3 Sheets—Sheet 1.

# W. W. HUBBELL.

## Shell.

No. 26,904. Patented Jan. 24, 1860.

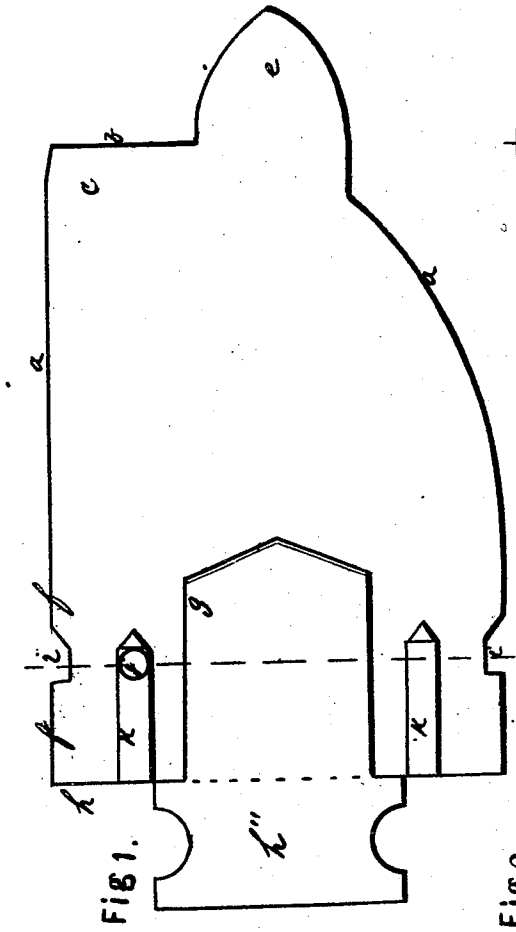


Fig 1.

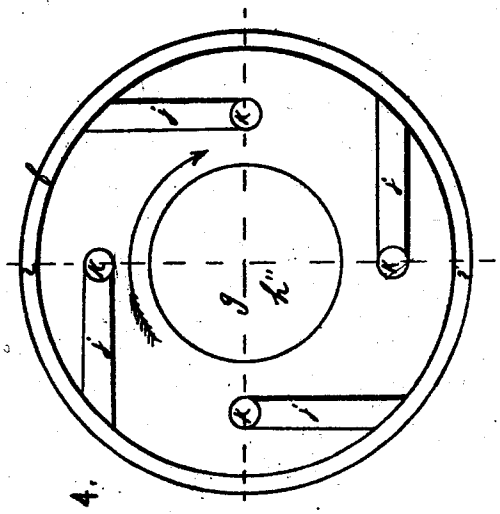


Fig 4.

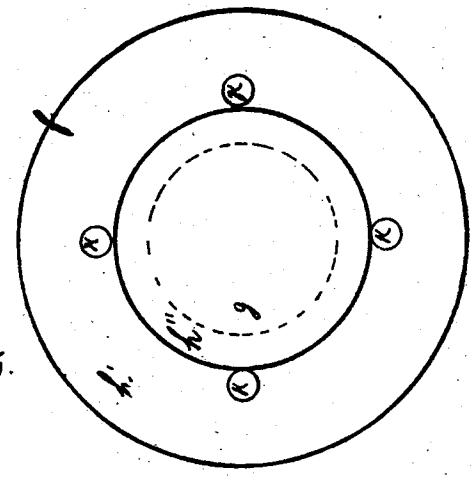


Fig 2.

Witnesses:
Charles D. Freeman
Penrose Fell

Inventor:
Wm W. Hubbell

3 Sheets—Sheet 2.

# W. W. HUBBELL.

## Shell.

No. 26,904. Patented Jan. 24, 1860.

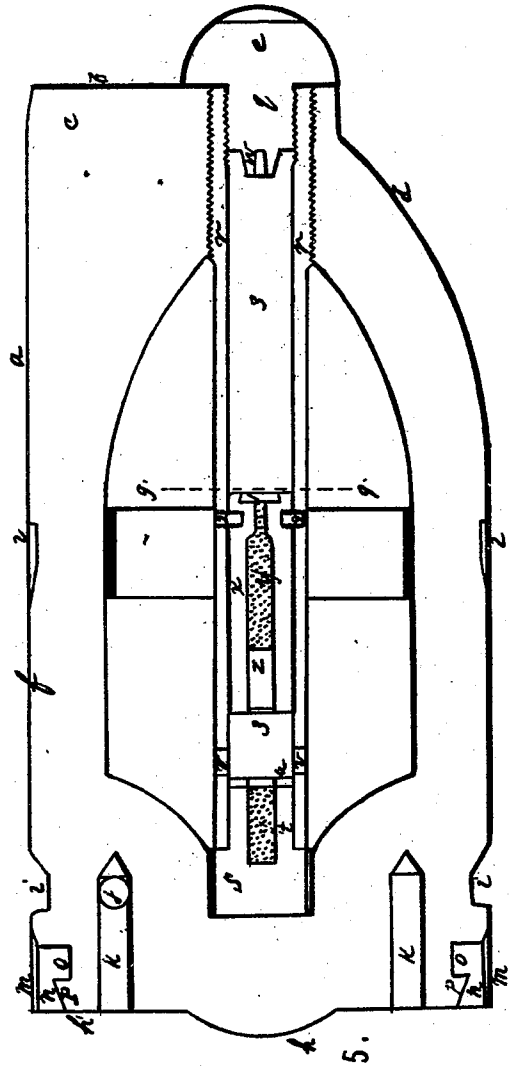

Fig 5.

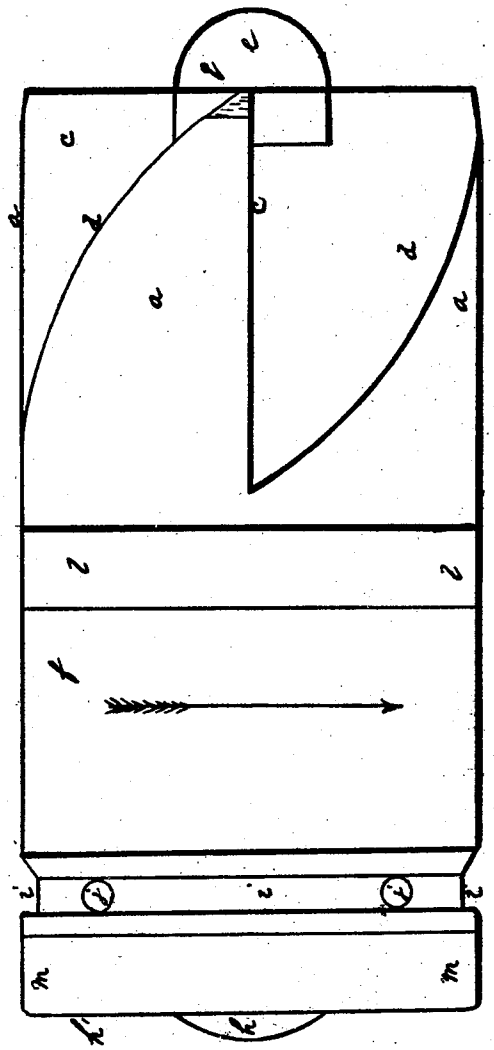

Fig 6.

WITNESSES.

Charles D. Sumner

Jerome Bell

INVENTOR.

Wm. W. Hubbell

3 Sheets—Sheet 3.

# W. W. HUBBELL.

## Shell.

No. 26,904.

Patented Jan. 24, 1860.

Fig 7

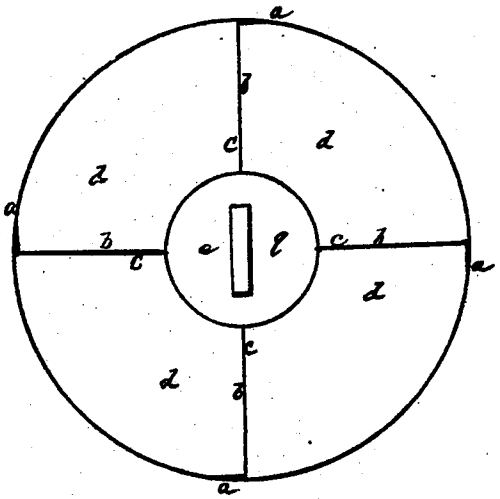

Fig 3.

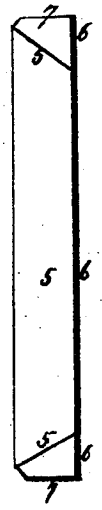

Fig 8.

Fig 9.

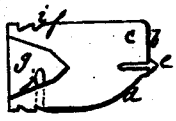

Fig 10

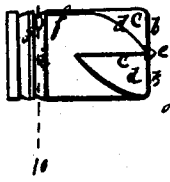

Fig 11.

Fig 12.

Witnesses:

Charles O. Freeman

Penrose Fell

Inventor:

Wm. W. Hubbell

# UNITED STATES PATENT OFFICE.

WILLIAM WHEELER HUBBELL, OF PHILADELPHIA, PENNSYLVANIA.

## IMPROVEMENT IN PROJECTILES FOR FIRE-ARMS.

Specification forming part of Letters Patent No. **26,904**, dated January 24, 1860.

*To all whom it may concern:*

Be it known that I, WILLIAM WHEELER HUBBELL, of the city of Philadelphia and State of Pennsylvania, attorney at law and scientific engineer, have invented a new and useful Improvement in Projectiles to Fire from Guns; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the annexed drawings, making part hereof, in which like letters and numbers of reference indicate similar parts.

The nature of my invention consists in the peculiar construction, consisting of the combination of means, hereinafter more particularly set forth, by which a better effect is produced from smooth-bored guns than heretofore in the particulars to be presently specified.

In the drawings, Figure 1 exhibits a longitudinal section of the solid or non-explosive projectile. Fig. 2 is a rear view. Fig. 3 is a sectional view of a vulcanized india-rubber ring, or of a sole-leather ring, with faces 7 and 6 to bear against the bore and the rear of the projectile by means of the pressure of the gas on the beveled face 5, and thus close the windage at the rear. It is to be attached to the front part of the cartridge for loading. Fig. 4 is a cross-section of the projectile, Fig. 1, on the red line 8 8. Fig. 5 is a longitudinal section of the projectile complete, adapted to explode on penetration. Fig. 6 is a side perspective view of the same. Fig. 7 is a front perspective view of the same. Fig. 8 is a cross-section of the igniting-cylinder, in front of the percussion-striker, on the red line 9 9, Fig. 5. Fig. 9 is a longitudinal section of the projectile, made of lead, with an iron point for small guns or fire-arms. Fig. 10 is a side perspective view of the same. Fig. 11 is a cross-section of the same on the red line 10, Fig. 10; and Fig. 12 is a front perspective view of the same.

The front portion of the projectile consists of a central point, *e*, projecting forward of four radiating cutting-edges, *b*, with four longitudinal faces, *c*, radiating from the central point, and from four other faces, *d*, extending transversely at right angles from the radial faces and curved back longitudinally from the point on a curve whose radius is equal to the diameter of the projectile. The sectional circumferential faces between these radial and curved faces are parallel to the axis or longitudinal central line of the projectile, are lettered *a*, and are sectional continuations of the cylindrical surface *f* of the body of the projectile. The rear part, *h'*, of the projectile is perpendicular to the cylindrical surface, except a bulge, *h*, at the center. By this arrangement of the metal and surfaces the projectile has a bearing in the gun equal to its length to keep it steady and diminish the shake and extent of angling consequent to the windage. The central point, *e*, is rendered capable of first starting the fracture of an object struck, and the cutting-edges, *b*, of afterward cutting and parting it from the center, to enable the projectile to be fired into iron vessels, and the combined radial and curved faces, being presented to the resisting atmosphere, produce an increase in the rotation of the projectile on its longitudinal axis during its flight, while the metal used to form them adds proper weight and strength to the front for range, true position, and for penetration.

The rear portion of the shot is provided with a circular recess or groove, *i*, turned or cast into the cylindrical body near to the rear surface, as shown in Figs. 1, 5, and 6, and from the rear surface, *h'*, parallel with the axis, but as near the circumference as is consistent with proper strength, are bored at equal distances apart, two or more holes, *k*, four being indicated in the drawings, Figs. 1, 2, 4, 5, and 6, each hole about a quarter of an inch in diameter, and extending in depth to the plane of the recess or groove *i*. From the recess or groove *i*, parallel with the radius of the diameter of the projectile, (see Fig. 4,) and so as to intersect and communicate with these holes *k*, are bored a similar number of holes, *j*, the effect of which is that these diagonal holes *j* discharge the gas that flows into them from behind the projectile through the holes *k* at a tangent to the circumference, so as to rotate the projectile by the reactive force of the gas when it is moving forward in the gun, and as these rotating holes or vents *j* discharge into the recess *i*, which is surrounded by the bore of the gun, forming a circular channel around the projectile, the gas readily circulates from these vents through the recess *i* to the windage-space between the projectile and bore of the gun, which windage is about four one-hundredths of an inch, and thereby the recess fa-

cilitates the effect of the rotating vents. The direction of inclination of these rotating vents *j* is such, as shown, in relation to the side on which the curved or rotating faces *d* are formed, that they both co-operate to effect the rotation of the projectile in the same direction, (and not to conflict by acting against each other.) The rotating vents *j* may communicate in common with a large central space, *g*, in the back part of the projectile, as shown in Fig. 9; but they have greater leverage or effective power, as they are bored farther from a radial line or nearer the circumference, when they have separate holes extending to the rear, and a proper strength of cast-iron is preserved, as exhibited in Figs. 1, 2, 4, 5, and 6.

In Figs. 1, 2, and 4 the central hole, *g*, is shown filled with a block of wood, *h''*, to which the cartridge is to be tied, and this hole *g* is formed in the shot to diminish the excessive weight of the rear over the front part of the projectile, and place the center of gravity farther forward. The front half of the length of the projectile should balance or be slightly heavier than the rear half, so that its momentum may naturally tend, together with the rotation, to keep or continue it in front in the flight. This principle of arrangement of the weight of the metal is intended to be observed in the proportions shown in Figs. 5 and 6, exhibiting the hollow or explosive projectile, which comprises the complete or entire invention adapted to a six-pounder gun. The rotative power of these diagonal holes or vents is greatly increased by causing the gas to close the windage between them and the gas in the rear of the projectile when the gun is fired. This effect I produce by the ring, Fig. 3, before described, or by first turning or casting on the back part of the shot a groove, *o*, Fig. 5, and behind it a flange, *p*, and I bevel the outer face of the flange, and cast into the groove and outside of the flange a band of lead, *n*, and surround the same with a copper band, *m*, of the same diameter as the projectile. The groove *o* and flange *p* secure the lead band firmly in this position, and the copper band *m* prevents the lead from leading the gun, and when the gas presses against the back part of the lead and copper band it forces them forward and they expand on the beveled surface and close the windage, leaving only the rotating vents to supply the gas forward of this rear band, and thereby increase their discharge and rotative power and effect on the projectile. This windage-band is serviceable where the projectiles are not subjected to very rough usage; but where rough transportation may deface them the band may be dispensed with, the rear being solid iron, as shown in Fig. 1, and the sole-leather or rubber ring, Fig. 3, may or may not be used, and the vents *k j* may be used without any windage-stopper to rotate the projectile in the gun, and the force of the vents *j* may also be increased by cutting grooves in the surface *f*, between them and the bases of the curved faces *d*, to increase the windage-discharge in front of them. It is to be observed that as this projectile is cylindrical in the body it is readily turned or ground off smooth to leave a windage of only four one-hundredths of an inch in the gun, which small windage saves the trajectory power of the gas very largely, and is necessarily to be observed in making the projectile of cast-iron, and all the corners and edges which would touch the bore must be well rounded off to prevent cutting of the gun.

Immediately behind the rotating faces *d*, and around the projectile, set in a groove with a rear beveled face, is a copper band, *l*, Figs. 5 and 6, intended to slide back and expand after the projectile has started in the gun, and raise its axis coincident with the axis of the gun, to correspond with the enlargement of the rear band.

For very accurate firing at long ranges, I recommend the use of the windage-ring or the bands; but for general field-service, where the projectiles are subjected to rough usage before being fired, I recommend the small allowance for windage and the use of the solid metal, as in Fig. 1. without the bands, but with the leather windage ring or stopper on the cartridge.

This projectile-casting may be filled and used as a shrapnel, and exploded by either a Boeman fuse or a common paper case time-fuse. To explode on firing into any works, fortification, town, vessel, or other structure, I have, in order to complete and give it full effect, invented an improved percussion exploding apparatus, which is an important part, and is exhibited in Figs. 5 and 8. To make this apparatus, make a separate wrought-iron or gun-metal cylinder, *r*, about half an inch in diameter inside, bored out smooth, 33. It may be about an eighth of an inch thick in the barrel, and the front end larger, and cut with a screw-thread, by which it is screwed into the projectile-casting, as shown at Fig. 5. This cylinder when made is open at both ends, and its length is sufficient to extend to near the back part of the inside of the casting, as shown, which is important to give time and sweep for a striker. The inside open end of this cylinder is fitted or filled up with an ash-wood plug, *s*, in which is a magazine-chamber filled with gunpowder, *t*, covered with paper. On this wooden plug, inside of the cylinder, is tightly fitted a ring of lead, *u*, one-tenth of an inch thick, with a hole about a quarter of an inch in diameter through it. This lead forms a non-elastic seat to receive a striker, to be presently described. Immediately in front of the lead ring, and through the cylinder, are drilled two holes, *v v*, each about two-tenths of an inch in diameter, and covered over with a band of paper around the cylinder, to keep out the explosive filling of the projectile, which is ultimately to be ignited by this apparatus through these holes *v v*. In the front end of the cylinder is screwed a gun-metal capping, *q*, the head of which forms the point in front of the

cutting-edges, and which head rests with a shoulder on the front of the projectile-casing. On the inner end of this capping, concentric with the cylinder, is formed a percussion-tube, *w*, adapted to enter a recess, 1, formed in the front of a striker.

The striker *x* is constructed of gun-metal, is square-sided, with the corners rounded off, so as to form guiding-surfaces against the inside of the cylinder, and so as to form open spaces, four in number, 4 4 4 4, Fig. 8, between the striker and cylinder, so that the air may circulate through the spaces as the striker plunges in the cylinder. The center of the striker is bored out from the rear, so as to form a chamber for gunpower, *y*, with a cork, *z*, screwed or sealed in place to keep the powder in this chamber. In the front end of the striker is formed a circular dovetail recess, 1, with a small central hole communicating from it to the magazine-chamber *y*. In this front recess, 1, is first placed a small piece of paper, then the recess is filled with moistened fulminating power, and when dry this is covered over with paper, and coated with gum-shellac. The striker is secured about half an inch from the lead seat or back part of the cylinder, as shown, by two lead screws, 2 2, each about one-tenth of an inch in diameter, which are screwed in two screw-holes cut in the striker directly opposite to each other and near its front end forward of the center of gravity of the striker, as shown. They are also screwed in the cylinder through the corresponding screw-holes, and they thus secure the striker in this position, which renders it safe to carry, and when the projectile starts in the gun the inertia of the striker, the relative position of its center of gravity, and the opposite relation of the lead screws cause it to cut these lead screws in two without arresting the striker by impingement on the sides of the cylinder, and leaving the severed screws still remaining in their respective holes, so as not to interfere with the striker, and the striker recedes to the rear of the cylinder, where the lead seat or ring receives its shock without causing it to react forward prematurely as the projectile moves along the gun. The striker remains in this position in the rear part of the cylinder during the flight until the projectile begins to penetrate any object, when the retardation of the projectile causes the striker, by its *vis inertiæ*, to plunge forward in the cylinder, the air in the cylinder passing through the open spaces 4 4 4 4 from in front to behind it as the projectile penetrates, and when the projectile has penetrated, the striker will have traversed the length of the cylinder from the rear to the front of the projectile, and as it strikes the fulminate against the tube it explodes the fulminate, which fires its own magazine *y*, blows out the cork *z*, and drives its fire to the back part of the cylinder and fires the auxiliary magazine *t* in the wooden plug near the holes *v v*, through which the fire passes into the powder in the hollow of the projectile, exploding it with effect on the object struck without regard to its time or extent of range from the gun. Carrying the fulminate in the recess in front of the striker (not in a percussion-cap on a tube) is important, as it relieves the fulminate of all extraneous pressure or inertia in starting in the gun, and fires the fulminate with the least practicable amount of concussion or resistance in penetrating. I have found by experiment made by me with this striker having a percussion-cap and tube in a cylinder, in 1848, that the striker may be secured in the base of the cylinder by making the cork *z* twice as long as shown, setting the lower end of the cork tightly into the hole in the bottom of the cylinder, from which the striker will disengage it when the projectile penetrates. The wooden plug in the end of the cylinder is forced firm against the back part of the shell in screwing down the cylinder, which supports the cylinder both longitudinally and transversely, and prevents it from bending, though the plug may be dispensed with and a solid end substituted, which, by experiment, I have found not as advantageous, and more expensive. This percussion-exploder may be used in projectiles fired from rifled cannon, or any other which will present the point *e* foremost with certainty on penetrating.

The body of this projectile for guns of six-pounder size and upward is made of cast-iron. For muskets it is made of lead, with the point of iron driven in it, as in Figs. 9, 10, 11, and 12. Its length and weight must be adapted to the strength of the gun. For bronze guns or field-artillery a length equal to two diameters for shells and one and a half diameters for shot are good proportions, as they are capable of standing the increase of strain due to the weight and smaller windage. For cast-iron guns the length should be adapted to give the proper weight which the particular gun is capable of projecting without excessive strain on the gun.

This projectile is particularly recommended for smooth-bored field artillery and other bronze guns capable of enduring the strain due to the increased weight to render them superior in general efficiency to rifled cannon.

The projectile may be filled with powder through a common filling-screw or through the conical hole for a common fuse in front to be used for time explosions in addition to the percussion-powder.

I do not here claim a striker fitted with a tube and cap and set in a hole in the front part of a shell-casting, as others have claimed it, and by experiments made by me in 1848 I have found it not practically efficient.

The improvements which I claim are:

1. The construction of the holes *k* and diagonal holes *j* so as to discharge the gas tangential to the cylindrical surface of the projectile, protected by the rear cylindrical surface, *m*, and in this manner rotate the projectile in the gun without increasing the ordinary windage, as described.

2. Forming the circular recess *i* from the

mouth of one diagonal hole *j* to the other entirely around them, in combination with the holes *k* and the cylindrical surface *m*, so as to facilitate the rotation in the gun in this manner, as described.

3. Constructing the holes *k* and *j* so as to discharge the gas tangential to the circumference opposite the corresponding faces, *d*, on the front, as shown, so as to have their reactive force of gas to coincide with the resistance of the faces, and in this manner operate with them to rotate the projectile in the same direction without rear grooves or increase of windage in the gun.

4. The expansible band *m n*, secured by the recess *o* and flange *p* on the back part of the projectile or its equivalent, in combination with the vents *j*, so that the closing of the windage by the band or ring behind the vents shall compel a greater flow of gas to pass through the vents *j* and increase their rotative action, as described.

5. The combination of the radial surfaces *c*, the curved surfaces *d*, the sectional surfaces *a*, and the cylindrical body *f*, with the flat rear *h'*, so as to cause the longest practicable bearing and the least shake or angular position of the projectile in the gun and the rotation, and by this steady position and rotative action acquire a true line of flight.

6. The extension of the carrying-cylinder *r r* to the back part of the projectile, in combination with the metallic striker *x*, the spaces 4 4 4 4, Fig. 8, and the rear side orifices, *v*, so as to allow the projectile time to penetrate, and the striker to effect its explosion.

7. The flat sides or open spaces 4 4 4 4, Fig. 8, between the striker and the cylinder, to allow the air to pass through from rear to front and front to rear of the striker, to facilitate its effective action in the cylinder.

8. The seat of lead *u* at the base of the cylinder to receive the striker as it recedes to the back part of the cylinder, and by its non-elastic nature prevent a reaction of the striker in the cylinder when the projectile starts in the gun.

9. The fulminate in the front end of the striker, in combination with the cylinder, the tube *w*, the chamber *g*, and the spaces 4 4 4 4, Fig. 8, so as to carry the fulminate in the gun, and cause it to explode the shell with certainty and ease on penetration, as described.

10. The combination of the firing-vents *v v* in the rear of the cylinder, with the magazine of powder *y* in the striker, so that the striker, when it explodes the fulminate in the front of the cylinder, shall discharge a body of fire back in the cylinder and through these firing-vents, to explode the shell after a sufficient time has elapsed to allow it to penetrate.

11. The wooden cylinder-seat *s*, in combination with the cylinder and striker, to steady the cylinder and receive the striker when starting in the gun, and also the auxiliary magazine of powder *t* in the cylinder-seat, in combination with the striker to facilitate the firing of the contents of the shell through the vents *v v*.

12. The point of metal *e* in front, in combination with the cutting-edges *b*, the radiating-faces *c*, the curved faces *d*, and the sectional surfaces *a*, so as to rotate and present the point foremost against an object, first puncture it at the center, and then cut and part it with the cutting-edges and surfaces to enable the projectile the more readily to penetrate an iron vessel.

13. The combination of the lead filling *n*, with the copper band *m*, to prevent the leading of the gun when closing the windage, as described.

14. The combination of the two opposite lead screws 2 2 with the cylinder and the striker, forward of the center of gravity of the striker, so as to secure and release and allow the striker to operate without impinging on the cylinder as it is released, and without obstruction from the severed lead as it plunges forward, as described.

15. The peculiar construction of the projectile consisting of the combination of the point *e*, the cutting-edges *b*, the radial faces *c*, the curved faces *d*, the sectional faces *a*, the cylindrical body *f*, the recess *i*, the rotating vents *j*, and flat rear *h'*, forming one projectile capable of rotating in a smooth-bored gun and acquiring initial velocity with diminished shake, of increasing its rotation in its flight, and of increased penetrative power.

WM. W. HUBBELL.

Witnesses:
CHARLES D. FREEMAN,
PENROSE FELL.