

8-5-1919

Magazine Rocket

Robert Goddard
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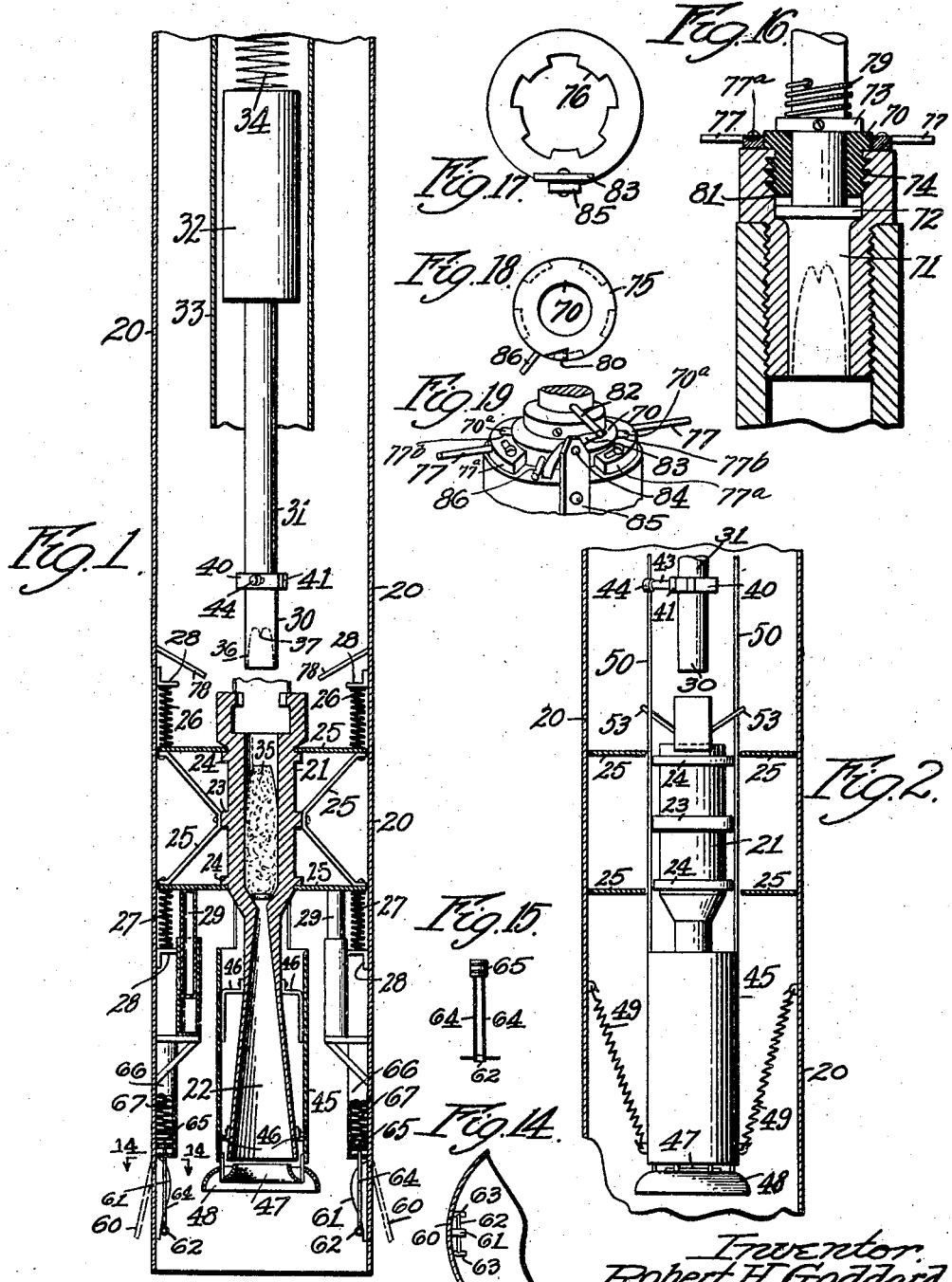
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Goddard, Robert, "Magazine Rocket" (1919). *WPI Patents Collection*. 28.
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1,311,885.

Patented Aug. 5, 1919.
 2 SHEETS—SHEET 1.

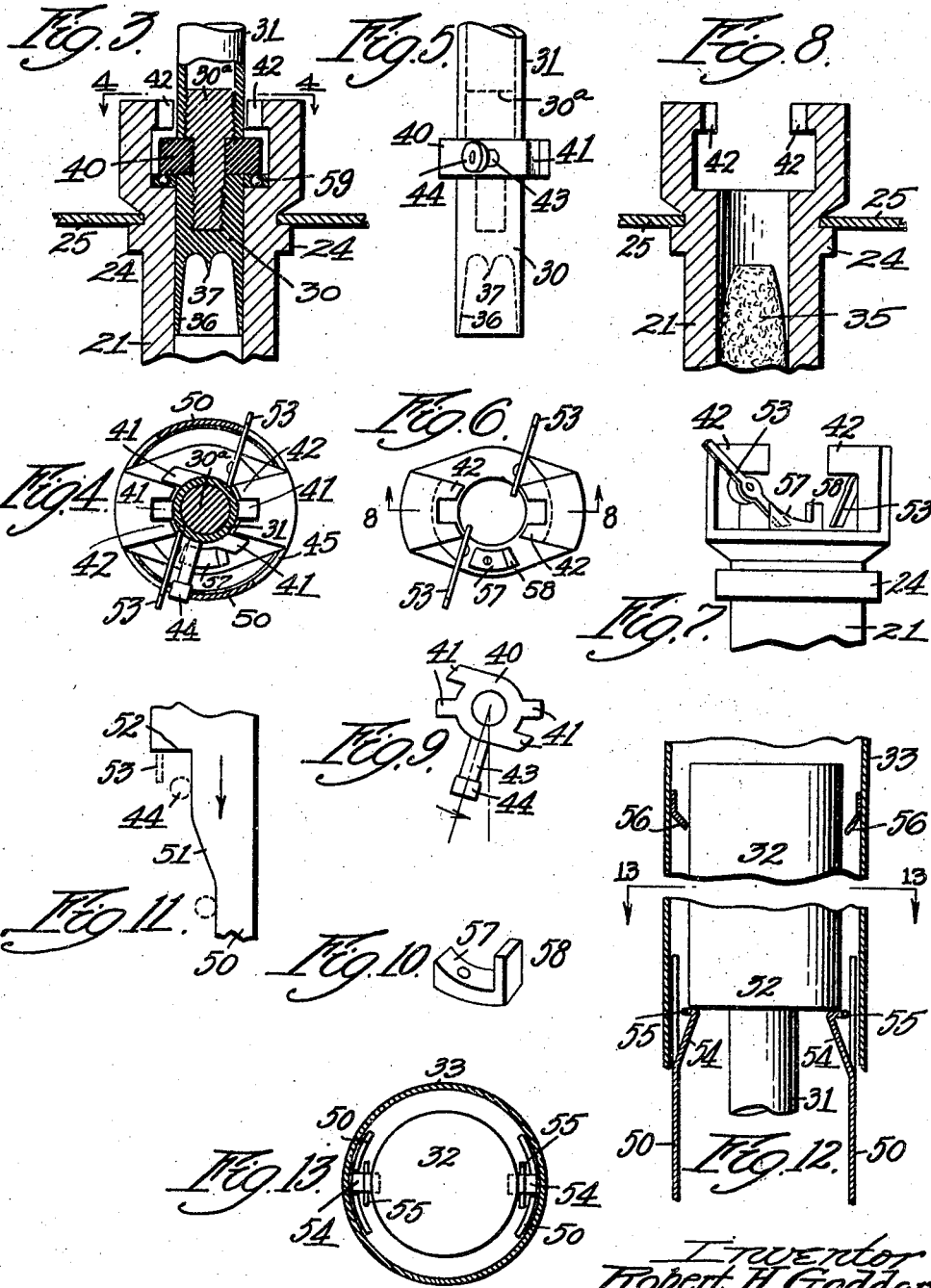


Witness
 C. F. Mason.

Inventor
 Robert H. Goddard
 by Attorneys
 Southgate & Southgate

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Witness
 C. F. Meehan

I, the Inventor
 Robert H. Goddard
 by attorneys
 Southgate & Southgate

UNITED STATES PATENT OFFICE.

ROBERT H. GODDARD, OF WORCESTER, MASSACHUSETTS.

MAGAZINE-ROCKET.

1,311,885.

Specification of Letters Patent.

Patented Aug. 5, 1919.

Application filed April 26, 1918. Serial No. 230,872.

To all whom it may concern:

Be it known that I, ROBERT H. GODDARD, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Magazine-Rocket, of which the following is a specification.

This invention relates to improvements in magazine rockets of the general type disclosed in my prior application Serial No. 201,472, filed November 12, 1917.

In this type of rocket a relatively small charge of explosive is ignited in the combustion chamber and the gases generated by the explosion are expelled through a tapered nozzle connected to the lower end of the chamber. A movable breech block is provided for closing the upper end of the chamber, and automatic devices are also provided for removing and replacing the breech block after each explosion, thus permitting the insertion of a fresh cartridge.

It is the general object of my present invention to improve the construction of magazine rockets of this type, simplifying the manufacture thereof and rendering the mechanism more reliable in operation.

With this general object in view, one feature of my present invention relates to the provision of devices for operating the reloading mechanism, such devices being actuated by the pressure of a portion only of the gases escaping from the combustion chamber. By this arrangement the forces to be controlled are materially reduced.

In the embodiment of my invention herein shown, I provide a movable member directly actuated by a portion of the escaping gases and controlling the operation of the reloading mechanism.

Another important feature of my invention relates to devices for locking the breech block in the combustion chamber, and for releasing the breech block after the pressure of the explosion is somewhat reduced.

Further features of my invention relate to devices for correcting deviation of the rocket from the true line of flight, to improved supporting structures for the several parts, and to an improved and simplified firing mechanism.

My invention further relates to certain arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of my invention and a modification thereof are shown in the drawings, in which—

Figure 1 is a longitudinal sectional elevation of my improved rocket;

Fig. 2 is a partial elevation, partly in section, and taken in a plane at right angles to the plane of Fig. 1;

Fig. 3 is a detail sectional elevation of the breech block and one form of locking device therefor;

Fig. 4 is a transverse sectional view taken along the line 4—4 in Fig. 3;

Fig. 5 is a partial elevation of the breech block shown in Fig. 3;

Fig. 6 is a plan view of the upper end of the combustion chamber shown in Fig. 3;

Fig. 7 is a front elevation of the parts shown in Fig. 6;

Fig. 8 is a sectional elevation taken along the line 8—8 in Fig. 6;

Fig. 9 is a plan view of the locking collar;

Fig. 10 is a perspective view of the cam which actuates the collar shown in Fig. 9;

Fig. 11 is a detail view of the means for unlocking the collar;

Fig. 12 is a detail sectional view showing the devices for raising the breech block;

Fig. 13 is a sectional view taken along the line 13—13 in Fig. 12;

Fig. 14 is a detail sectional view showing the devices for correcting the flight, taken on the line 14—14 in Fig. 1;

Fig. 15 is a front view of the mechanism shown in Fig. 14;

Fig. 16 is a sectional elevation of the chamber and breech block, and a modified form of locking device;

Fig. 17 is a plan view of the combustion chamber shown in Fig. 16;

Fig. 18 is a plan view of the locking collar shown in Fig. 16, and

Fig. 19 is a perspective view of parts shown in Fig. 18.

Referring to the drawings, I have shown a casing 20 within which is mounted a com-

bustion chamber 21 having its lower end extended to form a discharge nozzle 22. The combustion chamber is provided with flanges 23 and 24 to which is secured a frame-work 25 slidable in the casing 20. Springs 26 and 27 normally hold the combustion chamber in the position shown in Fig. 1, these springs being retained in position by brackets 28 secured to the casing 20. This method of supporting the parts allows the chamber to rise slightly within the casing at each explosion, thus relieving the sudden strain on the parts. If found desirable, air cylinders 29 may be mounted beneath the framework 25, the slow escape of air therefrom retarding the return movement of the chamber. Similar air cylinders (not shown) may also be mounted above the framework 25.

A breech block 30 (Fig. 1) closes the upper end of the chamber 21, said breech block having an upward extension 31 by which it is connected to a shell or other weighted portion 32 in the upper part of the rocket. The shell 32 is guided for longitudinal movement in an inner casing 33, and is pressed downward by a light spring 34.

Any suitable devices may be provided for firing the cartridge 35 in the combustion chamber, but I prefer to use the construction shown in Figs. 3 and 16, in which the upper end of the cartridge is received within a depending tapered flange 36. A firing pin 37 is formed in the upper end of the recess inclosed by the flange 36, and the upper end of the cartridge 35 is so shaped that it will be engaged by the firing pin 37 after the breech block has been forced downward over the cartridge. The cartridges are commonly formed with walls of smokeless powder or other thin combustible material, and may be crushed slightly by the breech block in its final downward movement, thus permitting it to be forced into the recess in the flange 36 and into engagement with the firing pin 37.

The flange 36 not only guides and centers the cartridge, but also is expanded slightly under the force of the explosion and prevents the escape of gases through the upper end of the combustion chamber. For this purpose the flange is made cylindrical on its outer surface and comparatively thin at its lower edge, and its length is preferably equal or greater than its diameter. In Fig. 16 I have shown the flange as extended to a somewhat greater extent than in Fig. 3.

In order to retain the breech block in position to close the combustion chamber until the pressure generated by the explosion has been reduced, I provide locking devices for the breech block. In the form shown in Figs. 3 to 12 these locking devices comprise a locking collar 40 having a plurality of

lugs 41 projecting therefrom, said collar being angularly movable upon the shank 30^a of the breech block 30. The lugs 41 cooperate with inwardly extending projections 42 formed on the upper end of the combustion chamber 21. When the lugs 41 are disposed beneath the projections 42, the breech block is securely locked in the combustion chamber. An arm 43 (Fig. 9) extends laterally from the collar 40 and may be provided at its outer end with a cam roll 44.

For actuating the arm 43 to unlock the collar 40, I provide a sleeve 45 (Figs. 1 and 2) slidably mounted on guides 46, conveniently secured to the outer surface of the nozzle 22. At its lower end the sleeve 45 is provided with an inwardly projecting annular flange 47 (Fig. 1), said flange projecting slightly within the lower end of the nozzle 22. This flange may be concave in section, as shown in Fig. 1, and a second flange 48 of convex section may be mounted outside of the flange 47. Springs 49 (Fig. 2) hold the sleeve 45 normally in the position shown in Figs. 1 and 2. The combined force of the springs 49 is greater than that of the spring 34.

When an explosion takes place in the combustion chamber, a certain portion of the gases engage the flange 47 and are deflected outwardly by said flange. Such engagement by the rapidly moving gases causes the sleeve 45 to move downwardly against the tension of the springs 49. The sleeve 45 is provided with two upward extensions 50 (Fig. 2), guided in recesses in the framework 25 and provided at their upper ends with a cam surface 51 (Fig. 11) on one extension and with shoulders 52 on both. As the sleeve and extensions are forced downwardly by the escaping gases, the cam surface 51 engages the cam roll 44 (Fig. 9) and turns the locking collar to the position shown in Fig. 4. The breech block is thus unlocked, and I have provided means for then positively starting the breech block from its seat. For this purpose levers 53 (Figs. 4, 6 and 7) are pivoted on the sides of the projections 42 of the combustion chamber 21 and have their short inner ends extended beneath the collar 40. As the sleeve 45 approaches its lowest position, the shoulders 52 on the extensions 50 engage the levers 53, and thus give the breech block a short positive upward movement.

Adjacent their upper ends the extensions 50 are provided with catches 54 (Fig. 12) adapted to engage beneath the shell 32 as the breech block is loosened by the levers 53. The force of the explosion having been exhausted by this time, the springs 49 return the sleeve 45 to original position, thereby raising the shell 32 against the pressure of the spring 34 and thus separating the breech block from the combustion chamber suffi-

ciently to permit a fresh cartridge to be introduced to the chamber by loading mechanism not shown. This loading mechanism may be of the form shown in my prior application Serial No. 201,472, or may be of any other convenient and suitable design.

As the sleeve 45 approaches its original position, pins 55 (Fig. 12) projecting laterally from the catches 54 engage downwardly inclined cam plates 56 on the inner casing 33 and are forced outwardly thereby, thus releasing the shell 32 and permitting the breech block to return to its original position.

I have also provided devices for moving the collar 40 to locking position after the breech block is thus returned. For this purpose I provide a cam plate 57 (Figs. 6 and 10) adapted to engage the arm 43 or roll 44 (Fig. 9) as the breech block descends, and to move the arm and with it the collar 40 to locking position. Such movement is limited by a shoulder 58 formed on the end of the plate 57. It is necessary that this movement shall take place during the final downward movement of the breech block, and I therefore provide a space beneath the projections 42 (Fig. 3) of the combustion chamber somewhat greater than the height of the collar, to permit this locking movement. If desirable, I may also provide ball bearings 59 (Fig. 3) beneath the collar 40 to permit it to be more easily moved. When the explosion takes place, the breech block is free to move upward slightly before the locking collar engages the projections 42, but this slight movement is not objectionable.

The mechanism thus far described provides therefore for positively locking the breech block until the force of the explosion has been reduced, means for thereafter unlocking and releasing the breech block and for raising the same to permit reloading of the chamber, and also provides for the return and relocking of the breech block before the next explosion occurs.

In Figs. 1, 14 and 15 I have indicated devices for correcting deviations in the line of flight. For this purpose resilient tongues 60 (Fig. 1) are cut in the casing 20, each tongue being integral with the casing 20 at its upper end and being provided on its inner side with a cam plate 61. A shaft or roll 62 is guided for vertical movement in ways 63 (Fig. 14) fixed to the casing 20. The shaft 62 is supported on each side of the cam plate 61 by straps 64 (Fig. 15) extending downwardly from a piston 65 mounted in a sleeve 66, the piston being normally retained in its lower position by a spring 67. Compressed air may be admitted below the piston, thus raising the piston 65 and causing the shaft or roll 62 to force

the cam plate 61 and tongue 60 outward, 65 and correcting the flight of the rocket. The admission of air on either side of the rocket will preferably be governed by a gyroscopic mechanism (not shown) which may be of any usual form and is no part of my invention.

In Figs. 16 to 19 I have shown a modified form of locking device. In this construction a locking collar 70 is loosely mounted on the shank of the breech block 71, the collar being retained between a flange 72 and a ring 73, and having a slight free longitudinal movement thereon. The collar 70 is provided with rings or ridges 74 cut away to form separated sectional teeth 75, as shown in Fig. 18. The combustion chamber is provided with corresponding grooves cut away to provide sectional projections 76 corresponding to the teeth 75.

For the purpose of unlocking the collar 70, I provide arms 77 projecting laterally from a ring 77^a secured to the top of the combustion chamber by screws extending through slots in the ring, thus permitting limited angular movement of the ring. Studs 70^a in the collar 70 extend into recesses 77^b in the inner edge of the ring when the breech block is in normal position. As the chamber and breech block rise, the arms 77 engage cam plates 78 (Fig. 1) fixed on the casing 20, which turn the collar as the combustion chamber approaches its upper limit of travel, thus releasing the collar and permitting further upward movement of the breech block. A spring 79 (Fig. 16) is fixed at one end to the shank of the breech block 71 and at its other end to the collar 70. The end of this spring extends through the collar in position to engage a shoulder 80 (Fig. 18). The spring acts to hold the collar normally against the flange 72 on the breech block and also in the position in which the teeth of the collar register with the recesses in the chamber, leaving the collar free to move longitudinally. As the breech block returns, the collar engages a shoulder 81 (Fig. 16) on the chamber and its further travel is prevented thereby. The breech block, however, continues to move for a short distance and in so doing a pin 82 fixed in the shank of the breech block engages the short end of a lever 83 (Fig. 19) pivoted at 84 on a bracket 85 fixed to the chamber. The longer depending end of the lever 83 engages a pin 86 on the collar 70 and turns the collar against the tension of the spring 79 to locking position. The parts remain in this position until the breech block and chamber are moved upward by the next explosion.

In this modification it will be seen that the locking and releasing of the breech block is controlled by the upward movement of

the combustion chamber, and that the sliding sleeve 45 and associated mechanism is not used.

Having thus described my invention, it will be evident that changes and modifications can be made therein by those skilled in the art without departing from the spirit and scope thereof as set forth in the claims, and I do not wish to be otherwise limited to the details herein disclosed, but what I claim is—

1. A magazine rocket having a casing, a combustion chamber, a nozzle, a relatively movable breech block, means to lock said breech block in said chamber, and separately movable devices operated by direct engagement therewith, of gases moving rapidly through said nozzle effective to unlock said breech block and to produce relative separation of said breech block and chamber after said parts are unlocked.

2. A magazine rocket having, in combination, a casing, a combustion chamber, a nozzle, a relatively movable breech block, and devices for moving said breech block away from said chamber, said devices being placed in operative condition by utilizing the kinetic energy of a portion only of the gases moving rapidly through said nozzle.

3. A magazine rocket having a casing, a combustion chamber, a nozzle, a relatively movable breech block, a member slidable longitudinally of said chamber and having a portion projecting into the path of the gases escaping therefrom, springs yieldingly holding said member in normal position, and parts on said member engaging said breech block when said member is displaced and raising said breech block as said member returns to normal position.

4. A magazine rocket having a casing, a combustion chamber, a nozzle, a relatively movable breech block, a sleeve slidably mounted on said nozzle and having an annular ring secured thereto projecting within the edge of said nozzle, and upwardly projecting cam plates movable with said sleeve and effective to unlock said breech block and to positively move said breech block from its seat on said chamber.

5. In a magazine rocket having a casing, a combustion chamber, a nozzle, and a relatively movable breech block, a collar on said breech block having a projecting arm, means to lock said collar in position, a lever fixed to said chamber and having one end disposed beneath said collar, and means acting on said arm to unlock said collar and also effective to actuate said lever to lift said collar from its initial position.

6. In a rocket, a combustion chamber, and a breech block having a flange depending within said chamber, said flange being substantially cylindrical on its outer surface

and decreasing in thickness toward its lower end, and having its length at least as great as its diameter.

7. In a rocket, a combustion chamber, a breech block, a cartridge, and means to fire said cartridge, said breech block having a depending flange with a recess therein gradually contracted toward its inner end to a diameter slightly less than that of the upper end of the cartridge and having a firing pin in the end of said recess adapted to engage and fire said cartridge when the cartridge is forced into said recess.

8. In a magazine rocket, a combustion chamber, a breech block, a locking collar movable on said breech block, cooperating locking projections on said collar and said chamber, and means to cause relative movement of part of said projections into and out of alinement with the other part.

9. In a magazine rocket, a combustion chamber, a breech block, a locking collar movably mounted on said breech block, cooperating locking projections on said collar and said chamber, and means to unlock said collar as said chamber rises and to lock said collar as the breech block descends.

10. In a magazine rocket, a combustion chamber, a breech block, a locking collar movably mounted on said breech block, cooperating locking projections on said collar and said chamber, means to unlock said collar to release said breech block, and means, actuated by the breech block as it descends, effective to lock said collar.

11. In a rocket, a combustion chamber, a breech block, a locking collar having limited angular and longitudinal movement on said breech block, means to stop the travel of the collar before the breech block reaches its seat, and devices actuated by said breech block effective to thereafter give said collar an angular locking movement.

12. In a magazine rocket, a casing, a combustion chamber, means to fire a propelling charge in said chamber, and means to correct the resultant flight of said rocket, said means comprising oppositely disposed vanes normally continuous with the surface of said casing, and means to deflect said vanes from normal position.

13. In a magazine rocket, a casing, a combustion chamber, means to fire a plurality of cartridges successively in said chamber, and means to correct the resultant flight of said rocket, said means comprising oppositely disposed vanes in said casing, cam plates on said vanes, actuating members guided adjacent said cam plates, and means to move said members relatively to said cam plates and vanes.

14. In a magazine rocket, a casing, a combustion chamber, a frame secured to said combustion chamber and slidable in said

casing, and springs yieldingly maintaining said chamber in normal position but permitting movement therefrom in either direction.

15. In a magazine rocket, a casing, a combustion chamber, a frame secured to said combustion chamber and slidable in said casing, yielding means holding said combustion chamber normally in mid-position

but permitting movement therefrom in either direction, and cushioning devices also 10 engaging said frame to reduce sudden movements thereof.

In testimony whereof I have hereunto affixed my signature.

ROBERT H. GODDARD.