(No Model.) 2 Sheets—Sheet 1.

E. L. ZALINSKI.

SHELL.

No. 384,660. Patented June 19, 1888.

Fig. 2.

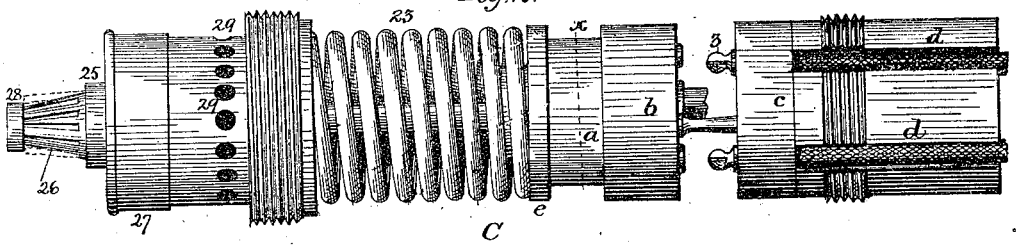


Fig. 5.

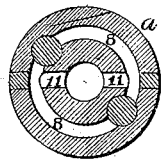


Fig. 4.

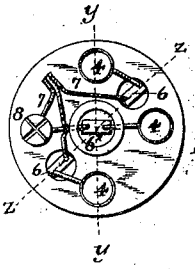


Fig. 3.

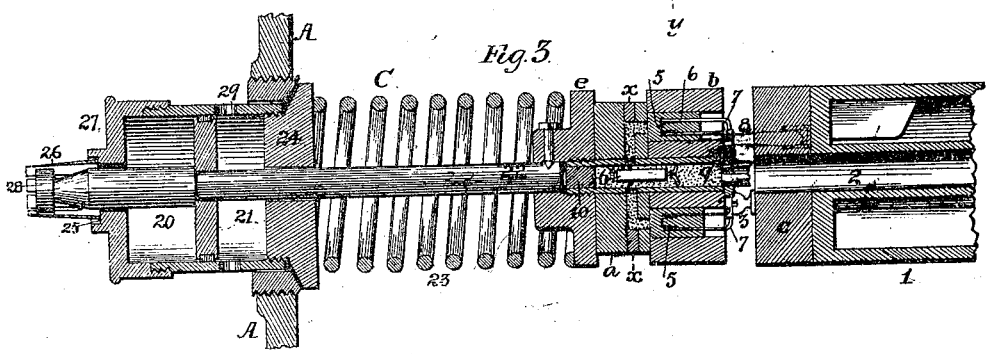


Fig. 6.

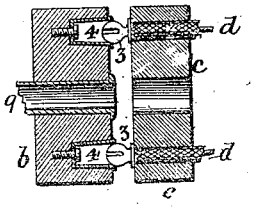


Fig. 7.

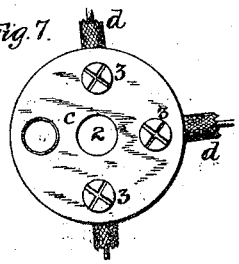
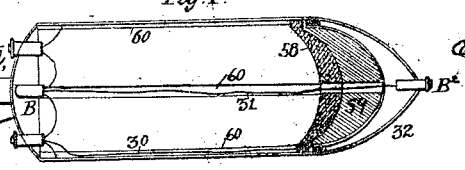


Fig. 1.



Witnesses.
A. P. Vanderventer,
F. B. Brock.

Inventor
Edmund L. Zalinski.
By W. A. Barbour.
Attorney.

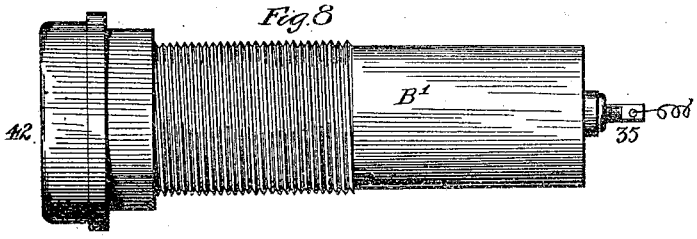
(No Model.) 2 Sheets—Sheet 2.

E. L. ZALINSKI.

SHELL.

No. 384,660. Patented June 19, 1888.

Fig. 8



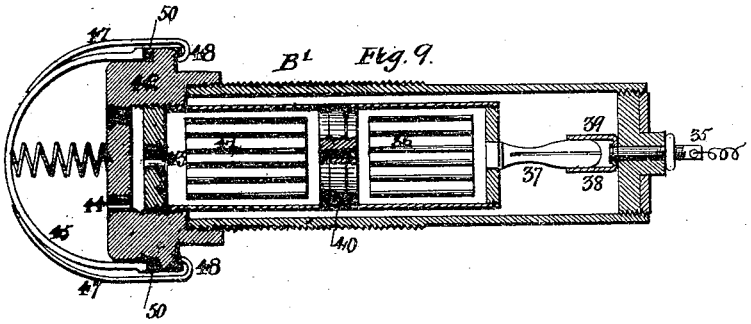


Fig. 11.

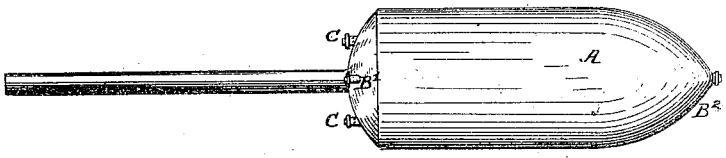


Fig. 12.

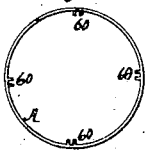
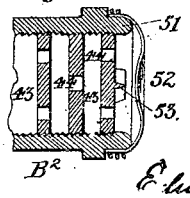


Fig. 10.



Witnesses.
A. D. Vandeventer.
C. B. Brock

Inventor.
Edmund L. Zalinski
By W. A. Bartlett.
Attorney.

UNITED STATES PATENT OFFICE.

EDMUND L. ZALINSKI, OF THE UNITED STATES ARMY.

SHELL.

SPECIFICATION forming part of Letters Patent No. 384,660, dated June 19, 1888.

Application filed October 25, 1887. Serial No. 253,297. (No model.)

To all whom it may concern:

Be it known that I, EDMUND L. ZALINSKI, lieutenant of artillery, United States Army, stationed at Fort Hamilton, in the State of New York, have invented certain new and useful Improvements in Shells, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to shells especially intended for high explosives; and the improvement mainly consists in the construction and arrangement of the electric batteries, circuit-breakers, and means for closing circuit, with some minor modifications in the structure of the shell to adapt it for the ready reception of the fuse and its connections.

The invention is a development of and improvement on electrical fuses and projectiles heretofore invented by me.

Figure 1 is a longitudinal sectional diagram on a small scale, showing the general relation of the batteries, circuit-breakers, and circuit-closing devices. It will be understood, however, that the location of parts may be changed without departing from the spirit of my invention. Fig. 2 is a side elevation of one of my firing-primers with circuit-breaker attachment, the circuits being open. Fig. 3 is a central longitudinal section of the same through the firing-charges—that is, on line *z z*, Fig. 4—the circuits being closed. Fig. 4 is an end view of the plunger, showing the wire connections to the firing-charges of the primer. Fig. 5 is a section on the line *x x*, Figs. 2, 3. Fig. 6 is a section of the parts *a b* on the line *y y*, Fig. 4. Fig. 7 is a rear end view of the part *c*, Figs. 2, 3. Fig. 8 is an elevation of the dry-battery casing. Fig. 9 is a longitudinal section of said casing and its batteries and protecting-cap. Fig. 10 is a partial section of the front end of a dry battery with frangible cover. Fig. 11 is a side elevation of the body of a projectile and part of a guiding-tail. Fig. 12 is a cross-section of the projectiles, showing interior ribs.

The letter A is used to designate the body of the shell, which contains dynamite or other high explosive. B indicates an electric battery, and C denotes a circuit-breaker and fuse or firing part, which will be described hereinafter.

Beginning at the front of the attachment C, the numeral 1 indicates a hollow cylinder of metal, which has grooves in its sides to receive a number of insulated electric wires, *d d*. There is a central passage, 2, in the cylinder 1, and the periphery of the cylinder is provided with a screw-thread or other means of attachment to a socket in the interior of the shell A. A short cylinder or disk, *c*, of rubber or other non-conducting material, retains the ends of all the wires *d*, and the wires terminate in split knobs 3 of metal, so that electrical connection can be readily made through the knobs and wires. The part 1 is in metallic connection with some portion of the body of the shell, which serves as a "ground" for any or all of the electric circuits where found convenient.

The split knobs 3 and their wire-connections may be in any convenient number and connected to as many different electric batteries as found convenient or desirable. I prefer to use at least two wet batteries and one or more dry batteries, so that the chances of failure by the non-action of a battery will be minimized. The short cylinder *b* is of rubber or similar material, containing a metallic cup, 4, opposite each of the split knobs 3. When this cylinder is moved into the position shown in Fig. 6, the cups 4 will receive the split knobs or pins 3, giving a close metallic contact. The split knobs, when pushed into these cups, will snugly fit by reason of the slight compression of the knobs.

Each cup 4 is connected by an insulated wire with a platinum or similar bridge, 5, inclosed within an explosive or combustible charge, 6, and the return-wire 7 from the bridge is connected to post 8, which preferably extends forward from the face of the rubber cylinder *b*. When the parts are brought into the position shown in Fig. 6, it will be seen that there is metallic connection from the insulated wires *d*, held by cylinder 1, through pins 3, cups 4, platinum bridges 5, and return-wires and post 80 to the metal of cylinder 1, with which post 80 is brought into electric circuit. Consequently an electric current through wires *d* can go to ground through the platinum bridges, and if it be strong enough will heat the bridges and ignite the powder at 6; but if the parts be separated, as in Fig. 1, all the electric circuits will be broken or open, and a current from

wires *d* cannot reach the platinum bridges to ignite the powder.

The powder composition, 6, is in contact with a disk, *a*, having a slow-burning-powder composition in arc-shaped grooves 8 in its face. The disk *a* may be turned on the tube 9, which tube forms the axis of the disk. The disk *a* is clamped between the cylinder *b* and the head *e* of plunger by turning up the screw 10 on tube 9. The fire communicated to the powder in grooves 8 will burn along said grooves a greater or less distance according to the position of the disk with reference to the primers in cylinder *b*. When the fire reaches radial grooves 11, it will pass along said grooves into the interior of tube 9 through small holes therein, and along said tube for any required distance. The tube 9 is preferably filled with fulminate, and may project forward any distance, through aperture 2, into the charge in the body of the shell. One of the primers, 6^x, is placed in tube 9, and this primer is connected with a battery which is intended to operate without delay action, and will be thrown into circuit to fire instantaneously without delay action.

The fuse-casing C screws into a socket or receptacle in the base of the shell. (See A, Fig. 3.) A part of the casing forms a cylinder, 20, in which there is a piston, 21, rigidly secured to the piston-rod 22, which rod 22 supports the plunger-head *e* and the parts *a b*. A strong spring, 23, interposed between cylinder-head 24 and the head *e*, tends to press said head and attachments forward toward the piece *c*, carrying the wire terminals and so close circuit. This action of the spring 23 is prevented until the projectile leaves the gun by means of the collar 25, having spring-arms 26, which collar is placed around the piston-rod 22 in rear of the rear cylinder-head, 27, the spring-arms 26 being held in an undercut groove in the knob 28 at the rear end of the piston-rod 22.

The cylinder 20 has a number of apertures, 29, in front of the piston 21. It being supposed that the detent spring-arms are in the position shown in Fig. 2, the spring 23 being somewhat compressed, we will suppose the projectile to be fired from the gun. The compressed air or gas used in firing (either in a pneumatic or other gun) enters the apertures 29 and forces back the piston 21, compressing the spring 23 still more. This backward movement permits the spring-arms 26 to release themselves from knob 28. (See dotted lines, Fig. 2, and full lines, Fig. 3.) As long as the compressed gas holds the piston and its rod back the circuits will remain open; but when the projectile leaves the gun the gas will escape from cylinder 20, and the spring 23 being now free to act will press the plunger *e* forward and close all the circuits at the rear of the projectile. This, however, does not fire the charge, but only puts the parts in firing position. The circuit-breaker described is a safety device to prevent premature explosions. One or more sensitive batteries, B, in the base of the projectile, (but insulated,) has connection with a wire, *d*, and a metallic connection, 30, with a plate or diaphragm, 31, a little in rear of the outer point, 32, of the projectile, but insulated from the body of the projectile. The outer shell, 32, is in metallic connection with the part *l* of the circuit-closer. Assuming the circuits to be closed at the rear, when the point of the projectile strikes a solid substance the point 32 will be collapsed and will then come in contact with the plate 31, thus closing circuit at the front and throwing the battery B into instant action. This battery B will be in connection with a wire leading to the platinum bridge in primer 6^x, so that the explosion takes place instantly.

If the projectile falls into the water, the concussion is not great enough to collapse the point of the shell and the battery B does not ignite the charge. It is desirable that the projectile shall have time to enter the water some distance, so as to get beneath a hostile ship, before the explosion takes place. For this purpose one or more delay-action batteries in casings B′ will be provided. Preferably there will be such a battery in the point and in the base of the shell. The battery-casing B′ is screwed into a socket in the base or point of the shell. The pole 35 of the battery is insulated from the casing, and is connected to one of the wires *d*, hereinbefore referred to.

The battery proper consists, preferably, of a number or series of cells, each cell being a complete battery in itself. The cell 36 has one element connected by a split post, 37, with a cup, 38, connected to the pole 35, but insulated by the rubber disk 39 from the casing B′. The cell 36 is a complete sensitized battery, but is insulated by the disk 40 from the cell 41, one element of the cell 36 being connected to the proper element in said cell 41 by a metallic connection through the insulating-disk 40.

The battery element in cell 41 is dry and incapable of action until wet. This dry cell, being in connection with the active cell 36, serves as a circuit-breaker therefor, the battery 36 having no connection to ground save through cell 41. When water is admitted to cell 41, however, it makes the cell 41 an active battery and throws into the circuit the battery 36, thus getting a large battery-power by sensitizing only one cell. This multiplication of batteries may be carried to any extent, one cell only being left unsensitized, and all the cells will be thrown into action when this one is sensitized by wetting.

The casing B′ has a head, 42, provided with diaphragms 43 44, perforated at different points, so that the water rushing into the holes in diaphragm 44 will be broken up on plate 43, and will not enter the battery-cell as a direct jet with such force as to do injury to the mechanism. This arrangement of diaphragms with holes "out of register" may be carried to a greater extent, so that the water-jet shall be broken up as much as necessary.

Over the head 42 a cup, 45, is placed and held onto the head by spring-hooks 47, entering a groove, 48, in the head. A spring, 49, is interposed between the head and cup, unless the spring of rubber gasket 50 be sufficient to throw off the cup 45 when the hooks are detached.

The cup or cap is placed on the casing B' before the battery is seated in the base of the shell. When the gas-pressure comes on said cap it is pressed forward, and the spring-hooks 47 spring out into the position shown in dotted lines. Then when the projectile leaves the gun the cap will fly off or be forced off by the spring and gasket, leaving the holes open for the entrance of water. Until that time the cup protects the battery from absorbing moisture, either from the air or from water which may be mixed with the air used in firing a pneumatic gun.

Another form of cover for the dry battery at the front of the shell is shown in Fig. 10. In this modification, 51 represents a ring or annular bearing at the front of the battery-case. On the front partition of the case there is a knife-edge or cutter, 53. A rubber diaphragm, 52, is stretched over the annular bearing and suitably secured to the battery-casing. When the projectile strikes in the water, this rubber diaphragm will be pressed back against the knife-edge and perforated, and the water will be allowed to enter the battery-casing to sensitize the battery. The diaphragm 52 may be of glass.

The body of the projectile A will have interior longitudinal ribs, 60, attached firmly by rivets or by casting with the metal. As many of these ribs may be used as found desirable. The ribs will serve the double purpose of protecting the wires which extend forward in the shell, and will hold the charge of the shell against rotation.

The front part of the shell may be weighted, when found necessary, by a lead or similar weight, 59, to place the center of gravity of the whole in the right position. The front of the projectile may also be filled with some soft substance, 58—as cotton—to act as a cushion and prevent explosion of the dynamite or gelatine in the shell by impact, as I have discovered that such explosion is much less destructive than when the charge is fired by a detonator from the rear.

The leaden weight 59 will be melted by the heat of the concussion and will not serve as an obstruction to the action of the explosive charge.

The movable part of the fuse, by which delay action is had, will be provided with an index, so that the time of combustion may be definitely regulated.

I have made numerous modifications of my devices above described, and do not consider the invention to be in precise details of construction. I have used several devices by which the air-pressure in the gun is enabled to hold the circuit open until the projectile leaves the gun. I have also used several other devices to protect the chemicals in the fuse from water until fired from the gun, which are probably the equivalents of the constructions above described.

It will be understood that all the batteries and circuit-breakers above described are adapted for use in a single shell, and can be so used. Nevertheless, I desire to claim such parts as may be operative in a shell if taken separately.

Having thus described my invention, what I claim is—

1. In a shell, an electric battery, metallic connections from said battery to a primer of the character described, and a plunger connected to the primer operated by gas-pressure in the bore of the gun when the gun is discharged to hold the primer out of circuit with the battery while the projectile is in the gun.

2. In a shell, an electric battery, a metallic connection extending from said battery, a primer, a plunger carrying said primer, and a detent which holds the primer out of circuit until released by the action of the gas-pressure in the gun.

3. In a shell, an electric battery, a primer in circuit to be ignited thereby, and an adjustable column of slow-burning compound connecting said primer with the explosive charge.

4. In a shell having an electric fuse, a circuit-breaker having a movable plunger, a piston on said plunger, and a cylinder containing said piston to which cylinder gas is admitted to force back the plunger, as set forth.

5. In a shell, an electric battery, metallic connections therefrom, a spring-plunger carrying primers having a path of movement toward the battery-connections, and a detent for said plunger, which detent is released by the gas-pressure in the bore of the gun when the piece is discharged.

6. An explosive shell, an electric fuse therefor, a metallic connection from said fuse to a front insulated portion of the shell, and a collapsible shield or point in metallic connection with the body of the shell, whereby the collapse of the point will close circuit, as set forth.

7. A shell having an inclosed weighting piece of easily-fusible metal near the front thereof and extending across the front of a charge of high explosive, substantially as described.

8. In a shell, the combination, with a plunger provided with a mechanism for forcing the same forward to close circuit, of a plurality of primers carried by said plunger, and separate batteries having connections in position to close circuit with each of the primers.

9. In a shell, a plunger carrying a plurality of primers, separate battery-connections to each primer, and a single electric connection whereby all the circuits are grounded in the wall of the shell, all in combination, substantially as described.

10. In a shell-fuse, the combination, with a battery inclosed in a casing, of a plurality of partitions between the battery and outer opening in the casing, said partitions having perforations out of line with each other, as set forth.

11. In a shell-fuse, an electric battery provided with a perforated partition, a cover outside of said partition, and retaining-catches for said cover adapted for release by the gas-pressure in the gun.

12. In a shell having an electric fuse, a detachable circuit-breaker which moves a primer carried thereby into circuit with the battery, and a detonator in position to be ignited from the primer, said detonator removably attached to the circuit-breaker, in combination substantially as described.

13. In a shell of the character described, a circuit-breaker in position to move and close the electric circuit, a primer and a detonator, and a delay-action fuse having a connection with the circuit breaker interposed between the primer and detonator, all combined as stated.

14. In a shell having an electric fuse, an electric battery and a primer, and suitable electric connections between the same, substantially as described, a spring circuit breaker and closer, the spring tending normally to close circuit between the battery and primer, but being forced back by the gas from the propelling charge while under such pressure in the gun, the combination being and operating substantially as described.

15. In a shell having an electric fuse, a circuit breaking and closing plunger, a spring for forcing the same to closed position, a detent operating to hold the spring compressed, and connections to the gas charge, whereby the plunger is held back against the spring-pressure while the projectile is in the gun, substantially as described.

16. In a shell, a fuse containing a chemical which will be thrown into chemical action by the entrance of water, a cover for said fuse, a holder on the shell retaining said cover in place while the shell is in the gun, and mechanism connected with the shell for automatically opening the cover after the shell leaves the gun, combined substantially as described.

17. A shell having a fuse containing a chemical which is made active by the entrance of water, a cover for said fuse, and mechanism on the shell for rupturing said cover by impact with water.

18. The combination, in a shell-fuse and connected to the primer thereof, of a sensitized and a non-sensitized battery, the latter forming part of the circuit of the former, as set forth.

19. In a shell-fuse, a metallic casing having a plurality of electric batteries or cells inclosed, one cell or battery being non-sensitized, but adapted to be thrown into operation by the entrance of water, said non sensitized battery forming part of the circuit and until made active serving as a circuit-breaker to the other batteries or cells.

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

EDMUND L. ZALINSKI.

Witnesses:
JOHN J. GRIFFIN,
STANLEY DWIGHT.