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64 Cartridge ammunition for small arms.

67 Apparatus providing ammunition for use in a hand gun, comprising a rechargeable compressed gas cartridge having a missile locating part (25) tapered to accept a push on missile (9) (FIGURE 1) or a push in missile (9A) (FIGURE 6) to provide a tool insertion gap (27, 27A) for removal of the missile for recharging the cartridge with compressed gas.

FIG. 1.

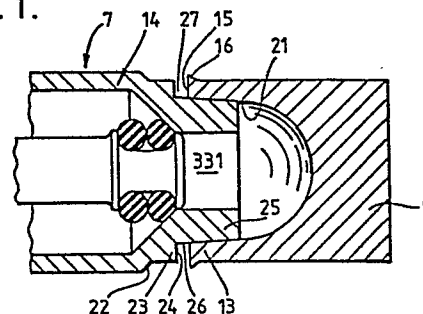
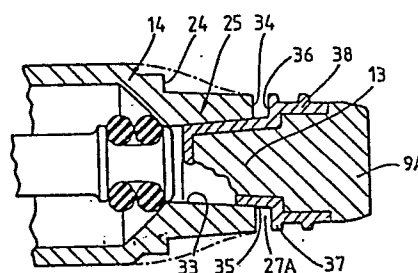


FIG. 6.



CARTRIDGE AMMUNITION FOR SMALL ARMS

This invention concerns improvements in or relating to cartridge ammunition, for small arms, generally of the kind comprising a
5 cartridge having a front discharge end and a rear base end, a gas storage space within the cartridge, missile locating means at the discharge end, valve means to release pressurised gas from said gas storage means into said discharge end portion for propelling the missile, and actuating means exposed at said base end for being struck
10 by a firing pin of a gun to open said valve means.

Several fundamentally different forms of such compressed gas cartridges are known.

15 In British Patent Specification Nos. 1601917, 1601918 and 2116681A we disclose forms of ammunition of said kind in which the cartridge has a hollow outer casing; a pressure cylinder provides the gas storage space within the casing; the valve means is at one end of the cylinder; and the missile locating means comprises a mouth at the
20 discharge end of the casing, the pressure cylinder being slidable within the casing to cause the valve means to open and permit compressed air, contained in the cylinder, to flow from the cylinder to the mouth of the casing to expel the missile. The rear end of the cylinder is exposed to serve as the actuating means. The ammunition
25 can be recharged with compressed air and a new missile, so as to be readily re-useable.

Although the ammunition was designed for use in a firearm, with temporary modification of the latter to provide a barrel sleeve and a
30 blunt firing pin, or for use in a similar weapon permanently adapted only to accept such ammunition, to enable missiles of air gun pellet form to be employed for qualification as an air gun and not as a firearm under the Laws of certain countries, the ammunition is quite capable of being constructed to deliver sufficient energy to propel a
35 missile considerably larger than an air gun pellet.

In British Patent Specification No. 2124346A we disclose an ammunition cartridge, for a round of ammunition of said kind, and comprising a casing having a hollow interior within which is provided the internal gas storage space, which space is disposed between a
5 hollow front discharge end portion of the casing and the hollow rear base end portion of the casing; the actuating means being actuable to cause gas to be discharged from the storage space into said hollow discharge end portion, said actuating means having a movable member, which extends longitudinally within said internal gas storage space to
10 said discharge end portion, and having a base end part accessible for striking by a firing pin for actuation of the actuating means, and characterised in that:-

- (a) a piston is provided in the casing in or adjacent to the base end portion;
- 15 (b) the base end part of the actuating means is actuable by a thrust in a first longitudinal direction for causing, in use, the piston to be exposed to opposed unequal thrusts, one of which thrusts is provided by gas stored under pressure in the casing; and
- 20 (c) said piston is movable by said unequal thrusts to move the movable member forcibly in a longitudinal direction opposite to said first longitudinal direction to open discharge valve means to allow gas to escape from said gas storage space through a discharge opening into said discharge end portion of the casing.

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In a particular development thereof the actuating means comprises static or reactive thrust means movable between a blocking position in which it exerts a static or reactive thrust on the piston in opposition to said one of said thrusts, and an actuated position in
30 which said static or reactive thrust is removed from said piston; and the static or reactive thrust means comprises at least one rigid member disposed in said base end portion, and a displacer which incorporates or constitutes said base end part of the actuating means, the displacer being actuable to allow or cause the rigid member or
35 members to move transversely relative to the piston.

This version has been developed to provide a round of ammunition of said kind and comprising a missile and a cartridge containing gas at a pressure of at least one hundred kilogrammes per square centimetre, the cartridge comprising discharge valve means openable by
5 a first force to discharge said gas to expel the missile; said cartridge further comprising a servo-mechanism adapted to utilise energy from the stored gas to provide said first force, and servo actuating means actuable by a second force smaller than said first force. This round of ammunition is quite easily capable of
10 discharging sufficient energy for propelling a missile considerably larger than an air gun pellet at a considerable velocity, even if the cartridge dimensioned to be small enough to fit into the firing chamber of, for example, a revolver.

15 However, in order to fit into, and operate properly in, the firing chamber, the round must be shaped and dimensioned so as to accurately conform to the critical dimensions of the equivalent explosive firearms round; and the missile must be of the same calibre as the bullet of the explosive firearms round if the use of a barrel
20 liner is to be avoided.

In experiments with various ones of such forms of cartridges, attempts to modify the pellet retaining mouths to accept oversize pellet forms, and to provide alternative means for locating a missile
25 in the cartridge have revealed problems of cost, unreliable and insecure location of the missile, malfunction due to gas leakage, ballistic instability or inaccuracy of the various missiles in flight, and potential damage to the expensive and re-useable cartridge. Furthermore, known procedures, such as swaging or crimping of the
30 cartridge around the base of the missile, are useless for the compressed air cartridges, if the latter are to be re-used.

According to the present invention there is provided apparatus comprising a re-useable rechargeable compressed gas cartridge having a
35 hollow front discharge end portion in combination with a form fitting missile, characterised in that the hollow front discharge end portion

provides a forwardly directed abutment face at or adjacent to one end of a missile locating part of the discharge end portion; in that the missile locating part provides at least one small angle conically tapered surface; in that a rear end portion of the missile provides a further conically tapered surface and a rearwardly directed abutment face at or adjacent to one end of said further surface; and in that the tapered surfaces are configured and dimensioned to interengage to hold the missile and missile locating part together so that said abutment faces are spaced apart to leave a tool insertion gap therebetween.

In one embodiment, the missile is in the form of a form fitting bullet having a rear end portion which provides, around its periphery, said further surface; and the rearwardly directed abutment face is provided by a rifling flange at the junction of the rear end portion with a body of the bullet.

According to the present invention there is also provided apparatus comprising a re-useable rechargeable compressed gas cartridge having a hollow front discharge end portion and a rear base end portion, a gas storage space within the cartridge, missile locating means at the discharge end portion, valve means to release pressurised gas from said gas storage means into said discharge end portion for propelling the missile, and actuating means exposed at said base end portion for being struck by a firing pin of a gun to open said valve means, in combination with a form fitting missile, characterised in that the hollow front discharge end portion provides an external annular shoulder presenting a forwardly directed abutment face adjacent to or at one end of a missile locating part of the discharge end portion; in that the missile locating part has a small angle conically tapered peripheral surface; in that the missile has a hollow rear end portion providing a conically tapered internal surface, a peripherally projecting rifling flange or skirt and rearwardly directed annular abutment face; and in that the dimensions of the tapered surfaces are such that they interengage to hold the missile on the missile locating part so that said abutment faces are

spaced apart to leave a tool insertion gap therebetween.

The apparatus preferably includes a simple forked or two pronged tool having prongs of taper wedge form, for insertion into said gap to force the missile off the cartridge, without damage.

Said small angle is preferably within the range of 2 to 4 degrees, about 3 degrees being especially preferred.

10 The apparatus may further include a pellet locating open ended nosepiece, internally adapted to contain a sub-calibre pellet, having a hollow rear end portion which provides a similar conically tapered internal surface and rearwardly directed abutment face, which is located on the missile locating part in place of the missile, so that
15 the cartridge can be used for a full calibre or sub-calibre gun.

As an alternative to the use of a nosepiece, the missile locating part may be internally and externally tapered to accept alternative forms of form fitting missile, e.g. a large calibre missile provided
20 with an internal tapered surface, and a smaller calibre missile provided with an external tapered surface.

However, a nosepiece is preferred for use with lightweight missiles, such as air gun pellets, having a delicate skirt at the
25 rear, because such pellets can be inserted forwardly into the nosepiece from the rear of the latter (when it is detached from the cartridge) so as not to risk damaging the skirt.

The invention also provides a round of ammunition comprising the
30 aforementioned cartridge and either the form fitting missile or the nosepiece with a sub-calibre missile therein.

At least the rear end portion of the form fitting missile is preferably made from aluminium, zinc or other material having
35 sufficient rigidity to provide a stable tapered surface, and sufficient softness to provide a rifling projection or band which can

adapt in shape to the rifling in the gun barrel, without damaging the rifling.

Apparatus of the invention will be disclosed further, by way of 5 example, with reference to the accompanying diagrammatic drawings based on one of the various forms of compressed gas rechargeable cartridge which may be employed in such apparatus. In the drawings:-

FIGURE 1 shows, in longitudinal cross-section, a nose end portion of a cartridge and a form fitting full calibre missile, of apparatus 10 of the invention;

FIGURES 2 and 3 show, in plan and side elevation, a tool of the apparatus of the invention;

FIGURES 4 and 5 show, in longitudinal cross-section the cartridge respectively in charged state and in a discharging state, together 15 with a nosepiece of the apparatus; and

FIGURE 6 shows, in longitudinal cross-section, a nose end portion of a modified cartridge and a second form of form fitting missile.

The apparatus generally comprises a round of ammunition 7 and a 20 tool 8.

The round of ammunition comprises a cartridge 12, together with a missile 9 as shown in FIGURE 1 or a missile 10 and retaining means 11 for holding the missile 10.

25

The embodiment of cartridge 12 shown, is an assembly comprising a hollow casing 13 within an intermediate portion of which is a gas storage space 318 disposed between a hollow front discharge end portion 14 and a rear base end portion 20 of the casing; and 30 comprising discharge valve actuating means 63 and, servo actuating means 62 arranged so that the means 62 is responsive to being struck by a firing pin of a gun to allow piston means 61 to utilise energy from compressed gas stored in the space 318 for forcing the discharge valve actuating means 63 to open the discharge valve means 30 to 35 permit said gas to leave said space via the discharge end portion 14.

The servo actuating means 62 is in the form of static or reactive thrust means 300 of a mechanical form which, in the non-actuated state of the servo mechanism, provides a static thrust to the piston 61 in reaction to the thrust provided by the stored gas pressure; and with
5 the exception of certain seals, e.g. "O" rings, the cartridges are all of metal construction.

The static thrust means 300 employs several rigid members in the form of six ball bearings balls 301A, each ball having a diameter of
10 2mm. A displacer 302A, a one piece hardened steel part, is machined to provide a peripheral cylindrical surface 307, and a part conical surface 311 on a head 304A which integrally incorporates a flange 310A. A further part conical surface 312 is provided between a waist 303A and a base end part 305A.

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The piston 61 has a body 321A and a recess 309A is defined in a piston skirt 321B. The base end part of the skirt is internally chamfered to provide the part conical abutment surface 306A (FIGURE 5).

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In the actuating means 60, a movable member 324A is integral with the piston and accommodates part of a displacer resetting spring 308, and a front end portion 324B is shaped to form part of the discharge valve means 30, and serves to carry and locate two resilient "O" rings
25 333A and 333B between a backing flange 332B and a head 335A. The first "O" ring 333A serves as a seal, whereas the rear "O" ring 333B serves as a spring.

The head 335A is dimensioned so as to be a clearance fit in a
30 discharge passage 331.

An end member 315A is screwed into the base end portion 20 of the casing, and integrally incorporates a base end flange of the cartridge.

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The head 335A is shaped and positioned so that it is accommodated

in one end of the discharge passage so as to substantially block a discharge aperture 329 in an end wall 316 (FIGURE 5) when the valve is closed. The first "O" ring 333A overlies the junction, and seals the junction, between the head and the discharge aperture whilst the valve 5 is closed to prevent escape of gas.

In use, in the loaded and charged condition of the round as shown in FIGURE 4, the static thrust means 300 is in a blocking condition in which the rigid members 301A abut the skirt 321B and tapered part 10 conical abutment surface 306A of the piston and are supported against movement towards the axis of the piston by engagement with the peripheral surface 307 of the head 304A. The piston is urged rearwards towards the base of the cartridge by a major thrust of the pressure of the gas stored in the space 318 and the much smaller 15 thrust of "O" rings 333A and B and these thrusts are opposed by the static resistive or reactive thrust exerted by the rigid members 301A on the piston, together with the thrust of the lower pressure, e.g. atmospheric pressure, existing in the cylinder to the rear of the piston, and the thrust of the displacer resetting spring 308 acting 20 between the piston and the static thrust means, so that the piston is held in an un-actuated state and the discharge valve means remains closed.

The base end part 305A is exposed to the base so that, when the 25 round is in the breech of a gun, the part 305A can be struck and moved forwards (towards the nose) by a firing pin 43 of a gun. When the head 304A is moved forwards from between the rigid members 301A, the inclination of the surface 306A causes the rigid members to move into the waist 303A. The dimensions of the rigid members and waist are 30 such that they can be accepted in a recess 309A in the rear of the piston thereby allowing the gas pressure to move the piston rearwards to an actuated position in which it abuts to the end member 315A as shown in FIGURE 5.

35 Rearward movement of the piston, and therewith the movable member 324A, pulls the valve means 30 from the discharge end portion 14, to

open the valve means to allow the compressed air to escape from the space 318 via the aperture 329 and the discharge 331 to expel the missile 9 or 10.

5 When the pressure in the space 318 drops to near atmospheric pressure, the spring 308 automatically restores the piston to the un-actuated position closing the valve means, and also thrusts the displacer rearwards so that a part conical surface 311, between the head and the waist, thrusts the rigid members radially outwards to the
10 blocking position so that the cartridge is restored to the mechanical condition shown in FIGURE 4.

After initial actuation of the static thrust means 300, the initial rearwards movement of the piston will bring the head 335A to a
15 transient position wherein the head has moved nearly, but not completely, out of the discharge passage 331 and discharge opening 329, and has lifted the first "O" ring 333A off the wall 316 so that there is a clear space between the "O" ring 333A and the wall 316 whilst flow from the space 318 is obstructed by the head. When this
20 transient position is reached the piston will have accelerated so that the head 335A passes through the transient position very rapidly to reach the fully open position shown in FIGURE 5 in a fraction of a second after passing through the transient position. The blocking of the flow by the head 335A until the seal 333A has completely
25 disengaged from the wall 316 greatly prolongs the useful working life of the seal 333A.

The cartridge can be recharged by pumping compressed air into the discharge passage 331. During recharging, compressed air is forced
30 around the head 335A, which is a clearance fit in the discharge passage 331, and the compressed air forces the first "O" ring 333A off the wall 316 against the resilient bias provided by the second "O" ring 333B, thereby allowing the gas to enter the space 318. When the space is fully charged up to the supply pressure of the compressed
35 gas, the second "O" ring 333B urges the seal 333A back into engagement with the wall 316 to close the valve, which thus serves as non-return

valve means for charging.

The cartridge is designed for use with gas pressure of 100 kgm/cm² to 400 kgm/cm², but higher pressures may be employed; and 5 includes shock attenuator or absorber means comprising a resilient shock absorbing insert 400, in the form of an "O" ring, disposed within the recess 309A. After actuation, the piston 61 and movable member 324A are caused to accelerate in a rearwards direction with extreme rapidity by the high gas pressure, building up a high momentum 10 in spite of the very restricted, e.g. less than 2mm, travel. This momentum is apparently sufficiently high to damage the cartridge at such higher pressures in the absence of the insert 400, which insert becomes compressed, between a rearwardly directed surface 401 of the piston and the head 304A, as shown in FIGURE 5, whereby to lessen the 15 shock impact of the piston skirt 321B on the end member 315A. With suitable modification of the shape of the surface 401, the "O" ring could be replaced by a metal or metal and elastomer compression spring.

20 The round of ammunition shown in FIGURE 1, comprising the cartridge 12 and the missile 9, is intended for use in an unmodified firearm, such as a .38 special revolver. The missile 9 is in the form of a full .38 calibre flat nosed aluminium or zinc bullet having a hollow rear end portion 13 shaped to provide a conically tapered 25 internal surface 21, an annular rearwardly directed abutment face 15 and a peripherally projecting rifling flange 16.

The round of ammunition shown in FIGURE 4, comprising the cartridge 12, the retaining means 11 and the missile 10, is intended 30 for use in a firearm, such as a .38 special revolver, provided with a barrel liner to sleeve the barrel shown to a .22 calibre. The retaining means 11 is in the form of a open ended nosepiece having a rear end portion 13A which is also shaped to provide a conically tapered internal surface 21 and an annular rearwardly directed 35 abutment face 15. The missile 10 is in the form of a .22 calibre air gun pellet, which is accommodated in a hollow forward part of the

nosepiece so that a skirt 17 of the pellet engages behind an internal shoulder 18 within the nosepiece.

The discharge end portion 14 of the cartridge 12 is formed from a relatively harder metal, e.g. steel, bronze or brass, and is shaped to provide a first annular external shoulder 22, to locate the round in the firing chamber of the gun; a second annular external shoulder 23, which provides a forwardly directed abutment face 24; and a missile locating means comprising a part 25 which has a conically tapered peripheral surface 26.

The surfaces 21 and 26 are inclined at about 3° to the axis of the cartridge 12, and are shaped and dimensioned to interengage to hold the bullet or nosepiece securely upon the locating part 25 so that the faces 15 and 24 are spaced apart to leave a tool insertion gap 27. In particular, the surfaces are dimensioned so that the gap is within a predetermined width range, e.g. from 0.5 to 1.0mm when the bullet or nosepiece is pushed onto the cartridge with thrust e.g. a recommend thrust of about one kilogramme, within a predetermined wide range, for example, 0.1 to 10 kilogrammes, the limits of which are, for example, one tenth of and ten times the recommended thrust to allow for error during assembly by the user and wear of the surface 26.

The tool 8 comprises a handle part 31 having two prongs 32 spaced apart by a distance slightly larger than the maximum diameter of the surface 26, which taper to provide parallel wedges increasing from a minimum thickness, at the tips, which is less than the minimum gap distance, e.g. 0.4mm, to a maximum, adjacent the part 31, which is greater than the maximum gap distance, e.g. 1.2mm or more, at a wedge angle which is small, e.g. 2° to 10° , preferably about 4° or 5° , to give a large mechanical advantage when the tool is inserted into the gap to remove a nosepiece, for insertion of a fresh pellet and recharging of the cartridge, or to remove a bullet, for recharging or disarming, whilst minimising the risk of damaging the abutment faces.

Instead of, or, as shown in FIGURE 6, in addition to, the conically tapered surface 26, the missile locating part 25 may be internally tapered to provide an internal conically tapered surface 33 for use with a modified form of form fitting bullet 9A. The surface 33 diverges to the front end of the part 25, and the front end provides a forwardly directed abutment face 34. The bullet 9A has an aluminium jacketed rear end part 13 which converges to the rear end to provide a peripheral conically tapered surface 35. At the front end of the surface 35, there is a rearwardly directed abutment face 36, which is provided, in part, by a peripherally projecting rifling flange 37 provided by the jacket 38. The surfaces 33 and 35 are dimensioned to interengage to hold the missile as previously described with reference to the surfaces 21 and 26, so as to ensure that the tool gap 27A is left between the faces 34 and 36. The tool will, in this case, have prongs 39 suitably spaced to fit the gap 27A, as indicated in broken lines to FIGURES 2 and 3.

The interior body and nose of the missile 9A are of lead, and the missile and portion 14 are preferably dimensioned so that, in use, the missile is located in the rear end of the barrel, or barrel liner, of the gun before firing. If the missile 9A is a full calibre missile the portion 14 will be shaped to fit the gun barrel and the surface 26, shoulder 23 and face 24 will be omitted, as indicated in broken lines in FIGURE 6.

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The invention is not confined to the precise details of the foregoing example and many variations and modifications are possible within the scope of the invention. For example, the apparatus may include dust caps, providing the surface 21, for covering the missile locating part 25 to close the passage when the bullet 9 has been fired or the nosepiece removed, in order to prevent ingress of dust, dirt or moisture into the spent cartridge.

The missile may have a nose of any suitable shape, and the nosepiece may be shaped to engage a liner, the front of the firing chamber or in the rear end of the barrel. For example, the missile

may be of composite form having a jacket of a suitable shape retentive material, such as aluminium or zinc, copper, tin or alloys thereof, which can provide a rifling flange or skirt which deforms, without damage to the bore of the barrel when subjected to the blast of the released compressed air or gas, to provide a sliding seal in the bore. Said shape retentive material should be at least as hard as aluminium and is preferably harder and more rigid; and said material is preferably softer than the material from which the part 25 is made. In particular, the bullets 9 and 9A are preferably zinc or zinc alloy diecastings.

The apparatus may include a suitable barrel liner such as that described in our British Patent Specification No. 2044896.

15 In particular, whilst one of the embodiments of cartridge disclosed in our said Specification No. 2124346A is illustrated and described in detail in the foregoing example of the invention, it is to be understood that the characteristic missile and missile locating portion of the present invention may be employed with any of the compressed gas cartridges disclosed in any of our aforementioned specifications and with any of a variety of other compressed gas cartridges of reuseable and rechargeable form with suitable modification of a front end part or portion of the cartridge to provide the characteristic missile locating portion of the cartridge 25 of the invention.

CLAIMS.

1. Apparatus comprising a re-useable rechargeable compressed gas cartridge having a hollow front discharge end portion (14) and a rear
5 base end portion (20), and a gas storage space (318) within the cartridge (12), missile locating means (11) at the discharge end portion (20), valve means (30) to release pressurised gas from said gas storage means space (318) into said discharge end portion (14) for propelling the missile (9, 10), and actuating means (62, 63) exposed
10 at said base end portion (14) for being struck by a firing pin (43) of a gun to open said valve means (30) in combination with a form fitting missile (9, 9A), characterised in that the hollow front discharge end portion (14) provides a forwardly directed abutment face (24, 34) at or adjacent to one end of a missile locating part (25) of the
15 discharge end portion (14); in that the missile locating part (25) provides at least one small angle conically tapered surface (26, 33); in that a rear end portion (13) of the missile provides a further conically tapered surface (21, 35) and a rearwardly directed abutment face (15, 36) at or adjacent to one end of said further surface (21,
20 35); and in that the tapered surfaces (15, 26, 33, 36) are configured and dimensioned to interengage to hold the missile (9, 9A) and missile locating part (25) together so that said abutment faces (15, 24, 34, 36) are spaced apart to leave a tool insertion gap (27, 27A) therebetween.

25

2. Apparatus as claimed in Claim 1 wherein the missile (9A) is in the form of a form fitting bullet having a rear end portion (13) which provides, around its periphery, said further surface (35); and the rearwardly directed abutment face (36) is provided by a rifling flange
30 (37) at the junction of the rear end portion (13) with a body (9A) of the bullet.

3. Apparatus as claimed in Claim 1 wherein the missile (9) is in the form of a form fitting bullet having a hollow rear end portion (13)
35 providing said further surface (21) therein; and the rearwardly directed abutment face (15) is provided at the rear end of the bullet.

4. Apparatus as claimed in Claim 1 wherein the missile locating part(25) provides two said small angle conically tapered surfaces (26, 33), one being an internal surface (33) and the other being an external surface (26), for receiving either of the bullets (9, 9A) 5 defined in Claim 2 and Claim 3.

5. Apparatus as claimed in any one of Claims 1 to 4 further including a pellet locating open ended nosepiece (11), internally adapted to contain a sub-calibre pellet (10), having a hollow rear end 10 portion (13A) which provides a similar conically tapered internal surface (21) and rearwardly directed abutment face (15), which is located on the missile (25) locating part in place of the missile (9), so that the cartridge can be used for a full calibre or sub-calibre gun.

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6. Apparatus as claimed in any one of Claims 1 to 5 wherein said small angle is within the range of 2° to 4° .

7. Apparatus as claimed in any one of Claims 1 to 6 further 20 including a forked or two pronged tool (8) having prongs (32) of taper wedge form, for insertion into said gap to force the missile (9, 9A) off the cartridge.

8. Apparatus as claimed in any one of Claims 1 to 7 wherein said 25 missile (9, 9A) is composed of zinc or an alloy of zinc.

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FIG. 1.

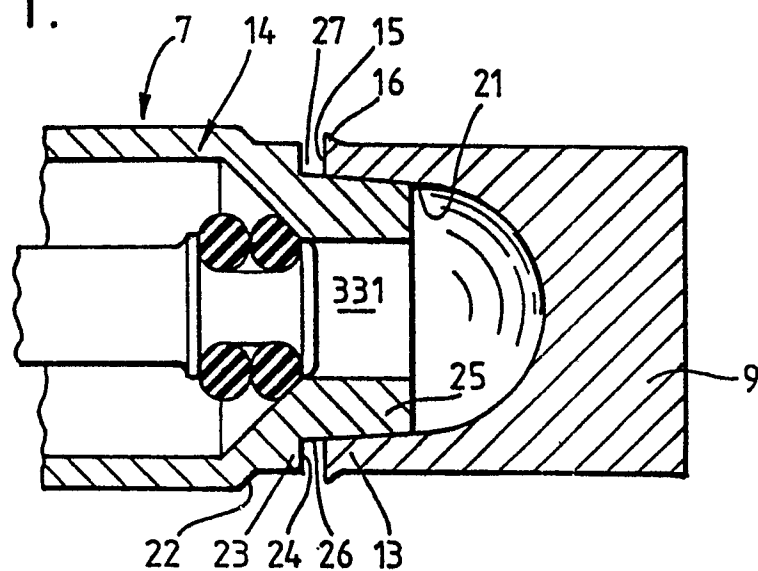


FIG. 2.

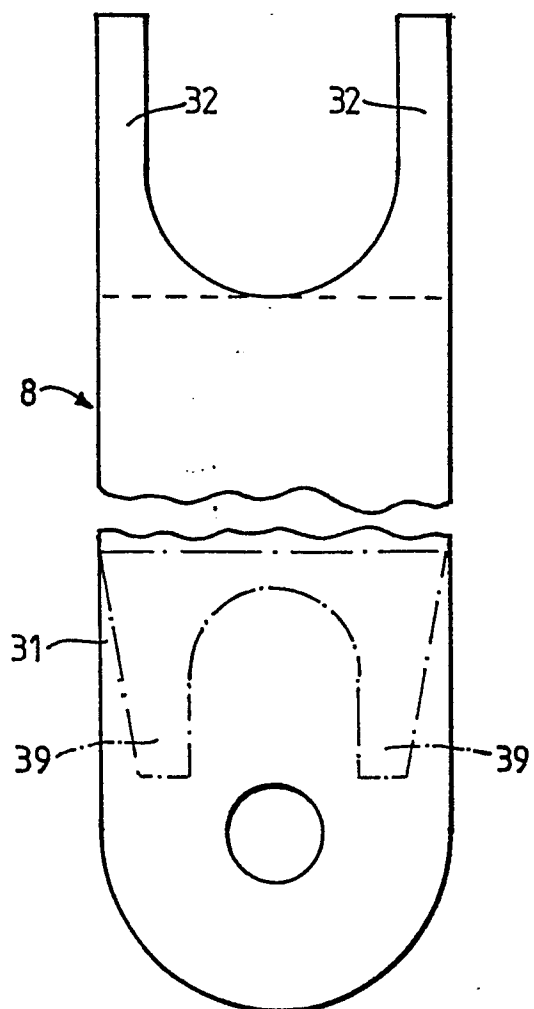


FIG. 3.

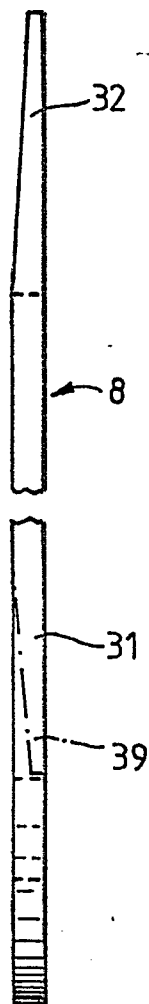


FIG. 4.

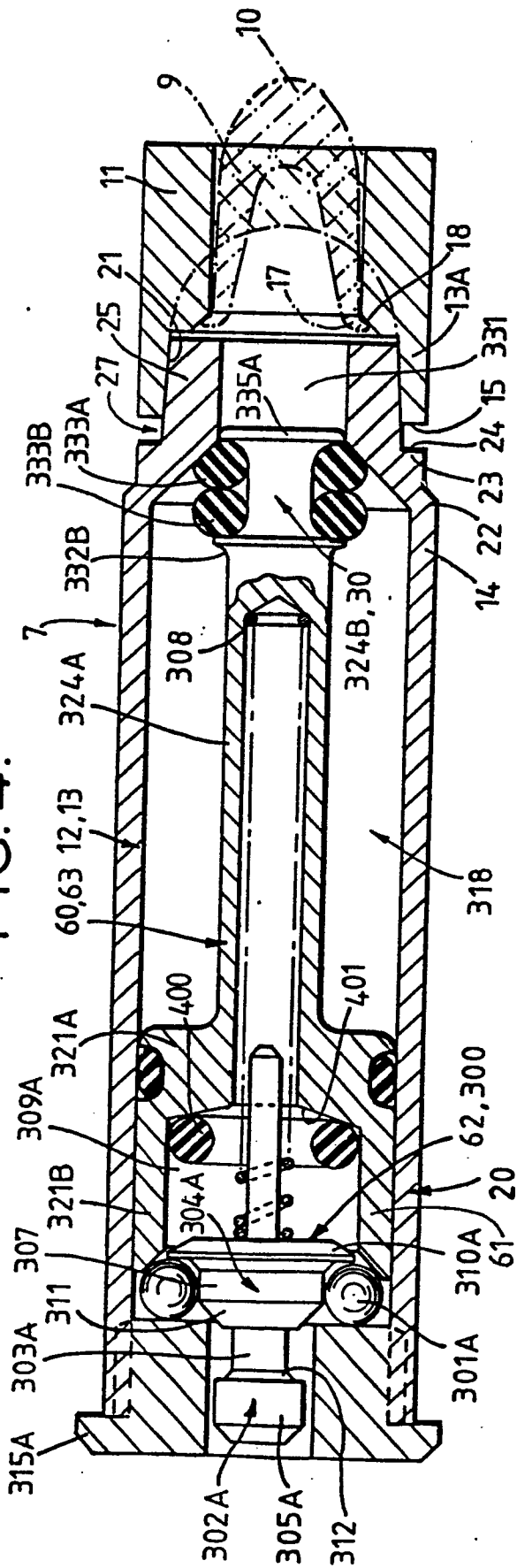


FIG. 5.

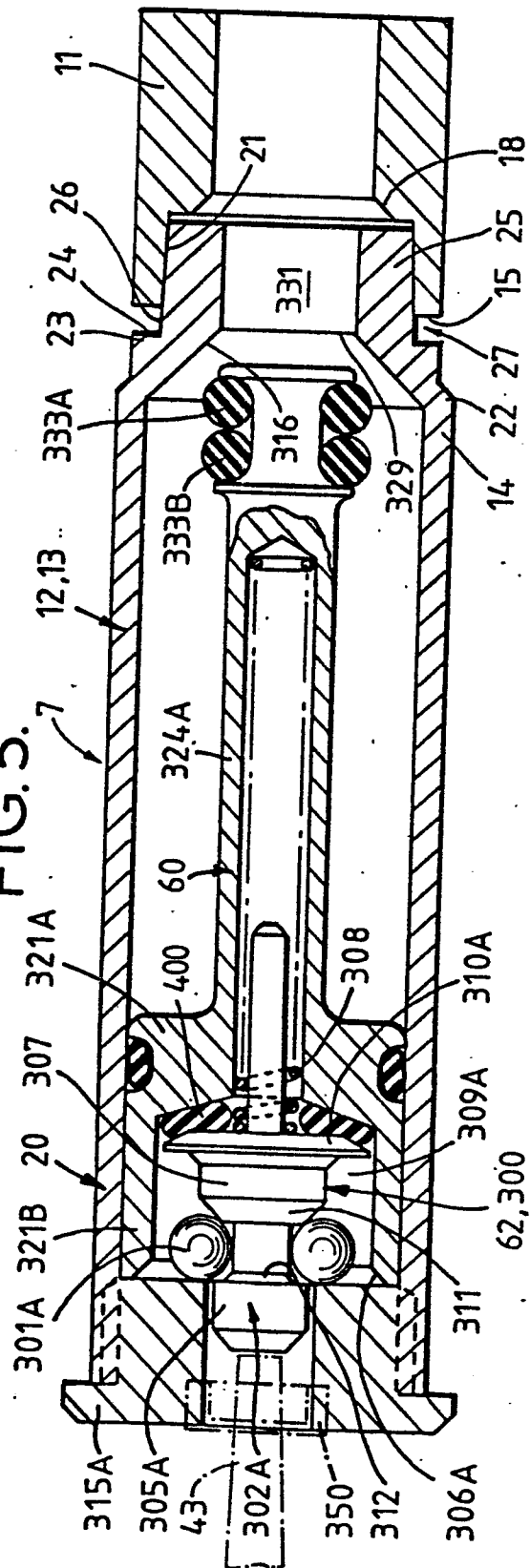


FIG. 6.

