W. K. RICHARDSON.

PROJECTILE.

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1,198,056.

Patented Sept. 12, 1916.

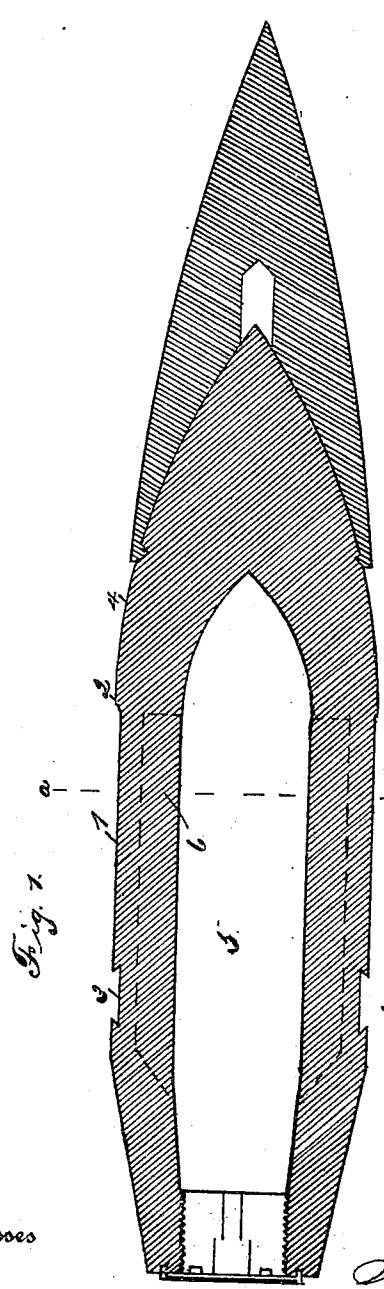


Fig. 1.

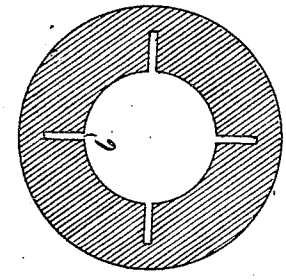


Fig. 2.

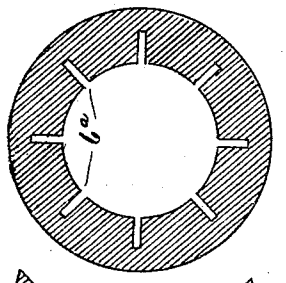


Fig. 4.

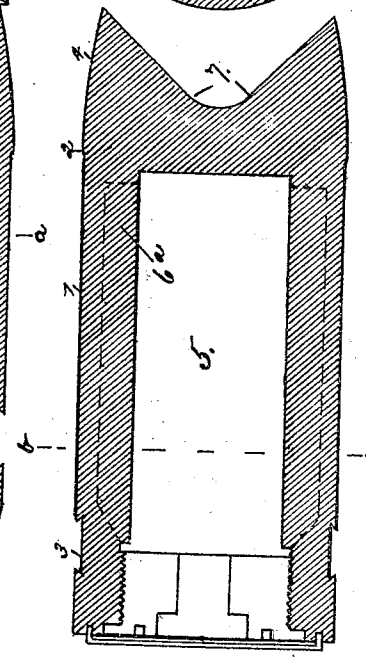


Fig. 3.

Witnesses

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PROJECTILE.

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To all whom it may concern:

Be it known that I, WILLIAM K. RICHARDSON, citizen of the United States, residing at Leavenworth, in the county of Leavenworth and State of Kansas, have invented certain new and useful Improvements in Projectiles, of which the following is a specification.

This invention relates to the wall construction of a projectile in connection with the charge chamber, and has for its object bursting of the projectile into any desired number and size of fragments.

Under the present form of construction it cannot be determined before detonation of the charge, whether a projectile will burst in twain, or into many fragments, a probable average is between 100 and 150 fragments, and they range in mass from ½ the entire projectile to fragments too small to be effective against the vulnerable material of the ship, and the velocity with which these fragments are thrown by detonation of the charge are inversely relatively proportional to the square root of their mass, multiplied by the effective gas surface. Therefore it is evident that at least ⅓ the mass of the projectile will not have sufficient velocity to render it destructive, while many of the fragments will be too small to be effective against the ship other than its personnel. The result of this object of the invention is attained by milling or gouging grooves lengthwise of the charge chamber of the projectile to a depth corresponding to the capacity of the charge chamber, considering the number of grooves employed.

A further object of the invention is to increase the sectional density of the shot without increasing the overall dimensions of the shot. This object is attained by reducing the diameter of the charge chamber, and thickening the wall of the shot. The wall of the shot is thickened by reducing the diameter of the charge chamber, and to insure bursting on detonation of a reduced charge, grooves are cut in the wall longitudinally of the shot to weaken the walls laterally to an internal pressure, and the effective pressure is increased by the additional surface afforded by the walls of the grooves.

A third object of the invention is to facilitate the manufacture of the shot, and especially armor piercing projectiles. The manufacturers of armor piercing projectiles experience considerable trouble producing a shot that will fill the requirements of the U. S. Ordnance Department. The shot must withstand the shock of impact upon the face of the armor plate, and after piercing the plate be in condition for effective bursting. The conditions must approach exactness. If the wall of the shot is too light impact will crush it, if too heavy the charge will not burst it, if of proper thickness of wall though not properly hardened and tempered they are subjected to cracking before use, or rupture on firing, due to internal strains. The difficulty of hardening and tempering the walls of a shot without producing internal strains that cause weakening or rupture of the metal is greater than in the thinner walls of shells and is due to unequal contraction. The sudden cooling of the outer metal after heating causes a greater hardness and a greater contraction per unit of area than the slower cooling metal interior. The grooves cut in the walls of applicant's projectile allows contraction without stress upon the inner face of the wall and to a depth corresponding to the depth of the grooves, for under the compressive stress of contraction of the outer metal the unchilled metal flows to the grooves.

A fourth object of the invention is to obtain the greatest blast effect that may be secured by a unit weight of bursting charge. The blast effect is directly as the velocity of the expanding gases, and in some proportion to their volume. A shot that will burst symmetrically and allow the gases the quickest unobstructed means of expansion will produce the greatest blast effect, and the greatest effective dynamic energy will be secured where the least energy of the detonating charge is absorbed in bursting the shell.

A further object of the invention is to produce a thick walled projectile that may be effective against a submarine boat whether on the surface or submerged. To accomplish this object I use a projectile the front end or point of which is concave. The object of employing this construction is for a dual purpose, 1st. should the boat be awash, its location being known by the presence of its periscope above the surface, the shot by direct or plunging fire hitting the surface of the water immediately above the boat will not ricochet, and will burst

below the surface of the water tending to crush the shell of the submarine which is not of heavy construction. 2nd. if the boat is on the surface, such a shot will have sufficient penetration on striking to pierce the shell, and fragmenting of the projectile disabling or destroying the boat.

With these and other objects in view the invention will be described in connection with the accompanying drawings in which:

Figure 1 is a longitudinal sectional view of a projectile embodying the invention, in which the dotted lines represent the outlines of grooves cut in the wall of the projectile. Fig. 2 is a cross-section on line *a*—*a* of Fig. 1, showing the width of the grooves. Fig. 3 is a longitudinal sectional view showing the shape of the front end or point of a modified form of a thick wall projectile provided with grooves. As this projectile is not designed for use against armor plate, the grooves extend nearer the outer surface of the shot. Fig. 4, is a cross-section on line *b*—*b* of Fig. 3.

Referring to Fig. 1, 1 indicates the cylinder of the shot which extends from the bourrelet 2 to the seat of the rotating band 3. 4 indicates the ogive of the shot proper. 5 indicates the charge chamber, other parts of the projectile will not be referred to and as they are well known no description is deemed necessary. 6, indicates grooves milled or gouged lengthwise of the charge chamber 5, somewhat exceeding in length the cylinder length of the projectile, and to a depth that will admit of the charge bursting the shell. As here shown there are 4 grooves so placed as to cause no eccentricity to the shot, but any desired number may be employed when placed equi-distant. The effective gas surface to produce rupture in a 12″ shot having a 6″ diameter charge chamber equipped with grooves as here shown, each 2″ deep, is greater than in an 8″ diameter charge chamber in a 12″ shot (density of loading in both cases being the same). The unit per effective gas surface per unit of cross-section of metal to be ruptured in blowing off the head, base and sides of the projectile is, as 1.83″ to 1.43″ respectively, and the shattering effect of detonation in applicant's projectile will be localized to the segments formed by the grooves thus controlling fragmenting of the projectile.

Referring to Fig. 3, this figure represents a shot having a somewhat longer cylinder length than would be used in either a long range or armor piercing shot, and in connection with the thick wall is to compensate for the loss of weight due to the point construction, and also to increase the capacity of the charge chamber. In this figure, 7, indicates a concave surface extending inward on the front end of the projectile from a point on the beveled surface of the shot forward of the bourrelet 2. This construction is to prevent the shot from ricocheting on impact with the water, the concave surface tending to bite on the water and to turn the shot downward as it checks its velocity. 6ª, indicates grooves cut lengthwise of the shot on the inner face of the wall. These grooves approach nearer to the outer surface of the wall than the grooves shown in Fig. 1.

By employing the construction herein described for armor piercing projectiles, it is evident the sectional density of the shot is increased without an increase in its superficial measurements, therefore the coefficient of reduction for any range is reduced, giving a flatter trajectory, and for a given range a greater striking energy. It also secures greater accuracy of fire for it eliminates some of the time which the deviating causes, such as gravity and the wind produce. It produces the maximum result on bursting by insuring a uniformity in fragmenting the projectile which cannot be attained by present construction. It admits the use of high explosives for the bursting charge, as explosive gelatin and picric acid.

The shattering effect of picric acid is excessive and under present construction of armor piercing projectiles the average fragment of a projectile when this explosive is employed is too small to be effective against the vulnerable material of the ship, such as the mechanism of the guns, engines, boilers and electric installations, and for this reason picric acid is not employed as a filler in armor piercing projectiles.

Due to applicant's construction this most desirable explosive can be used, for fragmenting of the projectile will be controlled by the grooves. This explosive being almost insensible to shock makes it a desirable filler, and the blast effect, the corrosive and suffocating effect of its gases, insures the greatest maximum destructive effect to both the ship and its personnel.

From the foregoing it is evident that I have produced means for controlling the fragmenting of a shot, without weakening the wall of the shot to resist either torsional or transverse strains the shot is subjected to, for I have thickened the wall of the shot, and to compensate for this added strength to the wall, I employ grooves which weaken the wall of the shot to an internal force. To compensate for a greater cross-sectional area of metal to be ruptured, I propose the employment of a higher explosive than is now generally used as a bursting charge, which is unsuitable under present construction of armor piercing projectiles to be employed. It is also evident that I have not weakened the wall of the shot to the force of impact; it being understood that a shot

of a given caliber will have a given weight, therefore my thick walled shot must have a reduced cylinder length, and due to these two dimensions the shot has less tendency to buckle and rupture under the shock of impact. By employing my means for controlling the fragmenting of a shot, a higher average velocity of the fragments on detonation of the charge is attained. Where a large number of fragments are produced in bursting of the shot, the gases flow to the line of least resistance, imparting a high velocity to the smaller fragments under the pressure and expansion of the gases. This correspondingly reduces the acceleration of the larger fragments, for the gases are dissipated behind the smaller fragments before the gas pressure has imparted momentum to the greater mass.

What I claim as new and desire to secure by Letters Patent is;

1. An armor piercing projectile provided with a solid head, a cylindrical portion of uniform columnar strength throughout the cylinder length of the projectile integral with the solid head and forming an interior charge chamber, grooves extending parallel with the axis of the projectile in the wall of said chamber throughout the cylinder length of the projectile, and a base plug for closing the rear end of said chamber.

2. An armor piercing projectile provided with a head, a cylindrical portion of uniform columnar strength throughout the cylinder length of the projectile integral with the head and forming an interior charge chamber, grooves extending parallel with the axis of the projectile in the wall of said chamber throughout the cylinder length of the projectile, the lands between the grooves being unbroken, and a base plug for closing the rear end of said chamber.

3. A hollow projectile provided with a concave head, a cylindrical portion, a centrally disposed chamber and grooves parallel with the axis of the projectile in the wall of said chamber forming unbroken lands.

4. A hollow projectile provided with a concave head, a cylindrical portion, a longitudinal charge chamber, radial grooves parallel with the axis of the projectile in the wall of said chamber forming unbroken lands of greater width than said grooves.

In testimony whereof I affix my signature.

WILLIAM KING RICHARDSON.