June 18, 1968 W. WALTHER 3,388,666

RIFLE GRENADE

Filed March 15, 1967 2 Sheets-Sheet 1

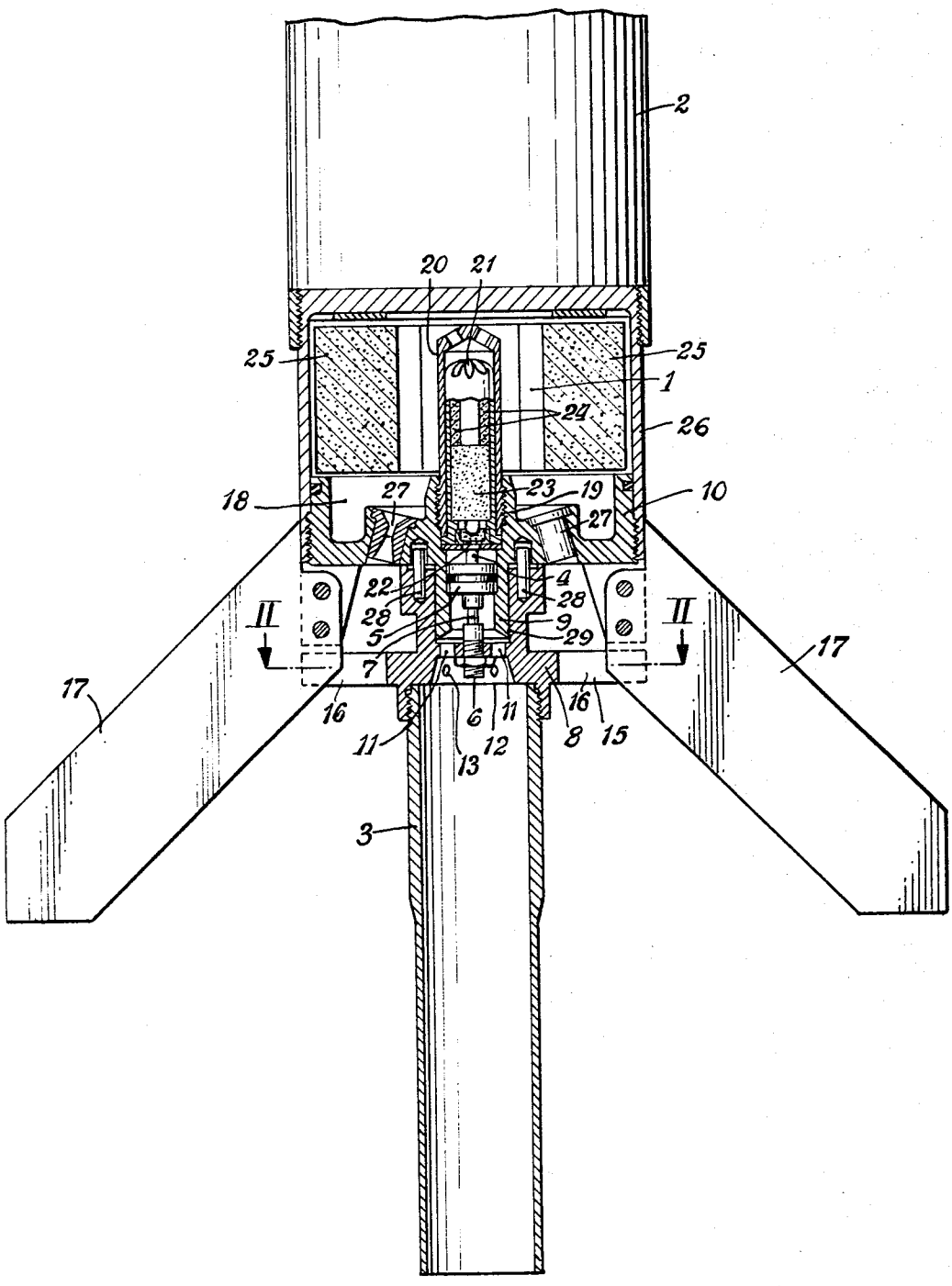

Fig. 1

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RIFLE GRENADE

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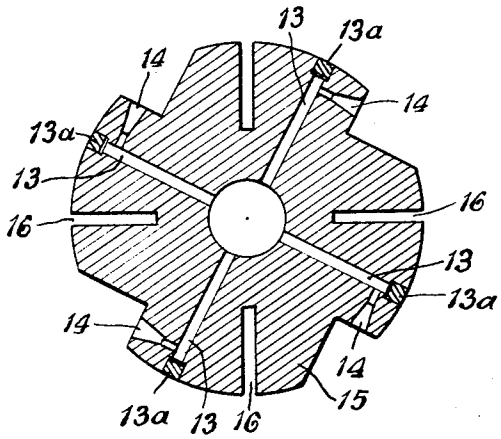

Fig. 2

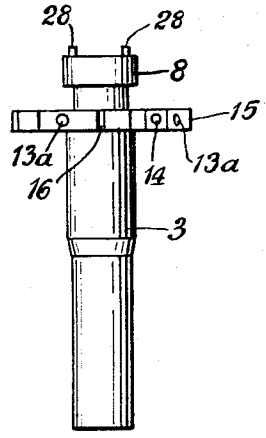

Fig. 4

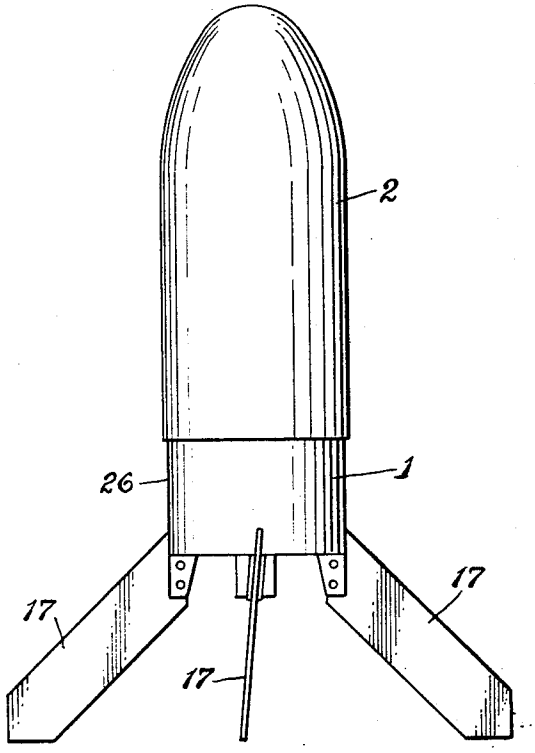

Fig. 3

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RIFLE GRENADE

Willi Walther, Johlingen, Baden, Germany, assignor to Industrie-Werke Karlsruhe Aktiengesellschaft, Karlsruhe, Germany, a corporation of Germany

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8 Claims. (Cl. 102—49.7)

ABSTRACT OF THE DISCLOSURE

A rifle grenade adapted to be propelled from a rifle by supplementary propulsive cartridge charges arranged in a propulsion unit disposed between a warhead and the customary tail sleeve inserted into the muzzle of the rifle. The improvement comprises the arrangement of a destructible link in the grenade for separating at the instant of firing the tail sleeve from the warhead, so that the tail sleeve is dropped while the grenade is caused to travel toward the target without any dead weight.

The invention relates to improvements in a rifle grenade which is provided with a supplementary propulsion unit and is intended to be attached by means of a tail sleeve to the muzzle end of a firearm.

In rifle grenades with supplementary propulsion means presently known, the propulsion unit is generally constructed to have a smaller diameter than the caliber of the grenade. This rather small diameter allows for only small propulsive charges even when the unit is considerably lengthened. The result of such construction is that in spite of great length, the thrust created by such propellants can only be low. Moreover, it is customary to ignite the propulsion unit directly by means of the gas pressure created by the propulsive cartridge charge, so that the combustion chamber wall must be made strong enough to withstand the high detonation pressure. Moreover, in the grenades presently referred to, the tail sleeve, besides serving as means for fastening the grenade to the gun barrel, is also used for carrying the stabilizing tail fins and these as well as the sleeve form "dead weight" after start and must be accelerated by the propulsion unit. Another drawback of present rifle grenades is the fact that they endanger the rifleman by the rearward blast of exhaust flames. In order to reduce this danger it has been the practice to employ weak propulsion charges with consequently lower energy and shorter length of rearward blast, but also having a limited firing range. Susceptible to improvement in known rifle grenades is also the imparting of spin motion to the grenade for correction of structural and thrust asymmetry to stabilize the trajectory. Conventionally this is effected by an arrangement of holes in the tail sleeve, which holes can be effective only during flight of the grenade so that very little correction is obtained at the instant of firing when the projectile leaves the rifle barrel.

It is an object of the present invention to overcome the disadvantages enumerated above and to provide a rifle grenade which is considerably lighter in weight than presently known grenades and which is furnished with a propellant producing a strong propulsive force.

For this purpose, this invention provides that between the propulsion unit and the tail sleeve of the grenade a piston equipped with a firing pin is inserted. The stem of this piston is provided with a reduced portion having a predetermined breaking point, which upon predetermined stress will break and thereby separate the propulsion unit from the tail sleeve and its head portion. When compared with the presently known rifle grenades, such separable construction has the advantage that the tail sleeve and its head portion are dropped immediately after firing, whereby the weight of the projectile is reduced and, owing to a more favorable mass propulsion relationship gained thereby, its flight velocity and firing range increased. The principle here employed of disposing elements not further used is similar to the practice with two-stage rockets.

Referring now to constructional details of the invention, it is provided that the piston with the firing pin is inserted gas tight in a centering piece of the combustion chamber bottom and, after firing, is freely movable therein along the firing direction, while the piston stem is connected with the head portion of the tail sleeve. This has the result that before firing there exists a rigid connection by way of the piston between the centering piece of the combustion chamber bottom and the head portion of the tail sleeve. This rigid connection is broken only during the firing action in that the gas pressure created by the propulsive cartridge charge destroys the piston stem portion at the predetermined low breaking point and releases the piston to move forward in the firing direction, so that its firing pin strikes the detonator of the ignition cartridge and thereby ignites a supplementary charge of the propulsive charge. Owing to the fact that the piston is inserted gas tight in the centering piece at the combustion chamber bottom, the high pressure resulting from firing of the propulsive cartridge charge cannot enter the combustion chamber, and therefore the wall of this chamber can be made thinner than heretofore with the result of reduction of overall weight. In accordance with this invention, the ignition pressure of the supplementary propulsion unit in the grenade is adjusted to a normal combustion chamber pressure, and since this is the highest pressure ever to occur in the chamber, it is possible to design the chamber walls for this substantially smaller pressure.

Another structural feature of this invention is the arrangement of holes in the face area of the tail sleeve head portion and the radial extension of this head portion into an annular face plate provided with radial bores and tangential discharge nozzles. By this inventive measure, it is made possible to divert the gas pressure of the propulsive cartridge charge to become effective in several directions. First, by the pressure acts through the holes in the face area of the head portion to disrupt the piston stem at its low breaking point and to impart the accelerative force for the initial velocity of the grenade; and, secondly, acts through the radial bores and the tangential discharge nozzles in the face plate to impart a spinning motion to the grenade at the instant of firing, an immediately effective correcting action for structural and thrust asymmetry which is far superior to the corrective means employed in conventional rifle grenades.

Swingably and settably secured to the combustion chamber bottom are also the stabilizing tail fins which extend rearward through suitable slots in the annular face plate of the tail head portion. This construction in which the combustion chamber bottom serves as carrier for the stabilizing tail unit is an inventive deviation from prior art constructions in which the tail fins are mounted on the tail sleeve. Mounting on the tail sleeve is impossible here, because the tail sleeve is dropped at the instant of firing and is not carried by the projectile in flight.

In order that, in accordance with this invention, separation between the grenade and its tail sleeve after breakage of the piston stem be unhindered, it is provided that the head portion of the tail sleeve be arranged on the centering piece of the combustion chamber bottom and that it be in connection therewith only through dowel pins engaging head portion and centering piece. This connection insures transmittal of torsional forces but will disengage upon axial movement. Such axial movement is

effected at the instant of firing when the rearward projecting blast flames of the supplementary propulsion unit in the grenade strike against the forward side of the face plate around the head portion of the tail sleeve. The force produced thereby will remove the head portion from the centering piece and disengage the dowel pins. Now the tail sleeve, slipped from the rifle barrel by the propulsive cartridge charge at the muzzle and counteracted by the supplementary propulsion, will drop to the ground and the rifle grenade, released from the tail sleeve, will travel toward its target. From this description, it will be clear that the dowel-pin engagement between the head portion of the tail sleeve and the combustion chamber bottom is necessary for transmitting the spinning motion imparted by the tangential discharge nozzles in the face plate of the tail sleeve to the grenade at the instant of firing and until this connection is subsequently disengaged.

According to another object of the present invention, the combustion chamber bottom is provided with a socket-like projection into the combustion chamber. This socket is suitable for receiving a shell surrounding an ignition cartridge containing an ignition propellant in additon to a supplementary ignition charge. The addition of an ignition propellant to the supplementary ignition charge insures that the main propulsive charge for accelerating the grenade in its flight is ignited immediately after the ignition of the supplementary ignition charge.

Other objects of the invention reside in the physical dimensioning of the propulsive unit and of the face plate extending radially from the head portion of the tail sleeve, both of which have a diameter substantially equal to the caliber of the grenade; and reside further in the arrangement of the face plate to the rear of the blast exhaust nozzles so that, at the instant of grenade firing, the flames of the exhaust jets will be deflected radially outward. The large diameter of the propulsion unit has the advantage that within its more ample combustion chamber, there can be accommodated a larger main propulsive charge of greater diameter but relatively short length; and the large diameter of the face plate and its arrangement behind the exhaust nozzles gives the assurance that the danger of accidental burns inflicted on the rifleman by the rearward projecting exhaust flames is practically eliminated, since the large face plate serves as protective shield in deflecting the blast.

A preferred embodiment of this invention is illustrated in the accompanying drawing, in which:

FIG. 1 is a broken away diagrammatic side view, partly in section, of a rifle grenade according to the present invention;

FIG. 2 is a cross-sectional view taken along the line II—II of FIG. 1;

FIG. 3 is a diagrammatic side view, on a reduced scale, of the grenade shown in FIG. 1, but without its tail sleeve;

FIG. 4 is a reduced-scale side view of the tail sleeve with head portion after separation from the grenade.

Referring particularly to FIGS. 1 and 4 the rifle grenade comprises generally a propulsive unit **1** with a warhead **2** and tail sleeve **3**. Interposed between the propulsive unit **1** and the tail sleeve **3** is a piston **5** equipped with a firing pin **4** and mounted on a stem **6**. The stem **6** includes a portion **7** of a reduced cross-sectional area having a predetermined breaking point. This portion **7** is calculated to break and separate the tail sleeve **3** with its head portion **8** from the propulsion unit **1** at the instant of firing. The piston **5** itself is arranged gas tight in a centering piece **9** forming a projection of the combustion chamber bottom **10**, while its stem **6** with its rear end is connected with the head portion **8** of the tail sleeve **3**.

The face area **12** of the head portion **8** is provided with holes **11** which communicate with radial bores **13** extending to the periphery of an annular face plate **15**, in which head portion **8** is centered (see FIG. 2). The radial bores **13** are closed at the periphery by plugs **13a** or the like and are provided near their outer plugged-up end with discharge nozzles **14** pointing at right angles to the bores **13** in substantially tangential direction with respect to the face plate **15**. Swingably and settably secured to suitable projections of the combustion chamber bottom **10** are flight-stabilizing tail fins **17** which extend rearward through suitable radial slots **16** in the face plate **15**. A socket-like projection **19** extends from the combustion chamber bottom **10** into the combustion chamber **18**. This socket **19** is suitable to receive a shell **20** which surrounds an ignition cartridge **21** containing a primer or detonator **22**, a small ignition propulsive charge **24** and a supplementary charge **23**. The shell **20** is surrounded by a main propulsive charge **25** engaging the outer combustion chamber wall **26**. The combustion chamber bottom **10**, which is provided with rearwardly directed exhaust nozzles **27** arranged in somewhat slanting and tangentially inclined direction, has also holes for receiving pins **28** which also engage the head portion **8** of the tail sleeve **3** and serve to transmit torsional force from the tail portion to the grenade.

The operation of the several elements at the instant of firing of the grenade is as follows: At the instant of firing, the ignition of a propulsive charge cartridge (not shown) creates a pressure at the rifle muzzle and ignites indirectly the propulsion unit **1** of the grenade in the following manner: The pressure from the propulsive charge cartridge enters the holes **11** in the face area **12** of the head portion **8** of the tail sleeve **3** and enters the interior of centering piece **9** of combustion chamber bottom **10** wherein piston **5** is freely movably inserted and gas tight. The pressure exerted against the piston **5** results in a tensile stress in the stem **6** which exceeds the breaking limit of the low-breaking portion **7**. After disruption of stem **6** at **7** the piston **5** is free to move and will be moved forward in the firing direction by the gas pressure. Such movement of the piston **5** causes the firing pin **4** to strike the detonator **22** of the ignition cartridge **21** which ignites the supplementary ignition charge **23** and the ignition propulsive charge **24**, whereby, in turn, the main propulsion charge **25** is ignited.

Simultaneously herewith a portion of the gas pressure created by the explosion of the propulsive charge cartridge progresses through the bores **13** in the face plate **15** and escapes through the discharge nozzles **14**. These jets of gas, substantially in tangential direction with respect to the grenade axis, impart already during the firing a twist or spinning motion to the grenade, which spin effectively corrects for structural and thrust asymmetry in the grenade flight. This initial spinning motion is transmitted from the tail sleeve head portion **8**, in whose face plate **15** the nozbles **14** are located, to the grenade by means of the pins **28** engaging the head portion **8** and the combustion chamber bottom **10**, the latter being an integral part of the grenade.

After the low-breaking portion **7** of stem **6** has been disrupted by the gas pressure produced by the explosion of the propulsive charge cartridge and after ignition of the propulsion unit **1**, the exhaust flames produced by the combustion discharged by the exhaust nozzles **27** at the combustion chamber bottom **10** impinge upon the face plate **15** at the head portion **8** of tail sleeve **3**. Owing to the broken stem **6**, the force against the face plate **15** caused thereby is capable of pushing the tail sleeve **3** including its head portion **8** off its seat at **29** on the centering piece **9**. Furthermore, the tail sleeve will be pushed off the rifle barrel by the explosion of the propulsive cartridge charge and when the impact of this charge explosion dies out, the tail sleeve will be free to drop to the ground, whereas the grenade will be accelerated by its propulsion unit on its flight toward its target. Since, as above mentioned, the exhaust blast flames, issuing immediately after firing, impinge upon the face plate **15** at the head portion **8** of the tail sleeve **3**, it will be understood that these flames by so impinging are deflected by the face plate which thus serves

also as a protective shield for the rifleman so that the danger of burn injuries is effectively prevented.

I claim:

1. A rifle grenade for attachment to the muzzle end of the barrel of a firearm, including a supplementary propulsive charge comprising a propulsive unit for accelerating said grenade in flight after firing and having a front face and a rear structure, a warhead mounted on said front face, a tail sleeve having a head portion, and connecting means between said rear structure and said head portion including destructible means adapted to be destroyed by the gas pressure created by the propulsive charge at the instant of firing to completely detach said tail sleeve from said propulsive unit.

2. A rifle grenade according to claim 1, in which said propulsive unit includes a combustion chamber having a bottom, and that said connecting means is arranged between said bottom and said tail portion and includes a centering piece projecting from said bottom, a piston movably inserted in said centering piece and having a rearwardly extending stem, a firing pin projecting from the front face of said piston, said stem at its rearward end being fixedly connected to said head portion and having a section of a predetermined breaking point, and means for directing the gas pressure created by the explosion of said propulsive charge to become effective upon said piston to disrupt said stem at its breaking point and thereby separate said tail sleeve from said propulsive unit.

3. A rifle grenade according to claim 2, wherein said means for directing the gas pressure against said piston consists of a face area in said head portion, provided with holes leading from said tail sleeve into said centering piece.

4. A rifle grenade according to claim 1, in which said propulsive unit includes a combustion chamber having a bottom and a circumferential wall, a centering piece extending axially from said bottom into the combustion chamber, the head portion of said tail sleeve being seated on said centering piece, a piston inserted for slidable movement in said centering piece and carrying on one of its ends a firing pin projecting into said combustion chamber, said piston being secured to a stem extending to said head portion and being secured thereto with its other end, a portion having a predetermined low breaking point in said stem, said piston being prevented from slidable movement in said centering piece as long as said stem is in one piece but being free to slide forward after said low-breaking point portion is disrupted, and means for directing the gas pressure resulting from explosion of said propulsive charge into said centering piece to push against said piston so as to disrupt said stem and move said piston forward.

5. A rifle grenade according to claim 4, wherein said head portion of said tail sleeve carries a radially extending annular face plate having a diameter substantially equal to the caliber of the grenade and having radial bores extending into the inner opening of said tail sleeve and being closed by plugs at the periphery of said plate, said bores communicating near the periphery of said face plate with substantially tangentially directed discharge nozzles which cause the gas pressure created by the ignition of the propulsive charge to produce a discharge through said nozzles resulting in a torsional force on said tail sleeve.

6. A riflle grenade according to claim 5, including pins inserted between said centering piece projecting from said combustion chamber bottom and said head portion of said tail sleeve, said pins serving for the transmission of the torsional force on said tail sleeve to said propulsive unit for imparting a spinning motion to the grenade.

7. A rifle grenade according to claim 5, including flight stabilizing tail fins swingably and settably secured to said combustion chamber bottom and extending rearwardly and engaging slots in said face plate of said tail sleeve.

8. A rifle grenade according to claim 1, including a main propulsive charge in said propulsive unit, means forming a combustion chamber in said unit, a socket projecting from the bottom of said chamber into the latter, a shell (20) inserted in said socket and surrounding an ignition cartridge (21) containing a detonator (22), a supplementary ignition charge (23, 24), and a main propulsion charge (25), said combustion chamber bottom carrying an outwardly projecting centering piece and being provided with exhaust nozzles, said head portion being adapted to be seated on said centering piece and being provided with a face area having holes therein leading into said centering piece, a piston axially movably inserted gas tight in said centering piece and carrying a firing pin (4) extending into said socket and being provided with a stem extending rearwardly to be fixedly secured to said head portion and forming the only unit-sustaining connection between said tail sleeve and said propulsive unit, a low-breaking-point portion in said stem, said piston being kept from sliding in said centering piece as long as said stem is in one piece but being free to slide forward to strike with its firing pin (4) and ignite said detonator (22) in said shell after said low-breaking point portion is disrupted by the developing gas pressure which enters through the holes in said face area into said centering piece to act on said piston, and an annular plate extending radially from said head portion to lie in rear of said exhaust nozzles in said combustion chamber bottom for deflecting the exhaust blast flames outwardly and for serving as a protective shield.

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BENJAMIN A. BORCHELT, *Primary Examiner.*

V. R. PENDEGRASS, *Assistant Examiner.*