(No Model.)

G. H. REYNOLDS & E. L. ZALINSKI.

PROJECTILE.

No. 421,309. Patented Feb. 11, 1890.

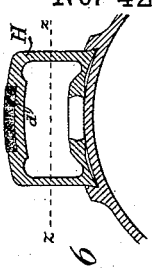

Fig. 6

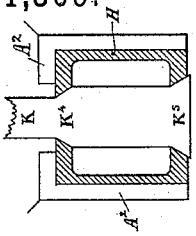

Fig. 7

Fig. 8

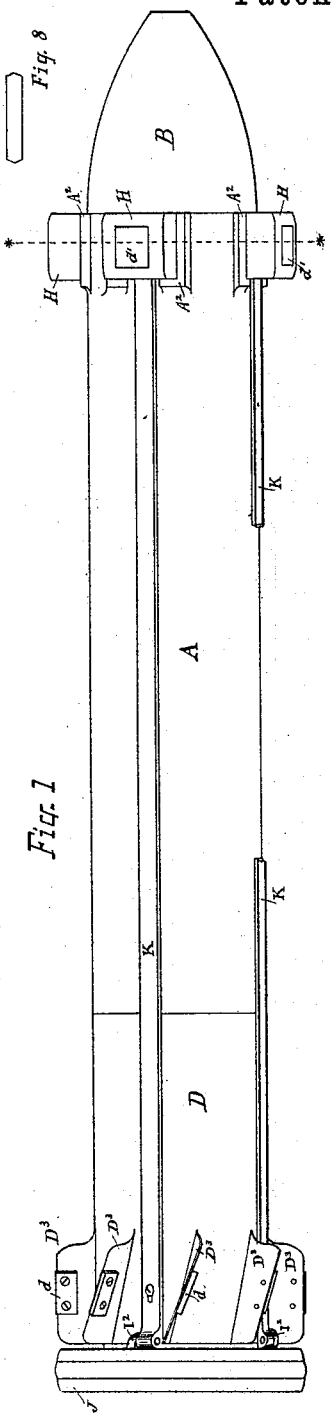

Fig. 1

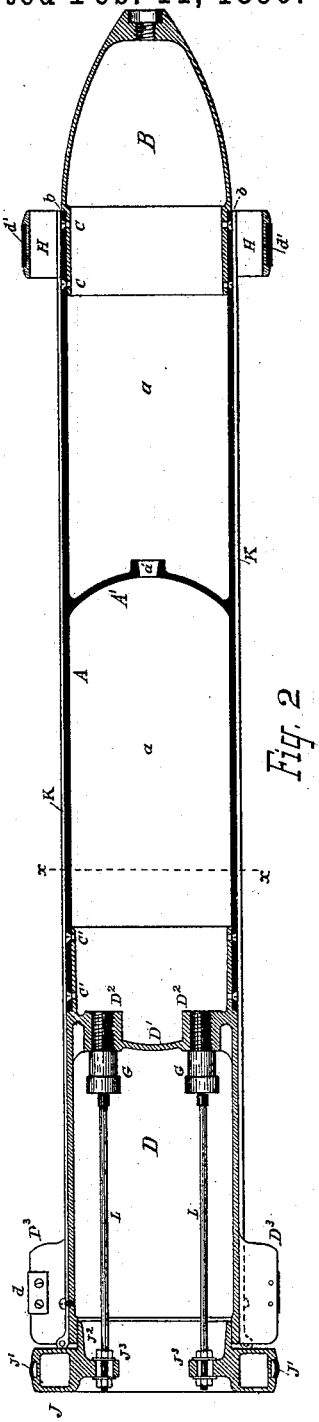

Fig. 2

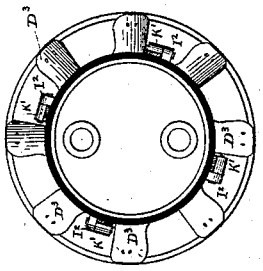

Fig. 3

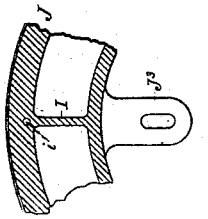

Fig. 5

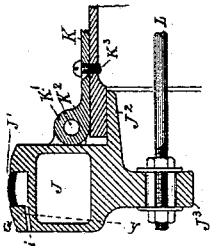

Fig. 4

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UNITED STATES PATENT OFFICE.

GEORGE H. REYNOLDS AND EDMUND L. ZALINSKI, OF NEW YORK, N. Y.

PROJECTILE.

SPECIFICATION forming part of Letters Patent No. 421,309, dated February 11, 1890.

Application filed March 14, 1889. Serial No. 303,356. (No model.)

To all whom it may concern:

Be it known that we, GEORGE H. REYNOLDS and EDMUND L. ZALINSKI, both of the city and county of New York, State of New York, have invented certain new and useful Improvements in Projectiles for Use in Pneumatic Guns, of which the following is a specification.

The invention relates to those kinds of projectiles which are called "sub-caliber projectiles," the bodies of which are so much smaller than the base of the gun that they experience little resistance from their air in the flight, but receive the impulse of a large charge of powder or a large quantity of compressed or other gas under tension, acting on a suitable attachment, filling the whole bore of the gun; and the objects sought are to secure accuracy of flight and the greatest attainable range.

What we consider the best means of carrying out our invention are fully described below, and shown in the accompanying drawings, in which—

Figure 1 represents a side view of the projectile; Fig. 2, a central longitudinal section of the same; and Fig. 3, a cross-section on the line *x x*, looking toward the rear of the projectile. The remaining figures are on a larger scale. Fig. 4 is a longitudinal section of a portion of the rear end of the projectile and its attached gas-check. Fig. 5 is a cross-section through a portion of the gas-check on the line *x y y* in Fig. 4. Fig. 6 is a cross-section of a part of the projectile on the line *y y* near the front end. Fig. 7 is a longitudinal section on the line *z z* in Fig. 6, and Fig. 8 is an end view of the releasing-rod.

Similar letters of reference indicate like parts in all the figures where they occur.

A is a main cylindrical portion of the shell of the projectile, which for distinctness is sectioned in solid black. It is cast or otherwise formed with a partition A′, extending across its interior at about the middle of its length, slightly domed to increase its ability to resist the "set-back" of the contents before it when the gun is discharged. The material of the shell may be brass or any material possessing the requisite strength to securely hold the material and to withstand the shock of discharge from the gun.

B is the head of the projectile, of the usual ogival shape. It is formed with a shoulder *b*, turned to accurately fit the inner circumference of the hollow cylindrical part A, the outside surface of the head at the joint with the shell being flush with the same, the two being fastened together by screws C C. The extreme point is thickened to allow of a screw-threaded hole for the reception of a detonator or other suitable fuse. (Not shown.)

The rear end of the shell A fits upon a contracted portion of a cylindrical casting D, the outer surface of which is flush with the outside of the shell A, and forms therewith a practically continuous cylinder. A rigid metallic partition or diaphragm D′ extends across the interior, having two bosses D^2 D^2, each of which is tapped for the reception of an electric fuse G. The casting D is secured to the shell A by screws C′ C′. The interior of the shell from the head B to the diaphragm D′ forms an inclosure for the dynamite or other explosive with which the projectile is charged, being divided into two chambers *a a* by the partition A′, there being communication between the chambers by the hole *a′*. This partition A′ serves to at once strengthen the shell and also to divide the set-back that the charge undergoes at the instant of firing.

Around the rear end of the cylindrical casting D and forming a part of it are formed helicoidal wings D^3 analogous to those of a screw-propeller or turbine water-wheel. The action of the air on these wings imparts a rotating motion to the projectile around its axis as it flies through the air. These wings nearly, but not quite, fit the bore of the gun; but the projectile is made to exactly fit the bore by pieces of indurated fiber or analogous material *d*, one of which is screwed to the side of each wing D^3, as shown. These bearing-pieces project beyond the diameter of the projectile at the wings to the extent required to exactly fit the bore of the gun (not shown) from which the projectile is to be fired. When thus held, the axis of the projectile at its rear end coincides with the axis of the barrel of the gun.

The forward end of the projectile is centered in the bore by blocks H, of hard brass or other elastic metal, cast in the form of cases as thin as is consistent with the strength required. As shown, four of these centering-blocks H are employed and the projectile is equipped for that number; but this may be

varied. These blocks H are of such height that when attached to the projectile they nearly fit the bore of the gun, the small space left like that existing at the wings being filled by pieces of indurated fiber d', which are let into recesses in the outer face of each block, being fastened therein by cement or screws or otherwise, as may be convenient. To receive these blocks there is formed on the outside of the shell a recess for each block, open toward the front of the projectile. These recesses lie between sufficient ridges A^2, cast or otherwise fixed on the exterior of the front part of A, and are slightly dovetailed. The blocks H are dovetailed to match, as shown in Fig. 6. The back of each recess is fitted with stop A^3, against which the centering-block H abuts when it is pushed home.

The rear end of the projectile is provided with a strong and tight-fitting annular sabot or gas-check. It consists, primarily, of a hollow ring of metal J, of a diameter nearly equal to the bore of the gun, the difference being made up by a packing-ring J', of leather or other suitable material, which fits into a corresponding recess J^4 in the periphery of the gas-check. When the gun is fired, the compressed air or other impelling-gas finds access to the space under this packing by small holes *i*, (see Figs. 4 and 5,) and distends the packing J' against the bore of the gun and tightly packs the joint against any leakage past the gas-check. The front and rear sides of the gas-check are connected at frequent intervals by ribs I, Fig. 5, which strongly brace the rear face to enable it to resist collapse from the pressure of the air behind it. Upon the front of the gas-check is formed a circular flange J^2, Figs. 1 and 4, which fits into the shell D, which is thickened at this point and turned to easily fit it.

Before firing the position of the gas-check relative to the shell of the projectile is such that a small space, Figs. 1, 2, and 4, exists between the end of the shell and the face of the gas-check, and it is held in this position by four steel bars K, which have hinged ends K', attached by pins K^2 to lugs I^2, which are formed at corresponding points on the front face of the gas-check. These bars extend through the spaces between the wings D^3, as shown in Figs. 1 and 3. To fasten the gas-check in the position shown, each bar K is fastened to the shell A by a screw K^3, Figs. 1, 2, and 4. The bars K K extend along the shell of the projectile to the centering-blocks H, one being broken away in Fig. 1 to allow the line of the shell to be shown. The forward ends of the bars K are widened by inclines arranged as shown in Fig. 7, and are engaged with the centering-blocks H in the manner shown in Figs. 6 and 7, one pair of inclines K^4 fitting into a similar tapering slot in the rear part of each block H and another pair of inclines K^5 engaging in the larger tapering slot in the forward part of H. The edges of the inclines K^4 and K^5, and also the corresponding slots in H, are each made with a double bevel, (see Fig. 8,) so that the bars cannot be lifted out of the flanges of the centering-blocks, and the latter are thus fastened to the gas-check J, and are secured to the body of the projectile, as before explained, by their sides fitting within the dovetailed inner sides of the ridges. On opposite sides of the center of the gas-check are lugs J^3, Figs. 2, 4, and 5, in the slotted holes of which are adjusted circuit-breakers L, the ends of which very nearly, but not quite, touch the caps of the electric fuses G G.

The projectile as thus described is put into the gun-barrel, and without further preparation is ready to be fired from the gun; but to obtain the best results in steadiness of flight and extent of range it is necessary that the projectile should be early released from the incumbrance of the gas-check J, the centering-blocks H, and connecting-bars K, all of which serve their purpose while the projectile is passing through the barrel, but which are serious hinderances during its flight through the air. The centering blocks H are of elastic metal, and when cast their sides are slightly inclined inward from the rounded top to the base, where they fit the recess, the amount of inclination being such that the block when placed by itself in position does not engage with the dovetail sides of the ridges A^2, but is free to move out radially. It is not until the bar K, with its tapering dovetailed end K^4 K^5, (see Fig. 7,) is forced into its place in the block H and thereby wedges the sides of the latter apart that the block is secured to the projectile as it is shown to be in Fig. 6. The bars being then fastened by their hinged ends K' to the lugs I^2 on the gas-check, and the screws K^3 being inserted through the bars into the body of the projectile, the whole arrangement is secure until the gun is fired.

When the high pressure of the air or gas used to impel the projectile is brought to bear upon it, the large portion of the force acting on the relatively light gas-check drives it forward relatively to the heavier projectile, which opposes by its inertia a much greater resistance to motion, and the gas-check moves forward until its front face bears fairly against the back edge of the rear part D of the projectile. In moving this small space and pushing the bars K forward with it the bars cut off the small screws K^3. The more easily to accomplish this the rear of the hole in each bar K through which the screw passes is beveled, (see Fig. 4,) forming a knife-edge which shears off the screw. The latter are preferably made of brass. As the bars K go forward relatively to the projectile, they partially move out of the double bevel-slots in the centering-blocks H, and the spring of the metal of which the centering-blocks are made causes them to contract to their original width, thus relaxing their hold on the inner faces of the ridges A^2. They are now practically disengaged from the projectile, though

they are held to it by the barrel of the gun while the projectile is passing along it; but the instant the projectile leaves the muzzle of the gun the air catches them and lifts them from the recesses, the bars K K turn on their hinges on the gas-check, which is itself caught by the air and left behind by the projectile, which, being now free from the incumbrance of its attachments, flies on its way under the strong impulse it has received, being kept point forward by the fact that the contents are in the forward part of the projectile, and the rear portion D is an empty shell, and being further steadied by being rapidly rotated on its axis by the action of the air on the helicoidal wings D^3.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. We can use a greater or less number of the helicoidal wings D^3. We can use a single electric fuse and a single circuit-breaker L, or we can dispense with these adjuncts and rely upon other means of firing alone.

We claim as our invention—

1. A projectile of a caliber smaller than that of the gun from which it is to be fired, in combination with a sabot of larger diameter attached to the rear, and of separate guiding-blocks attached near the front end and connected with the sabot, and provisions for detaching the projectile from both the sabot and blocks in the act of firing, substantially as herein specified.

2. A projectile of less diameter than the bore of the gun from which it is to be fired, and a set of guiding-blocks of metal at the forward end of the projectile, and provided with external bearing-faces of leather or analogous yielding material, a sabot, and a set of rods connected with the sabot and blocks, and moved relatively to the projectile in the act of firing, arranged to liberate the guiding-blocks and sabot by such movement, substantially as herein specified.

3. A sub-caliber projectile, a sabot of full caliber, a set of guiding-blocks at the forward end of the projectile, and a set of longitudinal bars connecting the sabot and blocks, arranged to be moved relatively to the projectile by the act of firing, combined as specified.

4. In a sub-caliber projectile, a set of rods or bars K, extending longitudinally, in combination with fastenings K^3, holding them to the projectiles, arranged to be sheared off by the act of firing, and with a sabot and with a set of guiding-blocks H at the forward end, attached to the projectile and to said bars and sabot, substantially as herein specified.

5. In a sub-caliber projectile, the body A, having dovetail longitudinal ridges A^2, cast thereon or otherwise fixed firmly on the exterior near the front, and stops A^3 at the rear of the dovetail recesses thus formed, in combination with the guides H and with the rods K, having inclines K^4 K^5, and connected at one end with the guides H and at the other end with the sabot, all as and for the purposes herein specified.

6. A sub-caliber projectile, in combination with a sabot of full caliber, guides H at the forward end of the projectile for guiding that end in its traverse through the bore of the gun, and with a set of wings permanently attached to the projectile near the rear end, and mechanism for detaching the sabot and the guiding means in the act of firing, all substantially as herein specified.

7. In a sub-caliber projectile, a set of wings D^3, permanently attached to the projectile near the rear end, the wings being helicoidal and of less diameter than the bore of the gun in which the projectile is to be fired, in combination with pieces of indurated fiber or analogous relatively soft material *d*, fixed on one face of each wing, and having one edge projecting outward to exactly match the bore of the gun, all substantially as herein specified.

8. In a projectile, the cylindrical body A, having an internal partition A′, cast integral with the main cylindrical body A, domed, as shown, to resist the set-back of the contents, and provided with a hole *a*′, adapted to strengthen the shell and hold the contents in place while allowing the fire to be freely communicated, all substantially as herein specified.

9. The combination, with a projectile adapted to carry explosive material, of a sabot arranged to move relatively thereto in the act of firing, and one or more rods L, extending forward from such sabot into the interior of the shell, and corresponding fuses G, located at the rear of the explosive-chamber, and with which the said rods are conected, adapted to ignite by such movement, all substantially as herein specified.

10. The packing J′, of vulcanized fiber or analogous soft material, in combination with the sabot having a circular groove or recess and holes *i*, and with a sub-caliber projectile connected with the sabot, and arranged for joint operation substantially as herein specified.

11. In a sub-caliber projectile, the body A, rear extension D, having the rigid partition D′, formed in one therewith, the part D, extending rearward as a hollow cylinder, and the sabot J, having the circular flange J^2, and a connection, substantially as described, between the sabot and said partition, all combined and arranged to serve as herein specified.

In testimony whereof we have hereunto set our hands, at New York city, New York, this 11th day of March, 1889, in the presence of two subscribing witnesses.

GEO. H. REYNOLDS.
EDMUND L. ZALINSKI.

Witnesses:
CHARLES R. SEARLE,
CHAS. F. BARTER.