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[54] IMPROVEMENTS IN OR RELATING TO ROCKETS

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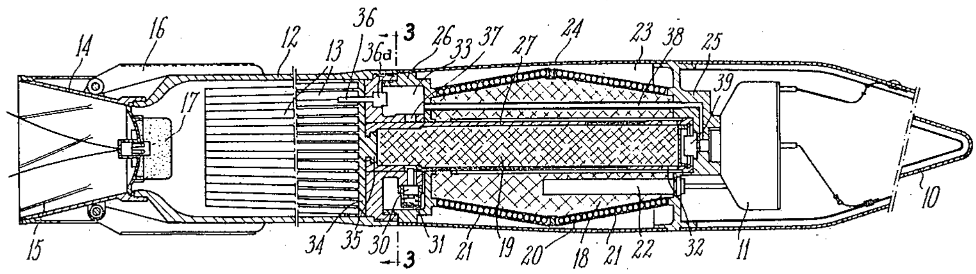
[57] ABSTRACT

This self-propelling projectile or missile, or rocket, comprises a fixed explosive charge and a movable explosive charge adapted, at the end of the combustion of the propulsive charge, to be transferred by the action of the combustion gases of the propellant toward the propelling body of the missile. Thus, an increment in the efficiency and range of the missile is obtained, as well as a considerable increase in the proportion of splints and in the cone of dispersion of the missile.

8 Claims, 3 Drawing Figures



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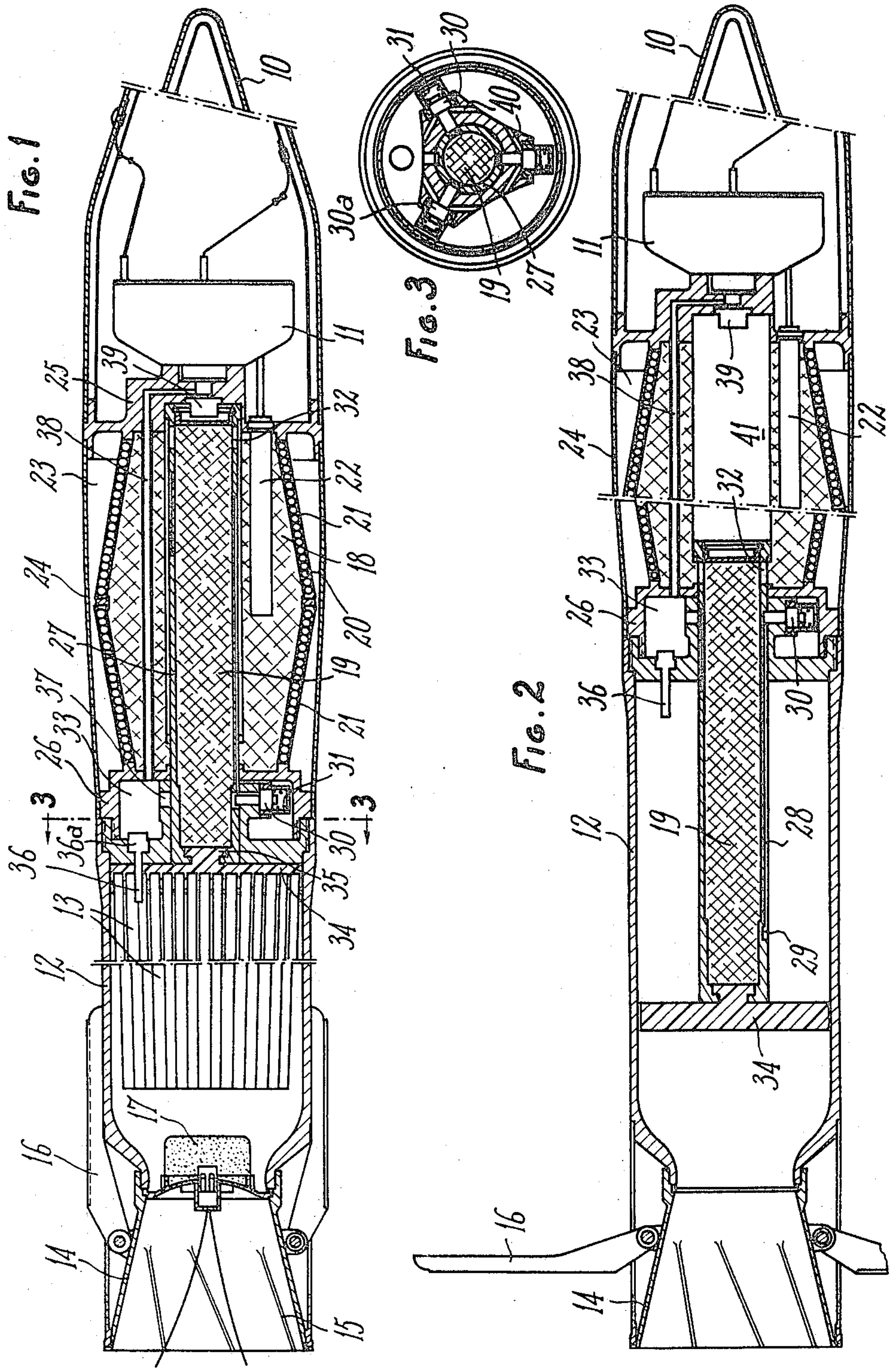

IMPROVEMENTS IN OR RELATING TO ROCKETS

The present invention relates to improvements in or relating to self-propelled missiles or like projectiles, notably rockets, and its primary object is to increase the efficiency of such missiles.

It is known that rockets comprise essentially an explosive charge and a propelling charge, the latter occupying a portion, frequently of considerable dimensions, of the missile body, which constitutes the "propulsive" body. This propulsive body is useful during only a very short period of the missile flight; thus, when the propellant combustion is completed, this section of the rocket constitutes a "dead weight" without any military efficiency, for during the explosion of the missile, as the propulsive body is not exposed to the action of the explosive charge, it will not exert any effective function since it cannot be transformed into fragments or splinters. In other words, in missiles usually referred to as "conventional," a far from negligible and completely useless mass is conveyed to the target contemplated, at the expense of an increment in the flight duration and a reduction in the permissible range.

With the present invention, this serious inconvenience of conventional missiles can be avoided because the self-propelled missile comprises, in addition to the conventional fixed explosive charge, a movable explosive charge which, at the end of the combustion of the propellant charge, will be transferred into the propulsive body.

The various features and advantages of this invention will appear as the following description proceeds, with reference to the attached drawing illustrating diagrammatically a typical form of embodiment of the invention, given by way of example since many modifications and variations may be brought thereto without departing from the basic principle of the invention. In the drawing:

FIGS. 1 and 2 are longitudinal sections of the improved rocket according to this invention, FIG. 1 showing the missile ready for the launching operation, and FIG. 2 the same missile at the end of the propellant combustion phase; and

FIG. 3 is a section taken along the line III—III of FIG. 1. In the example illustrated, the rocket comprises:

a head incorporating a double contact ogive **10**;

a fuse **11**, for example of the piezo-electric arming type;

a charge body comprising the double military charge according to this invention, and to be described in detail presently;

a propulsive structure enclosed in a body **12** containing the propelling charge which, in the example illustrated, consists of a "brush" type charge **13** as described in the U.S. Pat. No. 3,234,878.

The combustion gases are ejected through the divergent **14** comprising blades **15**. The stability along the desired trajectory is ensured by means of a fin-type spread-out set of vanes **16**. The "brush" type propelling charge is ignited by means of an electric igniter **17**.

The military charge consists of two portions, namely a fixed portion **18** and a movable portion **19**. The former consists in the selected example of two frustoconical blocks assembled by their major bases. This shape permits of raising the cone of dispersion of the splinters, and therefore of increasing its efficient range. The splinter effect is obtained, in this example, by using balls **20** distributed along the outer periphery of the charge in light-alloy sheaths **21** and embedded in epoxy resin. The charge is primed by a pair of detonators **22**. This assembly is housed in the charge body **23** streamlined by a plastic fairing or shell **24** fitted to the front and rear cross members **25** and **26**, respectively.

The movable portion **19** comprises an explosive sausage or bar enclosed in a light-alloy sheath **27** adapted to move backwards and fitted in the fixed portion of the charge specially shaped to this end. The sheath **27** is provided with guide grooves **28** and locking grooves **29**. The locking action is obtained by means of three collapsible studs **30** each urged by a spring **31**. This explosive block is adapted to be primed through a pair of ports **32** formed in the front portion of bar **19** and opening into the fixed portion **18** of the charge.

In the charge body **23**, an annular cavity **33** is formed which, as will be explained presently, acts as an accumulator chamber in which recesses are provided for said three locking studs **30**.

The "brush" type charge **13** of the propulsive section is anchored to a suspension block consisting, according to this invention, of a base plate **34** adapted to move in the propulsive body **12** and rigidly connected to the sheath **27** in which the movable charge **19** is contained, for example, in this example, by means of a projection fitted in said sheath. On the other hand, a passage **36** is formed through the base plate **34** for receiving a gas supply; this passage **36** opens into the accumulator chamber **33**. A non-return valve **36*a*** is provided at the outlet end of passage **36** in chamber **33** which comprises, on the other hand, a pressure-release port **37**.

The fixed charge **18** receives therethrough a tube **38** having a front extension extending through the front cross member **25** in which it is bent to direct the combustion gas from the propellant towards the front end face of the sheath **27** enclosing the movable charge **19**. Another non-return valve **39** prevents any untimely return of gases towards said chamber **33**.

This rocket operates as follows:

When firing the rocket, the gases developing as a consequence of the combustion of the propelling charge **13** penetrate into the accumulator chamber **33** via passage **36** and flow through the non-return valve **36*a***. The pressure then prevailing in chamber **33** is substantially the same as that prevailing in the propulsive body **12**.

This pressure is exerted immediately on the locking studs **30** due to the presence of passages **40** formed in the stud cavities, so that the gases are directed towards the underface of the heads **30*a*** of studs **30**, against the antagonistic force of return springs **31**. Thus, the studs **30** are withdrawn from the locking groove **29** in which they were previously engaged. The sheath **27** and the explosive charge contained therein can then move freely under the pressure exerted against its front face by the gaseous flow produced through tube **38**. However, this movement, due to the provision of the accumulator chamber, will take place only when the pressure in the propelling body **12** has dropped to a value such that the force exerted on the front face of sheath **27** exceeds that exerted on the rear face of base plate **34**.

Simultaneously with the release of the movable charge, the pressure actuates a piston in fuse **11**, shearing a lock pin therein and permitting arming of the fuse in a conventional manner. Since the fuse is conventional, its internal structure has not been shown in the drawing.

This is the static phase of the operation, followed by the kinetic phase. This kinetic phase (see FIG. 2) is started when the force exerted on the sheath **27** exceeds that exerted on base plate **34** of propulsive body **12**, so as to cause the sheath **27** and the charge **19** contained therein towards the rear of the missile. At the end of this stroke, the sheath uncovers the orifice **37**, thus causing the accumulator chamber to communicate (see FIG. 2) with the propulsive chamber in which the combustion is now completed, that is, with the atmospheric pressure.

At the same time, the pressure is released from the locking studs **30**, then registering with the front locking grooves of the sheath, in order to lock this sheath again and thus prevent any untimely movement thereof as a consequence of inertia during the impact.

The non-return valve **39** isolates the accumulator chamber **33** from the expansion chamber **41** consisting of the space now freed, in the fixed charge, by the sheath having moved to the rear, so that a constant force can be maintained on this sheath **27** and thus ensure the proper positioning and locking thereof.

The explosive bar **19** is primed by the main charge, due to the presence of said ports **32**.

The kinetic phase is now completed and the missile is ready to operate as contemplated.

With the provisions characterizing this invention and as proved by practical experience, it is possible to multiply by a coefficient approximating **5** the quantity of efficient splinters in relation to projectiles having a fixed single charge, thus increasing under the same proportion the actual or field efficiency of the projectile. This efficiency is further increased, considering now the splinter potential in the efficient cone of dispersion, by using on the one hand for the fixed charge the double frustoconical shape according to this invention, and, on the other hand, a piezo-electric fuse and double contact ogive assembly, which, on the other hand, is known per se.

Of course, this invention may be embodied with many variations without departing from the basic principles thereof, as set forth in the appended claims.

What we claim is:

1. A self-propelled missile having a front end and a rear end, first and second chambers, the first chamber being positioned rearwardly of the second chamber, a combustible propellant charge contained in said first chamber, an explosive charge contained in said second chamber, said explosive charge comprising a fixed portion and a movable portion, and means for moving said movable portion of said explosive charge into said first chamber upon completion of combustion of said propellant charge, the means for moving the movable portion of the explosive charge comprising means for transmitting the pressure of the propulsive gases generated by combustion of said propellant charge to said movable portion and further comprising means for delaying movement of the movable portion of the explosive charge until shortly before completion of the combustion of the propellant charge, the delaying means comprising an accumulator chamber, means connecting said accumulator chamber with the first chamber and means connecting said accumulator chamber with that portion of the second chamber containing the movable portion of the explosive charge.

2. The missile claimed in claim **1** wherein the movable portion of the explosive charge is housed in a sheath disposed coaxially within and rearwardly movable with respect to the fixed portion of the explosive charge.

3. The missile claimed in claim **2** wherein the sheath enclosing the second portion of the explosive charge comprises guide grooves and locking grooves and wherein the missile comprises locking studs engaging said guide and locking grooves and spring means urging said studs into engagement with said grooves.

4. The missile claimed in claim **2** wherein the sheath housing the second portion of the explosive charge comprises guide grooves and locking grooves, and wherein the missile comprises locking studs engaging said guide and locking grooves and means for transmitting the pressure of the propulsive gases to said studs for disengaging said studs from said grooves.

5. The missile claimed in claim **4** wherein the second portion of the explosive charge is housed in a sheath fixed to a movable block, and the propellant charge is suspended from said block.

6. The missile claimed in claim **5** wherein the sheath has a forward face and wherein the missile comprises an accumulator chamber, first duct means in the movable block connecting said accumulator chamber to the propellant charge and second duct means in the fixed portion of the explosive charge and connecting said accumulator chamber with the forward face of said sheath.

7. The missile claimed in claim **1** wherein the first chamber is positioned rearwardly of the second chamber, and wherein the missile comprises a sheath enclosing the movable portion of said explosive charge, said sheath having a forward face, a movable block at the rear end of said sheath, said block forming the forward wall of the first chamber enclosing the propellant charge, locking studs normally engaging said sheath, an accumulator chamber, valved duct means for transmitting propulsive gases from said first chamber to said accumulator chamber but blocking transmission of gases from said accumulator chamber to said second chamber, means for transmitting the pressure of propulsive gases from said accumulator chamber to said locking studs to disengage said studs from said sheath and means for transmitting the pressure of propulsive gases from said accumulator chamber to the forward face of said sheath to cause rearward movement of said sheath and said block into said first chamber when the pressure in said accumulator chamber exceeds the pressure in said first chamber, and means for venting said accumulator chamber when said sheath has moved into said first chamber, thereby to permit said locking studs to re-engage said sheath.

8. The missile claimed in claim **7** wherein the fixed explosive charge has the shape of two frustrated cones joined at their major bases.

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