Oct. 9, 1945. W. P. HUNSDORF 2,386,686

LONG RANGE GUN AND PROJECTILE THEREFOR

Filed July 5, 1941 2 Sheets-Sheet 1

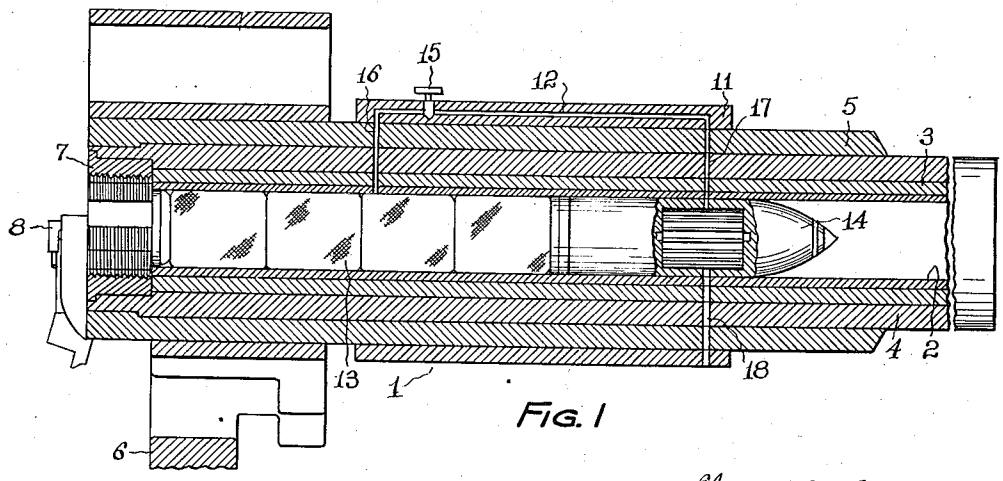


FIG. 1

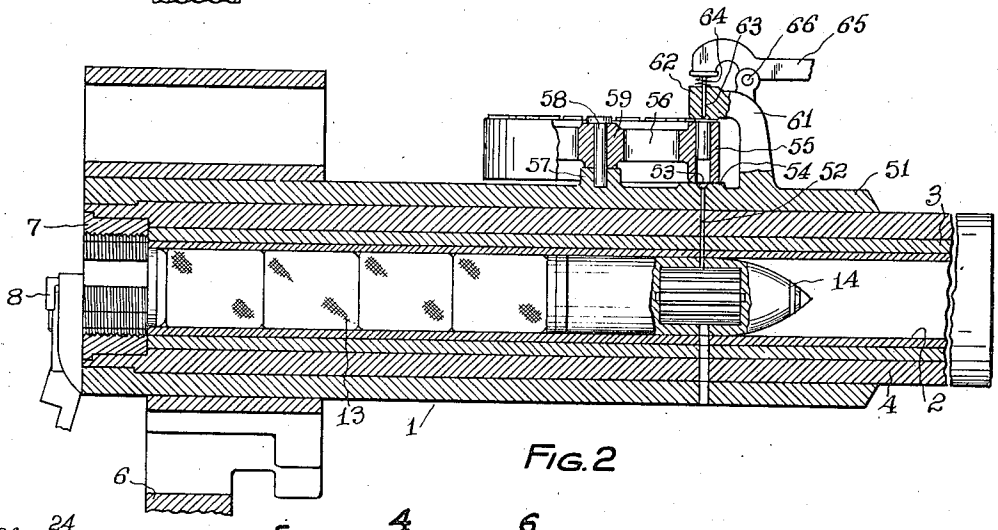


FIG. 2

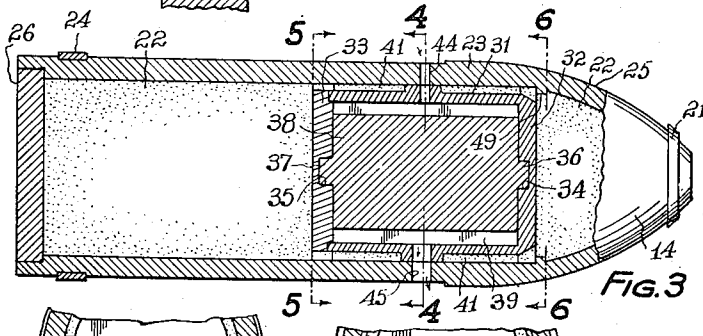


FIG. 3

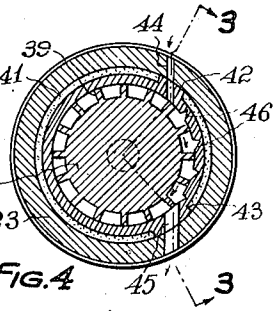


FIG. 4

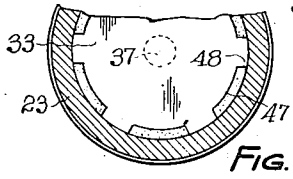


FIG. 5

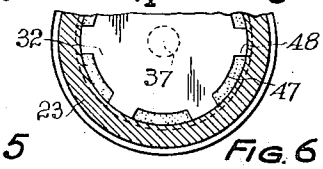


FIG. 6

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LONG RANGE GUN AND PROJECTILE THEREFOR

Filed July 5, 1941 2 Sheets-Sheet 2

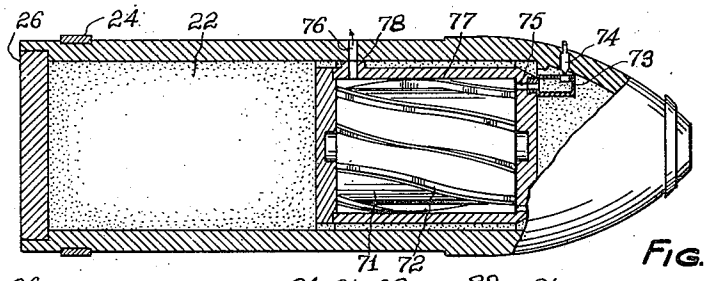


FIG. 7

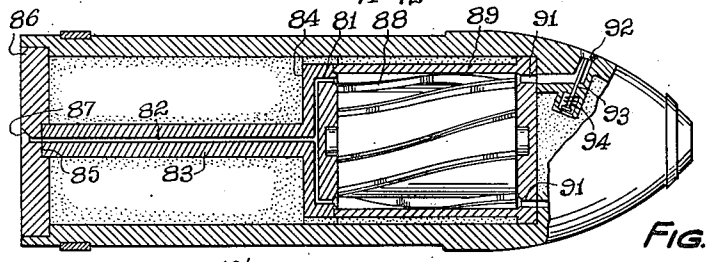


FIG. 8

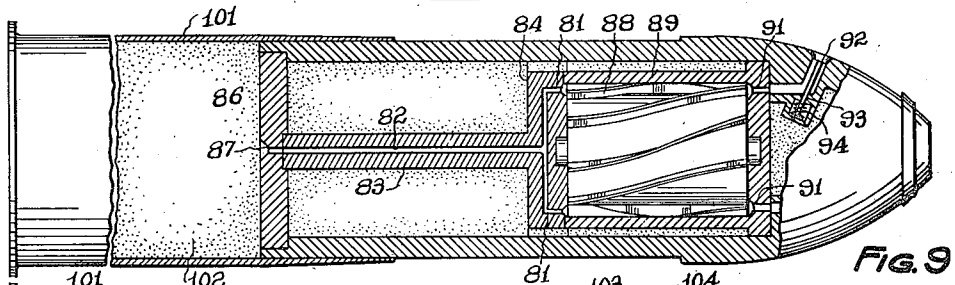


FIG. 9

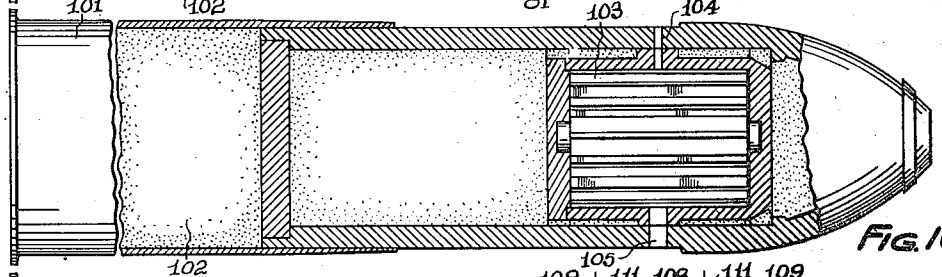


FIG. 10

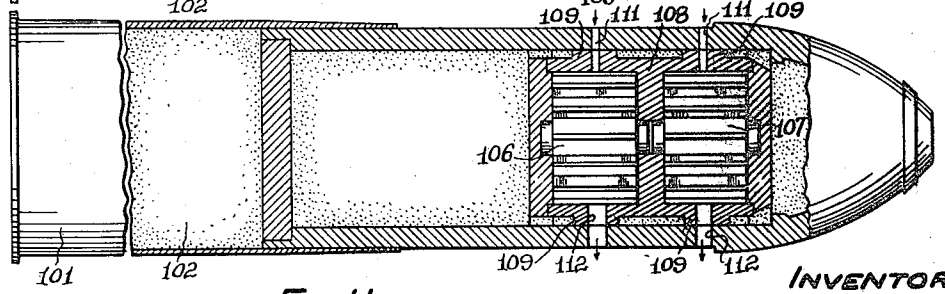


FIG. 11

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UNITED STATES PATENT OFFICE

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LONG RANGE GUN AND PROJECTILE THEREFOR

William P. Hunsdorf, Cleveland, Ohio, assignor of one-third to James L. Meikle and one-third to William J. Wesseler both of Cleveland, Ohio

Application July 5, 1941, Serial No. 401,127

2 Claims. (Cl. 89—1)

This invention, as indicated, relates to a long range gun and projectile therefor. More particularly it comprises a military unit in the form of a gun especially constructed to receive a certain type of projectile, and also including a projectile adapted to coact with such gun. The invention also includes a projectile having many of the features of the projectile just referred to, but adapted to be fired from guns of standard construction and especially from smooth-bore guns not particularly modified to accommodate such projectile. For certain special purposes it may even be found desirable to fire a projectile having certain of the features of the invention from a rifled gun barrel wherein an accelerated or modified stabilizing effect is to be brought about.

It is well recognized that there are disadvantages associated with the firing of projectiles from rifled cannon and the like inasmuch as certain friction losses are inevitable and the maximum propulsive effect of the gases cannot be attained. However, the spinning of the projectile is essential to prevent the tumbling of the same, and this is brought about through the sacrifice of accuracy and range as well as a reduced service life of the rifled cannon or similar projecting apparatus.

Many of the disadvantages just referred to can be avoided through the use of smooth-bore guns and a stabilizing means within the projectile. Such arrangement not only brings about greater accuracy and greater range but permits the manufacture of guns and projectiles of greater size without introducing destructive effects upon the gun structure due to vibration and erosion and excessive heating. Such improved projectile also does away with rotational drift. In addition such projectile retains its stabilizing effect in passing from the air into the water reducing the tendency to ricochet, or in the event of such action, to resist being diverted angularly to the right as with present high velocity projectiles fired from rifled guns. Such projectile construction where the stabilizing effect is maintained floats the shell broadside on the air and with such slower response to the angular fall brings about a greater range. A projectile of this type will have increased muzzle velocity and will be free of vibration. This, with the absence of rotational drift, will insure both accuracy and long range.

The principal object of the present invention is to avoid the disadvantages of projectiles fired from rifled cannon and at the same time to maintain or increase the accuracy of fire.

Another object of the invention is to provide for the construction of guns of very long service life and free of excessive heating or other difficulties of handling.

Another object of the invention is to provide for the construction of guns of larger size than any now available and with reduced recoil and vibration when in operation.

Another object of the invention is to provide for a gun having a high capacity in the way of range and accuracy with larger projectiles and also having greater simplicity and economy of construction and maintenance.

Another object of the invention is to provide a gun and projectile so related to each other as to permit variation and control of the translational and rotational speeds of the projectile to bring about certain predetermined effects.

Another object of the invention is to provide a projectile having stabilizing means within the same and free of the effects of rotational drift.

Another object of the invention is to provide a projectile of simple and inexpensive construction which will travel from smooth-bore cannon with greater accuracy and longer range than equivalent type of projectiles fired from rifled cannon.

Another object of the invention is to provide a projectile adapted to be discharged from a smooth-bore gun with a minimum use of the propulsive agent for rotational effects and with a maximum use of such agent for propulsive effects.

Another object of the invention is to provide a projectile free of sidewise thrust and having a minimum of recoil effect upon the gun mechanism.

Another object of the invention is to provide for separate control of the rotational speed of the stabilizing unit and for the discharge of the projectile from the gun barrel.

Other and further objects of the invention will appear in the course of the following description.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain structures embodying the invention, such disclosed means constituting, however, but several forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a central longitudinal sectional view showing the main portion of a smooth-bore gun with an explosive charge and with a projectile

partly in section, within the same, all embodying the principles of the invention;

Fig. 2 is a view similar to Figure 1 showing a modified form of gun structure with a separate power unit to rotate the stabilizing rotor;

Fig. 3 is a central longitudinal sectional view showing one method of constructing and assembing a projectile with an internal stabilizing rotor;

Fig. 4 is a transverse sectional view of the structure shown in Figure 3 as seen along the line 4—4 of Figure 3, looking in the direction of the arrows;

Figs. 5 and 6 are each fragmentary transverse sectional views of the structure shown in Figure 3 as seen along the lines 5—5 and 6—6, respectively, of Figure 3, looking in the direction, respectively, of the arrows;

Fig. 7 is a central longitudinal sectional view of a projectile with an internal stabilizing motor and with a self-contained rotor energizing unit;

Fig. 8 is a central longitudinal sectional view of a projectile with an internal stabilizing rotor adapted to be energized by the propulsive charge in the gun.

Fig. 9 is a side elevation, partly in section, of a cartridge case, or "fixed ammunition," provided with a projectile of the type shown in Figure 7 for large caliber ordnance;

Fig. 10 is a side elevation, partly in section, of a cartridge case, or "fixed ammunition," provided with a projectile of the type illustrated in Figures 1 and 2, for large caliber ordnance; and

Fig. 11 is a side elevation, partly in section, of a cartridge case, or "fixed ammunition," provided with a projectile having twin stabilizing rotors, each similar to the rotor shown in Figures 1, 2 and 10.

While the drawings show a number of embodiments of the invention, it is to be understood that a great many variations and combinations of the features shown may be made. Likewise for certain special conditions, changes in the valve shapes and positions, and the use of spring-pressed, or frangible unions for the fluid passageways of the gun and projectile, may be found advantageous. With high pressures and high velocities in the larger units the use of more expensive heat resisting alloys is warranted and longer range may thus be assured through the use of auxiliary means for rotating the projectile stabilizing unit. On the other hand the self-contained, or propulsive charge means for energizing the stabilizing rotor, has its own advantages in the medium size, more portable units, and involves less care in manufacture, transportation and use, than is the case with the projectiles designed for the maximum performance large size units.

It is of course to be understood that both army and navy, and aircraft use of this military unit is in contemplation.

As has been stated, the invention may take various forms, and it is adapted particularly for heavy ordnance. When so used the modifications in the gun structure, additional to the omission of the rifling, are of relatively simple character. As shown in Figure 1 of the drawing a large caliber gun 1 is provided, having a barrel 2 and the conventional supporting tubes and jackets 3, 4, 5. It also has a rearward supporting member 6, and has a breech block 7 and firing mechanism 8 of conventional construction. The barrel in addition has a tubular member 11 engaged over the rearward portion of the gun to provide a passageway 12 from the powder chamber 13 of the gun to the position of the projectile 14 immediately in advance of the powder chamber. The passageway 12, it will be noted, is provided with a control valve 15 whereby the pressure within such passageway may be controlled. The passageway 12 is connected with communicating passageways 16 and 17 extending transversely through the several members of the gun structure into the powder chamber and projectile area, respectively.

An exit passageway 18 is provided opposite the passageway 17 for the discharge of the gases moving through the passageways 16, 12 and 17, as heretofore described. The projectile 14 may take various forms, but one type of the same is illustrated in Figures 3 to 6. The projectile has the conventional timing device 21 and has space within the same for the bursting charge 22. It also has the conventional bourrelet 23 and sealing band 24. The head of the projectile may have the usual ogive 25, or may be modified in accordance with certain special uses, or may carry an auxiliary cap. A suitable base plate 26 is also provided. Each projectile is provided with a stabilizing unit which, as has been indicated, may take various forms. In the construction shown in Figures 3 to 6 a tubular casing 31 is provided having an end wall 32 and a closure plate 33 at the opposite end. The end wall and closure plates are provided with recesses 34, 35, respectively, to receive the stub shafts 36, 37, provided at the ends of the body of the rotor 38. The rotor is provided about the periphery with a plurality of blades 39 parallel to the central axis of the rotor, and spaced from each other a sufficient distance to provide suitable reaction space for the gas jets for energizing such rotor, as will be hereinafter described. At points centrally of the rotor the casing 31 is of reduced size intermediate its ends so as to provide circumferential space 41 for part of the bursting charge. It is formed, however, with a pair of bosses 42, 43. A passageway 44 is formed through the wall of the projectile in alignment with the boss 42 to provide entrance for the energizing fluid jet for the rotor, and an exit passageway 45 is provided extending through the boss 43 and the wall of the projectile. A plurality of reaction offsets 46 may be formed on the inner wall of the casing over the path traveled by the rotor propulsion gases to increase the propulsive effect of such gases. The ends of the casing, as will be noted in Figures 5 and 6, are cut away at spaced intervals to provide recesses 47 and spacing lugs 48. The lugs 48 bear frictionally against the inner wall of the projectile, the forward lugs engaging against an annular projection 49 on the inner wall of the projectile, and the bosses 42 and 43 registering with the passageways through the projectile.

A gun equipped as above described will conserve some of the energy used in the rifle type of ordnance and transform it into propulsive energy. A small portion of the powder gas pressure resulting from the propulsive powder charge will find its way through the passageway 12 to the passageways through the projectile so as to energize the rotor 38 and effect the stabilization of the projectile in such manner. The pressure thus taken from the powder chamber is of negligible amount leaving substantially the entire expansive force of the powder gases to be exerted against the base of the projectile. Since there is no friction to be overcome by rotating the entire projectile and

cutting grooves in the rotating band, as is the case with rifled cannon, the movement of the projectile in the smooth-bore gun illustrated will take place more quickly than in the rifle cannon, and there will be reduced gas pressure within the barrel at the start of the discharge, but with a higher muzzle velocity for the projectile by reason of better sealing and more effective use of the powder gases. The size and speed of the rotor will be proportioned to the weight of the projectile and its proposed trajectory. Likewise the position of the rotor within the projectile will be controlled by the general shape and weight of the projectile, as well as the condition of its intended performance. It will be noted that upon the explosion of the projectile the bursting charge will act upon the casing for the rotor and destroy some of the structural features of the stabilizing device. Should it be deemed of importance a bursting charge may be placed within the rotor, and various fracture lines may be placed across the projectile and the rotor so as to conceal the exact construction of the self-stabilizing projectile.

Under certain conditions it may be difficult to maintain the gas passageway **12** and its associated passageways in full operative condition free of obstruction, and in such case it may be desirable to use independent means for energizing the rotor preliminary to the firing of the gun. One means of accomplishing this method of utilizing the invention is disclosed in Figure 2 wherein the gun and projectile are substantially identical with those heretofore described, excepting as to the auxiliary mechanism supported on the upper side of the center of the jackets **51** of the gun. Such mechanism may take various forms, but the structure illustrated in Figure 2 provides a passageway **52** in the gun barrel, such passageway having an entrance port **53** centrally of a projection **54** against which cartridge chambers **55** of a cartridge wheel **56** are adapted to register in succession. The cartridge wheel is supported on a boss **57** engaged by a pivot pin **58** extending through the hub **59** of the cartridge wheel. The firing mechanism for the cartridge is provided on an arm **61** mounted on the jacket **51** having an extension **62** riding over the closed end of the cartridges as the cartridge wheel moves progressively. The extension **62** is provided with a firing pin **63** normally held retracted by means of a spring **64** and adapted to be forced against the cap of the cartridge by means of the hammer **65** supported on the pivot pin **66** at the upper portion of the arm **61**.

The projectile at first described is provided with a stabilizing rotor adapted to be energized by means of gas pressure received through passageways in the gun barrel. Other types of projectiles may be provided, however, wherein the power to rotate the stabilizing element is carried in the projectile itself, as in Figure 7, or is received through a passageway directly through the projectile structure, as is shown in Figure 8.

The construction shown in Figure 7 illustrates a projectile of the general type heretofore described, the rotor **71** having angularly set vanes **72** adapted to be acted upon by powder gases generated in a chamber **73** in the forward portion of the projectile, said chamber having an igniting device **74** and having a discharge passageway **75** in the path of travel of the vanes and a discharge outlet **76** for the gases. The rotor is enclosed within a casing **77** similar to the casing **31**, heretofore described, but has only the single boss **78** through which the passageway **76** is provided.

Various ways may be provided for igniting or initiating the gas discharge from the chamber **73** under certain conditions instead of a slow burning powder in such chamber, since gas forming means, or compressed gases of various kinds may be enclosed within the chamber and subject to release preliminary to the discharge of the projectile, or at any stage of its travel. Thus the rotor may be energized in the manner shown in Figures 1 to 2, and thereafter its speed maintained by means of a self-contained power supply.

The projectile shown in Figure 8 is substantially similar in outline to the projectiles heretofore described, and has a casing for the rotor somewhat similar to that disclosed in Figure 7; such casing, however, has no lateral passageway, but instead has a plurality of passageways **81** connected with the passageway **82** positioned centrally within an extension bar **83** mounted centrally of the end plate **84** of the rotor casing. The extension bar at the end is seated within a recess **85** in the end plate **86** of the projectile which end plate is provided with an enlarged central aperture **87** to permit the expanding powder gases of the propulsion charge to enter into the passageways **82** and **81** and to impinge upon the vanes **88** of the rotor which is mounted, as heretofore described, within the rotor casing **89**. Passageways **91** are provided in substantial alignment with the discharge ports of the passageways **81** to permit free discharge of the explosion gases at the forward end of the projectile. Valves **92** are provided at the outer ends of the passageway **91** to allow the gases to pass freely outwardly from the projectile during the high pressure period on the base of the projectile and thereafter to close through the action of the air pressure on the forward portion of the projectile. The valves are provided with stems **93** and springs **94** to normally maintain them in closed relation. It will be noted that after the rotor is energized the closing of the valves at the forward end of the projectile will virtually provide a low pressure chamber within which the rotor may continue its free rotation at high speed. The reduced pressure within the casing for the rotor will be present also in the other types of projectiles described inasmuch as there will be a suction or aspirating effect on the lateral ports of the rotor chamber when the projectile is in high velocity flight.

The projectiles heretofore described have been of the type designed for large caliber units wherein a separate powder charge is utilized. However, the invention is applicable to projectiles for guns of lesser caliber using "fixed ammunition." The adaptation of the invention for fixed ammunition units is disclosed in Figures 9 to 11, inclusive.

The projectile shown in Figure 9 is substantially identical with that shown in Figure 8, and like reference characters have been applied to the parts thereof. Such projectile, it will be noted, is seated within a cartridge casing **101** carrying the propulsive charge **102**. The casing is provided with the usual flange and percussive cap of conventional construction.

The units of fixed ammunition disclosed in Figures 10 and 11 are of the type shown in Figures 1 to 6, inclusive, wherein the stabilizing rotor **103** is energized through pressure gases received through a passageway **104** communicating with passageways within the gun similar to those shown in Figures 1 and 2. The pressure gas discharge is through the passageway **105**. The structure shown in Figure 11 includes a plurality

of rotors 106, 107, similar in action to the rotor 103 shown in Figure 10. The rotor casing 108, it will be noted, is provided with a plurality of bosses 109 through which the inlet passageways 111 for the pressure gases and the outlet passageways 112 for such pressure gases, are formed. The use of two rotors within the projectile provides for a certain measure of control through a variation of speed or direction of one or other of the rotors. Thus the rotor may be used to neutralize the stabilizing effect at a certain stage of travel of the projectile, and this may be accomplished by having one rotor operate in the normal manner, heretofore described, and having the second rotor operate only when energized by a mechanism, such as is disclosed in Figure 7, and this mechanism may be timed to operate at any predetermined period of lapsed time during the flight of the projectile. The second rotor may also be used as part of a timing mechanism to release articles carried in a chamber of the projectile, such as incendiary fragments, or other items of aerial warfare as are now in use. The rotors also may be set at different angles.

The advantages of the various embodiments of the invention above described have already been set forth in part. It should be mentioned, however, that there are so many minor or incidental factors that enter into precision performance of various types of guns and cannon that it is more accurate to regard them as integral and necessary parts of the combination rather than to state certain of the features alone bring about the highest performance. These various factors working together thus produce higher velocity and longer range for the projectile having equal propulsive charge and in addition reduce or eliminate vibration and side thrust.

The absence of rifling permits more efficient sealing adjacent the base of the projectile and at the same time reduces or eliminates the destructive erosion. The degree of ratio of rotary stabilizing movement may be proportioned to the degree of translational movement applied to the projectile or its parts. In view of the fact that the stabilizing rotor operates in a partial vacuum or area of reduced pressure the maintenance of a high degree of stabilizing effect may be carried on without increasing the drift or introducing non-uniform air pressure to interfere with the predetermined trajectory of the projectile or bring about loss of equilibrium before the objective is reached. In addition to the matter of improved performance of guns and cannon, particularly those of larger caliber, there are important advantages in the way of quantity production of the units of the various sizes without sacrifices of accuracy of performance. Such production also includes economies of material and labor, greater ease of transportation to the place of use as well as handling in action.

The gun or cannon also, by reason of its structural features mentioned, is less difficult to maintain in continuous service than structures of equivalent size of present types of such units.

Other modes of applying the principle of my invention may be employed instead of those explained, change being made as regards the structure herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. An apparatus of the character described having in combination, a projectile discharging unit, a projectile received in said unit said projectile having a chamber formed therein, a stabilizing member supported for rotation within said chamber upon a longitudinal axis of said projectile, means providing a duct extending transversely through said projectile and chamber, a source of pressure, and means within said projectile discharging device connecting one end of said duct with said source of pressure and means within the said discharge device connecting the other end of said duct to the atmosphere thereby providing a free open passageway extending transversely through said projectile discharge device and said projectile for gases to rotate said stabilizing member.

2. A projectile adapted to be received in a discharge device said discharge device having a bore and having an inlet passageway transverse of the bore and communicating at one end with the bore and at the other end with a source of pressure, and having an outlet passageway communicating at one end with the bore and at the other end with the atmosphere; said projectile having a chamber formed therein, a stabilizing member supported for rotation within said chamber upon a longitudinal axis of said projectile, means providing a duct extending transversely through said projectile and chamber, said projectile so constructed, proportioned and arranged that when received in the bore of said discharge device with one end of said duct in registry with the inlet passageway of said device the other end is in registry with the outlet passageway, whereby gases may be forced from the source of pressure through the passageways and duct to rotate said stabilizing member.

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