(No Model.)

H. J. W. DAM.

HIGH EXPLOSIVE PROJECTILE.

No. 576,038. Patented Jan. 26, 1897.

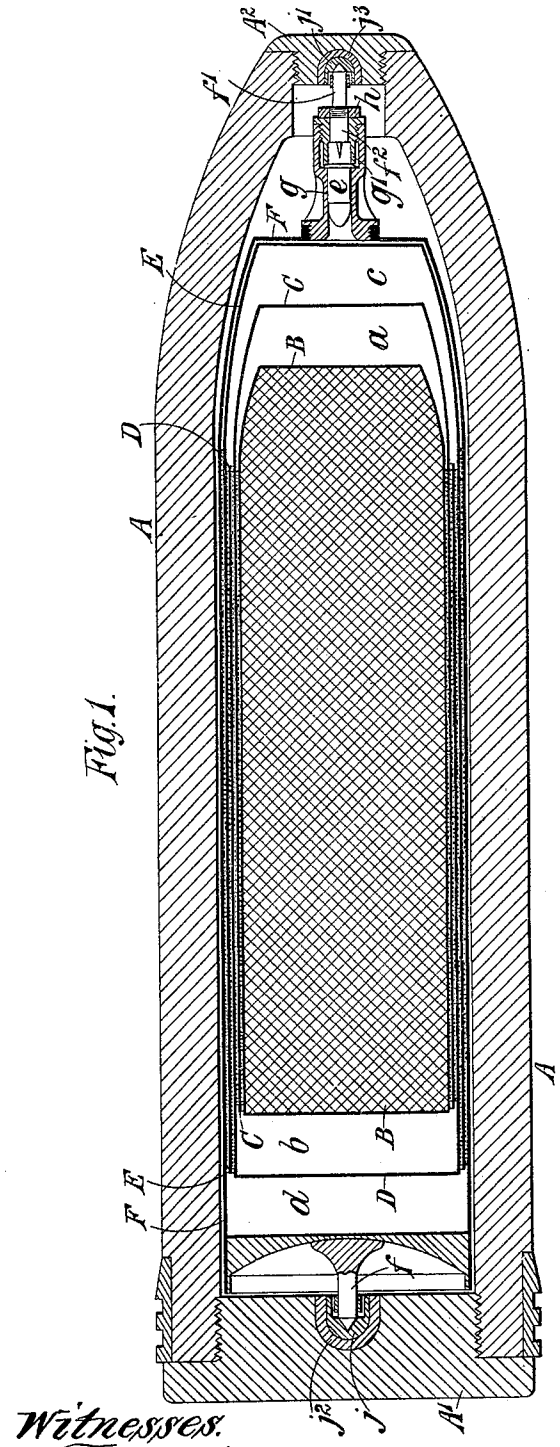

Fig. 1.

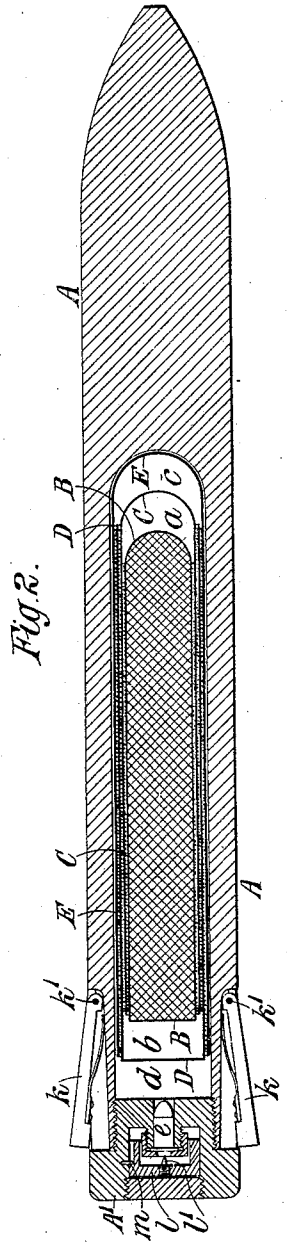

Fig. 2.

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UNITED STATES PATENT OFFICE.

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HIGH-EXPLOSIVE PROJECTILE.

SPECIFICATION forming part of Letters Patent No. 576,038, dated January 26, 1897.

Application filed February 1, 1896. Serial No. 577,718. (No model.)

To all whom it may concern:

Be it known that I, HENRY JACKSON WELLS DAM, author, a citizen of the United States of America, residing at London, England, have invented certain new and useful Improvements in Explosive Projectiles or Shells, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal central section of a common forged-steel shell having my improvements applied thereto. Fig. 2 is a longitudinal central section showing a shell constructed according to my invention for use with a smooth-bore gun.

The object of my invention is to provide for the safe and successful firing from service-rifled and smooth-bore guns with service charges of powder of high explosives, such as blasting-gelatin in armor-piercing and other shells; also, to provide a means for the safe storage, transport, and handling of high-explosive charges for such shells.

It is well known that the great objection to the use of high explosives in shells is their liability to prematurely explode. The causes of premature explosion when such shells are shot from service-ordnance with service charges are as follows: First, the shock or concussion due to the forward impulse imparted to the shell when the powder charge is fired; second, the sudden rotation of the projectile when it enters the rifling of the gun and its rotation during flight; third, lateral vibration of the shell in the gun, and, fourth, in the case of armor-piercing shell, the shock or concussion due to impact, whereby the shell is exploded before it can pierce the armor. Various improvements have been devised to obviate the liability to premature explosion from these causes, but, as far as I know, without any very satisfactory results.

Now according to my invention I accomplish the desired object in a very simple and effectual manner, as hereinafter described.

I obviate the first and fourth of these causes of accidental explosion—viz., shock and impact—as follows: I inclose the explosive charge in a cylindrical case with very thin walls, which is the innermost of a series of thin concentric sliding cases. These cases slide upon one another in alternately-opposite directions, or, in other words, telescope together. This telescoping is caused by the successive compressions of air in air-tight spaces left at both ends of each case. The shock of firing is thus received on four air-cushions and largely absorbed in friction and compression before it reaches the explosive charge, which in addition has air-cushions at either end; and, as will be seen from the drawings, Fig. 1, the explosive charge, when fired from the gun, is so far removed from shock that it remains practically *in statu quo* with relation to the shell itself, the series of cases inclosing it alone moving backward and forward around it in succession and receiving and absorbing so much of the concussion that the remainder ceases to be an element of danger. Similarly upon impact against armor the series of cushions will act in the same way in the opposite direction.

The second cause of premature explosion—viz., rotation—I obviate by preventing the rotation of the explosive charge. This is done by inclosing the series of telescoping cases in an outer air-tight case which is supported in the shell by central pivots at its ends, so that the said outer case is out of contact with the shell, except at the pivots. The shell, when rotated, will thus very slowly and imperfectly, if at all, impart rotation to the charge-case. When it is necessary to prevent even such imperfect rotation of the charge-case, I make spiral grooves on the interior of the shell-walls, so that when the shell is rotated the air therein next the shell-wall will be caused to move forward, and I form spiral grooves in the outer surface of the outermost sliding case, extending in such a direction that the forward current of air thus produced, acting on the sides of such grooves, will counteract any tendency of the outermost sliding case to rotate with the shell, or will tend to slowly rotate the said case in the opposite direction to the shell.

The third cause, lateral vibration of the shell when being driven out of the gun, I obviate by placing a cushion of air or rubber between the bearings on which the pivots turn, and the shell itself, which cushions, will diminish the jarring from lateral vibration to a point where it becomes negligible and will also reduce the rigidity with which the case is held in position and thus diminish the ro-

tatory friction on the pivots. I also place a ring of soft rubber on the pivots to neutralize any possible vibration which may be imparted by contact of the said pivots with the sides of the bearings. The said cases are made to fit closely one within another, and between the said cases I insert a suitable packing or lubricating material, such as grease or black-lead, or I provide other suitable means, such as greased packing, whereby an approximately air-tight joint will be formed between each case and the case which it incloses. The friction produced by the cases sliding on one another is the lowest amount consistent with keeping the joints reasonably air-tight. In this manner I insure that the inertia of the charge shall be very gradually overcome, both when the projectile or shell is discharged from the gun and upon impact, since the movements of the inclosed cases in either direction cause a compression of the series of air-cushions and a rarefaction of the air in one end of either the outermost or innermost case.

Referring to Fig. 1 of the drawings, A is the shell, which is provided with a removable base A′ and with a removable cap or plug A^2 at its apex. B is a case, of metal or other suitable material, which is filled with blasting-gelatin or other high explosive suitable for the purpose of my invention, preferably in such a manner as to insure the exclusion of air from the said case. This charge-case is closed at both ends and is inclosed in a series of protective-cases C, D, E, and F, which, with the exception of the outermost one, F, are closed at one end and open at the other and are arranged with their open ends alternately at either end of the shell. The outermost protective-case F is closed at both ends and is supported within the shell A by pivots $f f'$ at its ends, so that it and the shell can rotate freely relatively to each other.

The charge-case B is fitted in the case C so that it can slide longitudinally therein, and the cases D and E are similarly fitted in the cases E and F, respectively, suitable packing being provided to prevent or control the passage of air between the said cases from one end to the other. An air-space *a* is left between the forward end of the case B and the forward end of the case C, and an air-space *b* between the rear ends of the cases B and C and the rear end of the case D. In a similar manner an air-space *c* is left between the forward ends of the cases C and D and the forward end of the case E, and an air-space *d* between the rear ends of the cases D and E and the rear end of the case F. One end of the case F is screwed in or otherwise made removable, so that the inner cases can be introduced. It will be seen that by this arrangement a series of successive air-cushions is provided, so that when the shell is driven forward by the powder-charge relatively to the case E the air in the spaces *b* and *d* will be compressed and a partial vacuum will be formed between the forward end of the case E and the forward end of the case F and also between the innermost case B and the forward end of the case C. The compression of the air in *d* will cause the case D and its contents to rebound or move forward in the case E and thus compress the air in the space *c*, which compression will in turn cause the case C and its contents to move backward in the case D. The air in *b* will be further compressed by such backward movement and will cause the charge-case B to rebound or move forward in the case C and thus compress the air in *a*. A very efficient cushioning of the explosive charge is thus insured, obviating all liability to explosion of the said charge by the shock or concussion due to the sudden forward movement of the shell and the inertia of the inclosed charge and its protective tubes or cases.

I can use any suitable fuse, primer, or detonator for effecting the explosion of the bursting charge at the proper time.

In the drawings I have shown a revolver-cartridge *e* inserted in a tube *g*, attached to the case F, with its bullet end toward the bursting charge in the case B, and held securely in place by means of an inner tube *g′*, the pivot *f′* being prolonged, as at f^2, to form a firing-pin or striker, and being retained in position by means of a nut *h*, of lead or other suitable material. Upon impact the case F and its contents, being driven forward relatively to the shell by their momentum, strip the thread from the nut *h* and cause the priming of the cartridge *e* to strike the firing-pin f^2, so that the bullet of the said cartridge is shot into the bursting charge of the shell and causes the explosion thereof.

To diminish the jarring due to vibration of the shell, I mount the pivot-pins $f f'$ in bearings $j j'$, which are supported by soft-rubber cushions j^2 j^3, and I also place a ring of soft rubber around each of the said pivot-pins, so as to form a cushion between it and the sides of the metal bearing, should they touch.

To more effectually prevent rotation of the case F and its contents with the shell, I sometimes form spiral ribs, grooves, or corrugations on the interior of the wall of the shell and on the exterior periphery of the case F in such a manner that the rotation of the shell about its axis in one direction will, through the action of the air between the said case and the shell, tend to prevent rotation of the case F or to cause it to rotate slowly in the reverse direction.

To keep the sliding cases in their proper position relatively to the inclosing case F until the shell is fired from the gun, I affix to the inner wall of the case F, by means of glue or shellac or the like, supports of rubber, which will hold the cases D and E in position, but will break off, leaving a smooth surface, when the case F is driven forward with the shell-body relatively to the inclosed cases upon firing. The inner cases will be held in

their proper relative position, through friction and the elasticity of the air, until the air-cushions are compressed, as above described.

My improvements are applicable in a substantially similar manner to torpedoes carrying a very sensitive explosive.

In applying my improvements to armor-piercing shells I provide the shell with a suitable time and percussion fuse, so that the said fuse will be set in action upon impact, but will not operate to cause the bursting of the shell until a predetermined period has elapsed, thus allowing time for the shell to penetrate or pass through the armor before it is burst. I can, if desired, adapt for this purpose a fuse such as that shown in the drawings by making a part of its charge from slow-burning instead of from quick-burning powder.

In making an explosive projectile or shell in accordance with my invention for use with a smooth-bore gun I make the same very long in proportion to its diameter, as shown, for example, in Fig. 2. In this case, as there is no rotation of the shell, I dispense with the outer pivoted case and arrange the outer longitudinally-sliding case E within a suitable cavity in the shell A. Moreover, I provide the shell, near the base thereof, with four or any other suitable number of spring blades or vanes k, which are pivoted at k' in slots in the shell-body, so that they can be pressed inward when loading the gun and will be pressed outward again by their springs when the shell leaves the gun. These blades or vanes insure steadiness and accuracy of flight. In the shell shown the exploding device consists of a small-arm cartridge e, held in a cavity in the base A′ of the shell and arranged to be fired, upon impact, by a plunger l, having a firing-pin or striker l', and held back under ordinary circumstances by a pin m, which upon impact is broken off by reason of the momentum of the plunger l.

I am aware that it is not new to construct a shell with a separate longitudinally-sliding case or receptacle for the bursting charge so arranged in the said shell that there is, between the rear end of the said case and the base of the shell, a cushion of air which will absorb some of the force of the shock or concussion produced when the shell is driven forward in a gun, thereby diminishing the force of the shock imparted to the charge-case, and I therefore make no claim to such form of construction.

I am also aware that it has been proposed to make a shell with a longitudinally-sliding case having within it a receptacle for the bursting charge which is free to turn about its longitudinal axis, and I make no claim to a shell so constructed.

What I claim is—

1. The combination, with a shell, of a case supported therein by pivots at its ends, its wall or periphery being out of contact therewith, longitudinally-sliding protective tubes or cases open at one end and closed at the other end, arranged one within another, and a longitudinally-sliding charge-case inclosed in the innermost protective case, all being so arranged as to leave air-cushions between the ends of the several cases, for the purposes above specified.

2. An explosive projectile or shell or torpedo, comprising longitudinally-sliding protective tubes or cases open at one end and closed at the other end, arranged one within another, and a longitudinally-sliding charge-case inclosed in the innermost protective case, all being so arranged as to leave air-cushions between the ends of the several cases, substantially as hereinbefore described and for the purposes specified.

3. A burster-case for an explosive projectile or shell or torpedo, provided with central end pivots, longitudinally-sliding protective tubes or cases arranged one within another and inclosed in said burster-case, and a longitudinally-sliding charge-case inclosed in the innermost protective case, air-cushions being provided at the ends between said cases, substantially as hereinbefore described and for the purposes specified.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

HENRY JACKSON WELLS DAM.

Witnesses:
JOHN THOS. KNOWLES,
ALEXANDER W. ALLEN.