102-399 SR
XR 1,351,540
Search Room

CROSS REFERENCE

W. F. ROOS.

PROJECTILE.

APPLICATION FILED AUG. 21, 1917.

1,351,540.

Patented Aug. 31, 1920.

2 SHEETS—SHEET 1.

Fig. 2.

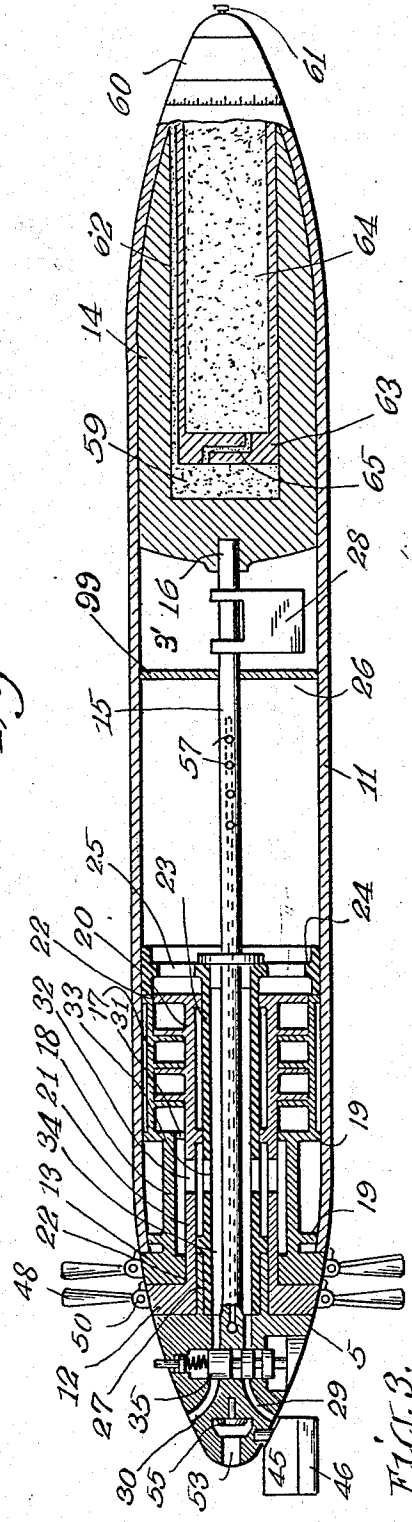



Fig. 1.

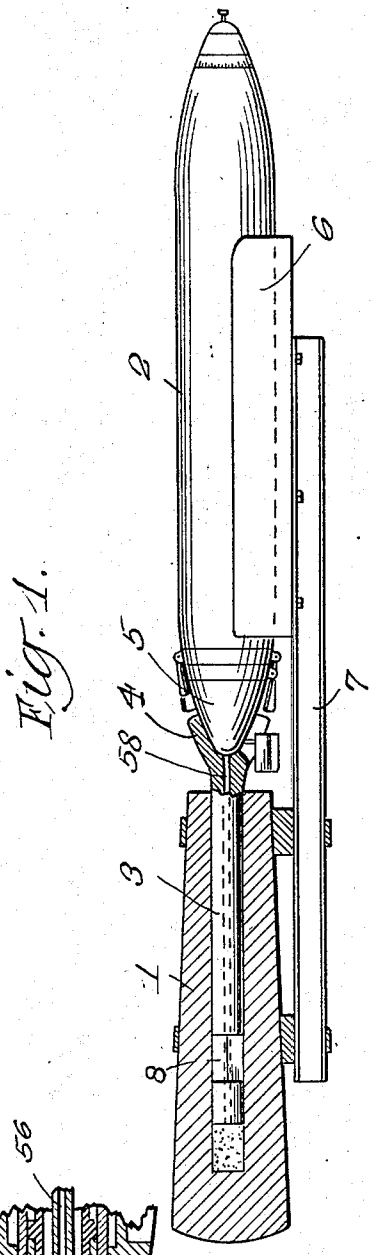
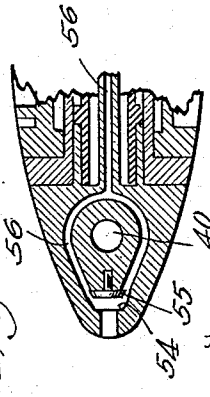



Fig. 3.




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1351540
OR IN 114/25

W. F. ROOS.

PROJECTILE.

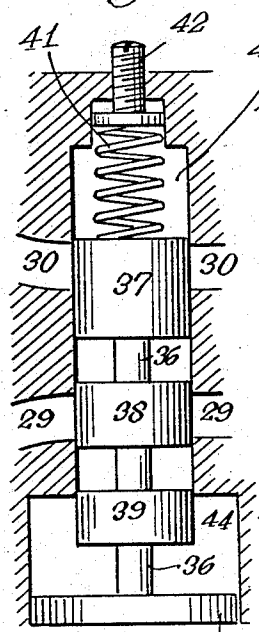
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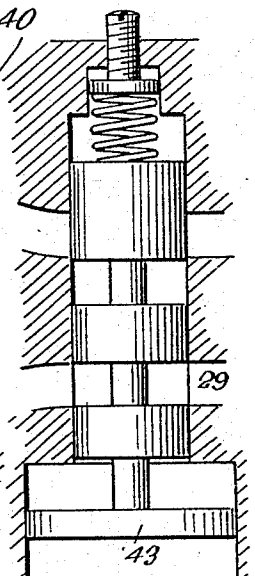
2 SHEETS—SHEET 2.

Fig. 4



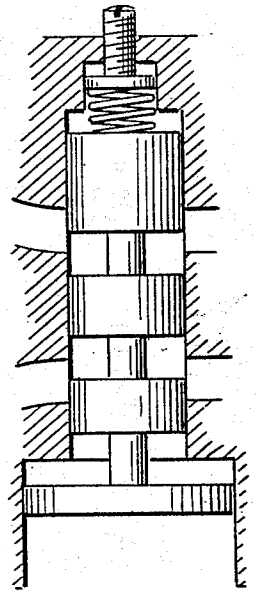

AIR PRESSURE

Fig. 5.



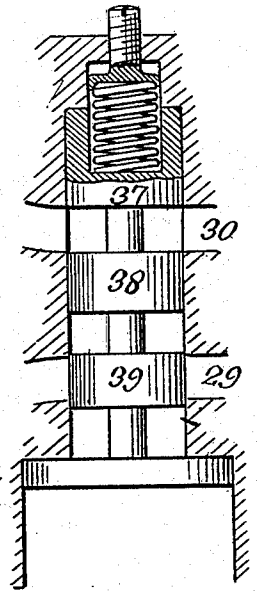

WATER PRESSURE ABOVE 15 FT.

Fig. 6



WATER PRESSURE AT 15 FT.

Fig. 7.




WATER PRESSURE BELOW 15 FT.

Fig. 8.

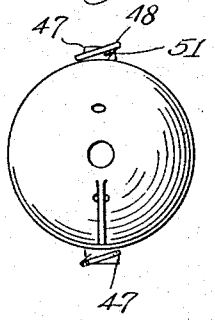



Fig. 9.

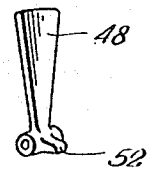
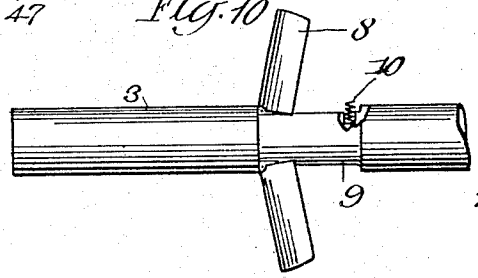



Fig. 10




William F. Roos,
INVENTOR

BY
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# UNITED STATES PATENT OFFICE.

WILLIAM F. ROOS, OF MAMARONECK, NEW YORK.

## PROJECTILE.

1,351,540. Specification of Letters Patent. Patented Aug. 31, 1920.

Application filed August 21, 1917. Serial No. 187,403.

*To all whom it may concern:*

Be it known that I, WILLIAM F. ROOS, a citizen of the United States, and a resident of Mamaroneck, county of Westchester, State of New York, have invented certain new and useful Improvements in Projectiles, of which the following is a specification.

My invention relates to projectiles, and particularly to that type of projectiles adapted to have a composite passage through air and water, each portion of the passage being of substantial extent.

If a projectile of the submarine type proceeds throughout the whole extent of its course under water, it is necessary to provide it with very strong and large propelling mechanism and chambers for storing the gas which is ordinarily used to propel the projectile. Furthermore, the problem of guiding a projectile in the proper line toward the target, and the problem of maintaining the projectile at the desired depth of submersion through the long flight, are difficult and necessitate providing the projectile with a great deal of intricate and delicate mechanism. If the projectile is propelled through the air for a considerable portion of its passage toward the target by being projected from a projecting device, which is gas-operated, the gas being provided either by combustion of powder or from a reservoir, the size and weight of the submarine propelling mechanism and gas container are greatly decreased and the possibility of the torpedo deviating from its course, either in the horizontal or vertical plane, is greatly lessened. The torpedo must, however, possess the special characteristics which permit it to be projected through the air without destruction of the propelling and directing mechanism.

The object of my invention is to provide means for propelling a projectile for an extensive passage through air before it enters the water. A specific feature of this object is the provision of means for propelling such a projectile of large diameter by means of a small projecting device.

Another object of my invention is to provide a projectile adapted to be propelled by a gas-operated projecting device with means for receiving and retaining a portion of the propelling gas.

Another object of my invention is to provide a projectile adapted to be propelled by a projecting device with means for directing it during passage in water. A specific feature of this object is the provision of a directing device for the projectile operated by gas contained in the projectile.

Another object of my invention is to arrange means for pre-heating the gas carried by the projectile.

Another object of my invention is to provide a projectile adapted to be propelled by a projecting device which embodies means for propelling it during passage in the water.

A more specific feature of this object is to provide propelling means operated by gas contained within the projectile.

Another object of my invention is to provide a projectile having a main body portion and a control-device carrying portion, a more specific feature of this object being the provision of a connection between the two portions whereby the control portion maintains a predetermined position about the axis of the projectile regardless of the position of the main portion relative to said axis.

Another object of my invention is to provide a projectile adapted to be propelled by a projecting device with propellers and means for driving them, the propellers being mounted so that they may be moved to a position where they will not interfere with the flight of the projectile as it passes through the air.

Another object of my invention is to provide a projectile having a gas container and a plurality of exhaust passages and means for controlling the flow of gas through said exhaust passages.

A further object is to provide a projectile having propellers and a gas-operated driving mechanism with a plurality of exhaust passages for the gas and means for controlling the flow of gas through the exhaust passages. It is a further object of my invention to arrange such a controlling means so that its operation is dependent upon water pressure.

A further object of my invention is to provide a projectile having means for propulsion and means for starting the propelling means when the projectile enters the water.

A further object of my invention is to provide a projectile having an explosive-carrying head and a propelling mechanism and a body portion constructed to withstand

strains arising when the projectile is projected through the air by a projecting device.

A further object of my invention is to provide a projectile having propelling means and an explosive-carrying head comprising an explosive container and means for propelling said container ahead of said projectile, a further and incidental object being to provide timing means for setting off the explosive charge.

Other and further objects of my invention will appear from the following description taken in connection with the drawings forming a part of this specification, and they will be pointed out in the hereunto appended claims.

In the drawings in which similar characters indicate similar parts,

Figure 1 is a view partly in section of a projectile and propelling means embodying features of my invention;

Fig. 2 is a longitudinal sectional view of a projectile embodying features of my invention;

Fig. 3 is a partial sectional view taken at right angles to the plane on which Fig. 2 is taken and is of the structure shown in Fig. 2;

Figs. 4, 5, 6 and 7 are detailed sectional views of valve mechanism showing different positions under different conditions;

Fig. 8 is a rear view of the projectile shown in Fig. 2;

Fig. 9 is a detail of one of the propeller blades; and

Fig. 10 is a detail.

For the purpose of disclosing and interpreting my invention I shall describe at least one embodiment of it, but I do not intend that my invention shall be limited to the specific features of the construction described, but, on the contrary, intend that it shall include such variations, modifications, adaptations and equivalents as occur to those skilled in the art, whether or not particular equivalents are referred to in the following description.

It is my desire that a gun of small bore, which may be operated by explosion of a powder charge, or by compresed air, may be used to propel the projectile 2, which has considerably larger diameter, and to that end I use an auxiliary member which has a rod 3 which fits within the bore of the gun and which has a head 4 which is formed to cooperate with the rear end 5 of the projectile, which will be more fully described hereinafter.

A supporting trough 6 is provided to support the projectile 2 before firing and to support it and guide it during the first part of its flight. This supporting device may take any form suitable to and corresponding with the contour of the projectile and the head 4 of the auxiliary member. The supporting member is preferably arranged so that the axis of the projectile will coincide with the axis of the projecting device 1. It is shown attached to the projecting device 1 by a beam 7, or any suitable connection may be used.

The auxiliary member has semi-cylindrical members 8 pivoted to it which fit within the end portion 9 and which are pressed out by a spring 10, so that they catch the air when the auxiliary member has passed out of the projecting device. This will hold the auxiliary member back and make the projectile 2 pass through the air freely. It is apparent from this construction that a projecting device of small bore may be used to propel a projectile of large bore through the air and that the projectile may be of the marine type, if it is so constructed that it will withstand the force applied to it in this way and if it is so constructed that the propelling parts of it will not interfere with its flight, and if it is so constructed that the propelling and directing mechanism begins to operate as soon as the projectile enters the water.

The projectile preferably includes a main body portion 11 and the rear end, or control device carrying portion 5. It is desirable to make the rear end 5 as nearly solid as possible, as shown, in order that it may withstand the shock of the projecting mechanism and two propeller carrying rings 12 and 13 are provided which comprise complete circular members which are positioned between the rear end portion and the main body portion 11 and take up a part of the thrust transmitted from the rear end portion to the main body portion. The main body portion includes the explosive carrying head 14 which will be more fully described hereinafter and a shaft 15 extends from the rear end portion to the solid portion of the explosive carrying head and is journaled therein at 16, and is also designed to carry a part of the thrust transmitted by the rear end portion to the main body portion.

The propeller driving mechanism comprises the outer turbine blade carrying member 17 which is connected by the sleeve 18 to the propeller ring 13. The sleeve 18 is journaled within the outer casing by the rings 19. The inner turbine blade carrying member 20 has blades alternating with the turbine blades 17, the blades being shaped in the well-known manner to cause the propellers to operate in opposite directions. The inner blade carrying member is attached to the propeller ring 12 by the sleeve 21. The sleeve 21 is journaled within the propeller ring 13 and within the outer turbine blade carrying member 22. The inner turbine blade carrying member 20 is also

journaled upon a hollow sleeve 23 which is rigidly held within the outer casing by a plate 24, which has turbine admission openings or nozzles 25 which communicate with the gas-carrying chamber 26. The rear end 5 is provided with an integral collar 27 which is journaled between the ring 12 and the sleeve 23.

Other arrangements for supporting the different parts relatively to one another may be devised, but the specific arrangement herein described is used for the purpose of disclosing and interpreting my invention.

Whatever arrangement of supporting the various parts is used, my invention includes the arrangement wherein the rear end 5 is mounted for rotation relatively to the main body portion of the projectile about the axis of the projectile. A pendulum weight 28 is attached to the rear end portion, for example, by being attached to the shaft 15, so that it is held in a predetermined position regardless of what position the main body portion assumes relatively to it. The main body portion may rotate about its axis, but the pendulum will always hold the rear end or control device carrying member in predetermined position. The projectile may be rotated by rifling, if it is shot from within the gun, or it may be rotated by rotating the member 3 by means of the rifling within the gun. In case the projectile is rotated it will be desirable to prevent as far as possible the rear end or controlling member 5 from rotating, and to this end I provide a partition 99 and form a vacuum chamber 3′, in which the pendulum weight 28 is positioned. With the pendulum positioned within the vacuum, rotation of the shaft 15 is less likely to occur when the projectile rotates. The control member 5 is provided with a plurality of exhaust passages 29 and 30, one of which is directed upwardly, and the other of which is directed downwardly, in the embodiment herein illustrated.

There may be some compressed gas within the chamber 26, and any additional gas entering it through the opening 53 will preheat it, but if there is no compressed gas therein then it will also be true that gas entering at the opening 53 from the propelling device will fill the chamber with heated gas, particularly if the gas in the projecting device is produced by the combustion of powder. The heated gas will produce a more efficient operation than cold gas.

The gas passing from the container 26 through the inlet nozzles 25 proceeds through the turbine blades rotating the turbine members in opposite directions and passes through the passages 31, 32, 33 and 34 to the exhaust passages 29 and 30. These exhaust passages are controlled by a pressure controlled valve 35, shown in detail in Figs. 4 to 7. The valve member 35 comprises a spindle 36 having enlarged portions 37, 38 and 39 which fit closely within the opening 40 in the rear end 5.

A spring 41, the tension of which is adjusted by the screw 42, normally keeps the valve member pressed to its lowermost position, at which the part 38 closes the passages 29 and the part 37 closes the passage 30. The spindle 36 has a large head 43 which fits closely within the recess 44 formed in the lower side of the control member 5. When the projectile is passing through the air, the air pressure and the spring 41 cooperate to hold the valve member in the position shown in Fig. 4. After the projectile has entered the water and is less than the desired distance below the surface, for example, fifteen feet, the water pressure holds the head 43 in the position shown in Fig. 5, and all of the exhaust passes through the passageway 29 and hence out the lower side of the control member so that the rear end of the projectile is raised and the projectile will proceed downwardly until it reaches the desired depth for which the spring has been set by the screw 42, and the valve assumes the position in Fig. 6, wherein part of the exhaust passes through each of the passages 29 and 30 and the only action upon the projectile is to assist in propelling it forwardly. If the projectile reaches a greater depth than the desired depth, the spring 41 is greatly compressed and the member 39 moves to a position to close the passage-way 29, as shown in Fig. 7, and the member 37 moves out of the passage-way 30, leaving it open, and the exhaust proceeds out through the upper side of the control member and by reaction causes the rear end of the projectile to move downwardly, causing the front end to move upwardly, and the projectile will proceed upwardly to the desired point of submersion. The exhaust passing through these passages may be the only means of propulsion as the turbine and propellers may be done away with if the passage through the water is to be of short extent.

The passages may also be differently arranged to produce different directing effect, for example, the passages may open out on the sides instead of at the top and bottom, in which case, auxiliary means, such as a gyroscope of the well-known type, is provided to control the exhaust through the passages to direct the projectile in a horizontal plane. Instead of having upwardly and downwardly directed exhaust passages formed within the control member, the control member may have depth-controlling rudders mounted upon it which are operated in the well-known way by a pressure-operated depth-controlling device, the essential feature of my invention being that the control member always remains in a

vertical plane by reason of its being mounted for rotation on the main body of the projectile so that the depth controlling mechanism will always act in a vertical plane instead of sometimes acting in a horizontal plane in cases where the main body of the projectile is rotated to 90° by accident. The control member carries a rudder 45 for directing the projectile in a horizontal plane, which rudder may be operated by a gyroscope in the well-known manner.

A weight 46 on this rudder assists in keeping the control member in position.

The propeller rings 12 and 13 are provided with ears 47 between which the propeller blades 48 are pivoted on axes 50 which form an angle with the axis of the projectile. The blades 48 also form angles with the axes 50. By this arrangement the propeller blades may fall down alongside of the projectile, as shown in Fig. 1, during its passage through the air, but as soon as the rotating mechanism begins to operate, the resistance of the water on the underside 51 of the propeller blade 40 will cause it to swing about its axis and the propeller blades will assume the position shown in Fig. 2.

Each blade is provided with a lug 52 to prevent it from swinging too far about its axis. The gas container may be charged in any desired way, but in order to admit to it and retain within it part of the propelling gas, I provide an opening 53 in the rear end 5. It is provided with a valve 54 with which a valve 55 is adapted to cooperate. The passage 53 leads into one or more branches 56 and passes around the valve opening 40 and into the shaft 15 through which it proceeds forward and discharges through the openings 57 into the gas container. If the projectile is propelled by an auxiliary member, the auxiliary member is provided with a passage 58 which leads from the source of propelling gas up to the opening 53. When the propelling gas is released, it passes through the opening 53 and into the chamber 26, and as soon as the propelling force is dissipated, the pressure within the container 26 forces the valve 55 down upon its seat 54. As the projectile passes through the air the valve member 55 closes the exhaust passages and there is no discharge from the chamber 26. However, as soon as the projectile enters the water, the pressure upon the valve head 43 operates the valve 35 and permits a flow of gas which passes through the exhaust passages 29 and 30 without passing through any turbine, or after passing through the turbine, as the case may be, and the projectile is propelled through the water at the proper depth.

Inasmuch as my projectile is designed to have a composite flight, it is provided with a head properly coöperating to make it effective under all conditions. The head is provided with the main explosive charge container 59 containing a charge which may be ignited by the time fuse 60 or by the percussion fuse 61 by the powder train 62. This container also carries an explosive charge container 63, the explosive charge 64 of which is ignited through the time fuse 65. The head of the projectile 14 is made heavy and the rear portion being comparatively lighter will act as a stabilizing tail. The weight of the head will tend to make it penetrate whether it strikes above or below the water line of an object and whether it is passing through the air or the water, the auxiliary explosive charge container will be propelled ahead of the projectile by the charge 59, and if the projectile strikes an object before the charge 59 explodes, then the charge 59 will tend to make the container penetrate the object struck and cause it to explode within the object.

It will be apparent from the foregoing that my invention embodies a projectile which may be propelled through the air for a considerable part of its passage and which will pass through the water during another considerable part of its passage.

It is also apparent that the propelling or guiding mechanism or both, according to what features are embodied in the projectile, will commence to act as soon as the projectile enters the water and that the controlling mechanism will always be in proper position to effect the desired control. It is also apparent that my projectile is so designed that it may be propelled in the manner described without destruction.

It is also apparent that my projectile is provided with an explosive-carrying head which is effective whether the explosion occurs in the air or whether the object is struck above or below the water line.

While I have stated that it may be desirable to use an auxiliary member within a small bore projecting device to propel a large bore projectile, it is apparent that many features of my invention may be embodied in a projectile propelled from a position within a projecting device.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a device of the class described, a projectile having a gas chamber, a gas-operated projecting device for said projectile and means for conducting a part of the projecting gas to said chamber and storing it there for use in propelling said projectile.

2. In a device of the class described, a projectile having a gas chamber, a gas-operated projecting device, a member adapted to fit within and be projected from said device and adapted to coöperate with said pro-

jectile and means for conducting a part of the projecting gas to said chamber and storing it there for use in propelling said projectile.

3. In a device of the class described, a projectile having a gas chamber, a gas-operated projecting device for said projectile and means for conducting a part of the projecting gas to said chamber and storing it there for use in propelling said projectile, said projectile having propelling means adapted to be operated by gas from said chamber.

4. In a device of the class described, a projectile having a gas chamber, a gas-operated projecting device for said projectile and means for conducting a part of the projecting gas to said chamber and storing it there for use in propelling said projectile, said projectile having propelling means adapted to be operated by gas from said chamber and pressure-controlled means for controlling said propelling means.

5. In a device of the class described, a projectile having a gas chamber, a gas-operated projecting device for said projectile and means for conducting a part of the projecting gas to said chamber and storing it there for use in propelling said projectile, said projectile having propelling means adapted to be operated by gas from said chamber, said projectile having an exhaust passage for said chamber.

6. In a device of the class described, a projectile having a gas chamber, a gas-operated projecting device for said projectile and means for conducting a part of the projecting gas to said chamber and storing it there for use in propelling said projectile, said projectile having propelling means adapted to be operated by gas from said chamber, said projectile having an exhaust passage for said chamber and pressure-controlled means for controlling said passage,

7. In a device of the class described, a projectile, a projecting device and a member adapted to fit within and be projected from said projecting device, said projectile having a main body portion, a substantially solid rear-end portion adapted to coöperate with said member and a propeller carrying member between said portions, said main body portion having an explosive-carrying head and a thrust member extending from said head to said rear-end portion.

8. In a device of the class described, a projectile, a projecting device and a member adapted to fit within and be projected from said projecting device, said projectile having a main body portion, a substantially solid rear-end portion adapted to coöperate with said member, and a propeller carrying member between said portions, said main body portion having an explosive-carrying head, a gas chamber and a thrust member extending from said head to said rear-end portion through said chamber.

9. In a device of the class described, a projectile, a projecting device and a member adapted to fit within and be projected from said projecting device, said projectile having a main body portion, a substantially solid rear-end portion adapted to coöperate with said member, and a propeller carrying member between said portions, said main body portion having an explosive-carrying head, a gas chamber and a thrust member extending from said head to said rear-end portion through said chamber and having a gas passage from said rear end to said chamber.

10. In a device of the class described, a main body portion, a control portion mounted to permit relative rotation between it and said main body portion and a gas chamber, said control portion having substantially oppositely directed exhaust passages leading from said gas chamber and means for controlling said passages.

11. In a device of the class described, a main body portion, a control portion mounted to permit relative rotation between it and said main body portion and a gas chamber, said control portion having substantially oppositely directed exhaust passages leading from said chamber, and pressure-operated means for controlling the passage of gas through said passages.

12. In a device of the class described, a main body portion, a control portion mounted to permit relative rotation between it and said main body portion, a gas chamber, said control portion having substantially oppositely directed exhaust passages leading from said chamber and a pressure-operated valve for controlling said passages.

13. In a device of the class described, a main body portion, a control portion mounted to permit relative rotation between it and said main body portion, a gas chamber and propelling means operated by gas from said chamber, said control portion having directing means operated by the exhaust from said propelling means.

In testimony whereof, I have signed my name to this specification.

WILLIAM F. ROOS.