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(71) Applicant and
(72) Inventor: **BUNNEY, Robert, Frederick** [GB/GB]; 68 The Coppins, Ampthill, Bedfordshire, MK45 25N (GB).

(74) Agent: **BURROWS, Anthony, Gregory**; Business Centre West, Avenue One, Business Park, Letchworth Garden City, Hertfordshire SG6 2HB (GB).

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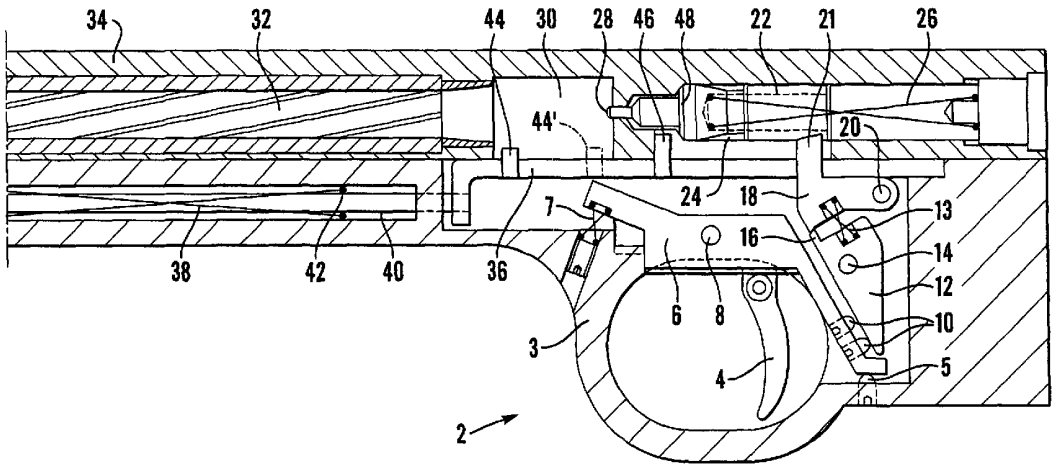

(57) Abstract: Various items of apparatus are disclosed including: 1) a gun (2) having a body (3), a trigger mechanism (4-21), a barrel (34), a magazine for holding a plurality of projectiles, and a traversing mechanism (44)) for advancing the magazine stepwise and unidirectionally through a transverse aperture (30) through the body (3), 2) a device for dosing an exact amount of propellant material into the magazine, 3) a device for inserting a primer into the magazine, 4) a device for removing a used primer from the magazine and/or seating a projectile in the magazine, and (5) bullets of which one is particularly designed for the user with the gun (2).

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APPARATUS

According to a first aspect of the present invention, there is provided a gun comprising a magazine for holding a plurality of projectiles, a body, a trigger mechanism for triggering the firing of a projectile from said magazine, a barrel for receiving and ejecting the fired projectile, a traversing mechanism for advancing said magazine stepwise and unidirectionally through a transverse aperture through said body, said magazine being arranged to be loaded with said projectiles from the front of said magazine into a plurality of chambers each having an opening at said front of said magazine, a propellant-material-receiving, rearward portion and a projectile-receiving, forward portion, the arrangement being such that, if a double charge of propellant material is loaded in said chamber, a projectile then loaded in said chamber would extend beyond said front of said magazine so that said magazine would be prevented from advancing through said transverse aperture.

Owing to this aspect of the present invention, it is possible for shooters interested in a muzzle-loading style of shooting with cylindrical bullets to do so in a multi-shot manner. In addition, the firing of a cylindrical bullet when a chamber has been "double-charged" with excess propellant material, which can lead to dangerous consequences when using highly volatile smokeless propellants, cannot occur.

The magazine can take the form of a linearly displaceable, load block or a rotary cylinder.

According to a second aspect of the present invention, there is provided in combination:-

a gun comprising a magazine for holding a plurality of projectiles, a body, a trigger mechanism for triggering the firing of a projectile from said magazine, a barrel for receiving and ejecting the fired projectile, a traversing mechanism for advancing said magazine stepwise and unidirectionally through a transverse aperture through said

body, said magazine being arranged to be loaded with said projectiles from the front of said magazine into a plurality of chambers each having an opening at said front of said magazine, a propellant-material-receiving, rearward portion and a projectile-receiving, forward portion,

propellant material in said rearward portion, and

a cylindrical bullet in said forward portion.

Owing to this aspect of the present invention, it is possible for shooters interested in a muzzle-loading style of shooting with cylindrical bullets to do so in a multi-shot manner.

According to a third aspect of the present invention, there is provided a gun comprising a magazine for holding a plurality of projectiles, a body, guiding surface portions of said body and serving to guide linearly advance of said magazine through a transverse aperture through said body, a trigger mechanism for triggering the firing of a projectile from said magazine, a barrel for receiving and ejecting the fired projectile, a traversing mechanism for advancing said magazine stepwise and unidirectionally through said transverse aperture, said magazine being arranged to be loaded with said projectiles from the front of said magazine.

Owing to this aspect of the present invention, it is possible for shooters interested in a muzzle-loading style of shooting with a magazine in the form of a rectangular chamber block to do so in a multi-shot manner.

According to a fourth aspect of the present invention, there is provided dosing apparatus for a firearm, comprising a container for receiving flowable material, a receiving device having therein a hole of a predetermined volume and for filling with material from said container, and an outlet through which the predetermined volume of said material in said hole leaves said apparatus, said receiving device being displaceable to move said hole between said container, where said hole is filled with said material, and said outlet, where the material in said hole is fully discharged.

According to a fifth aspect of the present invention, there is provided a method of loading a firearm with flowable material, comprising delivering said material from a container into a hole of a predetermined volume to fill said hole with said material, displacing said hole from said container to an outlet leading towards said firearm and fully discharging said material from said hole into said outlet.

Owing to these aspects of the invention, it is possible for a shooter to load an accurate amount of the material into the firearm, not only reliably, but also rapidly.

According to a sixth aspect of the present invention, there is provided dosing apparatus comprising a container for receiving flowable material, a receiving device having therein a hole of a predetermined volume and for filling with material from said container, and an outlet through which the predetermined volume of said material in said hole leaves said apparatus, said receiving device being displaceable to-and-fro to move said hole between said container, where said hole is filled with said material, and said outlet, where the material in said hole is fully discharged.

Owing to this aspect of the invention, it is possible to provide a relatively simple dosing apparatus.

According to a seventh aspect of the present invention, there is provided apparatus for inserting a primer into a projectile housing for a gun, comprising a primer supporting device, a primer inserting device and a projectile housing supporting device at respective opposite sides of said primer supporting device, and an operating device to operate said primer inserting device to force a primer in said primer supporting device into a projectile housing supported by said projectile housing supporting device.

According to a eighth aspect of the present invention, there is provided a method of inserting a primer into a projectile housing for a gun, comprising supporting said primer in a primer supporting device, supporting said projectile housing in a projectile housing supporting device,

and causing a primer inserting device to force said primer into said projectile housing.

Owing to these aspects of the invention, it is possible for a shooter to insert quickly a new primer.

The projectile housing can be, for example, a cartridge, a rectangular load block or a cylinder.

According to a ninth aspect of the present invention, there is provided apparatus for removing a used primer from a magazine for a gun, comprising a magazine supporting device, and a primer removing device operable to remove said primer from said magazine.

According to a tenth aspect of the present invention, there is provided a method of removing a used primer from a magazine for a gun, comprising supporting said magazine in a magazine supporting device and operating a primer removing device to remove said primer from said magazine.

Owing to these aspects of the invention, it is possible for a shooter to remove quickly a used primer.

Advantageously, the apparatus for removing a used primer may also have a projectile-loading device for loading a projectile into the magazine and, preferably, the primer removing device and the projectile-loading device may be operated by an operating device common to both.

According to an eleventh aspect of the present invention, there is provided apparatus comprising:

a gun having a body, a trigger mechanism, a barrel, a magazine for holding a plurality of projectiles, and a traversing mechanism for advancing said magazine stepwise and unidirectionally through a transverse aperture through said body,

a device for dosing an exact amount of propellant material into said magazine,

a device for inserting a primer into said magazine, and

a device for removing a used primer from said magazine and/or seating a projectile in said magazine.

Owing to this aspect of the invention, it is possible to

provide a shooter interested in a muzzle-loading style of shooting with a complete shooting package.

Owing to the various aspects of the invention, it is possible for shooters to remove quickly used primers, insert quickly new primers, and place exact amounts of propellant material and load projectiles into the magazine, so enabling a faster turnaround in shooting, therefore allowing a shooter to shoot more shots in a given time period.

The propellant material may be nitro-cellulose, a smokeless propellant powder.

The primers may be of the standard type, as used in metallic centre-fire cartridges. The primers contain a percussive material, such as fulminate of mercury, to ignite the nitro-cellulose powder since nitro-cellulose requires a hotter flame to be produced when the firing pin strikes than do traditional black powder propellants.

According to a twelfth aspect of the present invention, there is provided a wad-cutting, flat-based bullet of soft metallic material and of cylindrical form having a front end and a rear end, said rear end having a gas-check cap attached thereto.

Owing to this aspect of the present invention, it is possible to provide a shooter with a soft-metallic, wad-cutting bullet with a gas-check cap on its base to prevent damage to the base region of the bullet on firing.

According to a thirteenth aspect of the present invention, there is provided a bullet of cylindrical form and including at the front thereof a dome serving to co-operate with a centering portion of a loading pin for loading said bullet in a chamber.

Owing to this aspect of the invention, it is possible to ensure that the chamber is correctly aligned with the loading pin.

According to a fourteenth aspect of the present invention, there is provided a combination comprising a firearm chamber, a propellant charge at a rearward portion of

said chamber, and a bullet at a forward portion of said chamber, there being substantially no expansion volume remaining in said chamber for gas produced during firing of said bullet.

Owing to this aspect of the invention, it is possible to avoid the firing of the bullet with an excessive propellant charge in the chamber.

According to the fifteenth aspect of the present invention, there is provided a small arms bullet comprised of a bullet body of a non-ductile metallic substance and of circular cylindrical form having two ends and a ductile drive band closely encircling said bullet body at a location between said two ends.

Owing to this aspect of the invention, it is possible to provide shooters interested in small arms shooting with a bullet with an increased range for a given small arms size.

By small arms, what is meant is any arms size up to but not including heavy artillery weapons.

According to the sixteenth aspect of the present invention, there is provided a bullet comprised of a bullet body and a ductile drive band closely encircling said bullet body, wherein said drive band comprises a ridge and a groove about its circumference, and said ridge is located ahead of said groove and projects radially outwardly beyond an external peripheral surface of said body.

Owing to this aspect of the invention, it is possible to provide a bullet which has a drive band and the body of which, upon firing, does not deform.

In order that the invention may be clearly and completely disclosed, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 shows a fragmentary, vertical axial section through a firearm in the form of a pistol,

Figure 2 shows a view similar to Figure 1 of a second version of the pistol,

Figure 3 shows a perspective view of a magazine for the

pistol of Figure 1 or 2 with a vertical axial section through a chamber of the magazine,

Figure 4 shows a perspective view of a magazine for a firearm in the form of a revolver, shown partially in section,

Figure 5 is a front elevation of the magazine of Figure 3 for use in the pistol of Figure 1 or 2,

Figure 6 is an underneath plan view of the magazine of Figure 3,

Figure 7 shows a section taken on the line VII-VII of Figure 5,

Figure 8 shows a perspective view of a powder dosing device,

Figure 9 shows a perspective, partially sectional view of a primer inserting tool for inserting primers into the magazine of Figure 3,

Figure 10 shows a perspective view of a tool for removing used primers from and seating projectiles into the magazine of Figure 3,

Figure 11 shows half in elevation and half in axial section a soft-metallic, wad-cutting bullet,

Figure 12 is an elevational view of a rifle bullet body, and

Figure 13 is a fragmentary elevational view of the bullet with a drive band installed.

Referring to Figures 1 and 2, the firearm 2 includes a body 3 which mounts a trigger mechanism that includes a trigger 4. When the trigger 4 in Figure 1 is pulled backwards by a shooter's finger, a trigger bar 6, urged against a set screw 5 in the body 3 by compression springs 7 and 13, moves anti-clockwise about a transverse axis 8, so that firstly one and then the other of two set screws 10 in the bar 6 and providing a so-called "two-stage trigger" press against a bent 12 which is thereby turned, against the action of the compression spring 13, anti-clockwise about a transverse axis 14. In Figure 2, the trigger 4 is, in this version, disposed

more forwardly to lie almost directly beneath the transverse axis 8. When the trigger 4 is pulled backwards by a shooter's finger, the trigger bar 6, urged against the set screw 5 in the body 3 by the spring 7, moves anti-clockwise about the transverse axis 8 to an extent limited by a set screw 9. Instead of the "two-stage trigger" arrangement provided by the set screws 10 of Figure 1, there is, in Figure 2, a stepped portion 10' in the trigger bar 6, which, on the anti-clockwise motion of the trigger bar 6 around the axis 8, presses against the bent 12 which is, again, turned, against the action of the compression spring 13, anti-clockwise about the transverse axis 14.

In Figures 1 and 2, an abutment 16 on the bent 12 holds a sear 18 substantially stationary until the bent 12 turns to a point where the abutment 16 slides past the sear 18. At this point, the sear 18 is turned downwardly sharply, rotating anti-clockwise about a transverse axis 20 under the force acting on a detent 21 thereof from a firing pin 22 (shown in Figure 1 in its position after firing and in Figure 2 in its position before firing). When the firearm 2 is in a cocked condition, the firing pin 22 is in a position such that a groove 24 therein is engaged by the detent 21 and a compression spring 26 is exerting a force on the pin 22 to the left in Figure 2. When the firing pin 22 is released by the sear 18 the compression spring 26 forces the pin 22 towards the front of the firearm 2 and a point 28 of the pin 22 penetrates into a transverse aperture 30 through the body 3. Forward of the aperture 30 is a bore 32 of a barrel 34 of the firearm, a cocking mechanism of which includes a slide 36 reciprocable longitudinally of the firearm and urged forwardly by a compression spring 38 beneath the barrel 34. The spring 38 encircles a headed rod 40 which is fixed at its rearward end to the slide 36 and which at its headed forward end serves as an abutment for the forward end of the spring 38, the rearward end of which abuts against a shoulder 42 in the body 3. The slide 36 has fixed thereto two upwardly

projecting pins 44 and 46. The pin 46 is arranged to come to bear on an annular shoulder 48 of the firing pin 22 when the slide 36 is displaced rearwardly against the action of the spring 38 and so pushes the firing pin 22 back into its cocked position. That rearward stroke of the pin 46 is accompanied by a rearward stroke of the pin 44 from its full-line, foremost end position shown in Figure 1 to its rearmost end position 44' shown in dot-dash lines (Figure 2 shows the pin in its rearward position 44' only).

A magazine 50, as shown in Figures 3, 5, 6, and 7, is mountable in the aperture 30 so as to extend transversely of the firearm 2 and is formed at its underneath surface with a groove system 52 of a zig-zag form in which the pin 44 engages, so that reciprocation of the pin 44 between its foremost and rearmost end positions produces reliably unidirectional linear stepwise advance of the magazine 50 through the aperture 30, each full reciprocation of the pin 44 ending with each of five chambers 54 of the magazine 50 in turn aligned with the point 28 and the barrel 32. Each chamber 54 consists of a rearwardly open sub-chamber 56 for loading with a percussion cap type primer 63, a forwardly open sub-chamber 58 for loading, from the front, firstly with a propellant charge 62 into a propellant-receiving rearward portion 58' and secondly with a cylindrical bullet 64 into a projectile-receiving forward portion 58'', and a short bore 60 interconnecting and co-axial with the sub-chambers 56 and 58. The boundary between the two portions 58' and 58'' is defined by a bullet seating shoulder 58'''.

In use, with the firing pin 22 already cocked, as shown in Figure 2, the slide 36 is displaced rearwards part-way, and then a fully loaded magazine 50 is inserted into the aperture 30 with its end 50' leading, so that the pin 44 can enter an open-sided end 52' of the groove system 52. Then the slide 36 is returned to its foremost position, so that the pin 44 rides into a first, forward, aligning portion 52a of the system 52. The firearm can then be fired. A later full

reciprocation of the slide 36 not only cocks the firing pin 22 but also then brings the pin 44 into a second, forward, aligning portion 52b of the system 52. The firing and cocking cycle is repeated until the pin 44 leaves the opposite end 52'' of the system 52.

In Figure 4, the magazine 50 is in the form of a cylinder to be used with muzzle loading revolvers. The chambers 54 are distributed around a central bore 66 which runs longitudinally through the cylinder 50 for receiving a mounting pin of a revolver. A ratchet 68 of a ratchet mechanism produces reliable unidirectional stepwise advancement of the cylinder 50 through an aperture in the muzzle loading revolver, with each firing ending with each of six chambers 54 of the cylinder 50 in turn aligned with the point of the firing pin and the barrel of the revolver.

Referring to Figure 8, a powder dosing device 70 has a powder holding container 72 which is mounted on top of a body 74 and into which propellant powder is placed. The powder falls into and fills a hole 76 which is of a predetermined volume so that the exact amount of powder is measured to give optimum results on firing. The hole 76 is formed in a reciprocable bar 78 contained within the body 74. The bar 78 has an arm 80 coaxially attached to it which extends externally of the body 74 and terminates in a flat button 82. Once powder has filled the hole 76 a shooter pushes the button 82 towards the body 74 with his finger or thumb to move the bar 78 against the action of a compression spring 84. This moves the hole 76 inwards until it becomes aligned over an opening 86 through which the powder contained within the hole 76 empties into a conduit 88. The conduit 88 is of an external diameter to fit into the sub-chambers 58 of the magazine 50. In this way, the exact amount of propellant material can be delivered into any one of the propellant-receiving portions 58' of the sub-chambers 58. If too much propellant material is placed into the portion 58', by the shooter's inadvertently loading the sub-chamber 58 twice or

more with a dosage of propellant before firing, such overcharging being potentially dangerous for the shooter, the bullet 64 will protrude from the sub-chamber 58 in question. This prevents the magazine 50 from passing through the aperture 30 in either the pistol of Figure 1 or 2 or the revolver at least to an extent to allow that particular sub-chamber 58 to reach a firing position and therefore prevents any consequential accidents whilst shooting.

Figure 9 shows a primer inserting tool 90. The magazine 50 of Figures 3, 5, 6 and 7 fits into a supporting seat 92 with the sub-chamber 56 for receiving a primer facing inwardly towards a primer inserting plunger 94. Located between an end 100 of the plunger 94 and the seat 92 is a conduit 96 in which primers, from a primer storage device 98, align themselves in a single column. The primer located at the base of that column lies immediately in front of the end 100 of the plunger 94 and immediately behind an aligned sub-chamber 56 of a magazine 50 in the seat 92. An operating press 102 is connected to the plunger 94, and by the shooter's pressing down on a pad 104 of the press 102 the plunger 94 is pushed forward against the action of a spring 106. The forward movement of the plunger 94 causes its end 100 to force the primer, located at the base of the column in the conduit 96, into the aligned sub-chamber 56 of the magazine 50 located in the seat 92. The seat 92 has on its base a pin 108 for engaging in the groove system 52 on the base of the magazine 50 for aligning each sub-chamber 56. The shooter manually places the magazine in the seat 92 to align a particular sub-chamber 56 in the magazine to be loaded with a primer, with the pin 108 holding steady the magazine in the seat 92. The shooter repeats this procedure for each sub-chamber 56, with the magazine 50 being advanced through the seat 92 by the shooter.

Referring to Figure 10, a magazine de-primer and projectile loading tool 112 comprises a base 114, a magazine supporting section 116 which includes a de-priming seat 116'

and a projectile loading seat 116'', a de-priming pin 118, a projectile loading pin 120 having a concave pressing surface 121, and a handle 122. The pins 118 and 120 are each mounted at one end on the handle 122 by way of pin-and-slot connections 123 and are vertically guided in respective cylindrical bores in a horizontal arm 125 fixed relative to the base 114. The other end of the de-priming pin 118 is suspended by the handle 122 over the de-priming seat 116'. Likewise, the other end of the projectile loading pin 120 is suspended by the handle 122 over the projectile loading seat 116''. Once propellant material has been dosed in the portion 58' the bullet 64 is inserted into the portion 58''. The magazine 50, with each of its sub-chambers 58 loaded with propellant material and a bullet loosely seated, is then placed in the seat 116'' of the tool 112 with the sub-chamber 58 and the bullet 64 facing vertically upwards towards the pin 120. By the shooter's operating the handle 122, the pin 120 pushes the bullet further into the sub-chamber 58 to seat it finally against the shoulder 58'''. This operation is repeated for each sub-chamber 58, with the magazine 50 being advanced though the seat 116'' by the shooter.

Once a magazine has been used by the shooter, the used percussion cap primers need to be removed before the magazine can be used again. The magazine is placed in the de-priming seat 116' with the sub-chamber 58 facing upwards towards the pin 118. The de-priming part 124 of the pin 118 is shaped to fit into the sub-chamber 58 with its point 126 designed to project through the short bore 60 and push any used primer out of the sub-chamber 56. The used primers fall through the seat 116' and a bore 128 in the body 114 into a primer collecting cavity 130. A plug 131 for closing the opening to the cavity 130 can be removed from the body 114 to permit disposal of used primers collected therein.

Each of the firearms shown in Figures 1 and 2 and the revolver can be made to order to provide a safe smokeless powder gun for those interested in such shooting and can be

provided, in package form, with one or more of the powder dosing device, the primer inserting tool and the de-priming and projectile-loading tool described with reference to Figures 8 to 10.

Referring to Figure 11, the bullet 64 is a wad-cutting, flat-based bullet and has a cylindrical body 140 of a calibre to be loaded into the sub-chamber 58 of the magazine 50. The bullet 64 is also of a sufficient overall length that, when the bullet 64 is loaded into the sub-chamber 58 of the magazine 50 subsequent to a single measured dose of propellant material using the powder dosing device 70, the tip of a domed portion 142 of the bullet 64 is substantially co-planar with the rim of the front opening of the sub-chamber 58. Therefore, as already mentioned with reference to Figure 8, if more than a single dose of propellant material were to be placed in the portion 58', the bullet will protrude from the sub-chamber 58 and therefore indicate a potentially dangerous overcharging. The pressing surface 121 matches the surface of the dome 142 and co-operates therewith to align the sub-chamber 58, and thus the magazine 50, with the pin 120.

The bullet 64 also has at its rear end a gas-check cap 144 of any suitable material, preferably copper. The body 140 of the bullet 64 is composed of a soft metallic material, softer than copper, preferably a mixture of predominantly lead and a small amount of tin, for example a mixture of 99.5% lead and 0.5% tin, the tin being present to prevent the oxidisation of the lead. This relatively soft metallic material enables the rear end of the body 140 of the bullet 64 to be squeezed into the cap 144 during forming of the bullet. The cap 144 prevents damage to the base of the bullet 64. Owing to the anti-overcharging feature, the bullet 64 is pressed down on the propellant material in the sub-chamber 58 when loaded into the magazine 50, leaving in the sub-chamber 58 no expansion volume for gas when the propellant material is ignited on firing. In the absence of such a cap 144, the

large and sudden pressure increase at the base of the bullet 64, caused by the ignition of the propellant material, would deform the relatively soft metallic body 140, possibly leading to the soft metallic material of the bullet 64 becoming spattered around inside the sub-chamber 58. The cap 144 prevents such deforming of the bullet 64 on firing and therefore provides for consistent shooting. Consistent shooting of the bullet 64 can be aided by a lubricating fluid applied, particularly, to that surface of the bullet 64 which contacts the wall of the sub-chamber 58. The application of the lubricating fluid removes the need for the bullet to include grease grooves around its circumference.

At its front end, the bullet 64 has an annular wad-cutting ridge 146 to cut through and thus clearly mark a position on a target where the bullet hits that target.

Referring to Figures 12 and 13, a bullet 200 has a body 202 which has a similar profile to existing rifle bullets with a boat-tailed rear portion 204. However, the body 202 also has a co-axial, annular recess 206 in a mid-portion of the body 202.

The body 202 is of an optimal weight achieved by using heavier and harder material than that of conventional rifle bullets. The body 202 is made from a non-ductile hard metal or hard metal matrix, and preferably of alcanite (sintered tungsten and copper). This results in the body 202 being harder than the rifle barrel out of which the bullet 200 will be shot. Thus, the bullet 200 cannot be made to swage into the rifling of the barrel. The portion of the body 202a of the body 202 where the diameter of the body 202 is greatest is, therefore, designed to fit the bore of the rifle barrel with a close tolerance to keep it precisely aligned with the barrel axis. Additionally, the hard non-deforming body 202 will preserve the dynamic balance of the bullet 200. Furthermore, the increased weight of the bullet 200 allows its length to be kept at an optimal minimum. In this way, the amounts of energy wasted as heat when the bullet 200 travels

through the barrel is minimised.

The Greenhill formula:-

$$T = 150 \times \frac{D}{R}$$

where: T is the twist required (number of inches for one revolution), D is the bullet diameter (in inches) and R is the bullet length to diameter ratio (length divided by diameter),

establishes the barrel twist necessary so that a bullet of a given length will be adequately stabilized.

It should be noted that the use of heavier material and the effect of shortening the overall length for a given weight, means that to comply with Greenhill's formula the bullet 200 does not have to spin so fast to maintain stability. Therefore, less energy is expended to impart spin which means more energy to impart forward motion which further means that a higher thermal efficiency is achieved.

In order to impart the desired spin to the bullet 200 that the rifling generates and referring to Figure 2, the bullet body 202 carries a closely encircling drive band 208 of a ductile material and fitted into the annular recess 206. Once fitted on the bullet body 202, the band 208 has a slightly larger diameter than the part 202a where the diameter of the body 202 is greatest and the band 208 is designed to seal the bullet 200 against the barrel wall. The material for the band 208 needs to be both ductile enough to swage readily into the rifling and strong enough in shear to spin the bullet without distortion. The band 208 thus takes

the rifling of the barrel with the minimum of force. It is desirable that in sealing the bullet 200 within the rifle barrel the seal should be adequate, but should not generate excessive friction in the barrel. Therefore, the contact area between the bullet 200 and the barrel is kept as small as possible. To enable the band 208 to engage the rifling without exerting excessive force on the barrel or attempting to distort the bullet, the band 208 may have a series of alternate ridges 210, the diameter of which is equal to the rifled diameter, and grooves 212 which have a diameter smaller than the rifle barrel bore diameter. When the bullet 200 is fired the ductile material of each ridge 210 is displaced by the forward motion of the bullet 200 engaging into the rifling and is easily swaged into the immediately following groove 212 without increasing pressure between the bullet and the barrel.

The band 208 can be made of any suitable ductile metallic or non-metallic material and is attached to the body 202 securely in the recess 206. This can be done by mechanical means if the band 208 is made of ductile metal such as copper, or by moulding-on if it is made from a suitable ductile polymer.

The profile of the bullet 200, which is similar to that of current types, gives the desired performance owing to its aerodynamic efficiency. However, the bullet 200, once fired, remains supersonic for a longer period of time. The result of having the heavy bullet body 202 at a minimum length together

with a drive band 208 is that less pressure is generated in the breech and the time that the bullet 200 spends in the barrel is reduced with reduced friction being imparted on the bullet 200. This gives a higher muzzle velocity, extended range and more uniform performance with any bullet/cartridge/powder-charge combination.

The bullet 200 thus allows a shooter to shoot, with accuracy, over a longer range for a given size of fire arm. Thus, for a given range desired, the size of arm to be carried is kept to a minimum. This removes the harmonic effect (the way a barrel "wags") which is a result of increasing barrel length when achieving longer ranges with the larger of the small arms.

CLAIMS

1. A gun comprising a magazine for holding a plurality of projectiles, a body, a trigger mechanism for triggering the firing of a projectile from said magazine, a barrel for receiving and ejecting the fired projectile, a traversing mechanism for advancing said magazine stepwise and unidirectionally through a transverse aperture through said body, said magazine being arranged to be loaded with said projectiles from the front of said magazine into a plurality of chambers each having an opening at said front of said magazine, a propellant-material-receiving, rearward portion and a projectile-receiving, forward portion, the arrangement being such that, if a double charge of propellant material is loaded in said chamber, a projectile then loaded in said chamber would extend beyond said front of said magazine so that said magazine would be prevented from advancing through said transverse aperture.

2. In combination:-

a gun comprising a magazine for holding a plurality of projectiles, a body, a trigger mechanism for triggering the firing of a projectile from said magazine, a barrel for receiving and ejecting the fired projectile, a traversing mechanism for advancing said magazine stepwise and unidirectionally through a transverse aperture through said body, said magazine being arranged to be loaded with said projectiles from the front of said magazine into a plurality of chambers each having an opening at said front of said

magazine, a propellant-material-receiving, rearward portion and a projectile-receiving, forward portion,

propellant material in said rearward portion, and

a cylindrical bullet in said forward portion.

3. A gun according to claim 1 or 2, wherein a bullet-seating shoulder defines the boundary between said rearward portion and said forward portion.

4. A gun according to any preceding claim, wherein each chamber includes a rearwardly open sub-chamber for loading with a primer, and a short bore interconnecting said sub-chamber and said rearward portion.

5. A gun according to any preceding claim, wherein said magazine is a linearly displaceable, load block.

6. A gun according to any one of claims 1 to 4, wherein said magazine is a rotary cylinder.

7. A gun comprising a magazine for holding a plurality of projectiles, a body, guiding surface portions of said body and serving to guide linearly advance of said magazine through a transverse aperture through said body, a trigger mechanism for triggering the firing of a projectile from said magazine, a barrel for receiving and ejecting the fired projectile, a traversing mechanism for advancing said magazine stepwise and unidirectionally through said transverse aperture, said magazine being arranged to be loaded with said projectiles from the front of said magazine.

8. Dosing apparatus for a firearm, comprising a container for receiving flowable material, a receiving device having

therein a hole of a predetermined volume and for filling with material from said container, and an outlet through which the predetermined volume of said material in said hole leaves said apparatus, said receiving device being displaceable to move said hole between said container, where said hole is filled with said material, and said outlet, where the material in said hole is fully discharged.

9. A dosing apparatus according to claim 8, wherein said receiving device comprises a manually reciprocable bar formed with said hole, and a body closely receiving said bar.

10. A dosing apparatus according to claim 9, and further comprising a resilient return device urging said bar in one direction of reciprocation.

11. A method of loading a firearm with flowable material, comprising delivering said material from a container into a hole of a predetermined volume to fill said hole with said material, displacing said hole from said container to an outlet leading towards said firearm and fully discharging said material from said hole into said outlet.

12. A method according to claim 11, wherein said displacing is manual displacing of said hole against the action of a resilient return device.

13. A method according to claim 11 or 12, wherein said discharging is preceded by removably fitting an outlet conduit into a chamber of said firearm and comprises fully discharging said material into said outlet conduit.

14. Dosing apparatus comprising a container for receiving

flowable material, a receiving device having therein a hole of a predetermined volume and for filling with material from said container, and an outlet through which the predetermined volume of said material in said hole leaves said apparatus, said receiving device being displaceable to-and-fro to move said hole between said container, where said hole is filled with said material, and said outlet, where the material in said hole is fully discharged.

15. Apparatus for inserting a primer into a projectile housing for a gun, comprising a primer supporting device, a primer inserting device and a projectile housing supporting device at respective opposite sides of said primer supporting device, and an operating device to operate said primer inserting device to force a primer in said primer supporting device into a projectile housing supported by said projectile housing supporting device.

16. Apparatus according to claim 15, and further comprising a primer storage device, said primer supporting device comprising a conduit in which primers align in a single column.

17. Apparatus according to claim 15 or 16, wherein said primer inserting device comprises a plunger and said operating device comprises a manually operable press arranged to advance said plunger.

18. Apparatus according to claim 17, and further comprising a resilient return device arranged to retract said plunger.

19. Apparatus according to any one of claims 15 to 18, and

further comprising an aligning device usable for aligning, in turn, the chambers of a multi-chamber projectile housing with said primer inserting device.

20. Apparatus according to claim 19, wherein said aligning device comprises a fixed pin.

21. A method of inserting a primer into a projectile housing for a gun, comprising supporting said primer in a primer supporting device, supporting said projectile housing in a projectile housing supporting device, and causing a primer inserting device to force said primer into said projectile housing.

22. A method according to claim 21, in which primers are aligned in a single column in said primer supporting device.

23. A method according to claim 21 or 22, and further comprising aligning, in turn, the chambers of a multi-chamber projectile housing with said primer inserting device before each primer is forced into its associated chamber.

24. Apparatus for removing a used primer from a magazine for a gun, comprising a magazine supporting device, and a primer removing device operable to remove said primer from said magazine.

25. Apparatus according to claim 24, wherein said primer removing device comprises a primer-removing pin.

26. Apparatus according to claim 24 or 25, and also for loading a projectile into the magazine, said apparatus further comprising a projectile-loading device.

27. Apparatus according to claim 26, wherein said projectile-

loading device comprises a projectile-loading pin.

28. Apparatus according to claim 26 or 27, and further comprising an operating device common to both the primer-removing device and the projectile-loading device.

29. Apparatus according to claim 28, wherein said operating device comprises a lever arm carrying both the primer-removing pin and the projectile-loading pin substantially parallelly to each other, and a guide member serving to guide said pins for substantially vertical movement thereof.

30. A method of removing a used primer from a magazine for a gun, comprising supporting said magazine in a magazine supporting device and operating a primer removing device to remove said primer from said magazine.

31. Apparatus comprising:

a gun having a body, a trigger mechanism, a barrel, a magazine for holding a plurality of projectiles, and a traversing mechanism for advancing said magazine stepwise and unidirectionally through a transverse aperture through said body,

a device for dosing an exact amount of propellant material into said magazine,

a device for inserting a primer into said magazine, and

a device for removing a used primer from said magazine and/or seating a projectile in said magazine.

32. A wad-cutting bullet, comprising a flat-based bullet body of soft metallic material and of cylindrical form having a front end and a rear end, said rear end having a gas-check

cap attached thereto.

33. A bullet according to claim 32, wherein said soft metallic material is softer than the material of said cap.

34. A bullet according to claim 32 or 33, wherein said cap is of copper.

35. A bullet according to any one of claims 32 to 34, wherein said soft metallic material is substantially wholly lead.

36. A bullet of cylindrical form and including at the front thereof a dome serving to co-operate with a centering portion of a loading pin for loading said bullet in a chamber.

37. A bullet according to claim 36, wherein said bullet also includes at the front thereof an annular wad-cutting ridge encircling said dome.

38. A combination comprising a firearm chamber, a propellant charge at a rearward portion of said chamber, and a bullet at a forward portion of said chamber, there being substantially no expansion volume remaining in said chamber for gas produced during firing of said bullet.

39. A combination according to claim 38, wherein said bullet comprises a flat-based bullet body of soft metallic material and of cylindrical form having a front end and a rear end, said rear end having a gas-check cap attached thereto.

40. A combination according to claim 39, wherein said soft metallic material is softer than the material of said cap.

41. A combination according to claim 39 or 40, wherein said cap is of copper.

42. A combination according to any one of claims 39 to 41,

wherein said soft metallic material is substantially wholly lead.

43. A small arms bullet comprised of a bullet body of a non-ductile metallic substance and of circular cylindrical form having two ends and a ductile drive band closely encircling said bullet body at a location between said two ends.

44. A bullet according to claim 43, wherein said drive band comprises a ridge and a groove about its circumference, and said ridge is located ahead of said groove and projects radially outwardly beyond an external peripheral surface of said body.

45. A bullet according to claim 43, wherein said drive band comprises ridges and grooves about its circumference, and each ridge is located immediately ahead of an associated groove and projects radially outwardly beyond an external peripheral surface of said body.

46. A bullet comprised of a bullet body and a ductile drive band closely encircling said bullet body, wherein said drive band comprises a ridge and a groove about its circumference, and said ridge is located ahead of said groove and projects radially outwardly beyond an external peripheral surface of said body.

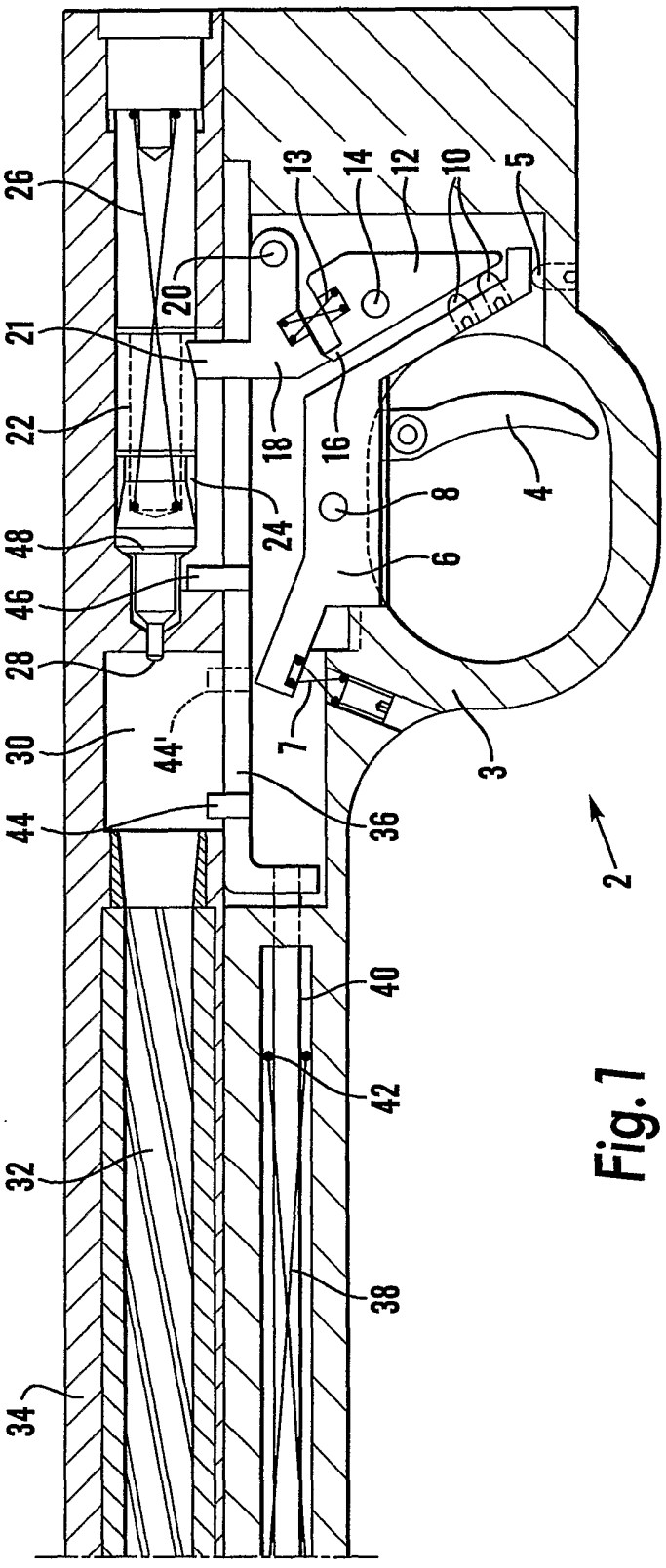
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Fig. 1

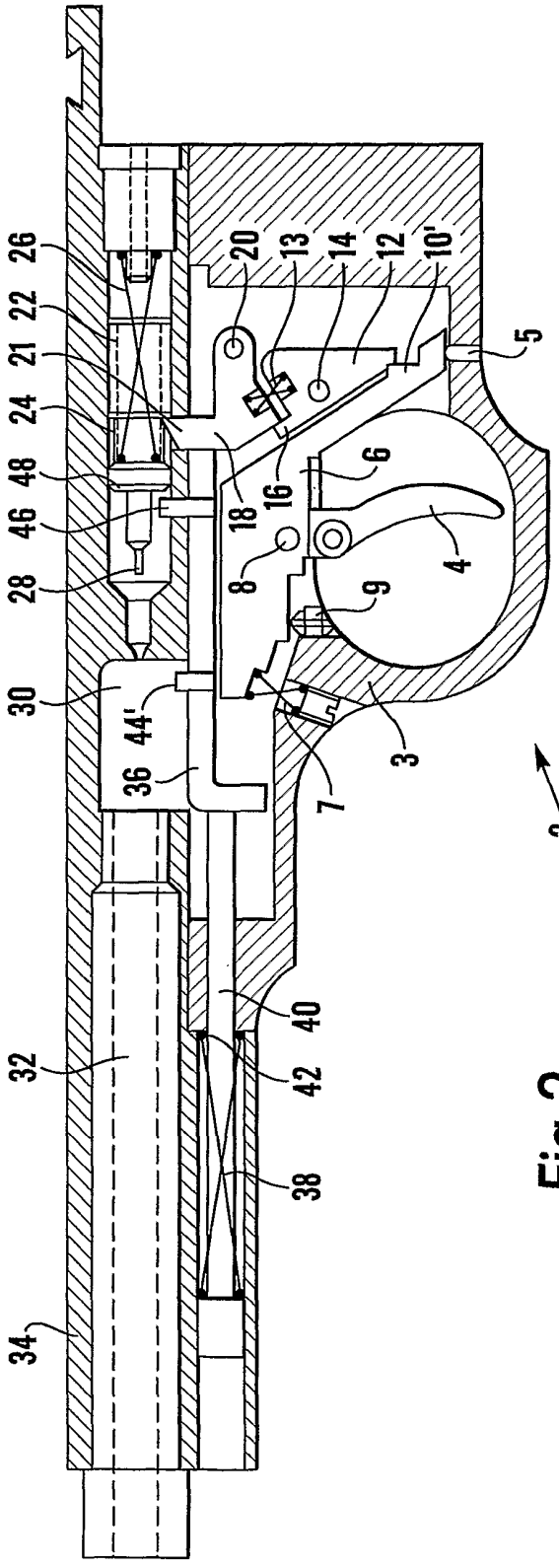
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Fig.2

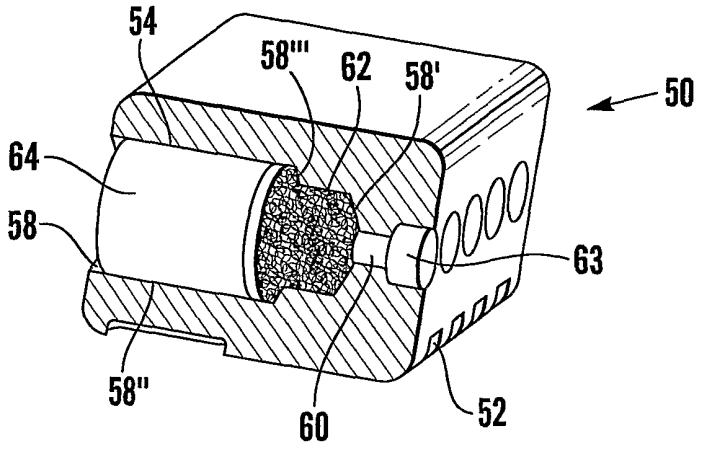


Fig.3

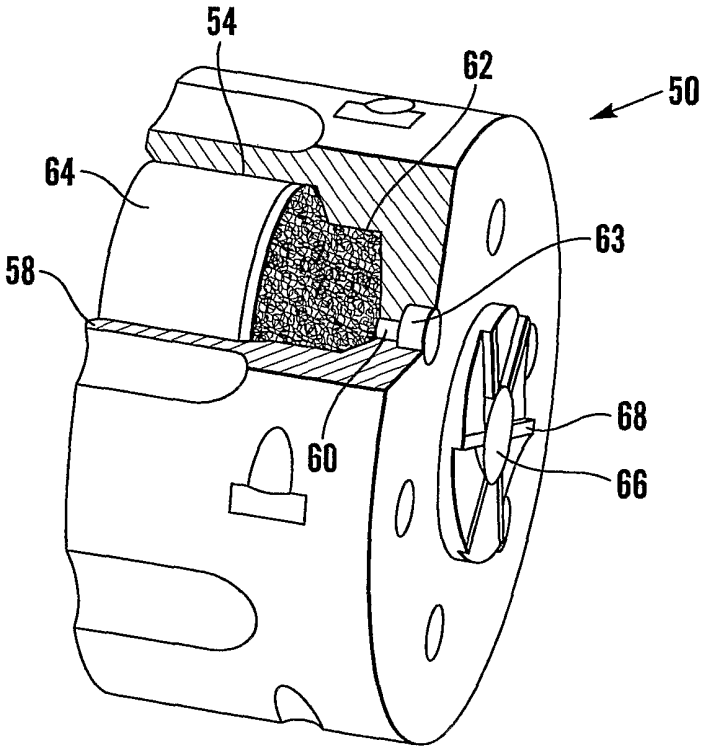


Fig.4

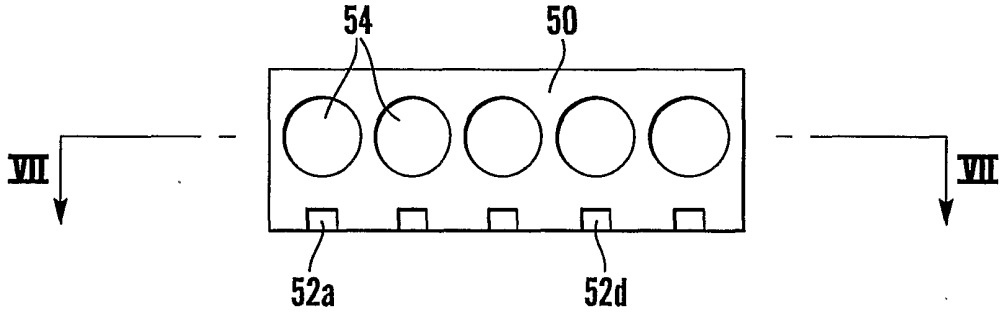


Fig.5

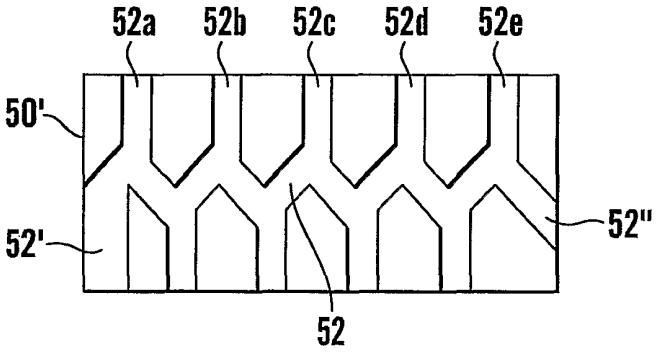


Fig.6

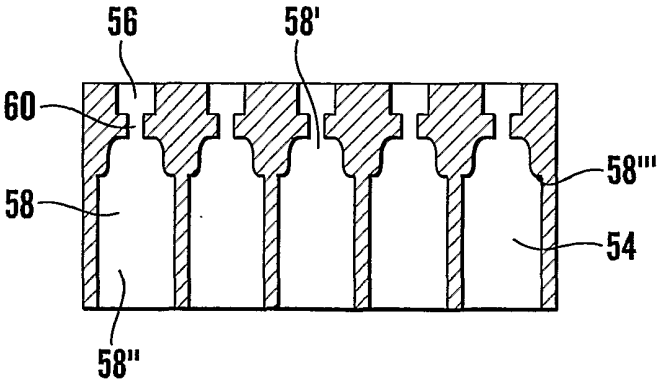


Fig.7

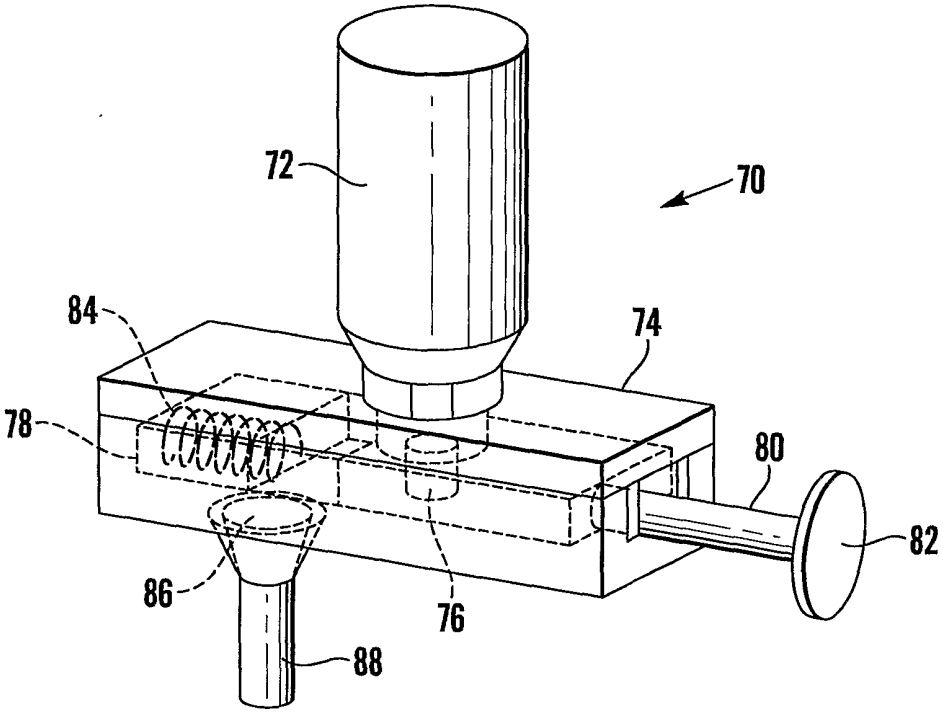


Fig.8

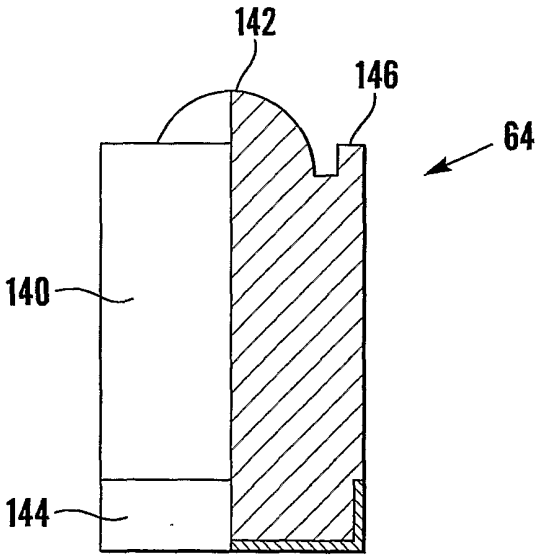


Fig.11

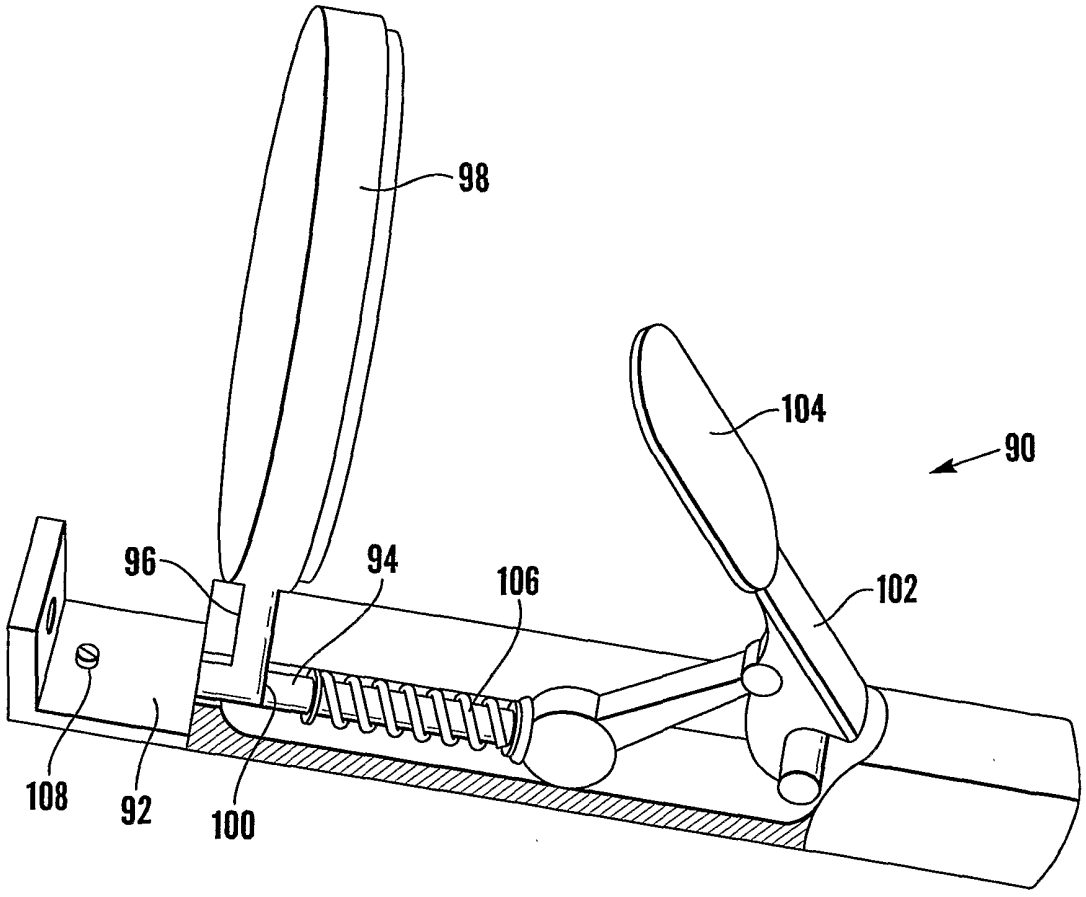
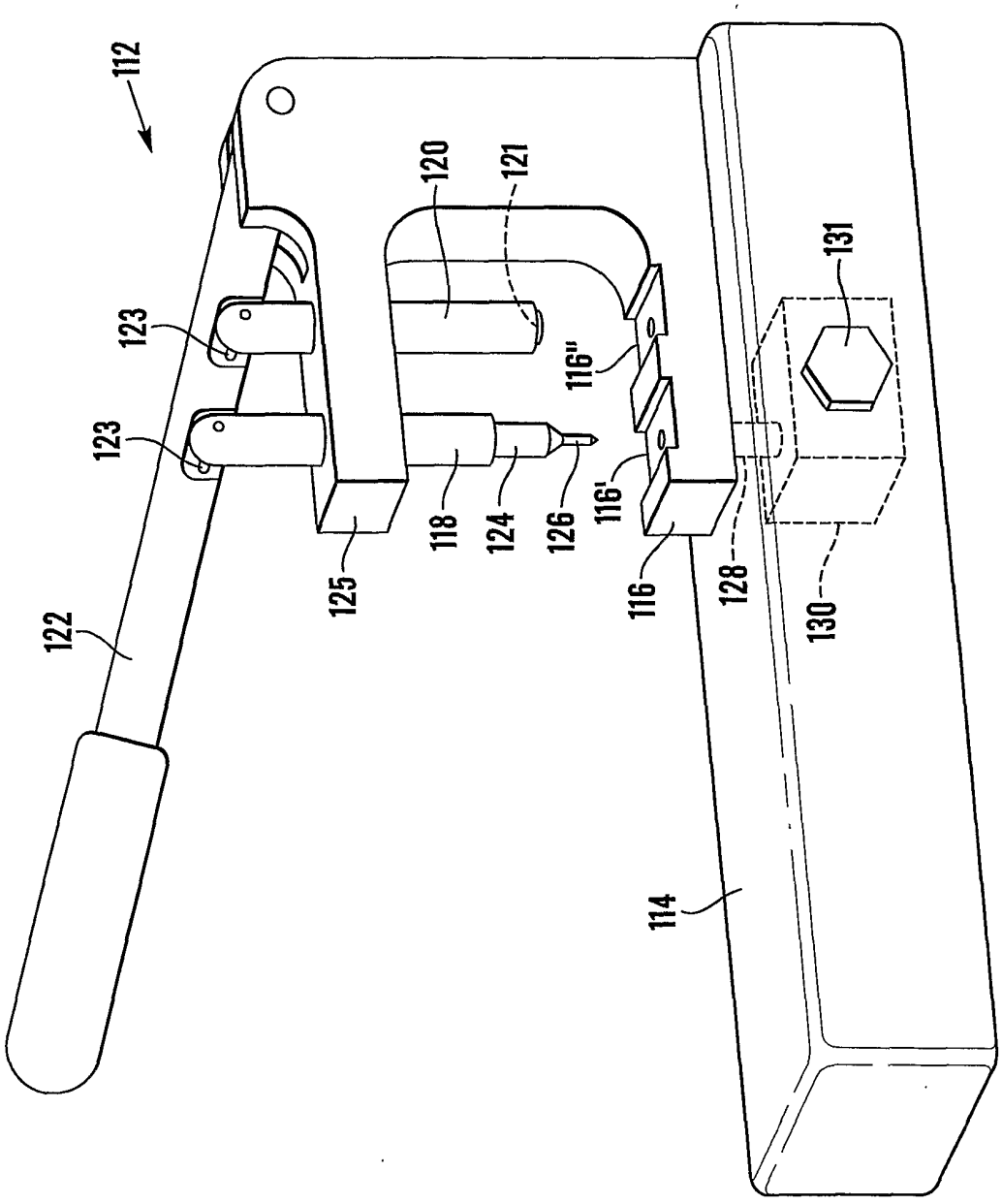


Fig.9

Fig. 10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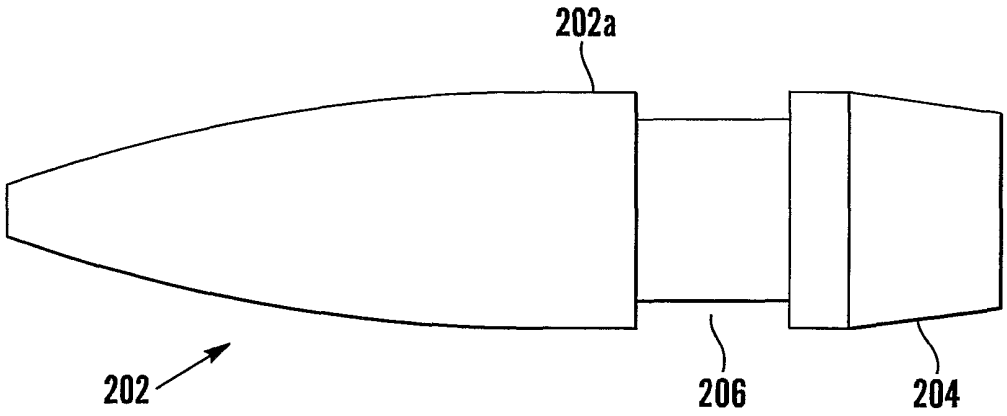

Fig.12

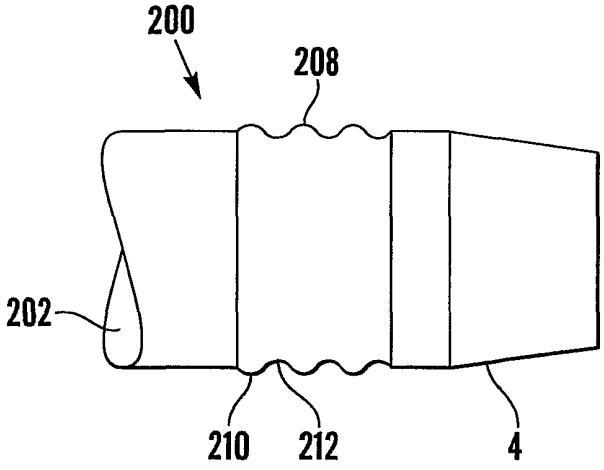

Fig.13

INTERNATIONAL SEARCH REPORT

Internationa lication No
PCT/GB 02/01017

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F41A9/64 F42B33/02 F42B33/04 F42B12/34 F42B14/00 F42B14/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F41A F42B F41C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 329 456 A (RANKINE STUART) 24 March 1999 (1999-03-24) page 4, line 26 -page 5, line 22 figures 1,2	1-4,6,7
Y	---	5
Y	DE 11 04 392 B (WALDEFRIED WIENKOOP) 6 April 1961 (1961-04-06) column 2, line 49 -column 3, line 28 figures 1-3	5

X	US 2 830 398 A (DONOHUE WILLIAM E) 15 April 1958 (1958-04-15) column 1, line 61 -column 2, line 24 figures 1,3	1,2,4,6, 7

A	WO 88 06265 A (BALLISTIVET INC) 25 August 1988 (1988-08-25)	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 May 2002	19. 08. 2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lostetter, Y

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Internal application No.
PCT/GB 02/01017

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-7

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-7

   A gun comprising a magazine for holding a plurality of projectiles, a body, a trigger mechanism, a barrel and a traversing mechanism.

2. Claims: 8-14

   A dosing apparatus for a firearm, comprising a container, a receiving device, an outlet and a method of loading a firearm.

3. Claims: 15-23

   An apparatus for inserting a primer into a projectile housing for a gun, comprising a primer supporting device, a primer inserting device, a projectile housing supporting device, an operating device and a method of inserting a primer into a projectile housing for a gun.

4. Claims: 24-30

   An apparatus for removing a used primer from a magazine for a gun, comprising a magazine supporting device, a primer removing device and a method of removing a used primer from a magazine for a gun.

5. Claim : 31

   An apparatus comprising a gun, a device for dosing an amount of propellant, a device for inserting a primer and a device for removing a used primer.

6. Claims: 32-42

   A wad-cutting bullet having a gas-check cap attached thereto.

7. Claims: 43-46

   A bullet having a ductile drive band encircling its body.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internationa lication No
PCT/GB 02/01017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2329456 A	24-03-1999	NONE	
DE 1104392 B	06-04-1961	NONE	
US 2830398 A	15-04-1958	NONE	
WO 8806265 A	25-08-1988	US 4760834 A	02-08-1988
		US 4771757 A	20-09-1988
		AU 1394188 A	14-09-1988
		WO 8806265 A1	25-08-1988