

[54] MULTISHOT PORTABLE LAUNCHING APPARATUS

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89/1.817

[51] Int. Cl. F41f 3/04
[58] Field of Search 89/1.8, 1.813, 1.814,
89/1.815, 1.816, 34, 1, 9; 42/87, 88

[56] **References Cited**
UNITED STATES PATENTS

3,122,059	2/1964	Choate et al.	89/1 R X
3,208,350	9/1965	Robinson	42/87 X
3,494,249	2/1970	Choate	102/93
3,641,868	2/1972	Reed	89/1.813

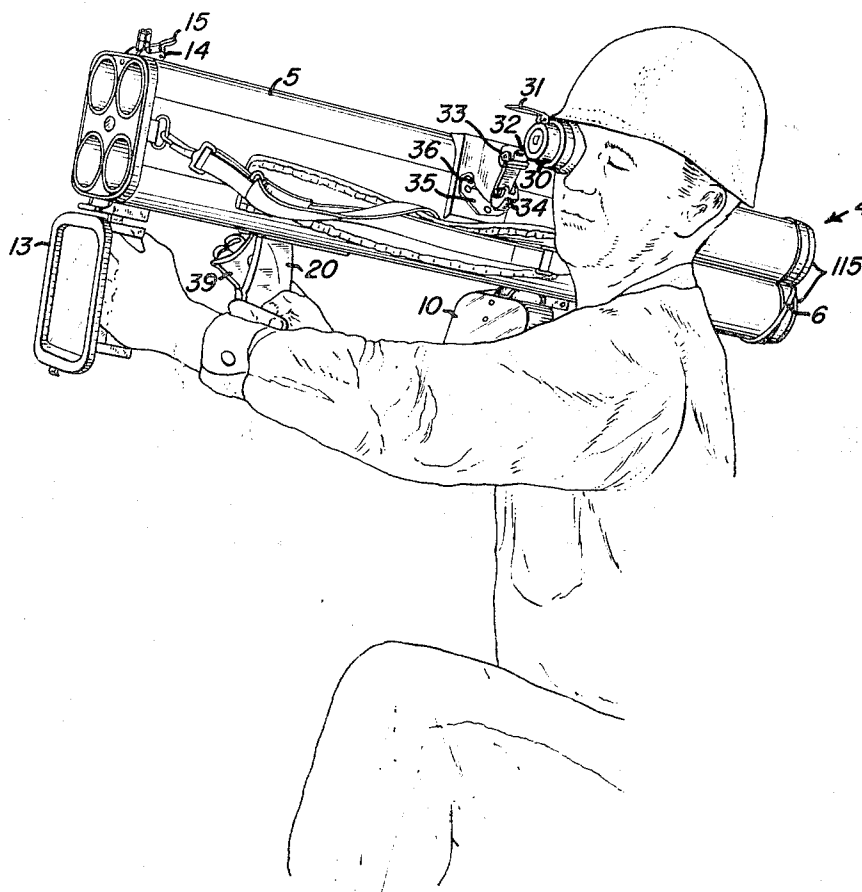
Primary Examiner—Samuel W. Engle

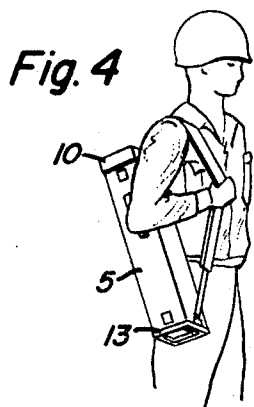
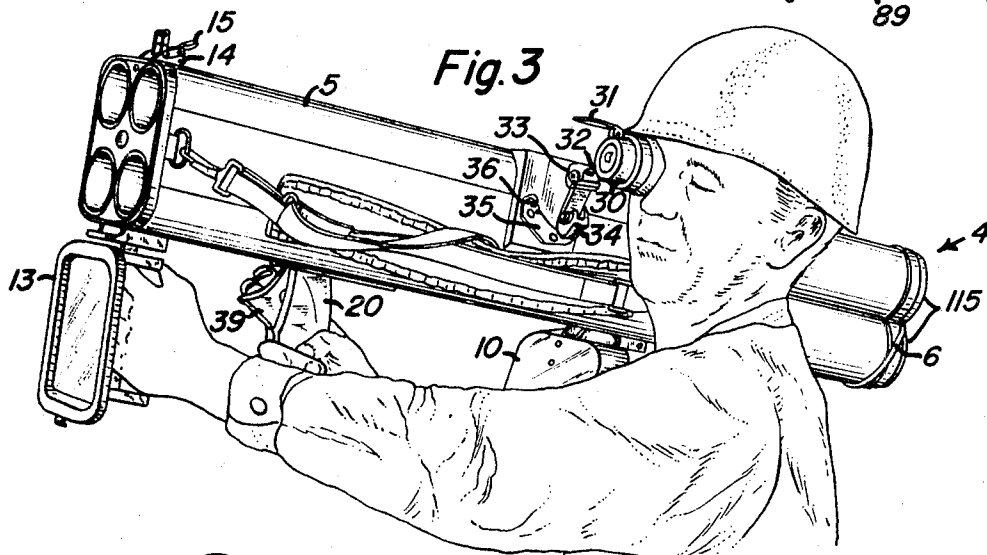
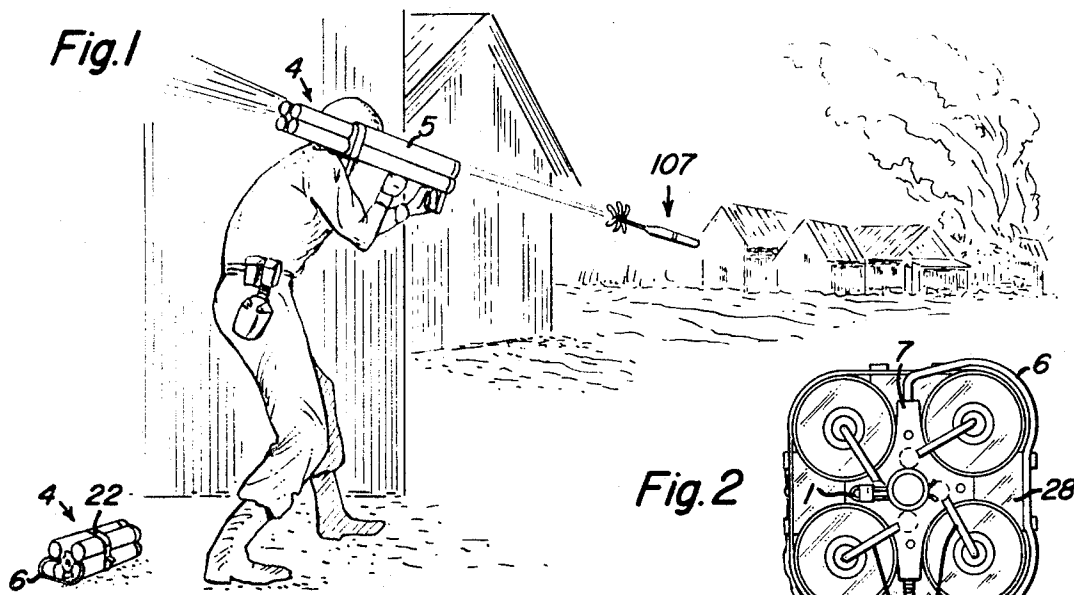
Attorney—Harry M. Saragovitz, Edward J. Kelly
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[57] **ABSTRACT**

An apparatus and method to launch a projectile containing a viscoelastic solution of high molecular weight polyisobutylene in triethylaluminum to a target site to inflict casualties and/or produce a conflagration; the apparatus being a multiple shot and portable means.

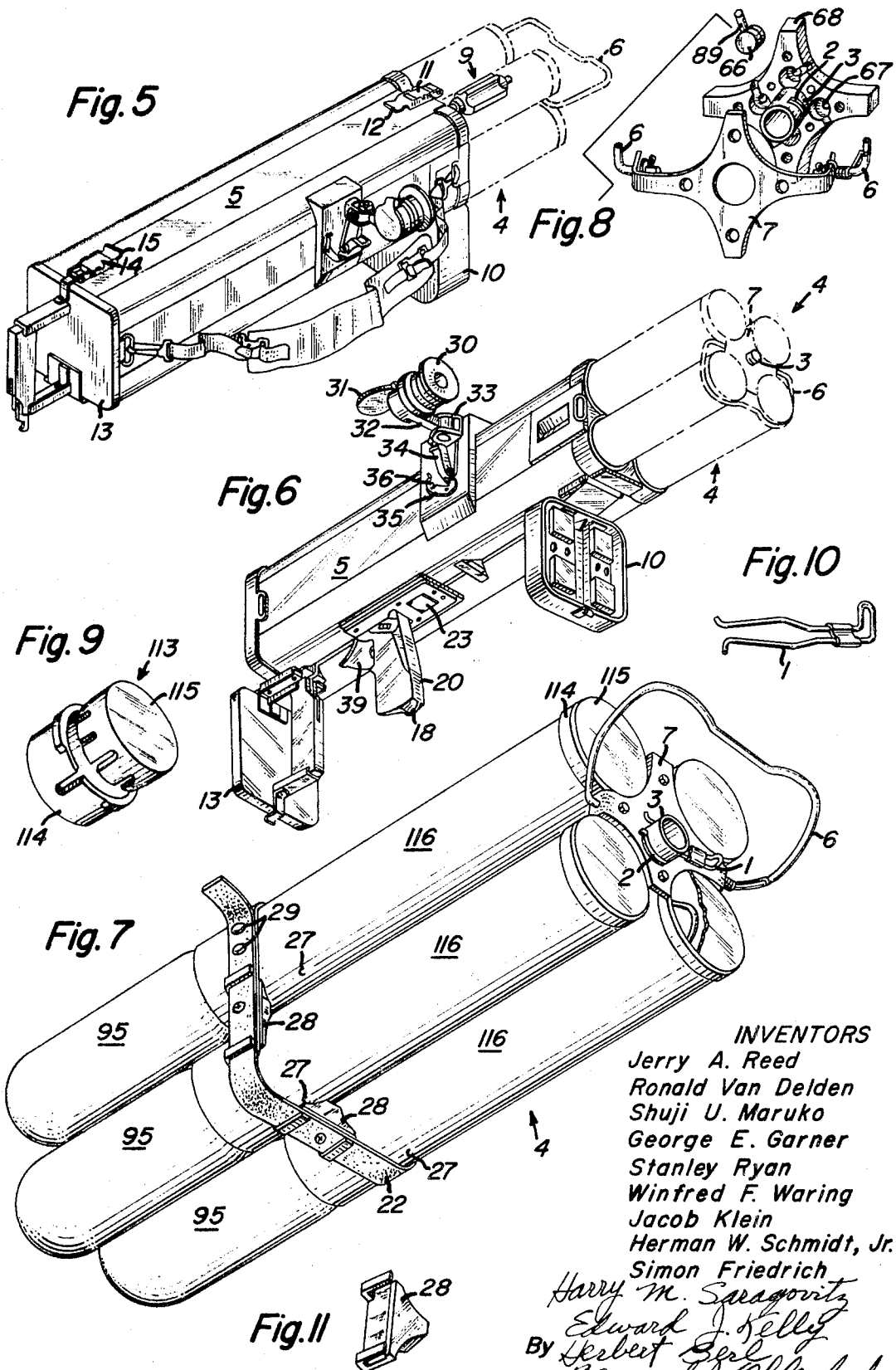
9 Claims, 34 Drawing Figures





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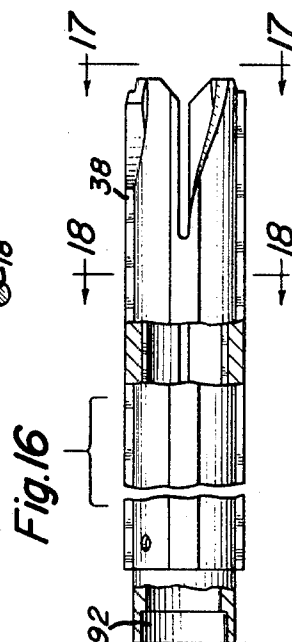
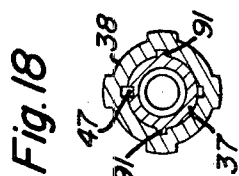
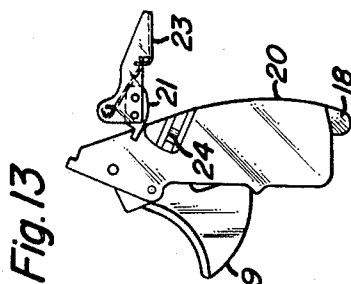
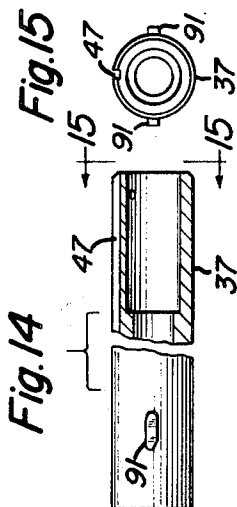
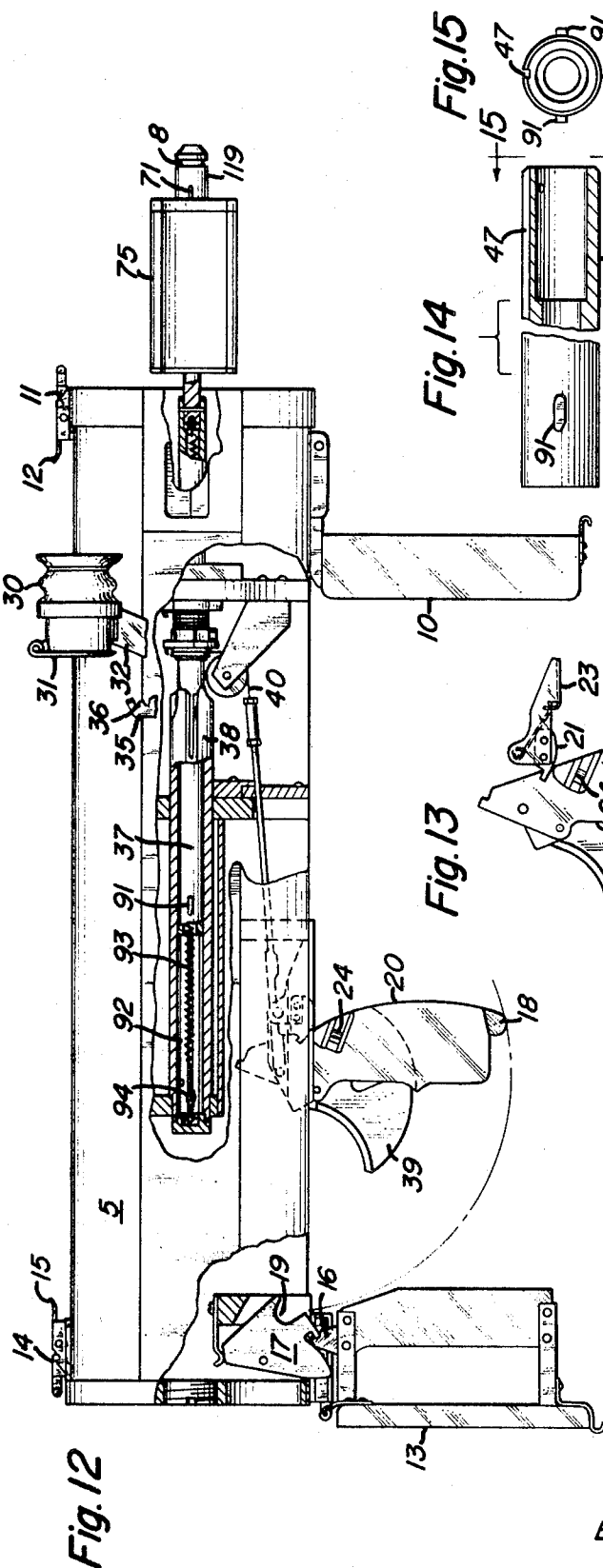
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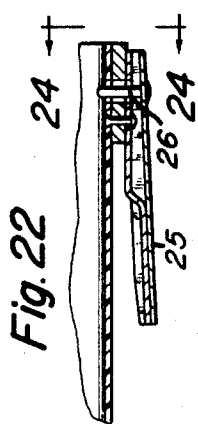


Fig. 23

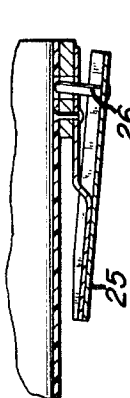


Fig. 24



Fig. 21

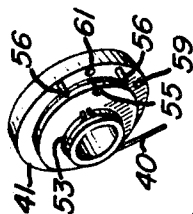
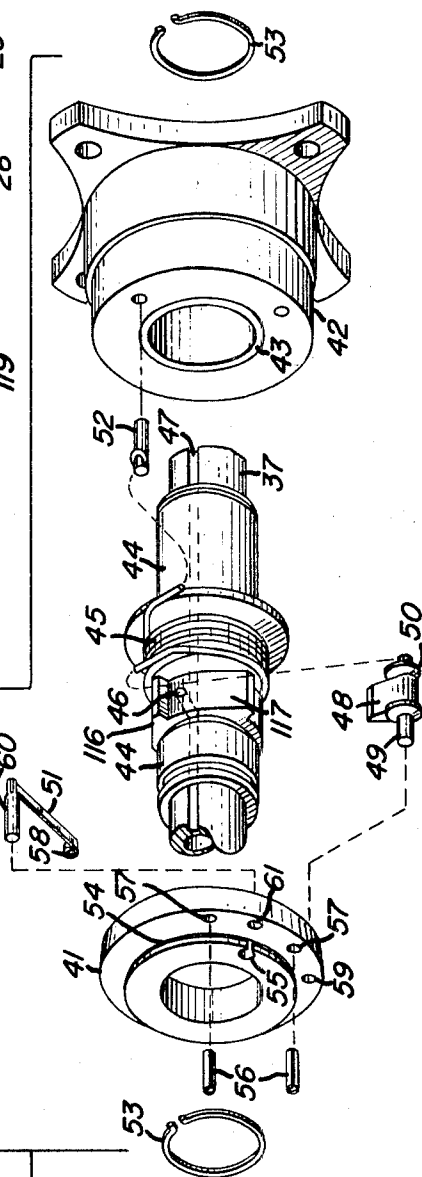
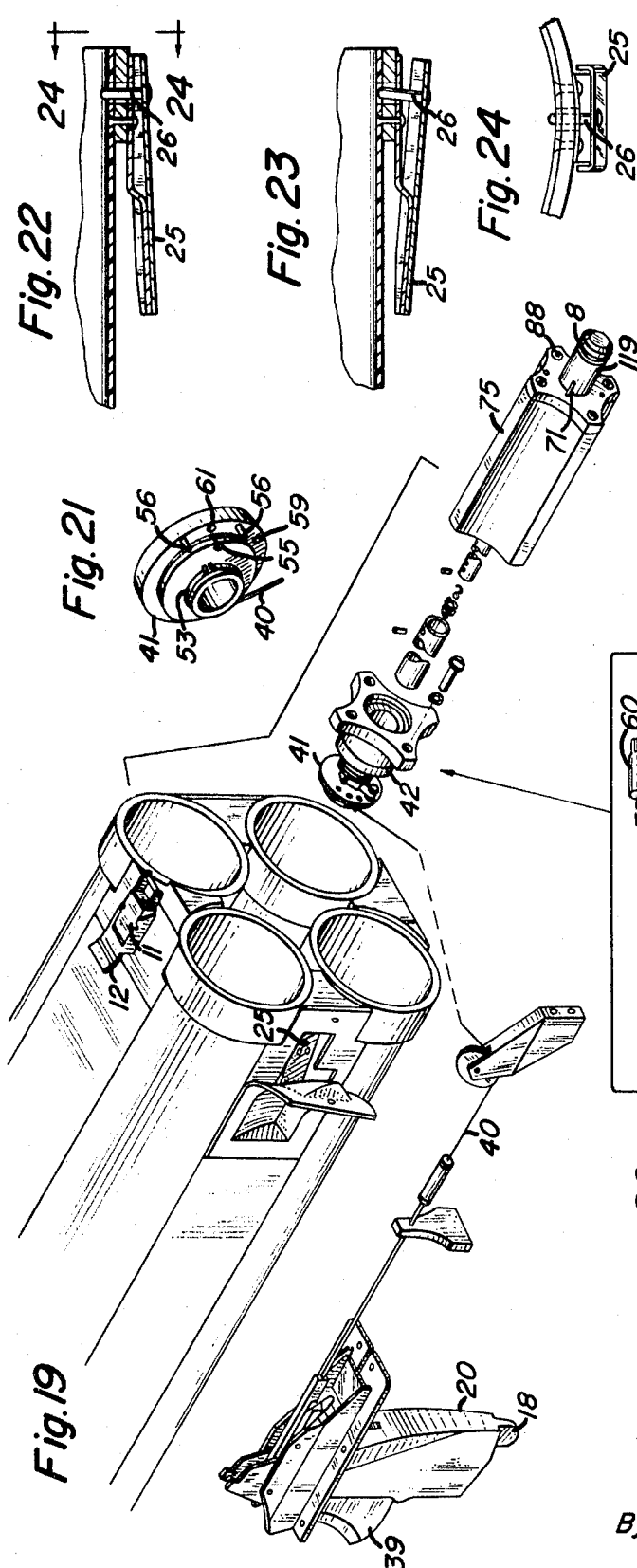


Fig. 19



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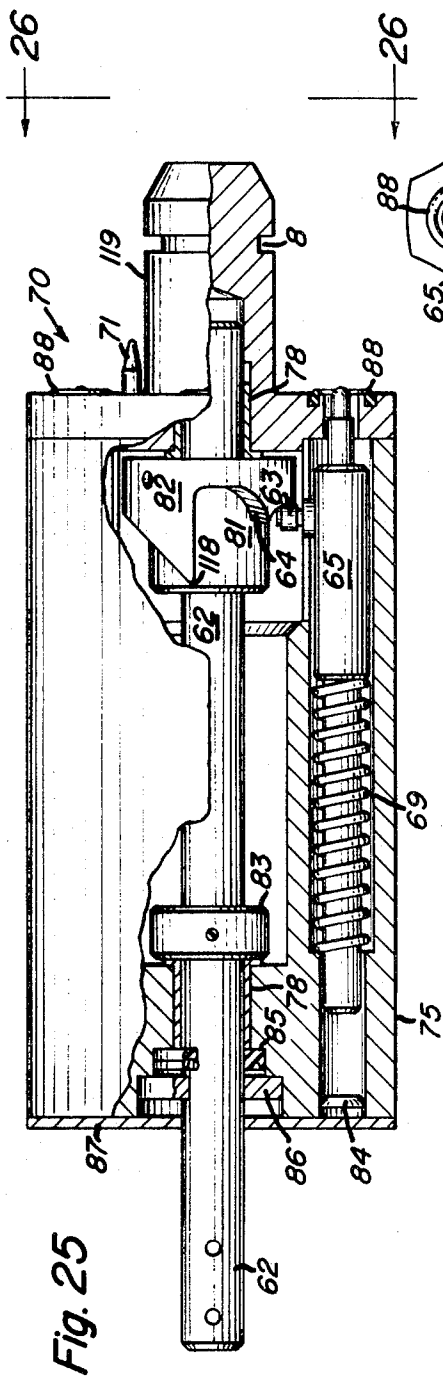


Fig. 25

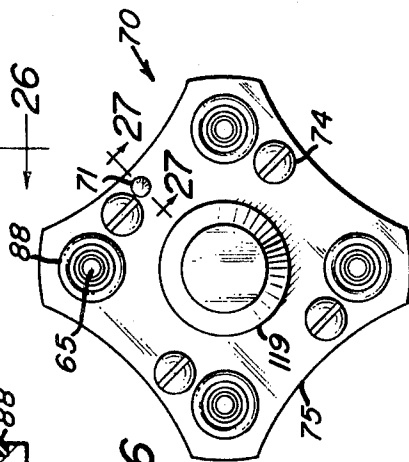


Fig. 26

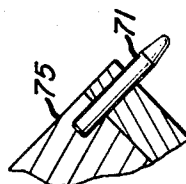
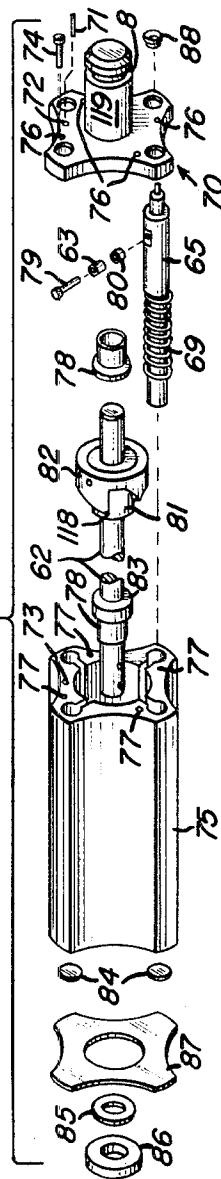


Fig. 27

Fig. 28



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Fig. 29

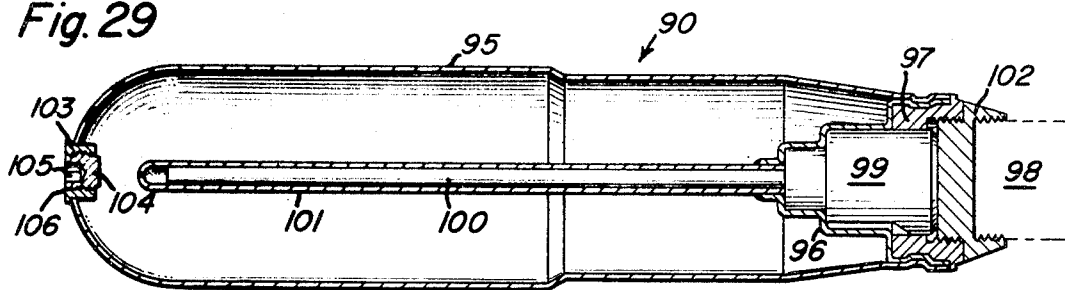


Fig. 30

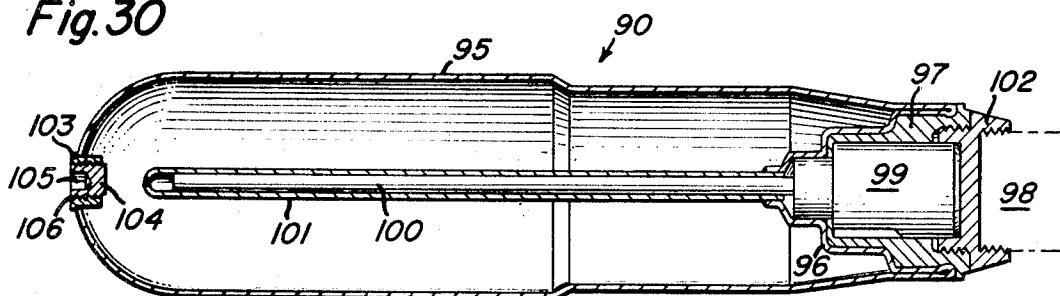


Fig. 31

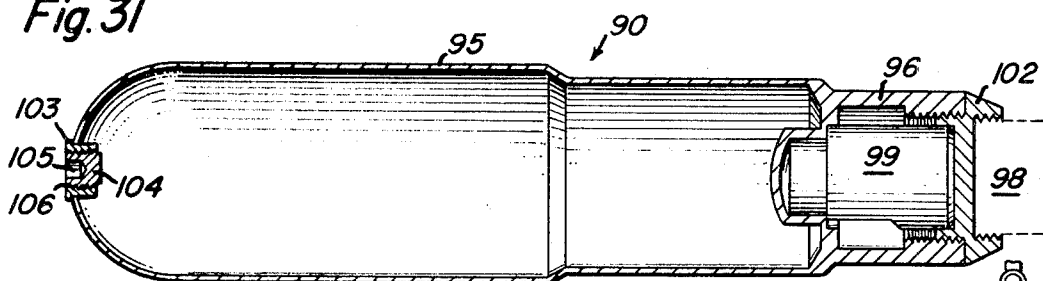


Fig. 32

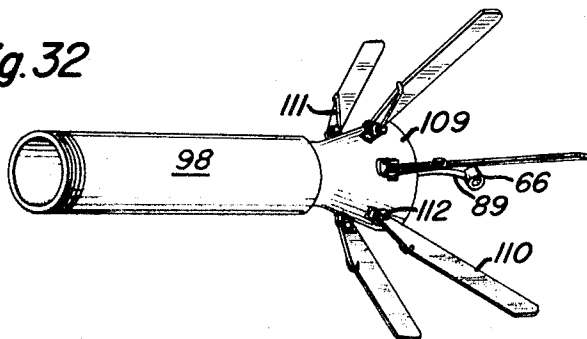
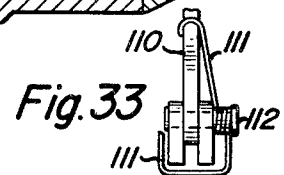
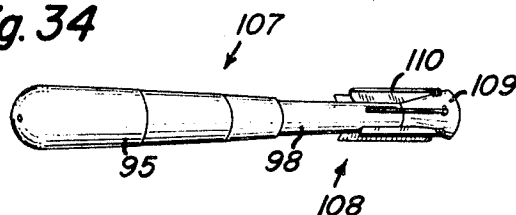


Fig. 34



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MULTISHOT PORTABLE LAUNCHING APPARATUS

DEDICATORY CLAUSE

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

Our invention relates to an apparatus and method for delivery of a projectile containing an incendiary material to a target site to defeat or neutralize hard and soft targets and/or initiate conflagrations.

While many means are known in the prior art for launching and disseminating incendiary materials, such as disclosed in U. S. Pat. No. 3,433,437, many problems existed with the prior art devices; such as being too sophisticated, requiring electrical activation of a propellant section to deliver the incendiary material to a target site rather than a simple mechanical activation, misfiring and similar malfunctions in spite of claims to the contrary, the necessity to use extreme caution in oxygen free atmospheres when filling the projectile with incendiary payload due to the composition of the payload, the necessity to use complicated means to arm the device such as spin activated air arming fuzes, the necessity to utilize complicated means to stabilize the projectile in flight, utilization for short range delivery only, inefficient operation, poor concentration of the incendiary material on the target site, necessity for fuel recharging, production of a readily identifiable signature due to the flame rod, presentation of a vulnerable weapon silhouette. Our invention was conceived and reduced to practice to solve the aforementioned problems and to satisfy the long felt need for a multishot and portable apparatus to effectively, efficiently, and accurately deliver a projectile containing incendiary material to a target site.

The principal object of our invention is to provide a simple, efficient, accurate, effective, long range, and portable multishot apparatus to deliver a projectile containing incendiary material to a target site.

Another object of our invention is to provide an apparatus for delivering an incendiary material to a target site which is actuated by simple mechanical means without a danger of misfiring or similar malfunction and which eliminates complicated arming means such as spin activated fuzes through the utilization of a fuze with graze element which in turn activates a central burster means to detonate the projectile on glance striking or direct impact.

Still another object of our invention is to make use of a pyrophoric incendiary material to insure spontaneous and complete ignition of the incendiary charge when the projectile is detonated after launch from our apparatus. A separate ignition system is not required.

A further object of our invention is to provide an apparatus for delivering incendiary material to a target site by means of a projectile which employs simple retractable fins to stabilize the projectile in flight.

A still further object of our invention is to provide an apparatus for delivering incendiary material to a target site which does not necessitate fuel recharging, does not produce a readily identifiable signature due to the flame rod, and does not present a vulnerable weapon silhouette.

Other objects of our invention will be obvious or will appear from the specification hereinafter set forth.

FIG. 1 is a view showing the utility of our apparatus in the firing mode.

FIG. 2 is a view of the aft end of the rocket clip for our apparatus showing the rocket motor igniters leading to the primer manifold.

FIG. 3 is a view showing the utility of our apparatus in the mode preparatory to firing as in FIG. 1.

FIG. 4 is a view showing the transport of our apparatus to a firing site.

FIG. 5 is a view of our apparatus with the rear cover open and the rocket clip shown in phantom.

FIG. 6 is a view of our apparatus, as in FIG. 5, with the front cover open, the trigger mechanism in the firing mode, and the sight in the open position for aiming.

FIG. 7 is a view of the rocket clip for our apparatus.

FIG. 8 is a detailed view of the aft end of FIG. 7.

FIG. 9 is a detailed view of the rocket retainer assembly.

FIG. 10 is a view of the retainer clip.

FIG. 11 is a view of the clip support spacer.

FIG. 12 is a cutaway view showing the components of our apparatus without the rocket clip.

FIG. 13 is a view of the handle and trigger mechanism of our apparatus.

FIG. 14 is a view of the extension shaft assembly of our apparatus.

FIG. 15 is a view through 15—15 of FIG. 14.

FIG. 16 is a view of the safety guide assembly of our apparatus.

FIG. 17 is a view through 17—17 of FIG. 16.

FIG. 18 is a view through 18—18 of FIG. 16.

FIG. 19 is a view of the launcher tube assembly and firing train of our invention.

FIG. 20 is an exploded view of the ratchet and drum assemblies of our apparatus.

FIG. 21 is a view of the cable drum assembly of our apparatus.

FIG. 22 is a view of the detent assembly locking the rocket clip in position.

FIG. 23 is a view of the detent assembly shown in FIG. 22 but in the open or depressed position to permit sliding the rocket within the launcher tubes.

FIG. 24 is a view through 24—24 of FIG. 22.

FIG. 25 is a view of the firing pin mechanism assembly of our apparatus.

FIG. 26 is a view of the firing pin mechanism cover assembly of our apparatus through 26—26 of FIG. 25.

FIG. 27 is a view through 27—27 of FIG. 26.

FIG. 28 is an exploded view of the firing pin mechanism assembly shown in FIG. 25.

FIG. 29 is a view of a warhead assembly embodiment of the projectile for the rocket clip for our apparatus; this embodiment having case, fuze well, and fuze well boss welded together at the aft end and a burster tube welded to the fuze well.

FIG. 30 is a view of a warhead assembly embodiment as in FIG. 29; this embodiment having an integral case and fuze well formed by deep reverse draw at the aft end.

FIG. 31 is a view of a warhead assembly embodiment as in FIG. 29; this embodiment having a one piece extruded case and fuze well and a threaded boss at the aft end.

FIG. 32 is a view of the rocket motor housing and fin assembly for the projectile to be used with our invention.

33 is a view of the fin assembly shown in FIG. 32.

FIG. 34 is a view of the projectile to be used with our apparatus.

Our invention as shown in FIGS. 1 to 34 will now be described in detail as follows:

Clip retainer 1, as shown in FIG. 10, is held in position by friction fit in slots 2 of manifold tube 3, as shown in FIGS. 7 and 8, and rocket clip 4, as shown in FIG. 7, is picked up by bail 6 and inserted within launcher means 5 while depressing spring latch 25, as shown in FIG. 23, to prevent detent 26 from engaging recess 27, as shown in FIG. 7; rocket clip 4 being pushed within launcher means 5 until shaft 119, as shown in FIG. 12, protrudes through manifold tube 3 and recess 8 mates with slots 2. Clip retainer 1 is automatically engaged by friction fit within slots 2 and recess 8 to maintain rocket clip 4 in a fixed position around firing pin mechanism assembly 75 shown at 9 in FIG. 5, rear cover 10 is closed, and the apparatus is carried to a firing site as shown in FIG. 4. Prior to inserting rocket clip 4 within launcher means 5, strap means 22 and spacers 28 are removed by unfastening convention snap fasteners 29, spacers 28, and strap 22 being shown in FIGS. 7 and 11. At the firing site, rear cover 10 is opened by releasing spring loaded latch 11 by lifting end 12, and front cover 13 is released in the same manner as rear cover 10 by releasing spring loaded latch 14 by lifting end 15 and cover 13 is rotated and retained in the open position, by latch 16 engaging toggle means 17 as shown in FIG. 12. Engagement of latch 16 with toggle means 17 simultaneously releases trigger handle latch 18 from toggle means recess 19, and the trigger handle assembly 20 is manually extended to the firing mode until it engages spring loaded trigger handle latch 21 to lock the trigger handle assembly in the open position, as shown in FIG. 12. To close cover 13 and store the trigger handle assembly 20 in a recess in the under side of the launcher means 5, the above described procedure for opening is followed in reverse order when storing launcher means 5; latch 21 being released by depressing button 23 as shown in FIG. 6. A conventional safety means 24 is provided in the trigger handle assembly, as shown in FIGS. 12 and 13, to prevent inadvertent firing of the rockets from clip 4 prematurely when the launcher is in the firing mode, as shown in FIGS. 3 and 6; the forward position being the safe position and marked "S" and the rear position being the firing position and marked "F." Reflecting sight assembly 30 is positioned in the firing mode by opening lens cover 31 by hinge means, rotating arm 32 to the vertical position within friction hinge 33, and locking spring loaded arm 34 in a notch means at the end of elevation adjusting plate 35 opposite to the storing position notch 36, as shown in FIG. 6. Sight 30 provides the optical line of sight by which launcher means 5 is aimed in azimuth and elevation and can be provided with any suitable reticle pattern, not shown in the drawing, within the skill of the art to suit a given application. Lastly, at the firing site, rocket clip 4 is extended from the launcher means 5 by bail 6 until detent 26, FIGS. 22 and 24, which is located in each rocket tube at a predetermined location to permit clip 4 to be inserted in any orientation, snaps into recess 27, FIG. 7, to permit positioning of the extension shaft 37 out of the safety guide tube 38 which removes the restrictions on trigger 39 stroke travel and firing mechanism assembly 9, as shown in FIGS. 5, 6, and 12. Details of the extension shaft assembly 37 and guide tube assembly 38

are shown in FIGS. 14 to 18 and consist of shaft assembly 37, keys 91, safety guide 38 having the internal spline configuration as shown in FIG. 17 to accept the shaft assembly 37 key structure of FIG. 15, as shown in FIG. 18, and recess 92 to house spring and swivel structure 93 and 94 respectively, swivel 94 being fixedly mounted at the end of safety guide assembly 38 and extension shaft assembly 37, as shown in FIGS. 12 and 19; spring 93 and swivel 94 being utilized to permit return of the extension shaft within launcher means 5 when storing the launcher and the swivel permitting the rotation of extension shaft assembly 37 without winding up the spring. Launcher means 5 is then aimed, as shown in FIG. 3, safety means 24 moved to the F-position, and a rocket fired at a target site, as shown in FIG. 1, by squeezing trigger 39. Each squeeze of trigger 39 applies tension to cable 40 connected to cable drum assembly 41, as shown in FIGS. 19 and 21, which causes the ratchet assembly shown in FIG. 20 to rotate 90°; the ratchet assembly consisting of mounting plate 42, bearing 43, ratchet shaft 44 inserted within bearing 43, torsion cable return spring 45 is located around shaft 44, drive pin 46 is press fit into shaft 44 and protrudes into the bore of shaft 44 to connect with groove 47 of extension shaft 37. Drum assembly 41 consists of pawl 48, pawl pin 49, washers 50, and pin and spring assembly 51. Pawl pin 49 and pin and spring assembly 51 are press fit into cable drum 41 by inserting pin 49 into hole 59 and pin 60 into hole 61, as shown in FIG. 20, and one end of torsion spring 45 is fastened to ratchet pawl pin 49 and the opposite end of spring 45 is fastened to support pin 52 which is press fit into mounting plate 42. Cable drum 41 and mounting plate 42 are secured onto ratchet shaft 44 by snap rings 53. Cable 40 is wrapped in drum groove 54 and held in position by locating the ball end of cable 40 in slot 55 and press fitting pins 56 in holes 57 of drum 41. Each squeeze of trigger 39 causes drum assembly 41 to rotate and pawl 48 fixedly mounted thereon to rotate with the drum assembly while at the same time pawl 48 is being put under spring tension through attachment to torsion cable return spring 45. Simultaneously with rotation of pawl 48, the pawl, held under compression with spring assembly 51 against ratchet 117, engages one of the arms 116 of ratchet 117, each arm being spaced 90° apart in our apparatus, but each arm can be spaced any suitable distance to suit a given application within the skill of the art, and rotates ratchet shaft 44 and extension shaft assembly 37 90° by virtue of the connection of ratchet 117 therewith through drive pin 46. When trigger 39 reaches full travel and is released, pawl 48 is returned to the original position by tension from spring 45 and the action is cyclically repeated with each squeeze of trigger 39. Each rotation of the ratchet assembly causes cam shaft 62 to rotate through 90° and cause cam bearing 63 to move along cam surface 64, as shown in FIG. 25 for the firing pin mechanism assembly, to cock firing pin 65 as bearing 63 rides up to cam peak 118 and to release firing pin 65 under tension of compression spring 69 after peak 118, FIG. 25, has passed bearing 63 to detonate primer 66 mounted in cavities 67 of manifold 68, as shown in FIG. 8; cover means 7 being fixedly mounted on structure 68. Each time trigger 39 is squeezed, a different firing pin is released to strike a primer until all rockets have been expelled from launcher 5. While the drawing shows the utilization of four launching tubes, it is within the skill

of the art to utilize our teaching to design a launching means to have any number of tubes to suit a given application. The firing pin mechanism assembly, as shown in FIGS. 25, 26, 27, and 28, consists of a cover 70, alignment pin 71 to align hole 72 with hole 73, machine screws 74 to mount cover 70 on housing 75 with mating holes 76 and 77, bearings 78, firing pin 65, compression spring 69, cam follower pin 79 press fit into firing pin 65 which supports guide sleeve 80, and cam bearing 63, cam shaft 62, cam sleeve 81, cam 82, collar 83, rubber seats 88, housing 75, gas checks 84 press fit into recesses in housing 75, cam shaft packing 85, retainer 86 for packing 85, and rubber spacer 87 affixed to the end of housing 75 by adhesive as shown in FIG. 25. Upon detonation of primer 66 by firing pin 65, flame from the detonation ignites rocket motor igniter 89, as shown in FIGS. 2 and 32, which in turn ignites a conventional rocket motor, not described herein and not being a part of this invention but the rocket motor housing is shown as structure 98 in FIGS. 29 to 34, which propels the projectile shown at 90 of our invention, as shown in FIGS. 29 to 31 and 34, to the target site. While any suitable case means can be designed within the skill of the art to suit any given application for projectile 90, the embodiments shown in FIGS. 29 and 31 are preferred for our projectile. The FIG. 29 embodiment utilizes a deep drawn case 95 having case 95, fuze well 96, and fuze well boss 97 welded together to form an integral unit for mounting a conventional set back arming fuze 99 therein, conventional burster assembly 100 to be detonated by fuze 99 upon impact of projectile 90 at the target site and burster assembly 100 to disseminate the payload upon detonation of assembly 100, and conventional threaded adapter 102 to mount and seal conventional rocket motor assembly 98 therein. A conventional filler plug boss 103 is fixedly mounted within case 95 by any conventional means, such as welding, and conventional filler plug 104 is mounted by any convenient means such as threadably in boss 103, after loading the payload within case 95, by inserting a tool means within tool recess 105; the plug and boss structure being the same for each embodiment shown in FIGS. 29 to 31. If desired, a sealing material may be applied within the skill of the art to suit a given application to threads 106 prior to inserting plug 104 in boss 103. The embodiment shown in FIG. 30 is identical to the FIG. 29 embodiment except case 95 and fuze well 96 are an integral reverse deep draw structure and fuze well boss 97 is bonded in position by any conventional adhesive material to suit a given application and mechanically held in position, such as by press fit. The embodiment shown in FIG. 31 is identical to the FIG. 29 and FIG. 30 embodiments except that case 95 and fuze well 96 are a one piece impact extruded structure having threaded boss 97 therein and burster assembly 100 is a conventional explosive burster charge located within tube 101. Each rocket as stored in rocket clip 4 prior to launch is shown at 107 in FIG. 34 and consists of case 95 constituting the warhead containing the payload, adapter 102, and the rocket motor assembly shown at 108; assembly 108 consisting of rocket motor housing 98, igniter 89, and fin assembly 109, as shown in FIG. 32 and FIG. 34; fin assembly 109 consisting of fins 110, clip spring 111 to open fins 110 in flight, and rivet pivot shaft 112 for mounting spring 111 and fins 110, as shown in FIG. 33. Fuze 99 is armed when the rocket shown at 107 accelerates in flight, and the fuze

can be set within the skill of the art to arm at any given velocity to suit any particular application. Any conventional rocket motor having noncanting fins, no nozzles and utilized without spin can be employed in our projectile. Rocket retainer assembly, shown at 113 in FIG. 9, consists of tube cap 114 and rocket retainer 115; the assembly 113 being used to hold each rocket shown at 107 in FIG. 34 within tube 116, as shown in FIG. 7, for example, provides protection for igniter 89 prior to launching of the rocket, and assembly 113 is blown off by the rocket motor's exhaust pressure when the rocket is launched. While any suitable payload can be used within the skill of the art with the rocket in our invention, such as incendiary, chemical, or explosive composition, our preferred payload is an incendiary composition. A problem existed with prior art incendiary compositions, such as gelled or thickened gasoline, which precluded their use in our apparatus, because the prior art compositions did not ignite and burn completely at the target site due to the inefficiency of the ignition system and the lack of long term stability using available gasolines. A research program was conducted in an effort to utilize a solution of polyisobutylene in triethylaluminum, hereinafter referenced as PIB and TEA respectively, as the payload in our apparatus, but all efforts produced an unsatisfactory payload until it was unexpectedly found that a viscoelasticity was introduced into the TEA which controlled the breakup of PIB-TEA to permit efficient dissemination when a high molecular weight PIB having an empirical Staudinger molecular weight of approximately 200,000 and a viscosity-average molecular weight of about 5,000,000 was dissolved in the TEA. Commercially available PIB, such as Vistanex L-200 and Oppanol B-200, dissolved in TEA in the amount of approximately 5 to 6 weight percent produced a satisfactory payload for our apparatus which disseminated under mild explosive conditions. The L-200 and B-200 notation references the empirical Staudinger molecular weight of about 200,000. The aforementioned term viscoelasticity is a simplistic combination derived from terms viscous and elastic which phenomenologically expresses the general rheological behavior of polymer-thickened liquids as well as many other fluids. Rheological properties for our PIB-TEA are set forth in the table below; the relaxation time being considered as the best single property to express the degree of viscoelasticity.

Rheological Properties Measured at 25°C For 6 wt. % PIB in TEA

Property	Value
Applied Shear Stress (τ)	4.83 dyne/sq. cm
Shear Rate ($\dot{\gamma}$)	0.00373 second ⁻¹
Calculated Recoverable Shear (ν_r)	0.784 shear units
Apparent Viscosity (η_a)	1300 poise
Shear Modulus (G)	6.17 dyne/sq. cm.
Normal Stress (P_n)	3.79 dyne/sq. cm.
Relaxation Time (T_r)	210 seconds

The above rheological properties are mathematically defined as follows: Shear Stress $= \tau = T/2\pi r_i^2 l_0$ wherein T = applied torque in dyne-centimeters, r_i = the radius of the inner cylinder (rotor) in centimeters of two concentric biconical cylinders of a modified Mooney-Ewart rotational viscometer having an air bearing incorporated to counteract the weight of the rotor to produce nearly frictionless motion and designed to enclose a sample substantially completely and operated in a shear rate range of 10^{-6} to 10^1 sec⁻¹ under torque ap-

plied by weights suspended from the shaft of the rotor, and l_0 = equivalent length of the aforementioned inner cylinder; Shear rate = $\dot{\gamma} = 2\omega/(1 - c^2)$ wherein ω = angular velocity of the aforementioned inner cylinder in radians/second and c = ratio of radii of inner to outer cylinders of the aforementioned viscometer. Recoverable Shear = $\nu R = 2\phi R (1 - C^2)$ wherein ϕR is the angular displacement of the aforementioned inner cylinder under elastic recoil in radians and c is as defined above; Apparent Viscosity = $\eta_a = (\tau/\dot{\gamma})$ wherein τ is the Shear Stress = $\tau = G R/\dot{\gamma}$ defined above and $\dot{\gamma}$ is the Shear Rate defined above; Shear Modulus = $G = \tau/\nu R$ wherein τ is the Shear Stress defined above and νR is the Recoverable Shear defined above; Normal Stress = $P_n = \tau \cdot \nu R$ wherein τ is the Shear Stress defined above and νR is the Recoverable Shear defined above; Relaxation Time = $TR = \eta/G = \nu R/\dot{\gamma}$ wherein η = viscosity, G is the Shear Modulus defined above, νR is the Recoverable Shear defined above, and $\dot{\gamma}$ is the Shear Rate defined above. The above rheological properties can be determined within the skill of the art by any suitable viscometer other than the aforementioned rotational viscometer. Preparation of our PIB-TEA payload requires care to assure complete polymer solvation and homogeneous dispersion and to avoid polymer shear - degradation. An exemplary PIB-TEA solution on a 50 gallon batch basis is prepared at 40° C to 70° C in a blender, such as a glass vessel 25 1/2 inches deep and 25 1/2 inches in diameter having a stainless steel anchor agitator 21 1/2 inches wide and 22 1/2 inches high centrally mounted therein and the blending system being hydraulic, in a nitrogen atmosphere. TEA is added to the blender first, the stirring speed, as in the above described blender system, of the stirrer is adjusted to about 100 rpm, finely cut PIB having an average dimension of one-sixteenth inch is added to the TEA over a one hour period, the PIB-TEA mixture is stirred for about 7 hours, and the PIB-TEA final solution product is stored under an inert atmosphere until loaded into the rocket shown in FIG. 34. On a 50 gallon basis, 14.5 pounds of PIB are added to 286 pounds of TEA and stirring is continued until all visual solid particles have dissolved; samples are taken on an hourly basis and the viscosity thereof determined by a capillary viscometer until the viscosity of the product is in the range of 150,000 to 250,000 centistokes at 40° C when stirring is discontinued and the aforementioned viscosity range is acceptable as the final product. Should the 250,000 centistokes viscosity be exceeded, additional TEA can be added and the PIB-TEA batch restirred as above discussed to obtain a product within the aforementioned acceptable viscosity range. PIB-TEA is loaded into case 95 in a nitrogen atmosphere through boss 103 and sealed therein by plug 105 as described above. The stirring operation is critical, because approximately 7 hours are necessary to completely dissolve the polymer and continued stirring after that time results in polymer degradation as demonstrated in the table below by the viscosity data as measured by an Ostwald type viscometer at 40° C.

Polymer Degradation

Stirring Time at 200 rpm in Hours	Viscosity in Centistokes
24.5	126000
48	69000
69.5	48000
100	34000

The TEA for the solution described above is a clear, colorless liquid which is stable in storage at all prevailing ambient temperatures between -40° to 160° F, is pyrophoric to air, reacts violently with water, has a freezing point of -52.5°C, has a boiling point of 194°C at 760 mm Hg, has a density of 0.837 grams/milliliter at 20°C, and has a viscosity of 2.80 centipoise at 25° C. The PIB-TEA solution is stable as evidenced by periodic viscosity measurements after storage for two years at ambient and desert storage temperature (160° F) conditions in contact with the component materials of the casing.

It is obvious that other modifications can be made of our invention, and we desire to be limited only by the scope of the appended claims.

We claim:

1. A portable and multishot apparatus to launch a projectile containing a payload composition to a target site comprising: a launcher means adapted to contain a plurality of tubes having projectiles therein to be launched; a sight means mounted on the launcher means to aim the launcher means in azimuth and elevation; a trigger means movably mounted on the launcher means; a guide tube assembly means fixedly mounted within the launcher means to provide a safety and travel guide means for an extension shaft assembly means; an extension shaft assembly means slidably mounted within the guide tube assembly means whereby, upon extension of the extension shaft assembly means said trigger means is actuatable; a spring and swivel assembly means located within the guide tube assembly means and having one end of the swivel component fixedly connected to the inside of the forward end of the guide tube assembly means and one end of the spring component fixedly connected to the inside of the aft end of the extension shaft assembly means to permit the extension shaft assembly means to rotate and travel within the guide tube assembly means and to return to a storage position and the other end of the swivel component and the other end of the spring component fixedly and swivelly connected to each other; a firing mechanism means fixedly connected to the aft end of the extension shaft assembly means and actuatable upon extension of said extension shaft extension means; a ratchet and drum assembly means movably connected to the firing mechanism means and mounted on the extension shaft assembly means to permit sequential launching of the projectiles; and a cable means connecting the trigger means and the drum assembly means to activate the ratchet and drum assembly means when tension is placed on the cable means by squeezing the trigger means.

2. The apparatus of claim 1 wherein the payload composition is selected from the group consisting of explosive composition, chemical composition, and incendiary composition.

3. The apparatus of claim 2 wherein the incendiary composition is a viscoelastic solution of high molecular weight polyisobutylene in triethylaluminum.

4. The apparatus of claim 1 wherein the guide tube assembly means has a spline configuration formed in the inside wall adapted to mate with key structures formed on the outside wall of the extension shaft assembly means, the extension shaft assembly means has a pair of key structures formed on the outside wall of the extension shaft assembly means 180° apart to mate with the spline configuration, and a longitudinal groove

structure is provided in the extension shaft assembly to receive a ratchet component drive pin.

5. The apparatus of claim 1 wherein the firing mechanism comprises a housing means, a plurality of spring loaded firing pin means movably mounted within the housing means to detonate a plurality of primer means fixedly mounted within a primer manifold means, a cam means rotatably mounted within the housing means adapted to cooperate with a cam bearing means to cock the firing pin means and to release the firing pin means under spring tension after cocking to detonate the primer means, a cam bearing means rotatably mounted adjacent to the forward end of each member of the plurality of firing pin means to sequentially travel over the surface of the cam means to cock the firing means and to release the firing pin means under spring tension after cocking to detonate the primer means, a plurality of primer means fixedly mounted within the primer manifold means adapted to be detonated by the firing pin means to activate a projectile, and a manifold tube means integral with and centrally located in the primer manifold means and extending in an aft direction, a slot means formed in a manifold tube extension means to receive a clip retainer means therein, and a clip retainer means adapted to be removably mounted within the slot means to engage a clip assembly to the firing mechanism after loading the plurality of tubes within the launcher means to permit extension of the extension shaft assembly means to remove restrictions on the trigger means and the firing mechanism.

6. The apparatus of claim 1 wherein the ratchet and drum assembly means has a ratchet component connected to a drum component; the ratchet component comprising a ratchet means, a mounting plate means to mount the ratchet and drum assembly within the launcher means and having a hollow and annular structure in the center thereof to receive a ratchet shaft means which surrounds the extension shaft assembly means, a torsion return spring means surrounding the ratchet shaft means and having the forward end fixedly connected to a pawl means and the aft end fixedly connected to a support pin means press fit into the mounting plate, a drive pin means being press fit into the ratchet shaft means and protruding into the bore of the ratchet shaft means to fix the ratchet means in position on the extension shaft means and to ride in a grove in the extension shaft assembly means to permit rotation through approximately 90° of a cam means within the firing mechanism means with each squeeze of the trigger means, and a support pin means to fixedly anchor the torsion return spring at one end.

7. The apparatus of claim 6 wherein a drum component is rotatably mounted on the ratchet shaft means to cooperate with the ratchet component; the drum component comprising an annular groove therein to receive the cable means therein, a recess formed integral with the annular groove to fixedly anchor one end of the cable means therein, means to hold the cable means within the annular groove, and a pawl means fixedly mounted on the drum component and adapted to engage the ratchet means to rotate the cam means within the firing mechanism means.

8. The apparatus of claim 1 wherein a safety means is integral with the trigger means to permit storing the apparatus in a safe position.

9. A method of sequentially delivering plural projectiles to a target area comprising the steps of:

providing a rear loading launcher having plural primer actuated propellable projectile guide tubes with an extendable centrally located spaced plural pin firing mechanism therebetween wherein the pins are actuatable in sequence by a trigger when the said firing mechanism is in the extended and locked position;

providing for assembly into the guide tubes a complementary number of and compatibly shaped projectile containing rockets in a clip having an interconnecting portion with plural spaced primers alignable with respective pins of said firing mechanism wherein the said interconnecting portion is attachable to the said firing mechanism;

assembling the clip and its projectile containing rockets into the respective said guide tubes from the rear of the launcher with the projectiles foremost and attaching the clip said interconnecting portion to the firing mechanism thereby associating the respective pins of the firing mechanism into alignment and engageable relation with the respective rocket primers;

moving the clip, associated rockets, and attached firing mechanism relative to the launcher tubes to the extended position and locking the assembly, to thereby secure the rockets to the launcher and enable trigger actuation;

and aiming the launcher at the target and sequentially firing the rockets by repetitively actuating the trigger which sequentially actuates the pins of the firing mechanism causing each to respectively detonate a primer which in turn fires its associated rocket to propel its projectile to the target.

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