(No Model.)

S. H. EMMENS.

HIGH EXPLOSIVE SHELL.

No. 400,903. Patented Apr. 9, 1889.

Fig. 2.

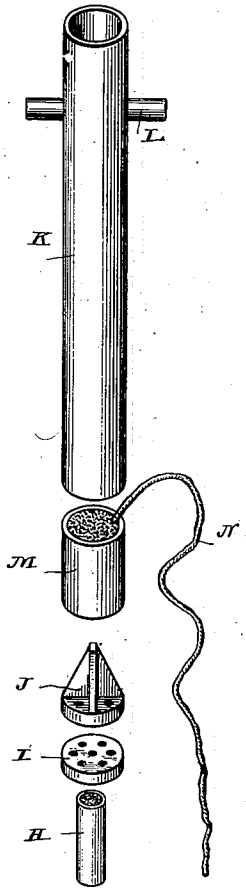


Fig. 1.

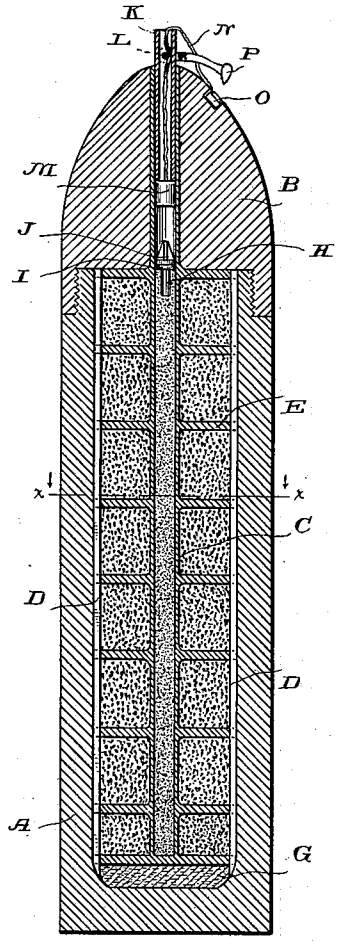


Fig. 3.

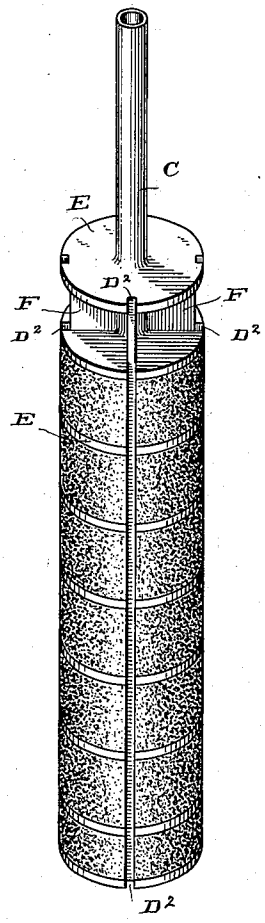


Fig. 4.

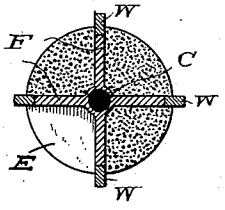


Fig. 1.ˣ

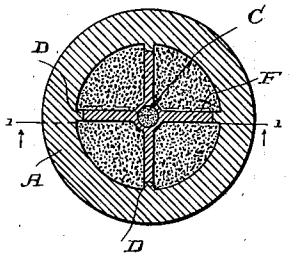
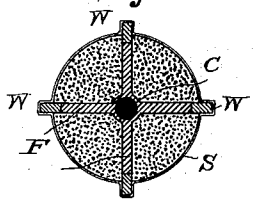


Fig. 5.



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UNITED STATES PATENT OFFICE.

STEPHEN H. EMMENS, OF LONDON, ENGLAND.

HIGH-EXPLOSIVE SHELL.

SPECIFICATION forming part of Letters Patent No. 400,903, dated April 9, 1889.

Application filed July 2, 1888. Serial No. 278,725. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN HENRY EMMENS, a subject of the Queen of Great Britain and Ireland, and a resident of London, in England, temporarily residing at Harrison, in the State of New York, have invented a new and useful Improvement in High-Explosive Shells, of which the following is a specification.

This invention relates to those shells for ordnance in which a hollow cylindrical body contains a charge of high-explosive behind a suitable head.

The present invention consists in certain novel parts and combinations of parts in such shells, whereby I aim to accomplish the following objects—namely, first, to more effectively guard against the explosion of the charge within the gun by preventing at once the crowding of the charge and its torsional displacement within the shell and thus preventing internal friction; second, to facilitate insuring the discharge of the shell at its destination by combining a time-fuse with a contact firing device, so as to meet the contingency of the projectile striking in such a way as not to operate the latter; third, to insure automatically firing the time-fuse when the projectile starts from the gun by a simple device which can be readily examined and tested.

A sheet of drawings accompanies this specification as part thereof. Figure 1 of these drawings represents a longitudinal section of a high-explosive shell illustrating this invention. Fig. $1^{\times}$ represents a cross-section on the line *x x*. Fig. 2 is a perspective view of some of the firing-device parts separated and enlarged. Fig. 3 is a perspective view of the exploding-tube and charge-holder detached, with portions of the main charge removed to expose the construction; and Figs. 4 and 5 are cross-sections of the latter, illustrating the method of charging it.

For convenience some of the parts will be described in the relative positions in which they appear in the drawings.

Like letters of reference indicate corresponding parts in the several figures.

This shell comprises a metallic body part, A, in the form of a hollow cylinder closed at its rear end and open in front, and a head, B, into which the front end of said body part screws and which is perforated axially for the projection of the exploding-tube C. The body A is provided with internal longitudinal ribs, D, which may be more or less numerous than shown in the drawings. The bore of the head B is cylindrical.

The exploding-tube C carries a number of diaphragms, E, notched so as to engage with the ribs D, but otherwise circular, so as to closely fit within the shell-body. These diaphragms are connected by longitudinal radial webs F, of the same thickness as the ribs D and coinciding therewith when the parts are assembled, as shown in Figs. 1 and $1^{\times}$.

The distance of the front or uppermost of the diaphragms E from the rear end of the tube C is a little less than the interior depth of the shell-body A, so that when such uppermost diaphragm is flush with the front end of the body, as seen in Fig. 1, there is a space, G, between the lowermost diaphragm and the bottom of the body-chamber.

The shell is charged in the manner illustrated by Figs. 3, 4, and 5, as follows: First taking the combined exploding-tube and charge-holder formed by said tube C, diaphragms E, and webs F, in an empty condition, each radial cavity therein is filled tightly with Emmensite or other high explosive to the full diameter of the diaphragms, grooves D^2, Fig. 3, fitted to the internal ribs, D, being formed by wooden laths, W, Figs. 4 and 5, temporarily inserted in the notches of the diaphragms. The whole is then dipped in melted paraffine-wax and coated with a skin, S, Fig. 5, of this material. The interior of the shell-body A is also filled with melted paraffine-wax, which is then poured out, enough being left in to fill the space G with solidified wax. The cylindrical charge, Fig. 5, formed by the tube C and its surrounding diaphragms, webs, and fillings of explosive, is then freed from the wooden laths, W, and inserted in the shell-body A, and the head B is screwed down tightly, so as to bear upon the uppermost diaphragm and press the charge firmly down upon the wax in the space G. The tube C is then filled with a bursting-charge of Emmensite or other high explosive to about the level of the uppermost diaphragm, and a detonator, H,

Figs. 1 and 2, is inserted in the top of such bursting-charge. A perforated wad, I, is pressed tightly down on the bursting-charge, and on this is placed a loose perforated plunger, J. A striking-tube, K, is inserted within the upper end of the tube C, and is furnished with a cross-pin, L, which keeps its inner extremity at any desired distance from said plunger J and its outer extremity at any desired distance from the nose of the head B. A detonator, M, is interposed between the inner end of the striking-tube and said plunger, and a time-fuse, N, attached to said detonator M, is stretched to another detonator, O, which is held in an external cavity in the head B. A hammer, P, pivoted on said pin L, is finally adjusted so as to strike the external detonator O when the shell moves suddenly forward. The shell is then ready to be placed in the gun. When the gun is fired, the crowding of the charge by the forward motion of the shell and the internal friction caused by the movement of rotation are both prevented by the interaction of the diaphragms, webs, and ribs, aided in some measure by the filling and coatings of paraffine-wax. When the shell strikes the mark "end on," the pin L breaks and the striking-tube K is thrust suddenly into the tube C, compressing the air between the detonator M and the bursting charge, while inertia causes the plunger J to fly forcibly forward against said detonator M. Both heat and percussion are thus availed of to insure the explosion of the detonators M and I, and by regulating the extent to which the striking-tube projects beyond the nose of the head B the shell may be caused to explode just in front of the mark, if desired. If the shell should not strike end on, or if it falls into mud or other soft substance, it will be exploded by the firing of the detonator M by the time-fuse N, the latter having been fired by the explosion of the detonator O by the hammer P at the discharge of the gun, as aforesaid. The time-fuse may obviously be of any desired length and adjusted as to duration of burning in customary manner. When the shell explodes, the division of its walls into thick and thin portions determines an equal distribution of lines of fracture, and the bursting-tube C, with its diaphragms and webs, breaks up into a destructive hail of fragments.

I am aware that United States Patent No. 382,223 has been issued to J. W. Graydon for a shell for explosives in which the charge is divided up into separate portions by transverse diaphragms and a central firing-tube. In my shell such diaphragms are supplemented by radial webs, internal ribs in the shell-body, and grooves in the main charge engaging with the latter, whereby rotatory friction within the shell is prevented, as aforesaid.

I am also aware of the peculiarly-combined time-fuse and contact firing device set forth in United States Patent No. 379,025, issued to the assignee of Thorsten Nordenfelt. The same general result is accomplished in my firing devices by different means, with the addition of the positive intrusion of the striking-tube to insure explosion in the event of endwise contact, which is lacking in the Nordenfelt device.

I claim as my invention and desire to patent under this specification—

1. In a shell for high-explosives, the combination, substantially as hereinbefore specified, of a hollow cylindrical shell-body having internal longitudinal ribs, a charge-holder comprising transverse diaphragms notched to coact with said ribs, and radial webs between said diaphragms coinciding with the ribs for preventing internal friction, in the manner set forth.

2. In a shell for high-explosives, the combination, with an axial bursting-tube and its charge, of a detonator in front of said charge, a flexible time-fuse attached to said detonator, and an inwardly-yielding striking-tube, through which said time-fuse extends, arranged in front of said detonator and protruding at the nose of the shell, substantially as hereinbefore specified.

3. In a shell for high-explosives, the combination, with an axial bursting-tube and its charge, of an anvil-plunger in front of the latter, a detonator in front of said plunger having a flexible time-fuse attached thereto, a striking-tube through which the time-fuse extends, provided with a cross-pin to limit its intrusion in advance of contact, an external detonator to which said time-fuse is connected, and an inertia-actuated firing-hammer pivoted on said cross-pin, substantially as hereinbefore specified.

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HUGH HENRY.