gun and its mounting constitutes a radically new element in ballistics particularly when it is realized that the rocket-missile has an explosive charge in addition to its jet-propulsion charge, and furthermore, when it is understood that the gun is operated under the surface of the sea.

A heavy slidable closure member **26** is provided for the opening in the heavy transverse bulkhead **27** of the vessel, which bulkhead may constitute the rear wall of the well-way, said closure member being raised and lowered in guideways (not shown) by the hydraulic cylinder and piston equipment **28**. A rocket-missile **29** is shown in gun-charging position within the water tight tubular charging chamber **30**, which communicates with the water tight storage chamber **31** of a size to contain a plurality of rocket-missiles stowed as shown. The charging chamber **30** is positioned so that it is substantially coaxial with the gun barrel when the latter is depressed into the trough **23** provided therefor. The combination of water tight chambers is supplied with compressed air under suitable high pressure by means of the conduit **32** and the air compressor **33**, which also supplies compressed air at will to the rocket-missile arrest equipment **34**, as well as to the rocket-gun control cylinders **17**.

In the submersible type of vessel illustrated, there has been merely indicated the pipe lines, pumps, valves, storage tanks for ballast, fuel and the like, internal combustion engines, clutch, electric motors, storage batteries and the like, there having been purposely omitted for the sake

of clearness and simplicity the great number of detailed parts of the submarine shown, it being believed that with the showing made in Fig. 1 and the description contained herein, experts skilled in the involved arts will be able to understand and carry out the features of this invention. The present vessel is, of course, equipped with radar and all of the other devices, instruments, and so forth for practical operation.

The rocket-missile is positioned or locked in the barrel of the rocket-gun by spring "dogs" such as illustrated at **35**, in order to prevent the missile from sliding back and slipping out of the barrel when the gun is elevated. The groove **36** in the missile is of course so formed as to allow easy entrance of the missile into the barrel, but to prevent its retreat once it has been pushed into its proper place.

With particular reference to Fig. 4 there is indicated at **40** the warhead firing mechanism, which may comprise the features of any desirable type of explosive device. It may have the contact or inertia type of firing pin, for example, with a time fuse for delayed action, or it may have a super-sensitive fuse, a time fuse or the like. It may contain a gyroscope device, certain electronic devices, electric "eyes" and the like, suitable for controlling the direction of flight, and the warhead may contain a radio responsive device for cutting off the rocket fuel by remote control and the like, together with certain other features.

A charge of high explosive is shown at **41**, and **42** is a high pressure flask of compressed nitrogen gas, or its equivalent, for bringing pressure at the proper time upon the liquid fuel and the liquid supporter of combustion for the jet propulsion. Here **43**, **44**, and **45** are the ducts for supplying the highly compressed nitrogen gas to the liquid fuel and to the liquid supporter of combustion, respectively. For example, **46** may indicate a supply quantity of liquid hydrocarbon (or a mixture of liquid hydrocarbons, benzol, high octane gasoline, or alcohol) and **47** may indicate a supply quantity of liquid nitrogen peroxide, sometimes classified as nitrogen tetroxide.

The ducts **43**, **44** and **45**, of course are provided with inertia operated valves (not shown) fashioned to be opened at the shock of departure of the rocket-missile from the rocket-gun when its light charge of powder is exploded, and the ducts **49**, **50**, and **51**, have like inertia operated valves (not shown), which ducts lead into the heavy-walled combustion chamber **52**, the thick walls **53** being welded to the casing of the missile. **54** is a metal casing for the light charge of slow burning powder **55**, fashioned to give the rocket-missile a swifter send-off than it would receive from its jet propulsion fuel. This swifter send-off is desirable for several reasons, among which is the certain operation of the inertia controlled valves.

A firing device is indicated at **56** which, as previously stated, may be an electro-mechanical percussion device, or an electrical heating device, and **57** indicates a fuse fashioned to ignite a combustible packing, cotton, for example (not shown) in the combustion chamber **52**, in readiness to ignite the jet propulsion fuel when it is injected into the combustion chamber along with its supporter of combustion.

With the foregoing description of parts, the operation of the complete system, and the invention involved therein, will now be pointed out. Assuming that the rocket-gun is mounted on a

submarine as illustrated and described, and it is desired to load the gun, the following detailed steps are essential, although simple and scientifically correct in principle. The rocket-gun is normally stowed or depressed against a stop, the bottom of the trough 23, in coaxial alignment with the charging chamber 30. The rocket-missile 29 which fits snugly but smoothly within the charging tube 30, has been driven forward therein up to its arrester 34 by the rocket-missile directly in its rear, under the urge of the compressed air from the duct 32.

The heavy closure 26 is then lowered by its hydraulic cylinder and piston 28. Sea water cannot enter the vessel at this stage because of the close fit of the rocket missile within the tube 30 and the highly compressed air about and behind the missile. The horizontal breechless rocket-gun, which is completely filled with water, is slid rearwardly within the casting 15 by compressed air admitted to the cylinders 17, to bring the rear end of the gun barrel into coengagement with the uncovered forward end of the charging tube 30. The arrest equipment 34 is then released whereupon the missile 29 will move forwardly under the urge of the compressed air into the barrel of the rocket-gun, and the missile therebehind will have moved forward into the charging tube up to said arrester.

At this point or phase of operation, a third rocket-missile is released from the storage chamber 31 and allowed to fall by gravity into a position coaxial with the charging tube and hence ready for subsequent loading. The missile 29 in entering the barrel of the gun forces the water out of the rear portion of said barrel, the missile moving forwardly until stopped and locked by the dogs 35. The barrel of the gun is then forced forward by a reverse operation of the compressed air cylinders 17 and their pistons, and the member 26 raised to close the forward end of the tube 30. The gun then may be elevated to any desired angle of fire by its electric motor and worm gearing.

The gun with its rocket-missile is fairly well balanced, and therefore does not require very powerful motors and gear to elevate it. The water in the forward portion of the rocket-gun barrel pours out of the numerous open slots 24, wherefore the gun may be safely fired by the electric wiring and percussion system. Because of the self contained cartridge construction of the new rocket-missile, comprising the light charge of propellent, in addition to the charge of fuel as already indicated, the missile leaves the gun swiftly and the jet propulsion subsequently goes into play. The hydraulic action of the water in the well-way takes the suddenly applied pressure and, by Pascal's law, distributes the pressure to the bulkheads of the vessel and through the ribs of the vessel to the surrounding water of the sea.

At low angle fire, as when the rocket-gun is elevated to an angle of 18 degrees, the new rocket-missile may be used as a battleship wrecker, and at high angle fire the gun may be used for distant bombardment of cities and fortified zones, and at still higher angles of fire the gun is well adapted for use against flying fortress attack. At low angle fire for battleship wrecking it is not necessary to know the exact range when the enemy is at rest, but merely necessary to get the enemy's bearing, because the long projectile "skip-shoots" over the surface of the water with a minimum of ricochet.

The present rocket-missile would be particularly deadly to the capital ship. With a delayed action impact firing mechanism the new rocket-missile may strike the hull of a super dreadnaught, a fifty five thousand tonner for example, and by the time the rocket-missile sinks to a depth of ten or fifteen feet, the high explosive charge 41 may be detonated, producing the hydraulic "mine effect" below the belt. Should the new rocket-missile as herein described have a diameter of 40 inches, and should the war-head member be 40 inches long, for example, which is perfectly feasible, the charge of TNT which it contains would be 7,000 pounds. Since the modern United States Navy torpedo carries a charge of only 600 pounds of TNT for its "torpedo effect" the new rocket-missile could be the equivalent of the blast of 12 navy standard torpedoes simultaneously exploded.

Applicant has illustrated a rocket missile of comparatively great war-head power for moderate ranges. He may reduce the war-head capacity for TNT by increasing the capacity for the liquid fuel for jet propulsion and therefore fashion a rocket-missile for great ranges. Whereas applicant has illustrated and described a submarine for his cooperative hull and superstructure thereof, rocket gun for any angle of fire and rocket cartridge missile, he desires to emphasize also the practically perfect adaptability of his new open-breech gun and cartridge rocket missile, to a surface vessel of moderate size, a swift destroyer for example.

Since the open breech rocket gun experiences no great strain in projecting its missile, it may be of very moderate weight, including all of its mechanism. Therefore it may be of great caliber and be mounted and served well toward the bow upon a light and swift surface craft. Sea water driven into the barrel of this gun, along with rain, by wind or wave, need cause no danger since it is quickly and automatically drained away when the gun is elevated and used. Whereas applicant has shown but one series of water draining slots, he may provide several series, rendering the gun barrel in its forward length, a directional guide only for the rocket missile. There need be no recoil to speak of transmitted through its trunnions to the light structure of the vessel.

Whereas the bulkheads of the well-way may be scientifically reinforced, longitudinally and/or laterally, there need be no great charge of slow-burning powder in the cartridge rocket-missile to start it, or even to give it a fairly high muzzle velocity. The rocket-missile, although it may be of great diameter and of great length, is not a dense missile, since apart from its thin metal shell it comprises explosives and liquid fuels of specific gravity under 2.

If a charge of powder is not used within the inner container 54, the center of gravity of the rocket missile is automatically shifted forward, and the after portion of the casing 29, minus the charge of powder, and the inner casing 54, which is blown back by the jet propulsion blast, act as a stabilizing tail. It is of course obvious that those skilled in the arts and sciences involved in this disclosure may vary the details of construction and operation of the various parts, without departing from the spirit of this invention, and therefore it is not desired to be limited to the foregoing disclosure, except as may be called for in the claim.

Having described my invention, I claim:

A rocket launching gun comprising a barrel

mounted in a well-way containing water whereby the barrel when in its inoperative position is disposed below the level of the water in said well-way, said barrel adapted to contain a rocket to be discharged therefrom, said barrel having trunnion mountings whereby said barrel may be elevated for firing with its forward end out of said well-way, and drain openings extending through the wall of said barrel, said openings disposed at a location immediately forward of the area occupied by the rocket when loaded in said barrel, whereby water contained in the barrel ahead of the rocket will automatically drain therefrom upon elevating said barrel to thereby provide unimpeded discharge of the rocket from said barrel.

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