E. RUBIN & A. F. STADLER.

Combination Shell-Fuse.

No. 200,223. Patented Feb. 12, 1878.

Fig: 1.

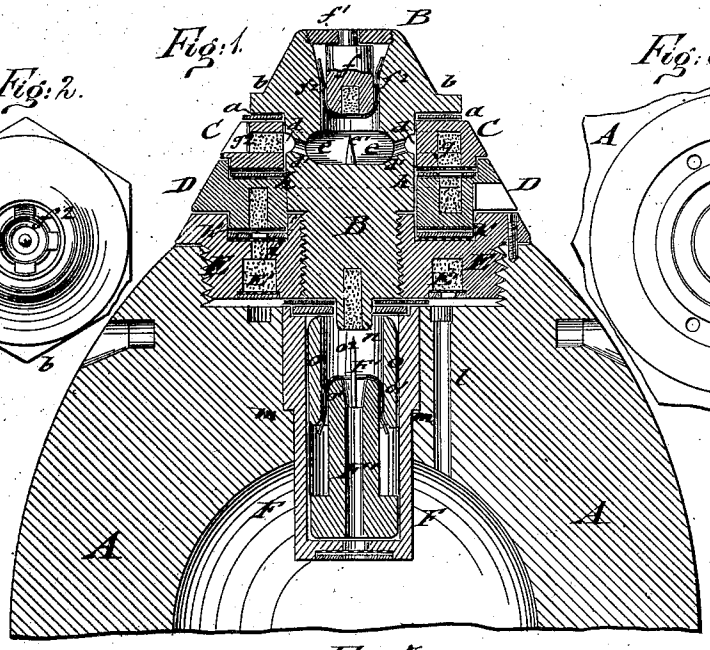


Fig: 2.

Fig: 3.

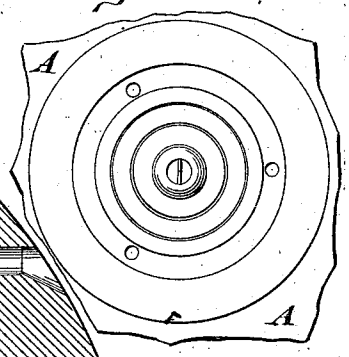


Fig: 4

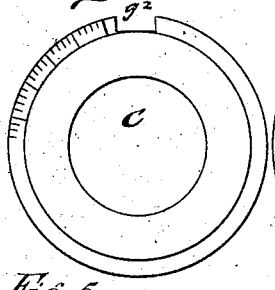


Fig: 7.

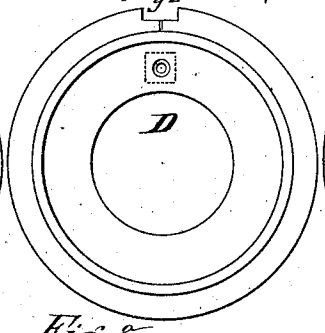


Fig: 9.

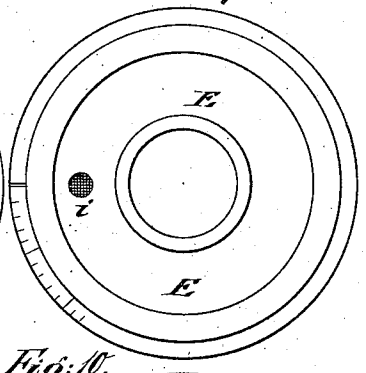


Fig: 5

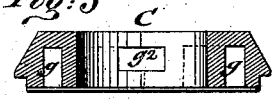


Fig: 8.

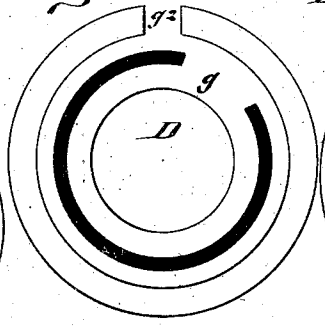


Fig: 10.

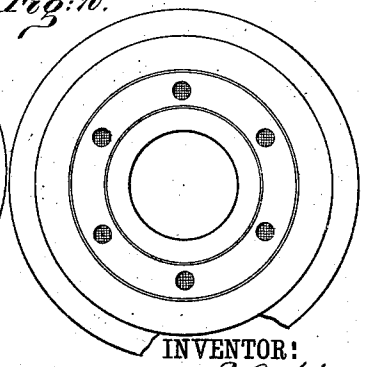


Fig: 6.



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UNITED STATES PATENT OFFICE

EDUARD RUBIN AND AUGUST FORNEROD-STADLER, OF THUN, SWITZERLAND.

IMPROVEMENT IN COMBINATION SHELL-FUSES.

Specification forming part of Letters Patent No. **200,223**, dated February 12, 1878; application filed January 3, 1878.

To all whom it may concern:

Be it known that we, EDUARD RUBIN and AUGUST FORNEROD-STADLER, of Thun, Switzerland, have invented a new and Improved Combination-Fuse for Projectiles, of which the following is a specification:

This invention has reference to that class of fuses for projectiles in which a time and percussion fuse are combined, so as to secure the positive and reliable explosion of the shell, either within a certain interval of time or at the moment when it strikes the ground.

This combination or double-acting fuse is specially adapted for time-shells of large size that are so arranged that the time-fuse begins to burn the moment the shell is fired from the gun, without necessitating any tool or instrument for adjusting it, the adjustment being simply made by means of graduated rings, in similar manner as in combination-locks.

The invention consists, essentially, of the combination of a percussion-fuse that is ignited by the sudden force imparted to the shell in firing with a double-graduated ring-fuse and a powder-chamber, and with a percussion-fuse that is thrown into action when the shell strikes an object.

The double ring-fuse is secured by a tightening-screw, that carries at its point or top end the sliding and spring-acted pin, with priming, and a fixed steel point for igniting the ring-fuse below the same, and at its lower end a fixed priming for the sliding and spring-acted pin-bolt and steel point of the percussion-fuse.

In the accompanying drawing, which illustrates our invention, Figure 1 represents a vertical central section of a shell with our improved combination-fuse. Fig. 2 is a top view of the fastening screw-bolt with the screw-cap removed; Fig. 3, a top view of the shell-screw with the fuse-rings removed. Figs. 4, 5, and 6 are, respectively, a top view, a central section, and a bottom view of the upper fuse-ring. Figs. 7 and 8 are top and bottom views of the lower fuse-ring, and Figs. 9 and 10, top and bottom views of the fuse-plate and powder-chamber.

Similar letters of reference indicate corresponding parts.

In the drawing, A represents a projectile of large size, which is provided with a combination-fuse consisting of a time-fuse and a percussion-fuse. The latter is arranged in a bolt-case at the inner point of the shell, while the former is attached to the same by a central screw-bolt, B, that forms, with the rings of the time-fuse, the tapering points of the shell. The time-fuse consists of an upper fuse-ring, C, and of a lower fuse-ring, D, which are seated on the ring-shaped fuse-plate E, that is screwed by an exterior thread into the shell, while an interior thread serves for the screwing in of the fastening screw-bolt B. A washer, *a*, is placed between the head of the screw-bolt B and the upper fuse-ring C.

The tightening screw-bolt B is made of brass, with a hexagonal shoulder, *b*, for taking hold of the bolt with a wrench and screwing it into the fuse-plate E, and with the same into the shell.

Above the hexagonal shoulder *b* the head is made conical. The upper portion of the shank of the screw-bolt is made smooth, the lower portion threaded. The smooth portion has an annular groove or channel, *d*, that communicates, by four radial holes or passages, *d'*, with a central cavity, *e*, turned out at the interior of the bolt-head. The lower wider part of the cavity *e* is provided with a fixed central-steel point, *e'*, while the upper part of the cavity is contracted and made flaring and threaded at the uppermost portion, in order to allow the insertion of a spring-supported firing-pin, *f*, and of a retaining screw-cap, f^1. The firing-pin *f* has a central bottom hole filled with suitable priming, and is supported on a steel spring, f^2, with radial and bent-up arms, stamped out and tempered, so as to carry the firing-pin, the outwardly-bent ends of the spring-arms resting on the flaring portion of the cavity *e*, as shown in Fig. 2, and supporting thereby the pin in such a manner that the same remains rigidly in position, regardless of handling or shaking, when moved from place to place.

The tension of the spring f^2 resists the usual shocks to which the shell is exposed in perfectly reliable manner, and forms a reliable safeguard against any premature ignition of the priming by contact with the steel points *e'*.

The upper fuse-ring C is made of an alloy

of ninety-seven parts of tin and three parts of antimony, and graduated in one-fifth of seconds at the outer conical perimeter.

The upper fuse-ring C is cast with a ring-shaped bottom groove, *g*, that is charged, under suitable pressure, with the fuse mass. This ring-shaped groove does not extend all the way around the ring, but is broken by a solid portion, g^1—the so-called bridge. (Shown clearly in Figs. 5 and 6.) A hole, g^2, is bored sidewise into the upper ring C, and filled with powder, that serves to light the mass pressed into the groove of the ring, and, when the latter is lighted, to draw off the gases of combustion. This hole is called the "igniting-hole," and the powder the "igniting-powder." The graduation on the outside of the ring is arranged for a burning time of ten seconds, and the outer part, at a point corresponding to the bridge, marked with the date of manufacture, number, &c.

The lower fuse-ring D is made in similar manner as the upper ring, but provided at the upper side with a cloth ring, *h*, for the purpose of holding and tightening the upper ring.

For carrying the fire from the upper to the lower ring, and extending thereby the time of burning, a hole is arranged in the ring *h*, and a wedge-shaped piece of powder inserted therein to connect with the mass in the groove of the lower fuse-ring. The connecting-piece is covered with parchment-paper and tin-foil, so as to protect it against moisture and changes of temperature. A small quantity of paraffine closes the exit-hole of the lower ring, and melts when the fire burns down to the lower ring, so as to facilitate the burning of the fuse and the free escape of the gases of combustion.

The fuse-plate E is composed of an alloy of 96.14 grams of zinc, 5.60 grams of copper, and 17.47 grams of tin. It has an outer shoulder, up to which it is screwed into the shell, the latter being recessed correspondingly. The flat-top surface of the fuse-plate E is covered by a cloth ring, *h'*, attached by shellac, which ring forms the seat for the lower fuse-ring. The outer surface is graduated, like the upper ring, in fifths of seconds, and numbered from 50 to 100, so as to represent another ten seconds of time. These divisions refer to the lower fuse-ring.

In the upper surface of the fuse-plate E is a small powder chamber or duct, *i*, by which the fire is conducted from the lower fuse-ring to a ring-shaped powder-chamber, E', closed at the top and covered with top and bottom gauze coverings and by a perforated bottom brass ring.

The powder-chamber of the fuse-plate E is connected, by three or more longitudinal holes bored through the head of the shell, with the interior powder-chamber of the same.

The percussion-fuse is set centrally into the head of the shell, and made of a bolt-casing, F, and an interior bolt-pin, F'. The bolt-casing F is supported by an outer shoulder, *m*, on an annular seat of the shell, and firmly retained in position by the fuse-plate E and screw-bolt B, a rubber packing-ring being interposed between the top of the bolt-casing and bottom of fuse-plate and center-bolt. The lower end of the screw-bolt is extended, by a small bored out and primed projection, *n*, into the bolt-casing, so as to be acted upon by the sliding bolt-pin F' when the shell strikes an object. The bolt-pin F' is guided in an upper guide-sleeve, *o*, and cushioned at the top by a spring, o^1, that is made exactly like the cushioning-spring of the slide-pin of the time-fuse.

The bolt-pin F' carries a steel point, o^2, and is bored out centrally through its entire length, so as to furnish a central firing-channel that is closed at the lower end by a piece of gauze-cloth, so as to prevent the powder-charge of the shell from getting into the interior of the casing and bolt-pin.

The bolt-pin is of brass and of cylindrical shape, and prevented by the cushioning guard-spring from striking the priming at the lower end of the center-bolt until, by the striking of the shell, sufficient force is imparted to the bolt-pin to overcome the resistance of the spring and strike the priming, exploding thereby the shell.

For the fuse-ring and priming any suitable approved mixture of ingredients may be used, a mass composed of five parts of chlorate of potash, four parts of sulphuret of antimony, and one part of glass-powder, united by a solution of gum-arabic, being well adapted for this purpose.

By setting the upper ring to the index-point of the lower fuse-ring, and then both to the desired number of seconds on the fuse-plate, the time-fuse may be adjusted to any length of time up to twenty seconds. The shell is then placed in the gun without requiring any other preparation, and the time-fuse lighted by the shock imparted to the shell by the firing of the gun, as thereby the pin in the head of the center-screw is thrown on the steel point of the same, so as to explode the priming and communicate the fire to the upper fuse-ring, then to the lower fuse-ring, and finally to the fuse-plate and shell. The shell can thus be set to explode at short as well as at long distances, as the time-fuse may be made to burn a shorter or longer time. Though the sudden motion imparted by the shell in firing ignites the priming of the time-fuse, it prevents at the same time the backward motion of the bolt-pin and sleeve of the percussion-fuse and the firing of the lower priming of the center-bolt until, by the striking of an object during its course, or at the end of its flight, it will throw the bolt-pin forward by the concussion, and explode the shell thereby. If the time-fuse is not desired at all, the bridge of the top ring is placed over the igniting-point of the lower ring, which is indicated by an arrow or other mark on the outside of the shell, by which the

circulation of the fire is cut off and prevented from passing to the lower ring.

The compact construction of the combination-fuse and the reliable action of either the time-fuse or the percussion-fuse at the proper time, so as to warrant the explosion of the shell either during its course, or at the point of destination, form a superior fuse for large and expensive kinds of shells, and preclude any possibility of their being not exploded, and thereby wasted.

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

1. A combination time and percussion fuse for projectiles, consisting of upper and lower graduated and adjustable fuse-rings, a connecting-fuse base-plate with interior powder-chamber, and of a retaining center screw-bolt arranged with devices to ignite the time-fuse at the moment of firing the gun, and a percussion-fuse at the moment of striking an object, substantially as and for the purpose set forth.

2. In a combination-fuse, the combination of the center screw-bolt B, having central cavity with radial exit-holes, a fixed firing-point, and a sliding and spring-cushioned priming-pin with the upper fuse-ring C, to communicate fire to the same at the moment of firing the gun, substantially as set forth.

3. In a combination-fuse, time-fuse rings having bottom grooves filled with fuse-composition, said grooves separated by a solid bridge and provided with an exit-hole for the escape of the gases, substantially as specified.

4. In a time-fuse, the combination of the sliding firing-pin *f*, having supporting-springs f^2, with the bolt B, having cavity *e*, screw-cap f^1, and points *e'*, and openings *d* communicating with fuse-rings, as and for the purpose set forth.

5. In a percussion-fuse, the combination of the sliding bolt F', having central firing-channel point o^2 and springs o^1, and the guide-sleeve *o* with the bolt-casing F and screw-bolt B, having a primed bottom chamber, as and for the purpose set forth.

In testimony that we claim the foregoing we have hereunto set our hands this 2d day of October, 1877.

ED. RUBIN.
AG. FORNEROD-STADLER.

Witnesses:
JOH JACOB SCHÄFER,
Lieutenant Colonel.
ALBERT PAGAN,
Capitaine d'artilleres.