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The cal. 12,7x107 GEPÁRD M1 sniper rifle

Technical description

PhD work

Choice of subject

By the beginning of the 1980's the reappearance and fast spread of personal armour (bullet proof wests, helmets), its continuously growing resistance ability and the extensive usage of the light armoured vehicles fundamentally limited the effectivity of conventional 7,62 mm caliber sniper rifles and conventional sniper combat.

The reason of that phenomenon was that the probability of a direct hit (to eliminate the target by a single shot) decreased because the effectively attachable target surface had been dramatically decreased. Practically the sniper rifles with conventional caliber had no chance against targets wearing personal armour beyond 800 meters. In parallel to this, the need for destroying long range (>1000m) targets (anti-tank mines, statical fighters, bombers, helicopters, command posts and radio-electronics stations) showed up. The tactical need for putting into service a rifle which was capable of shooting accurately beyond main sniper target-distances (150 – 300 m) with high bullet impact energy became clear. To fulfil these requirements the American 12,7 x 99 mm (Browning .50 caliber) RAI M500 single shot rifle and the Barrett M82 self loaded rifle were born.

At the late 1980's the Hungarian People's Army (HPA) did not have a rifle with sniper ability (the 7,62 mm caliber SzVD „Dragunov" rifle was a „rifle with scope" according to the regulation too), but comparing the then NATO and Warsaw Pact equipments the domestic need for a large caliber sniper rifle should have been real – if the HPA would have had the will to realize it.

At the late 1980's the domestic defense industry was not able to produce main individual combat weapon (assault rifle) economically in mass production,

because of HPA's lack of needs and low absorbing capacity and uncertain export possibilities. In the former state financed system the financial burden of developing new weapons was too high for state owned companies even though they could receive partial subsidy from the R+D budget of the army. At the same time because of the change in political and economic climate sole proprietors and small enterprises appeared in the defense industry mainly to repair and maintain hunting rifles but also, in a small scale, to implement military technology developments or to be a military contractor of the defense industry.

The intellectual capacity of the domestic defense industry was always world class and was able to create a new special purposed individual weapon. However the technical possibilities of the state industry did not measure up to the standards of the modern era, therefore it was hard to carry out innovations. Then again the small enterprises of the domestic defense industry, due to their size, were able to implement economical production on a small scale but on a proper quality level of development.

Based on these facts I realized that the conditions of a domestically designed and under hand craft circumstances economically produceable 12,7 mm caliber sniper ability individual rifle are given. The necessity to create such a weapon is justified by international examples (i.e.: RIA M500), so the circumstances and conditions of its combat applicability is not to be disputed but to be elaborated. In case of successful domestic development, according to the then literature data and inner informations, the export possibility forecasts were promising because this weapon was about to be the second in the world and first in Europe to appear among its category.

My aims of development

Based on the above mentioned issues my aims of development to create a large caliber individual sniper rifle were:

– the rifle can not be at a lower engineering quality level then its American counterpart,

– the rifle should be easily and safely handleable by an individual,
– the rifle should be mass produceable by the domestic industry
– the rifle should be at a new sniper capability level compared to its counterparts in the HPA,
– the rifle should be applicable without limitations within the environmental circumstances of military standards

Theoretical foundations of development

The development was based on extensive literature research basically aimed at the detailed acquaintance of sniper tasks, and at the theoretical analysis of problems that can occur while using 12,7 mm caliber rifles. I also got acquainted with professional rules and personal experiences of the domestic (police) snipers and with the opinions of shooters having extensive experience with large caliber rifles. As a result of my researches I stated the following theorem:

In order to destroy the target effectively the sniper can not be afraid of the recoil while shooting in any circumstances, especially not from the wounds that the weapon could make, because this „disturbing circumstance" is dramatic enough to balk the accurate shooting.

While comparing this basic requirement to the behaviour of a 12,7 mm caliber weapon during shooting I realized the contradiction that lies between the special needs of the sniper (low recoil) and the shooting rifle's burden on the sniper (recoil above the endurance limit of the body). To dissolve this contradiction I came up with the recognition that to create a state of the art Hungarian large caliber rifle I have to combine low recoil with high sniper capabilities.

According to this recognition I had to apply the following engineering solutions:

1 I had to lower the burden on snipers to ensure the accurate execution of their tasks,

1/1 To create a large caliber rifle with the lowest recoil possible I had to combine conventional muzzle brake with non-conventional engineering solutions,

1/1/1 As a muzzle brake I had to apply a construction with high efficiency and no damaging effect on the precision of the shooting (application of non-conventional muzzle brake, rejection of multichamber muzzle brake),

1/1/2 The hit on the shooter's shoulder can be „softened" by the temporal delay of the rearward momentum of the weapon and in addition the recoil burden can be lowered by using proper energy absorbing materials (buffers, shoulder pads).

2 I had to ensure the barrel's shift is as low as possible during shooting to be able to maintain the spatial position of the barrel defined while aiming,

2/1 i.e. – by the example of certain gun constructions – the barrel to rearward motion in own axis of bore with precision of allowance must be ensured, while the bullet leaves the zone of intermediate ballistic,

2/1/1 Therefore the braking recoil system must be built around central symmetry axis which is the axis of bore, in order to minimize the resultant of deviating forces which rise at right angles to axis of bore and in practice it can be achieved by applying cylindrical (pipe in pipe) constructions

2/1/2 In addition the line of axis of stock must be desingned into the elongation of axis of bore, in a way that the shoulder pad of stock must be intersected by the axis of stock. This can be achieved by the application of connected single axis barrels.

3 I had to ensure easy operation and portability in any circumstances typical in special sniper environments

3/1 To achieve that I had to ensure the shortest weapon length with the application of the longest barrel available,

3/1/1 To be able to minimize the weapon length besides the longest barrel I had to come up with an unconventional rifle design,

3/2 In addition the rifle must be easy to dismantle (without using a special tool) to be portable,

3/3 In order to put the rifle in a stabile position it had to be fitted with a bipod, and with adaptors to ensure its equipability to the PKMSz machine gun tripod.

The results of the development

To fulfil requirement **1/1/1** I applied an action-reaction single axle muzzle brake with 68% efficiency, allowed to be attached to the muzzle with narrow joint gap.

To fulfil requirement **1/1/2** I designed structural elements that move (slide forwards and backwards) while shooting. In addition I designed *polyurethane* 80 Shore hardness string buffers to absorb collide energy, and a multilayer polifoam sheet attenuator attached to the shoulder pad of stock.

By these I fulfilled requirement **1/1**, because I ensured the recoil stated in requirement **1**.

To fulfil requirement **2/1** I designed a weapon construction that allows the barrel to rearward motion in own axis of bore with precision of allowance as long as the bullet leaves the critical ballistic zone that effects the behaviour of the bullet.

To fulfil requirement **2/1/1** I designed a weapon frame and an uniaxial bore (pipe in pipe), surrounded by the barrel recoil spring and the cylindrical buffer.

To fulfil requirement **2/1/2** I designed the connection between the barrel and the stock with the application of uniaxial pipes connected in lines, besides I applied a special size shoulder pad of stock which allowed the line of axis of bore to intersect the sniper touching part of the shoulder pad. Besides due to the backwards sliding of the barrel I designed the sliding of the shoulder pad into the stock-pipe according to the requirement **2/1/1**. I received a patent for my engineering solution of **2/1/1**, **2/1/2**.

By these I fulfilled requirement **2** because I designed the recoil springs with really low compressed energy values and spring constants, the sliding surfaces with with narrow joint gaps. Because of this during shooting the axis of bore can shift minimally from the spatial position defined while aiming.

To fulfil requirement **3/1/1** I designed a single shot weapon where I minimized the loading space to the optimal, by designing the bolt and the trigger mechanism as one, which has to be taken out of the rifle to load and empty. I received a patent for this engineering solution as well. I designed a weapon construction which length of ammo slot does not reach the length of the bullet which could be installed into the stock. This solution resulted the shortest weapon construction available besides a fixed 1100 mm barrel length.

With this I fulfilled the requirement **3/1** so effectively that comparing to the average 57% of the weapon construction utility degree η_{kf} of a conventional sniper rifle, the GEPÁRD M1 construction reached η_{kf} = 71%.

To fulfil the requirement **3/2** I designed a quasi „take-down" weapon construction, which can be dismounted in two after the turn of a stud bolt. The rear support leg of the rifle is also attached by a stud bolt to the weapon frame.

To fulfil the requirement **3/3** I designed the weapon with a bipod attached to the weapon frame. The front bipod is foldable to be portable and can be fixed in that position as well, the rear support leg's height is adjustable and can be taken out of the rifle to be portable in a weapon carry sack. By an adaptor fixed to the fitting place of the front bipod and the rear support leg the weapon can easily be attached to the

PKMSz machine gun tripod and to the DSK heavy machine gun tripod with the adaptors designed by me.

With this I fulfilled the requirement **3**.

I executed the development using the engineering solutions **1** – **3**, under the development protocol of Institute for Military Technology (IMT) between 1988 – 1991. During this period the following number of rifles were produced:

- 2 experimental samples;
- 3 samples;
- 23 „0" series pieces of GEPÁRD M1 sniper rifles,

which fulfilled the prescribed military technology checking examinations after the necessary transformations.

The GEPÁRD M1 sniper rifle was put into service on 7. November 1991. by the first deputy of the Hungarian Army Chief of Staff.

From the 123 produced pieces Hungarian Army (HA) has 97, the Special Service of Police has 5, 9 were exported, the rest can be found in museums or by collectors.

The GEPÁRD M1 sniper rifle has been and is being used the units of the HA during participating in missions in Croatia, Bosnia and Herzegovina, Iraq, Afghanistan, but has been used by Special Forces of Police during their domestic and international duties as well. 10 expositions have appeared in foreign professional papers about the rifle, it has been continuously featured in Jane's Infantry Weapons year books since 1993, and has been featured in numerous foreign handgun and sniper rifle books.

My scientific results

By results of measurement, by troop test examination and by application an engineering construction, I justified in practice that:

I. the GEPÁRD M1 sniper rifle construction mainly designed by me is mass produceable and usable under military circumstances.

II. the GEPÁRD M1 sniper rifle construction designed by me reduces the burden on the sniper so effectively that, the sniper accuracy within the barrel-bullet system can be maintained.

III. the GEPÁRD M1 sniper rifle construction designed by me minimizes the barrel bounce during shooting, so the barrel differs slightly from its spatial position defined while aiming.

IV. the GEPÁRD M1 sniper rifle construction designed by me ensures easy operation, portability and combat capabilities in any circumstances typical in special sniper environments

The GEPÁRD M1 sniper rifle's usage, its years in service, the opinion of its users justifies my recognition that by an engineering solution to minimize the burden on a sniper in order to reach high sniper capabilities is achievable.

Recommendations

To the further usage of my theoretical and practical results I recommend to consider the followings:

1) The materialized GEPÁRD M1 single shot sniper rifle's accuracy can be improved by the usage of purpose-built sniper „match" quality bullets (e.i..: the American Hornady Amax, or the Russian „Sznájperszkij"). The capability utility can be further improved by handheld laser distance measurers and meteorological instruments (ones with proper quality are available for the everyday users as well!). Or by the restart of the „Manual ballistic computer to the GEPÁRD M1 sniper rifle" IMT development project which was started in 1991 then undeservedly abandoned, or by the purchase of any other purpose-built instrument available for the everyday users. International examples show how the scope of usage can be extended by such improved capabilities. The question of tactical application should be rethought by competent professionals with the knowledge of the rifle's capabilities.

2) From my scientific results:

– the engineering solution I have designed (patent protected) is applicable by every sniper rifle's construction with high muzzle energy to improve accuracy;

– it is possible to design and create an improved GEPÁRD sniper rifle following XXI. century technology considering the principles and construction of GEPÁRD M1 rifle;

The utility degree (η_{kf}) and the specific energy generating capability (E_{kf}) or specific bullet muzzle ensuring ability ratios of the weapon construction I have designed are applicable for comparing all weapons with near the same muzzle energy.

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