Feb. 8, 1955 C. N. HICKMAN 2,701,525

MORTAR SHELL LOADING DRIVER ROCKET

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Fig. 1.

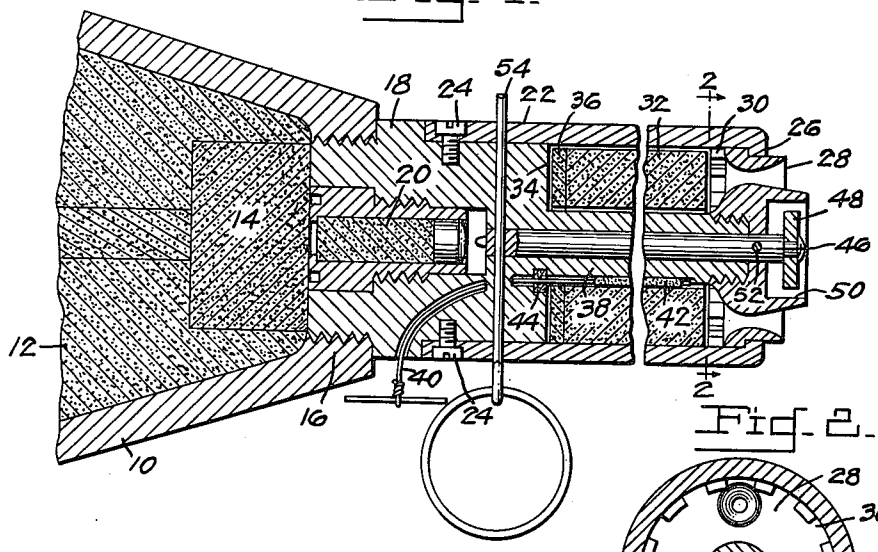


Fig. 2.

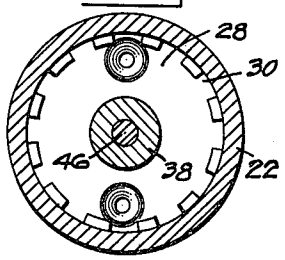


Fig. 3.

Fig. 4.

Fig. 5.

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MORTAR SHELL LOADING DRIVER ROCKET

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The conventional procedure in firing a mortar is to insert the cartridge into the muzzle and to drop it down the barrel. The cartridge acquires sufficient momentum so that its percussion cap is initiated by striking a fixed firing pin in the breech end of the mortar barrel. This procedure requires a sufficiently high angle of elevation of the barrel so that the cartridge will acquire a certain minimum momentum or velocity by the time it strikes the firing pin and as a corollary, a relatively loose fit of the bourrelet within the barrel bore to avoid excessive friction and consequent reduced velocity of drop. On the other hand, a loose fit of the bourrelet permits excessive blow-by of the propelling charge and, in an obvious manner, reduces muzzle velocity and range for any given projectile and propelling charge.

In my Patent 2,519,905, granted August 22, 1950, I have disclosed a driver rocket for attachment to the nose of a mortar cartridge or projectile which, when initiated, acts positively to drive the cartridge rearwardly along the mortar barrel so that it strikes the firing pin with sufficient momentum to insure initiation of the propelling charge.

The advantages inherent in the use of a driver rocket in connection with a mortar firing are numerous. The mortar can be fired with the barrel at very low angles of elevation, or even depression when required. Furthermore, the bourrelet can be given a much closer fit or tolerance within the barrel, resulting in less blow-by, and greater muzzle velocity and range for a given projectile and propelling charge. In addition, the use of driver rocket enables greater latitude of mortar design. For example, a mortar can be designed for quick elevation, loaded by its crew from cover with the barrel depressed, and then elevated to the desired angle and fired from cover.

The invention of my aforesaid patent, while extremely useful, was not readily adaptable to the use of a nose impact fuse.

It is therefore the principal object of this invention to provide a driver rocket of the type aforesaid which at the same time enables the use of an impact fuse in the nose of the projectile.

Another object is the provision of a driver rocket for a mortar projectile which, at the same time, insures detonation of the explosive charge therein at low or grazing angles of impact with the target.

Other objects and advantages will be apparent to those skilled in the art after a study of the following specification, in connection with the accompanying drawing.

In the drawing:

Figure 1 is an axial sectional view of a driver rocket assembly mounted on the nose of a projectile;

Figure 2 is a cross sectional view taken on the section line 2—2 in Figure 1;

Figure 3 is a view, similar to Figure 1 but having a modified form of this invention wherein the nose of the projectile rather than the driver rocket carries the projectile firing pin, and the pull-match igniter and nozzle are arranged axially of the motor chamber with a plurality of propellent grains in place of the single grain used shown in Figure 1;

Figure 4 is a cross sectional view of the firing pin plate and contiguous portions, taken on the line 4—4 in Figure 3; and

Figure 5 is an axial sectional view of another modification of this invention showing a differently located

pull-match and safety pin combined with structure similar to that shown in Figure 1.

In the drawing and the following detailed description similar characters of reference relate to similar or identical parts and portions throughout the several views.

A nose portion 10 of a projectile suitable for employment with this invention is represented in Figure 1 as having a charge 12, a booster 14 and an internally threaded portion 16 to receive one end of the body member 18 of the driver rocket. This body member 18 is designed to receive axially thereof a primer assembly 20, at one end, and the motor chamber 22 is secured to the body member 18 by any suitable means such as the screws 24. At the front end of the motor chamber 22 an inturned lip flange 26 functions as an abutment for a double nozzle member 28. The nozzle member 28 is provided with a circumferentially notched collar portion indicated at 30 adapted to retain the propellent grain 32 between nozzle member and a shoulder 34 on the body member 18, it being preferred that a quantity of black powder 36 be also included. The nozzle member is threaded onto the end of the reduced portion 38 of said body member.

Igniting means is illustrated in Figure 1 as comprised of a pull-match wire 40 preferably provided with a chemical at 42 to react chemically with another chemical at 44 to produce sufficient heat and flame to cause ignition of the black powder 36 and the propellent grain 32. If preferred, the chemical 42 can be deleted and the corresponding portion of the wire merely roughened or made in undulating form. Combustion gases emanating from the nozzle member 28 will drive the complete assembly, including the projectile, as to the left in Figure 1. To accommodate the wire 40 and the chemical at 44 the body member 18 is suitably bored and recessed, a portion of the space between the grain 32 and the reduced portion 38 being used for the wire and chemical at 42.

This invention contemplates combination of a driver rocket of the general character described above with a firing pin 46 arranged axially of the reduced portion 38 and extending forwardly to initiate detonation on impact with a target. The head 48 of the firing pin is within a recess 50 in the forward central portion of the nozzle 28. Safetying of the firing pin is accomplished by the shear pin 52 inserted through the firing pin and said nozzle and by the substantially conventional safety pin 54 inserted through aligned bores in the motor chamber 22, body member 18 and the firing pin.

In the modified form of this invention shown in Figures 3 and 4, the projectile nose fuse assembly, generally indicated at 54, includes a fuse body 56, an axially positioned primer 58, and a firing pin 60 with a shear pin 61 and a striker plate 62 of novel form. The striker plate includes a rim 64, hub 66 and radiating spokes 68, the last being accommodated in slots 70 provided in the adapter 72, as clearly indicated in Figure 4. The rim 64 is disposed externally of the adapter 72 and a glancing contact with a target will detonate the projectile, provided the safety pin 74 is withdrawn. In this modified form of the invention the adapter 72 has an axially positioned guiding ferrule 75 for the match wire 76 and suitable chemical substances 78 and 80, also arranged coaxially of the nose fuse 54 and motor chamber 82, are employed essentially as indicated in Figure 1. However, there is here provided a plurality of propellent grains 84 held in regularly spaced position by suitably dimensioned supporting pins 86 which are secured, by riveting or otherwise, to the front end plate portion 88 of the motor chamber 82. It will be noted that the single nozzle 90 is arranged axially of the motor chamber 82 and that the latter is threaded into the adapter 72 with an ignition washer 92 of black powder or the like held between the propellent grains 84 and the front face of the adapter. A closure disc 94 may be compressed between the adapter and the front end of the fuse body member 56 to protect the fuse from hot gases generated in the driver rocket.

In a second modified form of this invention, illustrated in Figure 5, the nozzle 96 having at least two exhaust openings 98 is threaded into the end of a motor cham-

ber **100** and formed integral with an element **102** corresponding to the reduced portion **38** in Figure 1. The propellent charge **104** may be of sheet type and wrapped around the element **102**, and the match **106** is located between the element **102** and the propellent charge **104** with the pull wire of the match extending through the nozzle and terminally connected, as indicated at **108** to a pull ring **110**. The pull ring is snapped over a nodule **112** for retention on the end of the nozzle **96**. A pin **114**, shown in dash lines in Figure 5, is connected by a loop **116** to the pull ring **110** and is inserted into a bore extending chordally into the nozzle **96** so that this pin serves to anchor the pull ring **110** at the side of the nozzle remote from the nodule **112**, but this pin **114** does not pass through the firing pin **118**. A shear pin **120** extends diametrically through the nozzle **96** and the firing pin shank, this pin **120** being designed to shear when the firing pin is driven rearwardly upon impact with a target. A washer **122** of black powder is preferably inserted at the end of the charge **104** adjacent the match chemical **124**.

The operation of this invention will be obvious from a consideration of the foregoing description taken with the drawing but in recapitulation it may be added that in all the disclosed forms of the invention the driver rocket can be activated by pulling a match wire, thus enabling the projectile to be driven into a mortar, without any considerable danger of detonating the bursting charge **12** of the projectile. The driver rocket assembly remains on the projectile during flight thereof and the firing pin, unsafetied immediately before rocketing the projectile into the mortar, is held in inoperative position during the loading, firing and flight of the projectile by a shear pin such as those indicated at **52**, **61** and **120** in Figures 1, 3 and 5, respectively.

In the rocket driver construction disclosed in my Patent 2,519,905, the rocket driver parted from the projectile at no great distance from the mortar and thus became a missile and constituted a hazard. An advantage not previously noted herein resides in the fact that according to the instant invention the rocket driver is a part of the projectile and does not become detached from the remaining portions of the projectile and constitutes no hazard to troops close to the mortar.

Obviously minor variation from the presently disclosed forms of this invention may be made without departure from the scope of the invention.

I claim:

1. The combination comprising a muzzle loaded ordnance projectile adapted to be fired from a gun barrel, a fuse on the nose end of said projectile to explode said projectile on target engagement, a rocket forming a part of said fuse and adapted to drive said projectile rearwardly into the said gun barrel from the muzzle thereof to a firing position, and a pull match to ignite said rocket.

2. The combination comprising a muzzle loaded ordnance projectile adapted to be fired from a gun barrel, a primer in said projectile, a firing pin normally held in spaced relation with said primer, a rocket fixed to the nose end of said projectile and adapted to drive the said projectile rearwardly into the said gun barrel from the muzzle thereof to a firing position and to remain fixed to the said projectile during flight, and means to ignite said rocket, the said firing pin including an actuator extending beyond the said rocket in one dimension.

3. A muzzle loaded ordnance projectile adapted to be fired from a gun barrel comprising a body member, a charge in said body member, a primer disposed adjacent said charge, a firing pin in the nose end of said body and normally in spaced relation with said primer, a combustion chamber formed around said firing pin and terminating forwardly in a plurality of flaring nozzles, a propellent in said chamber, and means to ignite said propellent to drive the said projectile rearwardly into the gun barrel to firing position, the said firing pin extending forward beyond the said flaring nozzles.

4. The invention according to claim 3 wherein the said propellent is a solid powder grain and the said means to ignite the said propellent is a pull match.

5. The invention according to claim 3 wherein the said propellent is of the wrapped sheet type and the said means to ignite the said propellent is a pull match.

6. A muzzle loaded ordnance projectile adapted to be fired from a gun barrel comprising a body member, a charge in said body member, a primer disposed adjacent said charge, a firing pin in the nose of said body and normally in spaced relation with said primer, a combustion chamber formed forwardly of said firing pin and terminating in an outwardly flaring nozzle, a propellent in said combustion chamber, means to ignite said propellent, and a striker plate engaging the said firing pin and extending radially beyond the said body.

7. The invention according to claim 6 wherein the said propellent comprises a plurality of grains in spaced position and the said means to ignite the said propellent comprises a pull match.

References Cited in the file of this patent

UNITED STATES PATENTS

58,646	Hunt	Oct. 9, 1866
479,738	Cunningham	July 26, 1892
2,519,905	Hickman	Aug. 22, 1950

FOREIGN PATENTS

516,818	Great Britain	Jan. 12, 1940