

A. L. WILLIS.
Pyrotechnic Signals.

No. 155,782.

Patented Oct. 6, 1874.

Fig. 1.

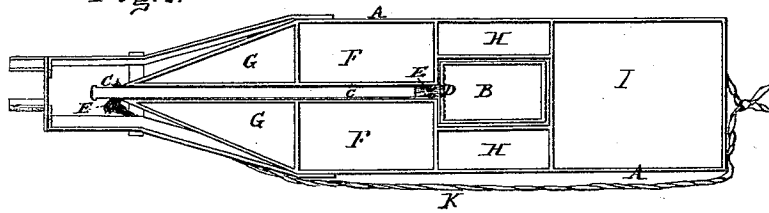


Fig. 2.

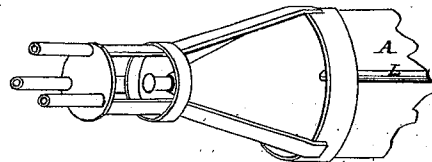
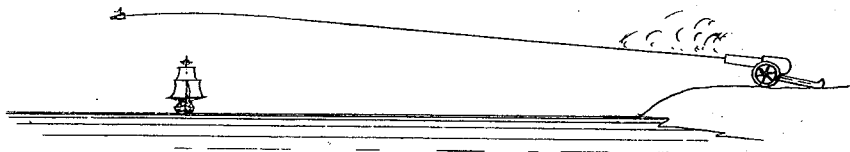


Fig. 3.



Witnessed
Albert E. Gacherle.
Wm. R. Wiley.

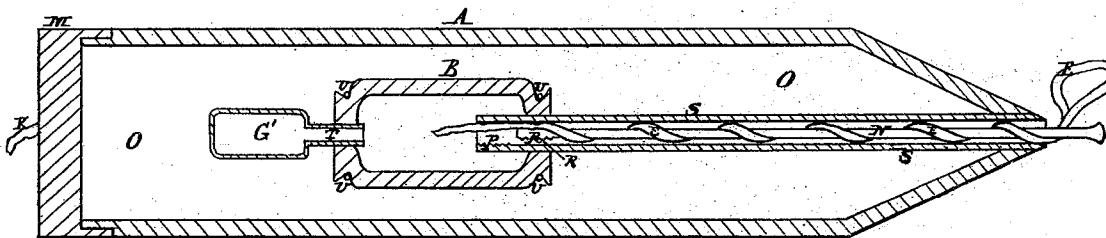
Inventor
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Fig. 4.



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UNITED STATES PATENT OFFICE.

AUGUSTUS L. WILLIS, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN PYROTECHNIC SIGNALS.

Specification forming part of Letters Patent No. **155,782**, dated October 6, 1874; application filed August 3, 1874.

To all whom it may concern:

Be it known that I, AUGUSTUS L. WILLIS, of Philadelphia, State of Pennsylvania, have invented new and Improved Projectiles for Fog and Danger Signaling, and apparatus for carrying the same into execution; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the annexed drawings making part hereof.

My invention consists of a projectile for signals possessing the triple attributes of whistling or shrieking in its flight, exploding with a loud noise, and displaying after explosion brilliant or various-colored lights, the first being attained by tubes or hollows on the forward end of the projectile other than the opening for the fuse, the second by an internal magazine containing powder or other highly-explosive compound, and the third by an additional magazine filled with a composition which, after explosion, will display various brilliant or colored lights; also, of an explosive projectile-signal constructed with tubular or hollow whistles at its forward end, the body of which is formed of gutta-percha, rubber, asbestos-board, or other material or fabric which, on explosion, will fly into small harmless pieces or particles, and the interior of which is packed with a granulated heavy substance, substantially as and for the purposes described.

To enable others skilled in the art to make and use my invention, I will particularly describe its construction and operation.

In the drawings, Figure 1 is a longitudinal section of my shell or rocket; Fig. 2, a detached view of the head of the shell, showing the attachment of the whistling-tubes, and also showing the side grooves; Fig. 3, a gun in position on the sea-shore, and a shell or rocket in transit; Fig. 4, a longitudinal section of another form of my shell.

A, Fig. 1, is the outer envelope of the shell or rocket; B, the magazine-chamber; D, the head of the magazine or cartridge, covered with a fulminating powder or compound; E, the fuse from the head of the shell; F, a hollow chamber, filled with sand, iron filings, powdered iron ore, or other substance of great

specific gravity; G, a hollow chamber, containing the fire-balls or compounds which emit particular lights after the shell has exploded; H, an annular chamber around the magazine-chamber B, also containing sand or heavy powdered substance; I, a rear chamber, containing a like material; K, fuse or fuses, passing from the fuse E in front, and attached to the rear by tying or otherwise, to insure the ignition of said front fuse E; L, the side grooves.

A, in Fig. 4, is the outer envelope, and M is a cap fitting over the rear end of A; B, the central magazine, containing the explosive mixture; G' a magazine connecting with magazine B, and containing the compound for producing the colored lights. O is the large chamber surrounding the magazines and tube, and contains the filling or ballast of iron filings. P is a grating on the interior of the inner end of tube S, and is covered with fulminate. R is a grating on the inner end of the rod or needle N, which may or may not be covered with fulminate. K is the rear end of the side fuse, passing along the side grooves from the front fuse E, which latter passes beside the rod or needle N to the interior of the magazine, and is so protected by the tube S as not to explode the magazine until the fire reaches the center of said magazine B. T is a narrow passage or fuse between chambers B and G', to communicate the fire or flame from the explosion of the contents of magazine B to those of magazine G'.

The shell is made of a size to fit the caliber of the gun or guns in which it is to be used, and the outer covering or envelope is of gutta-percha, or other substance sufficiently strong to withstand the discharge from the gun to retain its shape, and to fly into comparatively harmless and incombustible fragments. It is weighted with iron filings, sand, or other small particles weighty enough to secure the proper gravity.

The shell, when made of gutta-percha, is cast by the ordinary known processes in two halves, each half containing all the desired partitions. It is then charged with the various compounds, and the edges are softened by searing with a hot iron, and the two halves are joined together. The shaft or needle C

and fuse E may be inserted either before or after the two halves are joined together. The chamber B is charged by means of a cartridge containing the explosive material, said cartridge being provided with a fulminating head or cap. The fulminate is on the outside of said cap, and is exploded either by the concussion of the shaft C striking it, or by the fire from fuse E. A small hole under the fulminate, through the head of the cartridge, fires the magazine.

All the partitions and walls of the shell are made of substances which secure strength, with harmlessness after explosion, and I prefer gutta-percha, though other compositions may be used, such as a fabric compound composed of cement or resinous gum and fibers of any kind, or asbestos-board, wire webbing covered with cement, &c. The magazine containing gunpowder, condensed powder, gun-cotton, nitro-glycerine, or other explosive material is in the center of the shell, but the position of the fire-balls may be selected at pleasure, care being taken that they are so placed as not to be too much scattered and powdered by the force of the explosion of the shell. The fuse passes from the outside front end of the shell, inside of a tube, to the fulminating-cap of the magazine, and may be simply so arranged, or may be rendered surer of ignition by a supplemental fuse or fuses passing from the end of the shell along its outside to the back end of the shell, where they are secured by tying or otherwise.

Grooves L may, if desired, be cast on the sides of the shell, in which these supplemental fuses may be laid. Thus the fire from the explosion of the gun is certain to ignite the fuse. Instead of grooves L, holes may be cast or otherwise constructed in the shell, parallel with its length, and passing from front to rear beneath the outer surface of the shell.

The shaft or needle C passes alongside or through the fuse, and is so placed that if the shell should strike some object the said shaft would be forced against the fulminating-cap and explode the magazine instantaneously before the body of the shell enters such conflicting or opposing object, and the material of which the shell is composed flying into minute fragments, and being incombustible, is insurance against harm. The fuse, in burning, leaves a fiery train, which indicates the direction in which the shell is sped. I also attach to the shell tubes or other device, which, in the rapid transit of the shell through the air, give forth a peculiar and loud whistling noise, which attracts attention.

If the shell, in its flight, should pass a vessel close in shore, when the fog is so dense that the fiery train could not be seen, and the shell still had a long distance to traverse before explosion, then the noise of the whistle as it passes and recedes would indicate to such vessels the direction of the shore, or the point whence the shell came.

The whistles I have shown to be erected on light standards, so that if the shell comes in contact with any object the whistles and their supports will be crowded back on the shaft or needle, and not interfere with the explosion of the shell. The whistling-tubes may be cast or set on the slant of the head of the shell, or attached to a band slipped on the head, leaving the head of the shaft or needle free and projecting beyond them.

The form of shell shown in Fig. 4 is what I prefer in practice, as being the cheapest and simplest. The envelope A and cap M are of gutta-percha, cast in molds, the latter fitting over the former like a lid, and having its sides flush with the sides of envelope A. This form of shell I load as follows: The envelope A has an opening at its conical end to receive tube S. The cap M, of course, it is best to cast separately from envelope A, and before it is set in place the loading is done.

The magazine B I make of paper or heavy pulp, and into it I insert the powder or compound to be used as the explosive agent. I construct magazine G' of the same material, and join them together, as shown, by means of the fuse T. The tube S, to contain the fuse E and shaft or needle N, is now inserted through the end of magazine B, that end opposite to the one receiving fuse T. The magazine B is then secured rigidly around tube S and fuse T by means of cords U. The tube S is carried so far into magazine B that the fuse E will reach to about the center of said magazine. The magazines G' B and tube S are thus secured to each other, and they are then passed into the large end of envelope A, until the tube projects slightly through the conical end of the envelope A. The surrounding space O is then packed with iron filings, or material possessing like attributes of harmlessness, and the cap M is then applied. This cap is secured in position by searing the outside line of its joint with A with a hot iron. The materials, being rubber, will thus be induced to unite. The fuse E is then inserted through tube S. The powder in this fuse may be so combined as to show a peculiar-colored light in burning during the flight of the shell, and the shaft or needle N is set in place. The whistling-tubes are then adjusted to their position. The shell is thus made ready for service, and the gun is loaded with a charge graduated to carry the shell to the desired distance. I now, for additional protection to the shell, and to assist it in withstanding the discharge, place over its blunt end a tin cap, and place in the gun over the charge a wooden sabot. Both the tin cap and the sabot should be perforated to insure the ignition of the fuse of the shell. The gun is then discharged. The sabot is, of course, soon left by the shell in its flight. The latter traverses the required distance, and is finally exploded by the flame from the fuse. The fuse, during the flight, leaves a fiery train, and the whistling-tubes shriek until the shell

explodes. If the latter should come in contact with a vessel or her spars the shaft or needle N is thrown or pushed back, and the fulminate on the gratings P and R flashes from the friction and immediately explodes the shell.

The danger of striking vessels is very slight, and the shaft or needle N is, therefore, comparatively unnecessary. If it is dispensed with the tube S is filled with the fuse alone.

One disadvantage attending a front fuse is, that the violence of the progress through the air produces the escape of gases from the tube N, and smothers the fuse or makes it unreliable as to the length of time it will burn. This difficulty is almost wholly overcome in my shell by the disk in front, which supports the whistling-tubes. This disk, by covering the opening at the outer end, protects the tube and fuse from subjection to a powerful inrushing current of air, and insures the certain and reliable burning of the fuse. The disk does not rest upon the opening, but is supported at a little distance in front of it. By calling envelope A incombustible, I mean practically so for the purposes of my shell.

The great object of my invention is to furnish reliable and complete signals on occasions of dense fogs. These are often so dense that the sound of a fog-whistle or gun will not penetrate more than a mile or a mile and a half, and on some occasions not over one-half a mile.

The cost of the shell is inconsiderable, particularly in view of the perfection attained. For the salvation of imperiled vessels off a dangerous coast in dense fogs it is highly important to secure some method which will overcome all objections to signals now in use, and this is accomplished in a great degree by the above device.

I am well aware that rockets throwing out

lights have been used in signaling, and in pyrotechnic displays, and that a shell in its transit from a gun whistles in its flight from the unavoidable nature of its construction, as in a lesser degree a solid shot does, and also that a shell makes a report in exploding. But rockets are only capable of being thrown a moderate distance, and they make no noise, whereas my shell may traverse a distance of three miles before it explodes and throws out the lights—a degree of perfection not yet even approximately attained by any rocket which is propelled and sustained by the slow combustion of the charge contained within it.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A projectile-signal combining the triple attributes of whistling or shrieking in its flight, by means of tubes or hollows on its forward end other than the fuse-opening, of exploding with a loud report, by means of an internal magazine containing powder or other highly-explosive compound, and displaying after explosion various brilliant or colored lights, by means of a magazine containing composition which, on ignition, will display such lights, substantially as described.

2. An explosive projectile-signal, constructed with tubular or hollow whistles at its forward end, the body of which is formed of gutta-percha, rubber, asbestos-board, or other fabric or material which, on explosion, will fly into small harmless fragments or particles, and the interior of which is packed with a granulated heavy substance, substantially as and for the purposes described.

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