

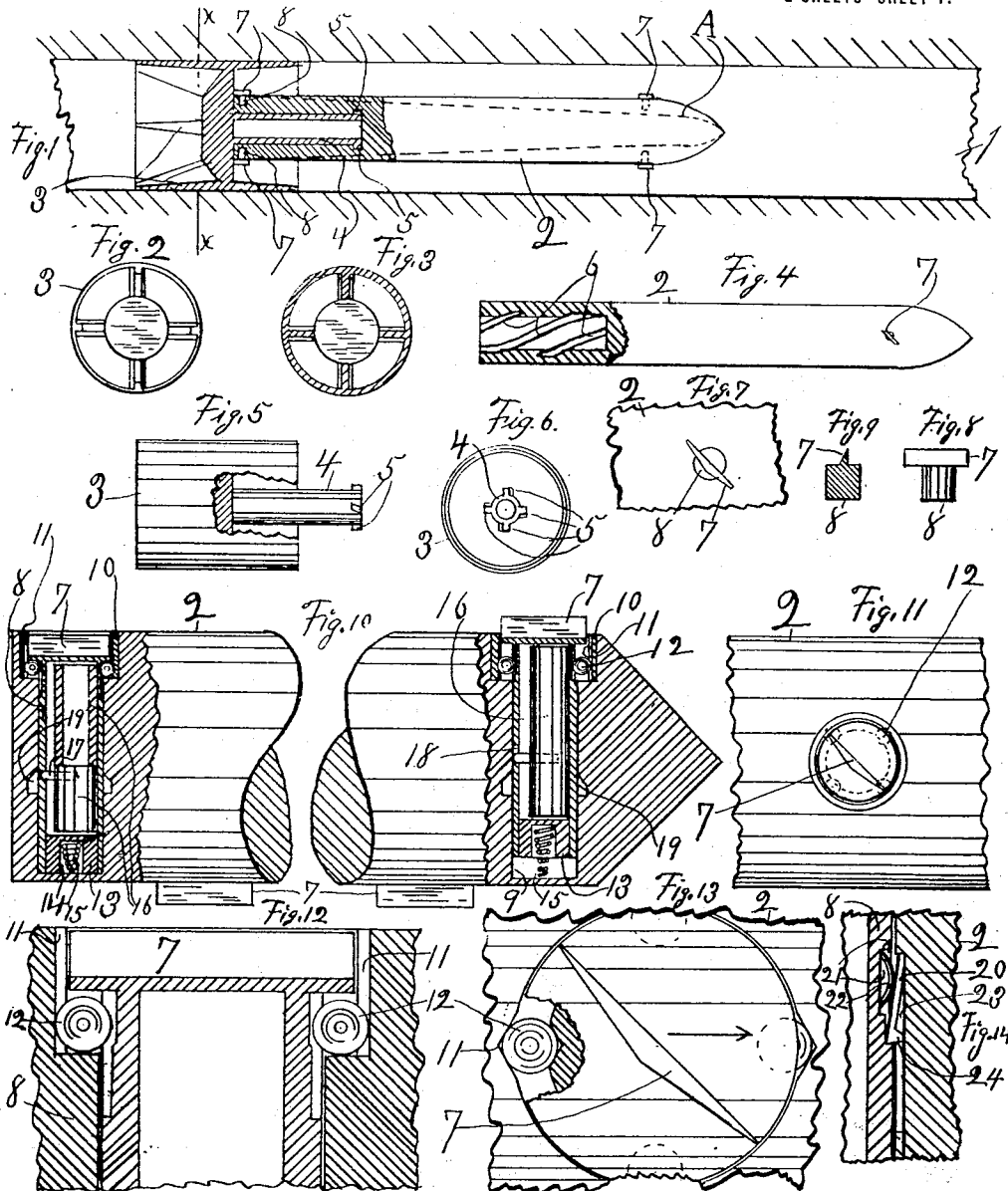
K. DOUGAN.
PROJECTILE.

APPLICATION FILED APR. 27, 1918.

1,327,655.

Patented Jan. 13, 1920.

2 SHEETS—SHEET 1.



Witnesses
Miss M. Sillam
B. Rudolph

Inventor
Kennedy Dougan

92.6

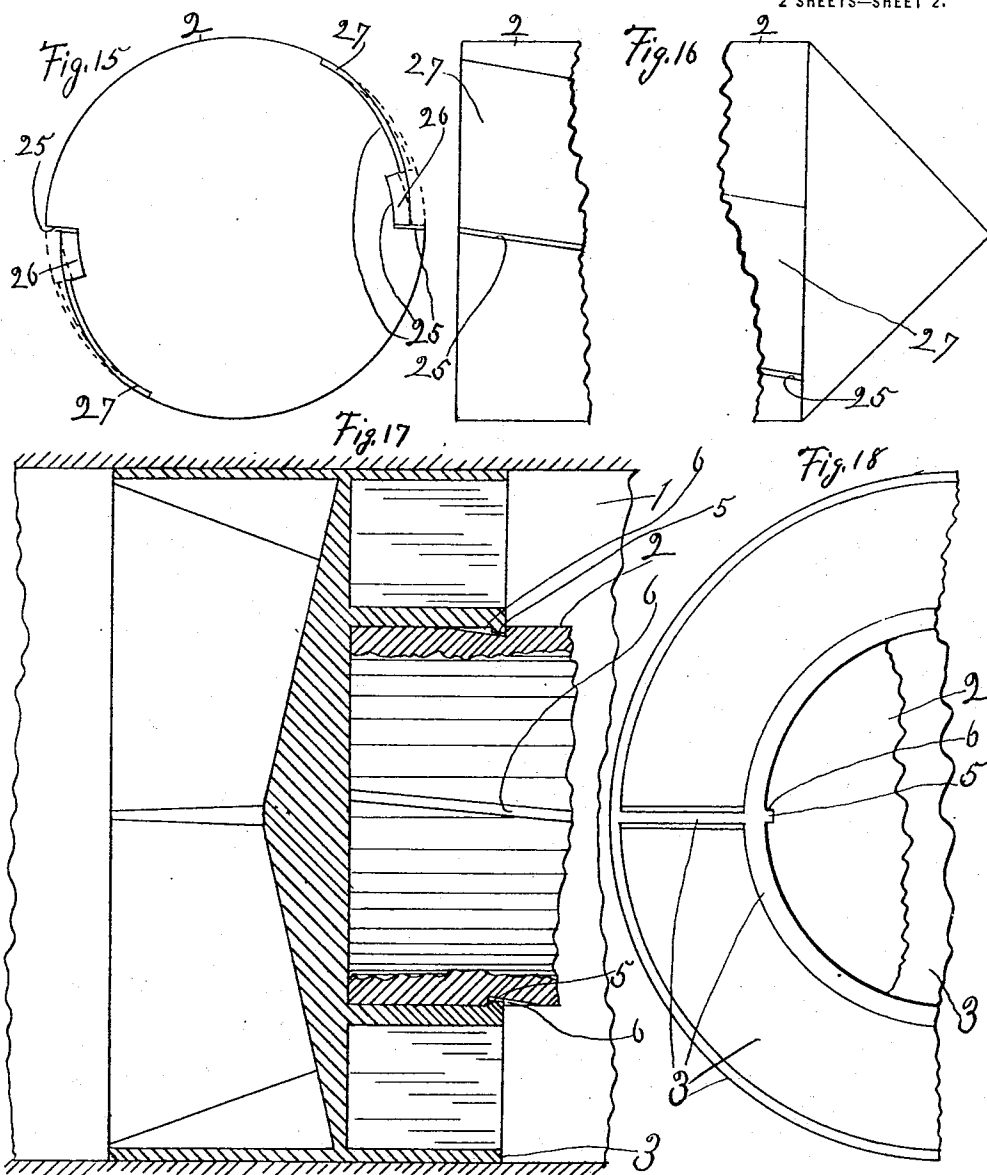
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UNITED STATES PATENT OFFICE.

KENNEDY DOUGAN, OF MINNEAPOLIS, MINNESOTA.

PROJECTILE.

1,327,655.

Specification of Letters Patent.

Patented Jan. 13, 1920.

Application filed April 27, 1918. Serial No. 232,090.

To all whom it may concern:

Be it known that I, KENNEDY DOUGAN, a citizen of the United States, and a resident of Minneapolis, in the county of Hennepin and State of Minnesota, have invented a new and Improved Projectile, of which the following is a full, clear, and exact description.

This invention relates to projectiles and the objects are, first, to provide a projectile that may be fired from a gun having a bore the diameter of which is greater than the diameter of the projectile; second, to provide means for firing a projectile from a gun having a bore of greater diameter than the diameter of the projectile; third, to provide means for imparting rotary motion to said projectile after it leaves the gun; fourth, to provide means for imparting rotary motion to a projectile when fired from a smooth bored gun having a bore of the same diameter as the projectile,—and, fifth, means adapted to keep the rotary motion of a projectile uniform during its flight after it will have attained the required rotary motion.

There are many very serious objections to the conventional means in use at present for imparting rotary motion to projectiles. The high linear velocity, in addition to the great pressure put upon the rifles in giving rotary motion to the projectile, combined with the high temperature of the propelling gases, all tend to rapid deterioration. Then, in order that the projectile shall have sufficient rotational velocity when nearing the end of its flight, to prevent tumbling, it must be given a velocity at the beginning of its flight far beyond that required to prevent tumbling. Then again, where a projectile is fired at a high angle of elevation, say 45 degrees, and to a great distance, the high initial angular velocity required to prevent tumbling when near the end of its journey will prevent its going head first, by gyroscopic action; that is to say,—if the longitudinal axis of the projectile is at an angle of 45 degrees on leaving the gun it will tend to continue at that angle to the end of its flight, owing to gyroscopic action, thus enormously increasing the air resistance and decreasing the travel of the projectile.

Referring to the drawings:

Figure 1 is a central longitudinal section

partly in elevation, of the projectile in combination with a head filling the bore of the gun, a portion of a gun barrel being shown diagrammatically.

Fig. 2 is an elevation of the head shown in Fig. 1, looking from the left.

Fig. 3 is a vertical section of the same head on the line $x-x$ looking toward the left.

Fig. 4 is a plan view of the projectile shown in Fig. 1, partly in section.

Fig. 5 is a side elevation of the head mentioned, with a portion broken away.

Fig. 6 is an end view of Fig. 5 looking toward the left.

Fig. 7 is an enlarged fragmental view showing one of the wings which rotates the projectile by contact with the air.

Figs. 8 and 9 are side elevation and vertical transverse section, respectively, of the wing and supporting portion shown in Fig. 7.

Figs. 10 to 14 inclusive, show a form of the projectile, adapted to be fired from a gun having a bore of the same diameter as the projectile. Fig. 10 is a side elevation of the projectile partly in section. Fig. 11 is a plan view of a portion of Fig. 10. Figs. 12 and 13 are enlarged views of details not clearly shown in Figs. 10 and 11. Fig. 14 is an enlarged view of a retaining device shown in its relation to a portion of the projectile.

Figs. 15 and 16 are end view, and side elevation respectively, of a projectile designed to be thrown from a gun having a bore of the same diameter as the projectile.

Figs. 17 and 18 show a form of the projectile and head, differing slightly from those shown in Fig. 1, and in which the spiral grooves are formed in the outer surface of the projectile and for practically its entire length, projections on the head extending into said grooves.

In the form of the projectile shown in Figs. 1 to 9 inclusive, and 17 and 18, the projectile and head separate almost immediately upon leaving the muzzle of the gun, the relatively greater air pressure on the head in proportion to its weight causing it to slow up more rapidly than the projectile. In separating, the connection between head and projectile, causes them to rotate in opposite directions, the separating force being very great, as traveling with a velocity of

2800 feet per second a flat surface meets with an air resistance of approximately 100 pounds per square inch.

Projectiles in order to travel the distance
5 due to their initial velocity and form, must travel head on, but it appears to be impossible to make a conventional projectile travel in that manner for a great distance, because if given sufficient rotary motion to prevent
10 its tumbling in the early stages of its flight, the gyroscopic action will prevent its going head on in the latter stages, thus presenting a very much increased surface area to the air and of a form not best calculated
15 to minimize air resistance. Another great difficulty in throwing projectiles desirable distances, is the fact that the enormous angular velocity required to prevent tumbling must be given to the projectile in a small
20 fraction of a second, which puts an enormous angular pressure upon the rifles, which in addition to the linear velocity and the accompanying high temperature, together with the heat of explosion rapidly erodes the
25 interior surface of the gun.

My invention is intended to render the rifling of large guns unnecessary, and thereby make it possible to throw projectiles desirable distances by making it possible to
30 give them the required lineal velocity without injury to the bore of the gun.

Figure 1 is a central vertical longitudinal section through the projectile and head with a portion of the gun being shown diagrammatically. 1 is the bore of the gun; 2, the
35 projectile; 3, a head filling the bore of the gun. 4 is a hollow cylinder stud formed integral with said head and provided at its outer end with a plurality of projections 5
40 which register with an equal number of spiral grooves 6 formed in the interior of projectile 2.

Fig. 2 is an end view of head 3 looking toward the right.

45 Fig. 3 is a transverse section of Fig. 2 on the line $x-x$ Fig. 1, looking toward the right.

Fig. 4 is a plan view partly in section of the projectile, 6 being the spiral grooves in
50 which the projections 5 are adapted to reciprocate. 7 are wings rigidly secured to the projectile at any suitable angle. (See the front end of Fig. 4.) Figs. 7, 8 and 9 are plan, elevation and sectional view respectively, of one of the wings 7. The cylindrical portion 8 which is formed integral
55 with the wing portion 7, is driven into a radial hole formed in the exterior portion of projectile 2.

60 The wings 7 need not be placed relatively as shown in Figs. 1 and 4 but may be placed in any desired position relative to each other or to the projectile. If thought advisable to use two instead of a greater number,
65 they may be placed at the middle of the

active surface of the projectile as such surface may be determined by experience. When the gun is fired and head 3 and projectile 2 are driven out of the smooth bore gun, the wings 7 moving against the air will
70 exert a very great rotative force on the projectile, a force of several hundred pounds for each square inch of wing surface; as soon as the air pressure in front of head 3 becomes greater than the gas pressure behind
75 it said head begins to slow up faster than the projectile owing to its relatively greater surface in proportion to its weight, which causes a movement of the head backward
80 relative to the projectile which through the action of the projections 5 in grooves 6 causes the projectile and head to rotate in opposite directions. A head 3 is of course
spent at each shot. While head 3 is much lighter than projectile 2 they will act upon
85 each other with approximately equal force owing to the larger diameter of head 3. The projectile will at all times, from the instant it leaves the muzzle of the gun until its force is spent, be acted on by a steadying force. 90

First: Before either wings 7 or the action between head and projectile can impart sufficient angular motion to the projectile to have any steadying influence, head 3 is holding it head-on, and would hold it head-on to
95 the end of its flight were it secured thereto. In separating from the projectile head 3 imparts ample angular motion thereto to prevent tumbling, and the wings 7 being at the proper angle and of the proper size, keep it
100 rotating at a speed in proportion to its velocity, slowing up as the velocity slows, thus permitting it to go head-on or nearly so, to the end of its flight. For very long range shooting it may be found that a projectile
105 of the form indicated by the dotted line A—Fig. 1, may be serviceable.

Referring to Figs. 10 to 14. inclusive:

These figures show a form of the projectile in which each wing is pushed out by a spiral
110 spring, and pulled back toward the center of the projectile by centrifugal force when the projectile is rotating at the required velocity. There is automatic means provided for keeping the outer edge of each wing
115 slightly below the surface of the projectile while being fired from the gun but which ceases to act when the projectile has practically reached its maximum linear velocity. 2 is the projectile; 7, the wings which are
120 shown formed integral with a cylinder 8 which reciprocates freely in a radial cylinder 9 formed in the projectile. One of the wings is shown in the position it will occupy when being fired and still in the gun, and one
125 near the front end of the projectile is shown out in active position after the projectile has left the gun and before being drawn back toward the center by centrifugal force. 10 is a cylinder rigidly secured in the pro- 130

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jectile and has four radially disposed ball races 11 formed therein in which balls 12 have movement. Formed in the exterior of cylinder 8 near its upper end are similar ball races which register with races 11. Rigidly secured in the lower end of cylinder 8 is a centrifugal weight 13 provided with a radial hole 14 containing a spiral spring 15 as shown, which constantly pushes toward the center of the projectile. Loosely carried in cylinder 8 is cylinder 16 the upper portion of which is hollow as shown. Rigidly secured in cylinder 16 is a pin 17 which extends radially through a hole 18 formed in cylinder 8. Formed in cylinder 9 is an annular space 19 having one side formed at an angle of about 45 degrees from the longitudinal axis of cylinder 8 as shown. It is obvious that if cylinder 16 is pushed toward the left with sufficient force that the end of pin 17 will strike the sloping surface of annular space 19 and cause said pin to move radially or in the direction of spring 15 thus pushing cylinder 8 in the same direction, compressing spring 15 and drawing wing 7 away from contact with the gun. The force for pushing pin 17 toward the left is supplied by the acceleration of the projectile in overcoming the inertia of cylinder 16. When the acceleration of the projectile ceases, spring 15 pushing on cylinder 8 forces pin 17 against the sloping surface forming one side of annular space 19 which pushes said pin 17 and cylinder 16 into the position shown in Fig. 10 to the left and then out into the position shown to the right. The object of the balls 12 is to reduce friction.

In order that balls 12 will not have to take the pressure of cylinder 8 and wing 7 during the acceleration of the projectile, the portion of cylinder 8 in longitudinal alinement with the balls is made slightly smaller than the adjoining portion, which permits said cylinder 8 to press firmly against cylinder 9, and wing 7 to press firmly against the adjoining portion of ring 10 without putting pressure on the balls; when spring 15 moves cylinder 8, the slightly larger portion of said cylinder engages the balls. This construction will be readily understood by reference to Fig. 12 which is drawn on an enlarged scale, and the ring 10 dispensed with, the ball races being formed in the projectile.

When being placed in the gun the wings 7 are pressed toward the center manually. To prevent wings 7 from being thrown out farther than shown in Fig. 10, to the right, there is a stop catch placed in a slot in the exterior of cylinder 8, which is pressed outward by a leaf spring, causing the outer end of said stop catch to engage a shoulder forming the outer end of a radial slot formed in the projectile. 20 is the catch, 21 the slot in cylinder 8; 22 is the leaf spring and 23 the slot in the projectile. There is

formed on the inner end of catch 20 a head 24 for the purpose of keeping it in place. In Figs. 15 and 16, Fig. 15 is an end and Fig. 16 a side elevation of the projectile. 25 are spiral grooves of the form shown formed in the exterior surface of the projectile, and extending nearly its entire length. Rigidly secured in these grooves at the points 27 are shields 26 formed with their free ends somewhat heavier than their stationary ends. When the projectile is moving through the air the action of the air on the radial surface of the spiral grooves 25 causes the projectile to rotate upon its longitudinal axis; when the required angular velocity is reached centrifugal force throws the free ends 26 of the shields outwardly, reducing the exposed radial surface of the spiral grooves thus preventing a further increase in the angular velocity of the projectile. The dotted lines show the shields thrown out shielding the entire radial surface of the spiral grooves. This could of course never occur in actual practice. The ends 27 of the shields are placed slightly below the surface of the projectile so as not to be affected by contact with the bore of the gun. The spiral grooves may be made deeper in one portion than in another or the form of the surface 26 may be varied from the radial.

Referring to Figs. 17 and 18:

1 is the bore of the gun; 2, the projectile, and 3 a head similar to that shown in Figs. 1, 2 and 3, save that the rotating projections extending from the head into the projectile extend into grooves formed in the exterior surface of the projectile. There is also a difference in the means of supporting the projectile which is obvious without explanation.

In separating, the projectile, in pulling away from the head acquires a rotary motion as will be understood from the description heretofore given of Fig. 1. The spiral grooves 6 will require very little angle with the longitudinal axis of the projectile, since a considerable angle would impart an undesirably high angular velocity to the projectile. Any of the projectiles herein described may be equipped with any of the wings herein described, and said wings may be placed at any point on the projectile or relative to each other.

The operation of the various features of my invention and the manner in which they act to produce the results claimed, have been given in connection with the description.

I claim:

1. A projectile so formed as to be rotated on its longitudinal axis by contact with the air in its passage therethrough, and means carried by said projectile for governing its angular velocity during its flight.

2. A projectile so formed as to be rotated

on its longitudinal axis by contact with the air in its passage therethrough, and centrifugal means carried by said projectile for governing its angular velocity during its
5 flight.

3. A projectile adapted to be fired from a gun having a bore greater than the diameter of said projectile, and a detachable head carrying said projectile and filling the bore
10 of said gun, said head and projectile being so connected that in separating angular motion is imparted to said projectile.

4. A projectile adapted to be fired from a gun having a bore greater than the diameter of said projectile, a detachable head carrying
15 said projectile and filling the bore of said gun, said head and projectile being so connected that in separating angular motion is imparted to said projectile, and wings
20 carried by said projectile adapted to impart rotary motion thereto through contact with the air.

April 26th, 1918.

KENNEDY DOUGAN.