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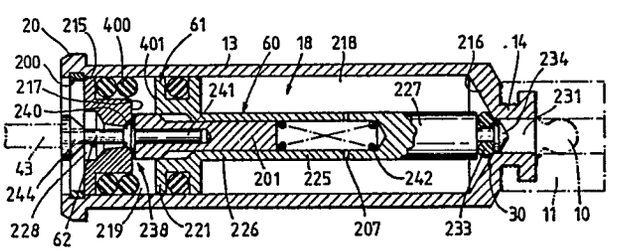
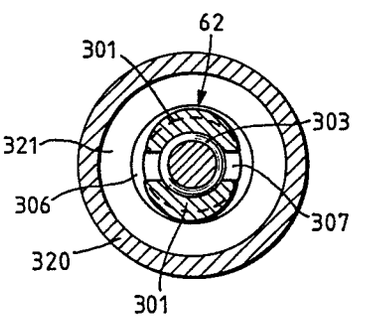
(54) Compressed gas ammunition for small arms.

(57) A round of ammunition comprising a missile (10), retaining means (11) for holding the missile, and a cartridge (12); and the cartridge (12) is an assembly comprising a hollow casing (13) within an intermediate portion of which is a gas storage space (18) disposed between a hollow discharge (front) end portion (14) and a base (rear) end portion (20) of the casing, discharge valve means (30) and actuating means (60). The actuating means generally comprises servo-piston means (61), servo actuating means (62) and discharge valve actuating means (63) arranged so that the means (62) is responsive to being struck by a firing pin (43) of a gun to allow the piston means (61) to utilise energy from compressed gas stored in the space to open the discharge valve means, and thus release the gas to expel the missile (10) from the retaining means. A shock absorber insert (400) is provided to cushion the end of the valve opening movement of the servo-piston (61).





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COMPRESSED GAS AMMUNITION FOR SMALL ARMS

This invention concerns cartridge ammunition for small arms, such as pistols rifles and automatic small arms, which ammunition is adapted to utilise air or another gas at high pressures to propel missiles, in which the cartridge is of a kind comprising a casing, a gas storage chamber in the casing, a piston reciprocable in a cylinder in the casing, discharge valve means controlling a discharge passage from the chamber to a front discharge end of the casing, and actuating means including rear or base end in a rear base end portion of the casing which rear part is actuable to allow the piston to be moved rearwards in said cylinder by gas pressure in said storage chamber, and including an elongate part extending within said storage chamber to connect said piston and valve means for opening the valve means when the piston moves rearwards.

In U.S.A. Patent Specification No. 387256 of 7th August 1888 N.W. Pratt discloses a pneumatic cartridge of the said kind, in which the rear part of the actuating means is in the form of a rotary gas cock, which is rotatable about an axis diametrical to the casing between a first position, in which air is trapped in the cylinder to the rear of the piston, and a second position in which the air can escape from the cylinder to allow the piston to move rearwards. However, it is evident that this cartridge was neither intended nor suitable for high pressure operation; and furthermore this cartridge required temporary plugs to be attached to the casing to prevent loss of pressure, and needed to be fired by means of a specially designed gun having no other purpose.

Radically improved forms of cartridge of the kind described, suitable for high pressure operation, for use as a direct substitute for firearms explosive (chemical) cartridges, are disclosed in our co-pending European Application No. 0100612A1 and British Patent Specification No. 2,124,346A, which should be considered in

conjunction with this present specification. These forms of cartridge are characterised, in part, by the rear or base end part of the actuating means exposed at the base end of the cartridge and being actuable by a thrust in a first longitudinal direction to allow the piston to be moved in a longitudinal direction directly opposite to said first for opening the valve means.

Experimental development and testing of forms of the cartridge designed for low cost mass-production for use with high gas pressures revealed the problem of occasional damage to some of the cartridges upon firing. Expensive to produce design modification and the use of high cost high strength materials produced answers to this problem but at an unacceptable cost for mass-production.

What is needed is a low cost answer which can be easily and realiably incorporated in mass-produced cartridges.

The present invention provides such an answer, and according to the present invention there is provided an ammunition cartridge, for a round of ammunition comprising a casing, a gas storage chamber in the casing, a piston reciprocable in a cylinder in the casing, discharge valve means controlling a discharge passage from the chamber to a front discharge end of the casing, and actuating means including rear or base end part in a rear base end portion of the casing which rear part is actuable to allow the piston to be moved rearwards in said cylinder by gas pressure in said storage chamber, and including an elongate part extending within said storage chamber to connect said piston and valve means for opening the valve means when the piston moves rearwards, and characterised in that:-

(a) the base end or rear part of the actuating means is exposed at the base end of the cartridge and is actuable by a forwardly directed thrust in a longitudinal deviation opposite to the rearwards direction of movement of the piston for opening the valve means;

and further characterised in that:-

(b) the cartridge includes shock attenuator or absorber means disposed so as to be compressed when said piston moves in said rearwards direction.

The shock attenuator or absorber means preferably comprises a resilient insert disposed so as to be compressed by the piston as the latter moves rearwards.

The shock attenuator or absorber means and the piston are preferably arrangd so that the latter can move rearwards through a predetermined distance prior to compressing the resilient insert.

The resilient insert is preferably in the form of a mass-produced elastomeric body, such as an "O"-ring, which is preferably made from nitrile rubber, neoprene, or other elastomer having good shear resistance and shape-memory so as to resist permenant distortion. Alternatively, the insert may be a metallic spring or may be of composite metal and elastomer construction.

The actuating means preferably comprises static or reactive thrust means movable radially inwards from a position in which it blocks rearward movement of the piston to a position in which the piston can move rearwards.

Said static or reactive thrust means preferably comprises at least one rigid member disposed in said rear base end porton and a displacer which incorporates or constitutes said base end or rear part of the actuating means, the displacer being actuable to allow or cause the rigid member or members to move transversely relative to the piston. Displacer bias means is preferably provided to restore the displacer automatically to an un-actuated position.

The piston is preferably hollow and contains and bias means.

An extension of the piston preferably serves as the movable member of the actuating means, and the discharge valve means is

preferably mounted on said extension so that at least part of the discharge valve means is permitted to move through a limited distance in a predetermined direction from a normal position relative to said extension, to facilitate charging of the cartridge with compressed gas.

In all embodiments the discharge valve means is preferably of poppet valve form for closing said discharge opening. The effective area of the valve means is preferably no more than about half the working area of the piston. Said effective area may be as little as one tenth of said working area, but is preferably between one third and one fifth of the working area to enable the discharge opening to be made sufficiently large to permit the compressed gas to be discharged rapidly.

The piston is preferably arranged to accelerate through a predetermined distance before opening the discharge valve means, so that the opening of the latter is rapid and sudden, and said distance is preferably minimal to minimise the delay between actuation and opening of the discharge valve means.

The invention includes a round of ammunition comprising a cartridge of the invention, a missile and retaining means to releasably retain and connect the missile to the cartridge.

The invention will be described further, by way of example, with reference to the accompanying diagrammatic drawings, wherein:-

FIGURES 1 and 2 show longitudinal cross sections through a first embodiment of cartridge of the invention in a normal state and in a discharging state respectively;

FIGURE 3 shows detail of a modified form of the first embodiment shown in FIGURES 1 and 2;

FIGURE 4 shows a second embodiment of a round of ammunition in accordance with the invention, in longitudinal cross-section in a loaded condition;

FIGURE 5 shows an enlarged detail of part of the round after firing;

FIGURE 6 shows an enlarged cross-section on the line III-III in FIGURE 4;

FIGURES 7 and 8 show, in longitudinal cross-section, a modified form of the second embodiment, in a loaded state and in a discharging state respectively; and

FIGURE 9 shows an enlarged detail of part of the round shown in FIGURES 7 and 8, in a transient state after initial actuation.

In all the embodiments and modified forms thereof described hereinafter, the rounds of ammunition generally comprise a missile 10, retaining means 11 for holding the missile, and a cartridge 12; and the cartridge 12 is an assembly comprising a hollow casing 13 within an intermediate portion of which is a gas storage space 18 disposed between a hollow discharge (front) end portion 14 and a base (rear) end portion 20 of the casing, discharge valve means 30 and actuating means 60. The actuating means generally comprises servo-piston means 61, servo actuating means 62 and discharge valve actuating means 63 arranged so that the means 62 is responsive to being struck by a firing pin 43 of a gun to allow the piston means 61 to utilise energy from compressed gas stored in the space 18 for forcing the discharge valve actuating means to open the discharge valve means 30 to permit said gas to leave said space and expel the missile 10 from the retaining means.

The cartridge is provided with shock attentuator or absorber means which is shown in all embodiments as comprising a resilient insert 400 in the form of an "O" ring, and the servo-piston means 61 has a rearwardly directed surface 401 which abuts and compresses the insert when the piston moves.

In the first embodiment and modified form thereof described with reference to FIGURES 1, 2 and 3, the servo-piston means 61 is inside the compressed gas storage space 18, and both sides of the piston means 61 are normally subjected to the pressure of the stored gas.

The servo actuating means 62 is in the form of closure means for opening of a servo-passage to subject the rear side of the piston means to a lower, e.g. atmospheric pressure, by venting of the gas behind the piston means, to subject the piston means to said pressure differential thereby causing the piston means to move rearwards for opening the discharge valve means 30. The missile 10 and the returning means 30. The missile 10 and the returning means, in the form of a snap-on nosepiece, are shown in broken outline in FIGURE 1.

In the first embodiment of cartridge assembly, the discharge end portion 14 of the casing 13 is of simple one piece form, and the base end portion 20 is internally grooved. An insert member 215 is retained in the base end portion by a circlip 200 engaged in the groove in said portion 20. The portion 14 defines a first wall 216, and the member 215 defines a second wall 217 confronting the first wall whereby to define, within the casing, the gas storage space 18 which in this embodiment extends rearwards beyond the intermediate portion of the casing and into the base end portion 20. The insert member 215 serves as a partition between the space 18 and the open end of the portion 20, and defines a servo passage 228 which extends through the second wall.

The piston means 61 comprises a piston 221 slidably located in the space 18 adjacent the second wall 217 to divide the space into a main storage portion 218 in front of the piston, and a servo cylinder portion 219 in which the piston can move.

The actuating means 60, in the first embodiment shown in FIGURES 1 and 2, further comprises a movable member 225 having a hollow rear portion 226 (integral with the piston 221) and a front portion 227. A bush 201 is slidably accommodated (as a clearance fit) in the portion 226, and a servo valve spring 242 is trapped in the portion 226 between the bush 201 and the front portion 227. A restricted charging passage 202 is provided in the portion 226 t to allow gas to pass from the main storage portion 218 through the portion 2326 along the outside of the bush 201 to the servo cylinder 219. The closure means

is in the form of servo valve means 238, which comprises a valve member 241 which extends through the passage 228 into the bush 201. The spring 242 urges a sealing part 240 of the valve member 241 into engagement with a seating 204 (FIGURE 2) on the insert member 215 to close the passage 228. A base end part 244 of the member 241 is disposed in the base-end portion 20 so as to be exposed. The spring 242 also serves as a sealing bias spring to urge the portion 227 towards the first wall 216 for closing the discharge valve means 30. The discharge valve means 30 comprises an "O" ring seal 233 and an end part 234 of the front part 227, which part 234 is a clearance fit in a discharge passage 231.

As shown in FIGURE 1, in the first embodiment the insert member 215 locates the insert 400 alongside a sealing ring 402, both of which are compressed by the piston 221 as shown in FIGURE 2. Instead of the rings 400, 402 a single large ring may be used as a seal and insert, or the sealing ring 402 may be employed as the shock absorber, the piston being modified to abut the ring 402 or to abut a hard plastics or metal short cylindrical thrust member inserted in place of the ring 400.

In the modified form of the first embodiment shown in FIGURE 3, the movable member 225A is solid except for a recess 205 for the sealing bias spring 236A for closing the discharge valve means 30, and for a restricted charging passage 202; and the closure means comprises solely a rear end part 251 is in the form of an exposed frangible web integral with a screwed in insert member 215A so as to close the servo passage 228A, which member 215A has an "O" ring peripheral seal. The unshown remainder of the cartridge is the same as shown in FIGURE 1.

As shown in FIGURE 3, the insert 400 is partially accommodated in a recess 403 in the insert member 215A. The recess 403 is dimensioned so that the maximum compression of the insert is limited by the surface 401 abutting the member 215A. In this embodiment in particular, the insert may be in the form of an annular or short

cylindrical body affixed to the insert member 215A or secured partially in the recess 403, so as to be replaceable with the insert member 215A after firing.

In use, when the closure means is opened by being struck by a firing pin 43 or 43A to open the servo passage, pressure in the servo cylinder portion 219 falls to atmospheric pressure, and the piston 221 moves towards the wall 217 thus opening the discharge valve means, e.g. as shown in FIGURE 6 and comprising the insert 400. In the modified form the pointed firing pin 43A is required to pierce the web 251 which serves as an exposed base end part of the actuating means. The member 251A can be unscrewed and replaced by a new member 251A.

In the first embodiment and the modification thereof, in the charged condition of the cartridge, the servo piston means 62 is subjected to two balanced opposing thrusts both deriving from the stored gas pressure; and the servo-actuating means 62 is operable, in use, to cause a change in the pressure acting on one side of the piston to unbalance the two opposing thrusts. However, this embodiment requires the servo-actuating means 62 to incorporate closure means, a barrier or partition and a servo passage which collectively serve as means for controlling gas flow.

In the second embodiment and a modified form thereof described with reference to FIGURES 4 to 9, the servo actuating means 62 is in the form of static or reactive thrust means of a mechanical form which, in the non-actuated state of the servo mechanism, provides a static thrust to the piston in reaction to the thrust provided by the stored gas pressure, and thus obviates the need for such means for controlling gas flow; and with the exception of certain seals, e.g. "O" rings, the cartridges are all of metal construction.

Referring to FIGURES 4 to 6, the second embodiment of the round of ammunition comprises the missile 10, the nosepiece 11 and the cartridge 12. The latter is an assembly in which the discharge end portion 14 is integral with the casing 13, and the assembly includes

an internal member 315 which is held by a circlip in the base end portion 20 of the casing. The member 315 has a central aperture 323.

The base end portion 20 provides a servo cylinder 319 at one end of a gas storage space 18 for the servo-piston means 61 which comprises a piston 321. The space 18 extends from the piston and through the intermediate portion of the casing to a first wall 316 defined by the discharge end portion 14. Discharge valve means 335 is provided to close a discharge aperture in the first wall at the rear end of a discharge passage 331.

The discharge valve means 30 comprises a bias spring 336 which acts on a backing washer 332 to compress an elastomeric secondary sealing ring 333 against a valve member 334 which abuts a head 335 at the end of a movable member 324. The valve member 334 has a 45° conically tapered seating face which sealingly engges the similarly tapered wall 316 around the discharge aperture, and the rings 333 engages the wall at the junction between the periphery of the valve member and the wall to seal said junction against ingress of gas stored at very high pressures.

The discharge valve actuating means 63 comprises the movable member 324, extending within the space 18 from the piston to the valve means 331; and the servo actuating means 62 comprises static thrust means 300 disposed in the base end portion 14. The static thrust means comprises a pair of rigid members 301 and a displacer 302 disposed between said members 301. The displacer (FIGURE 5) has a waist 303 between a head 304 and a base end part 305 exposed centrally at the base end of the cartridge casing 13.

In use, in the loaded and charged condition of the round as shown in FIGURES 4 and 6, the static thrust means 300 is in a blocking condition in which the rigid members 301 abut a tapered part conical abutment surface 306 of the piston and are supported against movement towards the axis of the piston by engagement with the peripheral surface 307 of the head 304. 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 18 and the much smaller thrust of the spring 336; and these thrusts are opposed by the static resistive or reactive thrust exerted by the rigid members 301 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 a displacer resetting spring 308 acting 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 305 is exposed at the base so that, when the round is in the breech of a gun, the part 305 can be struck and moved forwards (towards the nose) by a firing pin of a gun. When the head 304 is moved forwards from between the rigid members 301, the inclination of the surface 306 causes the rigid members to move radially inwards into the waist 303. The dimensions of the rigid members and waist are such that they can be accepted in a recess 309 in the rear of the piston thereby allowing the piston to move rearwards to an actuated position in which it abuts to the internal member 315 as shown in FIGURE 13.

Rearward movement of the piston and the movable member 324 pulls the valve means 331 from the first wall, to discharge the gas through the discharge end portion, thus expelling the missile.

The resetting spring 308 is stronger than the valve bias spring 336 so that, when the pressure in the space 18 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 blocking position so that the cartridge is restored to the mechanical condition shown in FIGURE 12. A washer 310 ensures that the rigid members 301 are ejected from the recess 309.

In FIGURES 4 and 5, the insert 400 is merely shown

diagrammatically inserted into the space between the insert member 315 and the surface 401. Alternatively, the insert 400A could be employed so as to be compressed between the surface 401A and the washer 310 on the displacer 302, if the recess 309 is longitudinally enlarged to limit compression of the insert 400A; or a thicker form of the washer 310, e.g. of steel backed hard resilient plastics could be employed as the shock absorber in place of the washer 310 and "O" ring 400A.

The cartridge can be recharged by pumping compressed gas into the discharge passage thereby causing the valve parts 332, 333 and 334 to move rearwards along the movable member 324 so opening the valve means against the bias of the spring 336. The discharge valve means thus serves as automatic non-return valve means during charging of the cartridge.

The static thrust means may be of any suitable form. For example, simpler part cylindrical rigid members may be employed instead of the rigid members shaped as shown in FIGURES 4 to 6. A single rigid member may be used in combination with means, such as a spring or an eccentric formation of part of the displacer, to hold the rigid member in an eccentric blocking position, the displacer being shaped and movable to move the rigid member to a position concentric or aligned with the recess 309 to actuate the piston.

The modified form of the second embodiment, shown in FIGURES 7 to 9, is similar to the second embodiment, but the modified form incorporates several improvements in its detail construction and arrangement, and is intended as a substitute for a .38 special firearms cartridge, for use in a firearm provided with a barrel liner.

In this modified form the static thrust means 300 employs several rigid members in the form of six ball bearings balls 301A, each ball having a diameter of 2mm. The displacer 302A is a one piece hardened steel part which is machined to provide the peripheral cylindrical surface 307, and the part conical surface 311 on a modified head 304A which integrally incorporates a flange 310A instead of the washer 310

shown in FIGURE 10. A further part conical surface 312 is provided between the shortened waist 303A and the base end part 305A. This form of the static thrust means is less expensive,is easier to assemble and is more reliable in operation than the form shown in FIGURES 4 and 5.

In the servo piston 321A the recess 309 is relatively large and 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 8). The "O" ring 400 is disposed within the recess 309A, as shown in FIGURES 7 and 8. After actuation, the ring 400 is compressed in the recess 309A between the head 304A and the surface 401 until the skirt 321B strikes the end member 315A.

In the actuating means 60, the movable member 324A is integral with the piston and accommodates part of the 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 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 in place of the spring 336 shown in FIGURE 4.

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

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

This modified form of cartridge is suitable for use with stored gas pressures of about 300 kilogrammes per square centimetre or more, and has a preferred working pressure range of between 200 and 300 kilogrammes per square centimetre, whereas some of the embodiments described hereinbefore are designed to work at lower pressures of, for example, 100 to 200 kilogrammes per square centimetre.

Furthermore, this modified form shown in FIGURES 7 to 9 is designed to improve the rate of discharge of the stored gas, and to operate reliably for a large number of charging and discharging cycles. For this purpose, the head 335A is shaped and positioned so that it is accommodatd in one end of the discharge passage so as to substantially block the discharge aperture 329 (FIGURE 8) 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 is closed to prevent escape of gas. After initial actuation of the static thrust means 300, the initial rearwards movement of the piston will bring the head 335A to the transient position shown in FIGURE 9, and in this position 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 18 is obstructed by the head. When this 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 8 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 disengaged from the wall 316 greatly prolongs the useful working life of the seal 333A. This effect is present at least to some extent in the previously described embodiments also. It can be seen, e.g. from FIGURES 7 and 8, that the piston can move rearwards, after actuation of the actuating means, through said transient position prior to compressing the insert 400.

After discharge of the compressed gas, the spring 308A restores the piston 321A to the position shown in FIGURE 15, and the part conical surface 311 causes the balls 301A to move radially outwards to the position shown in FIGURE 15 also.

During recharging, compressed air is forced 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, there by allowing the gas to enter the space 18. When the space is fully charged up to the supply pressure of the compressed gas, the second "O" ring 333B urges the seal 333B back into engagement with the wall 316 to close the valve, which thus serves as non-return valve means for charging.

The second embodiment and the modified form have the major advantage that if the round is overheated, e.g. by a fire, the seals ("O" rings) will melt and allow a slow leakage discharge of the gas, without any risk of an explosive discharge arising. The missile may be heavier than an air gun pellet. For example, a plastics or metal missile may be used having a weight of over one gramme, e.g. 2 to 4 gms., the missile 10A indicated in FIGURE 15 having a weight of about 3gms.

It has been found, when operating at high gas pressure, that the piston 61 and the actuating member 63 are subjected to very high acceleration, building up destructive momentum in spite of a limited, e.g. less that 2mm, rearward movement, which momentum is successfully restricted by the shock attenuator or absorber means, which deaccelerates the piston in a non-destructive manner after said high initial acceleration, so as to prevent damage to the cartridge.

The shock absorber means is very easily incorporated, at negligible cost, into the cartridge, and is easily modified to suit variations in cartridge design and size.

The invention is not confined to the precise details of the foregoing examples and many variations are possible within the scope of the invention as defined by the appended claims. For example, the cartridge and fixed members are preferably made of metal, and the piston is preferably of steel. The springs may be of metal or plastics material.

The retaining means may be of any suitable form; the detachable

nosepiece may be omitted, and the discharge end portion of the cartridge may be provided with an "O" ring form of retaining means as shown in FIGURE 1 of our British Patent Specification No. 1601917. The nosepiece or discharge end portion may have any suitable shape, e.g. to cooperate with a barrel liner of the form described in our British Patent Specification No. 2044896, which Specification explains the advantages of forward loading of the pellet, which is also permitted by the detachable nosepiece of the ammunition described herein.

The cartridge of the invention has the further advantage which is not available from any known form of compressed air cartridge, that the firing pin may rebound after striking the actuating means without impairing the discharge of the gas. In this respect also, the cartridge of the invention is similar to ordinary firearms explosive cartridges. The rear or base end part may be indirectly exposed at the base end of the cartridge, even though the rear or base end part has to be accessible for striking by a firing pin. For example, in order to reduce the risk of the cartridge being discharged accidentally or by tampering (by children) a protective and replaceable cap 350 (FIGURE 8) may be provided at the base end of the cartridge. Such a cap may be provided for any of the embodiments and must be of thin metal, plastics or other material which can be pierced by the firing pin, so that the rear base end part remains accessible for correct firing in a gun.

Various features and details of the several embodiments may be combined in many ways to yield a variety of other forms of cartridge employing the basic functional ideas disclosed herein.

CLAIMS

1. A rechargeable compressed gas small arms cartridge (12) comprising a casing (13), a gas storage chamber (18) in the casing (13), a piston (61) reciprocable in a cylinder (219, 319) in the casing (13), discharge valve means (30) controlling a discharge passage (231, 331, 331A) from the chamber (18) to a front discharge end (14) of the casing (13), and actuating means (60) including a rear or base end part (244, 251, 305, 305A) in a rear base end portion (20) of the casing (13) which rear part (244, 251, 305, 305A) is actuable to allow the piston (61) to be moved rearwards in said cylinder (219, 319) by gas pressure in said storage chamber (18), and including an elongate part (225, 324, 324A) extending within said storage chamber (18) to connect said piston and valve means (30) for opening the valve means (30) when the piston (61) moves rearwards, and characterised in that:-

(a) the base end or rear part (224, 251, 305, 305A) of the actuating means (60) is exposed at the base end of the cartridge (12) and is actuable by a forwardly directed thrust in a longitudinal direction opposite to the rearwards direction of movement of the piston (61) for opening the valve means (30);

and further characterised in that:-

(b) the cartridge (12) includes shock attenuator or absorber means (400, 400A) disposed so as to be compressed when said piston (61) moves in said rearwards direction.

2. A cartridge as claimed in Claim 1 wherein the shock absorber or attenuator means (400, 400A) comprises an elastomeric insert (400, 400A) disposed to be compressed by the piston (61) after the latter has moved rearwards through a predetermined distance.

3. A cartridge as claimed in Claim 1 or 2 including bias means (242, 308) to urge the piston (61) forwards.

4. A cartridge as claimed in Claim 3 wherein the shock absorber or attenuator means (400, 400A) is disposed between a base end part (20)

of the casing (13) and a rear end surface (401) of the piston (61).

5. A cartridge as claimed in Claim 1, 2 or 3 wherein the actuating means (60) comprises static or reactive thrust means (62) movable radially inwards from a position in which it blocks rearward movement of the piston (61) to a position in which the piston (61) can move rearwards.

6. A cartridge as claimed in Claim 5 wherein the static or reactive thrust means (62) comprises at least one rigid member (301, 301A) disposed in said rear base end portion (20) and a displacer (302, 302A) which incorporates or constitutes said base end or rear part of the actuating means (60), the displacer (302, 302A) being actuable to allow or cause the rigid member or members (301, 301A) move transversely relative to the piston (61).

7. A cartridge as claimed in Claim 6 wherein the shock absorber or attenuator means (400) is disposed between said displacer (302, 302A) and a rearwardly directed surface (401) of the piston (61).

8. A cartridge as claimed in Claim 7 as appended to claim 3 wherein the bias means (308) acts means acts also on the displacer (302, 302A) to urge the displacer rearwards.

9. A cartridge as claimed in Claim 3 or 4 wherein the base end or rear part (244, 251, 305, 305A) of the actuating means (60) comprises a poppet valve member (240); and wherein said bias means (242) also exerts a rearwardly directed closing thrust on said valve member (240).

10. A round of ammunition comprising a cartridge (12) as claimed in any preceding claim, a missile (10) and retaining means (11) to releasably connect the missile (10) to the cartridge (12).

FIG.1.

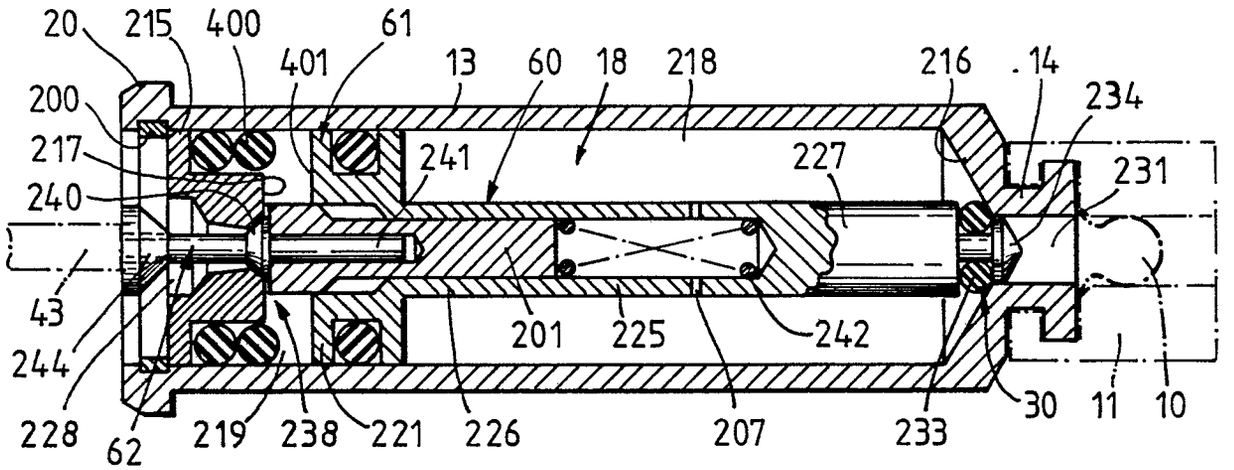


FIG.2.

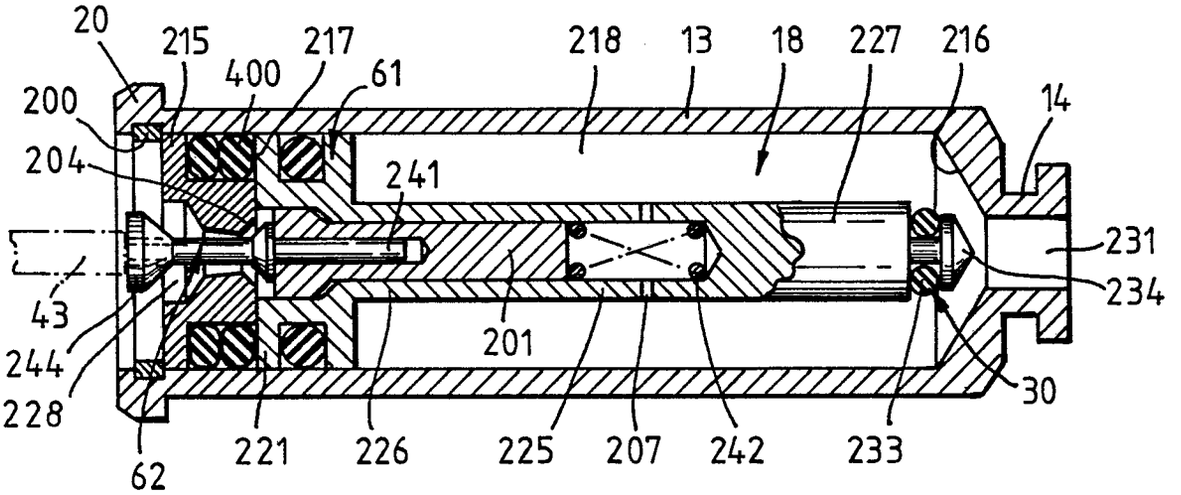
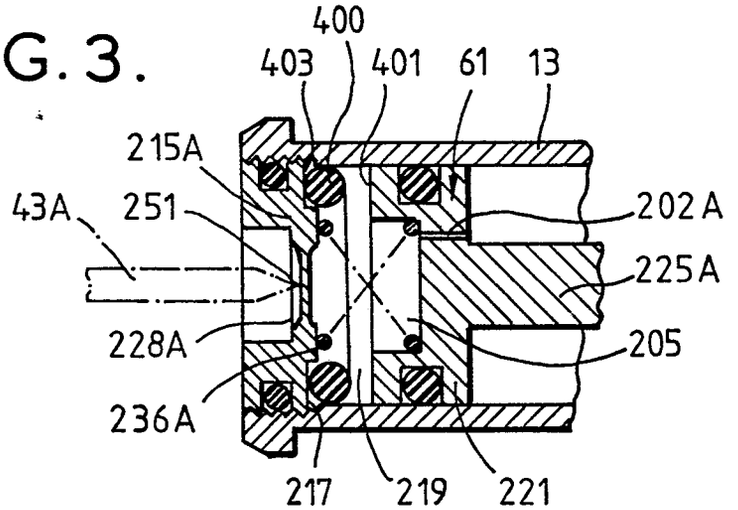


FIG.3.



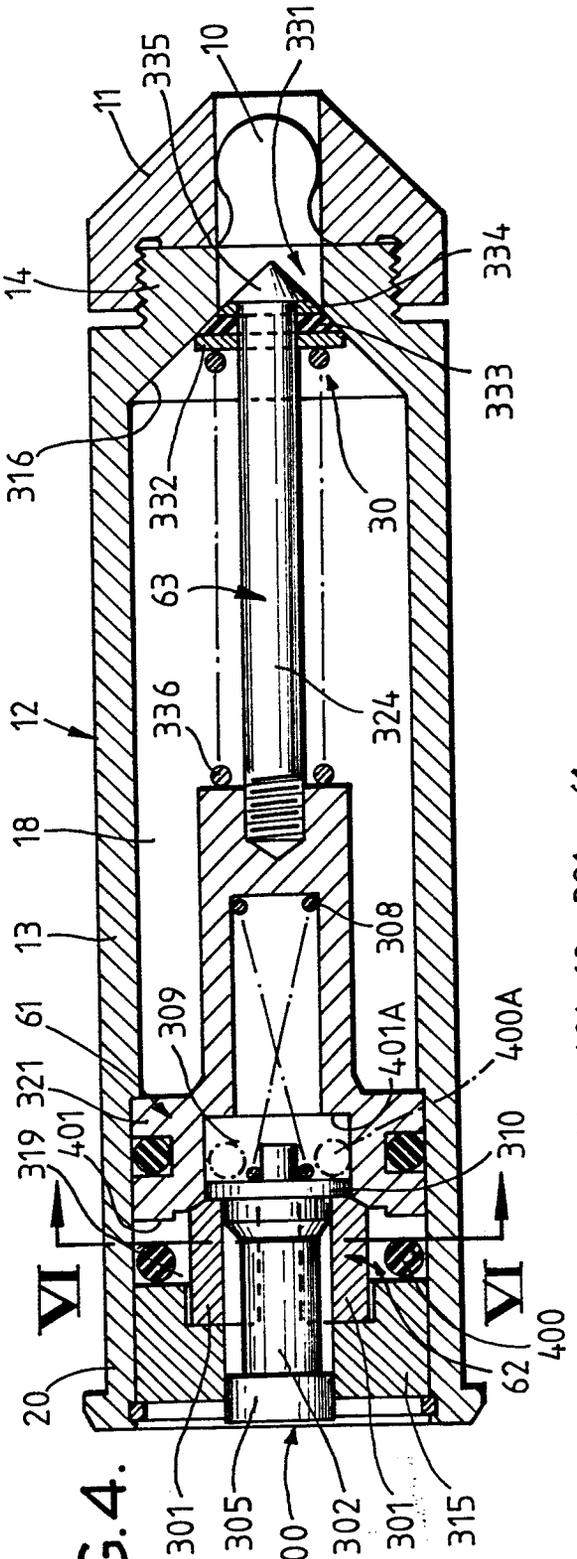


FIG.4.

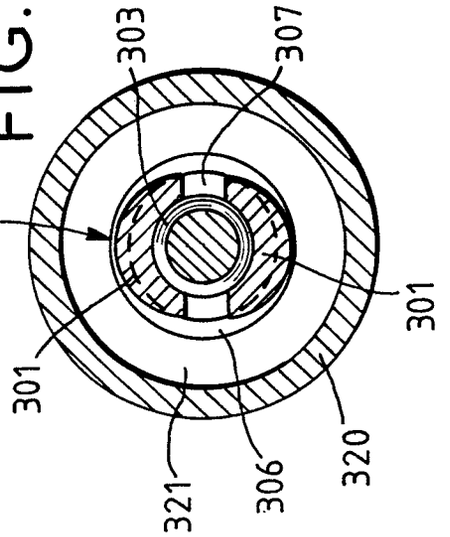


FIG. 6.

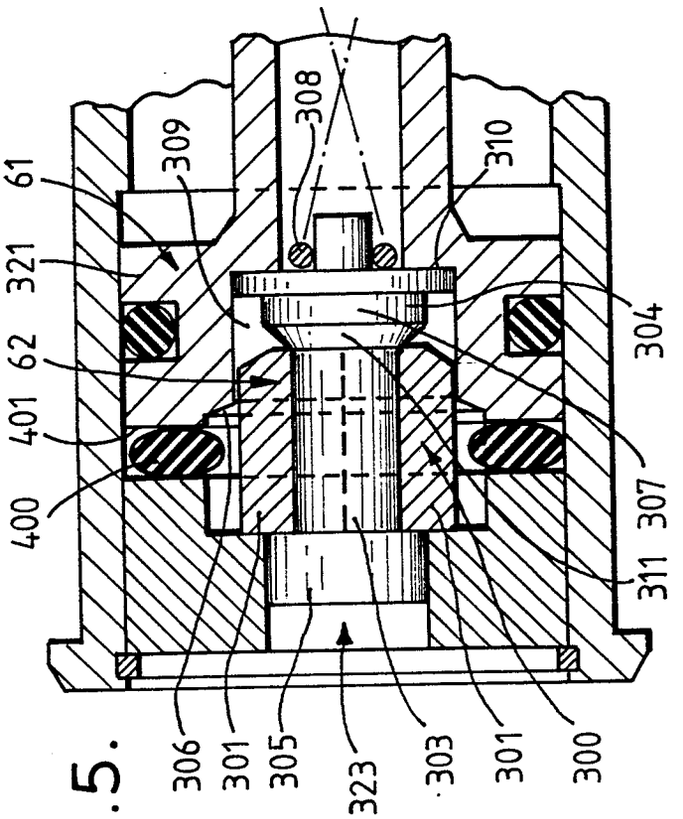
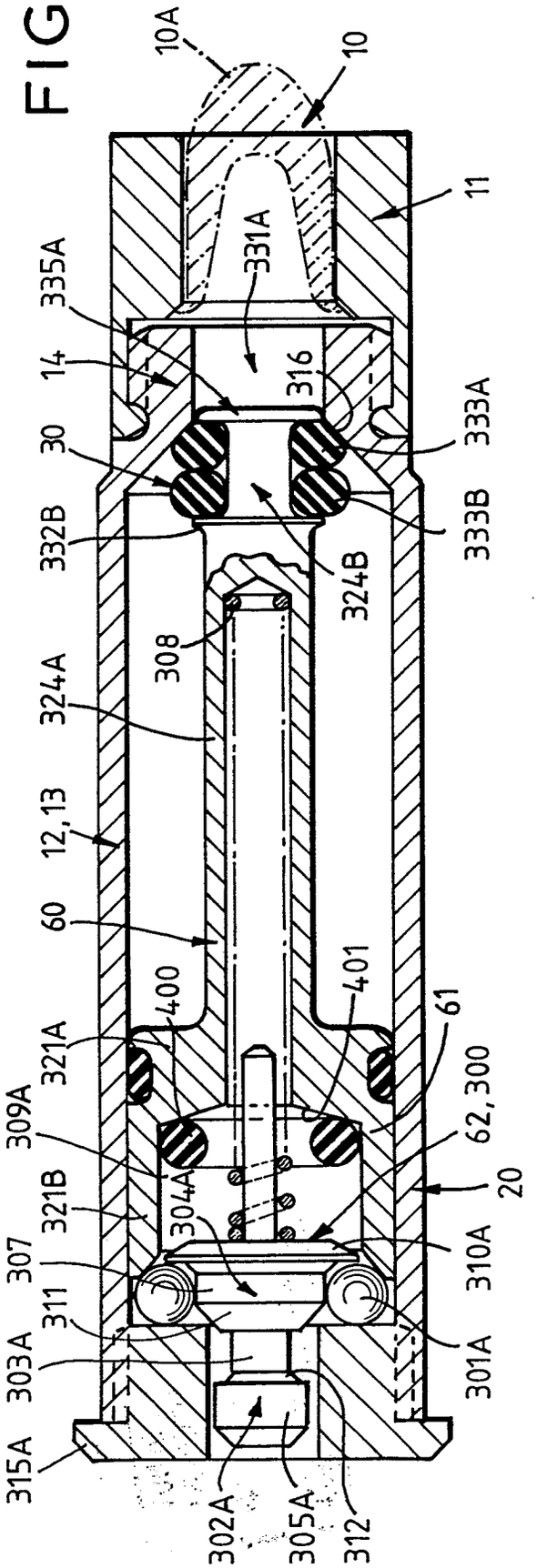


FIG.5.

FIG.7.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335A
14
316
30
333A
332B
333B
324B
308
324A
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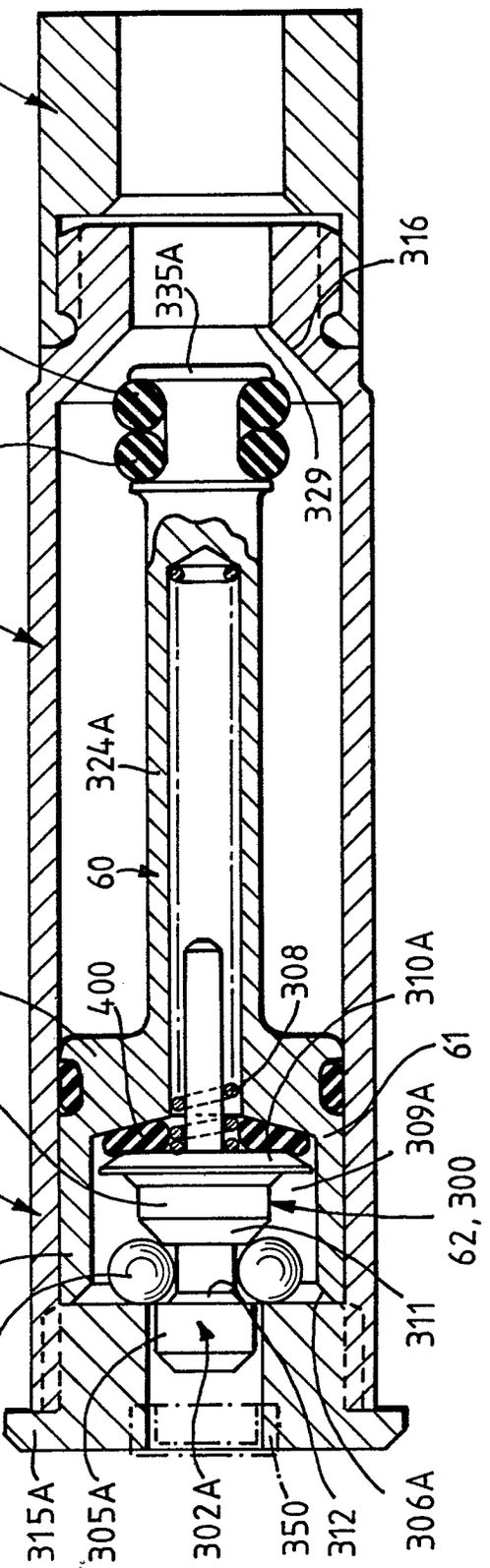
60
400
401
61
321A
309A
62,300
321B
304A
20
307
310A
311
303A
301A
315A
302A
305A
312

FIG.8.


11
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321A
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309A
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62,300
321B
311
301A
315A
305A
302A
350
312
306A

FIG. 9.