April 17, 1945. C. B. FERREL 2,373,883

SHELL STRUCTURE

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Fig 1

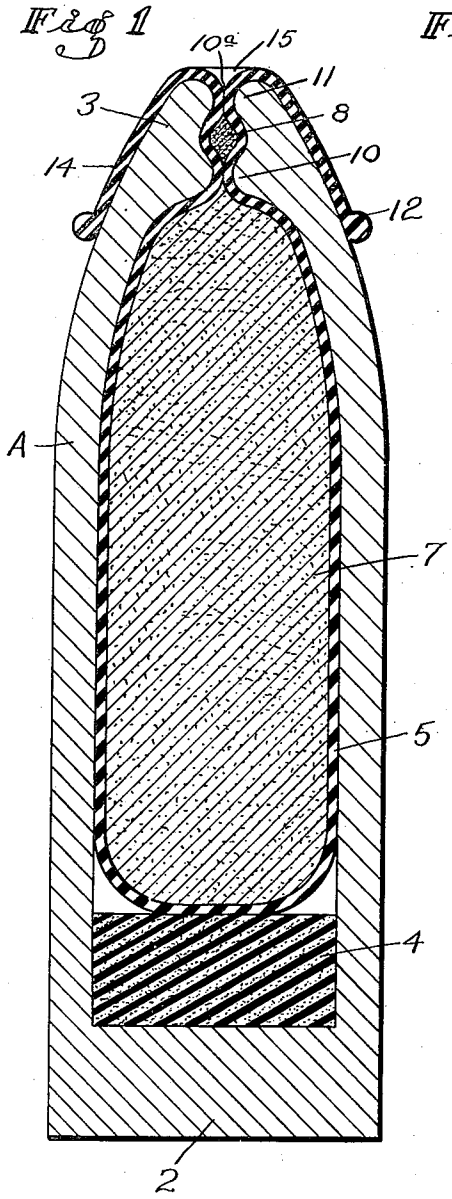
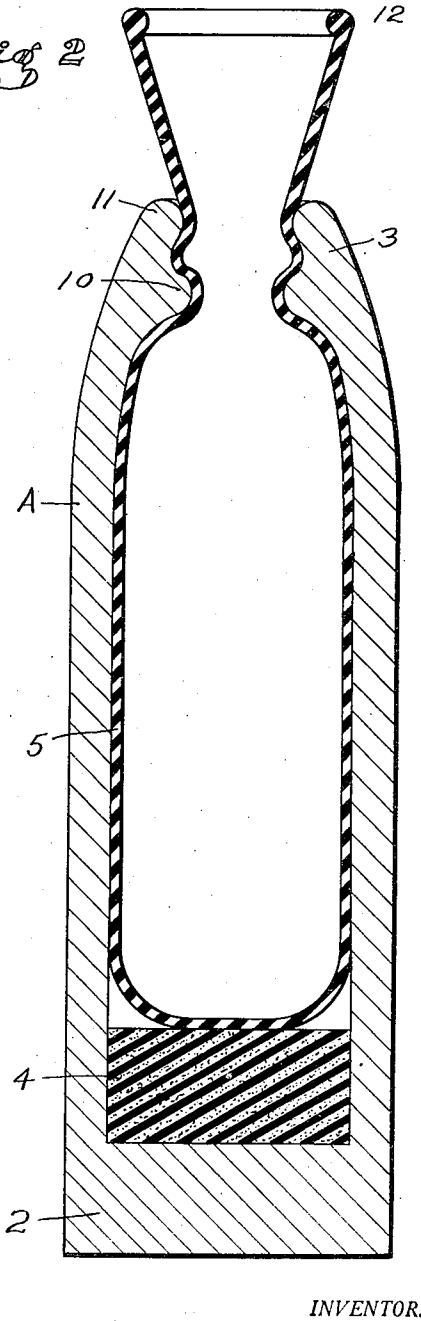


Fig 2



INVENTOR.
CLYDE B. FERREL
BY
Eastberg & Roemer
ATTORNEYS.

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SHELL STRUCTURE

Clyde B. Ferrel, San Francisco, Calif.

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4 Claims. (Cl. 102—56)

This invention relates to a shell structure and to a means of firing or detonating the same.

The object of the present invention is generally to improve and simplify the construction and operation of explosive shells, bombs, and the like, and in particular to provide a simple means of firing or detonating the same the instant a target fired upon is struck.

The shell structure is shown by way of illustration in the accompanying drawing, in which:

Fig. 1 is a central, longitudinal section of the shell, and

Fig. 2 is a similar section showing the manner in which the shell is loaded.

There are two general methods employed to control the time lag between the firing of a shell or bomb and the explosion thereof. One method requires the use of time fuses or clock-actuated timing devices or the like, while the other method employs a firing pin which is actuated by impact with the target. This latter type, while extensively used, depends upon a rather heavy impact in order to detonate the shell, and as such is not dependable when cannon are used on planes to shell enemy planes, as experience shows that the flimsy structure of the wings and fuselage of a plane does not give enough resistance or impact to detonate the explosive charge, with the result that the shell may pass through without exploding.

The purpose of this invention is to provide a means of detonating a shell or bomb which is so sensitive to impact that even the fabric, ply-wood or the thin sheet metal covering of an airplane wing or fuselage is more than sufficient to insure instant detonation of the explosive charge of the shell.

The structure of the shell and the means whereby it is detonated will now be described.

In the drawing, A indicates the body of the shell, 2 the rear end thereof, and 3 the pointed forward end or nose. Formed within the shell is a chamber at the inner end of which is placed a resilient cushioning pad 4 which is made of sponge rubber or the like, and placed within the chamber and extending through the open forward end of the shell (see Fig. 2) is a rubber bag 5 which is filled with T. N. T., nitro-glycerine jell, or any other suitable explosive substance. The outer open end of the bag has a bead 12 formed thereon, and the function thereof will hereinafter be described.

A predetermined or measured amount of, for instance, nitro-glycerine jell is placed in the bag 5 either before or after it is placed in the chamber of the shell. The front end of the shell is opened at the time (see Fig. 2) and is then closed, as shown in Fig. 1, to confine the explosive and at the same time to divide the explosive into a main charge 7 and a primary or detonating charge 8, this division being accomplished by forming an annular raised surface within the chamber adjacent the front end at the point indicated at 10, which at the same time forms a small outer chamber to receive the charge 8, this chamber being in turn closed by the outermost end of the shell or the lip indicated at 11. The closing of the open end of the shell may be accomplished by forming dies, by spinning operation, or otherwise. After the front or open end of the shell is closed, the projecting end of the rubber bag is folded back over the point of the shell, as indicated at 14, with the bead 12 rearmost.

In actual practice, the shell is fired from the cannon in any suitable manner. During its flight toward the target it travels at a comparatively high velocity, or at least at such a velocity that as it passes through the air the force or pressure of the air is great enough to exert a sufficient pull on the rearwardly extending portion 14 and the bead 12 to pull the portion of the bag containing the charge 8 outwardly, thereby forcing a portion of the nitro-glycerine into a recess 15 formed in the very nose of the shell, thus exposing the nitro-glycerine and placing it in front of the nose where it is partially vaporized by the air to form a layer of gas which is so sensitive to impact that the moment a target is struck it is detonated, with the result that it opens the nose of the shell sufficiently to simultaneously detonate the main charge 7.

The bead 12 is important as it offers more resistance to the air than the remaining portion. Thus by increasing or decreasing the thickness of the bead, practically any pull required may be obtained, and transfer of the nitro-glycerine from the charge 8 to the recess 15 during the flight of the shell is insured.

Nitro-glycerine is sensitive to shock, and this is the reason why the pad 4 is employed; that is, it cushions the main charge 7 at the time the shell is discharged from the cannon. The cushioning effect must obviously be sufficient to prevent detonation by shock.

It was previously stated that the front end of the shell was open during loading, as shown in Fig. 2, to permit insertion of the rubber bag and the filling thereof with a desired explosive, and that thereafter either by forming dies, by a spinning operation, or otherwise, the nose was forced

inwardly or closed so as to assume the position shown in Fig. 1. In this operation the main charge of explosive, indicated at 7, is sealed off at the point 10 and the primary or detonating charge at the point 10a. This latter closure is such that the rubber is compressed sufficiently to seal and retain the charge 8, but when a pull is exerted on the rubber during flight, a sufficient quantity of the nitro-glycerine will ooze outwardly and collect in the recess 15 to function as heretofore described. In other words, compression of the rubber when the lip 11 is forced inwardly is sufficient to seal and retain the charge 8, but the pressure is insufficient to prevent stretching or pulling outwardly of the rubber to decrease the area of the chamber 8 and thereby force the nitro-glycerine into the recess 15. Both the charges 7 and 8 may be nitro-glycerine, but the charge 7 may also be replaced by T. N. T. or any other detonating or burning explosive, though nitro-glycerine is essential as far as the charge 8 is concerned as it must be of a jell or liquid-like consistency in order to permit it to ooze out and collect in the recess 15 where it may be partially vaporized by the air to form a layer of gas which is highly sensitive to impact.

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

1. A shell of the character described comprising, an elongated cylindrical body portion terminating in a pointed nose, said body having a chamber formed therein containing a main explosive charge and a detonating charge, said detonating charge being placed in the nose forward of the main charge, and said detonating charge being composed of a semi-liquid substance, said nose having a recess formed on the exterior surface in front of the detonating charge, and means for transferring the liquid detonating substance during flight of the shell to the recess to vaporize and convert the liquid detonating substance into a gas which is readily detonated upon impact with the target.

2. An explosive shell terminating in a pointed nose and having a recess formed in the exterior surface of the nose, a detonating charge positioned rearwardly of said recess and in communication therewith, said detonating charge being composed of a liquid-like substance, and means actuated by air drag during flight of the shell for transferring the liquid detonating substance into the recess to cause vaporization thereof with a formation of gas which is readily detonated upon impact with the target.

3. An explosive shell terminating in a pointed nose and having a recess formed in the exterior surface of the nose, said shell having a chamber formed therein rearwardly of said recess, a rubber bag in said chamber and having its open end extending through the recess and folded back over the nose of the shell to form an air drag, a semi-liquid-like detonating substance filling the bag, means normally retaining said liquid substance against escape, but said means permitting transfer of the liquid substance from the chamber to the recess when the shell is in flight, and a bead on the folded back portion of the rubber bag whereby an air drag is produced to exert a sufficient pull on the bag to contract it and force the liquid-like detonating substance into the recess to cause vaporization thereof with a formation of a gas which is readily detonated upon impact of the target.

4. A shell of the character described comprising, an elongated body portion tapered at the forward end to form a nose, said body having a chamber formed therein and opening through the nose, a rubber bag forming a lining for said chamber and having its open end extending beyond the nose and folded back over the nose to form an air drag, a main charge of explosive contained in the bag, a second charge consisting of a semi-liquid detonating substance also contained in the bag forward of the main charge, means normally separating the two charges, an annular compressible lip in the nose of the shell compressing the rubber forward of the detonating charge to normally retain it against escape, and a recess in the nose of the shell into which the detonating charge is transferred by air drag upon the folded back rubber when the shell is in flight.

CLYDE B. FERREL.