Aug. 22, 1950 C. N. HICKMAN 2,519,905

DRIVER ROCKET

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FIG. 1.

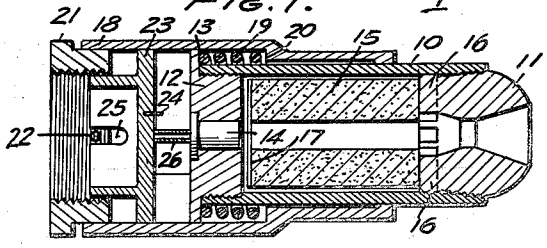

FIG. 2.

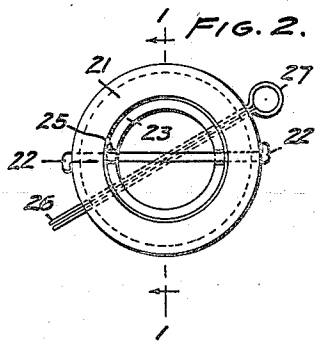

FIG. 3.

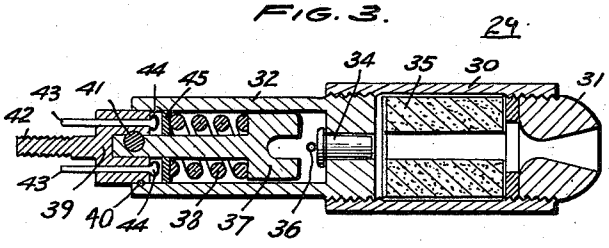

FIG. 4.

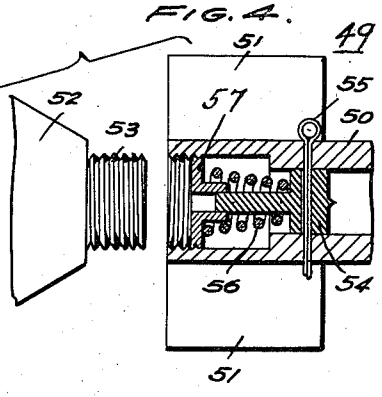

FIG. 5.

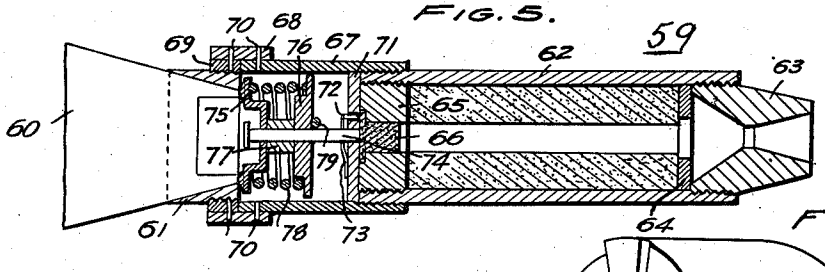

FIG. 10.

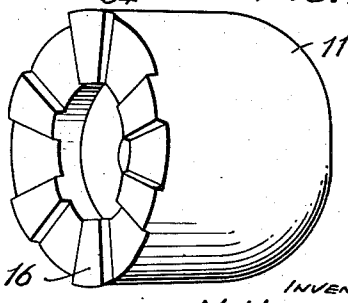

FIG. 6.

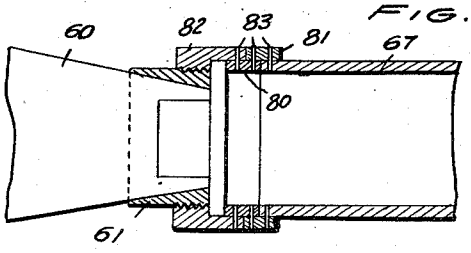

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FIG. 7.

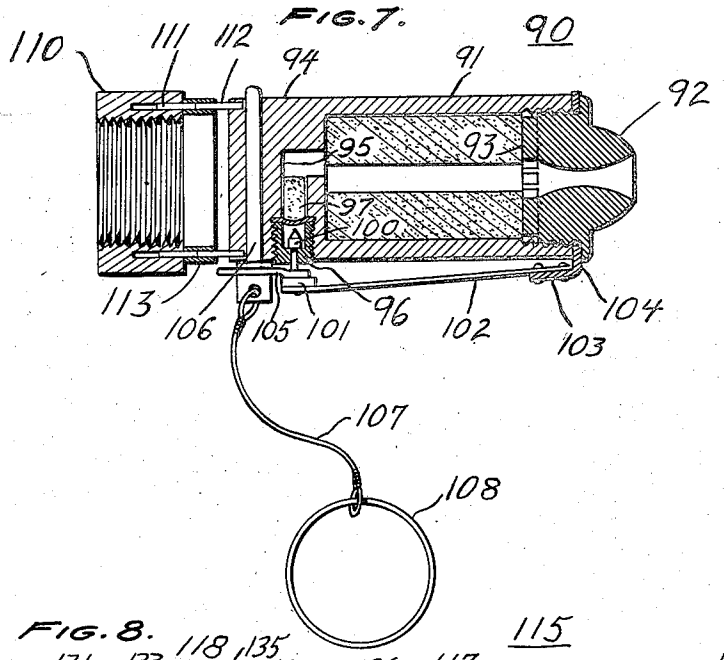


FIG. 8.

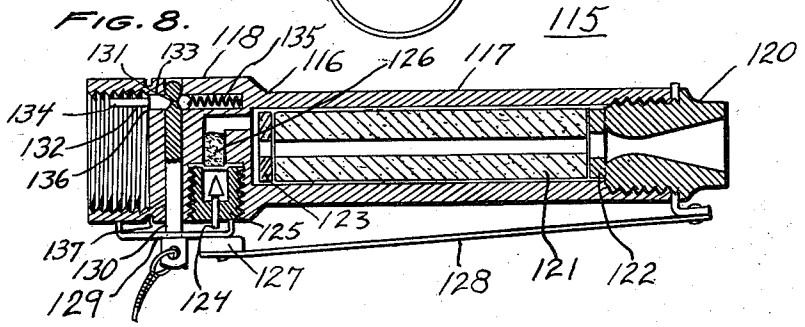
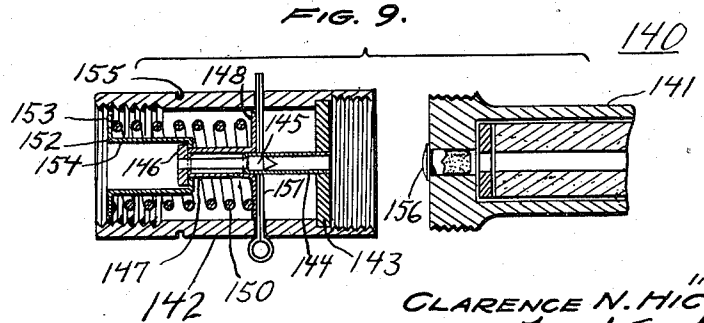


FIG. 9.



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UNITED STATES PATENT OFFICE

2,519,905

DRIVER ROCKET

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Application May 17, 1945, Serial No. 594,241

14 Claims. (Cl. 102—49)

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The invention described herein may be manufactured and used by or for the Government, for governmental purposes, without the payment to me of any royalty thereon.

This invention relates, generally, to rocket apparatus, and more specifically to driver rockets for muzzle-loaded ordnance.

In muzzle-loaded ordnance, such as the 4.2" chemical mortar (pages 372 through 378, "Chemicals in War," by Prentiss, 1937, McGraw-Hill Book Company, Inc.), the force of gravity is used to move the loaded projectile or shell from the muzzle down the mortar tube or barrel into the firing position. A fixed firing pin at the tube cap end or base of the mortar, fires the propellant as soon as the projectile slides back into the firing position against the firing pin. This method of loading and firing is satisfactory for high-angle fire of the chemical mortar, but is impossible for low-angle fire at point blank ranges, because of insufficient gravitational force to move the projectile into the firing position. That is, the mortar barrel must be elevated to at least a certain minimum angle in order for it to be operated.

The present invention covers the means which I have provided to permit a mortar to be effectively fired not only at low angles of elevation, but even with the mortar barrel depressed below the horizontal. Briefly stated, my present invention resides in providing driver rockets or mortars which can be attached to the nose end of a mortar shell and which will develop sufficient driving force to drive the shell backward through the barrel into the firing position. Although the driver rockets of this invention are found to be particularly useful in connection with loading and firing the chemical mortar at all angles of fire, it will be apparent that there are numerous other applications to which such devices may be put.

Although the present invention has been particularly made for use with the 4.2" chemical mortar, and will be described hereinafter in connection therewith, it will be apparent that it has general application to all types of muzzle loaded weapons.

The object of this invention, generally stated, is the provision of means whereby a muzzle loaded mortar may be fired at low angles of elevation, and even at angles of depression below the horizontal.

More particularly, an important object of this invention is to provide a driver rocket or motor adapted to be attached to the nose end or nose

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fuse of a mortar shell for driving the shell rearwardly into a firing position against the firing pin.

Another object of the invention is to provide such a driver rocket that will be automatically detached from the shell or projectile to which it has applied a desired thrust in response to launching of the projectile.

Still another object of the invention is to provide such a driver rocket or motor having a firing mechanism and suitable safety device to prevent premature firing.

Other objects and advantages of the invention will be readily apparent from the following detailed description of the embodiments illustrated in the accompanying drawings, in which:

Figure 1 is a longitudinal, vertical, sectional view of one embodiment of the invention;

Figure 2 is a left end, elevational view of the driver rocket shown in Figure 1;

Figure 3 is a longitudinal, vertical, sectional view of another form of driver rocket embodying my invention;

Figure 4 is an elevational view, partly in section, of still another form of driver rocket and the nose end of a shell to which the driver rocket may be attached;

Figure 5 is a longitudinal, vertical, sectional view of another driver rocket forming another embodiment of the invention;

Figure 6 is a vertical, sectional view of modified means for fastening the driver rocket of Figure 5 to the nose of a projectile;

Figure 7 is a longitudinal, vertical, sectional view of another form of rocket motor forming an embodiment of this invention;

Figure 8 is likewise a longitudinal, vertical, sectional view of still another driver rocket embodying the present invention;

Figure 9 is a longitudinal, vertical, sectional view of still another form of driver rocket forming another embodiment of this invention, the motor housing being shown separated from the ignition head; and

Figure 10 is an enlarged perspective view of the nozzle member of Figure 1.

Referring now particularly to Figures 1 and 2 of the drawings, a driver rocket is shown generally at 9 comprising a motor housing or casing 10 provided with a nozzle 11 threaded thereinto, and further provided with a front plug or head 12 threaded into the motor housing 10 and having a projecting flange 13. The plug or head 12 is apertured so as to receive a blank cartridge or primer 14 therein, as shown. The motor hous-

ing 10 contains a cylindrical powder grain 15 of a rocket-type propellant.

The propellant 15 may be of Russian powder, about 7/8" in external diameter and about 1 1/8" in length. The diameter of the throat of the nozzle 11 should be about 0.02 square inch. The inner end of the nozzle 11 may be provided with several radially arranged ridges 16 which serve as a powder trap supporting the grain 15 while the gaseous products of combustion pass to the nozzle between the ridges. The forward or left end of the powder grain 15 is provided with a coating of black powder 17, or the like, to assist in the ignition of the grain. Other powder such as H–4 (T–2) may be used by making suitable adjustment of dimensions.

A supporting sleeve 18 has a reduced section surrounding a portion of the motor housing 10 and an enlarged section also surrounding the left end of the housing 10 and extending therefrom. A shoulder 20 is provided between the two sections of the sleeve 18 and serves to retain a compression spring 19 in place in cooperation with the flange 13 of the plug 12. An internally threaded coupling 21 is slidably fitted in the left end of the sleeve 18, and is secured thereto by means of a shear wire or pin 22 passing through both of these parts, as shown in Figure 2. Within the sleeve 18 and between the coupling 21 and the plug 13, is provided a slidable plunger or piston 23 carrying a firing pin 24. The skirt portion of the plunger 23 is provided with a pair of diametrically opposed slots 25 through which the shear pin 22 extends. In order to provide for the safe firing of the driver rocket 9, a pull bar 26 is provided which extends through suitable slots in the sleeve 18 positioned so that the bar 26 separates the plunger 23 from the blank cartridge 14. The slots in the sleeve 18 accommodating the pull bar 26 are made longer than the width of the pull bar 26 so that it may shift in position axially of the driver unit 9. The pull bar 26 may be provided with a ring 27 at one end to which a pull cord may be secured.

The driver rocket 9, having been described in detail, its mode of operation is as follows:

The coupling 21 is screwed on to the front or nose of a projectile. As it is screwed on, the end of the projecting stud or thread on the projectile nose engages and pushes the member 23 further into the sleeve 18 thereby pushing against the pull bar 26 which in turn moves the head plug 12 to compress the spring 19. In Fig. 1, the driver unit parts are illustrated in the compressed or loaded position, although the nose of the projectile which supports the unit is not shown. The projectile with the driver unit screwed thereon is then loaded into the muzzle of a gun or mortar and the unit is ready for firing and to exert a thrust to push the projectile from the muzzle back into the firing position. The driver rocket is operated by withdrawing the pull bar 26 by hand. As the pull bar 26 is withdrawn, the spring 19 forces the motor housing 10, nozzle 11 and the plug 13 toward the projectile until the firing pin 24 engages the head of the cartridge 14 thereby firing the cartridge. The firing of the cartridge 14 ignites the black powder 17 on the end of the propellant grain 15 and thus ignites the propellant. As the grain 15 burns, the combustion gases escape from the motor housing 10 through the nozzle 11 exerting a thrust through the housing 10 and the plug 12 on the member 23 which being in contact with the end of the projectile applies the thrust to the projectile to push it rearwardly through the gun barrel into the firing position. When used in connection with the chemical warfare service mortar the movement of the projectile to the firing position is such as to fire the propellant charge by percussion as it seats in the firing position against the breech firing pin of the mortar. The charge 15 of the driver rocket burns in about 0.2 second to exert a driving thrust of about 40 pounds. When the projectile propellant is ignited, the forward acceleration of the projectile is sufficient to shear the pin or wire 22 which releases the sleeve 18 from coupling member 21. By providing a shear pin 22 that will shear at about a 200 pound thrust, the pin is not sheared by the 40 pound thrust of the driver rocket, but is sheared by the 600 pound thrust of the accelerating projectile as it leaves the gun. After the pin 22 shears, and the accelerating motion of the projectile has stopped, the compression of the spring 19 will eject the driver rocket unit from the path of the projectile, leaving the coupling member 21 on the nose of the projectile.

Referring now to the construction shown in Figure 3 of the drawings, a driver rocket is indicated generally at 29 which is in general similar to the driver rocket 9 of Figures 1 and 2. The rocket motor 29 comprises a motor housing 30, a nozzle 31, a plug or head 32, a propellant grain 35 and a firing cartridge 34. The plug 32 is cylindrical in shape and its right end is threaded into the motor housing 30. The blank cartridge 34 is seated in a central hole provided therefor in the plug 32, and is held in this seated position by a transverse wire 36 extending through the plug 32. A firing pin 37, surrounded by a compression spring 38, is carried within the extended portion of the plug 32. A coupling member 39 is attached to the plug 32 by a shear wire or pin 40, and the firing pin 37 is secured to the coupling member 39 by a pull pin or bar 41. The coupling 39 is provided with a threaded extension or stem 42 adapted to be screwed into the nose of a projectile so as to attach the driver rocket 29 thereto. A plurality of slidable pins 43 extend in parallel through the coupling member 39, and have heads 44 adapted to engage a washer 45 abutting the left end of the spring 38.

When the driver unit 29 is attached to the nose of a projectile, such as a 4.2" mortar shell, by screwing the stud 42 into the nose tube, the nose pushes the pins 43 through the coupling member 39 so that the ends 44 bear against the washer 45 and compress the spring 38. When it is desired to fire the driver rocket 29, the pull pin 41 is withdrawn permitting the spring 38 to drive the firing pin 37 against the blank cartridge or primer 34 so as to set it off. The primer 34 fires the charge 35 within the motor housing 30 which burns to deliver the desired drive or thrust to the projectile. The mode of operation is thus similar to that of the construction shown in Figures 1 and 2. As the projectile accelerates in forward movement on being fired from the mortar the shear wire 40 is sheared thereby releasing the main portion of the driver rocket 29 from the coupling member 39 so that the former may be pushed by the spring 38 from the path of the projectile.

The modified construction indicated generally at 49 in Figure 4, is in general like the constructions previously described except that the driver rocket body member 50 is provided with radially extending fins or vanes 51. This construction

serves to automatically detach the driver rocket 49 from the nose of a projectile 52 due to the rotation of the projectile as it is fired from a rifled barrel or tube. The vanes 51 are of such area as to tend to prevent the driver rocket 49 from rotating as fast as the projectile, thereby serving to unscrew the driver rocket 49 from the threaded extension 53 or projectile nose. The driver rocket 49 includes a firing pin 54, a pull bar 55 and a firing pin spring 56. A retainer or plunger 57 is provided which slidably fits over a stem extension of the firing pin 54, as shown, and serves to compress the spring 56 when the driver rocket 49 is screwed on to the threaded end 53. Upon pulling the bar 55 the firing pin 54 is released and serves to set off the propellant in the motor section (not shown) of the driver rocket 49.

In Figure 5 of the drawings, a modified construction is shown including means for detachably securing a driver rocket 59 to the tapered nose 60 of a projectile. The driver rocket 59 includes a motor 62 provided with a nozzle 63 and a powder trap 64. The forward or left end of the motor housing 62 is closed by a plug 65 apertured to accommodate a blank cartridge 66. A sleeve 67 is threadedly secured to the left end of the motor housing 62 and is provided with a ring 68, as shown. The ring 68 incloses a centrally threaded ring 69 having the same diameter as the sleeve 67, the ring 69 being screwed on to the threaded ring member 61. Radially extending shear pins 70 serve to initially secure the sleeve 67 to the ring 68 and to secure the ring 68 to the ring member 69.

Within the sleeve 67 and attached to the plug 65 by machine screws (not shown) is a plate 71. The plate 71 holds the cartridge 66 in place and carries a firing wedge 72 on a spring arm 73 in a position to be driven through an opening in the plate 71 so as to fire cartridge 66. The plate 71 also supports a stem 74. Opposing washers or plungers 75 and 76, separated by a collar 77, are slidably mounted on the stem 74 and retain a compression spring 78 therebetween. A pull pin 79 extends through the sleeve 67 from side to side to prevent the washer 76 from contacting the firing wedge 72 until it is desired to fire cartridge 66. A cylindrical grain of rocket type propellant (not shown) is carried in the rocket motor housing 62 as in the driver rocket 9 of Figure 1.

The method of operation of the driver rocket 59 of Figure 5 will now be described. The ring member 61 is secured to the nose 60 of a projectile by cement or the like. The driver rocket carrying rings 68 and 69 is secured to the ring member 61 by screwing thereon. As the ring 69 is secured to the ring member 61, the end of the projectile nose 60 engages and urges the washer 75 to the right along the stud 74 compressing the spring 78. The pull pin 79 abuts against the washer 76 preventing the latter from engaging the firing wedge 72. When it is desired to fire the driver rocket, the pull pin 79 is manually withdrawn permitting the spring 78 to push the washer 76 into engagement with the firing wedge 72 which latter then strikes the cartridge 66 to fire the same. When the cartridge 66 is fired, it ignites the rocket-type propellant in the motor chamber 62. The products of combustion from chamber 62 exhaust through nozzle 63 creating a driving thrust to the left to drive the projectile 60 into its firing position as explained hereinbefore. The drive thrust of the driver rocket is not sufficient to shear the pins 70. When the projectile itself fires and moves to the right, its accelerating force is sufficient to shear the pins 70. The driver rocket 59 is then free to fall away from the projectile nose 60, and drops out of the path of flight of the projectile.

In Figure 6 of the drawings a modified construction is shown whereby the driver rocket 59 of Figure 5 may be attached to the nose 60. This modified construction involves three rings 80, 81 and 82 connected by shear pins 83, as shown. The accelerating force is sufficient to shear the pins 83.

In an effort to simplify and lighten the driver rocket constructions described above in connection with Figures 1 through 6, the modified design indicated generally at 90 in Figure 7 of the drawings was developed. The driver rocket 90 represents approximately fifty percent reduction in weight and also eliminates the hazard of flying rings which exist in connection with driver rocket 59 of Figures 5 and 6. The driver rocket 90 comprises a rocket motor 91 having a nozzle 92 screwed into the rear or right end thereof. The inner face of the nozzle 92 is provided with radial ridges 93 which constitute a powder trap for the powder grain (not shown) retained in the chamber of the motor 91. The forward or left end of the motor 91 is a thickened section 94 and has an L-shaped opening 95 formed therein. The short leg of the opening 95 opens into the powder chamber while the long leg is tapped at its outer end so as to receive a firing pin holder 96. A blank cartridge 97 is held in place by the plug 96.

In order to ignite or fire the blank cartridge 97, a firing pin 100 is provided which is slidably retained in the holder or plug 96. The firing pin 100 is adapted to be driven against the blank cartridge 97 by a hammer 101 carried on one end of a leaf spring 102. The leaf spring 102 is secured at its opposite end to a projection 103 formed on a washer 104. The washer 104 is retained in place between the motor housing 91 and the nozzle 92, as shown. The hammer 101 is held away from the firing pin 100 by means of a flange 105 formed on the head of a pin 106 which extends crosswise through a hole provided therefor in the thickened section 94. A pull cord 107 with a pull 108 are provided for withdrawing the pin 106.

In order to attach the driver rocket 90 to the nose end or fuse of a mortar shell, an internally threaded ring 110 is provided which is adapted to be screwed on to the nose end or fuse. The ring 110 is secured to the motor 91 by means of two sets of pins 111, 112 which meet in an intermediate ring 113 therebetween. Registering holes are provided in the opposing ends of the thickened section 94 and the ring 110 so as to receive the ends of the pins 111 and 112. The recesses or holes for the pins 112 in the thickened end 94 are of such a depth that the pins 112 can extend thereinto to about one-half the length thereof, while the receiving holes in the ring 110 for the pins 111 are of such a depth that they can accommodate the full length of the pins 111. However, in the initial assembly of the driver rocket 90 the pins 111 abut against the ends of the pins 112 and extend only about halfway into the holes provided therefor in the ring 110, as shown in the drawings.

In operation, the driver rocket 90 is screwed on to the nose end or fuse of a mortar shell, and the shell is then positioned in the muzzle end

of a mortar barrel. When it is desired to fire the mortar, the pin 106 is withdrawn by means of the pull ring 108. As the pin 106 is withdrawn, the flange 105 carries back the hammer 101 until it clears the end of the flange 105, thereupon being forced by the spring 102 against the projecting end of the firing pin 100 so as to drive it against the blank cartridge 97. Thereupon the powder grain in the motor 91 is ignited and the driver rocket 90 drives the projectile into the mortar barrel. Upon acceleration of the projectile from the mortar barrel, the set-back force on the driver rocket 90 due to the acceleration is sufficient to cause the pins 111 to be driven to their full lengths into the ring 110 followed by pins 112. In doing so, the outer ends of the pins 111 clear the intermediate ring 113 and the driver rocket 90 is thereby freed from the projectile leaving only the ring 110 on the end thereof.

The diameter of the pins 111 and 112 may be as large as the rings 110 and 113 will permit. Since the set-back force due to detonation of the mortar shell is at least 2,000 lbs. and the propulsion force produced by the driver rocket 90 is not greater than 50 lbs., the weight of the pins are at some intermediate value.

It will be noted that in the driver rocket 90, Figure 7, there is no safety provision to prevent the withdrawing of the pin 106 prior to the assembly of the driver rocket on the end of a mortar shell. Partly to provide for such a safety means, and partly to provide a modified form of shearing construction, the driver rocket indicated generally at 115 in Figure 8 of the drawings was provided. The driver rocket 115 comprises a body 116 having a motor section 117 and a somewhat enlarged adaptor section 118. A nozzle 120 is screwed into the rear end of the motor section 117 and a powder grain 121 is secured therein between a powder trap 122 formed on the inner face of the nozzle 120 and a washer 123. The firing pin arrangement for the driver rocket 115 is similar to that of the driver rocket 90 in Figure 7. That is, a firing pin 124 is carried in a plug 125 which also serves to retain a blank cartridge 126 in its seated position. Hammer 127 carried by a leaf spring 128 is provided to strike the firing pin 124. The hammer 127 is normally separated from the firing pin 124 by means of a cup-shaped stamping 129 carried on the pin 130. The pin 130 extends through a transverse hole provided therefor in the adaptor section 118. The end of the pin 130 has a reduced section 131 which when the pin 130 is in place lies in a hole extending at right angles thereto in the section 118. A safety pin 132 is disposed within the hole and has a thickened section 133 and a reduced section 134. A compression spring 135 is provided which serves to bias the pin 132 out of the hole provided therefor in the section 118. However, after the pin 132 is inserted in this hole, the end of the hole is mutilated at its open end 136 so that the enlarged section 133 of the pin 132 cannot pass thereout. The thickened section 133 is of such size as to prevent the withdrawal of the pin 130. However, the reduced diameter section 134 is small enough to permit the pin 130 to clear it.

The forward or left end of the section 118 is internally threaded so as to permit attachment of the driver rocket 115 to the nose end or fuse of a mortar projectile. Where the threaded section ends, a circumferential shearing groove 137 is formed in the section 118 so as to provide a reduced thickness section.

In operation the driver rocket 115 is screwed on to a mortar projectile which is then placed in the muzzle of a mortar barrel. As the driver rocket 115 is being screwed on to the projectile, the nose abuts against the outer end of the pin 132 so as to push it inwardly against the force of the spring 135. When the driver rocket 115 is fully screwed on to the projectile, the pin 132 will have been pushed in sufficiently so that the enlarged section 133 no longer engages the reduced section 131 of the pin 130, thereby permitting the withdrawal of the pin 130 at will. The acceleration of the projectile from the mortar provides sufficient set-back to shear the section 118 at the groove 137 thereby permitting the driver rocket 115 to be separated from the projectile. The section 118 is made from plastic which is particularly suitable for this type of shearing arrangement.

In the Figure 9 of the drawings a still further modified form of driver rocket 140 is shown comprising a rocket motor 141 and a combined adapter and firing mechanism holder 142. The motor 141 is adapted to be screwed into the right end of the section 142 so as to abut against a washer 143 carried in the latter. A central sleeve 144 is carried from the washer or disc 143 which serves as a guide-way for the enlarged head of a firing pin 145. The end of the tube 144 is turned inwardly so as to prevent withdrawal of the enlarged firing pin head therefrom. The end of the firing pin 145 is secured to a washer 146, by soldering or otherwise, and the washer 146 is in turn secured to the end of a member 147. The member 147 comprises a tubular section, to the outer end of which the washer 146 is secured, and a flange section 148 which retains one end of a compression spring 150. The member 147 is retained in the position shown by means of a pin 151 extending transversely across the adaptor section 142.

The outer end of the spring 150 is retained by means of a member 152 having a flange section 153 and a tubular section 154. The tubular section 154 is turned in so as to slidably engage the exterior of the member 147. A weakened frangible section 155 is provided in the adaptor 142.

In operation, the driver rocket 140 is screwed on to the nose end or fuse of a mortar projectile. As it is being screwed on, the end of the projectile bears against the flange section 153 so as to compress the spring 150. In the attached position, the end of the projectile retains the flange 153 in a fixed position. When it is desired to fire the round, the pull pin 151 is withdrawn thereby releasing the member 147 so that it can move to the right. As it moves, the member 147 carries the firing pin 145 with it and causes it to strike against the blank cartridge 156, thereby energizing the rocket motor 141 as described heretofore. The acceleration of the projectile, as it leaves the motor will be sufficient to fracture the reduced section 155 thereby permitting the driver rocket 140 to be separated from the shell.

The exact size and design of the driver rockets described heretofore will depend upon the requirements decided upon. That is, a decision is made as to the maximum angle of depression for which it is desired to use a particular type of mortar. The maximum angle depression and the maximum weight of the motar shells to be used being known, the driver rocket can be designed so as to produce an adequate thrust to deliver the projectile or shell with sufficient force

to the rear end of a motar tube or barrel to ignite the same. A number of driver rockets embodying this invention have been made and successively tested with the 4.2 chemical mortar. Of course, the same principles would apply to any type of muzzle-loaded mortar.

Since certain further changes may be made in the foregoing constructions and different embodiments of the invention may be made without departing from the scope of the invention, it is intended that all matter described heretofore or shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense.

I claim:

1. In combination, a mortar shell adapted to be fired from a muzzle-loading mortar, and a driver rocket secured to the nose end of said mortar shell, said driver rocket comprising a casing having a forwardly-opening nozzle, a charge of propellant in said casing in communication with said nozzle, and means to ignite said propellant to thereby drive said shell rearwardly.

2. A driver rocket device comprising in combination, a motor housing for containing a propellant charge, a nozzle secured to one end of said housing, a head secured to the opposite end of said housing, said head having an aperture therein to receive a blank cartridge, a firing pin carried within said head, a spring in engagement with said pin, and a coupling element for securing said head to an object to be driven, said spring being compressed in response to operation of said coupling element to secure said head to the object to be driven.

3. A driver rocket device for use in driving a muzzle loaded ordnance projectile from the muzzle to the firing position in a gun, comprising a motor housing for containing a propellant charge, a nozzle at one end of said housing, a head at the opposite end of said housing, ignition means carried by said head for igniting said charge, coupling means detachably connected to said head and operable to fasten said device to the nose of said projectile, and means responsive to operation of said fastening means to arm said ignition means.

4. A driver rocket device comprising, in combination, a motor housing, a discharge nozzle secured at one end of said motor housing, means for closing the opposite end of said motor housing, an L-shaped opening provided in said closed end with a leg opening into the motor housing, and the other leg opening to the side of said motor housing, a primer secured in said side leg of the opening, a firing pin, firing pin holding means also in said side leg of the opening serving to retain said primer in place and to hold said firing pin in a position to strike the cartridge, a hammer for striking said firing pin, spring means for urging said hammer to strike said firing pin, and firing means adapted to normally separate said hammer from said firing pin and manually withdrawable to simultaneously bias said spring means and then release said hammer to detonate said primer.

5. The combination with a motar shell adapted to be fired by translation rearwardly from muzzle to breech within the barrel of a mortar, said shell having a nose, of a driver rocket comprising, a casing, means operable to attach said casing to the nose of said shell, a forwardly directed nozzle secured to the forward end of said casing, a propellant charge within said casing in communication with said nozzle, and means within said casing to ignite said charge to thereby propel said rocket and shell rearwardly within the mortar barrel.

6. The combination with a shell having a propelling charge ignited in response to rearward translation of said shell within a gun barrel from the muzzle thereof, of a driver rocket adapted to be attached to the nose of said shell and comprising a casing, a forwardly directed nozzle closing the forward end of said casing, a propelling charge in said casing, percussion means operable to ignite said charge, a spring adapted, when tensioned, to urge said percussion means into charge-igniting movement, and means responsive to attachment of said rocket to said shell, to tension said spring.

7. A driver rocket comprising a casing, a nozzle secured to the forward end of said casing and in communication with said casing, a propellant charge in said casing, normally safe percussion firing means carried by said casing and operable to ignite said charge, means operable to attach said casing to the nose of a shell with said nozzle directly forwardly, and means responsive to operation of said attachment means to arm said percussion firing means.

8. In a driver rocket, a motor housing, a nozzle and a head secured to and closing respective ends of said housing, a propellant charge in said housing, a primer carried by said head for igniting said charge, a firing pin slidable in said head to detonate said primer, a spring in said head and operable when stressed, to urge said firing pin into detonating relation with said primer, screw means united with said head for attaching said rocket to an object to be driven, and means responsive to turning of said screw means in attaching said rocket to an object, to stress said spring.

9. A rocket as recited in claim 8, and a safety pin connecting said firing pin and screw means, said safety pin being withdrawable to free said firing pin to the action of said spring.

10. A rocket device as recited in claim 4, safety means normally operative to prevent withdrawal of said firing means, and means responsive to attachment of said device to a mortar shell for driving the same, to render said safety means inoperative, whereby said firing means may be withdrawn.

11. In combination with a mortar shell adapted to be fired by translation rearwardly in and along a mortar barrel from the muzzle thereof, a driver rocket, a propelling charge in said rocket means operable to connect said rocket to the nose of said shell in position to translate the same rearwardly, normally inoperable firing means for igniting said propelling charge, and means responsive to operation of said connecting means in connecting said rocket to a shell, to render said firing means manually operable.

12. In a driver rocket, a housing having a forwardly-directed nozzle at its forward end, a plug closing the rear end of said housing, a primer mounted in an aperture in said plug in position to ignite a propellant charge in said housing, a sleeve secured to said housing and extending rearwardly therefrom, first and second washers reciprocably fitting said sleeve, a spring interposed between said washers, a firing pin carried by said plug and adapted to detonate said primer on impact by said first washer, manually-withdrawable safety means normally preventing impingement of said first washer against said firing pin, and means operable to simultaneously at-

tach said sleeve to the nose of a shell and to force said second washer toward said first washer to thereby stress said spring and urge said first washer into detonating impingement against said firing pin.

13. A driver rocket as recited in claim 12, said attaching means comprising a first ring, a second ring fitting over and about said first ring and said sleeve, and radial shear pins connecting said first and second rings and said second ring and sleeve.

14. A driver rocket device comprising, in combination, a motor housing, a propelling charge in said housing, a discharge nozzle closing one end of said motor housing, plug means closing the opposite end of said motor housing, a primer mounted in said plug means and adapted to fire said propelling charge, a firing pin mounted in a striking position relative to said primer and normally biased away therefrom, an igniter casing secured to said motor housing at the end opposite said nozzle, plunger means disposed within said casing and adapted to strike said firing pin

to detonate said primer, normally unstressed spring means in said casing and stressable to urge said plunger into firing movement, removable safety means normally preventing said plunger means from engaging said firing pin, means for coupling said driver rocket to the front end of a mortar shell, and means responsive to operation of said coupling means in connecting said device to a shell, to stress said spring means.

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