

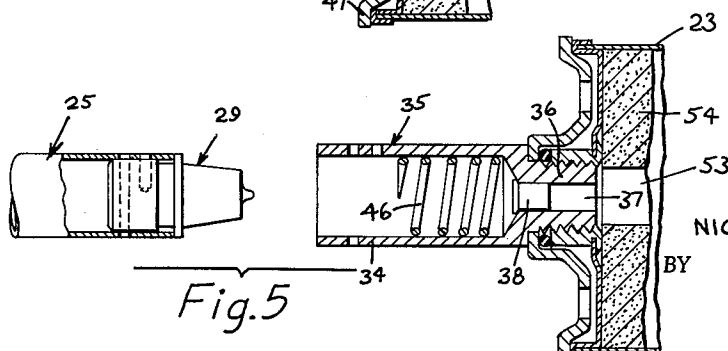
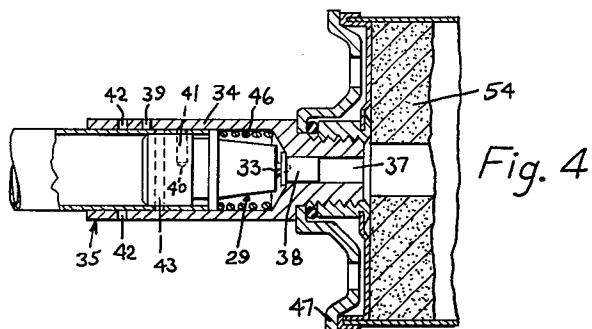
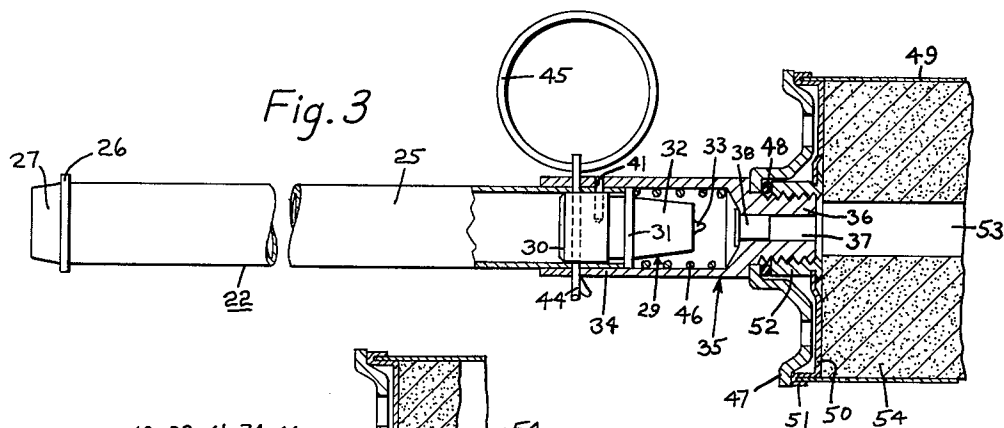
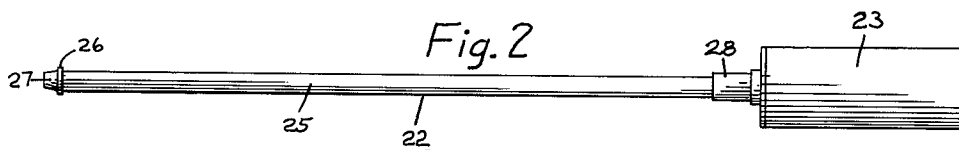
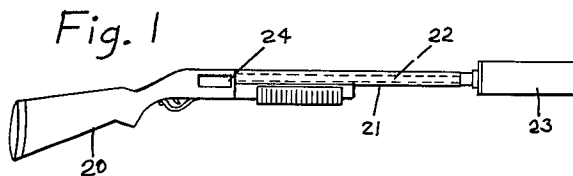
April 5, 1966

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GRENADE LAUNCHER

3,243,909

Filed Nov. 23, 1964

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

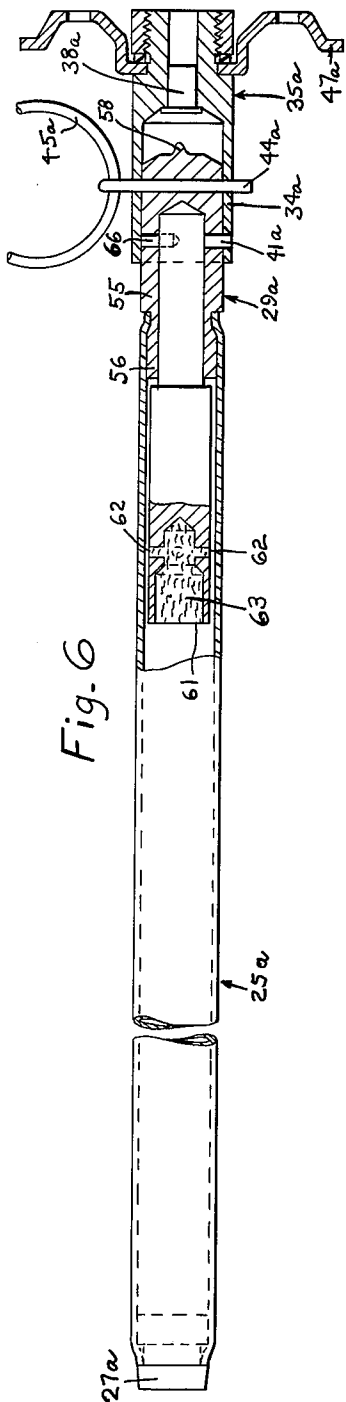


Fig. 6

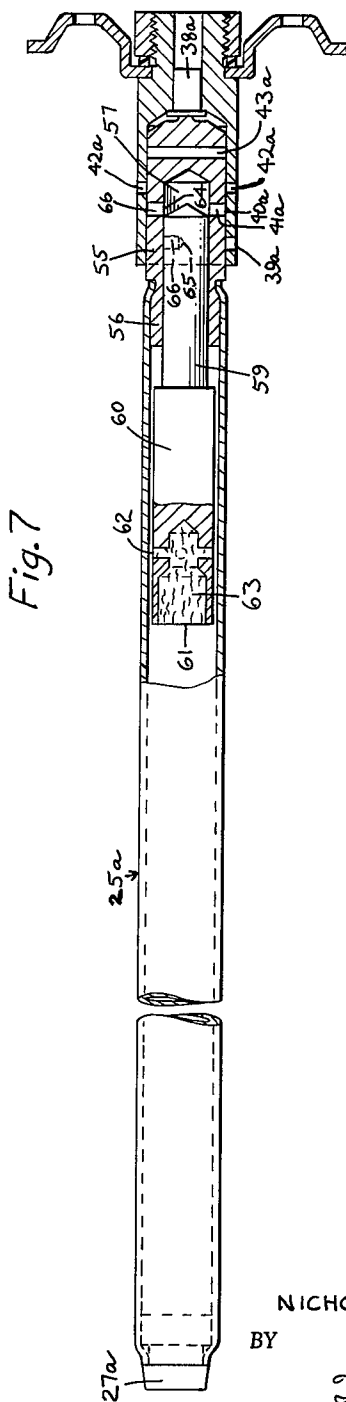


Fig. 7

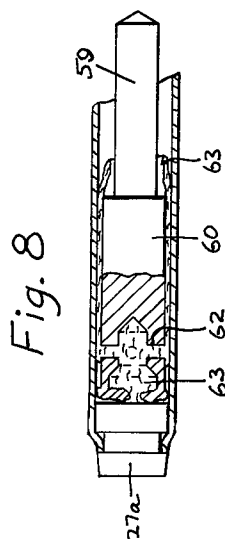


Fig. 8

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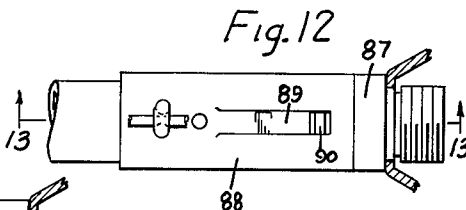
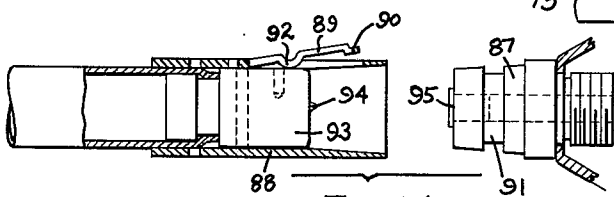
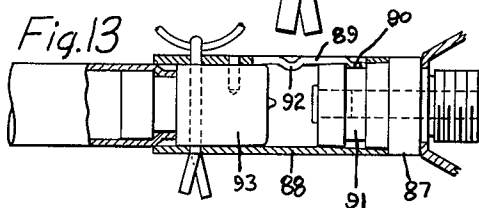
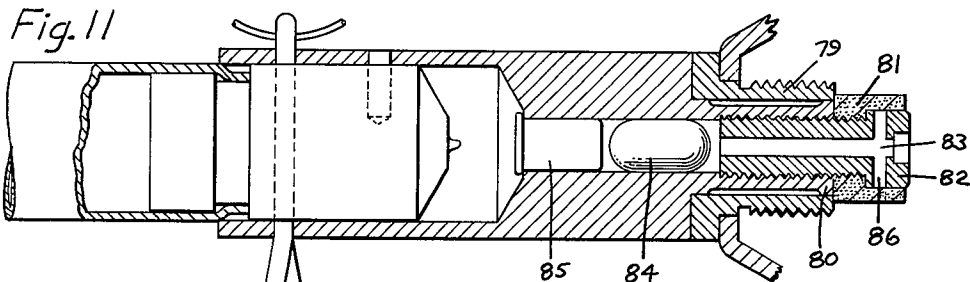
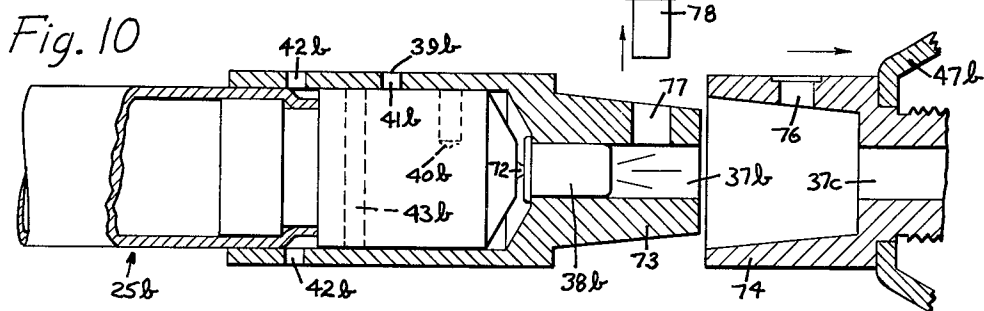
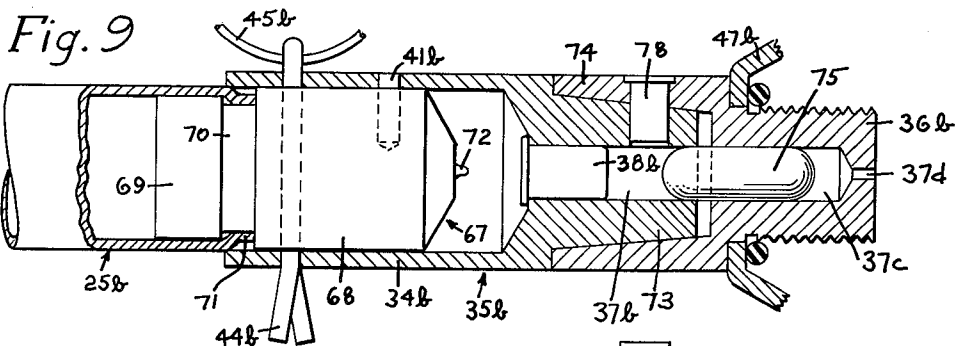
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3 Sheets-Sheet 3



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GRENADE LAUNCHER

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15 Claims. (Cl. 42—1)

This invention relates generally to grenade launching devices, and more particularly relates to devices for enabling grenades to be launched from police type shot guns and riot guns with complete safety to the personnel firing the weapons and of such construction that the grenade separates from the launching device in flight substantially before reaching its target.

In the past, launching mechanisms for grenades have been devised to enable grenades to be projected over substantial distances much in excess of that achievable by hand thrown action by launching the same from rifles. Grenade launching devices suitable for use with rifles have also been tried with shot guns, but have been generally unsuccessful and their use abandoned because of the substantial danger of explosion of the shot gun, attended by high probability of serious injury or death to the personnel firing the same. This explosion danger exists because shot gun type devices have relatively thin walled barrel structures in comparison to the barrel strength of a rifle, the explosive force of the propellant charge associated with a shot gun cartridge being normally confined to the firing chamber and being thereafter free to expand outward through the barrel to propel the cartridge charge. Since known types of grenade launchers devised for use with rifles effectively cap the end of the barrel, extending perhaps for a short distance inward therealong, when such a device is utilized in a shot gun barrel the explosive charge of the propelling cartridge expands into the shot gun barrel and is momentarily confined therein. The relatively weak barrel structure not being designed to withstand the high pressure build-up therewithin frequently is violently ruptured.

Additionally, rifle type grenade launchers usually employ a short shaft extending axially of the grenade device which in most cases travels with and remains part of the grenade. These shafts affixed to the grenade have been frequently grasped after the grenade has landed and been used as throwing handles for getting rid of the grenade before it discharges. Particularly has this been a problem where the grenade is not an explosive or fragmentation device but is instead a gas generating unit, as for example a tear gas grenade. Consequently, separation of the grenade from a launching device itself is highly desirable and attempts in this direction have been made. However, the known types of separable grenade launchers are either unreliable in operation or too complicated and expensive in production to be economically producible. Accordingly, it is a primary object of my invention to provide a novel grenade launching device which may be safely used with shot guns and riot guns without danger to the operating personnel by confining the explosive force of the propelling charge to the firing chamber and preventing rupture of the gun barrel.

Another object of my invention is to provide a novel grenade launching device of relatively simple construction which is economical to manufacture and reliable in operation effective to separate the launching device from the grenade itself after launch but substantially before impact at trajectory termination.

A further object of my invention is to provide a novel grenade launcher as aforesaid utilizing a plurality of interfitted parts which are relatively shiftable axially with respect to one another but which are initially held in fixed

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relationship as a composite assembly prior to grenade launching.

The foregoing and other objects of my invention will become clear by a reading of the following specification in conjunction with an examination of the appended drawings, wherein:

FIGURE 1 illustrates a side elevational view of a pump action single barrel shotgun with a grenade launcher according to the invention, and carrying a grenade, disposed within the shotgun barrel;

FIGURE 2 is a side view of the grenade launcher according to the invention with a grenade attached thereto;

FIGURE 3 is an enlarged cross-sectional view through the grenade and launching device attached thereto in the region of intersecurement illustrating constructional details thereof prior to utilization of the device;

FIGURE 4 is a view of the device of FIGURE 3 immediately after firing from the shotgun but prior to separation of the launcher from the grenade proper;

FIGURE 5 is a grenade and launching device of FIGURES 3 and 4 but just after separation of the grenade from the main part of the launcher;

FIGURES 6, 7 and 8 illustrate a modification of the invention which utilizes an inertial impact launcher separating structure instead of the compression spring structure of FIGURES 3, 4 and 5, FIGURES 6, 7 and 8 respectively illustrating the device prior to launch, immediately after launch and somewhat thereafter when launcher separation is effected;

FIGURES 9 and 10 illustrate a further form of the invention before and after launcher separation from the grenade in which such separation is carried out by internally generated gas pressure;

FIGURE 11 illustrates yet a further modification of the invention in which the launcher and grenade are held together by combustible means which burn away during flight after launching to permit separation of the grenade from the launcher; and

FIGURES 12, 13 and 14 illustrate a still further embodiment of the invention in which a mechanical interlock between the launcher and grenade is released just prior to impulse transmission to the grenade effective to cause separation from the launcher, FIGURE 13 being a longitudinal sectional view as would be seen when viewed along the line 13—13 of FIGURE 12, while FIGURE 14 illustrates the structure of FIGURE 13 after separation of the launcher from the grenade.

In the several figures, like elements are denoted by like reference characters.

Referring now to the drawings and first to FIGURES 1 to 3, there is observed in FIGURE 1 a shotgun designated generally as 20 having a barrel 21 within which is disposed an elongated cylindrical launcher device designated generally as 22 to the outer end of which is affixed a grenade 23, which may typically be a tear gas grenade. The elongated cylindrical launcher 22 is observed to be of sufficient length so that the end projected into the barrel is immediately proximate to the firing chamber 24 of the shotgun 20.

As best seen in FIGURE 2, the launcher 22 includes the elongated rod or tube 25 having a washer 26 of somewhat enlarged diameter relatively to the tube 25 affixed to its end by means of an end cap 27 press fitted into the rod, and a grenade firing and launcher disconnect assembly 28 associated with the tube 25 at its opposite end for connecting the launcher to the grenade 23. The diameter of the rod or tube 25 permits its easy insertion into the barrel of the shot gun but is of sufficient diameter to occupy most of the cross sectional area of the barrel to thereby minimize expansion of gas into the barrel from the firing chamber 24 when the gun is fired. The washer

26 carried by the launcher tube 25 immediately adjacent to the firing chamber 24 is typically fabricated of a resilient plastic and functions as a gas check to further impede gas discharge from the firing chamber into the barrel 21 around the tube 25 to thereby minimize pressure increase inside the barrel 21. Moreover, the washer 26 provides a frictional fit within the barrel which prevents the grenade and launcher from sliding out of the barrel when the launching gun is aimed downward for firing from the upper floors or roofs of buildings.

As best seen in the sectional view of FIGURE 3, the grenade end of propulsion tube 25 is fitted with a front plug 29 having a cylindrical rear section 30 disposed close fittingly within the end of the propulsion tube with the latter in abutment against an enlarged annular shoulder 31 of outer diameter equal to that of the propulsion tube 25. Extending forward from the annular shoulder 31 is a forwardly convergingly tapered truncated conical front section 32 from the front face of which forwardly axially projects a firing pin 33. The front plug 29 and forward end of propulsion tube 25 carrying the same are projected coaxially close fittingly forward into the open rear end of sleeve portion 34 of launcher connector 35. The forward end of launcher connector 35 consists of an externally threaded portion 36 of reduced diameter extending forward from the sleeve portion 34 and being provided with a bore 37 extending axially completely therethrough from the front face of the front end portion 36 rearward into the open front end of sleeve portion 34 in coaxial alignment with the firing pin 33 of the front plug 29. The axial bore 37 is of reduced diameter in comparison to that of the sleeve portion 34 and is of proper size to accept therewithin the body of a primer 38.

Drilled through the side wall of sleeve portion 34 and into the cylindrical rear section 30 of the front plug 29 are a pair of aligned holes 39 and 40 into which are projected a shear pin 41 effective to intersecure the propulsion tube 25 and sleeve portion 34 of the launcher connector 35. Also drilled completely through the sleeve portion 34 and rear section 30 of front plug 29 rearward of the shear pin position are aligned holes 42 and 43 respectively through which is projected a safety pin 44 which may take the form of a cotter pin. The loop end of the safety pin 44 has projected therethrough a safety ring 45 by means of which the safety pin 44 may be withdrawn when the grenade is about to be launched. Positioned within the sleeve portion 34 coaxial with and disposed about the conical front section 32 of front plug 29 is a substantially uncompressed compression coil spring 46 the rear end of which is disposed against the front face of front plug annular shoulder 31 while the front end is disposed against the front end of sleeve portion 34 proximate to the primer 38. Projected onto the threaded front end portion 36 of the launcher connector 35 through a central aperture therethrough is a thrust distributing flange 47 which is held in place on the end 36 by means of a rubber ring 48.

The grenade 23 is formed with a generally cylindrical side wall 49 and an annular substantially flat end plate 50 spun outward and around the end of the side wall 49 to clamp the same peripherally completely thereabout and form a rim 51. The center of the end plate 50 is circularly apertured and fitted with an axially extending collar 52 internally threaded to close fittingly threadedly receive the externally threaded front end portion 36 of the launcher connector 35. With the launcher connector 35 threaded into the grenade collar 52 the outer periphery of the thrust distributing flange 47 seats peripherally against the grenade case end rim 51 so that the thrust of the propulsion tube 25 during launch is distributed to the rigid rim and side wall of the grenade to thereby prevent the propulsion tube 25 from being driven axially into and through the grenade 23.

Referring now to FIGURES 4 and 5, when it is desired to launch the grenade 23 from a device such as the shot-

gun 20 of FIGURE 1, the safety ring 45 is pulled to extract the safety cotter pin 44 from the aligned holes 42 and 43 of launcher connector 35 and propulsion tube 25. The propulsion tube 25 is then slipped endwise into gun barrel 21 until the end cap 27 is proximate the firing chamber 24, in which case the sleeve portion 34 of launcher connector 35 is at least partially disposed within the end of the gun barrel 21. When thereafter the gun is fired the propulsion tube 25 moves sharply forward while the grenade 23 remains momentarily motionless due to inertial force, the shear pin 41 being of insufficient strength to transfer the impulse on the propulsion tube to the launcher connector 35. Consequently, the pin 41 shears and the propulsion tube 25 moves forward within the sleeve portion 34 of the launcher connector, compressing the coil spring 46 and causing the firing pin 33 of the front plug 29 to strike and fire the primer 38. The kinetic energy of the moving propulsion tube 25 is partly stored in the compressed spring 46 with the major portion of the thrust being transferred to the grenade 23 via the thrust distributing flange 47. The grenade 23 and propulsion tube structure are thus launched from the gun 20 as a unit.

The kinetic energy stored in the compression spring 46 as potential energy is now released by expansion of the compressed spring 46 resulting in a pair of reaction forces which tend to respectively add a forward velocity component to the grenade 23 and a retarding velocity component to the propulsion tube 25 resulting in separation of the two as shown in FIGURE 5. The grenade 23 continues onward toward its target area while the propulsion tube 25 drops away. The ignited primer 38 burns forward through the axial bore 37 of the launcher connector front end 36 and into an axially extending bore 53 formed within the combustible solid chemical composition 54 contained within the grenade 23, igniting the composition and initiating the production of tear gas for example.

Turn now to a consideration of FIGURES 6, 7 and 8 which illustrate a modified form of the invention in which separation of the grenade from the propulsion tube is effected by an inertia actuated sledge device instead of by the compression spring 46 shown in the embodiment previously described. Comparison of FIGURE 6 with FIGURE 3 discloses a basic similarity in structure in that both embodiments utilize a propulsion tube having a closure end cap at the end thereof intended for disposition proximate to the firing chamber of the launching gun, and a front plug physically secured in the grenade end of the propulsion tube and disposed within the rear hollow sleeve end of a launcher connector, which latter contains a primer and is physically secured to the grenade to be launched.

In FIGURE 6, the propulsion tube is designated as 25a with its firing chamber end cap designated as 27a and with the front plug designated as 29a. The front plug 29a has a generally cylindrical axially extending main body portion 55 the rearwardly extending section of which is of reduced diameter, as shown at 56, so that the front end of the propulsion tube 25a may be slipped axially thereover and crimped inward peripherally thereabout at its front end to secure the propulsion tube to the front plug. The front plug reduced diameter rear section 56 is provided with a forwardly extending axial bore 57 which extends forward for a substantial distance into the main body portion 55, while extending axially forward from the front face of the front plug 55 is a firing pin 58.

The main body 55 of the front plug 29a is projected close fittingly but freely slidably within the rear sleeve portions 34a of a launcher connector 35a of precisely the same configuration as the launcher connector 35 previously described in connection with the embodiment of FIGURE 3, the launcher connector 35a carrying a thrust distributing flange structure 47a and being secured to a grenade 23a. The front plug 29a and launcher connector

35a are provided with aligned transversely extending holes 42a and 43a into and through which is projected a safety cotter pin 44a which in turn carries a safety pull ring 45a. Similarly, the launcher connector 35a and front plug 29a are provided with aligned transversely extending apertures 39a and 40a into which is projected a shear pin 41a. The front plug 29a and launcher connector 35a are thus held from axial relative shift by the safety pin 44a and the shear pin 41a.

Disposed within the propulsion tube 25a and front plug 29a is a sledge, typically made of lead, consisting of a pair of axially end aligned front and rear cylinders 59 and 60 respectively, the front cylinder 59 extending close fittingly within the axial bore 57 of the front plug 29a while the rear cylinder 60 is disposed completely within the hollow interior of the propulsion tube 25a. The rear end of the rear cylinder 60 is provided with a large diameter axial bore 61 extending forward for a distance from the rear end thereof and from which bore 61 radially extend a plurality of passages 62. The thin walled hollow cylinder formed by the bore 61, and the radial passages 62 are filled with a solid extrudable substance 63, such as paraffin. Drilled transversely through the main body portion 55 of the front plug 29a and into the front portion of the front cylinder 59 of the sledge are a pair of aligned holes 64 and 65 within which is disposed a shear pin 66.

As in the case of the embodiment of FIGURE 3, when it is desired to launch a grenade by means of the apparatus illustrated in FIGURE 6, the safety pin 44a is first drawn by means of the pull ring 45a, and the propulsion tube 25a and rear portion of launcher connector 35a are endwise projected into the barrel of the launching gun until the end plug 27a is proximate to the firing chamber. When the gun is fired, the grenade 23a and lead sledge inside of the propulsion tube remain momentarily substantially stationary while the propulsion tube 25a is driven sharply forward in the barrel of the launching gun. The shear pins 41a and 66 are immediately sheared off so that the front plug 29a moves forward with respect to the sledge and with respect to the launcher connector 25a into the position illustrated in the showing of FIGURE 7. The firing pin 58 strikes the primer 38a to thereby cause ignition of the grenade 23a.

The forward thrust of the propulsion tube 25a is then transmitted to the front end of the launcher connector 35a which launches the grenade via the thrust distributing flange structure 47a in the manner already previously described. The high inertia of the lead sledge causes it to effectively remain stationary while the propulsion tube 25a moves rapidly outward through the gun barrel. Consequently, the forward end of the propulsion tube end plug 27a sharply strikes the rear end of the sledge cylinder 60 causing the relatively thin walls thereof which define the end bore 61 to crush inward and to force the paraffin outward through radial passages 62 and into the annular space between the sledge and the inside surface of the propulsion tube walls in the manner best illustrated in the showing of FIGURE 8.

The paraffin extrusion functions as a dash pot or shock absorbing device having a coefficient of restitution of substantially zero so that the sledge is not thrown violently forward through the propulsion tube but remains at the rear end thereof. A large fraction of the kinetic energy of the propulsion tube is absorbed by the sledge with the consequent very rapid deceleration of the latter causing the grenade 23 to separate immediately and continue on toward its target alone. The deceleration of the propulsion tube causes it to fall to earth within a relatively short distance after discharge from the barrel of the launching gun. If desired, a flexible washer functioning as a gas check could also be utilized in the embodiment of the invention just described.

FIGURES 9 and 10 illustrate a third embodiment of the invention in which separation of the grenade from the

propulsion tube structure is effected by gas pressure generated internally in the device after launch. As in the previously described embodiments, the propulsion tube 25b has affixed thereto at its front end a plug 67 comprising a front cylindrical formation 68, a rear cylindrical formation 69 of reduced diameter sufficient to be close fittingly projectable into the front end of the propulsion tube, and a reduced neck portion 70 between the front and rear cylindrical formations into which the front end of the propulsion tube 25b is peripherally crimped as at 71. The forward face of the front cylinder 68 is provided with a forwardly axially extending firing pin 72. The front plug 67 is projected close fittingly slidably into the open ended sleeve portion 34b of a launcher connector 35b, the launcher connector being provided with a forwardly extending portion which is externally threaded at its forward terminal end 36b.

The launcher connector 35b differs from the previously described launcher connectors in that it is provided with a section intervening the sleeve portion 34b and the externally threaded front portion 36b comprising two inter-fitted axially separable parts in the form of a tapered plug 73 fitted smoothly within a complementally shaped receiving sleeve 74, the tapered plug 73 extending convergently forward from the front end of the sleeve portion 34b while the receiving sleeve 74 extends divergently rearward from the back end of the externally threaded portion 36b. Thus, the launcher connector 35b instead of being a unitary device is in fact formed from two interfitted readily separable parts which during launching separate from one another in the manner to be hereinafter described to effect separation of the grenade from the propulsion tube.

Extending coaxially through the front end of the launcher connector 35b from the front wall of the sleeve portion 34b to the front face of the externally threaded portion 36b are bores 37b, 37c and 37d, the bores 37b and 37c being of substantially the same diameter while the bore 37d is of reduced diameter. Projected into the bore 37b from the front of the sleeve portion 34b is the primer 38b, and disposed partly within the bore 37b and mainly within the bore 37c is a slug or lozenge of solid or compressed combustible chemical material, or a capsule of black powder for example.

Drilled transversely through the sidewall of sleeve 74 and into tapered plug 73 respectively are aligned holes 76 and 77, the inner end of hole 77 opening into the axial bore 37b of the tapered plug 73. Seated in the hole 76 and projecting into hole 77, is a light weight coupler 78 which prevents separation of the two parts of the launcher connector so long as the coupler remains in position as shown in FIGURE 9. An empty twenty-two caliber shell is suitable as such a coupler. Drilled transversely through the sleeve portion 34b and into the front cylinder 68 of the front plug 67 are the aligned shear pin holes 39b and 40b respectively within which is disposed a shear pin 41b. Drilled completely through the sleeve portion 34b and front cylinder 68 of front plug 67 are the aligned holes 42b and 43b through which is projected the safety cotter pin 44b which carries at its loop end a safety pull ring 45b.

When it is desired to launch a grenade, the safety pin is drawn and the device is loaded as before into the gun with the latter being then fired. The propulsion tube 25b drives forward causing front plug 67 to shear off the shear pin 41b and causing the firing pin 72 to ignite the primer 38b. The ignited primer 38b firing forward ignites the lozenge or slug 75 which latter burns both backward and forward so that a gas pressure is built up in the bore 37b while simultaneously the forward burning of the lozenge through the forward bore 37d ignites the material inside the grenade. When the pressure build up in the bore 37b reaches a predetermined point it ejects the coupler 78 which allows the

grenade to separate from the propulsion tube. Separation is also aided by the gas pressure in the bores.

FIGURE 11 illustrates a form of launcher connector somewhat similar to that described in FIGURES 9 and 10 in that the launcher connector is a two part device with the forward portion being fixedly secured to the grenade and separable from the rear portion which remains with the propulsion tube when the latter separates from the grenade. The front part 79 of the connector has close fittingly slidably projected thereinto a cylindrical nose part 80 extending forward from the rear part of the launcher connector. The front part 79 is initially secured to the nose 80 by means of the annular combustible washer 81 fixed upon the nipple 82 threadedly engaged into the front end of the nose 80, the outside diameter of the washer 81 being larger than the bore through the front portion 79 within which the cylindrical nose 80 is disposed.

The nipple 82 is provided with an axially extending bore 83 which extends from the grenade interior rearwardly to a larger bore in the connector rear part within which are disposed a combustible lozenge 84 and primer 85, the primer being adapted to ignite the lozenge upon launch. Extending radially outward from the front part of axial bore 83 of the nipple 82 to the combustible washer 81 are a plurality of radial bores 86 effective to allow the ignited lozenge 84 to fire not only axially into the grenade for igniting the same but also to fire radially through the bores 86 and ignite the combustible washer 81. The washer 81 is quickly self consumed upon ignition and the interlock between the launcher connector front portion 79 and cylindrical nose 80 of the rear portion is therefore destroyed permitting the nose to slide rearward out of the front portion 79 and permit separation of the grenade from the propulsion tube.

FIGURES 12, 13 and 14 illustrate another form of two part launcher connector in which a plug type front part 87 is axially rearwardly convergingly tapered to close fittingly slide into the front end of a tubular rear part 88. The tubular part 88 is provided with a plurality of spring fingers 89 extending longitudinally of the tubular part and having radially inwardly offset latch ends 90 seated in a circumferentially extending groove 91 in the front plug 87. As best seen from FIGURES 13 and 14, the spring fingers 89 are also provided intermediate their ends at a point rearward of front part 87 with inwardly offset shoulders 92 which are driven radially outward by plug 93 when the latter moves forward within the tubular rear part 88 of the launcher connector under influence of the propulsion tube upon firing from a launching gun. The outward movement of the shoulders 92 of spring fingers 89 disengages the latch ends 90 from the groove 91 of the front part 87 of the launcher connector just prior to impact of the firing pin 94 against the igniting primer 95 carried by the launcher connector front part 87. The launcher connector front part 87 and the grenade to which it is fixedly secured are thus released from mechanical interlock with the launcher connector tubular rear part 88 and attached propulsion tube, and these two sections are thereby free to separate.

The safety pin structure and shear pin arrangement which intersecure the propulsion tube and front plug 93 on the one hand to the launcher connector tubular rear portion 88 on the other hand are observed to be precisely the same as has been previously described for the other embodiments and need not be again here described. Similarly, ignition of the combustible solid material of the grenade from the ignited primer 95 is carried out in the manner already set forth in connection with the showing of FIGURE 3 and need not again be detailed.

Having now described my invention in connection with particularly illustrated embodiments thereof it will be appreciated that modifications and variations of my in-

vention may now occur from time to time to those persons normally skilled in the art without departing from the essential scope or spirit of my invention, and accordingly it is intended to claim the same broadly as well as specifically as indicated by the appended claims.

What is claimed as new and useful is:

1. In combination with a missile containing an ignitable charge, a gun launchable propulsion and ignition device comprising in combination,

- (a) a launcher connector secured to said missile and adapted to have secured thereto in axially shiftable relation thereto an elongated propulsion tube,
 - (b) missile charge igniting means carried by said launcher connector,
 - (c) an elongated generally cylindrical propulsion tube having a closed rear end and a forward end, and provided at its forward end with firing means effective to fire said igniting means by impact therewith, said propulsion tube being of sufficient length to extend rearward completely through the barrel of the launching gun from the front end of the barrel to the firing chamber,
 - (d) releasable connecting means fixedly connecting said propulsion tube to said launcher connector so that the said firing means is proximate to and aligned with but spaced rearwardly away from said igniting means along a line coaxial with the cylindrical axis of said propulsion tube, release of said connecting means being causable by force on said propulsion tube directed axially forward when said missile is launched from a gun thereby permitting forward axial motion of said propulsion tube relative to said launcher connector operative to effect impact of said firing means with said missile charge igniting means,
 - (e) and means initially coupled to said launcher connector operative to effect separation of said propulsion tube from the missile after said connecting means has been released.
2. The device as set forth in claim 1 wherein said means operative to effect separation of said propulsion tube from the missile comprises biasing spring means engaged with said launcher connector and said propulsion tube effective to drive the same apart by release of energy stored in said spring means when said propulsion tube moves axially forward with respect to said launcher connector after release of said releasable connecting means.
3. The device as set forth in claim 1 wherein said means operative to effect separation of said propulsion tube from the missile comprises a sledge device disposed within said propulsion tube proximate to the forward end thereof and secured thereto by releasable securing means which release said sledge device under the influence of force generated by said propulsion tube when the latter moves axially forward with respect to said launcher connector upon launch from the launching gun, said sledge device when released being freely axially shiftable within said propulsion tube, the mass of said sledge device being such that its acceleration colinear with that of the propulsion tube is of substantially smaller magnitude, whereby said propulsion tube moves rapidly forward relative to said sledge device until the rear end of said propulsion tube strikes said sledge device causing rapid deceleration of said propulsion tube and separation from the missile.
4. The device as set forth in claim 1 wherein said launcher connector includes coaxially aligned axially separable front and rear sections, said front section being fixedly secured to the missile for travel therewith and said rear section being physically engaged with said propulsion tube and separable therewith from said front section when said propulsion tube separates from said missile, said releasable connecting means which connect said launcher connector to said propulsion tube being operative only to connect said propulsion tube to said launcher connector rear section, and said means operative to effect separation of said propulsion tube from the missile com-

prise means carried by and initially interconnecting said launcher connector front and rear sections.

5. The device as set forth in claim 4 wherein said means interconnecting said launcher connector front and rear sections comprises at least one axially extending resilient finger carried by said rear section provided with a radially inwardly projecting latch element at its free forward end and a radially inwardly projecting cam element rearward of its forward end, said camming element projecting into the path of motion of said propulsion tube, said front section being provided with a latch element receiving recess into which said finger carried latch element is projected to interlock said front and rear sections, release of said interlock being effected when said propulsion tube moves forward upon launch to strike said camming element and radially outwardly shift said resilient finger and the latch element carried thereby.

6. The device as set forth in claim 4 wherein said means interconnecting said launcher connector front and rear sections comprises quickly consumable combustible means ignitable by said missile charge igniting means.

7. The device as set forth in claim 4 wherein said means interconnecting said launcher connector front and rear sections comprises a piston disposed close fittingly in radially extending end aligned bores formed respectively in said front and rear sections, the outer end of the outer one of said aligned bores opening through the side of said launcher connector and the inner end of the inner one of said aligned bores opening into a chamber into which said missile charge igniting means fires when struck by said propulsion tube carried firing means, said piston being driven by gas pressure radially out of said aligned bores to disconnect the front and rear sections of said launcher connector by gas pressure generated by said igniting means when the latter is fired upon launch.

8. In combination with a missile containing an ignitable charge, a gun launchable propulsion and ignition device comprising in combination,

(a) a launcher connector having a front part fixedly secured to the rear end of the missile and having a hollow cylindrical sleeve extending rearwardly therefrom adapted to have forwardly projected thereinto in axially shiftable relation thereto an elongated propulsion tube, said front part having a bore extending axially completely therethrough from the front of said sleeve to the front face of said front part,

(b) missile charge igniting primer means projected into the rear end of said launcher connector front part bore through said sleeve,

(c) an elongated generally cylindrical propulsion tube having a closed rear end and a forward end, and provided at its forward end with firing pin means effective to fire said primer by impact therewith, said propulsion tube being of sufficient length to extend rearward completely through the barrel of the launching gun from the front end of the barrel to the firing chamber and provided with means at the rear end effective to prevent pressure buildup in the gun barrel when the launching gun is fired.

(d) shear pin means fixedly connecting said propulsion tube to said launcher connector so that the said firing pin means is proximate to and aligned with but spaced rearwardly away from said primer along a line coaxial with the cylindrical axis of said propulsion tube, shearing of said shear pin means being causable by force on said propulsion tube directed axially forward when said missile is launched from a gun thereby permitting forward axial motion of said propulsion tube within said launcher connector sleeve part operative to effect impact of said firing pin against said primer,

(e) and means initially coupled to said launcher connector operative to effect separation of said propulsion tube from the missile after said shear pin has been sheared.

9. In combination with a missile containing an ignitable charge, a gun launchable propulsion and ignition device comprising in combination,

(a) a launcher connector having a front part fixedly secured to the rear end of the missile and having a hollow cylindrical sleeve extending rearwardly therefrom adapted to have forwardly projected thereinto in axially shiftable relation thereto an elongated propulsion tube, said front part having a bore extending axially completely therethrough from the front of said sleeve to the front face of said front part,

(b) missile charge igniting primer means projected into the rear end of said launcher connector front part bore through said sleeve,

(c) an elongated generally cylindrical propulsion tube having a closed rear end and a forward end, and provided at its forward end with firing pin means effective to fire said primer by impact therewith, said propulsion tube being of sufficient length to extend rearward completely through the barrel of the launching gun from the front end of the barrel to the firing chamber and provided with means at the rear end effective to prevent pressure buildup in the gun barrel when the launching gun is fired,

(d) shear pin means fixedly connecting said propulsion tube to said launcher connector so that the said firing pin means is proximate to and aligned with but spaced rearwardly away from said primer along a line coaxial with the cylindrical axis of said propulsion tube, shearing of said shear pin means being causable by force on said propulsion tube directed axially forward when said missile is launched from a gun thereby permitting forward axial motion of said propulsion tube within said launcher connector sleeve part operative to effect impact of said firing pin against said primer,

(e) and means initially coupled to said launcher connector operative to effect separation of said propulsion tube from the missile after said shear pin has been sheared and after said primer has been fired.

10. The device as set forth in claim 8 wherein said means operative to effect separation of said propulsion tube from the missile comprises a compression spring disposed within the sleeve part of said launcher connector and against the forward part of said propulsion tube effective to drive the same axially apart by release of energy stored in said compression spring by compression thereof when said propulsion tube moves axially forward within said launcher connector sleeve part after shearing said shear pin.

11. The device as set forth in claim 8 wherein said means operative to effect separation of said propulsion tube from the missile comprises a sledge device disposed within said propulsion tube proximate to the forward end thereof and secured thereto by shear pin means which shear and release said sledge device under the influence of force generated by said propulsion tube when the latter moves axially forward with respect to said launcher connector upon launch from the launching gun, said sledge device when released being freely axially shiftable within said propulsion tube, the mass of said sledge device being such that its acceleration colinear with that of the propulsion tube is of substantially smaller magnitude, whereby said propulsion tube moves rapidly forward relative to said sledge device until the rear end of said propulsion tube strikes said sledge device causing rapid deceleration of said propulsion tube and separation from the missile, said sledge device carrying shock absorbing means at its rear end effective to provide a substantially zero coefficient of restitution upon impact of said sledge device with the rear end of said propulsion tube.

12. The device as set forth in claim 8 wherein said launcher connector front part includes coaxially aligned

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axially separable front and rear sections, said front section being fixedly secured to the missile for travel therewith and said rear section including said sleeve and being physically engaged with said propulsion tube and separable therewith from said front section when said propulsion tube separates from said missile, said shear pin means which connect said launcher connector to said propulsion tube being operative only to connect said propulsion tube to said launcher connector rear section, and said means operative to effect separation of said propulsion tube from the missile comprise means carried by and initially interconnecting said launcher connector front and rear sections.

13. The device as set forth in claim 12 wherein said means interconnecting said launcher connector front and rear sections comprises at least one axially extending resilient finger carried by said rear section provided with a radially inwardly projecting latch element at its free forward end and a radially inwardly projecting cam element rearward of its forward end, said camming element projecting into the path of motion of said propulsion tube, said front section being provided with a latch element receiving recess into which said finger carried latch element is projected to interlock said front and rear sections, release of said interlock being effected when said propulsion tube moves forward upon launch to strike

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said camming element and radially outwardly shift said resilient finger and the latch element carried thereby.

14. The device as set forth in claim 12 wherein said means interconnecting said launcher connector front and rear sections comprises quickly consumable combustible means ignitable by said missile charge igniting means.

15. The device as set forth in claim 12 wherein said means interconnecting said launcher connector front and rear sections comprises a piston disposed close fittingly in radially extending end aligned bores formed respectively in said front and rear sections, the outer end of the outer one of said aligned bores opening through the side of said launcher connector and the inner end of the inner one of said aligned bores opening into the said front part axial bore into which said missile charge igniting primer means fires when struck by said propulsion tube carried firing pin means, said piston being driven by gas pressure radially out of said aligned bores to disconnect the front and rear sections of said launcher connector front part by gas pressure generated by said igniting means when the latter is fired upon launch.

No references cited.

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