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H. P. MERRIAM.

DETONATING MECHANISM FOR EXPLOSIVE SHELLS.

No. 431,376. Patented July 1, 1890.

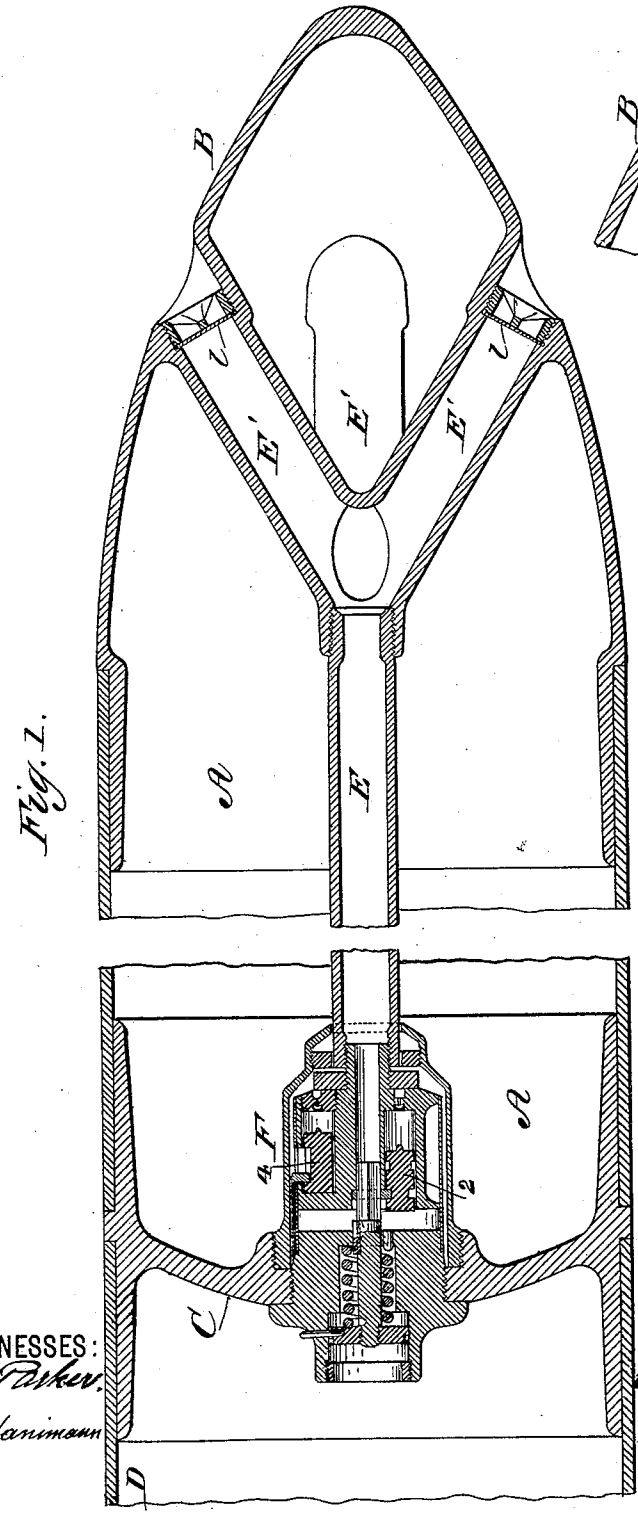


Fig. 1.

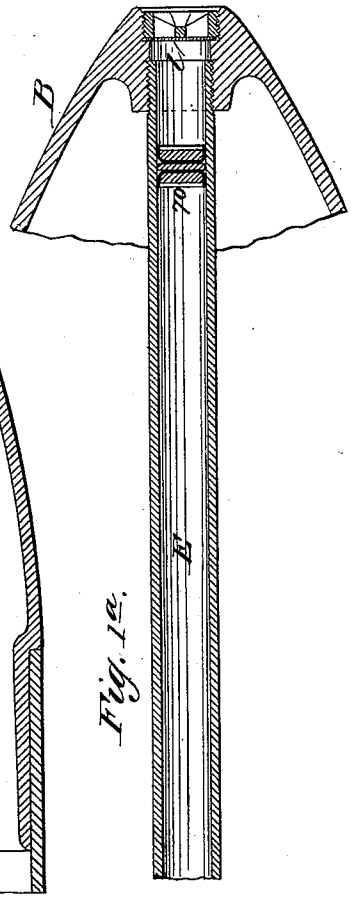


Fig. 1a.

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Fig. 2

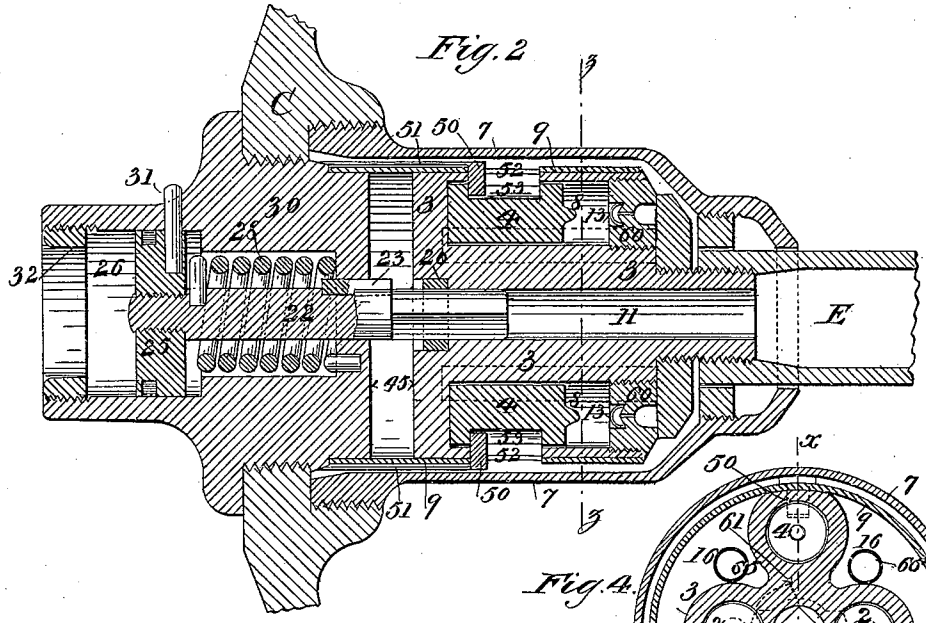


Fig. 4.

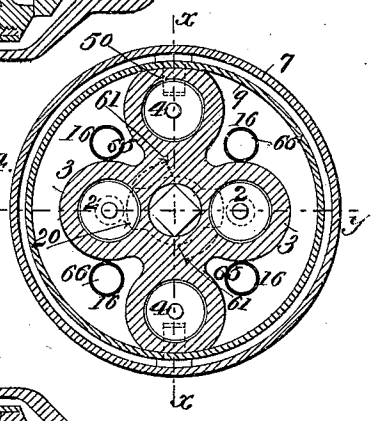


Fig. 3

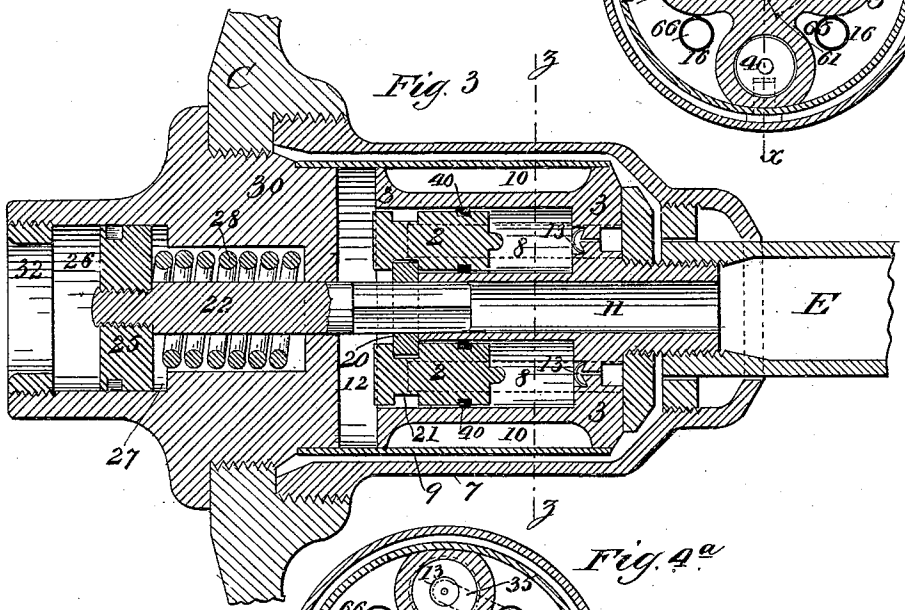
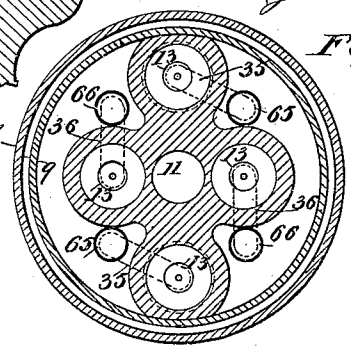


Fig. 4a



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Fig. 6.

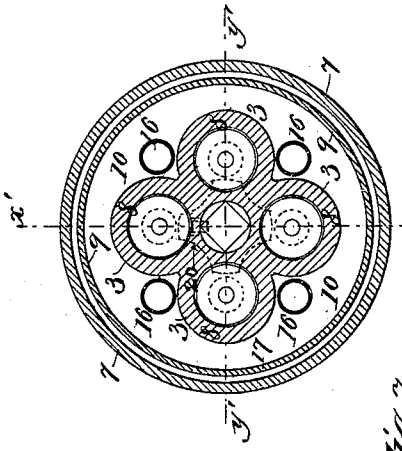


Fig. 8.

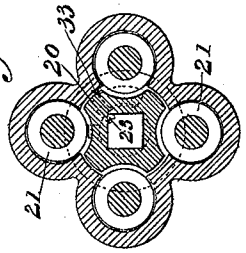


Fig. 7.

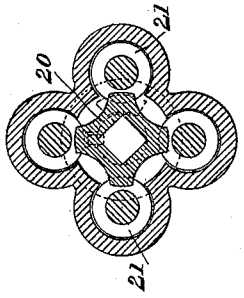


Fig. 5.

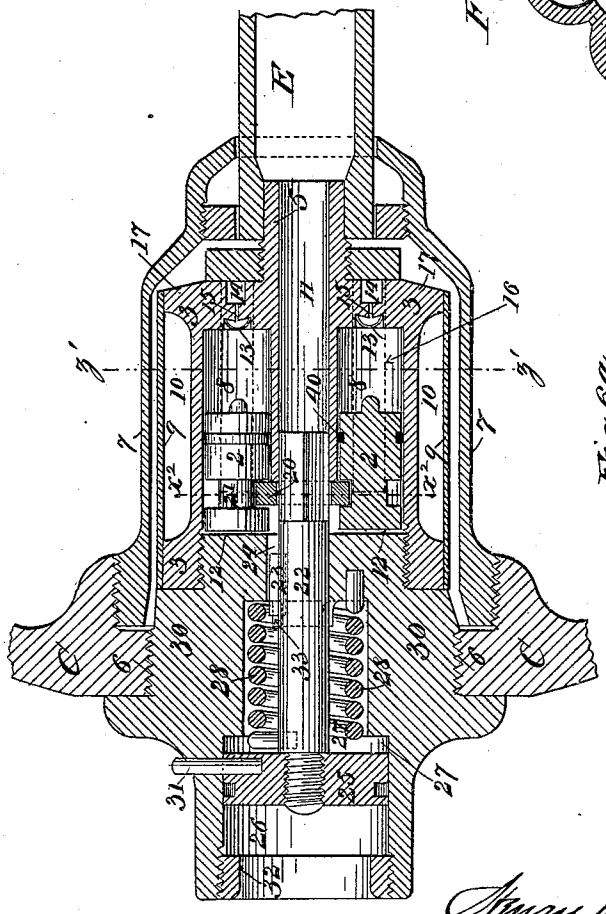
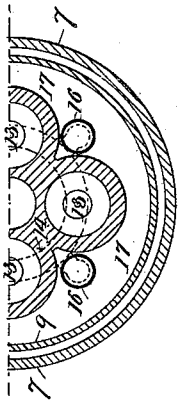


Fig. 6a.



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UNITED STATES PATENT OFFICE.

HENRY P. MERRIAM, OF NEW YORK, N. Y.

DETONATING MECHANISM FOR EXPLOSIVE SHELLS.

SPECIFICATION forming part of Letters Patent No. 431,376, dated July 1, 1890.

Application filed December 23, 1889. Serial No. 334,693. (No model.)

To all whom it may concern:

Be it known that I, HENRY P. MERRIAM, a citizen of the United States, residing at the city, county, and State of New York, have invented certain new and useful Improvements in Detonating Mechanism for Explosive Shells, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal section of the shell, the detonators appearing as if in section on the line *x y*, Fig. 4; Fig. 1ª, a similar longitudinal section of a part of the shell, showing a modification; Fig. 2, an enlarged longitudinal section of the instant-detonators on the line *x x*, Fig. 4; Fig. 3, an enlarged longitudinal section of the delay-detonators on the line *y y*, Fig. 4; Fig. 4, a cross-section of Figs. 2 and 3 on the line *z z*, looking toward the base; Fig. 4ª, a cross-section on the line *z z* looking toward the head; Fig. 5, an enlarged longitudinal section of the detonators, all employed with delay-action, corresponding with either the line *x' x'* or *y' y'*, Fig. 6; Fig. 6, a cross-section of Fig. 5 on the line *z' z'*, looking toward the base; Fig. 6ª, a half cross-section on the line *z' z'* looking toward the head; and Figs. 7 and 8, detail views in cross-section on the line x^2 x^2, showing different positions of certain parts.

My invention especially relates to dynamite or other highly-explosive shells; and its object is to detonate the shell-charge from any suitable point in the body of the shell by pressure of water upon the head of the shell after it plunges at the end of its flight. In order to accomplish this end and dispense with elaborate mechanical apparatus, such as heretofore employed, my invention consists in providing a tube or tubes or other waterway or pressure-transmitting passage through the shell from head to base, or to that portion near the base where the detonator is located, said tube or tubes being open or capable of opening at the one end for the admission of water and communicating at the other end with plungers or other movable parts that cause the discharge of the detonating compound.

My invention further consists in so constructing such tube or tubular structure that it may be utilized also as a mechanical connection between the collapsible head of the shell and the detonator, and in combining with such tubular structure separate detonators having different time element of action, according as the shell strikes a solid or a water target.

A is the chamber of the shell, filled with high explosive; B, the head, which is sufficiently rigid to resist the blow of immersion, but collapsible by impact upon a solid target, and C the base.

D is an extension of the cylinder, bearing the spiral guiding-blades commonly employed when the projectile is used as a subcaliber.

E is the conducting tube or passage extending substantially from head to base and preferably axial to the shell.

E' are branches of the tube E, designed for the purpose of exposing the open or receiving part of the tube in various directions to insure proper entrance of the water should the shell tend to "tumble" and strike sidewise. The branches E' may, if desired, be arranged in spiral lines of inclination in order to more directly receive the column of water, the rotation given to the shell during its flight causing the mouths of the tubes to describe a spiral path. The radiating structure of the branches E' also serves to insure driving the tube E back by mechanical force during impact of the shell when the collapse of the head B occurs only at one side by reason of glancing off or by similar causes, as above stated. As illustrated in Fig. 1ª, however, the invention may be modified by extending the tube E fully to the front or apex of the shell.

The tube E at its mouth or mouths or other part is provided with a thin diaphragm 1, of water-proof material, that may be easily ruptured, this being designed to exclude any action of air-pressure during flight before the blow of immersion occurs.

Various constructions may be employed also of the detonator F. I have elected to illustrate a form wherein the plungers 2 and hammers 4 move with relation to the detonator-case in a line longitudinal to the shell, whereby they may be respectively actuated

either by an endwise movement of the tube E with relation to the shell or by pressure received through the tube E.

I will first proceed to describe the construction illustrated in Figs. 5 and 6, wherein all the cap-discharging pieces 2 are actuated by pressure from the tube E, constituting plungers, and providing for delay action only. 3 is the detonator-case, having a nipple 5, slid into the tube E and screwed onto the nut 30, which is in turn screwed into the base C of the shell at 6, whereby said case is fixed with relation to the shell, but may be conveniently removed from the socket formed by the envelope 7, which retains the explosive filling of the shell in the chamber A. The case 3 contains cylinders or barrels 8, wherein the plungers 2 fit with packings 40. Surrounding the case 3 there is a cylinder or envelope 9, covering the concaved interior of said case, forming a chamber 10, wherein gun-cotton is placed and will burst the envelopes 9 and 7 when discharged. 13 are fulminate-caps, 15 the channels thereof, and 14 a circular channel filled with slow-burning compound, such as compressed-meal powder. 16 are the detonators proper, consisting of thin tubes fastened into the flange 17 of the case 3 and filled with fulminating-mercury, communicating with the channel 14, as indicated in Fig. 6a. The case 3 also has a central passage 11, communicating with the tube E and communicating with the space 12 at the backs of the hammers. 20 is a locking-collar for retaining the hammers from accidental forward movement. The collar 20 bears elevations and depressions on its periphery, whereby it engages with circumferential grooves 21 in the hammers 2 when in the position shown by Fig. 7 and clears the hammers entirely when rotated to the position shown by Fig. 8. The collar 20 bears a squared hole, through which the squared end of a rotating stem or shaft 22 extends and fits loosely. The passage 11 being round in cross-section, a spline 23 is provided to the stem 22, bearing in a groove 24, to keep it from turning under normal conditions. 25 is a piston upon the stem 22, fitting the cylinder 26, and exposed to pressure applied to the rear of the projectile from the gun-barrel during the act of firing. 28 is a combined compression and torsion spring fastened between the stem 22 and stationary nut 30 of the shell, which tends to rotate the stem and collar 20 from the position in Fig. 7 toward the position in Fig. 8, and also to force the piston 25 out after pressure is released back of it. 31 is a stay-pin of soft metal that is sheared off by the action of said pressure, and 32 an abutment for receiving the piston 25 when thrown back by the spring. The spline 23 is of limited length, so that when the piston and stem 22 are driven back by the spring and complete their stroke the spline 23 will leave its groove 24 and rotate, by means of the spring 28, until it strikes a stop 33 and brings the collar 20 to the position of Fig. 8. This releasing action occurs the instant the shell is fired from the gun, and the gas-pressure from the gun-barrel forces the piston 25 forward the extent of the space 27, shearing the pin 31, and, the spring 28 then releasing the plungers 2, the latter are free, subject to being driven forward upon the fulminate-caps 13 when pressure is applied in rear of them from the tube E by the blow of immersion. The delay element depends on the composition of the slow-burning compound in the channel 14.

Referring now to Figs. 2, 3, and 4, the construction is similar to the foregoing with the exception that the detonator-case 3 is not screwed to the nut 30 in the base of the shell, but in lieu thereof is screwed to the rear end of the tube E and located apart from the nut 30 to permit being driven back; also, that there are but two of the pressure-plungers employed, the other members, such as in Fig. 5, being substituted by the instant-detonator hammers 4, which have no pressure communication with the tube E, but fit the cylinders 8 loosely to act upon the caps 13 by their inert position when the tube E is driven endwise, carrying the case 3 with it. The distance of the case 3 from the nut 30 is equal to or in excess of that of the hammers 4 from the caps 13, whereby the necessary stroke is imparted. The cylinder or envelope 9 remains stationary and the case 3 slides within it when driven back. 50 are latches connected to the stationary nut 30 by flat springs 51, which bear them. The latches engage through the mortises 52 with the recesses 53 in the hammers 4, retaining them from accidental forward movement. The springs 51 permit the latches to be withdrawn, releasing the hammers, when the parts are taken out and the screwed plugs 60, having channel-connection to the instant-detonators 65, are removed. The channels 35, Fig. 4a, are filled with instant-burning composition connecting the detonators 65 with the caps of the hammers 4, and the channels 36 are filled with slow-burning composition connecting the detonators 66 with the caps of the plungers 2. It will be seen, as indicated in Fig. 4, that the hammers 4 are located at a greater radial distance from the axis of the case 3 than are the plungers 2. The hammers 4 are thereby accessible to the removable latches in the mortises, and they also clear the rotary locking-collar 20, which in this instance has but two wings engaging with the plungers 2. The rotation of the two-winged collar is limited by abutment of its wings on the shoulders 61 of the recess in which it revolves.

In operating the blow of immersion will rupture the diaphragm or diaphragms 1, the water entering the tube E in a solid column. A certain amount of air, such as will occupy the tube E and its connecting-passages under normal conditions, acts as an interposed elastic cushion between the water column and the detonating-plungers and other mechanical parts, so that the mechanism will not be sub-

ject to injury or disqualification to act by a too sharp blow of the liquid. As a further security, and to prevent the escape of the air from the tube E through any of the branches E′ should the shell strike sidewise, an additional feature, consisting of an air-tight piston 70, Fig. 1ª, may be interposed between the water and the air, it being capable of sliding throughout the length of the tube E and compressing the air by the momentum of the water column upon the opposite side.

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

1. The combination, with an explosive shell, of a detonating-hammer, and a passage communicating therewith through the body of the shell from an opening in the surface thereof directed so as to receive a column of water when the shell strikes a water target.

2. The combination, with an explosive shell, of a detonator actuated by pressure, and a tube or passage extending through the body of the shell connecting with the detonator and with an opening or openings in the head of the shell directed so as to receive a column of water when the shell strikes a water target.

3. The combination, with an explosive shell, of a detonator actuated by pressure and a tube or passage axial to the shell communicating with the detonator and with an opening or openings in the head of the shell directed so as to receive a column of water when the shell strikes a water-target.

4. The combination, with an explosive shell, of a detonator actuated by pressure, a tube or passage axial to the shell connecting with the detonator, and branches of said tube or passage communicating with openings in various parts of the head of the shell directed so as to receive a column of water when the shell strikes a water target.

5. The combination, with an explosive shell, of a detonator actuated by pressure, a tube or passage axial to the shell connecting with the detonator, and radiating branches of said tube oblique to the axis of the shell communicating with openings in various parts of the head of the shell, substantially as and for the purpose described.

6. The combination, with an explosive shell, of a detonator actuated by pressure, a detonator actuated by impact, and a tubular shaft connecting between said detonator and the head for the shell at an opening or openings thereof, acting both as a transmitter of pressure and of concussion, in the manner described.

7. The combination, with an explosive shell, of a detonator actuated by pressure, a detonator actuated by impact, and a tubular structure consisting of an axial tube and divergent tubes radiating therefrom at an angle connecting between various parts of the head of the shell at openings thereof, and said detonators, said structure acting both as a transmitter of pressure and of longitudinal or lateral concussion, as on the head of the shell.

8. The combination, with an explosive shell, of a detonator actuated by pressure, a tube or passage extending therefrom through the body of the shell to an opening or openings in its surface, and diaphragms interposed in said tube or openings thereof capable of rupture by the blow of immersion, as described.

9. The combination, with an explosive shell, of a detonator actuated by pressure, a tube or passage extending therefrom through the body of the shell to an opening or openings in its surface, and a piston interposed in a cylindrical part of said tube or passage, for the purpose described.

10. The combination, with an explosive shell, of a detonator having fulminate-caps and pressure-actuated plungers opposite them, of a tube or passage communicating with said plungers and with openings in the surface of the shell.

11. The combination, in a pressure-actuated detonator for explosive shells, of a case containing cylinders or barrels, plungers therein, fulminate-caps opposite the plungers connecting to the detonating compound, a passage in the case for admission of pressure to the plungers, an endwise-movable shaft axial to the case, a locking-collar thereon having elevations and depressions in its periphery which rotate in a circle intersecting the path of of the plungers, a piston exposed to pressure applied to the rear of the projectile, and a torsion-spring and spline connected to the shaft, co-operative therewith, as described, to rotate the elevations of said collar out of interposition in the path of the plungers when pressure is applied to the piston.

12. The combination, with an explosive shell, of a movable detonator-case having cylinders or barrels parallel to the axis of the shell, a part of said barrels containing pressure-actuated plungers, and a part thereof containing hammers actuated by impact, fulminate-caps opposite said plungers, and hammers communicating with the detonating compound, and a tube or passage communicating with the backs of said plungers and with openings in the surface of the shell.

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