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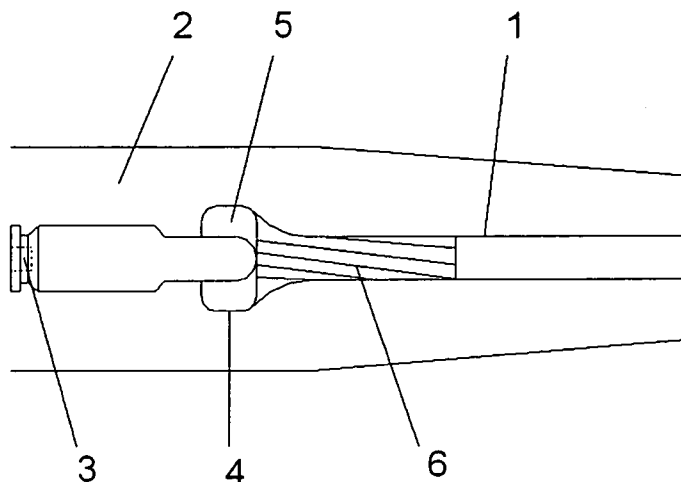


FIG. 1

(57) Abstract: Barrel of those which have a smooth bore and a chamber, housing in its interior the cartridge, and which has a gas expansion chamber between the chamber and the rest of the smooth tube, where said gas expansion chamber has two differentiated areas: one open of greater calibre than the smooth tube and another formed by a plurality of longitudinal helicoidal or rectilinear grooves. The curved bottom of the grooves stems from the curvature of the end of the open area and crests therebetween form part of the calibration of the smooth tube. The cartridge is wrapped in a sheath where the charges of the two phases are found. The detonation of the initiating capsule is transmitted to the first phase through a metallic cannula. Between the two phases of explosion is created a security space which prevents the two phases from

exploding at the same time.

IMPROVED CARTRIDGE AND BARREL**DESCRIPTION**

5 Improved cartridge and barrel for fire arms and/or such like.

OBJECT OF THE INVENTION

10 The present invention intends to achieve ballistic values superior to those achieved by conventional barrels, whether they are smooth or striated, with the advantage that is provided by the rotation of the projectile using a smooth barrel in its helicoidal groove version and a slightly sub-calibrated projectile.

BACKGROUND OF THE INVENTION

15 The firing mechanism existing until the first third of the 19th century consisted of a hammer with a flint fragment at its end, which upon the trigger of the weapon being actuated struck a steel disc, lighting a small amount of gunpowder placed in a hole at the end of the barrel, which thus transmitted the deflagration to the
20 gunpowder which drove the bullet inside the barrel of the weapon.

Also, the bore of the rifle (internal surface of the barrel) was smooth and the lead bullet spherical, which facilitated its deformation and deflection during the firing, making it almost impossible to hit an enemy at more than 100 m. On the other hand,
25 the poor quality of the gunpowder used made the stray bullets practically inoffensive at more than 500 m.

Towards 1830, rifles that fired with the percussion cap mechanism were widespread and rifles with threaded bores began to become widespread, although
30 modifications in the composition and shape of the bullet were already common at the beginning of the 19th century.

At the beginning of the 19th century, people began to harden lead bullets, alloying them with antimony or coating them with copper in order to keep the bullet
35 from deflecting from its normal trajectory, due to the deformations caused during the

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firing; they were also given a cylindrical-conical shape (tip) in order to favour the rotation of the bullet when it was fired from a threaded bore barrel.

5 The first mention of the use of grooves inside the barrels is found in an edict of the Swiss Government from 1563, which describes crude weapons of little use as they used crude handgun bullets or of the barrels of that time, because these were not perfectly spherical, which made the use of grooves unacceptable for years and smooth barrels preferential.

10 The threaded bore consists of engraving a series of grooves along the internal surface of the barrel, which turn in a certain direction around the axis of the barrel, and at a certain distance (groove passage). The grooves cause the bullet to rotate (gyroscope effect), and in this way keep a stable trajectory during their advancement, as they maintain their axis parallel with the line of flight. As a
15 consequence, it increases the reach and the accuracy of the weapon.

 The next great innovation was the appearance of the cartridge, which contains in a single element, the projection loading thereof and the fulminate which initiates the firing, which until then came separate or partially wrapped in the paper
20 that was used as a plug for the charge. The first cartridges appeared around the decade of 1840, and tended to be wrapped in cardboard or waxed cloth and sometimes did not include the primer which was placed in a similar manner to the traditional percussion weapons tearing the cartridge at its rear part upon inserting the cartridge and locking the weapon. The loading of the weapon was simplified and
25 was extremely sped up with the use of the cartridge.

 Currently, most of the cartridges can be divided into four components: the sheath, which serves as a bearer of the projection charge (gunpowder) and is the part which has the rest of the elements which compose the cartridge; initiating
30 capsule (piston), which is the part of the cartridge where the initiating substance in charge of beginning the ignition is housed; the gunpowder, which is the propelling charge of the cartridge, whose mission is to drive the bullet; and the bullet, which is the projectile fired. In shotgun cartridges, another component is added, the plug, which on the one hand takes maximum advantage of the gases produced in the
35 combustion of the gunpowder thanks to a perfect internal sealing of the cartridge at

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the moment of firing and, on the other, contains and protects the pellets in their trajectory inside the barrel, preventing that they deform due to brushing against the walls.

5 With regard to the types of barrels, there is a distinction made between: smooth barrels, more appropriate for cartridges with pellets (shotguns), and threaded barrels, which have spiral grooves inside the barrel which make the bullet turn on its axis.

10 The fulminate, upon being struck, detonates violently. This explosion causes a blaze which in contact with the gunpowder initiates a chemical reaction which turns it into gas. Due to this reaction, an increase in volume is produced, which translates into pressure which drives the bullet.

15 As we have seen in the types of barrels, in order to improve the accuracy and strength thereof, some are striated spirally in the bore so that they acquire great accuracy, but as a consequence, the problem arises of the high friction suffered by the bullets. These barrels are very limited in their deflagration speed because of the acceleration velocity of the projectiles in the barrel, and in some cases because of
20 the deformation speed of the projectile as it adapts to the grooved bore.

DESCRIPTION OF THE INVENTION

25 In order to solve the previously described problems, the present invention proposes a sheathed cartridge, and which uses two separate propellant charges, which cause the explosion to be produced in two phases, the first of them at the centre of a gas expansion chamber, and the second when the projectile has already advanced considerably down the barrel, there not existing in the current state of the art any of these characteristics.

30

 In the current barrels, by using only the pushing force, the velocity of the propellant that we can use is limited. The present invention, by making use of explosive propellants in the two phases mentioned, instantaneously releases a large quantity of gas, which through effect of the overpressure can even become plasma.

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The explosion of the first of the two phases which supported by the cartridge is produced when the detonation of the initiating capsule transmits its push through the cannula of the sheath to the first phase assembly + projectile, driving it and moving it towards the centre of the open gas expansion chamber, until situating
5 itself at the beginning of the set of crests which are between the grooves, at the same time that it separates from the neck of the sheath.

The innovation in the design of the barrel consists in the use of a gas expansion chamber (open area of greater calibre than the chamber or the tube) and
10 of a series of rectilinear longitudinal grooves or slightly helicoidal which, starting at the bottom of the gas expansion chamber walls extend in smooth decline along the barrel, crests emerging from between them which, in turn, make up the initial structure of the calibration of the bore.

15 As the first phase contributes a stronger explosion and velocity which the projectile can absorb in its acceleration by simple pushing, these groove relieve that enormous pressure, but furthermore are able to take advantage of it, as the jet of gas does not only pull the projectile along and suction it, but also provides it with a rotational movement about its own axis which will give it the stability both on its path
20 down the barrel and in flight, if the grooves are helicoidal. It is because of all of this that a triple effect of pushing, pulling and suction is created, as is explained in more detail below:

Pushing force: is produced because the explosion takes place right behind
25 the projectile, and therefore takes advantage of the part of the explosive push in the direction of the vector of the barrel, such as the push reflected by certain areas of the chamber walls.

Pulling force: the grooves, which serve as a relief in the explosion, are
30 relatively narrow passages which due to the Venturi Effect create jets of high pressure which pull the projectile by its sides, additionally transferring to it a rotational movement, if helicoidal grooves are used, which will give it stability, both in its path down the barrel and in flight.

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Suction force: the gases, which have been absorbed by the projectile at a higher velocity than this (and which turn like a whirlwind if helicoidal grooves are used), create a pressure drop zone in front of it. This gas (or plasma) flow is furthermore able to extend, far in front of the fire mouth, the impact of the projectile
5 with the atmosphere.

During this process, and in order to speed up the projectile even more, the brutal explosion of the charge of the second phase is produced, which will cause a projectile which is already in free acceleration to accelerate even more. This second
10 explosion can be produced once the projectile has surpassed the area of the barrel with the grooves.

The smooth grooves will be of the length necessary to end up speeding up the projectile with the charge of the second phase of the cartridge, and will be of the
15 same calibre from the area of the grooves to the fire mouth, being able to add any type of flash hider, muzzle brake or other type of flash or recoil attenuator.

Additionally, if "sabot"-type projectiles are used, the friction is minimised and the surface exposed to the explosions is increased without, however, increasing the
20 mass of the projectile too much.

DESCRIPTION OF THE DRAWINGS

In order to complement the description being carried out and with the
25 purpose of helping towards a better understanding of the characteristics of the invention, in accordance with a preferred example of embodiment thereof, a set of drawings is attached as an integral part of said description, wherein the following, in an illustrative and non-limitative character, has been represented:

30 Figure 1.- Shows a schematic view of the barrel with the cartridge inserted in the chamber thereof.

 Figure 2.- Shows a quartering of the cartridge.

 Figure 3.- Shows the phases of the process.

35

PREFERRED EMBODIMENT OF THE INVENTION

The present invention consists of a barrel and an improved cartridge, so that the explosion is produced in two phases, thereby achieving ballistic values greater
5 than those achieved by conventional barrels.

The barrel is made up of a smooth bore (1) and a chamber (2) to house in its interior the cartridge (3). Between said chamber (2) and the rest of the smooth tube is the gas expansion chamber (4), made up of two differentiated areas: the first open
10 area (5) and of greater calibre than the smooth tube, and a second area (6) formed by a plurality of longitudinal helicoidal or rectilinear grooves, whose flows pull, suction and provide rotational movement to the projectile about its own axis, giving it stability, in the event that they are helicoidal. The curved bottom of said grooves stems from the curvature of the lateral end of the open area (5) and the crests form
15 part of the calibration of the smooth tube. The chamber (2) houses a cartridge (3), with the first phase protruding until the centre of the expansion chamber, and with the projectile inserted therein, so that this is featured inside the bore formed by the set of crests, in order to focus the explosion of the first phase in the gas expansion chamber (4), and that said first explosion phase does not run into and has a space
20 until the crests of the grooves (6) allowing it to have an advanced explosion produced by the detonation.

The cartridge (3) is composed of an exterior sheath which has an initiating capsule (7) housed in its rear end. In its interior there are the charges, both of quick,
25 compact explosiveness, the charge of the second phase (8), in an inverted cone shape at the end facing the first phase, and the charge of the first phase (9), doubly threaded at one end of the cannula and at the neck of the sheath, and at the other end threaded in turn the projectile (10), which will preferably be of the sabot type, with the advantage of minimising the friction and increasing the surface exposed to
30 the explosions, without increasing the mass of the projectile too much. A metallic cannula (11) transmits the detonation of the initiating capsule (7) until the explosive of the first phase (9). Between both phases of explosion, (8) and (9), a security space (12) is created which makes the two phases of explosion detonate one after the other, preventing them from doing it at the same time without achieving the
35 desired effect.

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5 A: Once the cartridge (3) is housed in the chamber (2), part of the charge of the first phase (9) which protrudes from the metallic cannula (11), is situated almost in the centre of the open gas expansion area (5), and with part of the projectile (10) already inside the path of the grooved area, and without the first phase (9) running into the beginning of the grooved area (6).

B: When the detonation of the initiating capsule (7) is produced, this pushes the first phase (9) lighting it, thus initiating the detonation sequence in two differentiated phases.

10 C: The first phase (9) explodes and the open area (5) expands, finding an exit through the grooves (6), pulling by its lateral sides and suctioning in front of the projectile (10) in addition to pushing it.

15 D: After the explosion of the first phase (9), the projectile (10) abruptly accelerates due to that push, pull and suction, at the same time that it begins to turn in the direction of the grooves, if they are helicoidal (6), pulled along by the lateral currents and suctioned by the resulting whirlwind. Thus, the friction is reduced to a minimum, helping the second phase speed up the projectile as much as possible from the velocity achieved by the first phase. As can be observed, the consecutive, but "almost" simultaneous, explosion of the second phase mainly generates pushing force, since the projectile is
20 practically in the smooth span and furthermore, it speeds it up starting from a velocity and acceleration already achieved by the first phase.

25 In order to avoid critical structural tensions that could produce the explosion of the first phase in the internal walls of the barrel, the distance that the first phase (9) can advance until the limit of the grooves (6) will be greater than the length of the material stuffed into the neck of the cannula (11).

30 In addition to the initiating charge (7), both the first phase (9) as well as the second (8) can have secondary initiating charges, both in order to ensure the lighting of the phases and so that they do so in the times set, in a uniform and standardised manner, in order to establish standardised ballistic values, in necessary cases.

35 In the event of long barrels, opening valves can be added for drops in interior pressure, in order to counteract the possible decelerating effect that could produce

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an implosion after the explosion of the second phase due to the difference between the volume to be filled and the volume produced by the explosion of the second phase.

CLAIMS

1. Barrel of the type which have a smooth bore and a chamber, housing in its interior the cartridge, and which has a gas expansion chamber between the
5 chamber and the rest of the smooth tube, **characterised in that** said gas expansion chamber has two differentiated areas:
a first open area of the gas expansion chamber and of greater calibre than the smooth tube,
a second area of the gas expansion chamber formed by a plurality of longitudinal
10 grooves.
2. Barrel of the type which have a smooth bore and a chamber, housing in its interior the cartridge, and which has a gas expansion chamber between the chamber and the rest of the smooth tube, according to claim 1, **characterised in**
15 **that** the longitudinal channels of the second expansion area are helicoidal.
3. Barrel of the type which have a smooth bore and a chamber, housing in its interior the cartridge, and which has a gas expansion chamber between the chamber and the rest of the smooth tube, according to claim 1, **characterised in**
20 **that** the longitudinal channels of the second expansion area are rectilinear.
4. Barrel of the type which have a smooth bore and a chamber, housing in its interior the cartridge, and which has a gas expansion chamber between the chamber and the rest of the smooth tube, according to claims 1 to 3, **characterised**
25 **in that** the curved bottom of the grooves stems from the curvature of the end of the open area.
5. Barrel of the type which have a smooth bore and a chamber, housing in its interior the cartridge, and which has a gas expansion chamber between the
30 chamber and the rest of the smooth tube, according to claims 1 to 4, **characterised in that** the crests of said grooves form part of the calibration of the smooth tube.
6. Improved cartridge, of those that are wrapped in a sheath, **characterised in that** in its interior are two differentiated phases:

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First phase: an explosive charge doubly threaded at the end of the cannula and at the neck of the sheath, and at the other end threaded at the same time the projectile, which will preferably be of the sabot type.

5 Second phase: an explosive charge which will be in the shape of an inverted cone at the end facing the first phase.

7. Improved cartridge, of those that are wrapped in a sheath, according to claim 6, **characterised in that** the detonation of said initiating capsule until the first phase is transmitted through a metallic cannula which forms part of the sheath.

10

8. Improved cartridge, of those that are wrapped up in a sheath, according to claims 6 and 7, **characterised in that** between the two phases of explosion is a security space.

15 9. Improved cartridge, of those that are wrapped in a sheath, according to claim 7, **characterised in that** the first phase contains secondary initiating charges.

10. Improved cartridge, of those that are wrapped in a sheath, according to claim 7, **characterised in that** the second phase contains secondary initiating charges.

20

11. Improved cartridge, of those that are wrapped up a sheath, according to claim 7, **characterised in that** the distance that the first phase can advance until the limit of the grooves of the barrel will be greater than the length of the material stuffed into the neck of the sheath.

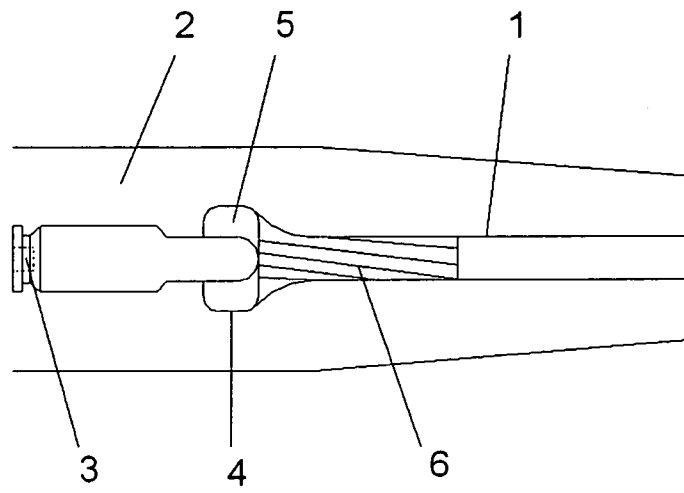


FIG. 1

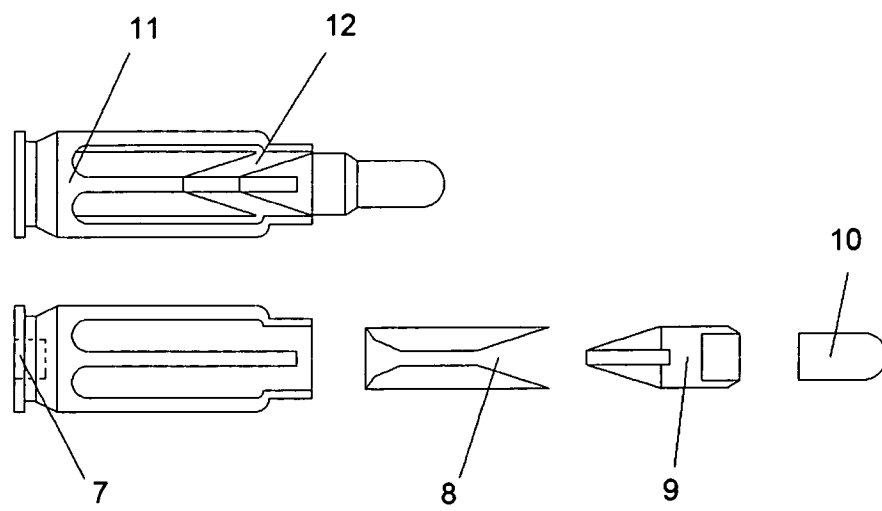


FIG. 2

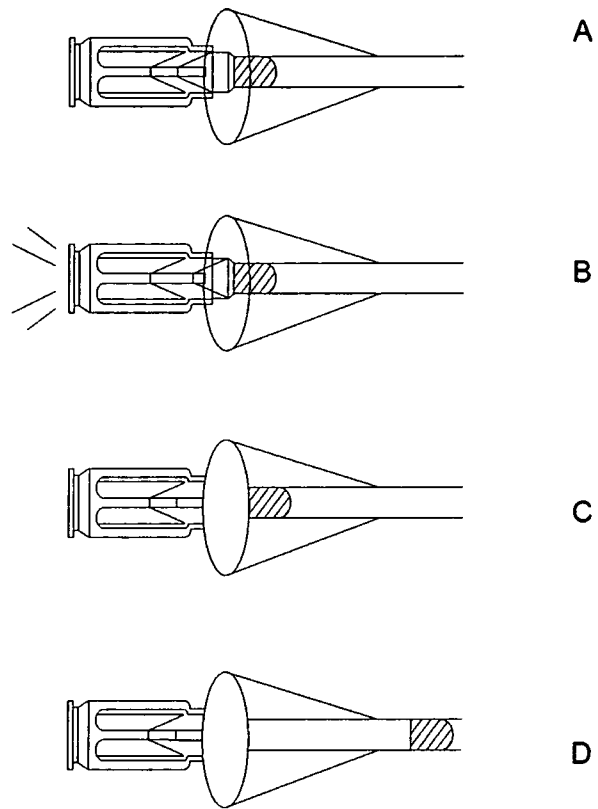


FIG. 3