(No Model.) 2 Sheets—Sheet 1.

H. BERDAN.

AMMUNITION FOR SUBMARINE GUNS.

No. 478,216. Patented July 5, 1892.

Fig. 1.

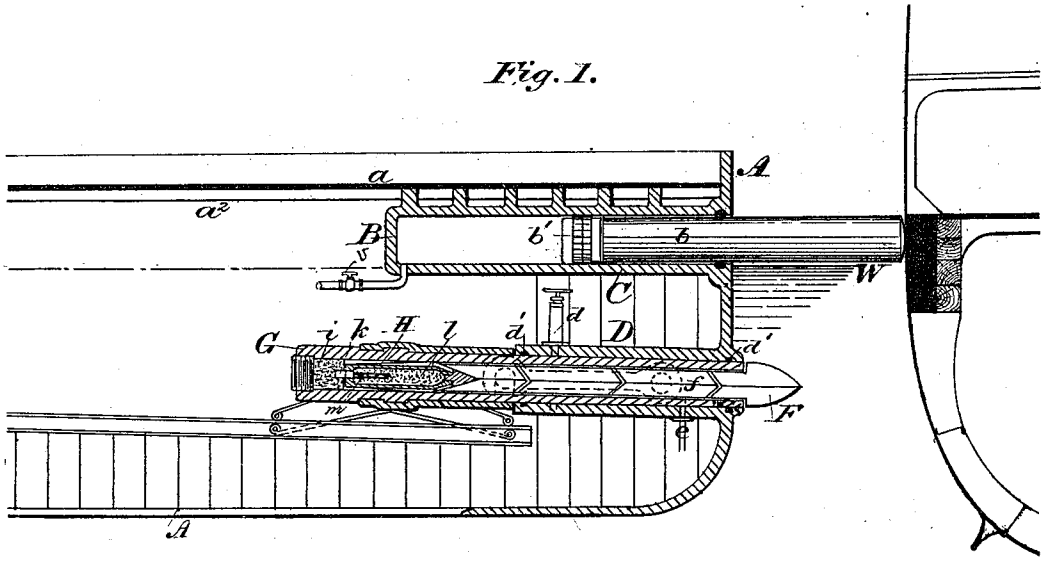


Fig. 2.

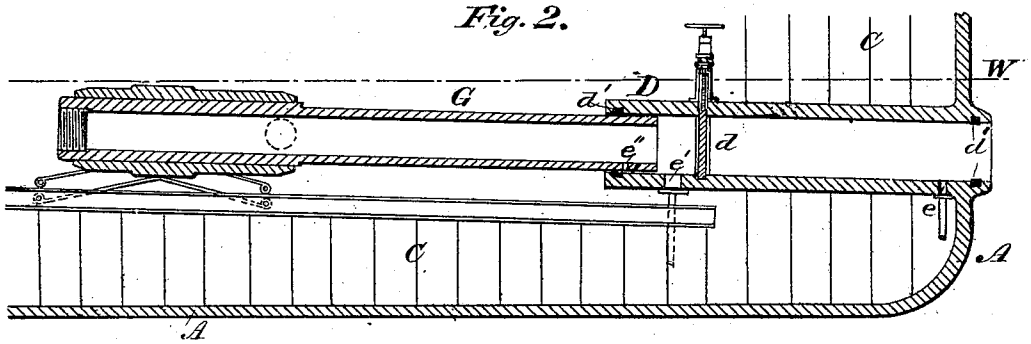
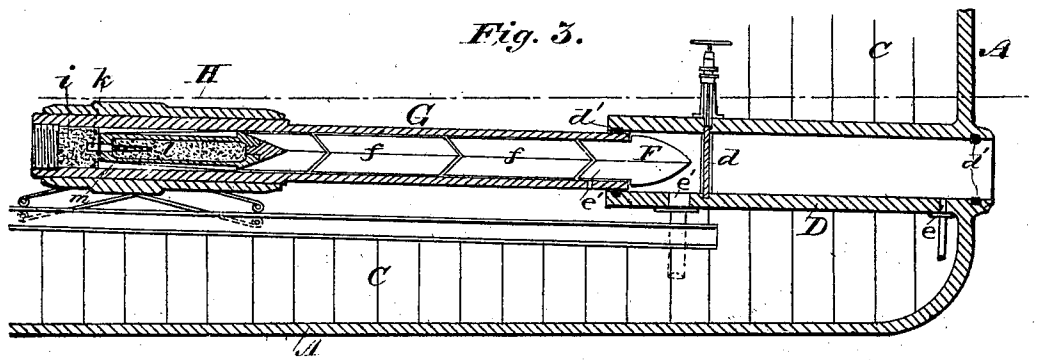


Fig. 3.



Witnesses:

F. C. Brecht.

Joseph H. Hamman.

Inventor:

Hiram Berdan

(No Model.) 2 Sheets—Sheet 2.

H. BERDAN.

AMMUNITION FOR SUBMARINE GUNS.

No. 478,216. Patented July 5, 1892.

Fig. 4.

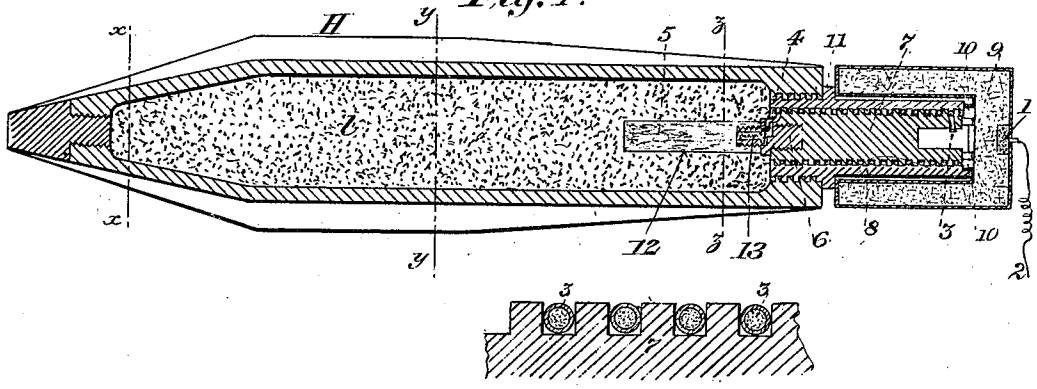


Fig. 5a.

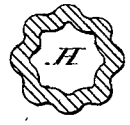


Fig. 5.

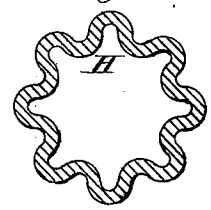


Fig. 5b.

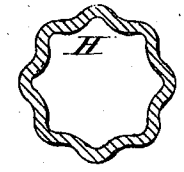


Fig. 6.

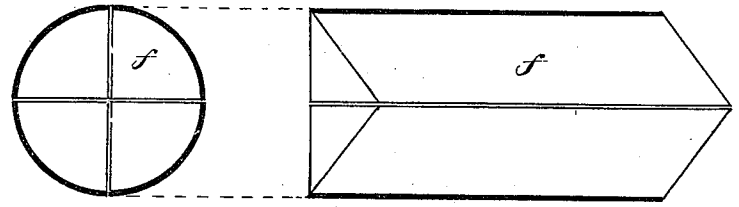
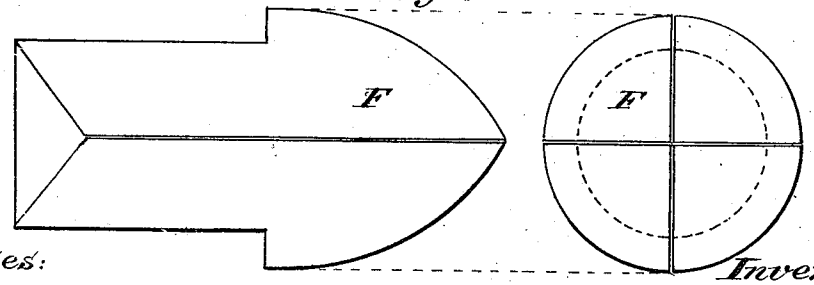


Fig. 7.



Witnesses:
F. C. Brecht,
Joseph H. Haunter.

Inventor:
Hiram Berdan

UNITED STATES PATENT OFFICE.

HIRAM BERDAN, OF WASHINGTON, DISTRICT OF COLUMBIA.

AMMUNITION FOR SUBMARINE GUNS.

SPECIFICATION forming part of Letters Patent No. 478,216, dated July 5, 1892.

Application filed March 22, 1892. Serial No. 425,988. (No model.)

To all whom it may concern:

Be it known that I, HIRAM BERDAN, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Ammunition for Submarine Guns; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

The object of the invention is to provide better ammunition for a submarine gun than heretofore known for the purpose of firing a shell into the hold of a ship.

The nature of the invention consists in the improved shell, air-cylinders, time-fuse, and propelling-charge case employed, whereby a projectile or shell containing high explosive can be fired into the hold of a ship with greater certainty and with less injury to the gun than with any ammunition heretofore employed in submarine guns for that purpose.

I have illustrated the invention in the accompanying drawings, in which—

Figure 1 represents a longitudinal section of the bow of the vessel I employ and the submarine gun therein loaded, with air-cylinders and tampion, with what I designate as my "hydraulic buffer" in position against an iron-clad ship. Fig. 2 is an enlarged longitudinal sectional view of the lower part of the vessel and the submarine gun, showing the gun drawn back preparatory to loading. Fig. 3 is a view similar to Fig. 2, but showing the gun loaded and in position to be moved forward. Fig. 4 is a longitudinal sectional view of the shell, also showing in detail the improved detachable firing charge, the time-fuse, its spindle, and sleeve, and showing immediately underneath the large figure an enlarged sectional view of the time-fuse spindle, displaying the sections of the leaden coil containing the time-fuse composition. Fig. 5^a shows a section of the shell at $x\ x$, disclosing the corrugations. Fig. 5 is a similar view of the shell at $y\ y$. Fig. 5^b is a similar view of the shell at $z\ z$. Fig. 6 is an enlarged detail view of the form of air-cylinder employed, and Fig. 7 is a similar view of the tampion employed.

The position of the gun when loaded and ready for firing, with the air-cylinders in place, is shown in Fig. 1. When drawn back ready for loading, the gun is in the position as shown in Fig. 2, and when loaded ready for firing its position is as shown in Fig. 3.

For the purpose of clearly explaining the construction and operation of my improved ammunition I submit herewith the detail drawings, Figs. 4, 5^a, 5, 5^b, 6, and 7.

Fig. 4 shows in detail the time-fuse coiled around its spindle, (designated by the figure 7,) which spindle is constructed with square threads for the reception of said fuse. One end of the fuse (designated as 3) projects into the space at the end of the spindle 7, the covering to which space and the corresponding plate in the powder charge are of such material and of such strength as to allow the gas from the powder charge to readily penetrate to and ignite the time-fuse. The propelling charge of powder is in a water-tight metal case shoved onto the sleeve 8, which contains the time-fuse. 4 represents the forward end of the fuse, which passes through the plug 6, which is screwed into the fuse-spindle and supports the dry gun-cotton tube in the shell (designated as 12) and the small tube 13 for the fulminate of mercury, which is ignited by the end of the fuse 4. 1 represents the fulminate of mercury in the propelling-charge case, which is ignited by the electric wire 2 and sets fire to the gunpowder. The gas from the gunpowder then penetrates the plate 9 and ignites the time-fuse, as hereinbefore described. 5 represents the dry gun-cotton in the tube, which ignites the wet gun-cotton 1 in the shell. 8 represents the sleeve containing the time-fuse spindle, &c. H represents the shell. 10 represents the octagonal flange to the fuse-spindle for convenience in wrenching it into the sleeve 8, and 11 represents the octagonal flange of the said sleeve 8 for convenience in screwing the same into the shell. The time-fuse is, as shown in detail, Fig. 4, (in which the figure 3 is made to represent the fuse generally,) incased in a leaden tube, and is

here represented to be fifty feet long. The fuse composition burns at the rate of one-half inch per second, thus giving a burning time of twenty minutes, which is considered amply sufficient for the officers and crew, with their effects, to escape without injury. Any time desired can be obtained, however, by different lengths of fuse, as shown by experience and practice to be most necessary and desirable.

The tampion F is employed to keep the water out of the gun, and the air-cylinders *f* are sometimes employed with the shell when so constructed as to allow the gas to pass the shell; but they are invariably employed when the shell fits the bore of the gun, as sometimes constructed for the purpose of increasing the capacity of the shell, so as to prevent the air when compressed by the projectile from expanding the muzzle of the gun. The construction of the tampion and air-cylinders is as shown in detail in Figs. 7 and 6, respectively. The shell H is here shown with passages extending forward of the cylindrical part of the shell with corresponding internal corrugations for the purpose of increasing the capacity of the shell for gun-cotton and lessening the weight of the same, this being one of the various forms which I may employ without departing from the scope of my invention, as shown by cross-sections, Figs. 5ª, 5, and 5ᵇ, to give the required strength to the shell at that point with as little metal as possible and allow a portion of the gas to pass the projectile for the purpose of forcing the tampion out of the gun; also, for the purpose of allowing the compressed air to pass back and around the shell when the pressure of the air and gas forward of the shell is greater per square inch than the pressure of the gas behind the shell, thereby lessening the liability of expanding the muzzle of the gun when the air-cylinders are not employed, for the reason that the pressure of the air and gas is always free to equalize itself. The point of the shell is made of hardened steel and is dished out, so as to enter a plate at a very flat angle.

The advantage of the propelling charge of powder being detached is partly for the convenience of handling the projectile to avoid damaging the powder charge while placing this heavy shell into the gun; but the more important object is that of being able to readily change the size of the propelling charge as required by the kind of ship to be attacked, as some of the ships are more delicately constructed than others, and without having a charge regulated somewhat in proportion to the resistance the ship would offer a charge regulated to the stronger ship would throw the projectile or shell entirely through a weakly-constructed ship, such as an ordinary cruiser or merchant-ship. There would probably be required three sizes, designated as a "minimum," "maximum," and "normal," and as the gun employed is a breech-loading gun a few seconds would be sufficient to open the breech and change the propelling charge. Each propelling charge will have its electric wire attached to it, so as to be fired by electricity automatically when the vessel strikes the ship.

The normal charge of powder employed is two hundred pounds. The weight of the projectile when loaded is five thousand pounds, and the weight of the obstructions, including hydrostatic pressure, air-cylinders, and tampion, is seven thousand pounds. The muzzle velocity of the shell, with the details as above, is three hundred and forty feet per second, which is sufficient to penetrate a plate of three inches thickness, which is supposed to represent the two plates employed in iron-clads of three-fourths-inches thickness each, making one and one-half inches, and an allowance of one and one-half inches for the frame-work, &c., making a total of three inches. The weight of the gun will be about twenty-two tons.

The proportions of the shell as shown in the drawings will admit of about four hundred pounds of wet gun-cotton being employed; but it will be seen that any amount may be employed that is thought necessary, and it is evident that with the time-fuse constructed on this system the shell cannot explode until the vessel has had ample time to get out of the way of the ship; in fact, almost any length of time could be obtained with a fuse constructed on this system, and as far as any suggestion of the shell being removed from the attacked vessel during the time consumed by the burning of the fuse is concerned the impossibility of such a procedure will be seen when it is borne in mind that the shell is five thousand pounds in weight, and being buried into the hold of the ship would be difficult to get at.

It is proper to state here that I regard the bursting of the shell inside the ship an indispensable feature for destroying iron-clads or ships of war when made on the honeycomb or compartment system, which is almost universal now with all first-class iron-clads or ships of war.

It will be seen that, according to my system, the projectile has a short and uniform distance to pass through the water; also, that the gas presses against the rear end of the shell in the gun until the point of the projectile has reached the side of the ship in place of throwing the projectile through the water by its momentum, as heretofore.

By this description and the figures of the drawings my invention will be fully explained.

I have shown my shell in combination with a vessel of special construction, but hereby disclaim such construction, as it is the subject-matter of another pending application, Serial No. 425,987, filed March 22, 1892. In this case I limit myself to the construction of the shell and certain parts identified and cooperative therewith, as shown in Figs. 4, 5ª, 5, 5ᵇ, 6, and 7.

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

1. The combination of a shell, substantially as described, with air-cylinders in front thereof, all in operative relation, substantially as and for the purpose herein set forth.

2. A shell, substantially as described, having a time-fuse attached to its rear end, a spindle around which the time-fuse is coiled, and a sleeve for protecting the fuse, substantially as and for the purpose herein set forth.

3. A shell, substantially as described, having a metal case attached to its rear part carrying the propelling charge and a time-fuse, all in operative relation, substantially as set forth.

4. A shell, substantially as described, having a fuse-spindle and sleeve, the fuse encircling said spindle, and a metal case for carrying the propelling charge surrounding said sleeve, said parts being attached to the rear of the shell, and all in operative relation therewith and with each other, as set forth.

5. A shell, substantially as described, having a fuse-spindle, the fuse encircling said spindle, and a metal case carrying the propelling charge surrounding the fuse, said parts being attached to the rear of the shell and separable therefrom and from each other, as set forth.

6. A shell, substantially as described, charged with wet gun-cotton and a case of dry gun-cotton, a tube of fulminate of mercury, and a time-fuse, substantially as described, all combined and in operative relation, as set forth.

7. A shell constructed with longitudinal corrugations corresponding internally and externally thereof, whereby the gas freely passes the shell, as and for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

HIRAM BERDAN.

Witnesses:
JOSEPH H. HANNEN,
T. C. BRECHT.