

E. GATHMANN.
HIGH EXPLOSIVE SHELL.

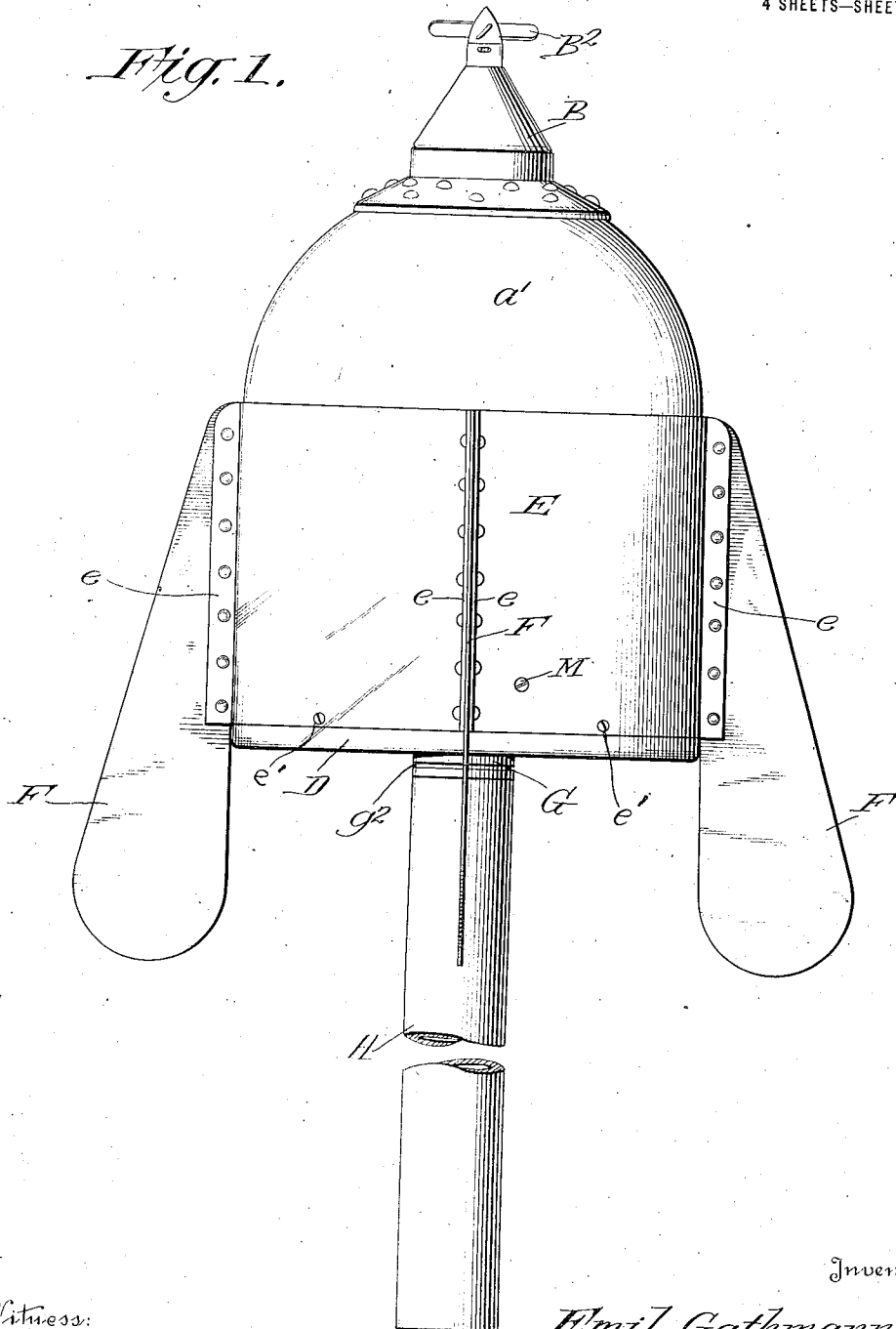
APPLICATION FILED MAY 11, 1917. RENEWED JULY 21, 1919.

1,316,296.

Patented Sept. 16, 1919.

4 SHEETS—SHEET 1.

Fig. 1.



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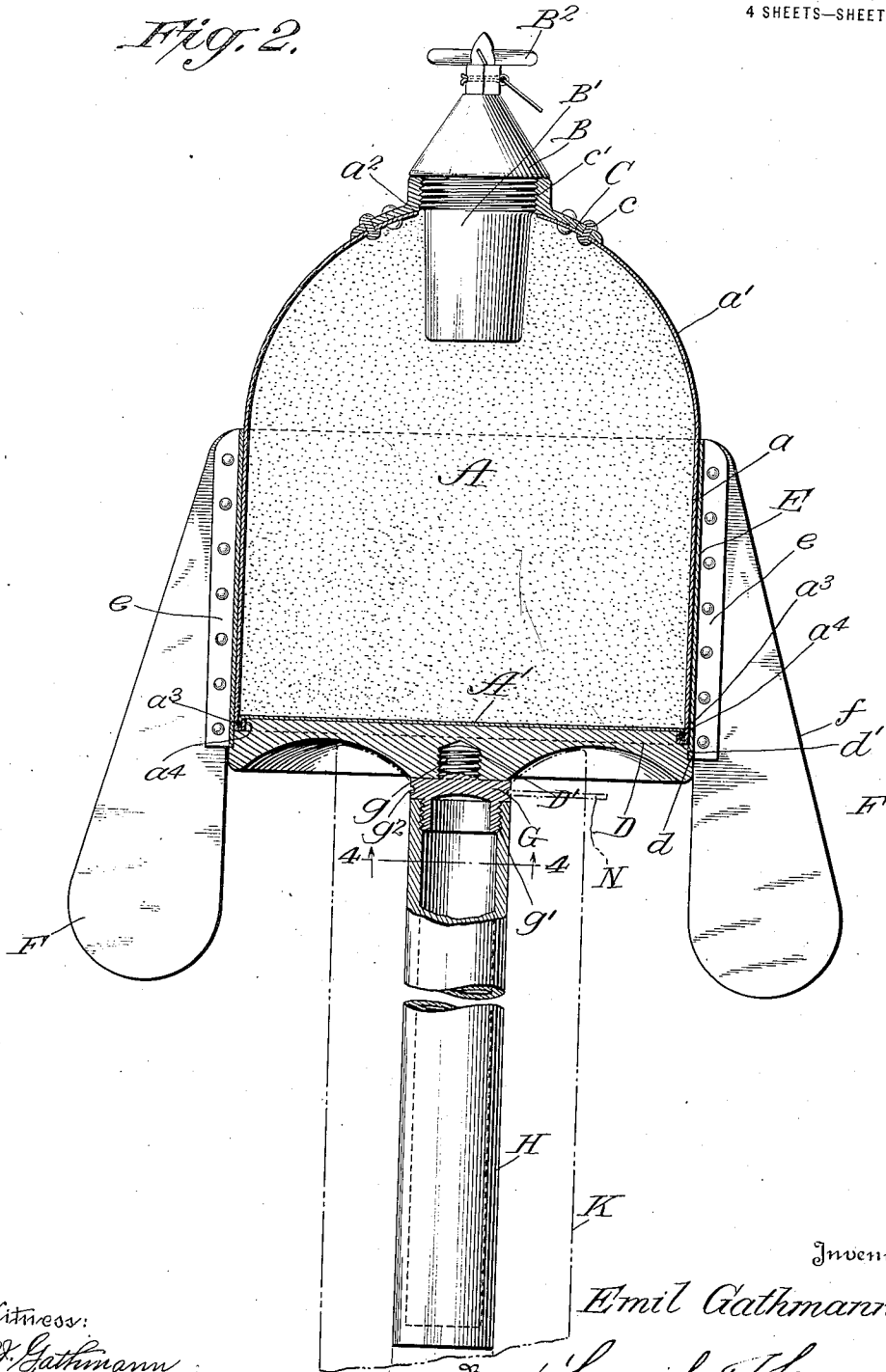
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4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig. 3.

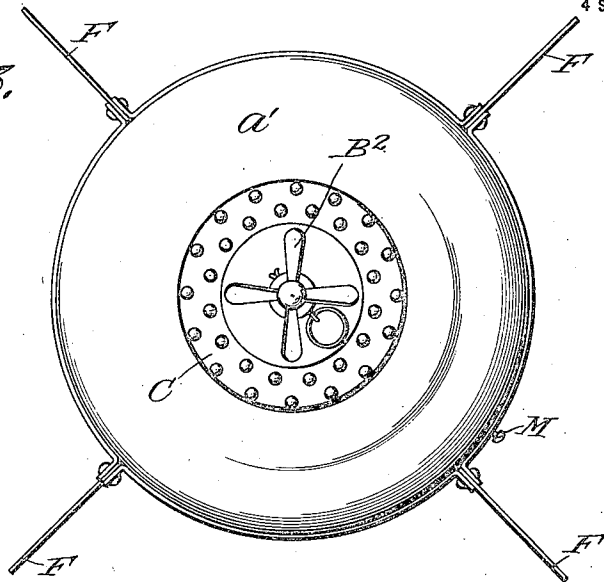
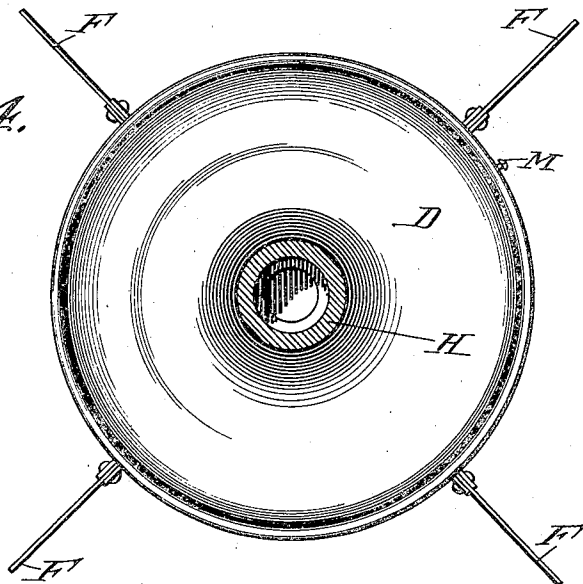


Fig. 4.



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4 SHEETS—SHEET 4.

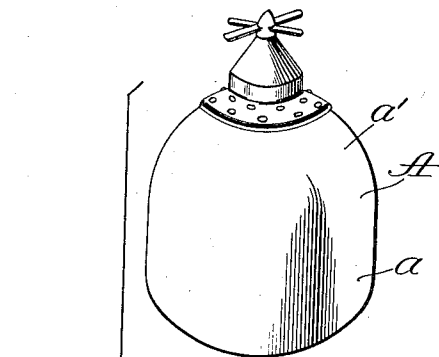


Fig. 5.

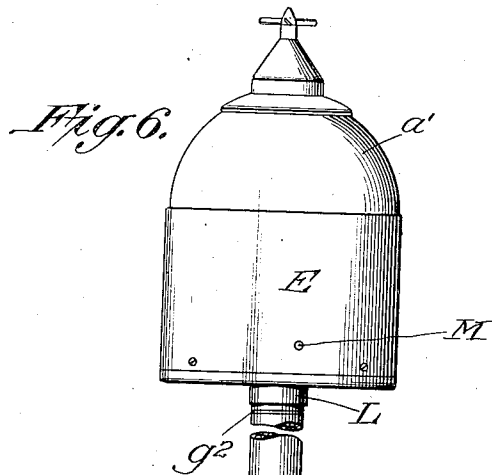
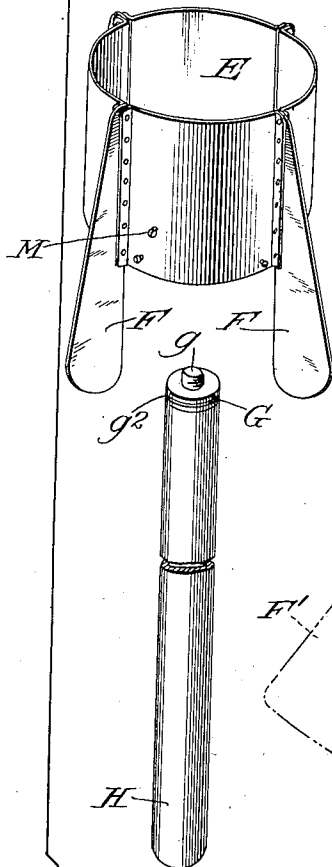
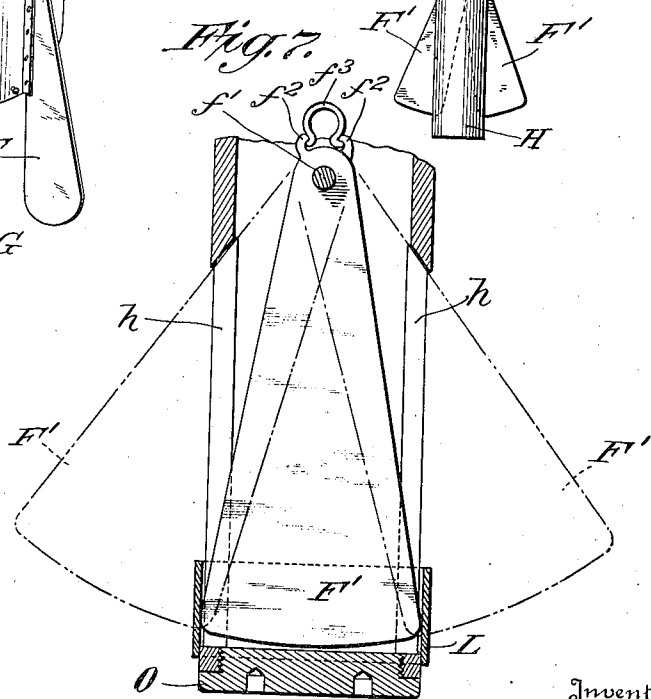


Fig. 7.



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HIGH-EXPLOSIVE SHELL.

1,316,296.

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To all whom it may concern:

Be it known that I, EMIL GATHMANN, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in High-Explosive Shells; and I do hereby declare the following to be a full, clear, and exact description of the same when taken in connection with the drawings accompanying this specification.

The general object of the present invention is the provision of an improved shell of large caliber and especially adapted to carry a large charge of high explosive, the shell being of the type known as "torpedo shells" or "aerial torpedoes". A shell of the type contemplated by the present invention is intended to be fired from a light smooth bore gun of sub-caliber diameter relatively to the bursting chamber of the shell and with a relatively low initial velocity, whereby the gun may be mounted on a relatively light mount and on an ordinary merchant marine vessel. Projecting rearwardly from the bursting chamber of the shell, is a stem or tail piece of sub-caliber diameter which enters the bore of the gun, when the shell is placed in position from the muzzle end of the gun. The firing or propelling charge is secured in a pressed cartridge case, in accordance with the usual practice, and is loaded into the gun through the breech end thereof.

An armament of this character is designed mainly for protection against submarine torpedo boats and mine fields. It is demonstrable that a shell of the character described is infinitely more effective than a shell of small caliber having a high initial velocity, for the reason that a large shell, when exploded in the vicinity of a submarine, for example, produces highly destructive effects, whereas a small shell, must score a direct hit, in order to produce destructive effects.

A more detailed object is to so construct the parts of the shell that they may be stored in disassembled relation and readily assembled for firing, when occasion demands. For example, the chamber carrying the high explosive may be detached from other parts of the shell, permitting storage of the explosives in places especially designed for

the purpose, and storage of the other parts in any other convenient places.

A full understanding of the invention will be attained from the ensuing detailed description when taken in connection with the accompanying drawings, which illustrate a structural embodiment of the invention in a preferred form. The novel features of the invention will be particularly pointed out and specified in the claims at the end of the specification.

In the drawings:—

Figure 1 is a longitudinal elevational view of a high explosive shell of large caliber constructed in accordance with the present improvements.

Fig. 2 is a medial section of the same, partly in elevation.

Fig. 3 is a front end elevation of the shell.

Fig. 4 is a transverse sectional elevation taken in a plane indicated by the line 4—4 of Fig. 2.

Fig. 5 is a perspective view showing the parts of the shell in disassembled relation.

Fig. 6 is a longitudinal elevation of a modified form of shell.

Fig. 7 is a fragmentary detailed view of the modification illustrated in Fig. 6.

Like characters of reference in the several figures indicate the same parts.

As shown, the bursting chamber of the shell is formed separately from the stem or tail piece, and other parts, and consists of a container A of large caliber adapted to contain a large charge of high explosive, for example, approximately fifty pounds of trinitrotoluol, which is one of the most destructive compounds known to science. The container may have a spun or drawn brass wall comparatively thin in cross section, and the main body portion *a* is made substantially cylindrical, as shown. The front end *a'* of the container is made somewhat conical in shape, in accordance with the usual practice and the tip or apex thereof is provided with a hole *a²* adapted to receive the priming charge chamber B' of a safety detonator or fuse mechanism B, which may be of the type described and illustrated in my co-pending application. Fuse mechanism of this type embodies vanes or wings B² which are rotated by the pressure or resistance of

- the air to the flight of the shell and the rotation of said vanes is utilized to move a detonating charge and percussion cap into proximity to the priming charge B' and the percussion cap into position to be engaged by a firing hammer on impact of the shell. The details of construction of the detonator, however, form no part of the present improvements.
- For securing the detonator to the bursting chamber or container A, an adapter C is provided, said adapter consisting of a suitable brass casting machined to fit over the tip of the container A and secured thereto by rivets *c*. The adapter is provided with a threaded hole *c'* into which is screwed the threaded portion of the priming charge chamber B' of the detonator, as shown in Fig. 2.
- At its rear end, the container A for the explosive charge is closed by a lateral closure plate A', preferably constructed of the same material as the container and of substantially the same thickness in cross section. Plate A' is formed at its edge with a rearwardly projecting annular flange or crimped portion *a*³, and the wall *a* of the container at the rear end thereof is formed with a forwardly projecting annular flange *a*⁴ which is rolled over the edge of flange *a*³ to hold the closure plate A' in position on the container A. Preferably, the entire inner wall surface of the container is coated with a neutral lacquer of a melting point higher than trinitrotoluol and both sides of the closure plate A' are similarly coated.
- The bursting charge of high explosive in the container A is, in accordance with the invention, intended to be fired from a light smooth-bore gun of sub-caliber diameter, and, for this purpose, the container is supported on the stem or tail piece which enters the bore of the gun, by means of a supporting means or cage which receives the container, said cage being constructed in the following manner: The base or shock plate D is constructed of a homogeneous annular steel forging comparatively thick in cross section to withstand the shock produced by the firing pressure from the gun. Formed on the edge of the shock plate is an annular recess *d*, into which is fitted a cylindrical member E, secured to the shock plate D by means of a plurality of screws *e'*. The cylindrical member E is of a caliber diameter corresponding substantially to the explosive charge container A, whereby the latter may be detachably fitted into the cylindrical member E by a relative axial movement of the container and cylindrical member. When the container is mounted in the cylindrical member, the annular flanged portion of the container fits into an annular recess *d'* formed in the front face of the shock plate D, said recess being concentric with the longitudinal axis of the shell. The container A may be locked by suitable means M to the cylindrical member E.
- In the form of the invention shown in Figs. 1 to 5 inclusive, the cylindrical member E is formed of a plurality of segments E', preferably four in number, and the longitudinal edges of each segment are provided with lateral flanges *e*, which are bolted or riveted to the corresponding flanges of adjacent segments. Secured between each adjacent pair of flanges is a vane F constructed preferably of spring steel and lying in a plane substantially parallel with the longitudinal axis of the assembled shell. As shown in Fig. 3, the vanes F are four in number and the outer edges *f* of the vanes incline or converge toward the tip or apex of the assembled shell. The vanes assist in maintaining the shell in its proper course toward its objective, by causing the shell to travel point-on in a manner similar to that of an arrow.
- Centrally located in the rear face of the shock plate D is a threaded socket D', the longitudinal axis of which coincides with the longitudinal axis of the assembled shell. Screwed in the socket D' is the head *g* of a coupling piece G, which is further provided with a threaded flange *g'* projecting from the rear face of the coupling piece and screwed into the forward end of a stem H of sub-caliber diameter relatively to the cylindrical member and bursting chamber of the shell. In this manner the stem H may be detachably connected to the shock plate D, the stem projecting rearwardly therefrom and lying concentric with the longitudinal axis of the assembled shell. The stem is adapted to be loaded into the muzzle end of a gun K of sub-caliber diameter, as indicated by the dot-and-dash line of Fig. 2, and when the assembled shell is so positioned in the gun, the bursting chamber and cage are located beyond the muzzle of the gun. Both the coupling piece and the stem are preferably constructed of machined steel forgings having a high tensile strength.
- In order to augment the effect of firing pressure on the shell at the moment of discharge of the shell from the gun, and to increase the initial velocity which is necessarily relatively low, the rear face of the shock plate is dished, this being attained by forming an annular concave groove D² in the rear face of the shock plate. The groove D² constitutes a pocket against which propelling gases impact, thereby greatly augmenting the initial velocity and increasing the range of the shell.
- In the form shown in Figs. 6 and 7 the cylindrical member E is made in one piece, instead of four, and the guiding vanes are mounted within the hollow stem H. Two vanes F' are pivoted at their forward ends

on a lateral pin f' secured in the stem. The vanes are of sector like shape and are adapted respectively to project through longitudinal slots h formed in the wall of the stem.

5 At its forward end each vane is provided with a projection f^2 disposed oppositely to a similar projection formed on the other vane. A spring f^3 interposed between the projections f^2 of the two vanes, acts to force
10 the latter through their respective slots h in the manner shown in Fig. 7. A cap L slidably mounted on the stem normally holds the vanes within the stem. Before loading the shell in the gun, said cap may be removed, or may slide along the stem, to the
15 position shown in Fig. 6, as the latter enters the bore of the gun. The rear end of the stem is closed by a plug O screwed into the stem.

20 With a shell constructed in the manner above described, the parts thereof are preferably stored in the convenient disassembled relation shown in Fig. 5. When it is desired to fire a shell, the stem may be connected to the cage by screwing the stem in
25 the shock plate of the former. After this is done, the stem may be loaded in the muzzle end of the gun with the cage located beyond the muzzle. Finally the bursting chamber or container A with the fuse mechanism is
30 inserted in the cylindrical member of the cage. The last mentioned operation may be effected after the stem has been loaded in the gun, or prior thereto, as desired. A
35 sealing lock which may be spring controlled, or consist of a shear pin N or various other well known fragile seals, may be employed to definitely lock the stem in the bore of the gun before the same is fired. The seal will
40 be automatically broken upon discharge of the shell from the gun.

What is claimed is:—

1. A shell of the class described, comprising a cage of relatively large caliber diameter, means carried by the cage for directing
45 the flight of the shell, a stem mounted on and projecting from the rear end of said cage, said stem being of sub-caliber diameter relatively to the cage, and adapted to be
50 loaded in the muzzle end of a gun of sub-caliber diameter for firing the shell, and a container for explosive material formed separately from the cage and of large caliber diameter corresponding substantially to the caliber diameter of the cage,
55 whereby the container may be removably inserted in the cage for support thereby during firing and flight of the shell.

2. A shell of the class described, comprising a cage of relatively large caliber diameter, means carried by the cage for directing
60 the flight of the shell, a stem mounted on and projecting from the rear end of said cage, said stem being of sub-caliber diameter relatively to the cage and adapted to be
65

loaded in the muzzle end of a gun of sub-caliber diameter for firing the shell, and a container for explosive material formed separately from the cage and of large caliber diameter corresponding substantially to the caliber diameter of the cage, said container being inserted in the cage by a relatively axial movement of the cage and container.

3. A shell of the class described, comprising a hollow substantially cylindrical member of relatively large caliber diameter and having its front end open, a base plate connected to the cylindrical member and forming a closure for the rear end thereof, a stem
75 mounted on and projecting rearwardly from said base plate, said stem being of sub-caliber diameter relatively to the cylindrical member and adapted to be loaded in the muzzle end of a gun of sub-caliber diameter
80 for firing the shell, and a container for explosive material formed separately from the cylindrical member and of large caliber diameter corresponding substantially to the caliber diameter of the cylindrical member
85 whereby the container may be removably inserted in the cylindrical member for support thereby during firing and flight of the shell.

4. A shell of the class described, comprising a hollow substantially cylindrical member of relatively large caliber diameter and having its front end open, a base plate connected to the cylindrical member and forming a closure for the rear end thereof, there
95 being a socket formed in the rear face of said base plate concentric with the axis of the cylindrical member, a rearwardly projecting stem detachably secured in said socket, said stem being of sub-caliber diameter
100 relatively to the cylindrical member and adapted to be loaded in the muzzle end of a gun of sub-caliber diameter for firing the shell, and a container for explosive material formed separately from the cylindrical member and of large caliber diameter
105 corresponding substantially to the caliber diameter of the cylindrical member whereby the container may be removably inserted in the cylindrical member for support thereby during firing and flight of the shell.

5. A shell of the class described, comprising a hollow substantially cylindrical member of relatively large caliber diameter and having its front end open, a base plate connected to the cylindrical member and forming a closure for the rear end thereof, there
120 being an annular recess formed in the front face of the base plate, a stem mounted on and projecting rearwardly from the base plate, said stem being of sub-caliber diameter relatively to the cylindrical member and adapted to be loaded in the muzzle end of a gun of sub-caliber diameter for firing the shell, and a container for explosive material
130

formed separately from the cylindrical member and of large caliber diameter corresponding substantially to the caliber diameter of the cylindrical member, said container
 5 comprising a wall having a cylindrical portion, a lateral closure plate mounted in the rear end of the cylindrical wall, the closure plate being provided with a peripheral rearwardly projecting flange and the wall of
 10 the container with a peripheral forwardly projecting flange rolled over the flange of the closure plate for holding the latter in place, said container being inserted in the cylindrical member with the flanged portion
 15 of the container located within the annular groove of the base plate.

6. A shell of the class described, comprising a cage of relatively large caliber diameter and having its front end open, a base
 20 plate connected to the cage and forming a closure for the rear end thereof, a stem mounted on and projecting rearwardly from said base plate, said stem being of sub-caliber diameter relatively to the cylindrical
 25 member and adapted to be loaded in the muzzle end of a gun of sub-caliber diameter for firing the shell, the rear face of the base plate being provided with a dished surface whereby the action of firing pressure on the
 30 rear face of the base plate is augmented, and a container for explosive material formed separately from the cage and of large caliber diameter corresponding substantially to the caliber diameter of the cage, whereby
 35 the container may be removably inserted in the cage for support thereby during firing and flight of the shell.

7. A shell of the class described, comprising a cage of relatively large caliber diameter and having its front end open, a base
 40 plate connected to the cage and forming a closure for the rear end thereof, a stem mounted on and projecting rearwardly from said base plate, said stem being of sub-caliber diameter relatively to the cylindrical
 45 member and adapted to be loaded in the muzzle end of a gun of sub-caliber diameter for firing the shell, the rear face of the base plate being provided with a concave annular groove, whereby the action of firing pressure
 50 on the rear face of the base plate is augmented, and a container for explosive material formed separately from the cage and of large caliber diameter corresponding substantially to the caliber diameter of the cage,
 55 whereby the container may be removably inserted in the cage for support thereby during firing and flight of the shell.

8. A shell of the class described comprising
 60 ing a cage of relatively large caliber diameter, a stem mounted on and projecting from the rear end of said cage, said stem being of sub-caliber diameter relatively to the cage and adapted to be loaded in the muzzle end
 65 of a gun of sub-caliber diameter for firing

the shell, a container for explosive material formed separately from the cage and of large caliber diameter corresponding substantially to the caliber diameter of the cage,
 70 whereby the container may be removably inserted in the cage for support thereby during firing and flight of the shell, and vanes secured to the shell and disposed in planes substantially parallel with the longitudinal axis of the shell for assisting in the flight of
 75 the latter toward its objective.

9. A shell of the class described, comprising a hollow substantially cylindrical member of relatively large caliber diameter and having its front end open, a base plate connected to the cylindrical member and forming
 80 a closure for the rear end thereof, a stem mounted on and projecting rearwardly from said base plate, said stem being of sub-caliber diameter relatively to the cylindrical
 85 member and adapted to be loaded in the muzzle end of a gun of sub-caliber diameter for firing the shell, a container for explosive material formed separately from the cylindrical member and of large caliber diameter
 90 corresponding substantially to the caliber diameter of the cylindrical member, whereby the container may be removably inserted in the cylindrical member for support thereby during firing and flight of the shell, and
 95 vanes mounted on the cylindrical member and disposed in planes substantially parallel to the longitudinal axis of the shell for assisting in the flight of the latter toward its objective.
 100

10. A projectile of the class described, comprising a holder for an explosive container, a shock plate to which said holder is secured and having a seat for the container,
 105 a stem projecting from the rear of such shock plate, said stem being of sub-caliber cross section relative to the shock plate, and adapted to be loaded in the muzzle end of a sub-caliber bore gun for imparting velocity to the projectile, and an independent relatively
 110 large container for explosive material formed to seat on the shock plate, and means whereby the said container for explosive material may be removably secured by the holder against the said shock plate, for support
 115 thereby during assembly, projection and flight of the shell.

11. A projectile of the class described, comprising a shock plate having its forward
 120 face formed to receive a container, a stem projecting from the rear of said shock plate, said stem being of sub-caliber cross section relative to the cross section of the shock plate, and adapted to be loaded in the muzzle
 125 end of a gun of sub-caliber for projecting the shell, and an independent self-contained container of large volumetric capacity for explosive material formed to seat removably on said shock plate for support thereby during
 130 assembly, projection and flight, and

means to retain said container on the shock plate.

12. The herein described method of destroying submarine vessels which consists in
5 confining large masses of high explosive in air and water proof containers, and in projecting the same by explosive charges located remote therefrom, whereby the high explo-

sive is not confined save by its own container and whereby it is removed from the vicinity 10 of the projector into the vicinity of the submarine vessel, and in detonating said high explosive when submerged to produce torpedo or mine effects on the hull or material of said vessel.

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