F. M. HALE.

AMMUNITION.

APPLICATION FILED MAY 15, 1914.

1,141,540.

Patented June 1, 1915.

3 SHEETS—SHEET 1.

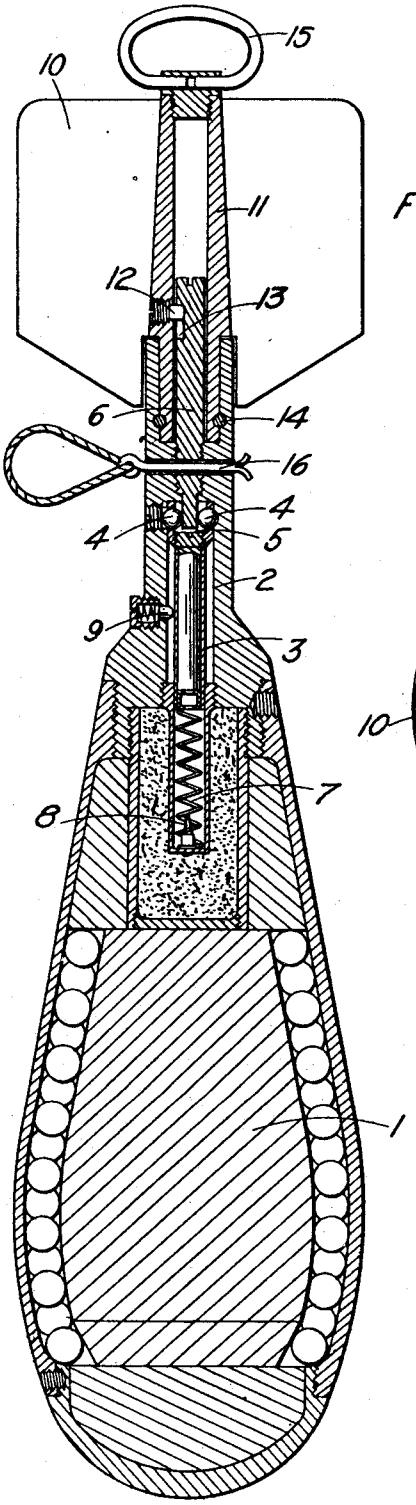
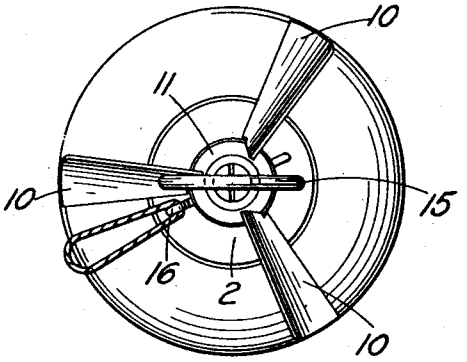


FIG. 1.

FIG. 2.



WITNESSES.

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INVENTOR.

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3 SHEETS—SHEET 2.

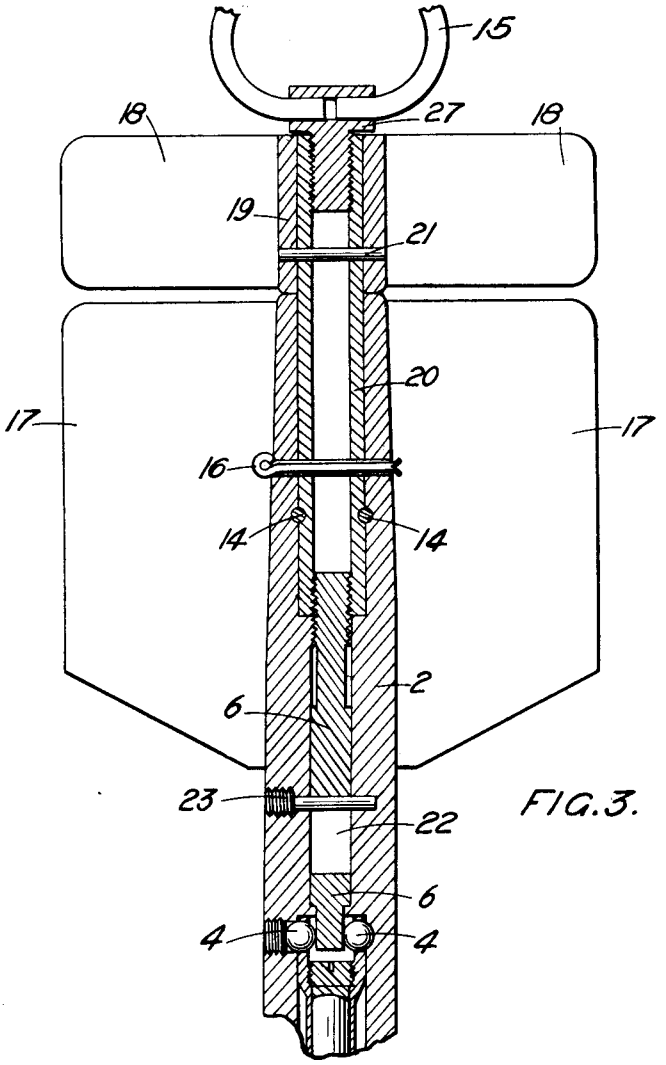

FIG. 3.

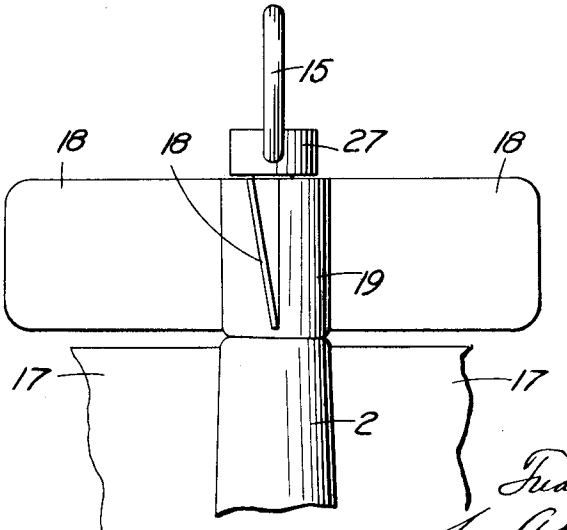

FIG. 4.

WITNESSES.

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AMMUNITION.

APPLICATION FILED MAY 15, 1914.

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3 SHEETS—SHEET 3.

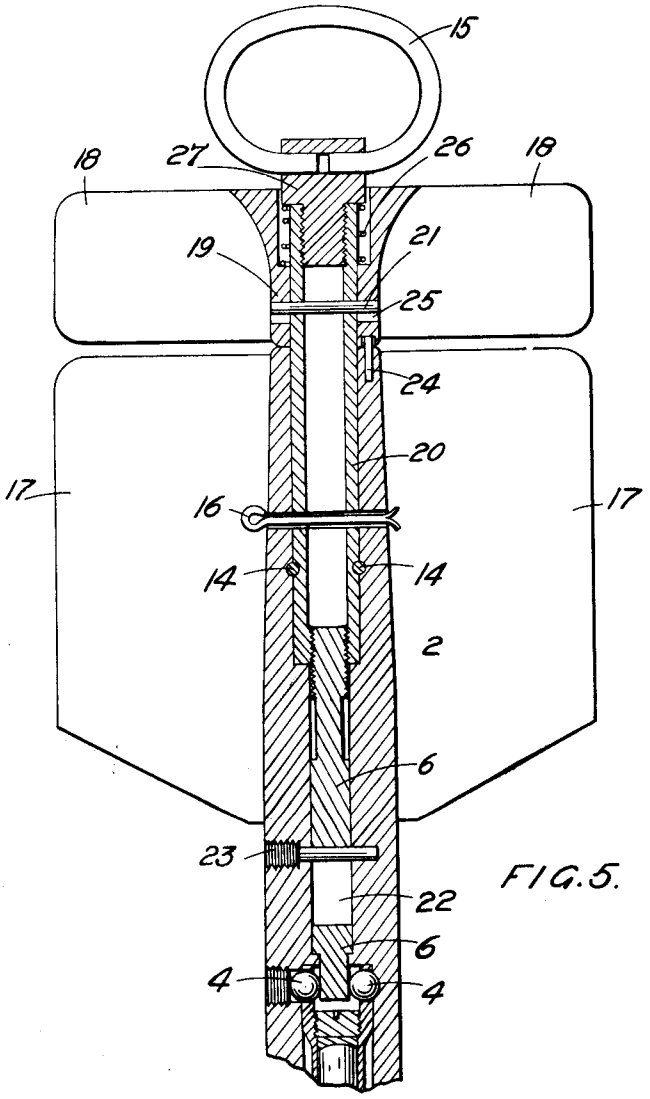

FIG. 5.

WITNESSES.

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UNITED STATES PATENT OFFICE.

FREDERICK MARTEN HALE, OF BROMLEY, ENGLAND.

AMMUNITION.

1,141,540. Specification of Letters Patent. Patented June 1, 1915.

Application filed May 15, 1914. Serial No. 838,732.

To all whom it may concern:

Be it known that I, FREDERICK MARTEN HALE, a subject of the King of Great Britain and Ireland, and a resident of Bromley, in the county of Kent, England, have invented certain new and useful Improvements in and Pertaining to Ammunition, of which the following is a specification.

This invention relates to shells or similar bodies (hereinafter referred to as shells) intended to be dropped or discharged from air-craft, and particularly to such shells provided with means intended not only to render the shell safe by preventing it from exploding before it has reached a safe distance from the air-craft, but also to insure certainty of explosion on impact by securing that the part of the shell that should impinge against an object in order to produce the explosion of the shell will impinge upon the object struck.

Now according thereto a shell of the kind referred to, provided with a wind-vane device rotatable by the air during the flight of the shell and adapted when the shell has traveled a predetermined distance from the air-craft to arm the shell, is so constructed that after the shell has been so armed the wind-vane device becomes fixed in relation to the body of the shell and is thereby caused to exercise a controlling effect on the attitude of the shell during its flight.

According to one construction included within this invention, a shell of the kind referred to is constructed with arming mechanism such as is described in the specification of my British Patent 26764 of 1911—that is to say, there is mounted on the rear portion of the body of the shell, a fan or wind-vane device which is adapted to be rotated by the action of the air during the flight of the shell and, when the shell has traveled to a safe distance, to be thereby caused to arm the shell—and in addition the fan device of this mechanism is adapted, when it has armed the shell, to be caused to become fixed in relation to the body of the shell and then to have, under the action of the air, a controlling effect on the attitude of the shell such as to cause the portion of the shell that should strike the object in order to produce the explosion of the shell on impact, to be the foremost portion of the shell.

According to a modification for the purpose of preserving the shell in its correct attitude during flight from the moment of discharge from the air-craft, helically arranged attitude-controlling wind-vanes are fixed on the rear portion of the body of the shell, and, for releasing a movable firing element after the shell has traveled a predetermined distance from the air-craft, a releasing wind-vane device adapted to be rotated by the action of the air during the flight of the projectile is also mounted on the shell. This releasing wind-vane device is adapted to become fixed in relation to the body of the shell after it has released the movable firing element in order to take part in exercising control on the attitude of the shell. In the case of this modification, in order to cause the releasing wind-vane device to operate more quickly, its vanes are arranged so as to cause its rotation to be in the direction opposite to that of the body of the shell produced by the vanes affixed thereto.

According to another modification the rotatable wind-vane device is further adapted to be normally locked so as to be prevented from rotating but is adapted to be automatically unlocked, and so allowed to rotate, by the passage of the shell through the air.

The various features of the invention are hereinafter set out in the claims appended hereto and the invention is illustrated by the accompanying drawings, in which:—

Figures 1 and 2 are cross-sectional and end views respectively of an example of a shell which is of the shrapnel type and of the above mentioned construction. Figs. 3 and 4 are views in cross-section and in elevation respectively of part of an example of a shell according to the above mentioned modification, and Fig. 5 is a cross-sectional view of part of an example of a shell according to the above mentioned further modification.

In the example shown in Figs. 1 and 2, the body portion 1 of the shell comprises a suitably shaped casing which contains the explosive and shrapnel charges and has attached to it a tail-piece 2. The movable detonator 3 is normally retained within the tail-piece 2 by means of the balls 4 which project through holes in the extension 5 of the detonator casing into a groove in the wall of the tail-piece and are held in this position by the front end of a releasing

spindle 6. When the spindle 6 is withdrawn in the manner hereinafter described the balls 4, being no longer prevented from moving inward, will not offer any appreciable resistance to forward movement of the detonator 3, against the action of the spring 7, under the action of inertia on impact of the shell. The detonator 3 is thus free to impinge on the striking pin 8 and therefore to explode, and so to explode the main explosive charge on impact of the shell.

A spring catch 9 is provided for preventing a rebound of the detonator when once it has moved forward against the firing-pin so that its explosion within the body of the shell in proximity to the main explosive charge is insured.

For the purpose of withdrawing the releasing spindle 6 after the required period has elapsed after the discharge of the shell from the air-craft, the spindle 6 has a screw-thread connection with the tail-piece 2 and is adapted to be rotated and so withdrawn, by means of wind-vanes 10 helically arranged on a sleeve 11, one end of which engages in a corresponding recess in the rear end of the tail-piece 2 and is rotatably held therein by the steel pins 14.

The outer end of the releasing spindle 6 is adapted to slide within the sleeve 11 and is connected therewith by a pin 12 which projects from the sleeve 11 into a longitudinal slot 13 in the releasing spindle 6, which is thereby adapted to be rotated by the wind-vanes and so caused, owing to its screw-thread connection with the tail-piece 2, to move longitudinally within the sleeve 11 as far as it is permitted by the pin 12 and slot 13.

It will be obvious that when the spindle 6 has been withdrawn sufficiently for the inner end of the slot 13 to engage with the pin 12 further rotation of the sleeve 11 is prevented and therefore the wind-vane device is held stationary with regard to the body of the shell and so is enabled to exercise a controlling effect on the attitude of the shell and thus to preserve steadiness in the flight of the shell.

A handle 15 is attached to the sleeve 11, and a safety pin 16, adapted to be withdrawn by hand before the shell is discharged, is provided for preventing accidental rotation of the wind-vane device before discharge.

In use the safety pin 16 is first removed and the shell then dropped, or otherwise discharged, from the air-craft. The wind-vane device is rotated by the passage of the shell through the air and after a predetermined distance has been traversed by the shell the releasing spindle 6 becomes withdrawn sufficiently to release the detonator 3. The sleeve 11 carrying the wind-vanes 10 has then become locked by the engagement of the end of the slot 13 with the pin 12 and the flight of the shell is accordingly controlled and steadied by the vanes. On impact of the projectile, the detonator 3 moves forward, owing to its inertia, against the action of the spring 7, and impinges on the striking pin 8 and thus explodes the main charge of the shell.

In the example shown partially in Figs. 3 and 4, the portion of which not shown is similar to the corresponding portion of the example shown in Figs. 1 and 2, the tail-piece 2 has permanently fixed thereon three helical vanes 17, which cause rotation of the body of the shell during flight and tend to preserve it in its correct attitude during flight from the moment of its discharge from the air-craft. On the end of the tail-piece 2 in rear of the vanes 17 is mounted a releasing wind-vane device comprising the vanes 18 which are helically mounted on a boss 19 connected to a sleeve 20 by a pin 21. The sleeve 20 is rotatably mounted in the tail-piece 2 by means of the pins 14 and at its inner end has a screw-thread connection with the releasing spindle 6 which is prevented from turning by the engagement in a slot 22 therein of a pin 23. The inclination of the vanes 18 is, in the example shown, opposite to that of the vanes 17, but it will be obvious that they may, if desired, be inclined in the same direction as the vanes 17, but in any case of course the two sets of vanes must have pitches such as to produce the required differential rotational movement of the body of the projectile and the wind-vane device.

It will be seen that when the safety pin 16 (which normally prevents rotation of the releasing wind-vane device) has been removed, and the shell is discharged from the air-craft, the attitude of the shell is controlled by the vanes 17, while the releasing wind-vane device is at the same time rotated in a direction opposite to that of the shell, and will, after the shell has traveled a predetermined distance through the air, withdraw the releasing spindle 6 so as to release the detonator.

The example shown in Fig. 5 is similar to that shown in Figs. 3 and 4, but the releasing wind-vane device is adapted to be normally locked and so prevented from rotating but to be automatically unlocked, and so allowed to rotate, by the passage of the shell through the air. For this purpose the boss 19 is provided with a slot 25 for the engagement of the pin 21 and is thus enabled to slide longitudinally on the sleeve 20. In the end of the tail-piece 2 is fixed a pin 24 which is adapted to engage in a corresponding hole in the boss 19 and so prevent rotation of the releasing wind-vane device. The boss 19 is normally pressed against the end of the tail piece 2 by the spring 26 which en-

gages with shoulders on the boss 19 and on the plug 27 screwed into the sleeve 20. In order to cause the boss 19 to be moved sufficiently far away from the tail-piece 2 for it to clear the pin 24 when the shell is in flight, the upper part of the external surface of the boss 19 is inclined so as to present a surface such that the pressure of the air upon it produced by the forward movement of the shell will be sufficient to overcome the resistance of the spring 26 and move the boss 19 back far enough to clear the pin 24.

The safety pin 16 adapted to be withdrawn by hand before the discharge of the projectile from the air-craft may be omitted if desired.

The example shown in Figs. 1 and 2 may obviously be modified to act in a manner similar to that of the example shown in Fig. 5, by providing a pin on the end of the tail-piece 2 and adapting the sleeve 11 to be moved longitudinally against the action of a spring by the pressure of the air on an inclined surface thereon.

In the examples shown in Figs. 3 and 4 and in Fig. 5 the length of the slot 22 in the releasing spindle 6 is made less than the longitudinal movement of the spindle 6 which is necessary to disengage it from the sleeve 20, so that the releasing wind-vane device is caused to become fixed in relation to the body of the shell after withdrawing the spindle 6.

In the example shown in Figs. 3 and 4 and in Fig. 5 the releasing wind-vane device is provided with four vanes so as to render it impossible for all its vanes to take up positions exactly in line with the fixed vanes 17 on the body of the projectile.

If, in any of the examples described, the bursting charge is of trinitrotoluol or other explosive similarly inert, not only will no explosion of the shell be produced by the violent fall of the air-craft to the ground since it can only be fired by its detonator and when the latter has been released by the requisite rotation of the wind-vane device, but also, owing to the normal location of the detonator 3 in the tail-piece 2 and so as not to be surrounded by the explosive charge to be fired thereby, the shell is not liable to be exploded when in the magazine of the air-craft by the explosion of the detonator by the impact of a bullet or other projectile.

Shells of the shrapnel type such as hereinbefore described and illustrated are intended mainly for attacking trenches, camps, and an enemy in the field, but shells according to this invention may obviously be of any other type—for example, they may be of the "all-high-explosive-type", which is designed for dropping on warships and fortified positions where structural damage is the first consideration.

Obviously modifications other than those hereinbefore described may be made without departing from the scope of the invention.

What I claim is:—

1. A shell adapted to be discharged from air-craft comprising a rotatable wind-vane arming device mounted on the rear portion of the body of the shell and adapted by its rotation in relation to said body to arm the shell, and means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby.

2. A shell adapted to be discharged from air-craft comprising helically arranged wind-vanes fixed on the rear portion of the body of the shell, a rotatable wind-vane arming device mounted on said rear portion and adapted by its rotation in relation to said body to arm the shell, and means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby.

3. A shell adapted to be discharged from air-craft comprising a rotatable wind-vane arming device mounted on the rear portion of the body of the shell and adapted by its rotation in relation to said body to arm the shell, means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, and means adapted normally to lock said wind-vane arming device in relation to said body.

4. A shell adapted to be discharged from air-craft comprising helically arranged wind-vanes fixed on the rear portion of the body of the shell, a rotatable wind-vane arming device mounted on said rear portion and adapted by its rotation in relation to said body to arm the shell, means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, and means adapted normally to lock said wind-vane arming device in relation to said body.

5. A shell adapted to be discharged from air-craft comprising a rotatable wind-vane arming device mounted on the rear portion of the body of the shell and adapted by its rotation in relation to said body to arm the shell, means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, means adapted normally to lock said wind-vane arming device in relation to said body, and means adapted to be caused by the discharge of the shell from the air-craft to unlock said wind-vane arming device.

6. A shell adapted to be discharged from air-craft comprising helically arranged wind-vanes fixed on the rear portion of the body of the shell, a rotatable wind-vane arming device mounted on said rear portion and adapted by its rotation in relation to

said body to arm the shell, means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, means adapted normally to lock said wind-vane arming device in relation to said body, and means adapted to be caused by the discharge of the shell from the air-craft to unlock said wind-vane arming device.

7. A shell adapted to be discharged from air-craft comprising a rotatable wind-vane arming device mounted on the rear portion of the body of the shell and adapted by its rotation in relation to said body to arm the shell, means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, locking means adapted normally to prevent rotation of said wind-vane device in relation to said rear portion, and means adapted on discharge of the shell from the air-craft automatically to move said wind-vane device into a position in which it is free from the influence of said locking means and thereby rendered capable of revolution.

8. A shell adapted to be discharged from air-craft comprising helically arranged wind-vanes fixed on the rear portion of the body of the shell, a rotatable wind-vane arming device mounted on said rear portion and adapted by its rotation in relation to said body to arm the shell, means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, locking means adapted normally to prevent rotation of said wind-vane device in relation to said rear portion, and means adapted on discharge of the shell from the air-craft automatically to move said wind-vane device into a position in which it is free from the influence of said locking means and thereby rendered capable of revolution.

9. A shell adapted to be discharged from air-craft comprising a fixed firing element, a movable firing element normally located away from and in rear of said fixed element but adapted to impinge on said fixed firing element upon impact of the shell, means adapted to maintain said movable firing element in its normal position, said means including a rotatable wind-vane device mounted on the rear portion of the body of the shell and adapted to release said movable firing element after said wind-vane device has performed a predetermined number of revolutions in relation to said rear portion under the action of the air during the passage of the shell therethrough, and means adapted to prevent rotation of said wind-vane device in relation to said rear portion after it has performed said predetermined number of revolutions.

10. A shell adapted to be discharged from air-craft comprising a fixed firing element, a movable firing element normally located away from and in rear of said fixed element but adapted to impinge on said fixed firing element upon impact of the shell, means adapted to maintain said movable firing element in its normal position, said means including a rotatable wind-vane device mounted on the rear portion of the body of the shell and adapted to release said movable firing element after said wind-vane device has performed a predetermined number of revolutions in relation to said rear portion under the action of the air during the passage of the shell therethrough, means adapted to prevent rotation of said wind-vane device in relation to said rear portion after it has performed said predetermined number of revolutions, and helically arranged wind-vanes fixed on said rear portion.

11. A shell adapted to be discharged from air-craft comprising a fixed firing element, a movable firing element normally located away from and in rear of said fixed element but adapted to impinge on said fixed firing element upon impact of the shell, means adapted to maintain said movable firing element in its normal position, said means including a rotatable wind-vane device mounted on the rear portion of the body of the shell and adapted to release said movable firing element after said wind-vane device has performed a predetermined number of revolutions in relation to said rear portion under the action of the air during the passage of the shell therethrough, locking means adapted normally to prevent rotation of said wind-vane device in relation to said rear portion, means adapted on discharge of the shell from the air-craft automatically to move said wind-vane device into a position in which it is free from the influence of said locking means and thereby rendered capable of revolution, and means adapted to prevent rotation of said wind-vane device in relation to said rear portion after it has performed said predetermined number of revolutions.

12. A shell adapted to be discharged from air-craft comprising a fixed firing element, a movable firing element normally located away from and in rear of said fixed element but adapted to impinge on said fixed firing element upon impact of the shell, means adapted to maintain said movable firing element in its normal position, said means including a rotatable wind-vane device mounted on the rear portion of the body of the shell and adapted to release said movable firing element after said wind-vane device has performed a predetermined number of revolutions in relation to said rear portion under the action of the air during the passage of the shell therethrough, locking means adapted normally to prevent rotation of said wind-vane device in relation to said

rear portion, means adapted on discharge of the shell from the air-craft automatically to move said wind-vane device into a position in which it is free from the influence of said locking means and thereby rendered capable of revolution, means adapted to prevent rotation of said wind-vane device in relation to said rear portion after it has performed said predetermined number of revolutions, and helically arranged wind-vanes fixed on said rear portion.

13. A shell adapted to be discharged from air-craft comprising a rotatable and axially movable wind-vane arming device mounted on the rear portion of the body of the shell and adapted by its rotation in relation to said body to arm the shell, means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, adjacent parts of said wind-vane arming device and said rear portion being adapted when in engagement to prevent rotation of said wind-vane arming device in relation to said rear portion but adapted to be disengaged by an axial movement of said wind-vane device, and a spring adapted to hold normally said wind-vane arming device with said parts in engagement.

14. A shell adapted to be discharged from air-craft comprising helically arranged wind-vanes fixed on the rear portion of the body of the shell, a rotatable and axially movable wind-vane arming device mounted on said rear portion and adapted by its rotation in relation to said body to arm the shell, means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, adjacent parts of said wind-vane arming device and said rear portion being adapted when in engagement to prevent rotation of said wind-vane arming device in relation to said rear portion but adapted to be disengaged by an axial movement of said wind-vane device, and a spring adapted to hold normally said wind-vane arming device with said parts in engagement.

15. A shell adapted to be discharged from air-craft comprising a rotatable and axially movable wind-vane arming device mounted on the rear portion of the body of the shell and adapted by its rotation in relation to said body to arm the shell, means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, adjacent parts of said wind-vane arming device and said rear portion being adapted when in engagement to prevent rotation of said wind-vane arming device in relation to said rear portion but adapted to be disengaged by an axial movement of said wind-vane device, a spring adapted to hold normally said wind-vane arming device with said parts in engagement, and an air-resisting surface connected to said wind-vane arming device and adapted to cause, owing to the pressure of the air thereon on discharge of the shell from the air-craft, the aforesaid axial movement of said wind-vane arming device against the action of said spring.

16. A shell adapted to be discharged from air-craft comprising helically arranged wind-vanes fixed on the rear portion of the body of the shell, a rotatable and axially movable wind-vane arming device mounted on said rear portion and adapted by its rotation in relation to said body to arm the shell, means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, adjacent parts of said wind-vane arming device and said rear portion being adapted when in engagement to prevent rotation of said wind-vane arming device in relation to said rear portion but adapted to be disengaged by an axial movement of said wind-vane device, a spring adapted to hold normally said wind-vane arming device with said parts in engagement, and an air-resisting surface connected to said wind-vane arming device and adapted to cause, owing to the pressure of the air thereon on discharge of the shell from the air-craft, the aforesaid axial movement of said wind-vane arming device against the action of said spring.

17. A shell adapted to be discharged from air-craft comprising helically arranged wind-vanes fixed on the rear portion of the body of the shell, a rotatable wind-vane arming device mounted on said rear portion and adapted by its rotation in relation to said body to arm the shell, and means adapted to prevent further rotation of said device in relation to said body after the shell has become armed thereby, the vanes of said wind-vane arming device being inclined in a direction opposite to that of the aforesaid helically arranged wind-vanes.

Signed at London, England, this 5th day of May, 1914.

FREDERICK MARTEN HALE.

Witnesses:
FREDK. HUTCHINGS,
WM. O. BROWN.