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TRANSLATION

ENGLISH TITLE: CLASSES AND TYPES OF AUTOMATIC WEAPONS

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FOREIGN TITLE: KLASSI I TIPY AVTOMATICESKOGO ORUZHIIYA

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ABSTRACT:

There are four classes of automatic weapons, classified according to the manner in which they make use of propellant gas energy in operating the automatic mechanism for reloading.

The first class, featuring "blow back" bolts, uses recoil energy. The second class, consisting of gas operated weapons, uses propellant gas for reloading. The third class, characterized by "blow forward" barrel weapons, uses forward bolt energy. The fourth class is made up of assorted types in which reloading is based on several different methods. For example, in the Mauser system the bolt is unlocked by recoil of the entire weapon while the other parts in the reloading mechanism operate on the principle of bolt recoil.

→ The report describes this mechanism by each class.

KEY WORDS:

Small Arm Engineering

Weapon Firing Mechanism

Small Arm Weapon

Weapon Component

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Friedrick Engels in his work "History of the Rifle," wrote, "Not one conscientious soldier should be unaware of the principle of construction and method of operation of his weapon." These remarkable words stated in the year 1861 retain their meaning even now, when the soldier is equipped with automatic weapons.

Designers and gunsmiths from various countries have produced a large number of automatic weapons, machine guns (light, medium, heavy), pistols, automatic rifles and guns. However, all types of automatic weapons regardless of their differences have many similarities. Repeated attempts have been made to systematize these weapons. However, the only valid classification was worked out by the outstanding Soviet gunsmith V. G. Federov in 1931. Supplemented by scientist A. A. Blagonarov, this classification is the only one which is scientifically acknowledged. At its basis are methods of utilizing the energy of propellant gases for operation of the automatic mechanism. In this manner, the classes, groups and types of automatic weapons are distinguished (Figure 1).

The automatic weapons PPSH (Shpagin submachine gun), PPS (Sudayov submachine gun), Makarov pistol and Margolin sport pistol, familiar to our soldiers from the time of the Great Patriotic War, are all members of the first class—systems with blow-back bolts. A diagram of similar systems is given in Figure 2.

At first glance it seems astonishing: how is it possible to fire a weapon which has a bolt completely disconnected from the barrel and only held to it by a spring? As we know when firing propellant gas will act not only on the bullet but on the bolt as well, pushing it to the rear. This is what happens. This is the basis for the automatic action. As the bullet moves through the barrel the massive bolt, as a result of its weight and force exerted by the driving spring, withdraws no more than one and one-half to two and one-half millimeters. This is sufficient for the bolt to acquire the necessary inertia without leakage of gas to eject the spent cartridge case and move to the extreme rear position. The bolt is pushed forward by the driving spring. The bolt rams a round into the chamber and strikes the primer, and another round is fired. This is how the weapon fires automatically.

A weapon of this system is characterized by simple design, low cost of manufacture, convenient handling and rapid firing familiarization.

Why is it then that all weapons do not operate on this principle? The fact is that in such a case a very heavy bolt is required, which is only possible in weapons which fire low-power (pistol) rounds. For example, if an automatic rifle constructed on this principle were to fire the 1908 round (Translator's Note: 7.62x54 R), the entire bolt assembly for such a rifle would weigh more than two and one-half kilograms.

Figure 1. Diagram of Automatic Weapon Classification

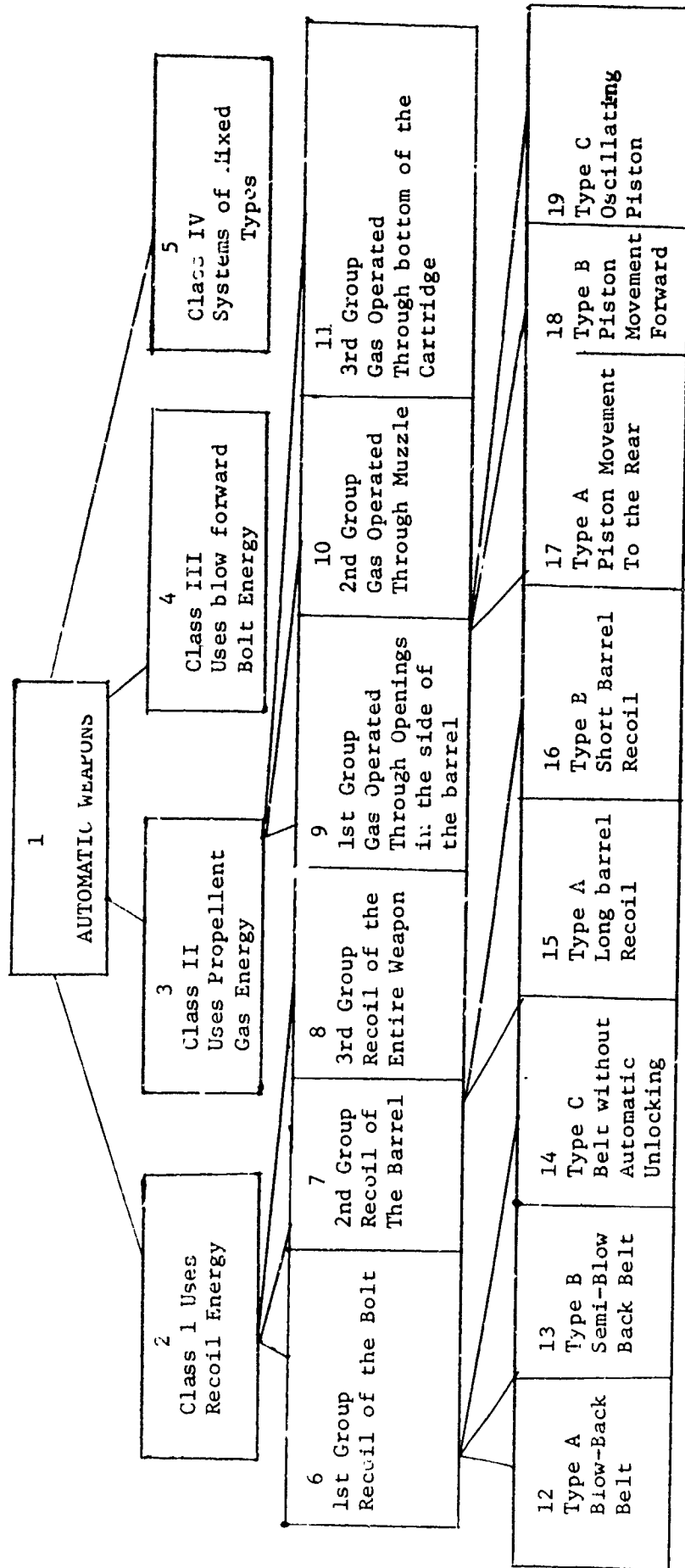




Рис. 2. Схема автоматического оружия со свободным затвором: 1 — возвратно-боевая пружина; 2 — затвор; 3 — гильза; 4 — ствол

Figure 2. Automatic weapon with a blow-back bolt.

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|-------------------|-----------|
| 1. driving spring | 2. bolt |
| 3. cartridge case | 4. barrel |

Another shortcoming of a blow-back bolt operated automatic weapon is the forceful impact of the moving parts when thrown to the extreme rear position. To reduce this impact, in a number of models (for example the German MP-40 automatic weapon) the so-called "out of battery firing" principle is employed, wherein the primer is struck and the propellant is ignited before the bolt reaches the extreme forward position. Part of the recoil energy is expended in braking of the moving part as it moves forward, reducing the recoil force of the bolt. However, systems of this type do not operate uniformly during continuous fire, since the rate of recoil depends on the rate of forward motion, and the latter varies from shot to shot.

Several designers have tried different methods to eliminate the shortcomings of blow-back automatic weapons. They have adapted hesitation locks and various devices to brake the bolt while the bullet is still inside the barrel. At the beginning of the 20th century the Russian gunsmith Ya. U. Roshchepoy designed an automatic rifle and demonstrated that a weapon based on this principle would not be reliable since the force of friction varies from shot to shot. Models produced at a later time confirmed this conclusion. Special felt washers were installed in the American Thompson submachine gun in order to lubricate the hesitation lock after every shot. Also an additional sear notch was installed on the bolt if by chance it does not reach the extreme rear position.

During the last war the author of this article and other Soviet soldiers had occasion to become familiar with the Thompson submachine gun.

Our soldiers were not impressed by the weight (more than 6 kilograms loaded), slow rate of fire, overly large caliber (11.43 millimeters) and other shortcomings. It in no way compared favorably with our PPSH. And as we know the Americans tried to supply us with Thompson submachine guns on a lend-lease basis. Presently they are selling this obsolete and deficient weapon to their allies in the aggressive block.

The first automatic weapon in the world was built by the Russian gunsmith V. G. Federov in 1916. The Russian Army during WWI was the first to have an automatic weapons company, and was armed with Federov automatic weapons. This weapon as well as the familiar model 1910 heavy machine gun (Maxim machine gun) and a number of other models used the recoil energy of the barrel.

The principle of operation of these systems is illustrated in figure 3.

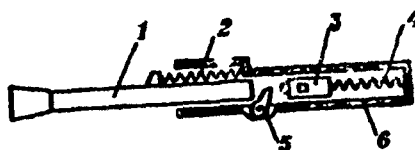


Рис 3. Схема автоматического оружия с коротким ходом ствола: 1 — ствол со ствольной коробкой; 2 — возвратная пружина ствола; 3 — затвор; 4 — возвратная пружина затвора; 5 — ускоритель; 6 — короб.

Figure 3. Automatic weapon with short barrel recoil.

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|-------------------------|-------------------------|
| 1. barrel with receiver | 2. barrel return spring |
| 3. bolt | 4. bolt driving spring |
| 5. accelerator | 6. receiver |

The bolt is firmly attached to the barrel. When fired the bolt and barrel move to the rear. After travelling a certain distance the bolt is separated and the barrel returns forward as a result of action of the barrel return spring. The bolt continues to move to the rear, ejects the cartridge case, and stops at the cocked position. When the barrel assumes the forward position, the bolt is automatically released from the cocked position. The cycle is repeated to constitute automatic fire.

Due to the good operational reliability, ease of cartridge case ejection, and low tendency to foul, short barrel recoil systems have received wide distribution. This system is employed in particular in the famous Soviet pistol Model 1933 (TT), American Colt, German Mauser, Walters, Parabellum and as well as in the Browning pistol which is in use in a number of countries.

A shortcoming of these systems is the complicated mechanism associated with the barrel movement, and the almost essential accelerators for bolt unlocking.

Models such as the Kalashnikov assault rifle, Degtyarev light machine gun, company machine gun, Goryunov medium machine gun, and DShK heavy machine gun make up the second class. The American rifle Garand M-1, the new M-14 rifle, and its M-15 (with heavy barrel) designed for standard NATO round also belong to the second class.

This class includes weapons which use propellant gases for reloading. The most widespread are weapons in which gases are brought out through a hole in the barrel. (Figure 4)



Рис. 4. Схема автоматического оружия с отводом пороховых газов: 1 — газовая камера; 2 — поршень; 3 — лоток; 4 — затворная рама; 5 — затвор; 6 — возвратная пружина.

Figure 4. Gas operated automatic weapon.

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|-----------------|-----------|-------------------|
| 1. gas cylinder | 2. piston | 3. piston shaft |
| 4. slide | 5. bolt | 6. driving spring |

Upon firing, as soon as the bullet passes the hole in the barrel, part of the propellant gas enters the gas cylinder causing the piston to push the slide and bolt to the rear. The slide and bolt do not immediately extract the cartridge case but only after travelling a certain distance. This is conducive to easy ejection of the cartridge case. Another advantage of this class is regulation of propellant gas. Thus at low temperatures when the moving parts are retarded by cold lubricant the amount of gas can be increased. This is also true for fouled weapons. Increasing or decreasing the gas is accomplished by rearrangement of the gas regulator which has openings (grooves) of variable section.

Gas operated weapons are characterized by high rate of fire and light moving parts. They are of a simpler design than weapons in which the barrel recoils. Their shortcomings are harsh automatic motion with associated lower firing accuracy, and obstruction of the gas cylinder, which requires frequent and thorough cleaning of the weapon.

It is characteristic that before the First World War preference was given to recoil barrel automatic weapons but presently gas operated weapons are more widely used.

The entire third class of automatic weapons, blow forward barrel systems, is represented by only one model (pistol).

The fourth class is composed of weapons of mixed types in which various reload operations are based on various methods. For example, in the Mauser system, the bolt is unlocked by the principle of recoil of the entire weapon, while the remaining mechanisms operate on the principle of bolt recoil.

Knowledge of the classification of automatic weapons is highly important. By studying armament materiel, soldiers of the Soviet Army become thoroughly acquainted with their method of operation. Thus they are not restricted to their own weapons and may take possession of those of their comrades. During the last war our soldiers quickly learned to skillfully use enemy weapons in combat.