(No Model.)

J. W. GRAYDON.

HIGH EXPLOSIVE SHELL.

No. 382,225. Patented May 1, 1888.

Fig. 1.

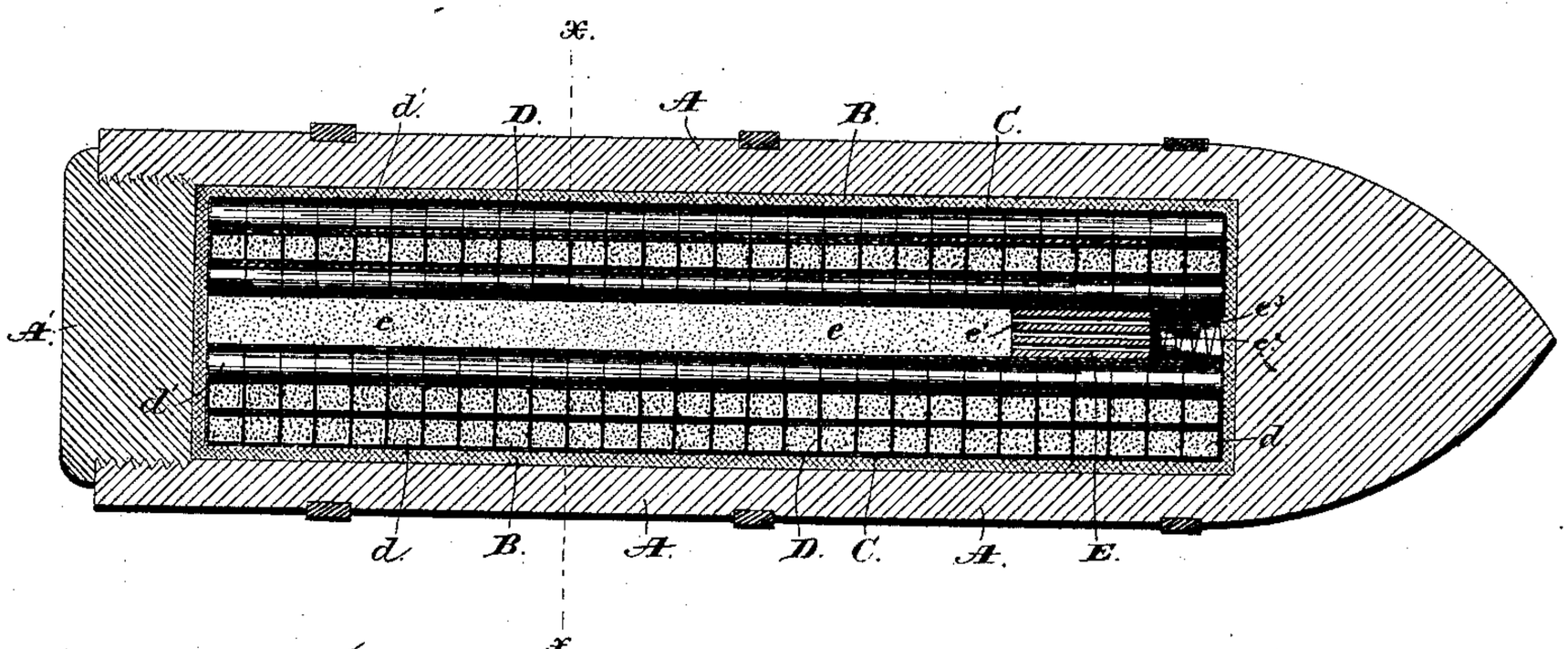


Fig. 6.

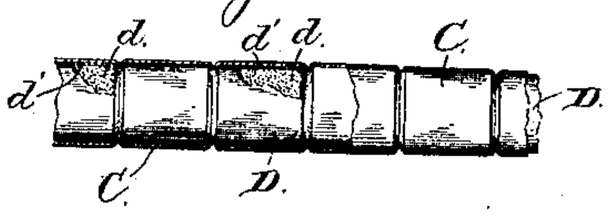


Fig. 2.

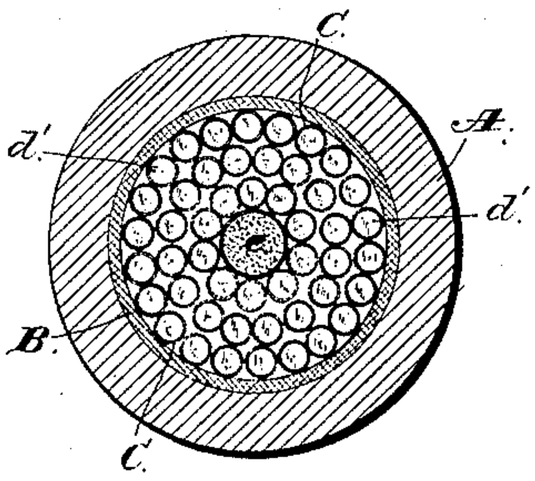


Fig. 7.

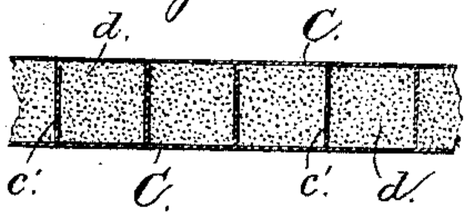


Fig. 4.

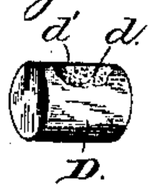
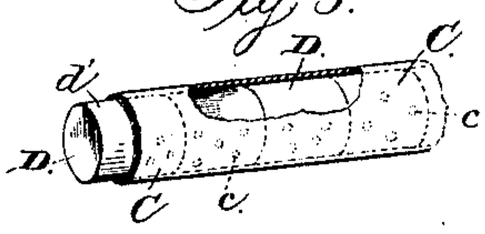


Fig. 5.

Fig. 3.



Witnesses:
Jas. E. Hutchinson.
Henry C. Hazard.

Inventor.
James W. Graydon.
by Pindle and Russell
his Attorneys.

UNITED STATES PATENT OFFICE.

JAMES W. GRAYDON, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO THE GRAYDON DYNAMITE PROJECTILE CARTRIDGE AND HIGH EXPLOSIVE COMPANY, OF SAME PLACE.

HIGH-EXPLOSIVE SHELL.

SPECIFICATION forming part of Letters Patent No. 382,225, dated May 1, 1888.

Application filed February 15, 1888. Serial No. 264,064. (No model.)

To all whom it may concern:

Be it known that I, JAMES W. GRAYDON, of Washington, in the District of Columbia, have invented certain new and useful Improvements in High-Explosive Shells; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 shows a longitudinal section of a shell loaded in accordance with my invention; Fig. 2, a transverse section of the same on line *x x* of Fig. 1; Fig. 3, a detail perspective view of a portion of one of the pellet-holding tubes with a portion of its side broken away to show the pellets within it; Fig. 4, a detail perspective view of one of the pellets with a portion of its envelope broken away; Fig. 5, a similar view of a different form of pellet; Fig. 6, a detail view in elevation, showing a modification of my invention; and Fig. 7, a detail sectional view of a tube and its contents, showing a still further modification.

Letters of like name and kind refer to like parts in each of the figures.

In my applications Nos. 237,448, 242,520, and 264,063 for United States Patents I have shown and described certain ways and means for securing safety against premature explosion of high-explosive shells when the same are fired from guns with powder.

The essential idea of the invention as covered by my said applications is to separate the charge of explosive in the shells into a large number of small portions, and to segregate such portions of explosive from each other by inclosing-envelopes. By thus making the mass of the explosive up into small pellets, each pellet consisting of a small amount of the explosive with an inclosing-envelope, I have found that I prevent the concentration or collection of the nitro-glycerine or other highly explosive and sensitive component part of the explosive used, which takes place when a mass of dynamite or analogous high explosive is subjected to pressure or shock. It is this collection or concentration of the extremely sensitive nitro-glycerine from dynamite, under the shock and pressure of starting the projectile in a gun with powder, that has made it impossible to use powder with safety as the propelling-charge of dynamite shells, as heretofore loaded. In said other applications I also show and describe means for preventing heat from whatever source, whether from the flame of the propelling-charge or from friction, or compression of the air penetrating to the explosive of the shell-charge. As shown, this means of protection from heat consists of a lining or casing within the shell made of asbestus or other material non-conductive of heat, entirely inclosing the charge.

In my invention as covered in the present application I use the same idea of dividing the shell-charge up into small portions, and separating such portions from each other by envelopes. I also prefer to make use of the non-conducting lining for the shell or envelope for the charge.

In the drawings, A designates the casing of the shell, which can be of any of the well-known forms of armor-piercing or other shells for muzzle-loading or breech-loading guns. All that is necessary is that there shall be some opening through which the interior of the shell-chamber can be got at. As shown in the drawings, the charge-chamber is closed at its rear end by the ordinary screw-plug, A′. Within such chamber, which is preferably cylindrical, but not necessarily so, fits the charge-inclosing envelope B, which, like the shell-lining or charge-envelope shown and described in my other applications referred to, can be made of asbestus or other material non-conductive of heat. Within this envelope are the longitudinally-arranged tubes C C, packed closely alongside of each other. Such tubes can be of material non-conductive of heat, of metal, paper-board, or any other desired material.

While I prefer to make them of non-conducting substances—as asbestus, paper-board, or wood—I do not limit myself thereto.

Whatever the material that is used for the tubes, it should be such as will not be liable to crumble under the shock of starting the shell from the gun or to strike sparks if one tube should rub on another. Each tube C is filled with a series of explosive pellets, D D,

each composed of a small portion, *d*, of dynamite or other high explosive inclosed in an envelope, *d'*.

In the drawings I show two forms of pellet—a cylindrical one in Fig. 4 and a round or spherical one in Fig. 5. Whichever form is used, the pellet should be of a diameter equal to the bore of the tube, so as to fit closely in the latter. I prefer to have the pellets cylindrical, so that a series of them placed end to end will fill the entire space within the tube. The envelopes of the pellets can be flexible, as of paper or cloth treated with paraffine, or inflexible, as of papier-maché, pasteboard, wood, or other stiff material. For the cylindrical pellets I prefer to use for the envelope material which is both stiff or rigid and non-conductive of heat. For the round form of pellet a flexible covering—such as paper or cloth treated with paraffine—can be used to advantage. Where the tubes C C exactly fill the space within the envelope B from end to end of the same, they need not have closed ends; but I prefer to close over both ends of each tube when it has been loaded. As indicated in dotted lines in Fig. 3, each tube can be provided with a number of perforations, *c c*, to admit the passage of fire from the charge-exploding fuse E. As shown, such fuse is a contact one, consisting of a tube filled with powder or quick explosive, *e*, and a plunger, *e'*, near the front end of the tube, provided with a percussion-primer, e^2, and normally held rearward by a spring, e^3. This form of fuse is, however, merely shown as an example of what might be used.

Instead, any desired fuse, whether it be a time or contact one provided with a body of powder or other explosive to shatter the pellets and fire their contents, can be employed. The pellets with which the tubes are loaded can be packed in them without attachment to the tube-sides; but I contemplate fastening them to the tubes by glue, cement, or other means, so that each one shall be separately and independently supported by the tube. This construction would keep each pellet free of any pressure caused by the weight of the others. If desired, the separate and independent supporting of each pellet can be secured by crimping the tube or otherwise forming shoulders within the tube, which will hold the pellets from any longitudinal movement within the tube.

With the pellets packed and inclosed in the tubes, as described and shown, there is no chance of any friction of the different portions of explosive against one another or against the walls of the shell-chamber, while with the whole charge of explosive divided up into pellets, as set forth, there is no danger of exploding the contents of the shell by direct shock, as when said shell is fired from a gun by a powder-charge. With the pellets attached to or supported against longitudinal movement by the walls of the respective tubes, the weight of the series of pellets in any one tube is not brought upon the rear pellets of such series when the shell is started in motion.

A modification of the construction where the pellets of explosive in a tube are supported independently of each other would be a tube in which, as shown in Fig. 7, there are cross-partitions *c' c'*, dividing the mass of explosive within the tube up into a number of small separate portions.

Having thus described my invention, what I claim is—

1. In a shell, a series of frangible tubes each containing a portion of the shell-bursting charge, with the contents of each tube divided up into small parts held normally separate from each other, substantially as and for the purpose specified.

2. In a shell, in combination with the frangible tubes, each loaded with a charge of high explosive divided up into small portions by separating media, a fuse provided with a quantity of explosive to shatter such separating media and fire the whole shell-charge, substantially as and for the purpose shown.

3. In a shell, the bursting-charge composed of high-explosive pellets, in combination with a series of frangible tubes longitudinally arranged within the shell-chamber, each tube containing a number of the explosive pellets, substantially as and for the purpose described.

4. In a shell, longitudinal tubes packed side by side within the shell-chamber, each loaded with high-explosive pellets consisting of small portions of high explosive inclosed in rigid envelopes, substantially as and for the purpose described.

5. In a shell, in combination with the series of tubes in the shell-chamber, a series of high-explosive pellets in each tube supported by the walls of the tube against longitudinal movement therein, substantially as and for the purpose specified.

6. In a shell, tubes made of material non-conductive of heat, each inclosing a series of high-explosive pellets composed of portions of high explosives inclosed in envelopes, substantially as and for the purpose set forth.

7. In a shell, the longitudinal tubes of material non-conductive of heat arranged side by side within the shell-chamber, and each loaded with a number of high-explosive pellets consisting of small portions of explosive inclosed in envelopes, substantially as and for the purpose described.

8. In a shell, in combination with the series of longitudinal tubes packed side by side within the shell-chamber, the series of high-explosive pellets in each tube, each of such size as to fit the tube and composed of a small portion of dynamite inclosed in an envelope, and a fuse provided with a quantity of explosive to shatter the tubes and pellet-envelopes and fire the whole shell-charge, substantially as and for the purpose specified.

9. In a shell, in combination with the longitudinal tubes arranged parallel with each other and each loaded with a number of high-

explosive pellets, a casing of material non conductive of heat inclosing the bundle of tubes, substantially as and for the purpose shown.

10. In a shell, in combination with the shell-casing and the lining therein made non-conductive of heat, the series of longitudinal tubes arranged side by side within the shell-chamber, likewise made of material non-conductive of heat, and each loaded with high explosive separated into small portions by suitable dividing media, substantially as and for the purpose set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 9th day of February, A. D. 1888.

JAMES W. GRAYDON.

Witnesses:
J. C. PRATT,
A. S. PRATT.