F. I. DU PONT.

EXPLOSIVE PROJECTILE.

APPLICATION FILED SEPT. 15, 1910.

995,635.

Patented June 20, 1911.

FIG. 3.

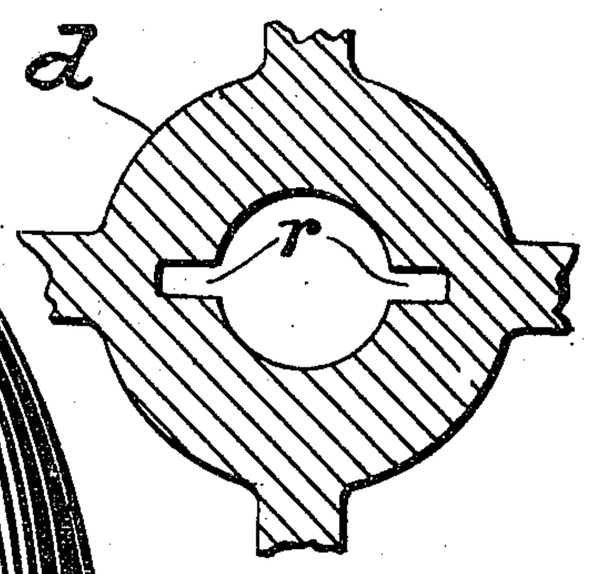

FIG. 2.

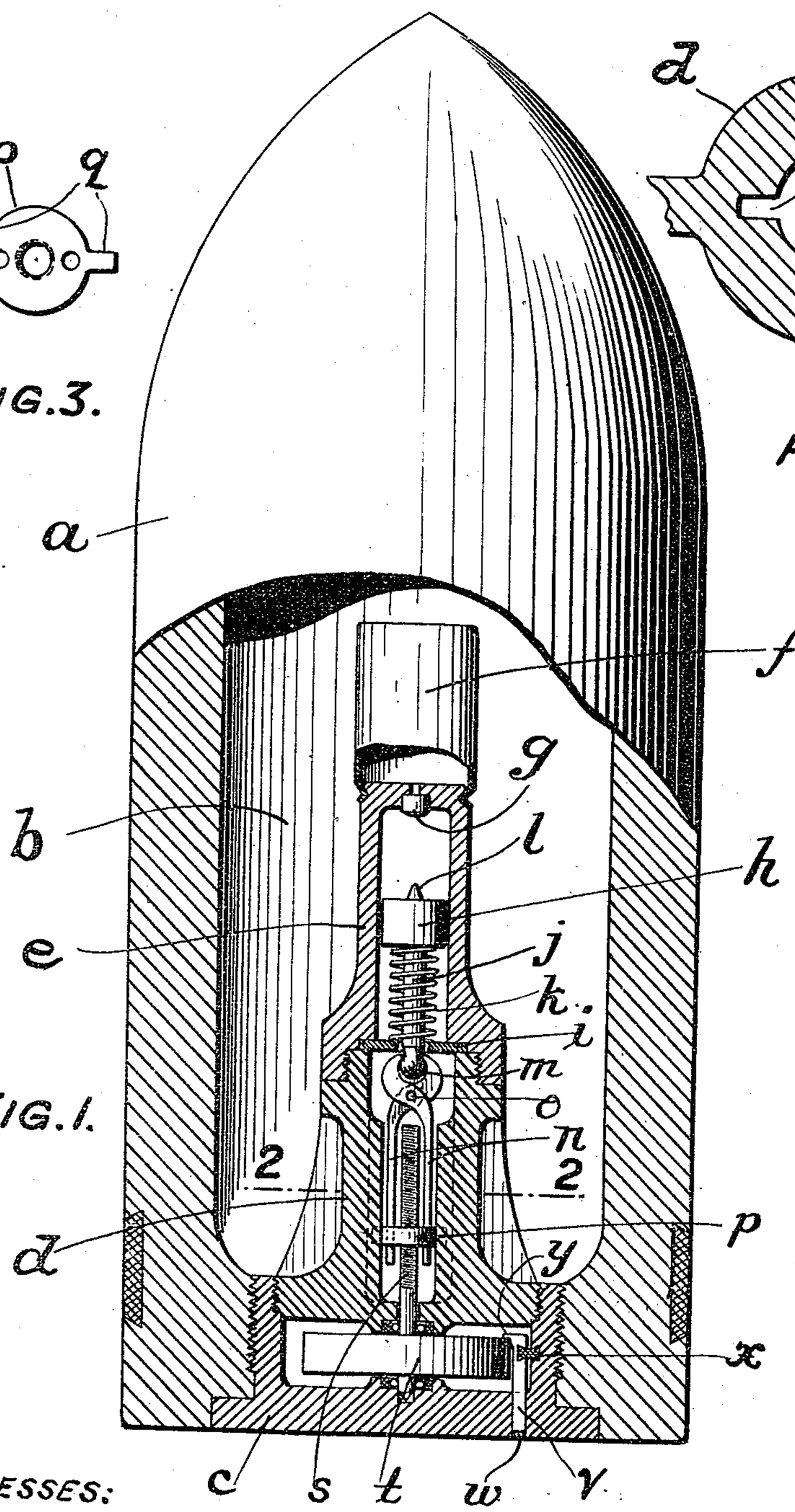

FIG. 1.

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EXPLOSIVE PROJECTILE.

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To all whom it may concern:

Be it known that I, FRANCIS I. DU PONT, a citizen of the United States, residing at Wilmington, county of Newcastle, and State of Delaware, have invented a new and useful Improvement in Explosive Projectiles, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

The object of the invention is to provide means for exploding a projectile, for instance a shrapnel shell, a given time after the same has left a gun, with greater accuracy than has heretofore been done.

The invention consists in means, controlling the firing of the detonator, whose operativeness depends upon the rotation imparted to the shell when it passes from a cannon, which means is adapted to be rendered operative after a given number of rotations of the shell.

A preferred embodiment of my invention is shown in the accompanying drawings, in which:

Figure 1 is a longitudinal section through the projectile; Fig. 2 is an enlarged section of the casing on the line 2—2 of Fig. 1; and Fig. 3 is an enlarged plan view of the nut.

a is a shell with a space *b* to be filled with explosives.

c is a cap screwed into the base of the shell.

d is a steel casing screwed into the inwardly projecting annular flange of the cap and projecting into the space *b* of the shell.

e is a detonator support screwed onto the end of the casing *d*.

f is a detonator filled with a high detonating explosive capable of detonating the explosive contained in the space *b*. The detonator *f* is supported on the end of the support *e*.

g is a primer, supported on the end of the support *e*, whose function is to ignite the detonating material in the detonator *f*.

h is a plunger or hammer slidable within the cylindrical body of the support *e*.

i is a ring or collar secured at the lower end of the support *e* and through which normally extends a rod or shank, *j* carried by the hammer *h* and forming with it the firing pin

k is a spring confined between the hammer *h* and the ring *i*. The function of the spring *k* is to drive forward the hammer *h*, whose point *l* punctures the primer *g*.

The lower end of the firing pin has a knob *m* which is held by a holder *n*, which consists of two levers shaped like the two arms of a pair of pincers and, like them, pivoted near their holding ends, *o* representing the pivot pin, which is rigidly held in the casing *d*, so that the jaws of the holder may be opened or closed but cannot be moved from the center *o*. In its normal position, the arms of the holder *n* extend through two holes in a nut *p*, which is longitudinally movable in a central cylindrical shaped orifice in the casing but is prevented from turning therein by means of projections *q*, which extend into longitudinally extending recesses *r* formed in the casing and opening into the space in which the nut slides. Through the threaded central orifice of the nut extends a screw *s*, which extends beyond the threaded end of the casing *d* into the space between the casing *d* and cap *c*, and has there mounted upon it a fly-wheel *t*. The screw, or the extension thereof carrying the fly-wheel, turns in bearings on both the cap *c* and casing *d*.

When a projectile passes from a cannon it is rotating at about 7000 r. p. m. This is caused by the rifling. When a projectile provided with the above described mechanism starts its flight from a cannon, all said mechanism, except the fly-wheel *t* and screw *s*, rotates with the shell, but the fly-wheel, which is free to turn relatively to the shell, and whose axis is coincident with the center of rotation of the shell, does not get started by the force which determines the rotation of the shell, and therefore remains stationary, or nearly so, while the shell and its other contained mechanism is revolving. The effect upon the mechanism is precisely the same as if the wheel were revolving while the other mechanism remained stationary. Hence, as soon as the projectile starts to rotate, the nut *p*, which at this time is at or near the upper end of the screw *s*, starts to move toward the base of the projectile. After a certain number of revolutions, the nut passes beyond the arms of the holder *n*, whereupon these arms, by the action of the spring *k* tending to pull the knob *m* out from the jaws of the holder *n*, and also by the centrifugal force of the rotating projectile, fly apart (their

free ends moving into the recesses *r*), thus releasing the knob *m*, and permitting the spring *k* to project the firing pin against the primer of the detonator.

It is desirable to provide special means to prevent the rotation of the fly-wheel within the shell during the handling of the shell or at any other time than during the flight of the shell. Such means is shown in Fig. 1. *v* is a piston slidable within guides formed by the cap *c* and casing *d*. On the outer end of the piston is a gas check *w*, which may be formed of a cup-shaped piece of copper and which is exposed, with the base of the projectile, to the firing chamber of the gun. *x* is a lead pin, swaged into both the piston and the side of the cap *c*, the pin being adapted to maintain the piston *v* in its normal position. The piston is provided, at its inner end, with a projection *y*, which engages a notch in the periphery of the fly-wheel *t* so long as the piston is in its normal position and thereby restrains the fly-wheel from rotation relatively to the shell. In firing the projectile, the pressure of the gases, acting upon the piston *v*, is sufficiently strong to deform the lead pin *x* and move the piston a sufficient distance to unlock the fly-wheel *t*.

From the foregoing description it will be understood that the time of explosion of the projectile may be regulated with great accuracy. The mechanism for exploding the projectile will be released when the number of rotations of the shell equals the number of turns of the screw *s* between the starting point of the nut *p* and the outer ends of the arms of the holder *n*. The distance of travel of the projectile in a single rotation of the projectile being a known factor, and the distance traveled by the projectile in the number of rotations required to release the holder being therefore also known or readily determinable, the mechanism for exploding the shell will necessarily be released after the shell has traveled this known or determined distance. It will also be understood that the nut *p* may be adjusted on the screw *s*, so as to regulate to a nicety the time of explosion. The only modifying factor necessary to consider is the possible small amount of rotation of the fly-wheel with the shell, but this factor, if not negligible, is fixed and ascertainable and will not therefore affect the accuracy of the operation of the mechanism.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:—

1. In a projectile, the combination with the shell, of a relatively heavy fly-wheel positioned wholly within the same and rotatably mounted in bearings therein on an axis coincident with the longitudinal center line of the projectile, mechanism rotatable with the projectile, geared to the fly-wheel, and light in weight relatively thereto whereby substantially none of the rotary movement of the projectile is imparted to the fly wheel, a primer, and means adapted to explode the primer, geared to said mechanism and arranged to function only after a predetermined number of revolutions of the projectile around the fly-wheel.

2. In a projectile, the combination with the shell, of means positioned wholly within the shell and rotatably mounted in bearings therein on an axis coincident with the longitudinal center line of the shell, whereby, in the flight of the shell, the rotary movement thereof is not imparted to said mechanism, other means rotatable with the shell and gearing with the first named means, and firing-mechanism controlled in its operation by one of said means.

3. In a projectile, the combination with the shell and the primer contained therein, of a fly-wheel located entirely within the shell and freely rotatable relatively to the shell on the latter's longitudinal axis, and primer-exploding means operable by the fly-wheel in its relative movement of rotation.

4. In a projectile, the combination with the shell and the primer contained therein, of a fly-wheel rotatably mounted in bearings within the shell on an axis coincident with the longitudinal center line of the shell, and means, operable by the fly-wheel, including gearing and a primer exploding device.

5. In a projectile, the combination with the shell, of means positioned wholly within the shell and rotatably mounted in bearings therein on an axis coincident with the longitudinal center line of the shell, whereby, in the flight of the shell the rotary movement thereof is not imparted to said mechanism, other means rotatable with the shell and gearing with the first means, and firing mechanism connected with the last named means and controlled in its operation thereby.

6. In a projectile, the combination with the shell, of a fly wheel and shaft positioned within the shell and rotatably mounted on an axis coincident with the longitudinal center thereof, means rotatable with the shell and gearing with said shaft, and firing mechanism connected with said means and controlled in its operation thereby.

7. In a projectile, the combination with the shell, of means positioned wholly within the shell and rotatably mounted in bearings therein on an axis coincident with the longitudinal center line of the shell, other means rotatable with the shell and gearing with the first named means and movable longitudinally of the shell, and firing mechanism connected with and controlled by the longitudinally movable means.

8. In a projectile, the combination with

the shell, of a fly wheel located entirely within the shell and freely rotatable relatively to the shell on the latter's longitudinal axis, normally inoperative firing mechanism, and intermediate mechanism between said fly-wheel and firing mechanism, operable by the fly wheel in its relative movement of rotation, to render said firing mechanism operative.

9. In a projectile, the combination with the shell, of firing mechanism, a fly wheel located entirely within the shell and freely rotatable relatively to the shell on the latter's longitudinal axis, means normally restraining the firing mechanism from operation, and intermediate mechanism between said fly-wheel and restraining means, operable by the fly-wheel, in its relative movement of rotation, to render said restraining means inoperative.

10. In a projectile, the combination with the shell, of firing mechanism, a shaft arranged along the longitudinal axis of the shell, a fly-wheel on the shaft, said shaft and fly-wheel being inclosed within the shell and free to rotate relatively to the shell, means normally restraining the firing mechanism from operation, and intermediate mechanism between said shaft and restraining means, operable by the shaft, in its relative movement of rotation, to render said restraining means inoperative.

11. In a projectile, the combination with the shell, of a fly-wheel and screw rotatable relatively to the shell, a firing pin, a holder normally holding said firing pin from operation, and a nut on the screw movable longitudinally thereof and adapted to normally hold said holder in its operative position but to render said holder inoperative in the course of the travel of the nut along the screw.

12. In a projectile, the combination with the shell, of a fly-wheel and screw rotatable relatively to the shell, a nut on the screw, a longitudinally movable firing pin, a spring tending to actuate the firing pin, a holder normally restraining said spring and pin from operation and normally locked by said nut in its operative position but adapted in the movement of the nut along the screw to be unlocked, thereby releasing said spring and pin.

13. In a projectile, the combination with a firing pin, of a holder restraining the same from operation, said holder comprising a plurality of hinged arms, mechanism rotatable relatively to the shell, and a nut actuated by said mechanism having orifices through which said arms normally extend, whereby the arms of the holder are held in operative position until said nut moves beyond the ends of said arms.

14. In a projectile, the combination with the shell, of a detonator support, a firing pin longitudinally movable therein, a spring tending to actuate said firing pin, a holder comprising a plurality of hinged arms forming jaws at one end normally engaging said pin and holding it from actuation, mechanism rotatable relatively to the shell, and a nut actuated by said mechanism having orifices through which the other ends of said arms extend, whereby said nut holds the jaws of the holder closed upon the pin until said nut in its travel disengages said arms.

15. In a projectile, the combination with the shell, of a casing therein having a longitudinal passage, a cap adapted to close the base of the shell, a screw extending into said passage and into the space between the casing and the cap, said screw being located substantially along the axis of rotation of the shell, a fly-wheel on said screw in the space between the casing and the cap, a nut on said screw and movable in the passage in the casing, and firing mechanism adapted in said movement of the nut to be rendered operative.

16. In a projectile, the combination, with the shell, of a casing therein having a longitudinal passage, a screw extending into said passage, a fly-wheel on the screw, the axis of said screw and fly-wheel substantially coinciding with the axis of the shell, a nut on said screw and movable in the passage in the casing, a detonator support mounted on said casing and having a longitudinal passage, a firing pin movable in said passage, a spring adapted to actuate said pin, and a holder engaging said nut during a part of the latter's travel and adapted when so engaged to hold said spring inoperative.

17. In a projectile, the combination with the shell, of a casing therein having a longitudinal passage and longitudinal recesses opening into said passage, a rotatable screw extending into said passage, a fly-wheel on the screw, a nut on the screw, projections on the nut extending into said recesses whereby the nut is held from rotation of the screw, and firing mechanism adapted in said movement of the nut to be rendered operative.

18. In a projectile, the combination with the shell, of normally inoperative firing mechanism, rotatable mechanism adapted, upon rotating a given number of revolutions, to render said firing mechanism operative, a piston longitudinally movable in the base of the shell and normally locking said rotatable mechanism from operation, and means normally holding said piston in locking position but adapted to yield to permit the piston to move to unlock said rotatable mechanism under the influence of the gases for propulsion of the shell from the gun.

19. In a projectile, the combination with the shell, of normally inoperative firing mechanism, rotatable mechanism adapted, upon rotating a given number of revolutions

to render said firing mechanism operative, a piston longitudinally movable in the base of the shell and normally locking said rotatable mechanism from operation, and a deformable pin connecting the shell and piston and normally holding the latter in locking position.

In testimony of which invention, I have hereunto set my hand, at Wilmington, Delaware, on this 10th day of September, 1910.

FRANCIS I. DU PONT.

Witnesses:
M. M. HAMILTON,
E. E. WALL.