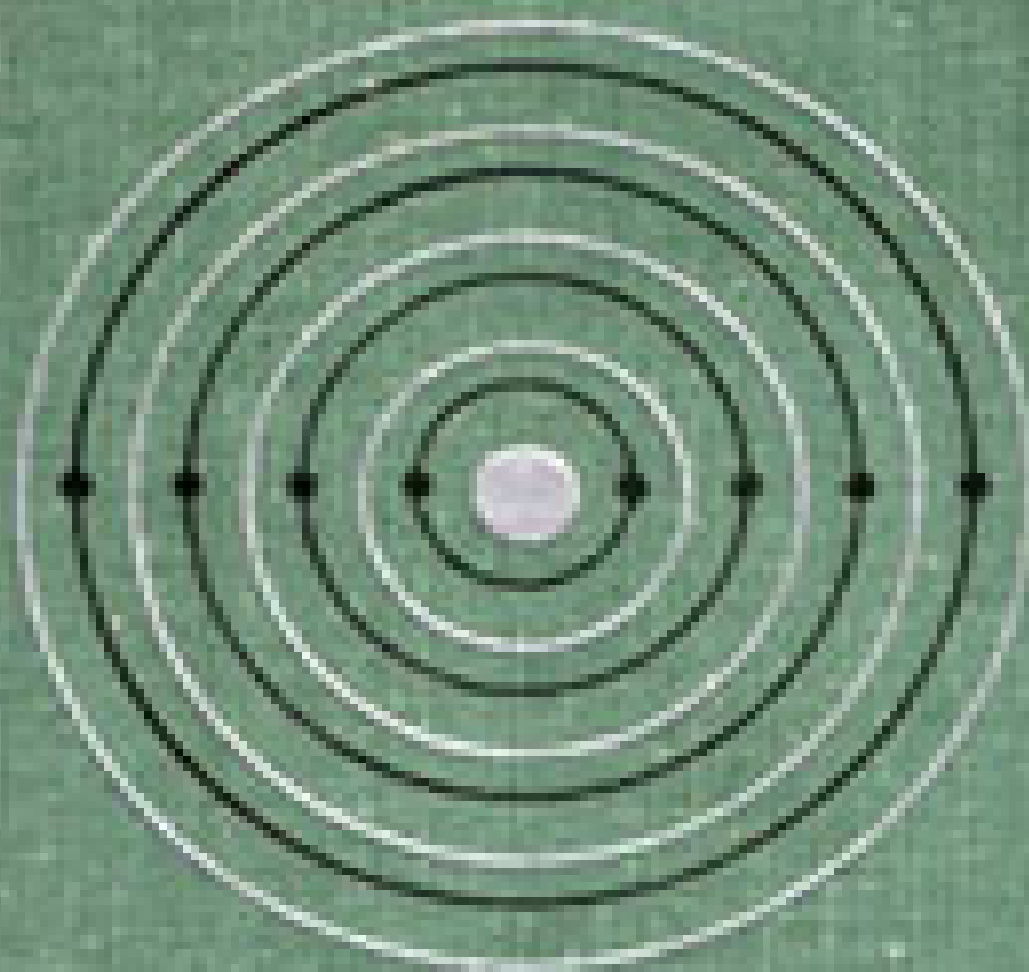


А.А.ЮРЬЕВ

ПУЛЕВАЯ СПОРТИВНАЯ СТРЕЛЬБА



Yuryev A.A. - "Competitive Shooting"



3rd edition, revised and supplemented

Translated from RU using Google Translate

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From the author

The level of sports results has increased so much in recent years that its further improvement is possible only under the condition of the all-round development of the athlete, deepening of his theoretical knowledge, organization of the educational and training process strictly on a scientific basis, corresponding to the modern provisions of the Soviet theory of physical education.

Therefore, in the book offered to the attention of readers, the author sought to reflect the modern level of technology and tactics of sport shooting from various types of weapons, as well as the experience accumulated over recent years in educational and training work, and thereby provide all possible assistance to shooters in their work to further improve their sports skills.

This book is the third edition, revised and supplemented. It is intended for shooters of senior sports categories, coaches and instructors of shooting sports. The book can be a useful manual for masters of sports, especially in terms of shooting technique and tactics of performing individual shooting exercises.

The first and second sections of the book are devoted to weapons, cartridges and ballistics. Assigning these issues the role of auxiliary material, the author introduces the design characteristics of the most common models of domestic weapons used in shooting sports, and brief data on cartridges. The book also contains material on internal and external ballistics, albeit in a small volume.

The third section - "Technique of Making an Accurate Shot" - is the main one in the book. Here, as much as possible, the issues concerning the shooting position, aiming, holding the breath and pulling the trigger are presented in detail. The author considered it necessary to acquaint the reader with the mechanism of the nervous processes in the shooter's body when making a shot.

The chapter "Preparation" includes some data on the human locomotor system and the statics of the human body with practical

conclusions for the shooter, which should help the athlete in finding and mastering the most advantageous posture options for himself.

The chapter "Aiming" contains information about the human eye and its work during aiming. A large place is devoted to the selection of sighting devices and shooting in unfavorable lighting conditions.

The chapter "Releasing the Trigger" along with material directly related to the technique of controlling the trigger, provides some information on the physiological and psychological processes occurring in the human body during the release of the trigger and the firing of a shot. Considerable space is given to the errors made by the shooter when releasing the trigger and measures to combat them.

The fourth section of the book is devoted to the issues of shooting technique and tactics when performing individual exercises. It covers in sufficient detail the important issues of the rate and rhythm of shooting, breaks between shots and series of shots, and the specifics of shooting in adverse weather conditions.

The fifth section includes material concerning the educational and training process and the shooter's performance at competitions. Despite the fact that this section has been significantly expanded in comparison with the two previous editions, the material should generally be considered auxiliary.

The main practical conclusions on shooting techniques and tactics, instructions and advice aimed at preventing mistakes made by the shooter during training and competitions are given on the basis of the experience accumulated by the best shooters and coaches of our country. They are also based on scientific research data.

The book's extensive illustrative material is not only a means of explaining the text, but in itself, in most cases, should serve as a subject of careful study.

Section I.

WEAPONS AND AMMUNITION

Chapter 1. Weapons information

The domestic industry provides sports shooters with a wide choice of various models of high-quality rifles and pistols. These models, differing from each other in various design and ballistic characteristics, at the same time have a standard shape and size within their model, which, of course, do not always correspond to the physical data and individual characteristics of a particular sportsman. Therefore, in each individual case, it is necessary, firstly, to choose the most suitable model of weapon for yourself, taking into account, say, its weight characteristics; secondly, to adjust the weapon and, thirdly, to debug it.

Adjustment and debugging of weapons, concerning the improvement of interaction of parts and mechanisms, production of new handles, etc., as well as their repair are usually carried out by gunsmiths, in workshops. However, since much here is connected with satisfaction of purely individual requests of the sportsman-shooter, his tastes, he must be able to do it independently. Moreover, it is necessary to constantly keep in mind that the rules of competitions impose very strict requirements on each type of weapon.

Taking these requirements into account, we provide material concerning rifles and pistols used for sporting purposes.

1.1.1 Classification and design characteristics of rifles

Rifles used in shooting sports are divided into four classes: service, free, small-caliber sport, and pneumatic.

Free rifles, in turn, are divided into three groups: small-caliber, large-caliber, rifles for shooting at targets "Running Deer" and "Running Boar".

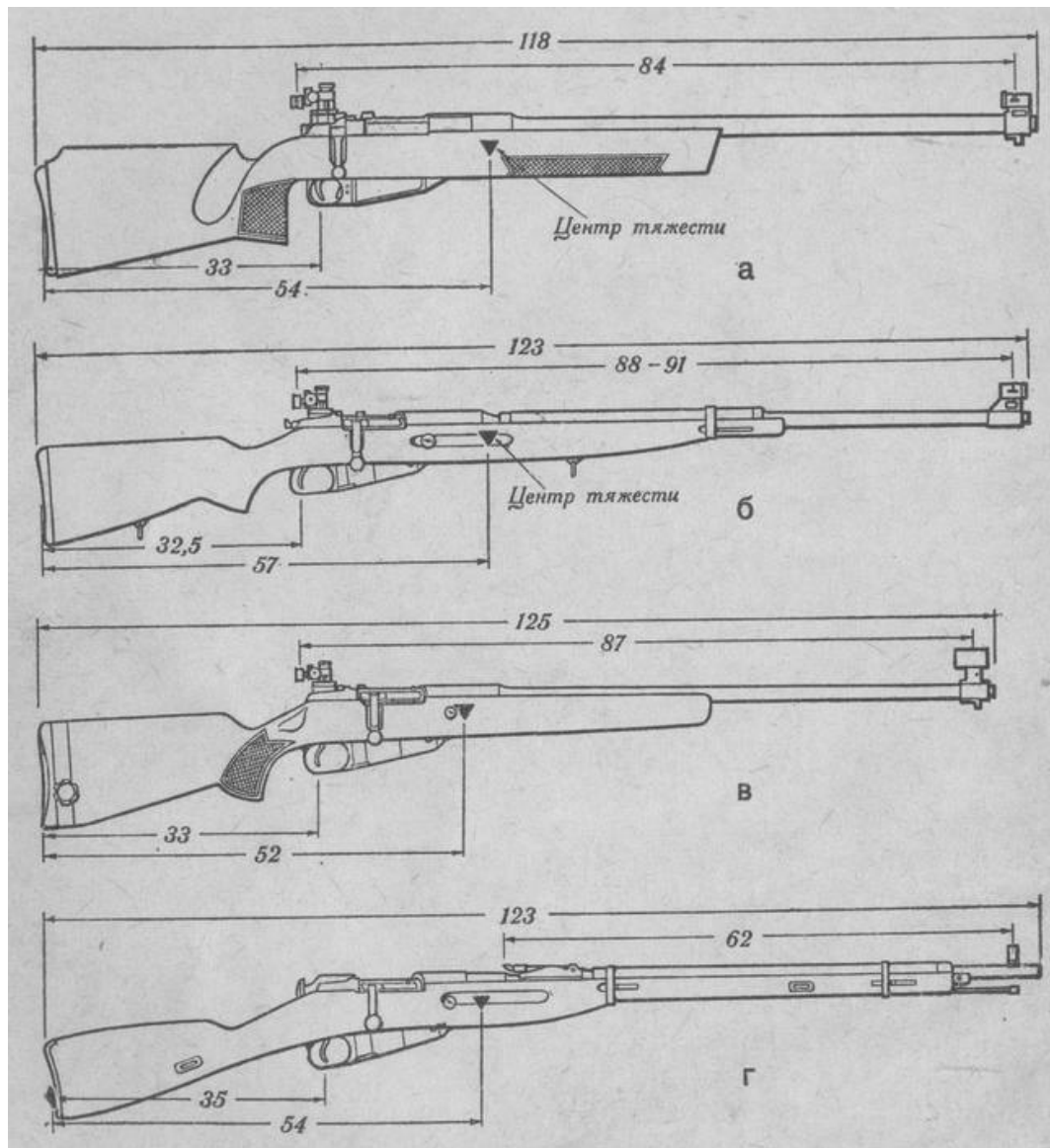


Fig. 1 - Service rifles:

a - standard AVL; b - standard AV; c - BI-7.62; d - model 1891/30 (dimensions in cm).

Large-caliber service rifles (Fig. 1). Caliber - up to 8 mm. Weight should not exceed 5 kg (without belt). Total length - no more than 125 cm. Trigger pull - no less than 1.5 kg. Only hemp front sight is allowed; sight - any, except optical.

The competition rules prohibit any changes to the rifle design, removal of any parts, or making additional devices. It is also prohibited to use a bayonet, a "champignon", balance weights, a trigger mechanism with an accelerator (setter), a hook on the buttstock, a movable buttstock, a hole in the stock for the thumb. At the same time, the latest competition rules allow the removal of the barrel pad.

The following exercises are performed with a service rifle: AB-1, AB-2 - shooting from a prone position at a distance of 100 m at target No. 4; AB-4, AB-5 - standards (shooting from three positions - prone, standing and kneeling) - at a distance of 100 m at target No. 4 and 300 m at target No. 3; AB-D ("duel shooting") - at a distance of 300 m at target No. 4-a edged (5 targets in two adjacent sectors).

When performing these exercises, it is allowed to use a carbine or an army rifle - with an open sight. Moreover, the belt can only be fastened with straps, without additional devices and screws.

Random rifles (Fig. 2-4). Caliber - 5.6-8.0 mm, and small-caliber - 5.6 mm for rimfire cartridge.

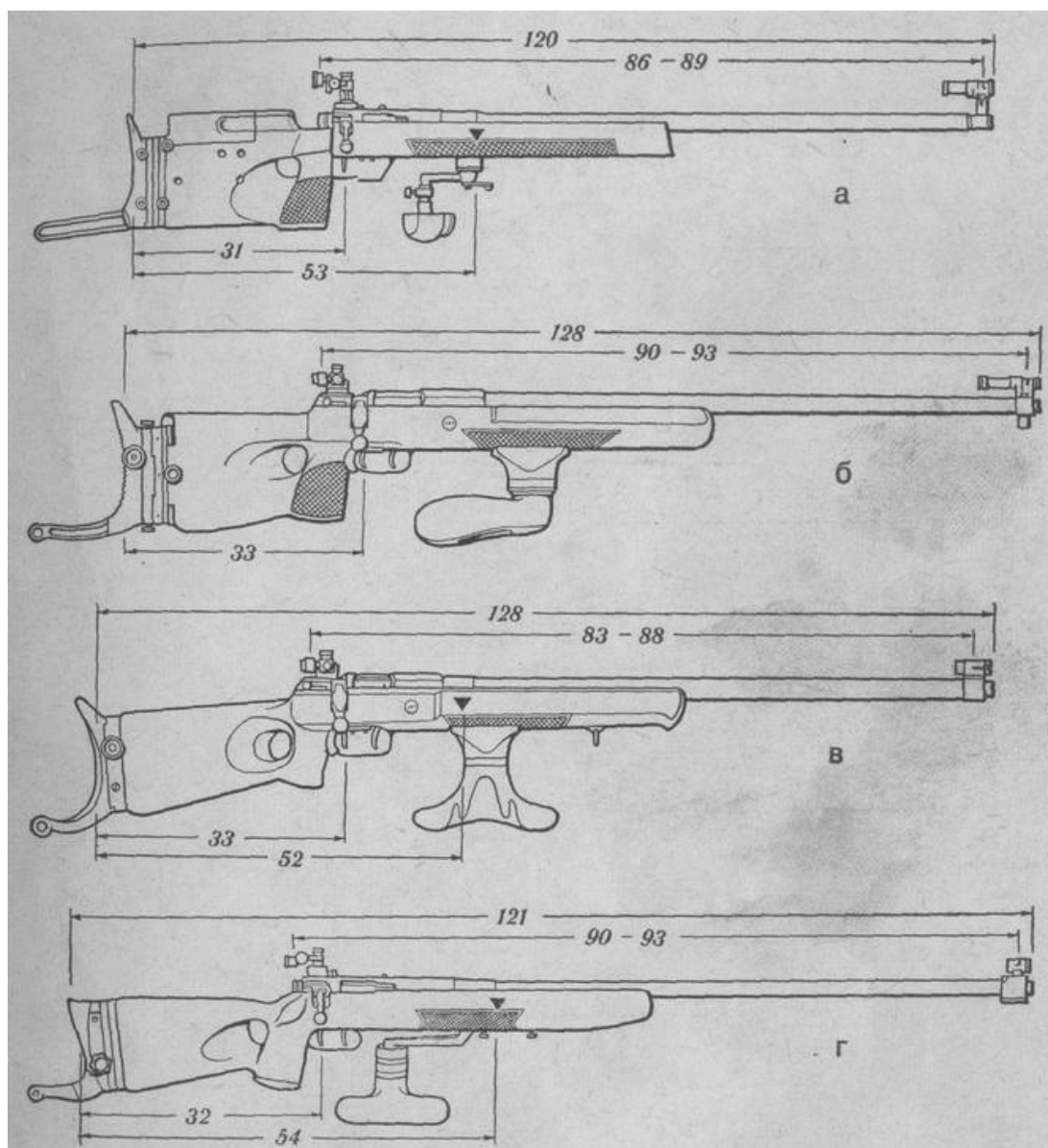


Fig. 2 - Arbitrary rifles, caliber 7.62 mm:

a - "Typhoon-1"; b - MC-13-2; c - MC-13; d - "Zenit-3".

Rifles of this class are intended for particularly precise sport shooting, therefore they are distinguished by more careful manufacture of barrels, very good accuracy and stability of fire. Free rifles have a comparatively greater weight (up to 8 kg). As a rule, they are equipped with trigger mechanisms with an accelerator (setter), diopter sights, distinguished by high accuracy of corrections, replaceable front sights, different in width and configuration; flat colored glass (light filters) can be used in sighting devices. The shape of the neck of the stock is pistol-shaped, often with a hole for the thumb of the right hand, which creates maximum convenience for the shooter; the fore-end of the rifle is thickened, with a sliding sling swivel. For convenience when preparing for shooting, rifles are equipped with a sliding butt with a hook and a removable hand rest for shooting while standing - a "champignon".

Free rifles are usually single-shot (except for rifles designed for shooting at the Running Deer target, which are equipped with a magazine).

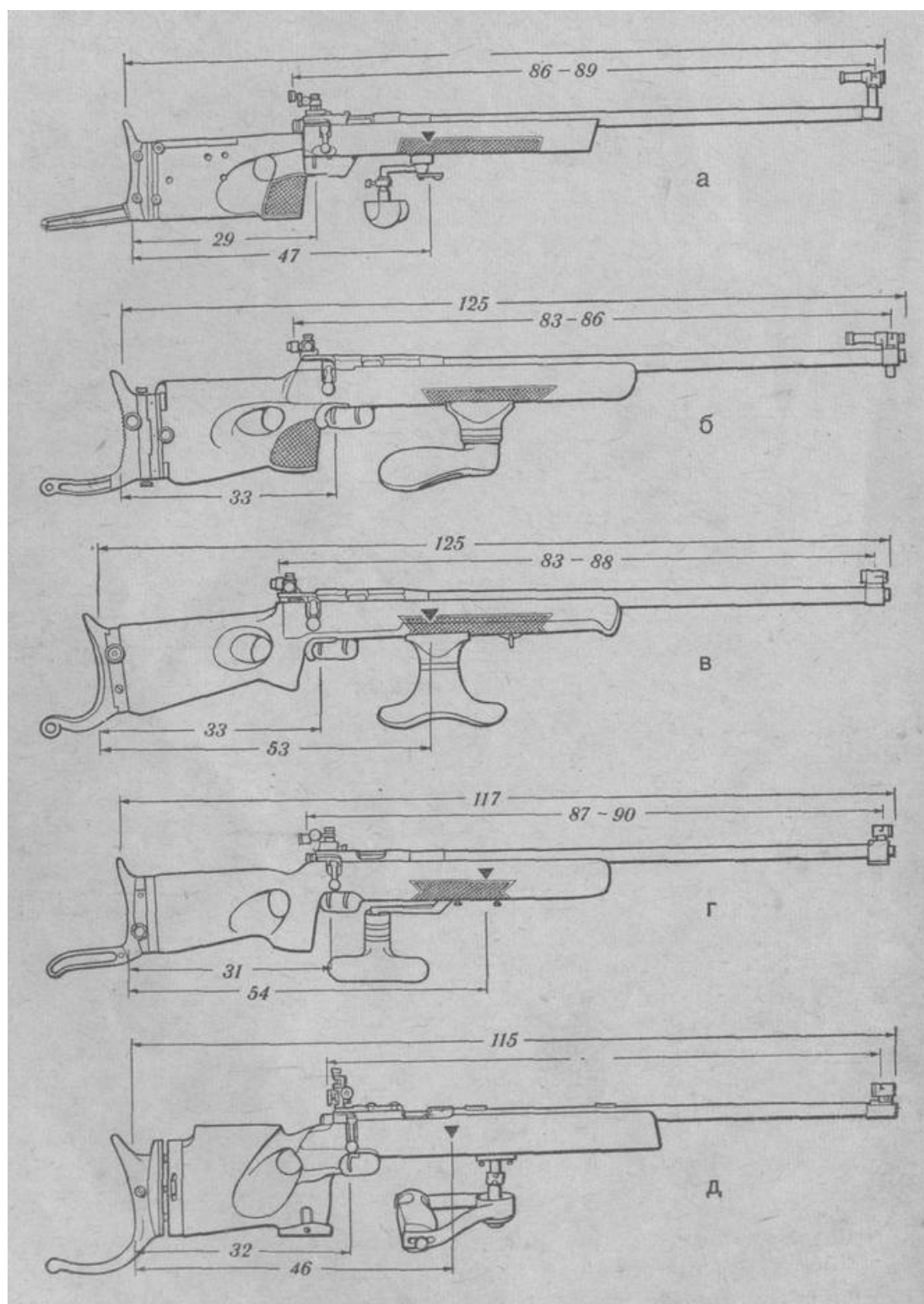


Fig. 3 - Arbitrary rifles, caliber 5.6 mm:

a - "Typhoon-3"; б - MC-12-3; в - MC-12; г - "Strela-3"; д - Anschütz, model 1413 (FRG).

According to the competition conditions, it is not permitted to: increase the weight of free rifles with a hook and "champignon" over 8 kg (without a belt); use a specially shaped stock that creates support on the left side of the chest; increase the "champignon" so that its lower surface is removed from the upper part of the barrel by more than 20 cm.

Any rifles for shooting at the Running Deer and Running Boar targets. The caliber for shooting at the Running Deer target is up to 8 mm, for the Running Boar target - 5.6 mm. Weight - no more than 5 kg (with a sight, without a sling). The trigger pull on rifles intended for shooting at the Running Deer must be at least 1 kg, for shooting at the Running Boar - at least 0.5 kg. Any sight can be installed on these rifles. When shooting at the Running Boar, only 5.6 mm rimfire cartridges are allowed.

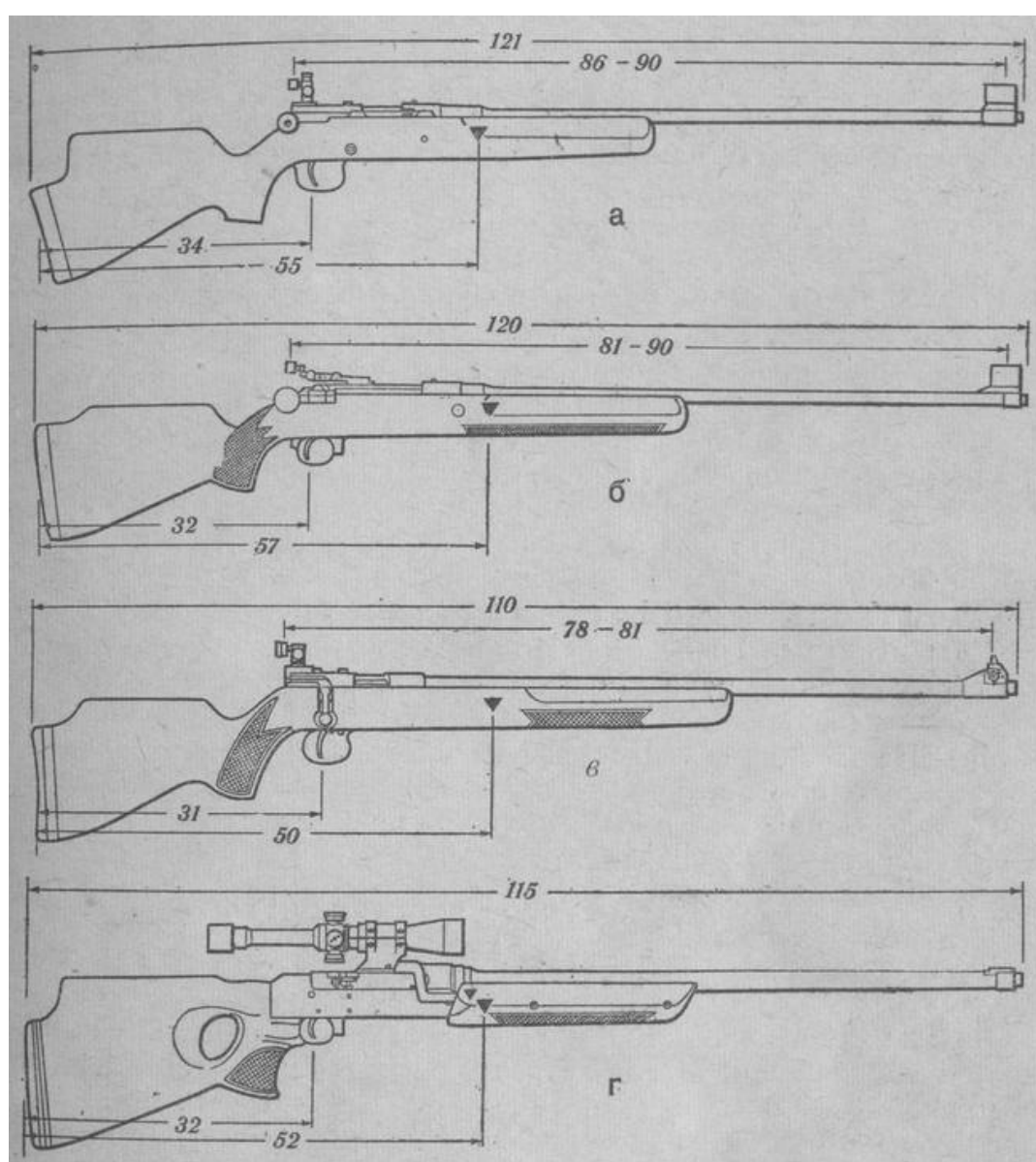


Fig. 4 - Arbitrary rifles for shooting at the "Running Deer" and "Running Boar" targets, caliber 5.6 mm:

a - MBO-1M; b - MC-80-1; c - BK-2; d - MC-81-5.

The use of a self-loading rifle and a "champignon" is prohibited here.

The following exercises are performed from small-bore (5.6 mm) free rifles: MV-3 - shooting from a prone position at a distance of 50 m at target No. 7 and 100 m at target No. 4; MV-4, MV-5, MV-6 - standards (shooting from three positions - prone, standing and kneeling) at a distance of 50 m at target No. 7; MV-8, MV-9 - shooting from a prone position at a distance of 50 m at target No. 7.

From large-caliber (up to 8.0 mm) free rifles, exercises PV-5 and PV-6 are performed - standards (shooting from three positions - lying down, standing and kneeling) at a distance of 300 m at target No. 3.

From multi-shot free rifles designed for shooting at the "Running Deer" target, exercises PV-1, PV-2, PV-3, PV-4 are performed - shooting at a distance of 100 m with single and double shots.

From small-caliber free rifles designed for shooting at the "Running Boar" target, exercises MV-10, MV-11, MV-12 are performed - shooting at a distance of 50 m with a time of 5 seconds per shot (with a slow running "boar") and 2.5 seconds (with a fast running).

Small-bore sport rifles (Fig. 5). Caliber - 5.6 mm. They are used in competitions, as well as in sport and training shooting during initial training. Sport rifles have a relatively small weight - no more than 5 kg (without a belt). They are equipped with conventional trigger mechanisms, the trigger pull is arbitrary. Any sight can be installed, except for an optical one. The length of the sight is allowed up to 5 cm, its diameter - up to 2.5 cm, the distance from the center of the sight to the axis of the barrel bore - no more than 4 cm.

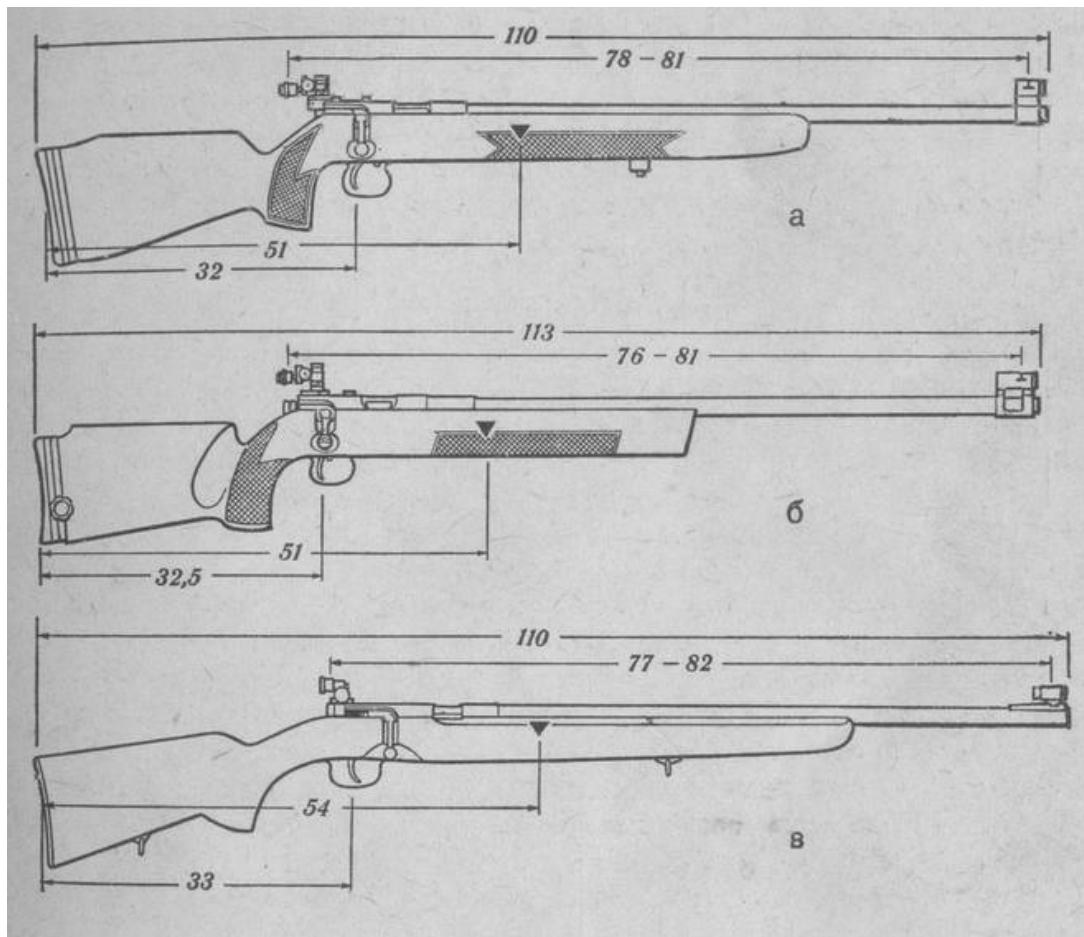


Fig. 5 - Sporting rifles, cal. 5.6 mm:

a - SM-2; b - "Ural"; c - TOZ-12.

Individual adjustment of the stock, height and length of the buttstock is allowed, but in strict accordance with the competition rules. Thus, the maximum permissible dimensions of the stock: fore-end - 6 * 6 cm; the distance from the axis of the barrel bore to the lowest point of the fore-end in front of the bracket - 8 cm, to the lowest point of the pistol grip - 13 cm, to the lowest point of the buttstock - 18 cm, to the most distant point on the side of the buttstock from the vertical plane passing through the axis of the barrel bore - 4 cm; the height of the buttstock butt - 15 cm, the depth of the notch on the buttstock butt - up to 2 cm, the maximum movement of the buttstock butt in both directions is 3 cm.

The competition rules prohibit: installing a hook on the buttstock, using a "champignon", moving the front sight and sight to the side, making a rest for the thumb or a hole for it in the stock, using balance weights and installing a trigger mechanism with an accelerator (setter).

The following exercises are performed with sport rifles: MV-1 and MV-2 - shooting from a prone position at a distance of 25 m at target No. 6 and 50 m at target No. 7; MV-5 and MV-7 - standards (shooting from three positions - prone, standing and kneeling) at a distance of 25 m at target No. 6 and 50 m at target No. 7.

Pneumatic rifles (Fig. 6). Caliber - 4.5 mm. Since 1966, shooting from pneumatic weapons has been included in the programs of world and European championships. The ever-increasing popularity of this type of sport shooting both in our country and abroad is due to the fact that with low economic costs, training can be carried out in any room, since the equipment of the target installation does not require special expensive devices.

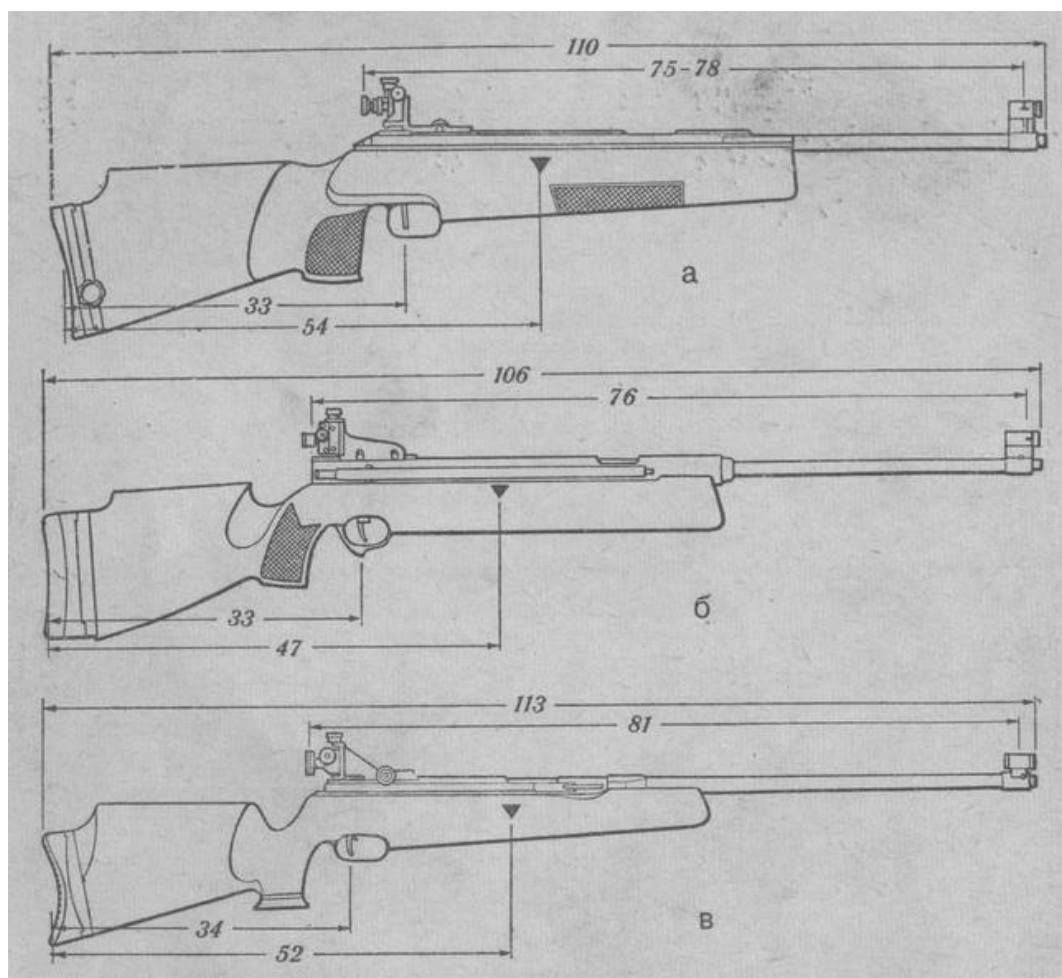


Fig. 6 - Air rifles, cal. 4.5 mm:

a - PV; b - model 3.121 (GDR); c - Feinwerkbau, model 300 (FRG)

The competition rules impose the same requirements on air rifles as on sport rifles.

The exercises VP-1, VP-2, VP-3, VP-4 and VP-5 are performed with air rifles - shooting standing and kneeling at a distance of 100 m at target No. 8.

With all the abundance of rifle models and types, shooters prefer several of the most successful models. The main design characteristics of the most widespread models in shooting practice are given in Table 1.

Main design characteristics of rifles

Table 1

Weapon class	Model	Caliber, mm	Weight, kg	Rifle length, mm	Barrel length, mm	Sighting line length, mm	Trigger type	Trigger pull, kg
Service	Standard AVL rifle	7.62	No more than 5.0	1180		840-870	Ordinary	Not less than 1.5
	Standard AB rifle	7.62	5.0	1230	730	880-910	Ordinary	Not less than 1.5
	BI-7.62	7.62	4.5	1250	730	875	Ordinary	Not less than 1.5
	Army model 1891/30	7.62	4.0	1230	730	616	Ordinary	Not less than 1.5
Arbitrary	MC-13-2	7.62	No more than 8.0		760	900-930	Schnellern.	Unlimited
	MC-13	7.62	No more than 8.0	1285	760	830-880	Schnellern.	Unlimited
	"Zenit-3"	7.62	No more than 8.0	1375	760	900-930	Schnellern.	Unlimited
	"Typhoon-1"	7.62	No more than 8.0	1315	760	890-930	Schnellern.	Unlimited
	"Zenit-4"	6.5	No more than 8.0	1375	760	900-930	Schnellern.	Unlimited
	"Typhoon-2"	6.5	No more than 8.0	1315	760	890-930	Schnellern.	Unlimited
	MC-12-3	5.6	6.5	1250	750	830-860	Schnellern.	Unlimited
	MC-12	5.6	6.5	1250	750	830-860	Schnellern.	Unlimited

	"Strela-3"	5.6	No more than 8.0	1350	760	870-900	Schnellern.	Unlimited
	"Taiga-2"	5.6	6.0	1350	680	870-900	Schnellern.	Unlimited
	"Taiga"	5.6	6.0	1100	680	775-805	Schnellern.	Unlimited
	"Typhoon-3"	5.6	No more than 8.0	1375	760	865-910	Schnellern.	Unlimited
	An-schütz, model 1413 (FRG)	5.6	7.0	1150	690		Ordinary	Unlimited
	MC-81-5	5.6	4.5	1150	730		Trigger	Not less than 1.0
	MC-80-1	5.6	4.5		715	810-900	Ordinary	Not less than 1.0
	MBO-1M "Vostok"	5.6	4.5	1206	730	860-900	Trigger	Not less than 1.0
	BK-2	5.6	4.5	1100	680	780-810	Ordinary	Not less than 1.0
Sports	TOZ-12	5.6	3.5	1100	640	750	Ordinary	Unlimited
	SM-2	5.6	No more than 5.0	1100	680	780-810	Ordinary	Unlimited
	"Ural"	5.6	No more than 5.0	1135	680	760-810	Ordinary	Unlimited
	An-schütz	5.6	No more than 5.0					
Pneumatic	PV	4.5	No more than 5.0	1080-1100	460	750-780	Ordinary	Unlimited

Model 3.121 (GDR)	4.5	No more than 5.0	1060	416	760-790	Ordinary	Un-limited
Fein-werk-bau, model 300 (FRG)	4.5	4.5	1085	455	810-840	Ordinary	Un-limited

1.1.2 Classification and design characteristics of pistols (revolvers)

Pistols (revolvers) used in shooting sports are divided into four classes: large-caliber service pistols, small-caliber free pistols, small-caliber sport (standard) pistols for long cartridges, and pneumatic pistols.

Large-caliber service revolver pistols (Fig. 7). Caliber - 7.62-9.65 mm. Competition rules impose the most stringent requirements on them with regard to design changes, as well as the use of devices that facilitate shooting. For sport shooting, it is permitted to use pistols (revolvers) with a barrel length of no more than 15.3 cm, a trigger pull of at least 1.36 kg, and a sighting line length of no more than 22 cm.

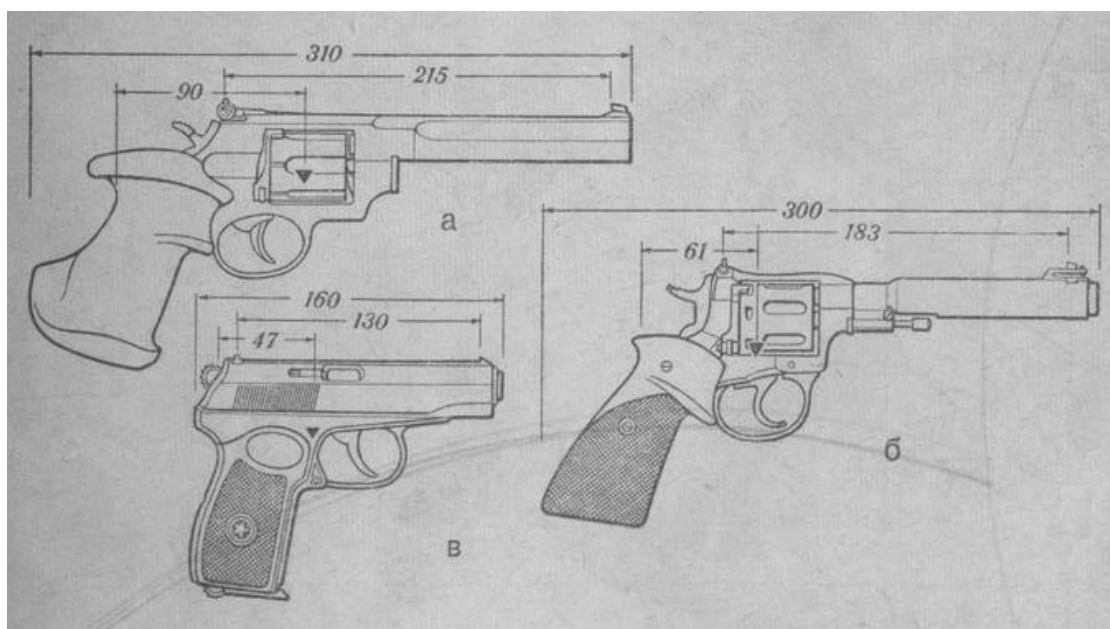


Fig. 7 - Large-caliber revolver pistols, cal. 7.62-9.65 mm:

a - TOZ-36 revolver; b - pre-fired revolver; c - Makarov pistol (PM).

It is allowed to use a special handle, but its width should not exceed 50 mm. In this case, it is possible to make a handle with different thickness of cheeks; use a "mushroom"; make a protrusion on the back of the frame or handle, but not more than 30 mm.

Only open sights are permitted on revolver pistols of this class. The latest competition rules allow for the installation of "click" mechanisms on the sights, allowing the rear sight or front sight to be moved without the aid of a tool. However, it is prohibited to extend the front sight beyond the muzzle and the rear sight beyond the rear upper edge of the frame.

The following exercises are performed from large-caliber service revolver pistols: RP-1, RP-2, RP-3, RP-4, RP-5 - slow shooting at a distance of 25 and 50 m at a target with a black circle (No. 4) and accelerated shooting at a distance of 25 m at a silhouette (target No. 1).

Free small-caliber pistols (Fig. 8). Caliber - 5.6 mm. Pistols of this class are intended for particularly accurate sport shooting. The rules of the competition provide for the least number of restrictions regarding their design changes.

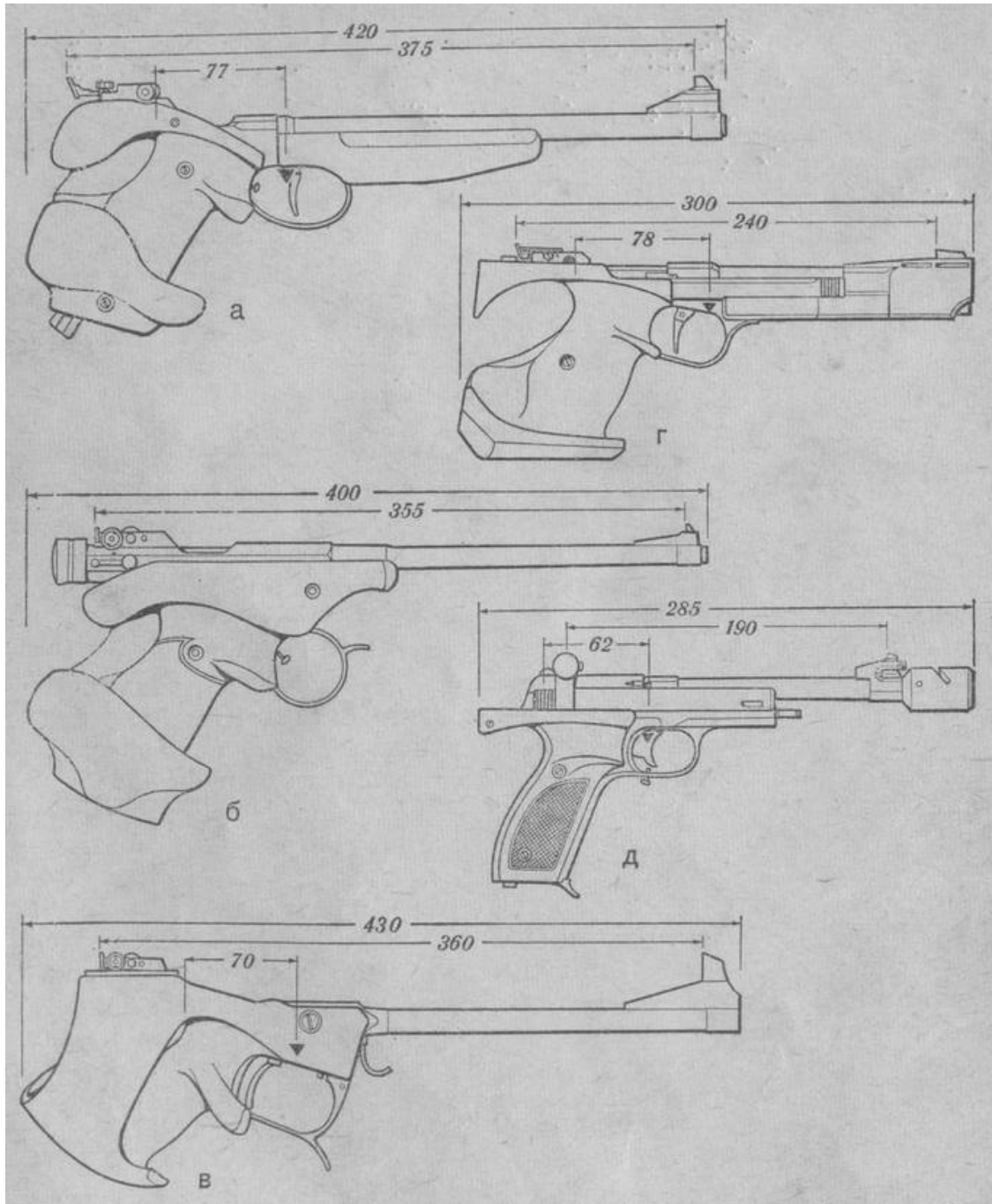


Fig. 8 - Random pistols, caliber 5.6 mm:

Single-shot (match): a - TOZ-35; б - MC-2-3; в - MC-55-1. Self-loading: г - IZH HR-31; д - MCU.

Arbitrary single-shot (match) pistols (Fig. 8 a, б, в). Caliber - 5.6 mm. Slow-fire pistols of any weight, any length and with any trigger tension are used. In the overwhelming majority of cases, they are equipped with a trigger mechanism with an accelerator (setter). It is allowed to install any sights, except for optical ones; flat colored glass (light filters) can be used in sighting devices. It is allowed to use orthopedic grips on pistols of this class, however, with certain restrictions: the weapon must be separated from the hand without preliminary release of any devices; in addition, the grip must only touch the hand when the hand with the pistol is raised to the firing position.

Free self-loading pistols (Fig. 8, g, d). Caliber - 5.6 mm. These pistols, intended for rapid shooting at silhouettes, have the following restrictions: the pistol with weights must weigh no more than 1.2 kg; the vertical distance from the top of the front sight to the trigger guard - no more than 40 mm together with weights and other accessories. The competition rules also provide for certain restrictions regarding the dimensions of the pistol: with accessories (weights, compensator and grip) it must fit in a case with internal dimensions of no more than 300 * 150 * 50 mm (an increase of one of the three dimensions by 5% is allowed).

Exercises MP-3 and MP-6 are performed from free single-shot (match) pistols - slow shooting at a distance of 50 m at target No. 4.

Exercises MP-7 and MP-8 are performed from free multi-shot pistols - rapid shooting at a distance of 25 m at silhouettes (targets No. 1).

Sport (standard) small-caliber pistols for a long cartridge (Fig. 9). Caliber - 5.6 mm. Pistols of this class are used in competitions, as well as in training sessions during initial training. They are subject to many of the same strict requirements as service revolver pistols: barrel length - no more than 15.3 cm; pistol weight - no more than 1.36 kg; trigger pull - no less than 1 kg; sighting line length - no more than 22 cm. Grip width - no more than 50 mm. Different thicknesses of the "cheeks", the use of a "mushroom", a protrusion on the rear part of the frame or grip are allowed, but no more than 30 mm.

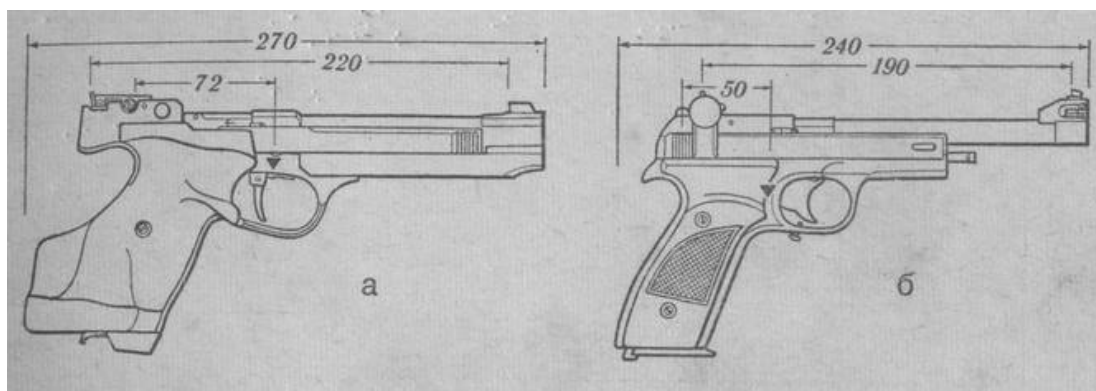


Fig. 9 - Sporting (standard) pistols for long cartridges, cal. 5.6 mm:

a - IZH HR-30; b - Margolin pistol.

The sight is open; a click mechanism can be installed on it. The pistol with all the accessories must fit into a case with internal dimensions of 300*150*50 mm.

The competition rules prohibit the use of a muzzle brake (compensator), placing the front sight beyond the muzzle of the barrel and the rear sight beyond the rear upper edge of the frame, placing weights below 40 mm from the top of the front sight, and using light filters.

From sport (standard) small-caliber pistols for long cartridges, exercises MP-1, MP-2 MP-4, MP-5, MP-9, MP-10 are performed - slow shooting at a target with a black circle at a distance of 25 m at target No. 4, accelerated shooting at a sil-

houette at a distance of 25 m at target No. 1, slow and accelerated shooting at a distance of 25 m at target No. 4.

Pneumatic pistols (Fig. 10). Caliber - 4.5 mm. Pistol weight - no more than 1.5 kg (including gas cylinder); trigger pull - no less than 0.5 kg. There are also restrictions on dimensions - the pistol must fit into a case with internal dimensions of 420 * 200 * 50 mm. It is allowed to use any sight, except for an optical one.

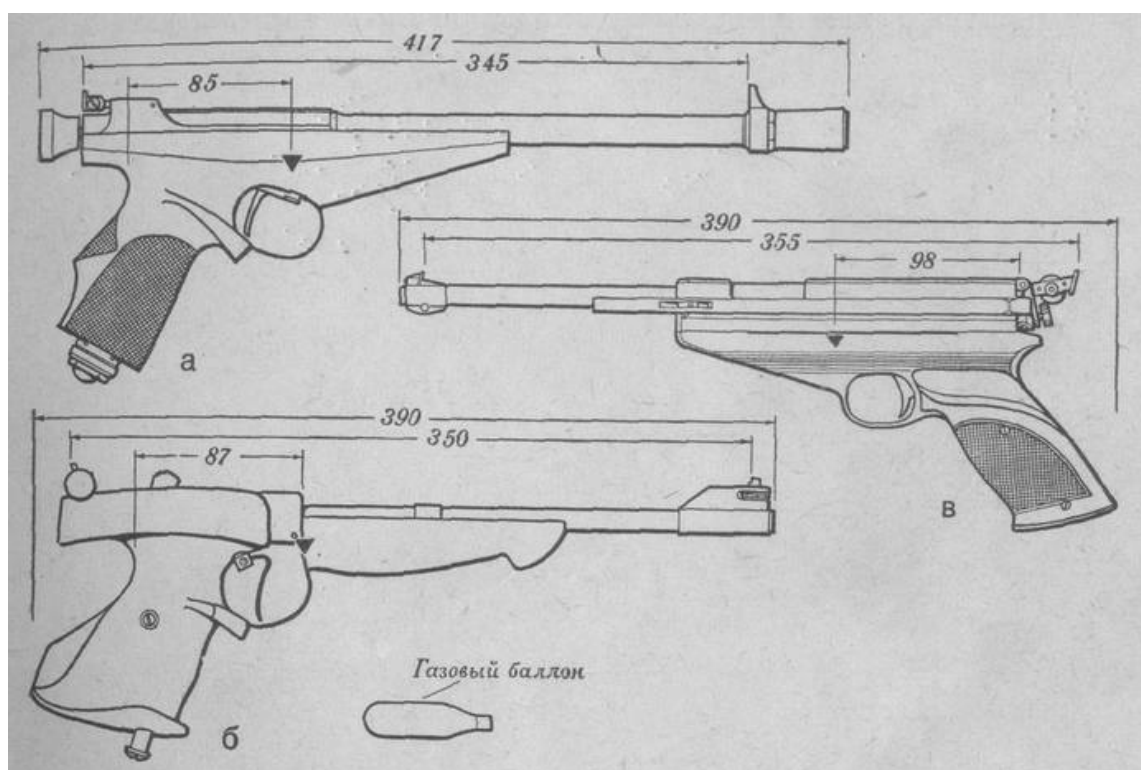


Fig. 10 - Pneumatic pistols, cal. 4.5 mm:

a - MC-50-2; b - Solovyov gas-cylinder pistol (GPS); c - Feinwerkbau, model 65 (FRG).

Exercises PP-1, PP-2, PP-3 are performed with pneumatic pistols - shooting at a distance of 10 m at target No. 9.

The main design characteristics of revolver pistols used in sport shooting are given in Table 2.

Basic design characteristics of pistols (revolvers)

Table 2

Weapon class	Model	Caliber, mm	Weight, kg	Weapon length, mm	Barrel length, mm	Sighting line length, mm	Trigger type	Trigger pull, kg	Power supply type

Service (military)	Makarov pistol (PM)	9.0	0.73	160	93	130	Ordinary	1.36	8- round maga- zine
	Revolver TOZ-36	7.62	1,2	310	150	215	Ordinary	Not less than 1.0	6- round drum
	Revolver with a bar- rel	7.62	1.05	300	140	183	Ordinary		7- round drum
Arbitrary	Pistol MC- 2-3	5.6	1.5		270	355	Schnellern.	Un- lim- ited	Single shot
	Pistol MC- 2	5.6	1.35	400	290	355	Schnellern.	Un- lim- ited	Single shot
	Pistol IZH- 1	5.6	1,2	435	280	400	Schnellern.	Un- lim- ited	Single shot
	TOZ-35 pistol	5.6	1.3	420	300	370	Schnellern.	Un- lim- ited	Single shot
	Pistol MC- 55-1	5.6	1.0		280	370		Un- lim- ited	Single shot
	Pistol IZH HR-31	5.6	1,2	300	135	240	Ordinary	Un- lim- ited	10 round maga- zine
Sports (stan- dard)	Pistol MC- 1	5.6	1,2	285	160	276	Ordinary	Un- lim- ited	10 round maga- zine
	Pistol IZH HR-30	5.6	1,2	270	152	220	Ordinary	Not less than 1.0	10 round maga- zine
	Margolin's pistol	5.6	1.0	240	150	190	Ordinary	Not less than 1.0	10 round maga- zine
Pneu- matic	Pistol MC- 50-2	4.5	0.8	417		345	Ordinary	Not less than 0.5	Single shot
	Solovyov's gas-cylin-	4.5	1,1	390	290	350	Ordinary	Not less	Single shot

	der pistol (GPS)							than 0.5	
	Feinwerk- bau pistol, model 65 (FRG)	4.5		390		355	Ordinary		Single shot

In addition to the listed accessories attached to the weapon, the competition rules allow the sportsman-shooter to use a gun sling no more than 4 cm wide, a fore-end pad for a free rifle, an overlay cheek on the upper comb of the butt when shooting from a service rifle with an optical sight and from a free rifle, removable weights on free and sport weapons (except for sport and air rifles), a compensator (muzzle brake) of any design on a free pistol.

1.1.3 Sighting devices

Sights of various types are installed on small arms depending on their purpose. Despite the abundance of systems, they are all divided into three types: open, dioptric and optical. Each of these types has its own advantages and disadvantages and is good only for certain types of shooting.

Sights for rifles

When shooting from a rifle, all three types of sights are used.

Open sights are those (Fig. 11) in which the front sight and a semicircular or rectangular slit on the sighting bar are used for aiming.

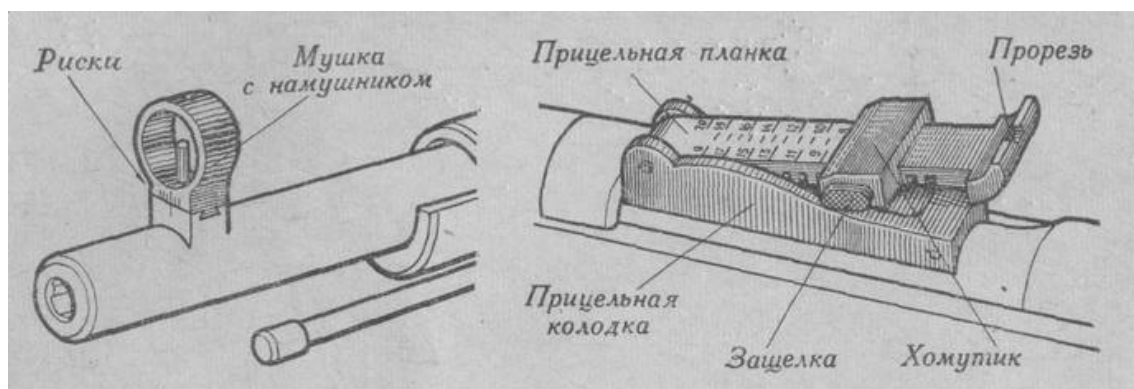


Fig. 11 - Open sight of a service rifle

Experience shows that for most shooters with normal vision, the most convenient sight is a sight with a semicircular slit with a rectangular front sight. Such a sight is installed, for example, on the small-caliber rifles TOZ-8 and TOZ-9.

Dioptric sights are those in which a plate (rear sight) with a small round hole (diopter) serves for aiming, which is intended for the same purpose as the slot in

an open sight. The front sights on weapons with such a sight are rectangular or ring-shaped.

Dioptric sights installed on domestic rifles are shown in Fig. 12.

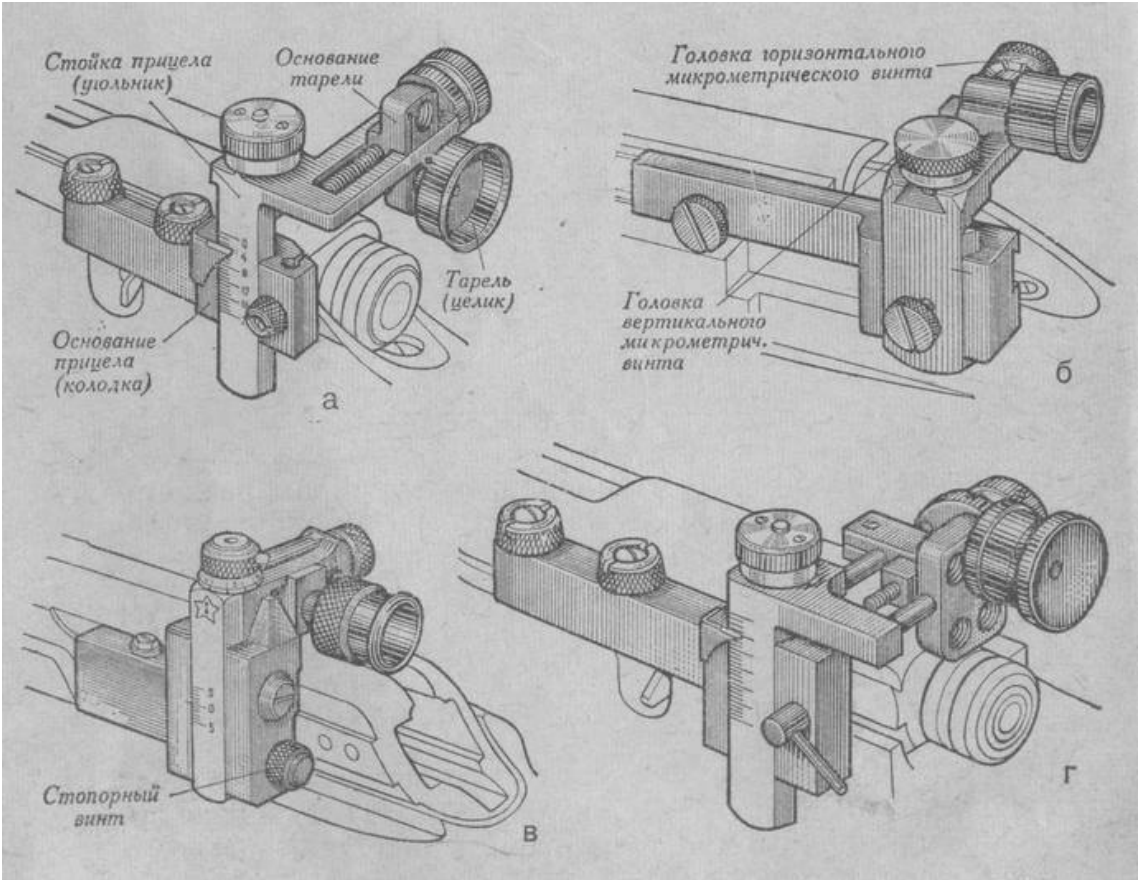


Fig. 12 - Types of diopter sights installed on domestic rifles:
a - "Ural"; b - TOZ-12; c - MC-13; d - "Typhoon".

The plate with the diopter hole moves vertically and horizontally by rotating the micrometer screws. The heads of these screws do not rotate smoothly, but rather in jumps, or, as shooters say, in clicks, thanks to special locks. As a rule, they have the same thread pitch, due to which the value of one click is the same for both vertical and horizontal corrections.

Table 3 shows the correction value per click for various diopter sight systems.

The average point of impact shift when shooting from rifles with a diopter sight from the correction by one click, mm

Table 3

Weapon model	Sighting system	Firing range, m

		10	50	300
Standard AVL rifle	Factory model			15
AB	Factory model			15
BI-7.62	Factory model			15
MC-13-2	Factory model			15
MC-13	Factory model			15
"Zenit-3"	Factory model			15
"Typhoon-1"	Factory model			15
"Zenit-4"	Factory model			15
"Typhoon-2"	Factory model			15
MC-12-3	Factory model		2.5	
MC-12	Factory model		2.5	
"Taiga-2"	Factory model		2.5	
"Taiga"	Factory model		2.5	
"Typhoon-3"	Factory model		2.5	
Anschütz	Factory model		2.5	
SM-2	Factory model		2.5	

"Ural"	Factory model		2.5	
TOZ-12	DI		4.0	
TOZ-8 (TOZ-9)	"DOSAAF-M-1"		4.5	
TOZ-8 (TOZ-9)	"Sniper"		7.0	
TOZ-8 (TOZ-9)	"Fighter"		6.5	
TOZ-8 (TOZ-9)	"Solovyova"		5.0	
PV		1.0		
Model 3.121 (GDR)		0.5		
Feinwerkbau, mod. 300 (Germany)		0.5		

Optical sights are those consisting of a system of lenses in a metal frame (housing), in which sighting threads are used for aiming instead of a front sight.

The rifles for shooting at the "Running Deer" and "Running Boar" targets are usually equipped with optical sights: TO-4, which has a fourfold magnification, TO-6 - sixfold and TO-6P - with a variable magnification from one and a half to six (Fig. 13). Nowadays, among leading sportsmen, redesigned optical sights are widely used - with two sighting stumps (two stumps), separately moving additionally installed flywheels (drums).

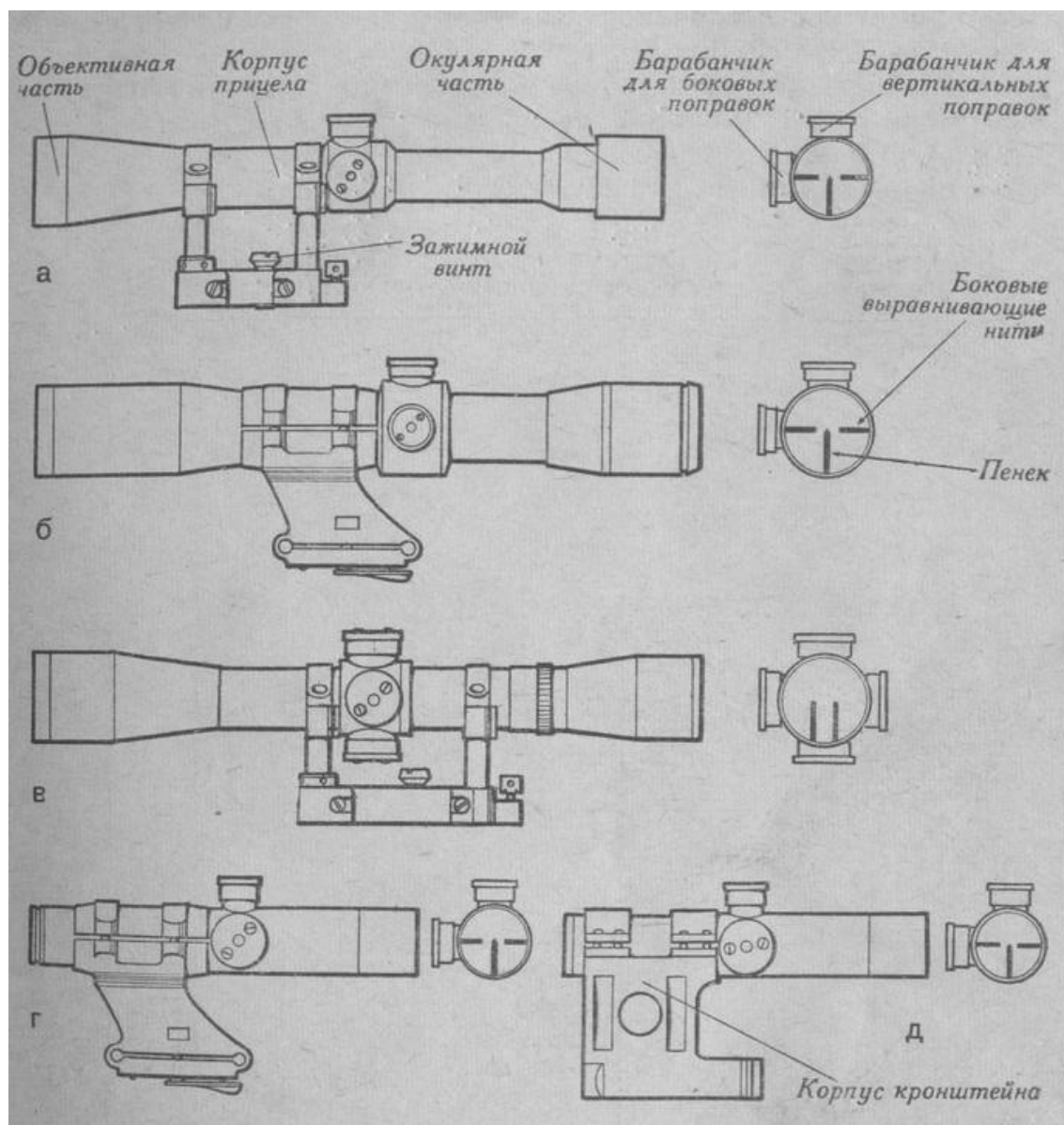


Fig. 13 - Optical sights used when shooting at the "Running Deer" and "Running Boar" targets:

a - TO-6; b - TO-6p; c - TO-6s; d - TO-4; e - PU.

Vertical and horizontal movement of the aiming threads (or aiming stump) of the optical sight is carried out by rotating the flywheels (drums) mounted on micrometer screws. The drums of hunting optical sights (TO-4, TO-6, TO-6P) have divisions (equal) for corrections. The value of each division is equal to $1/1000$ of the distance. Therefore, when moving the drum by one division, the average point of impact (API) when shooting at a distance of 100 m will move by 10 cm, when shooting at 50 m - by 5 cm. The micrometer screws have a certain free play (backlash). Therefore, when rotating the flywheels, the aiming threads remain motionless for some time.

The free play of the screws is especially noticeable when making small, fine adjustments. Therefore, the sight setting must always be changed by turning the

handwheel in the same direction. Experienced shooters usually finish turning the handwheel in the clockwise direction. If, for example, it is necessary to move the sight from a higher setting to a lower one, the handwheel should be turned several divisions at once by turning it counterclockwise, and then, returning to the desired mark, finally set the sight by turning it clockwise.

Pistol-revolver sighting devices

Despite the fact that the competition rules allow any sights except optical ones to be installed on any pistol-revolvers, in the practice of shooting sports in our country only open sights are common, consisting of a front sight and a notch on the rear sight or the crest of the sighting bar.

The most convenient for sportsmen was an open sight consisting of a semicircular slit in combination with a rectangular front sight. This shape is typical for sighting devices of revolver pistols of all classes, produced by domestic arms factories.

However, sights differ significantly in their design. Depending on the method of making adjustments, sights installed on revolver pistols can be conditionally classified into two groups:

- sights, the design of which makes it possible to make only lateral corrections and only with the help of a tool; this group includes sights of military revolver pistols, in which lateral correction is carried out by moving the front sight (or rear sight) with a hammer and a punch;
- sights with mechanisms with "clicks" that allow the most accurate lateral and vertical corrections without any tools (Fig. 14); they are now installed on all revolver pistols (except for military ones).

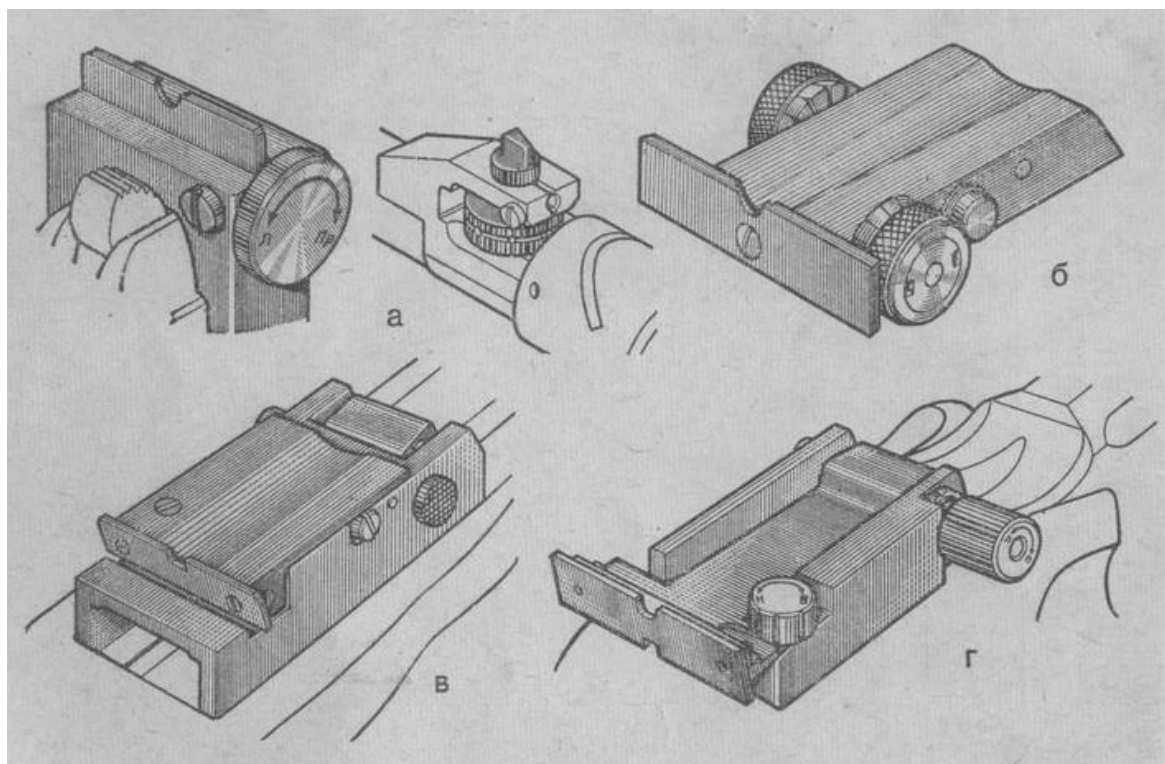


Fig. 14 - Types of open sights installed on domestic free and sport pistols:
a - MTSU; *b* - MTs-2-3; *c* - IZH HR-31; *d* - TOZ-35.

To make horizontal adjustments to the sighting devices when shooting from revolver pistols, you can refer to Table 4.

The average point of impact shift when shooting from pistols (revolvers) when adjusting the sight setting by one click, cm

Table 4

Weapon model	Sight type	Correction (clicks, turns of micrometer screws)	Firing range, m		
			10	25	50
Revolver TOZ-36	Open, micrometer screws	1 revolution vertical 1 revolution horizontal		5.0 5.0	
Rebarreled revolver	Open, micrometer screws	1 revolution vertical 1 revolution horizontal		3.5 7.0	
Pistol MC-2-3	Open, with clicks	1 click vertical 1 click horizontal			0.4 0.7

Pistol MC-2	Open, with clicks	1 click vertical 1 click horizontal			1.0 1.0
Pistol IZH-1	Open, with clicks	1 click vertical 1 click horizontal			0.4 0.7
TOZ-35 pistol	Open, with clicks	1 click vertical 1 click horizontal			1.0 1.0
Pistol MC-55-1	Open, with clicks	1 click vertical 1 click horizontal			0.4 0.7
Pistol IZH HR-31	Open, with clicks	1 click vertical 1 click horizontal		1.0 1.0	
Margolin's pistol	Open, with clicks	1 click vertical 1 click horizontal		0.65 0.65	
Pistol IZH HR-30	Open, with clicks	1 click vertical 1 click horizontal		1.0 1.0	
MCU pistol	Open, with clicks	1 click vertical 1 click horizontal		0.65 0.65	1.3 1.3
Solovyov's gas pistol (GPS)	Open, with clicks	1 click vertical 1 click horizontal	0.1 0.1		
Feinwerkbau pistol, mod. 65 (FRG)	Open, with clicks	1 click vertical 1 click horizontal	0.15 0.15		

Chapter 2. Cartridges

In sport shooting, two types of cartridges are used: rimfire and centerfire.

Edge-fire cartridges (caliber 5.6 mm) are used in initial training, training sessions and competitions when shooting from rifles and pistols at distances up to 100 m.

Cartridges with a centerfire cap (caliber 5.6-9.65 mm) are used in sport shooting from rifles, pistols and revolvers at distances up to 300 m.

Depending on the requirements for the ballistic characteristics of sport cartridges, they are divided into three groups: regular sport cartridges, target cartridges, and target cartridges with increased accuracy.

The domestic industry produces the following types of cartridges for sport shooting:

7.62mm target rifle cartridge;

7.62mm target rifle cartridge "Extra";

6.5mm target cartridge;

5.6mm rifle cartridge for shooting at the Running Deer target;

5.6 mm sport and hunting cartridge;

7.62 mm sporting cartridge for the 1895 model revolver;

7.62mm sport pistol cartridge;

5.6 mm rimfire sport and hunting cartridge;

5.6mm rimfire target cartridge;

5.6mm rimfire target cartridge "Extra";

5.6 mm target rimfire cartridge "Rekord";

5.6mm pistol target shortened rimfire cartridge.

The 7.62 mm rifle cartridge (Fig. 15) consists of a bullet, a cartridge case, a powder charge and a primer. According to the ignition system, this

is a centerfire cartridge, the powder charge of which is ignited by the striker striking the primer located in the center of the cartridge case cap.

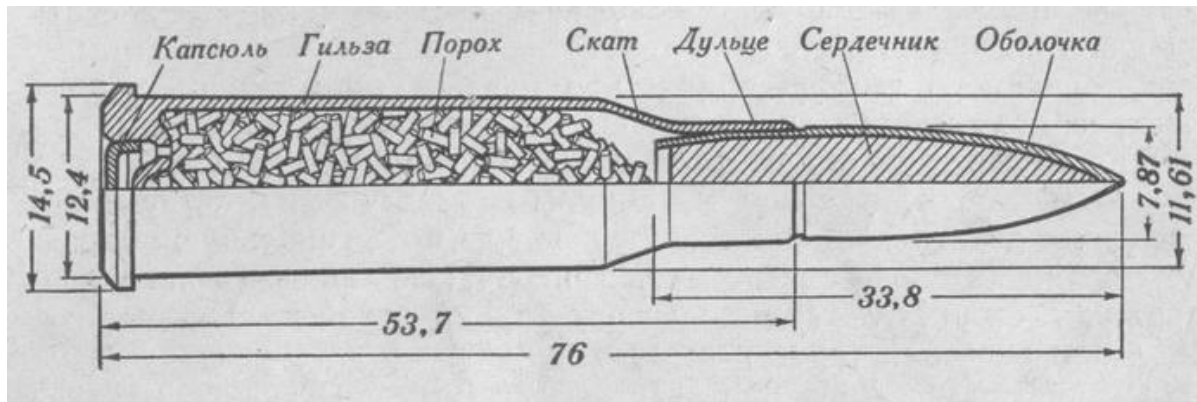


Fig. 15 - 7.62mm target rifle cartridge (dimensions in mm)

7.62- and 6.5-mm target cartridges are intended for shooting during training and competitions. They are distinguished by good accuracy of fire: the average diameter (diameter) of bullet dispersion when shooting at 300 m is no more than 13 cm. Due to high manufacturing precision, target cartridges do not require additional selection or calibration. They are produced in various batches, slightly differing in caliber and weight of bullets, weight of charge and grades of powder (see Table 5). The batch of cartridges is usually indicated on the packaging boxes. A large assortment of them allows athletes to select the most suitable batches for the barrel of their rifle.

Basic design and ballistic characteristics of cartridges

Table 5

Cartridge type	Sample cartridge	Caliber, mm	Cartridge weight, g	Bullet weight, g	Charge weight, g	Length of cartridge, mm	Bullet length, mm	Initial bullet speed, m/sec	Maximum pressure of powder gases
Centerfire rifles	Target rifle	7.62	24.0-25.3	11.63-11.88	3.22	76.2-76.9	33.06-33.40	738-774	2500
	Target rifle "Extra"	7.62	25.5-26.5	12.85-13.05	3.0-3.1	75.5-76.0	33.35-33.65	754-766	3000

	Target rifle	6.5	21.78-22.30	9.78-9.90	2.4	72.5-72.8	33.25-33.75	743-760	3900
	For shooting at the target "Running Deer"	5.6	10.5-11.6	2.70-2.80	1.7	48.4-48.9	14.90-15.15	1056-1080	2700
	Sport and hunting	5.6	10.9-11.7	3.45-3.55	Wed 1.21	47.7-48.7	14.85-15.35	881-896	2700
Centerfire pistols	Sports for revolver model 1895.	7.62	10.9-11.3	6.47-6.53	0.11	38.48-38.73	13.9	183-198	-
	Sports pistol	7.62	11.5-11.9	7.38-7.43	0.102	26.12-26.4	15.1	188-203	-
Small caliber side fire	Sporting and hunting with steel sleeve	5.6	3.41-3.54	2.55-2.60	0.011-0.014	25.0-25.5	11.85-12.00	315-345	1300
	Target	5.6	3.43-3.55	2.56-2.59	Avg. 0.117	25.0-25.5	11.85-12.00	305-345	1300
	Target rifle "Extra"	5.6	3.33-3.43	2.56-2.59	Avg. 0.117	25.0-25.5	11.80-11.95	320-340	1300
	Target rifle "Record"	5.6	3.33-3.43	2.56-2.59	Avg. 0.104	25.5-25.0	11.80-11.95	320-340	1300
	Pistol target shortened	5.6	2.77-2.91	2.15-2.18	0.011-0.014	18.3-18.8	9.8-10.1	220-245	900

7.62 mm target cartridge "Extra". In recent years, our industry has been producing special cartridges that differ from ordinary target cartridges in that they have a more ballistically perfect bullet shape. Their accuracy is very high. They are intended for shooting at particularly important competitions. According to technical specifications, "Extra" cartridges have a bul-

let dispersion diameter when shooting at a distance of 300 m of no more than 9 cm (Fig. 16).

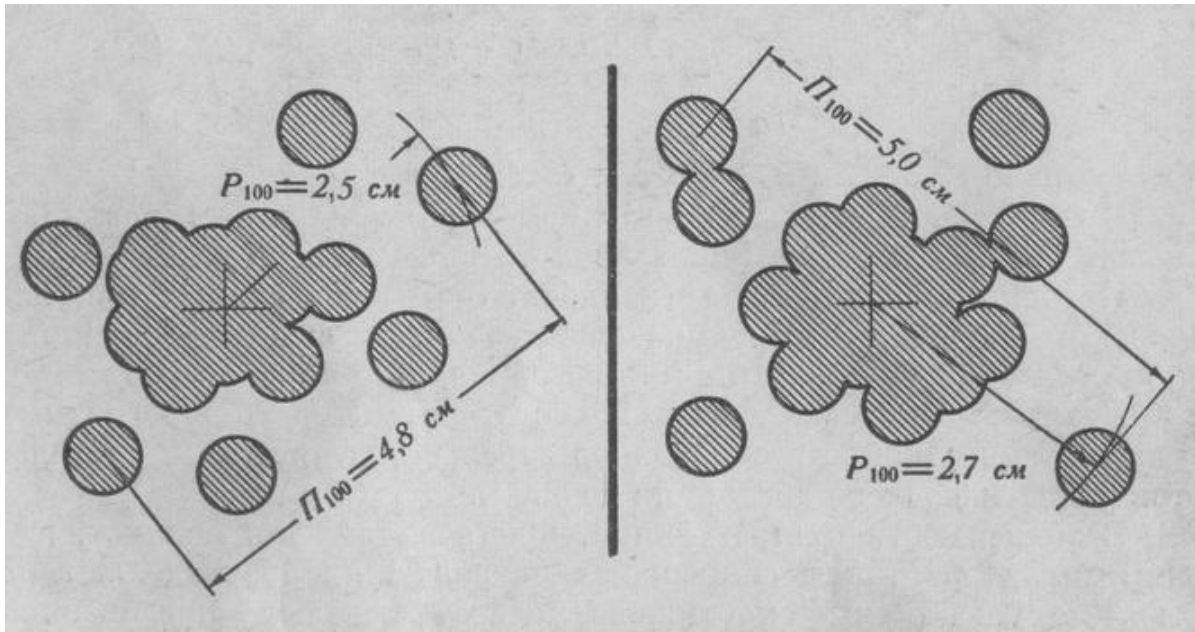


Fig. 16 - Bullet dispersion when firing 7.62 mm target rifle cartridges "Extra" at 300 m in series of 20 shots (actual size)

5.6 mm rifle cartridge for shooting at the "Running Deer" target (Fig. 17). With a very high initial bullet velocity, these cartridges allow successful shooting at a moving target with less lead. In addition, the weak recoil of the weapon creates the most favorable conditions for shooting double shots. The cartridge has good accuracy and stability of fire. According to technical requirements, the dispersion of bullets when shooting at 100 m should not exceed 6 cm (Fig. 18).

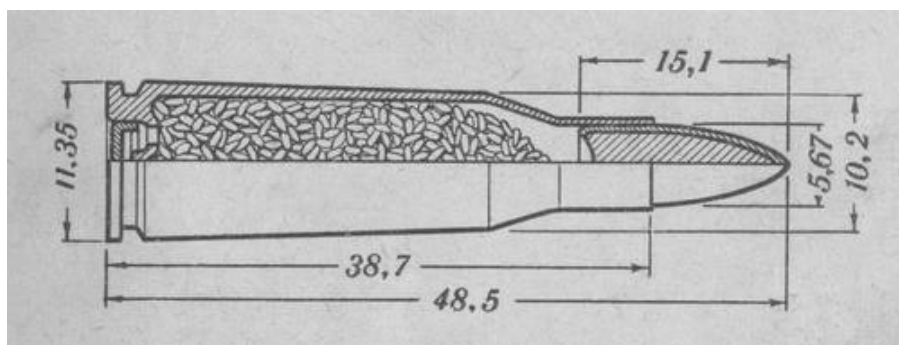


Fig. 17 - 5.6mm rifle cartridge for shooting at the Running Deer target (dimensions in mm)

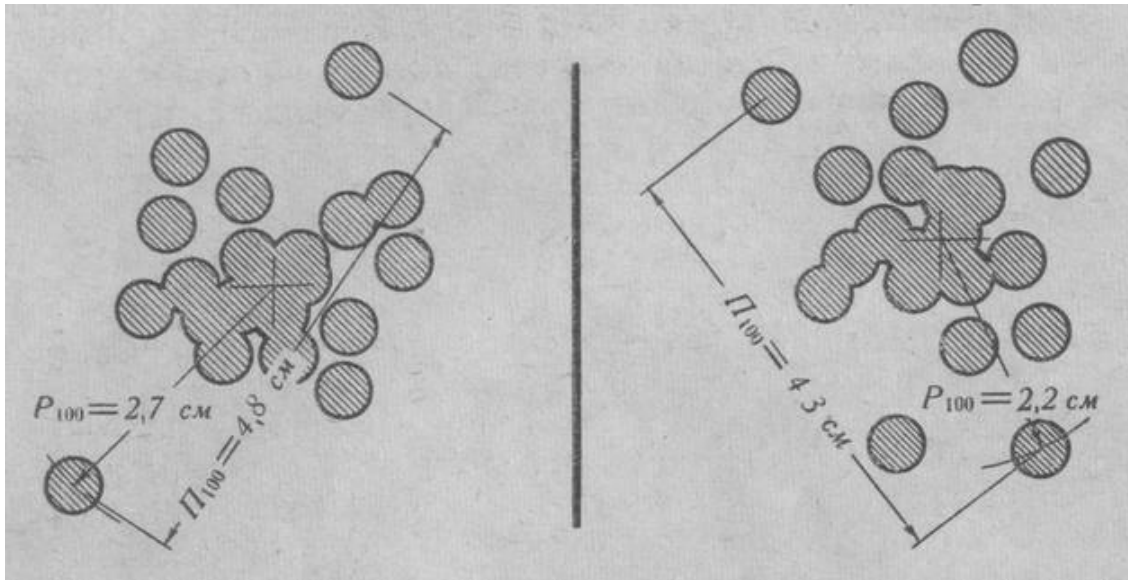


Fig. 18 - Bullet dispersion when firing 5.6 mm rifle cartridges for shooting at a "Running Deer" target at 100 m in series of 20 shots (actual size)

The 5.6 mm sport and hunting cartridge has a semi-jacketed bullet. It is also used for shooting at the Running Deer target. The cartridge has a slightly lower muzzle velocity compared to the described rifle cartridge, but its accuracy is better: when shooting at 100 m, the bullet dispersion diameter does not exceed 5.5 cm.

The 7.62 mm sport cartridge for the 1895 model revolver (Fig. 19) is designed for shooting from a re-barreled sport revolver. Its purpose is for shooting during training and competitions. The cartridge has good accuracy: when shooting at 25 m, the bullet dispersion diameter is on average up to 4 cm.

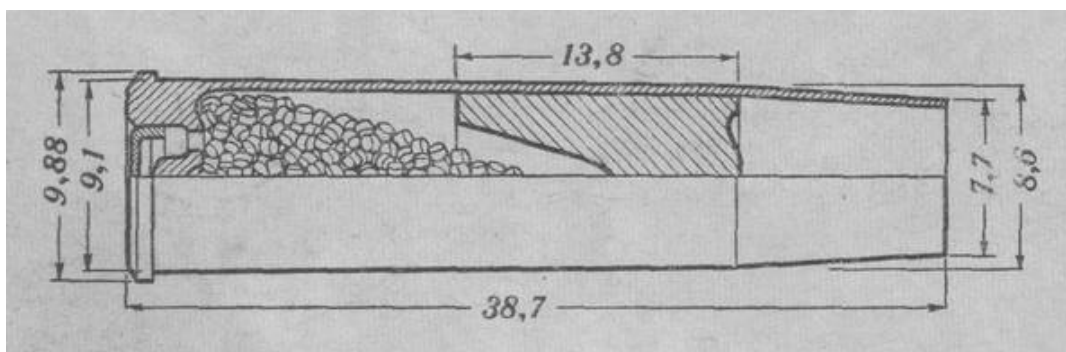


Fig. 19 - 7.62 mm sport cartridge for a revolver

The 7.62 mm sport pistol cartridge (Fig. 20) is produced specifically for training and performances at particularly important competitions. The accuracy of these cartridges is very high: when shooting at 25 m, the largest bullet dispersion diameter is up to 3 cm (Fig. 21).

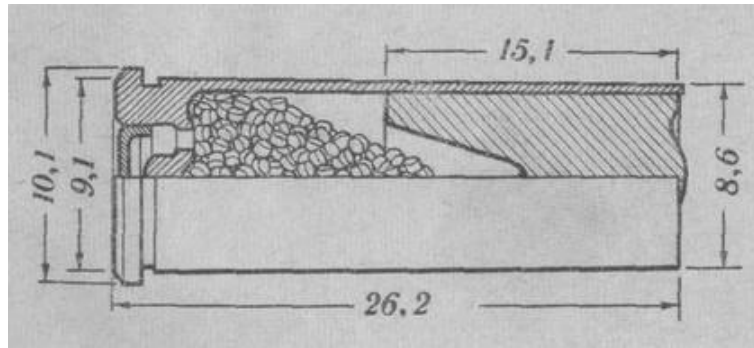


Fig. 20 - 7.62 mm sport pistol cartridge

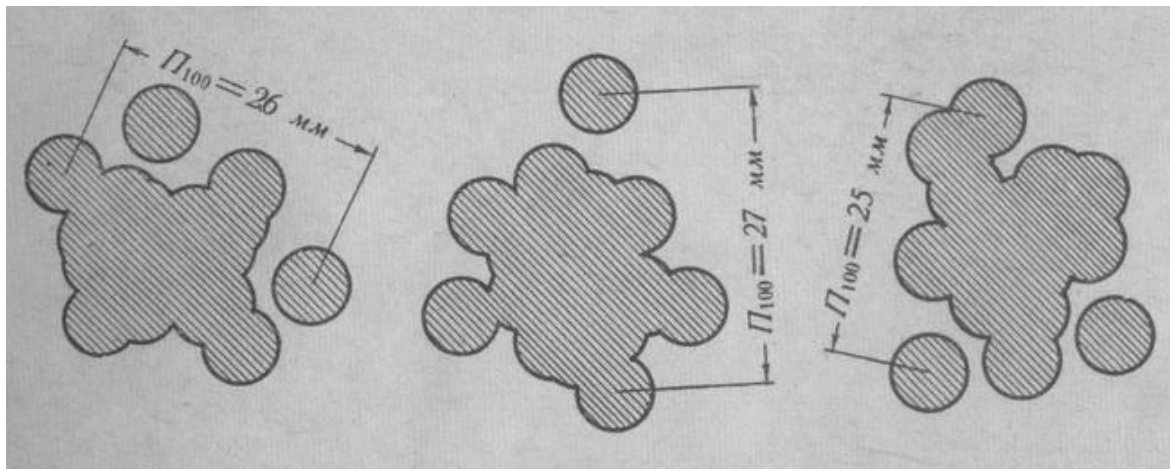


Fig. 21 - Bullet dispersion when firing 7.62 mm sport pistol cartridges at 25 m in series of 20 shots (actual size)

5.6 mm rimfire cartridge . Small-caliber cartridges are the most common in shooting sports. Excellent accuracy, weak shot sound, relatively low penetration, allowing for inexpensive shooting ranges to be built within the city, and finally, low cost contribute to their popularity.

A small-caliber cartridge consists of a bullet, a cartridge case, a powder charge, and a percussion compound (Fig. 22). According to the ignition system, this is a rim-fire cartridge: the powder charge ignites when the striker strikes not a special primer, but the rim of the cartridge case, into which the percussion compound is pressed.

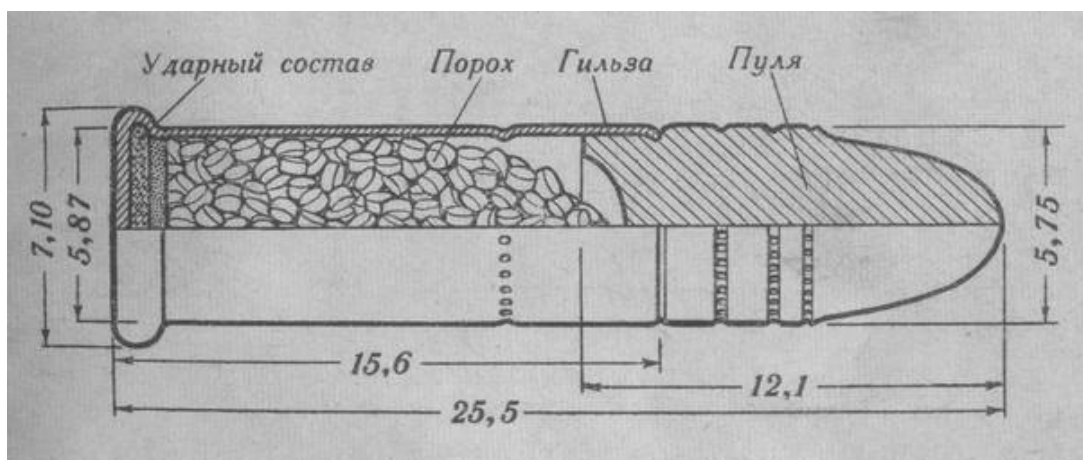


Fig. 22 - 5.6mm rimfire target cartridge

The cartridge is loaded with smokeless powder and a non-corrosive primer composition, which facilitates the preservation of the rifle barrel, increasing its "survivability".

5.6 mm sport and hunting cartridges with a steel case have good accuracy, which fully satisfies the tasks of the initial training of an athlete and training shooting. Cartridges are produced in two categories: the first - the average diameter of the bullet dispersion is no more than 3 cm; the second - no more than 4 cm (when shooting from a small-caliber rifle at 50 m). These cartridges are distinguished by their ease of manufacture, and therefore low cost.

5.6 mm target rimfire cartridges (Fig. 22) have high accuracy. They are intended for major sporting events. The best lots of target cartridges provide a bullet dispersion of 1.6-2 cm when shooting from small-caliber rifles at 50 m.

They are produced in separate batches, slightly different from each other, which allows the shooter to select the cartridges for the weapon barrel that provide the best accuracy.

The 5.6 mm Extra and Record rimfire target rifle cartridges are produced in separate lots for shooting at particularly important competitions. Their bullets have improved ballistic characteristics, due to which the cartridges have very high and stable accuracy. Thus, when shooting at 50 m, the average dispersion diameter of the bullets for the Extra cartridges is 1.2 cm, and the largest is 1.7 cm, for the Record cartridges, respectively, 1.1 and 1.4 cm (Fig. 23).

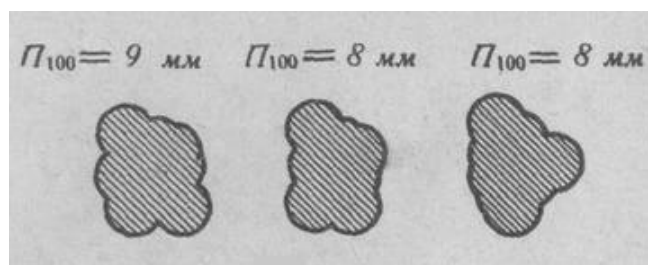


Fig. 23 - Bullet dispersion when firing 5.6 mm target rifle cartridges of the "Rekord" rimfire at 50 m in series of 20 shots (actual size)

5.6 mm pistol target shortened rimfire cartridges (Fig. 24) are used only for rapid shooting at silhouettes. They differ from regular small-caliber cartridges in having a shortened case, a lighter bullet, and a smaller powder charge. Using cartridges with a lower charge power gives significant advantages in rapid shooting from a pistol: the weapon shifts less under the recoil, as a result, the shooter spends less time aligning the front sight in the slot before the next shot. The lots of cartridges of this type produced by our industry have sufficient accuracy of fire to prevent the bullet from being fired from the "ten" when shooting at 25 m at silhouette targets - the average diameter of the bullet dispersion is 3 cm (Fig. 25). It is recommended to shoot short cartridges only from pistols with a shortened chamber (MC-1-2, IZH HR-31, etc.), which are made specifically for this cartridge.

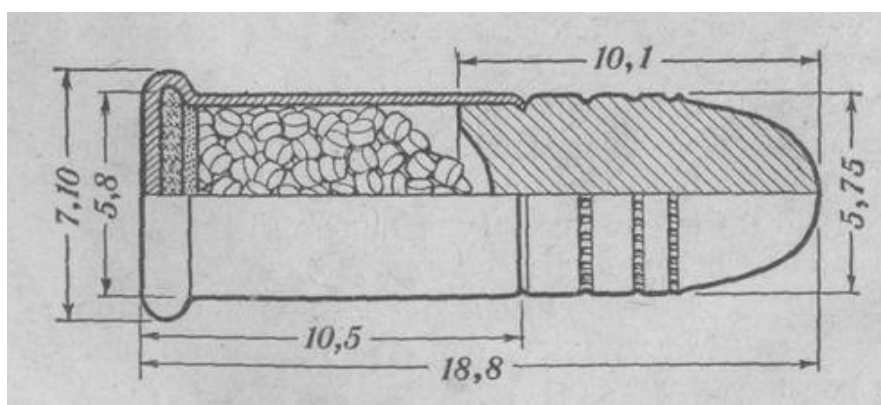


Fig. 24 - 5.6mm pistol target shortened rimfire cartridge (dimensions in mm)

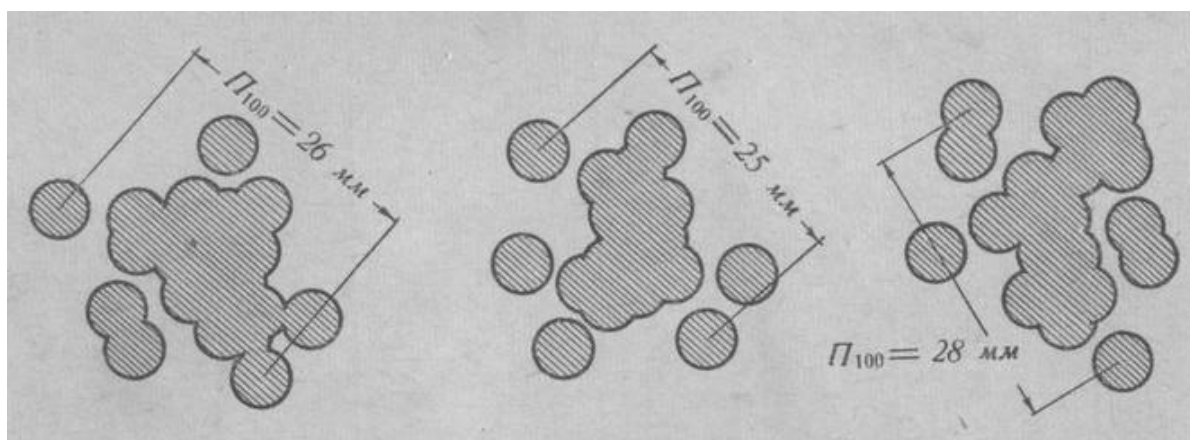


Fig. 25 - Bullet dispersion when firing 5.6 mm pistol target shortened rim-fire cartridges at 25 m in series of 20 shots (actual size)

The main design and ballistic characteristics of the cartridges are given in Table 5.

Section II.

SHOT

A shot is the ejection of a bullet (projectile) from the barrel of a firearm by the pressure of gases formed during the combustion of a powder charge.

The powder charge, when burning, turns into gases with very high pressure and high temperature. When the pressure reaches a certain value, the bullet begins to move with increasing speed. Flying out of the barrel, it maintains the obtained movement in the air by inertia.

The science that studies the movement of a bullet (projectile) is called **ballistics**. Depending on the nature of the forces acting on the bullet, a distinction is made between internal and external ballistics.

Internal ballistics studies the movement of a bullet in a barrel under the action of powder gases and all the phenomena that cause and accompany this movement. It is designed to solve the problem of how to give a bullet the highest speed without exceeding the permissible pressure of powder gases in the barrel of a weapon.

External ballistics studies the movement of a bullet after the action of powder gases on it ceases - after it leaves the barrel. It solves the problem of at what angle to the horizon and with what initial speed a bullet of a certain weight and shape should move in order to reach the target.

Knowledge of the laws of internal and external ballistics helps the shooter to competently solve issues of weapon adjustment and operation, master the technique of firing a shot, and also consciously work with the sight, and correctly analyze the results of his shooting.

Chapter 1. Explosives

Explosives (ES) are unstable mixtures and chemical compounds that are capable of quickly transforming into a gaseous state under the influence of minor external influences (impact, friction, injection, heating, etc.).

An explosion is an extremely rapid physical or chemical change in a substance, accompanied by an equally rapid transformation of its potential (latent) energy into mechanical work. This work is produced by expelled gases, which tend to expand and thus create a sharp increase in pressure in the environment surrounding the explosion site. A very sharp increase in pressure is a characteristic feature of an explosion. An accompanying sign of an explosion is a loud sound.

A chemical reaction accompanied by an explosion is called **an explosive transformation**.

Characteristic signs of an explosion:

— **the short duration of the process** — the speed of the transition of the explosive from a solid or liquid state to a gaseous state, i.e. to the final system of transformation products. Depending on the chemical composition of the explosive and the conditions under which the explosion occurs, explosive transformations occur at different speeds — from hundredths to millionths of a second. Thus, a charge of smokeless powder burns in a rifle in 0.0012 sec., 1 kg of dynamite explodes in 0.00002 sec.;

— **gas formation** - the presence of a large amount of gaseous explosion products capable of expansion. It is expressed approximately by the following figures: 1 liter of pyroxylin gives 994 liters of gaseous explosion products, 1 liter of nitroglycerin - 1121 liters of gaseous explosion products;

— **heat release** during the explosive transformation reaction, which increases the elasticity of gas products. Thus, when a

charge burns in a rifle cartridge, about 3 large calories of heat are released.

Depending on the chemical composition of the explosive and the explosion conditions, explosive transformations occur at different speeds, at which rapid combustion, its own explosion, and detonation can occur.

Rapid combustion of explosives is the process of explosive transformation that spreads throughout the entire mass of explosives at a speed of no more than a few meters per second. If this process occurs in the open air, it is usually not accompanied by any sound effect. An example is the combustion in the open air of, say, grains of black powder, which occurs at a speed of 10-13 mm/sec.

In a closed volume, the combustion of explosives is more energetic, and the combustion is accompanied by a sharp sound. A typical example of such an explosive transformation is the combustion of a smokeless powder charge in the barrel bore (speed of approximately 10 m/sec). The combustion of explosives is accompanied by a more or less rapid increase in gas pressure in the barrel bore, which, as it forms, spreads toward the least resistance, moving the bullet or projectile along the bore and pushing it out of the barrel.

The explosion itself is a process of explosive decomposition, which occurs at a tremendous speed, measured in hundreds of meters per second. It is accompanied by a sharp increase in gas pressure, which entails the splitting and crushing of surrounding objects.

Detonation is a process that spreads through the explosive with the maximum possible explosive transformation speed, usually measured in thousands of meters per second. For example, the detonation speed of pyroxylin reaches 6800 m/sec, nitroglycerin - 8200 m/sec. By the end of the explosion, that is, by the time the entire charge decomposes, the gases do not have time to expand and still have the original volume of the explosive. A huge movement of gases develops in all directions. This leads to the fragmentation of the barrier into tiny pieces.

While an ordinary explosion usually occurs from heating the explosive, detonation in most cases occurs when the same or another explosive explodes in the immediate vicinity of the main charge (or at some distance from it). An explosive that can cause detonation in another explosive is called **a detonator** .

Depending on their application, explosives are divided into three large groups: initiating, crushing, propellant, or gunpowder.

Initiating explosives are distinguished by the fact that the usual form of their explosive transformation is complete detonation. They are most sensitive to external influences and easily explode from a slight impact, prick, flame beam, etc. They are mainly used to make all kinds of igniters and to load caps used to initiate explosive transformations of other explosives (Fig. 26). For loading cartridge cap-igniters, a striking composition (a mixture of mercury fulminate, potassium chlorate and antimony) is mostly used.



Fig. 26 - Impact composition (initiating explosives) in rifle cartridges

Crushing (high explosive) explosives are those that detonate reliably and are relatively safe to handle. They are detonated by primers of initiating explosives. Their explosive transformation speed reaches several hundred meters per second. They are used as explosive charges of shells, aviation bombs, mines and grenades. High explosives include pyroxylin, nitroglycerin, dynamite, TNT, hexogen and other explosives.

Propellants or **gunpowders** are explosives whose explosive transformations are characterized by rapid combustion, occurring mostly at a speed of several meters per second. Gunpowders are used in all types of firearms as a source of energy that imparts

movement to the bullet (projectile). Therefore, of all types of explosives, gunpowders are of the greatest interest for shooting.

Let's get acquainted with their properties at least in general terms.

Smoky, or black, gunpowder is ballistically disadvantageous and unproductive in its work. After the explosion, the volume of its powder gases becomes only 280-300 times greater than the initial volume of the charge.

The chemical basis of smokeless powders are crushing explosives - pyroxylin and nitroglycerin, treated with certain solvents that allow regulating the combustion rate of these powerful explosives.

Pyroxylin is made from substances rich in fiber or cellulose - cotton, wood, flax, hemp, etc., appropriately treated with nitric and sulfuric acids. It is an almost white mass, outwardly indistinguishable from the material from which it is made.

Nitroglycerin is made from a mixture of pure dehydrated glycerin with nitric and sulfuric acids. It is a clear, odorless liquid that can dissolve some types of nitrocellulose.

Smokeless powders are insoluble in water; their hygroscopicity is insignificant. However, when stored in a damp place, their humidity increases (up to 20%), which reduces their ballistic properties.

The specific gravity of different types of smokeless powders varies between 1.55 and 1.63.

Ignition temperature is 180-200° C. As the charge temperature increases, the burning rate of the gunpowder increases, as the heat consumption required to heat it decreases.

Smokeless powders have a high production capacity. Thus, 1 kg of powder produces about 900 liters of powder gases during an explosion, which allows the pressure in the barrel of a large-caliber rifle to develop up to 3200 atm.

Smokeless powders have significant strength and elasticity, so they are little deformed and do not grind into dust during transportation and vibrations.

The quality of smokeless powder is determined by how regular and uniform in shape and size the powder grains are. This largely determines the uniform and regular formation of powder gases during firing, and therefore the accuracy of shooting.

Chapter 2. Internal ballistics

When the trigger is released from the cocking position, the firing pin strikes the cap, causing an instant explosion of the percussion composition. The resulting strong flame penetrates the thickness of the powder charge, igniting the grains of gunpowder. The powder charge, igniting, almost simultaneously releases elastic powder gases. As it burns, the gases become cramped in the powder chamber (chamber). Trying to expand, they press with equal force in all directions. Meeting the resistance of the strong walls of the barrel and the bottom of the cartridge case, resting against the bolt cylinder, the powder gases spread in the direction of least resistance, pushing the bullet in front of it. It cuts into the rifling, rotates, passes through the bore of the barrel and is thrown out in the direction of its axis.

This is how the phenomenon - **the shot** - occurs . It happens very quickly - for example, in the barrel of a large-caliber rifle, the bullet moves for only about 0.0015 seconds.

As the gunpowder burns, the amount of gunpowder gases increases, causing their pressure to rapidly increase. When it reaches a certain value, sufficient to overcome the forces of resistance to movement (the bullet being squeezed into the muzzle of the cartridge case, being cut into the rifling, etc.), the bullet begins to move.

The pressure of the powder gases required for the bullet to fully penetrate the rifling is called **the forcing pressure** . In small arms, it fluctuates between 250-500 kg/cm² (when firing shell bullets).

Since the bullet begins to move before the charge has completely burned out, the pressure of the powder gases in the barrel changes. At the beginning, when the bullet has not yet acquired a high speed, the amount of gases increases significantly faster than the volume of the space behind the bullet (the space in the barrel between the bottom of the cartridge case and the bottom of the bullet) increases, and the gas pressure in the barrel increases, reaching its greatest value. This causes the bullet to accelerate. As

a result, the increase in the amount of gases can no longer keep up with the increase in the space behind the bullet, and the pressure in the barrel begins to gradually decrease.

Once the charge has burned, the bullet's further movement occurs under the influence of a constant, freely expanding amount of powder gases, which have an even greater reserve of energy due to their elasticity. Continuing to expand, they increase the speed of the bullet.

Subsequently, the powder gases, escaping from the barrel bore at a speed greater than the speed of the bullet, continue to exert pressure on the bottom of the bullet at some distance from the muzzle of the weapon (up to 20 cm), increasing its speed. Thus, as the bullet moves along the barrel bore, its speed continuously increases, reaching its greatest value several centimeters from the muzzle.

The pressure of the powder gases reaches its maximum value at the beginning of the rifled part of the barrel, a few centimeters from the bullet entrance. The highest pressure that the powder gases develop in the barrel of a large-caliber rifle when firing a heavy bullet is 3200 kg/cm^2 , in the barrel of a small-caliber rifle and small-caliber pistol - 1300 kg/cm^2 , and in the barrel of a sports revolver - $1000\text{-}1100 \text{ kg/cm}^2$.

The gas pressure at the moment the bullet leaves the barrel is called muzzle pressure. In the service rifles AVL, AV, BI-7.62 it is approximately 430 kg/cm^2 , in a small-caliber rifle - about 200 kg/cm^2 , and in a small-caliber pistol - $500\text{-}600 \text{ kg/cm}^2$ (depending on the barrel length). The nature of the change in the pressure of the powder gases in the barrel and the increase in the speed of the bullet when firing from a rifle are shown in Fig. 27.

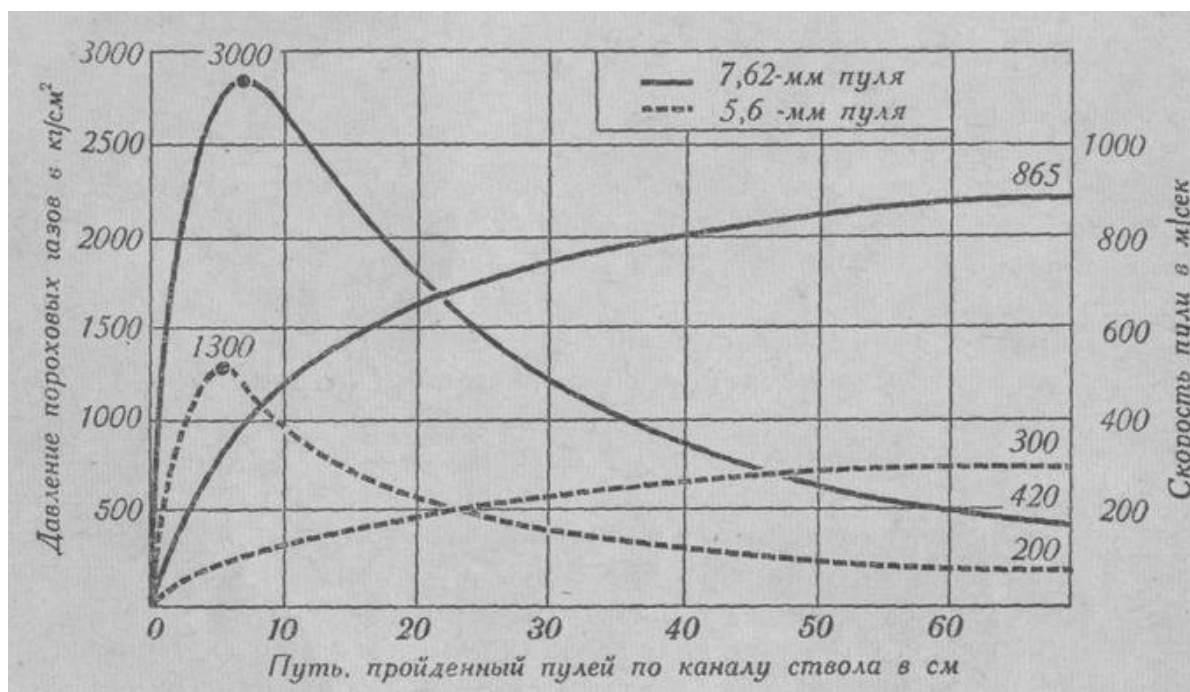


Fig. 27 - Curves of powder gas pressure and bullet velocity in the barrel of the service rifle AB and small-caliber rifle

It should be noted that the nature of the increase in powder gas pressure in the barrel bore largely depends on the density of the powder charge: as it increases, the rate of powder combustion increases sharply, and consequently, the gas pressure (up to the occurrence of detonation). Therefore, to avoid accidents, do not shoot cartridges with deeply seated bullets.

As is known, with increasing humidity, gunpowder burns more slowly, which is why the pressure of the powder gases in the barrel increases more slowly. With a damp powder charge, a **delayed shot** is possible, in which a noticeable period of time passes between the striker striking the primer and the sound of a shot. If the humidity of the charge is high and the power of the primer is insufficient, the flame beam from the explosion of the percussion composition cannot simultaneously ignite all the powder grains - it ignites only the nearby layers of powder, and from them, after a certain period of time, the next ones ignite. If there is no shot after the trigger is released, do not rush to reload the weapon, you should wait for some time so that the powder charge does not explode with the breech open.

Particular care is required if the cartridges have been stored for a long time without hermetically sealed packaging and in a place that is not dry enough.

2.2.1 Strength and "survivability" of barrels

When the charge burns, the powder gases in the gun barrel develop, as we have already said, very high pressure. Even the lowest pressure in the muzzle of the barrel at the moment the bullet leaves is equal to several hundred atmospheres (one technical atmosphere is equal to the pressure of 1 kg per 1 cm² of area). Naturally, in order to withstand such stress, the gun barrel must be very strong. It depends on the thickness of the barrel walls and the quality of the metal.

In accordance with the nature of the gas pressure curve, the barrel of a firearm is made thicker in the breech and thinner in the muzzle. The thickness of its walls is calculated with such a safety margin that they can withstand the pressure of powder gases significantly higher than normal, by several hundred or even thousands of atmospheres. Thus, for a standard AB rifle, the maximum pressure in the barrel of which reaches 2850-3200 atm, the additional safety margin is 2650-2300 atm. This means that its barrel in some cases can withstand enormous pressure - up to 5500 atm.

When a shot is fired, the barrel walls expand to resist the gas pressure. Therefore, its strength is calculated so that the metal is subjected only to elastic deformations of expansion: it expands under pressure and returns to its original dimensions when the pressure is released. If the pressure in the barrel exceeds the calculated value (in this case, 5500 atm), then residual deformation will occur and the barrel will be swollen (Fig. 28) or even torn.

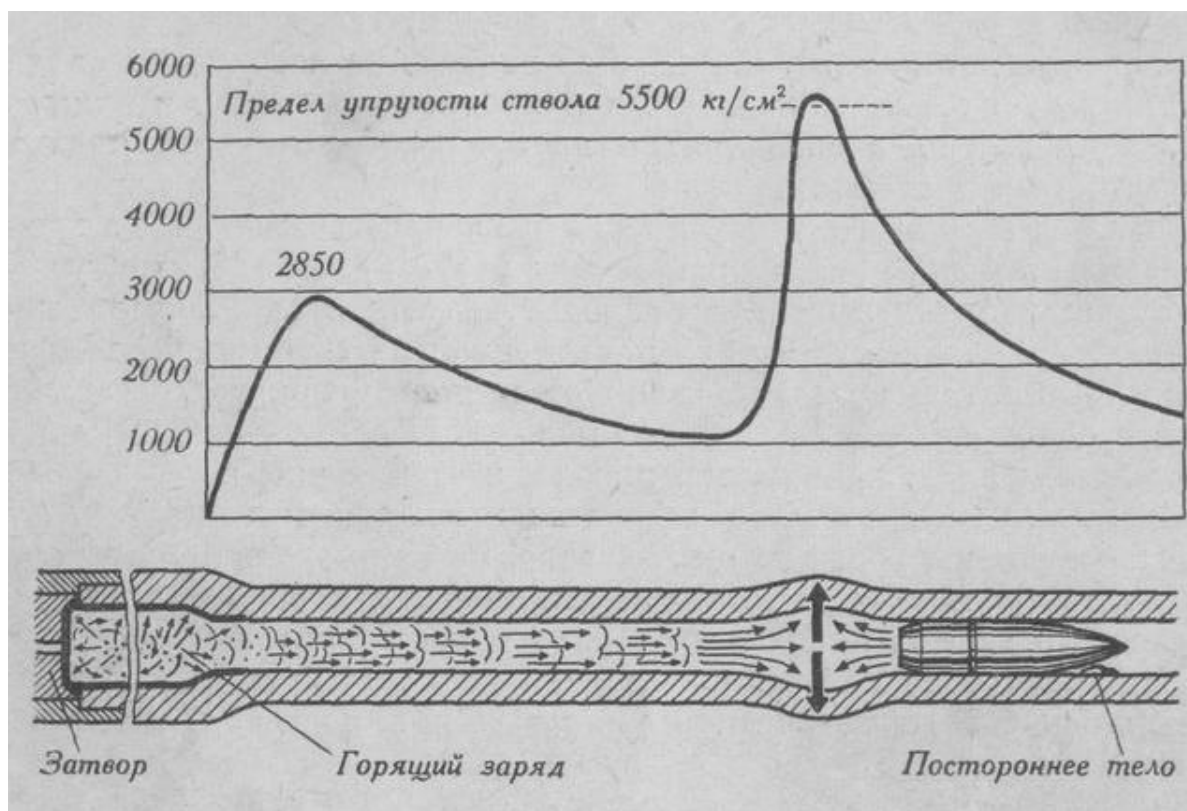


Fig. 28 - Diagram of the barrel bore swelling, which is formed when the pressure of the powder gases exceeds the safety margin of the barrel

In practice, rifle barrels breaking is an extremely rare case, especially thick, massive barrels of arbitrary rifles. However, barrel swelling is a fairly common occurrence. There are especially many weapons (small-caliber) with swollen barrels in shooting ranges where shooters are given basic training. In the overwhelming majority, this is the result of careless handling and illiterate use of weapons.

The cause of the formation of bulges is usually foreign bodies found in the barrel bore during firing: a rag left after cleaning, tow, pieces of the cartridge case mouth, thick grease collected in a drop, a plug of dirt or snow. They become an obstacle, a kind of brake, which leads to some slowing down of the bullet. The elastic powder gases following the bullet, colliding with its bottom, create a reverse wave. The main mass of gas continues to move in the direction of the muzzle. The collision of two gas waves creates a strong radial pressure exceeding the safety margin of the barrel (see Fig. 28). This sharp increase in pressure causes bulging, and sometimes even rupture of the barrel.

It is not difficult to detect a barrel bulge by carefully examining its channel - it looks like a shadow ring. Sometimes it can be found by touch - it protrudes outward in the form of a ring-shaped bulge on the barrel.

To avoid swelling, it is necessary to thoroughly wipe the bore of the gun and carefully inspect it before shooting. It is also necessary to protect the cartridges from contamination, store them in the package, and not in bulk.

Small swellings in the middle of the barrel or in its breech part have little effect on the accuracy of the shot. However, it is risky to compete with a rifle that has a swelling: bullets may fall off the rifling. A rifle that has a swelling of the barrel in the muzzle part becomes completely unsuitable for accurate shooting.

During operation, the weapon barrel wears out significantly. This is due to a number of mechanical, thermal and chemical reasons.

Passing through the barrel bore, the bullet gradually rounds off the edges of the rifling fields under the action of high friction forces - the inner walls are abraded. In addition, particles of powder gases moving at high speed strike the walls of the bore with force, causing so-called work hardening on their surface. The essence of this phenomenon is that the surface of the bore is covered with a thin crust with brittleness gradually developing in it. The elastic deformation of the barrel expansion that occurs during firing leads to the appearance of small cracks on the inner surface of the metal. The formation of such cracks is also facilitated by the high temperature of the powder gases, which cause partial melting of the surface of the bore. High local stresses arise in the heated layer of metal, which lead to the appearance and enlargement of cracks. The increased brittleness of the surface layer of the metal and the presence of cracks on it lead to the fact that when the bullet passes through the bore, metal chips are formed in the places of cracks.

The barrel also wears out a lot from the carbon deposits left in the barrel bore after the shot. This is the residue of combustion of the percussion composition and gunpowder, as well as metal scraped off from the bullet or melted from it, pieces of the cartridge case mouth torn off by gases, etc.

The salts contained in the carbon deposits have the property of absorbing air moisture, dissolving in it and forming solutions which, when reacting with the metal, lead to corrosion, the appearance of a rash in the barrel bore first, and then cavities. All this leads to a change in the surface of the barrel bore, its caliber increases, especially at the bullet entrance, and, naturally, to a decrease in its strength as a whole.

An increase in caliber also leads to a decrease in the initial velocity of the bullet, and hence to a sharp deterioration in the weapon's performance, that is, to the loss of its ballistic qualities.

However, the accuracy of a rifled weapon deteriorates not only due to the destruction of the barrel bore surface and its wear. One of the reasons for the deterioration of the accuracy of a rifled weapon is the tombacization of the barrels when firing shell bullets and the lead coating of the barrels when firing small-caliber cartridges, that is, the deposition of metal on the lands and in the corners of the rifling, which is also layered unevenly. And since metal deposits occur differently in each barrel, the combat changes differently in each rifle. This happens especially sharply in small-caliber rifles. Therefore, each shooter should study the nature and features of the combat of his rifle and determine in which mode it has the best combat, depending on which periodically clean the barrel from lead. Thus, there are barrels that are distinguished by the best combat during the first 200-300 shots, that is, immediately after removing the lead from the barrel; There are also rifles that require 40-50 shots to be fired before they can regain their best performance within 200-500 shots, etc.

The suitability of a barrel for further shooting is determined by its **"survivability"** - the ability to withstand a certain number of shots, after which it loses its ballistic qualities.

The service rifle AB barrel's "survivability" is 10-12 thousand shots. However, practice shows that barrels usually begin to lose their ballistic qualities after 3500-5000 shots. Of course, their combat remains good, but not so much that it would be possible to achieve particularly high results in shooting.

Proper care, careful handling and timely cleaning of the barrel will help extend its lifespan.

2.2.2 Muzzle velocity and muzzle energy of a bullet

Starting to move along the barrel under the action of powder gases, the bullet reaches its maximum speed a few centimeters from the muzzle. Then, moving by inertia and encountering air resistance, it begins to lose speed. Since the speed of the bullet changes all the time, it is customary to record it only in certain phases of movement, usually when leaving the barrel.

The speed of the bullet at the moment it leaves the barrel is called the initial speed. It is measured by the distance that the bullet could cover in 1 second after leaving the barrel if neither air resistance nor its own weight acted on it.

Since the speed of the bullet at some distance from the muzzle when leaving the barrel bore hardly changes, in calculations it is usually assumed that the bullet has the greatest (maximum) speed at the moment of leaving the barrel bore, that is, that the initial speed of the bullet is the greatest (maximum). It is usually designated as V_0 .

When firing from the AV and BI-7.62 service rifles, the muzzle velocity (V_0) of a light bullet is 865 m/sec, and of a heavy bullet - 800 m/sec; when firing from a small-caliber rifle, the muzzle velocity of a bullet of different lots of cartridges fluctuates within the range of 305-345 m/sec, and when firing from a 9-mm Makarov pistol (PM) - 315 m/sec.

The initial velocity is one of the most important characteristics of not only cartridges, but also weapons. However, it is impossible to judge the ballistic properties of weapons only by it. It is also necessary to consider the weight of the bullet. It is very important to know what energy the bullet has, what work it can do.

It is known that the energy of a moving body depends on its weight (mass) and speed of movement. Therefore, the greater the weight and speed of movement, the greater the kinetic energy of the bullet.

Penetration effect of a light bullet of a service rifle (distance up to 100 m)

Table 6

Material	Bullet penetration, cm
Steel plate	0.6
Iron plate	1,2
A layer of gravel or crushed stone	10-12
Brickwork	15-20
Pine boards (2.5 cm each) spaced at 2.5 cm intervals	35 boards
Wood by the end	Up to 150
Layer of soft clay	70-80
Earth	60-70
A layer of compacted snow	Up to 350

The penetrating action of a bullet (Table 6, 7) is characterized by its kinetic energy (live force). The kinetic energy imparted to the bullet by the powder gases at the moment of its flight from the barrel bore is called muzzle energy. The energy of a bullet is mea-

sured in kilogram-meters (1 kgm is the energy required to perform the work of lifting 1 kg to a height of 1 m).

Penetration effect of a small-caliber rifle bullet (distance up to 25 m)

Table 7

Material	Bullet penetration, cm
Sheet iron	0.2
Brickwork	2.0
Reinforced concrete	1,2
Pine boards	8.0
Plywood	3.2
Dry oak	3.0
Layer of soft clay	8.0
Tightly compacted sand or slag	10.0

Rifle bullets have enormous kinetic energy. Thus, the muzzle energy of a light bullet when fired from a service rifle is 360 kgm. To obtain such energy in such a short period of time, a machine with a capacity of 9600 hp would be required.

As we can see, the initial speed and muzzle energy of the bullet have great practical significance. With an increase in the initial

speed of the bullet and its muzzle energy, the firing range increases; the trajectory of the bullet becomes flatter; the influence of external conditions on the flight of the bullet is significantly reduced, and its penetrating effect increases.

2.2.3 Recoil of the weapon and formation of the angle of departure

When the charge burns, the expanding powder gases press with equal force on the entire surface of the volume they occupy. The pressure of the gases on the walls of the barrel bore causes elastic expansion, the pressure on the bottom of the bullet makes it move quickly along the bore, the pressure on the bottom of the cartridge case, and through it to the breech is transmitted to the entire weapon and makes it move in the direction opposite to the movement of the bullet. It can be said that when a shot is fired, the forces of the powder gases throw the weapon and the bullet in different directions. The movement of the weapon back when fired is called **recoil**.

According to the laws of mechanics, the same force, acting on bodies of different mass (weight), sets them in motion at a speed inversely proportional to their mass (weight). If we neglect the reactive action of powder gases on the muzzle, we can say that the recoil speed of a weapon is as many times less than the initial speed of a bullet as the bullet is lighter than the weapon.

Recoil begins with the start of the bullet's movement and reaches its greatest force at the moment it leaves the barrel.

When firing a rifle, the shooter feels recoil - a sharp push in the shoulder. The desire to reduce the sensation of impact during recoil led to the creation of a stock with a curved buttstock neck. The force of pressure of the powder gases causing recoil acts along the axis of the barrel in the direction opposite to the flight of the bullet. The shooter feels the recoil of the rifle in the shoulder at a point lying below the axis of the barrel. The shoulder's counteraction to recoil is the reaction force that is directed in the opposite direction and equal to it. A pair of forces is formed that makes the rifle rotate with the muzzle upward during the shot (Fig. 29). The torque also

contributes to the fact that the recoil of the rifle is less noticeable to the shooter.

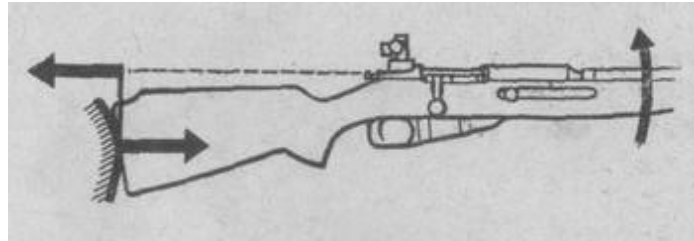


Fig. 29 - A pair of forces causing a rifle to rotate with the muzzle upward when fired

It is interesting that the shooter feels the recoil of different rifles, even of the same model, differently. In one case, the blow to the shoulder is bearable, in another, it is strong. This sensation depends on how the recoil is transmitted from the barrel through the stock to the shooter's shoulder. In order for the recoil to be normal and the rifle not to push hard into the shoulder, it must be adjusted accordingly. Thus, in the service rifles AVL, AV and BI-7.62, the recoil is least noticeable when it is transmitted from the barrel to the stock only through the stop and the dowel - in this case, most of the wood of the stock takes part in the shock absorption.

When shooting a pistol or revolver, the recoil is felt by the hand. The counteraction of the hand is also the reaction force that is directed in the opposite direction and is equal to the recoil force. Since when grasping the pistol or revolver handle, the middle part of the hand is below and to the right of the barrel bore axis, the recoil force and the reaction force create pairs of forces that rotate the weapon in both the vertical and horizontal planes (Fig. 30). As a result of the interaction of these two pairs of forces, the muzzle of the pistol or revolver deflects upward and to the left when fired.

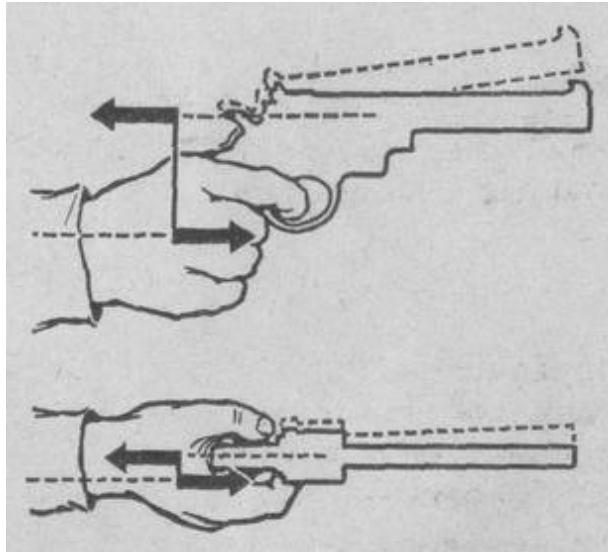


Fig. 30 - Pairs of forces causing a pistol and revolver to rotate their muzzle up and to the left when fired

Recoil from a weapon has a negative effect on shooting accuracy. Not to mention that it tires the shooter and is one of the reasons why some young shooters jerk the trigger, recoil when firing significantly deviates the barrel of the weapon from the initial direction given to it during aiming.

As we can see, when a shot is fired, the weapon, under the influence of recoil and the reaction of the shooter's shoulder (or hand), not only moves back, but also rotates with the muzzle upward. Moreover, the barrel starts to rise upward when the bullet is still in the barrel bore. Consequently, at the moment of the shot, the barrel (the bore axis) shifts by a certain angle. The angle formed by the direction of the bore axis before the shot and at the moment the bullet leaves is called **the ejection angle** (Fig. 31).

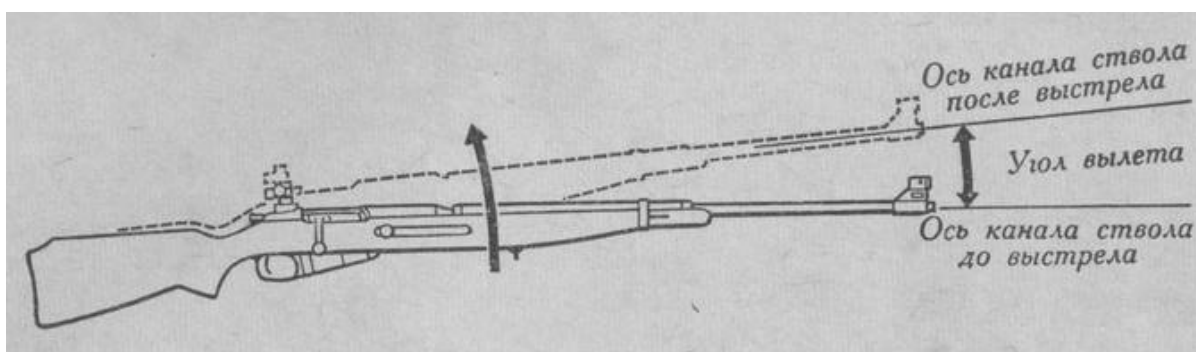


Fig. 31 - Departure angle

The takeoff angle is a variable value and depends to a large extent on the position: if the shooter holds the rifle tightly and uses a tightly stretched sling when shooting from a rifle or uses a tight grip when shooting from a pistol or revolver, the takeoff angle is smaller. The takeoff angle value is even more dependent on the length of the arm of the pair of forces rotating the weapon - as it increases, the takeoff angle also increases (Fig. 32).

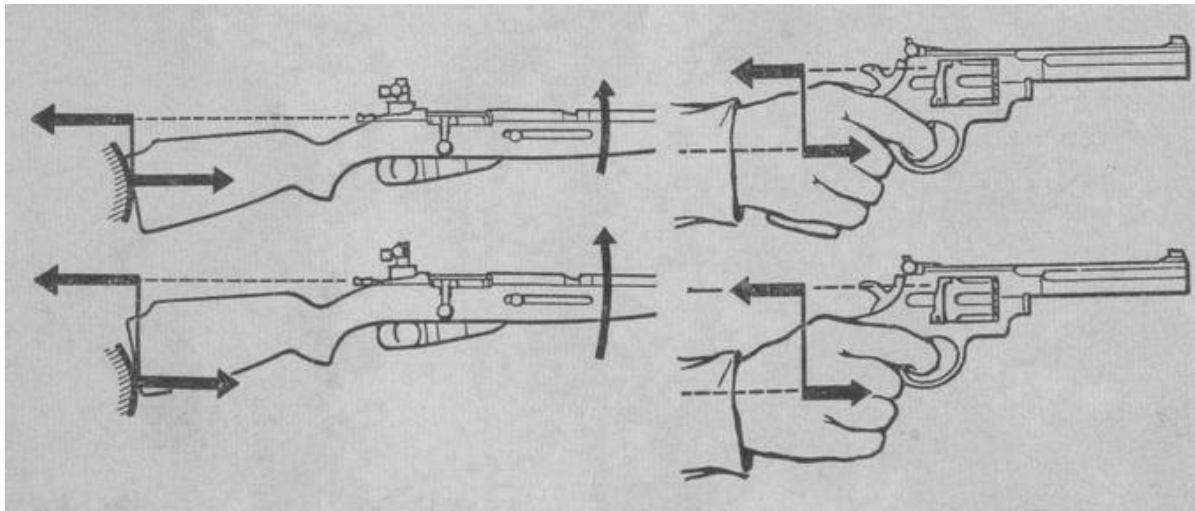


Fig. 32 - Dependence of the angle of departure on the shooter's position or grip (when shooting from a revolver pistol)

It is quite obvious that a non-uniform butt (or non-uniform grip) leads to the fact that with each shot the angles of departure are different, resulting in a vertical dispersion of bullets (and when shooting from a pistol and revolver, also horizontally).

Therefore, in order to achieve accurate and stable shooting, it is necessary to develop the ability to correctly and uniformly prepare before each shot, and to carefully and individually adjust rifle butts and pistol orthopedic grips.

The formation of the launch angle is a very complex phenomenon, depending not only on the recoil of the weapon, but also on the vibration of the barrel.

When the charge burns and the resulting impact of the powder gases, the barrel begins to vibrate. The thinner the barrel, the more it vibrates; the more massive (as, for example, in arbitrary rifles), the less vibration. The phenomenon of vibration consists in the fact that all points of the barrel perform some oscillations relative to

their normal position. In this case, the range of oscillations of points located along the entire length of the barrel is different. It turns out that there are such points on the barrel that do not oscillate at all - the so-called nodal points (Fig. 33). Together with other parts of the barrel, its muzzle also oscillates. Since the wave-like oscillations of the barrel begin before the bullet flies out of it, the final direction of the bullet depends on which phase of the oscillations of the muzzle of the barrel coincides with the moment of its departure.

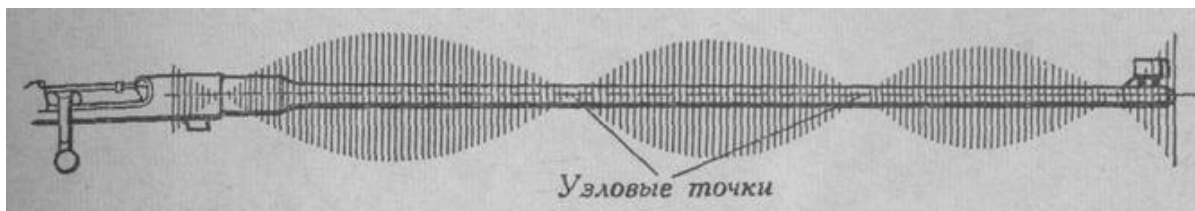


Fig. 33 - Schematic representation of barrel vibration during firing

Thus, the value of the angle of departure depends to a large extent on the vibration of the barrel. If, during its vibration, the muzzle part of the barrel at the moment of the bullet's departure is directed higher than before the shot, then the angle of departure that arose during the vibration is positive; if lower, it is negative.

Strictly speaking, the shooter is completely indifferent to the angle of departure obtained during shooting - positive or negative. It is important that it is relatively constant and there is no large spread of bullets. Uniformity in the angles of departure can be achieved by adjusting the weapon so that the barrel can always experience vibrations in a uniform manner. To do this, the barrel is adjusted to the fore-end so that there is a gap between them or a seal is installed that will allow the barrel to touch the fore-end only in a certain place. It is necessary to ensure that no foreign solid body (a stone, thickened grease with dust, etc.) gets into the gap between the fore-end and the barrel, which can disrupt the free vibration of the barrel. The same consequences can be caused by warping of the stock due to swelling or shrinkage, or temporary deformation of it, caused by strong heating of the barrel during prolonged shooting at an accelerated pace.

It is therefore very important to develop the habit of thoroughly checking and inspecting your rifle before and during shooting, pay-

ing particular attention to the fit of the barrel in the rifle stock.

It should be noted that the recoil and vibration of the barrel significantly affect the accuracy when shooting with a rest. Practice shows that when switching from a hard rest to a soft rest and vice versa, the contact of the rifle with the rest further or closer to the muzzle or breech noticeably affects both the accuracy of the shot and the accuracy of the shot - the change in the average point of impact (API). To avoid unexpected movements of the API and the scattering of bullets, it is best not to put the rifle on it, but to use the rest as a support for the forearm and left hand. Moreover, the use of the rest should not interfere with the shooter's usual position.

Chapter 3. External Ballistics

2.3.1 Bullet trajectory

A bullet, having received a certain initial velocity when leaving the barrel, tends by inertia to maintain the magnitude and direction of this velocity. If the bullet were flying in an airless space and the force of gravity did not act on it, the bullet would move in a straight line, uniformly and infinitely. However, a bullet flying in the air is affected by forces that change the flight speed and direction of movement. These forces are the force of gravity and the force of air resistance (Fig. 34).

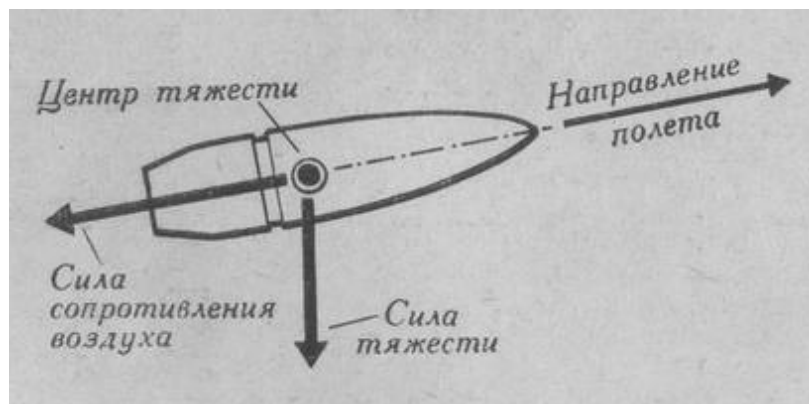


Fig. 34 - Forces acting on a bullet during its flight

As a result of the combined action of these two forces, the bullet loses speed and changes the direction of its movement, moving along a curved line passing below the direction of the barrel bore axis.

The line that the center of gravity of a moving bullet (projectile) describes in space is called **the trajectory** .

Ballistics considers the trajectory above (or below) the weapon's horizon - an imaginary infinite horizontal plane passing through the launch point (Fig. 35).

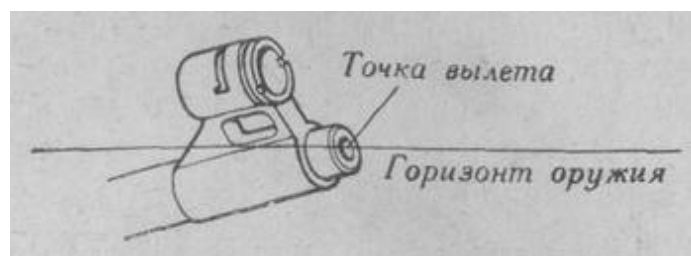


Fig. 35 - Weapon horizon

The movement of the bullet, and therefore the shape of the trajectory, depends on many conditions. Therefore, it is necessary first of all to consider how the force of gravity and the force of air resistance act on the bullet separately.

The effect of gravity . Let us imagine that no force acts on the bullet that has flown out of the barrel bore. In this case, it would move by inertia infinitely, uniformly and rectilinearly in the direction of the barrel bore axis and would fly the same distances every second with a constant speed equal to the initial speed. Then, if the gun barrel were aimed straight at the target, the bullet, following in the direction of the barrel bore axis, would certainly hit it (Fig. 36).

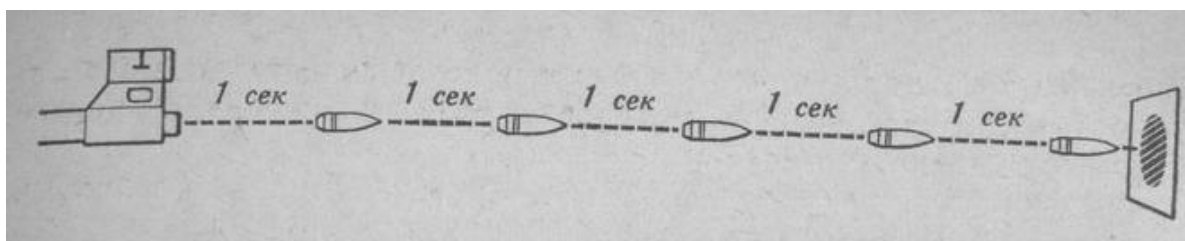


Fig. 36 - Bullet movement by inertia (if there were no gravity and air resistance)

Let's now assume that the bullet is acted upon only by gravity. Then, like any freely falling body, it will begin to fall vertically downwards.

As is known from mechanics, the height of the fall: $H = gt^2 / 2$

where g is the acceleration of gravity (9.8 m/sec^2), t is the time in seconds.

Thus, in 1 sec. the bullet will fall down $9.8 \cdot 1^2 / 2 = 4.9 \text{ m}$, in 2 sec. - $9.8 \cdot 2^2 / 2 = 19.6 \text{ m}$, in 3 sec. - 44.1 m , in 4 sec. - 78.4 m , etc. (Fig. 37).

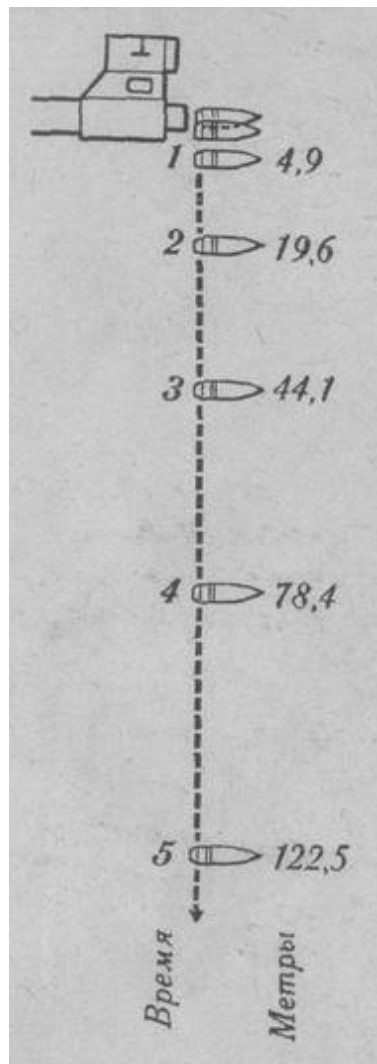


Fig. 37 - Fall of a bullet (in a vacuum) under the action of gravity

If we assume that during the inertial flight in airless space the bullet is affected by the force of gravity, then under its action the bullet will fall below the line of the continuation of the barrel bore axis by 4.9 m in the first second, by 19.6 m in the second, etc. Then, if you aim the weapon at the target, the bullet will fly under the target (Fig. 38).

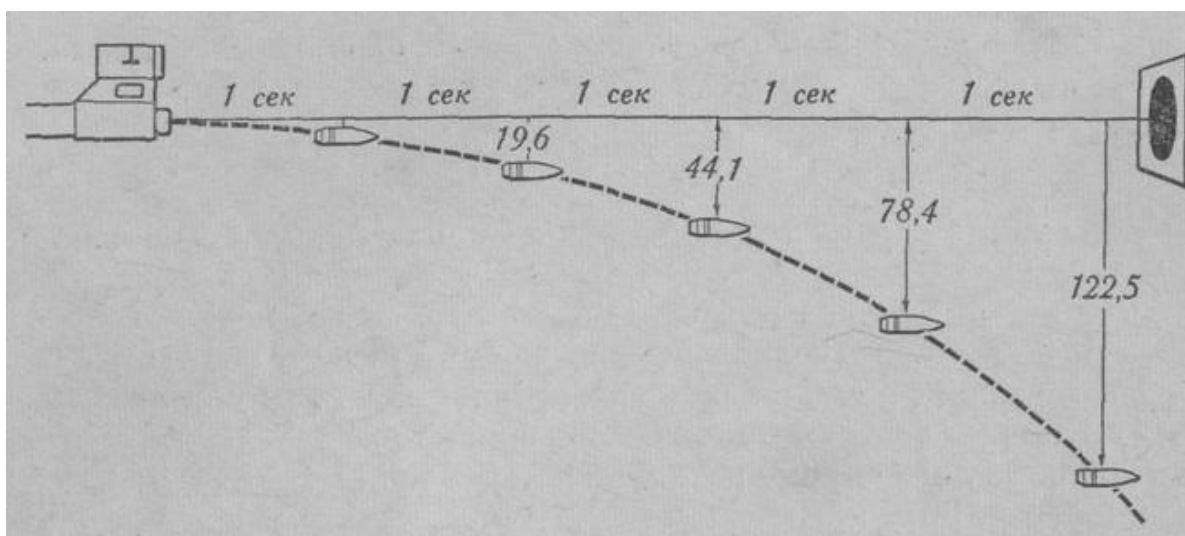


Fig. 38 - The movement of a bullet (if gravity acted on it, but air resistance did not act on it)

Therefore, in order for the bullet to fly a certain distance and hit the target, it is necessary to point the gun barrel somewhere above the target. To do this, the barrel bore axis and the gun's horizontal plane must form a certain angle, which is called **the elevation angle** (Fig. 39).

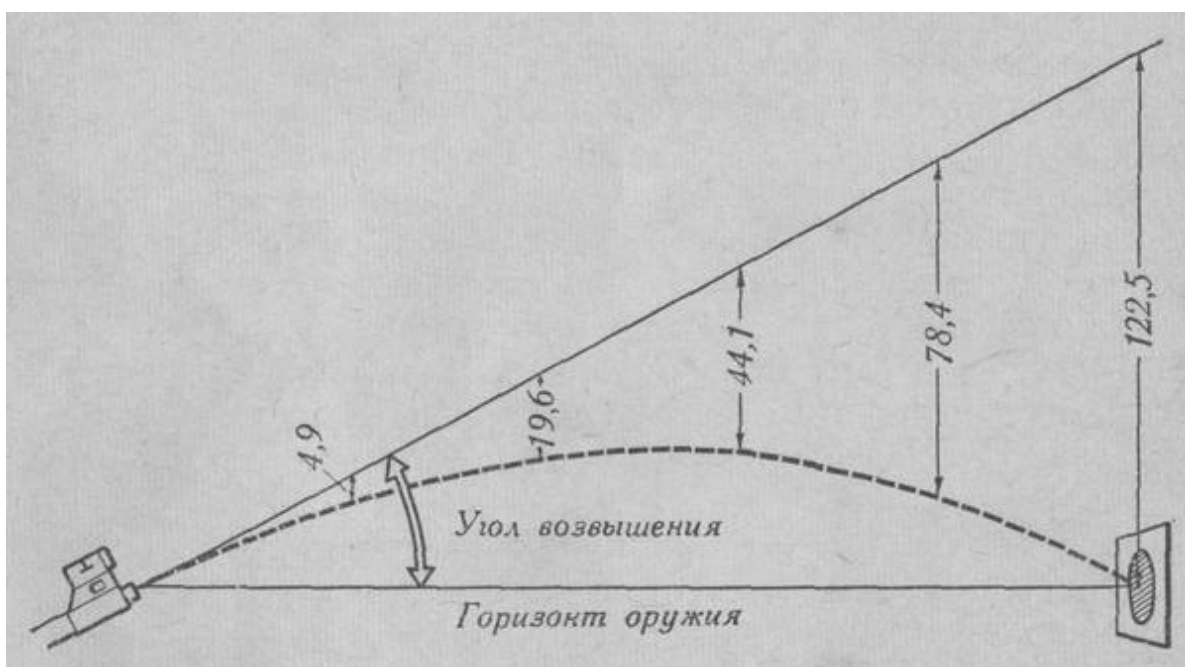


Fig. 39 - Elevation angle (bullet trajectory in airless space)

As can be seen in Fig. 39, the trajectory of a bullet in a vacuum, acted upon by gravity, is a regular curve - a parabola. The highest point of the trajectory above the horizon of the weapon is called its

apex. The part of the curve from the point of departure to the apex is called the ascending branch. Such a trajectory is distinguished by the fact that the ascending and descending branches are absolutely identical, and the angle of throw and the angle of incidence are equal.

The effect of air resistance . At first glance, it seems unlikely that air, which has such a low density, could provide significant resistance to the movement of a bullet and thereby significantly reduce its speed.

However, experiments have shown that the force of air resistance acting on a bullet fired from a 7.62 mm rifle is greater - 3.5 kg.

Since the bullet weighs only a few grams, the great braking effect that air has on a flying bullet becomes obvious.

During flight, the bullet spends a significant portion of its energy to push apart air particles. A photograph of a bullet flying at supersonic speed (over 340 m/sec) shows that an air condensation forms in front of its nose (Fig. 40). From this condensation, the head ballistic wave spreads in all directions. Air particles, sliding along the surface of the bullet and breaking away from its side walls, form a zone of rarefied space behind the bullet. Trying to fill the resulting void, the air particles create swirls, as a result of which a tail wave is pulled behind the bullet.

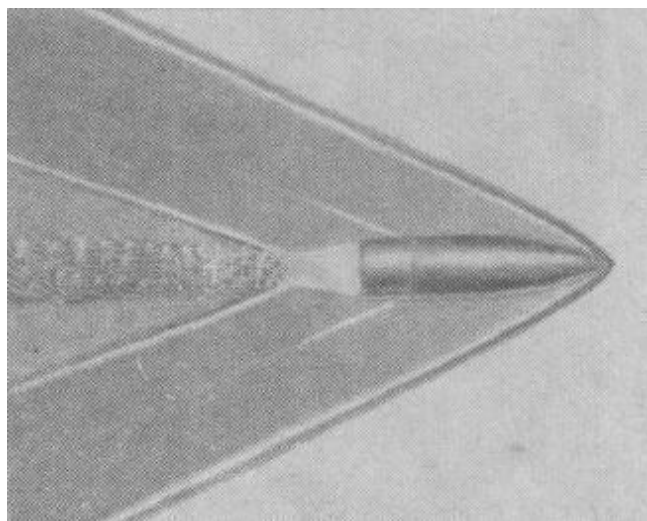


Fig. 40 - Photograph of a bullet flying at supersonic speed (over 340 m/sec)

The compaction of air in front of the bullet's nose slows its flight, the rarefied zone behind sucks it in and further increases the braking; the walls of the bullet experience friction against air particles, which also slows its flight. The resultant of these three forces is the force of air resistance. How great the effect of air resistance on the flight of a bullet can be judged from the graph shown in Fig. 41.

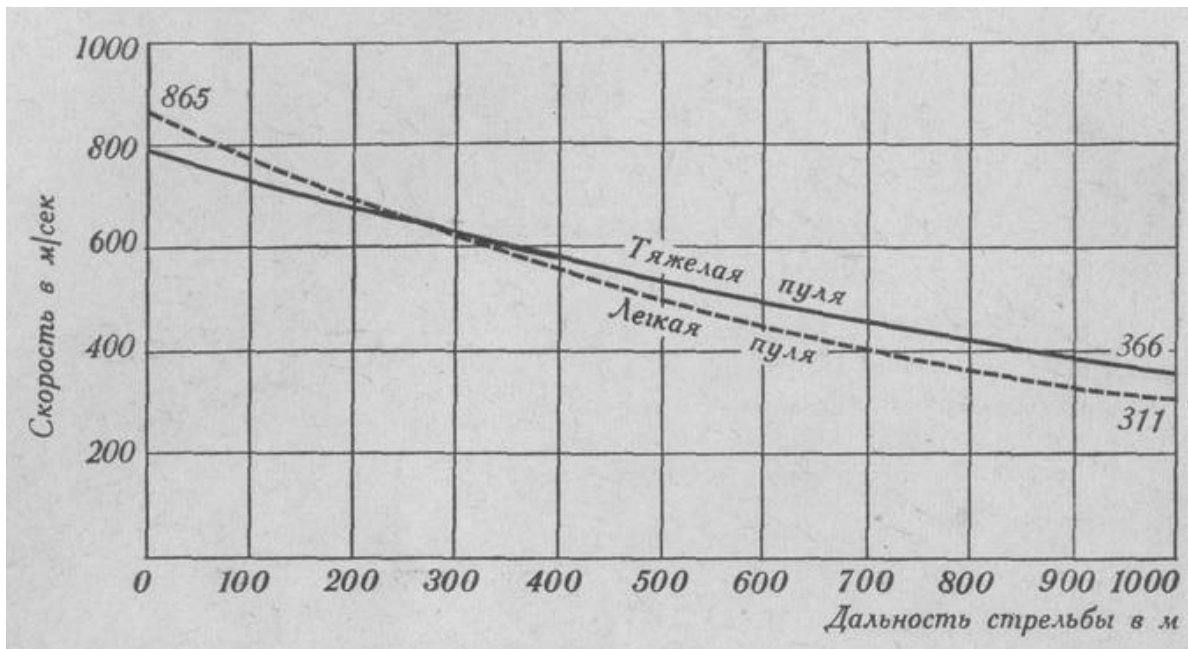


Fig. 41 - Final velocity of light and heavy bullets when fired from a 7.62 mm service rifle

Consequently, under the action of air resistance, the bullet's trajectory loses the shape of a regular parabola - now it looks like an asymmetric curve: the top divides it into two unequal parts, and the ascending branch is always longer and longer than the descending one. When shooting at medium distances, the ratio of the length of the ascending branch of the trajectory to the descending one can be conventionally taken as 3:2.

2.3.2 Effect of air resistance on an oblong bullet

In order for air resistance to slow down the bullet's flight less, its caliber must be reduced and its weight increased. This explains the appearance of an oblong-shaped bullet.

How does the force of air resistance affect such a bullet? To do this, you need to know not only the magnitude of this force, but

also the direction in which it acts and the point of its application.

During flight, a bullet tends by inertia to maintain the direction of its longitudinal axis that was given to it by the barrel.

If the bullet were flying in airless space, the direction of its longitudinal axis would be unchanged and the bullet would fall to the ground not with its head, but with its bottom (Fig. 42).

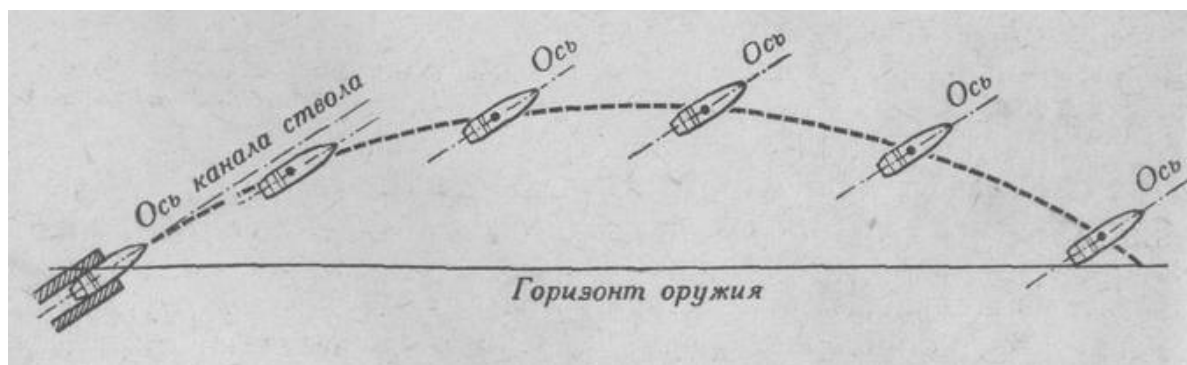


Fig. 42 - Direction of the bullet axis in airless space

However, under the influence of air resistance, its flight occurs differently. At the first moment, when the bullet flies out of the barrel, air resistance only slows its movement (Fig. 43, a). But as soon as it begins to descend under the influence of gravity, air particles begin to press not only on the head part, but also on its side surface (Fig. 43, b).



Fig. 43 - The effect of air resistance on a bullet:

a - at the very beginning of its flight; *b* - during its flight.

The further the bullet descends, the greater part of its lateral surface is exposed to air resistance. And since air particles exert significantly greater pressure on the head than on the tail, they tend to tip it backwards with the head (Fig. 44).

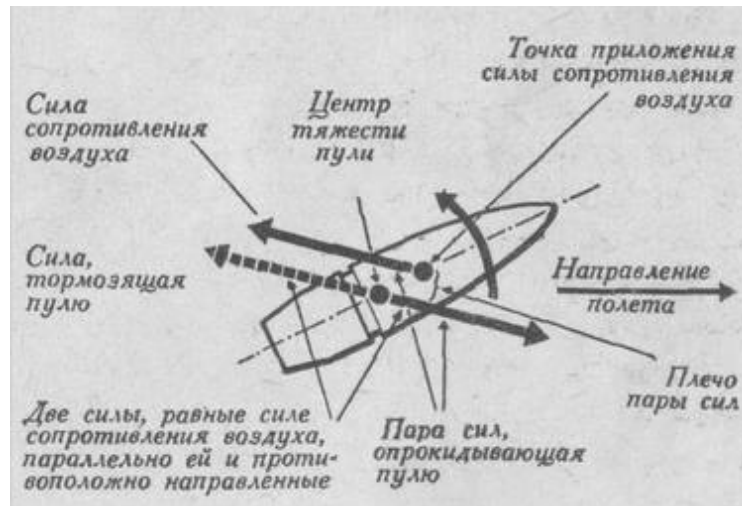


Fig. 44 - The overturning effect of air resistance on a flying bullet

Consequently, the force of air resistance not only slows down the flight of the bullet, but also tends to tip its head backwards. And the higher the speed of the bullet and the longer it is, the stronger the tipping effect of the air. It is quite clear that with such an action the bullet will start to tumble in flight (Fig. 45): exposing first one side, then the other to the air flow, it will quickly lose speed. As a result, the flight range will be short, and the accuracy will be unsatisfactory.

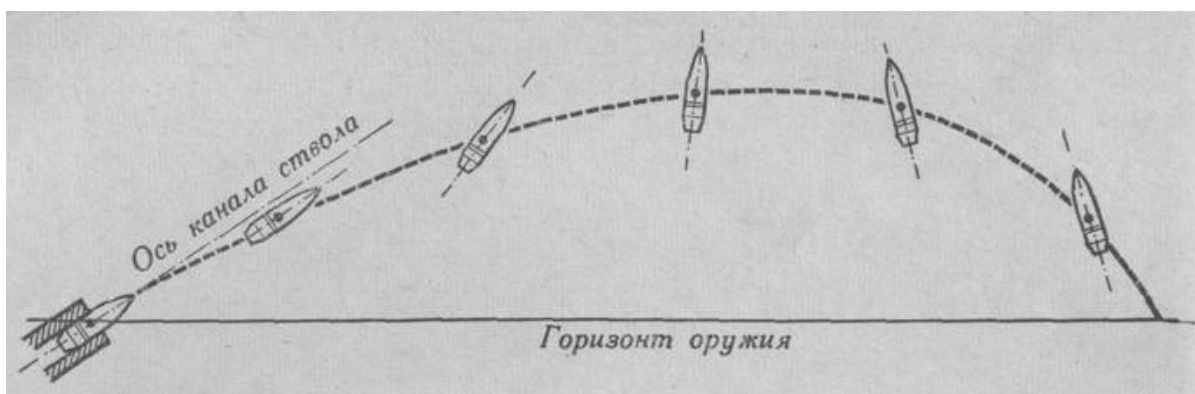


Fig. 45 - Flight of a non-rotating elongated bullet in the air

2.3.3 Rotation of the bullet around its longitudinal axis

It is known that a body acquires considerable stability if it is given a rapid rotational motion around its own axis. An example of the stability of a rotating body is the toy "top". If it is given a rapid rotational motion around its axis, it will stand stably on its pointed end.

In order for the bullet to acquire the ability to fight the overturning effect of air resistance and maintain stability in flight, it must also be given a rapid rotational motion around the longitudinal axis. The bullet acquires this thanks to the helical rifling in the gun barrel. Under the action of the pressure of the powder gases, the bullet moves forward along the bore, simultaneously rotating around its longitudinal axis. After leaving the barrel, it maintains the obtained motion by inertia - translational and rotational.

Without going into details of physical phenomena related to the action of forces on a body undergoing complex motion, it is nevertheless necessary to say that a bullet in flight performs regular oscillations and describes circles around the trajectory with its head part (Fig. 46). At the same time, the longitudinal axis of the bullet seems to follow the trajectory, describing a conical surface around it (Fig. 47).

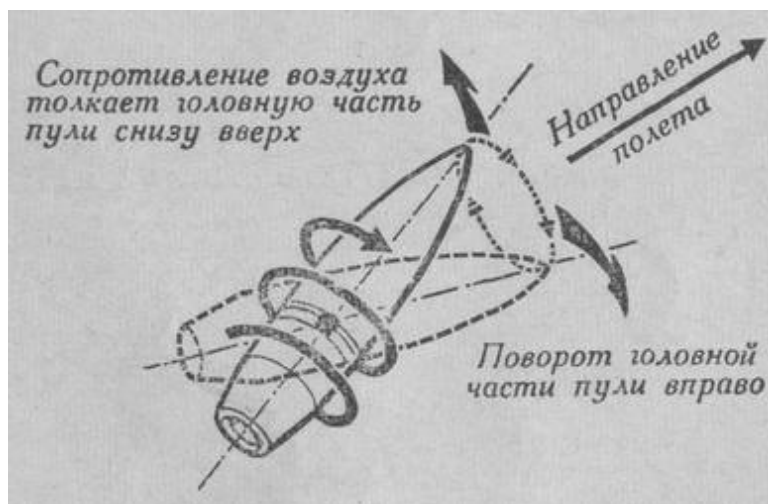


Fig. 46 - As a result of two rotational movements, the bullet gradually turns its head to the right (in the direction of rotation)

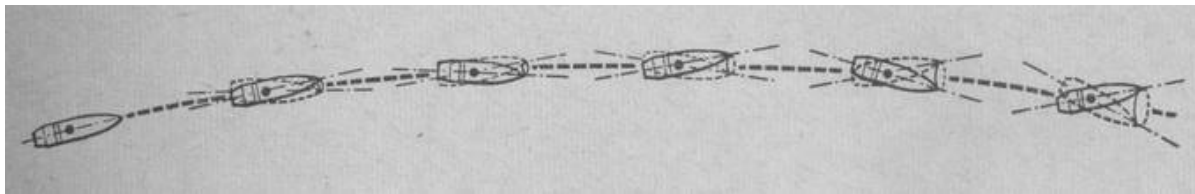


Fig. 47 - Flight of a rotating bullet in the air

If we apply the laws of mechanics to a flying bullet, it becomes obvious that the greater the speed of the bullet and the longer it is, the more the air tends to overturn it. Therefore, different types of cartridges require different rotation speeds. Thus, a light bullet fired from a service rifle has a rotation speed of 3604 rpm, and from a small-caliber rifle - only 830 rpm.

However, the rotational movement of the bullet, which is so necessary to give it stability during flight, also has its negative sides.

As we already know, a rapidly rotating bullet is continuously subjected to the overturning force of air resistance, due to which the head of the bullet describes a circle around the trajectory. As a result of the addition of these two rotational movements, a new movement arises, deflecting its head away from the plane of fire (the vertical plane passing through the axis of the barrel bore) (see Fig. 46). In this case, one side surface of the bullet is subjected to more air particle pressure, the other to less. This deflects the bullet to the side. The lateral deviation of a rotating bullet from the plane of fire in the direction of its rotation is called **derivation**.

As the bullet moves away from the muzzle of the weapon, the magnitude of its deflection rapidly and progressively increases.

When shooting at close and medium distances, the deviation does not have much practical significance. Thus, when shooting at a distance of 300 m, the deviation is 2 cm, at a distance of 600 m - 12 cm. Derivation should be taken into account only for particularly accurate shooting at long distances, making appropriate adjustments to the sight installation.

2.3.4 Dependence of the trajectory shape on the throwing angle. Trajectory elements

The angle formed by the horizon of the weapon and the continuation of the axis of the barrel bore before firing is called **the elevation angle** .

However, it is more correct to talk about the dependence of the horizontal firing range, and consequently, the shape of the trajectory on **the throwing angle** , which is the algebraic sum of the elevation angle and the departure angle (Fig. 48).

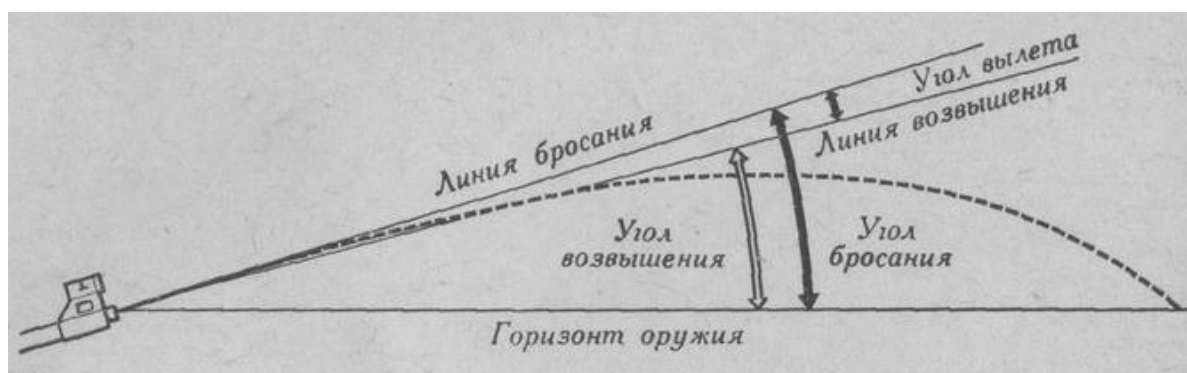


Fig. 48 - Elevation angle and throwing angle

So, there is a certain relationship between the bullet's flight range and the throwing angle.

According to the laws of mechanics, the greatest horizontal range of flight in airless space is achieved when the throwing angle is 45° . As the angle increases from 0 to 45° , the bullet's range increases, and from 45 to 90° , it decreases. The throwing angle at which the horizontal range of the bullet is greatest is called **the angle of greatest range** .

When a bullet flies in the air, the angle of greatest range does not reach 45° . Its value for modern small arms fluctuates within $30-35^\circ$, depending on the weight and shape of the bullet.

Trajectories formed at throwing angles less than the angle of greatest range ($0-35^\circ$) are called **flat** trajectories. Trajectories formed at throwing angles greater than the angle of greatest range ($35-90^\circ$) are called **overhead** trajectories (Fig. 49).

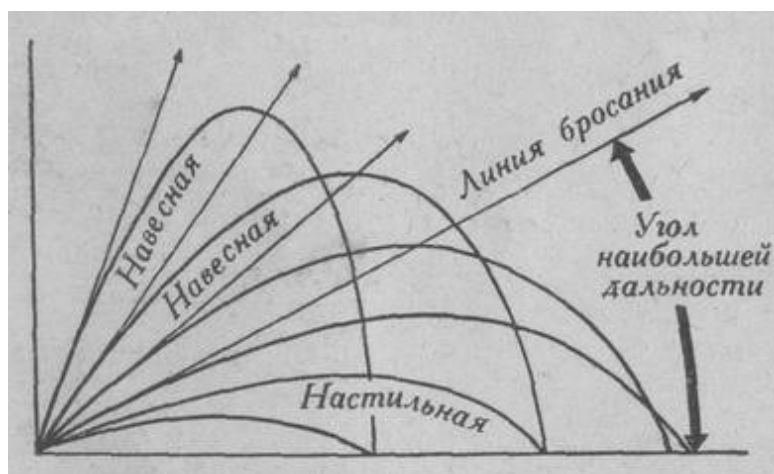


Fig. 49 - Flat and overhead trajectories

When studying the movement of a bullet in the air, the designations of the trajectory elements shown in Fig. 50 are used.



Fig. 50 - Trajectory and its elements:

the launch point is the center of the muzzle of the barrel; it is the beginning of the trajectory;

the horizon of the weapon is a horizontal plane passing through the launch point. In drawings and pictures showing the trajectory from the side, the horizon has the form of a horizontal line;

the elevation line is a straight line that is a continuation of the bore axis of the aimed weapon;

the throwing line is a straight line that is a continuation of the bore axis at the moment of firing. Tangent to the trajectory at the launch point;

firing plane is a vertical plane passing through the elevation line;

elevation angle is the angle formed by the elevation line and the horizon of the weapon;

throwing angle is the angle formed by the throwing line and the horizon of the weapon;

launch angle is the angle formed by the elevation line and the throwing line;

impact point is the point of intersection of the trajectory with the horizon of the weapon;

impact angle is the angle formed by the tangent to the trajectory at the point of impact and the horizon of the weapon;

horizontal range is the distance from the launch point to the point of impact;

trajectory vertex - the highest point of the trajectory above the weapon horizon. The vertex divides the trajectory into two parts - trajectory branches;

the ascending trajectory branch - the part of the trajectory from the takeoff point to the apex;

the descending trajectory branch - the part of the trajectory from the apex to the point of impact;

trajectory height - the distance from the trajectory vertex to the weapon horizon.

Since in sport shooting the distances for each type of weapon remain basically unchanged, many shooters do not think at all about what angle of elevation or throwing they should shoot. In practice, it has proven much more convenient to replace the throwing angle with another, very similar one - **the aiming angle** (Fig. 51). Therefore, slightly deviating from the presentation of external ballistics issues, we give the elements of weapon aiming (Fig. 52).

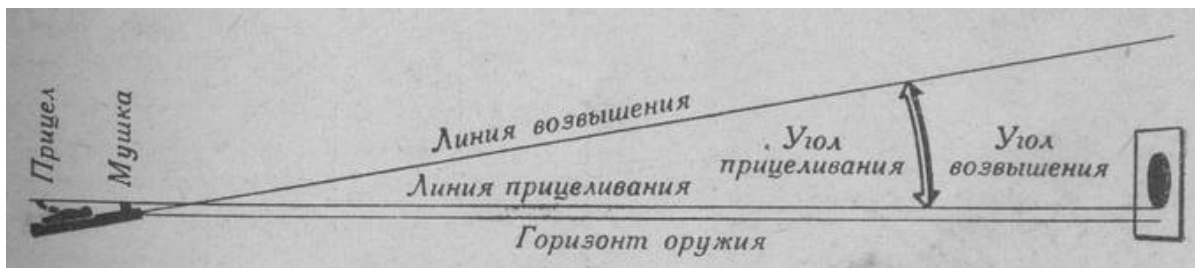


Fig. 51 - Aiming line and aiming angle



Fig. 52 - Elements of aiming a weapon at a target:

aiming line - a straight line passing from the shooter's eye through the sight slits and the top of the front sight to the aiming point;

aiming point - the point of intersection of the aiming line with the target or the target plane

(when moving the aiming point);

aiming angle - the angle formed by the aiming line and the elevation line;

target elevation angle - the angle formed by the aiming line and the weapon's horizon;

elevation angle - the algebraic sum of the aiming angles and the target elevation angle.

It would be useful for a shooter to know the degree of flatness of the trajectories of bullets used in sport shooting. Therefore, we provide graphs characterizing the excess of the trajectory when shooting from various rifles, pistols and revolvers (Fig. 53-57).

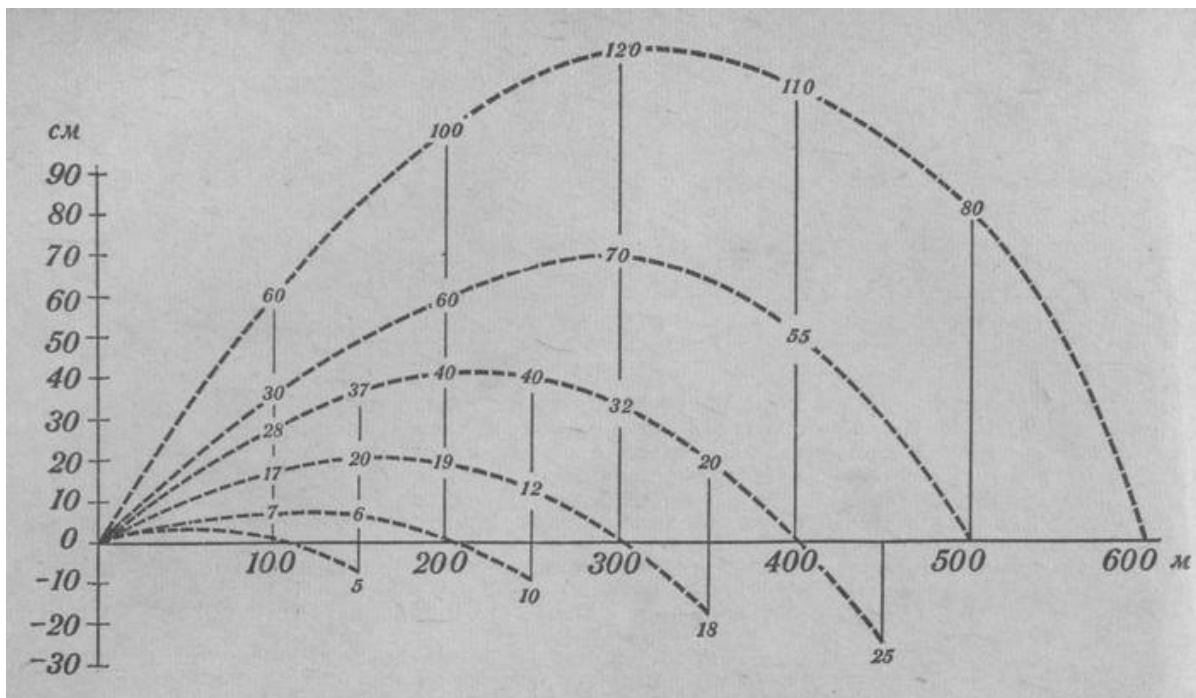


Fig. 53 - Excess of trajectory over the aiming line when shooting a 7.6 mm heavy bullet from a service rifle

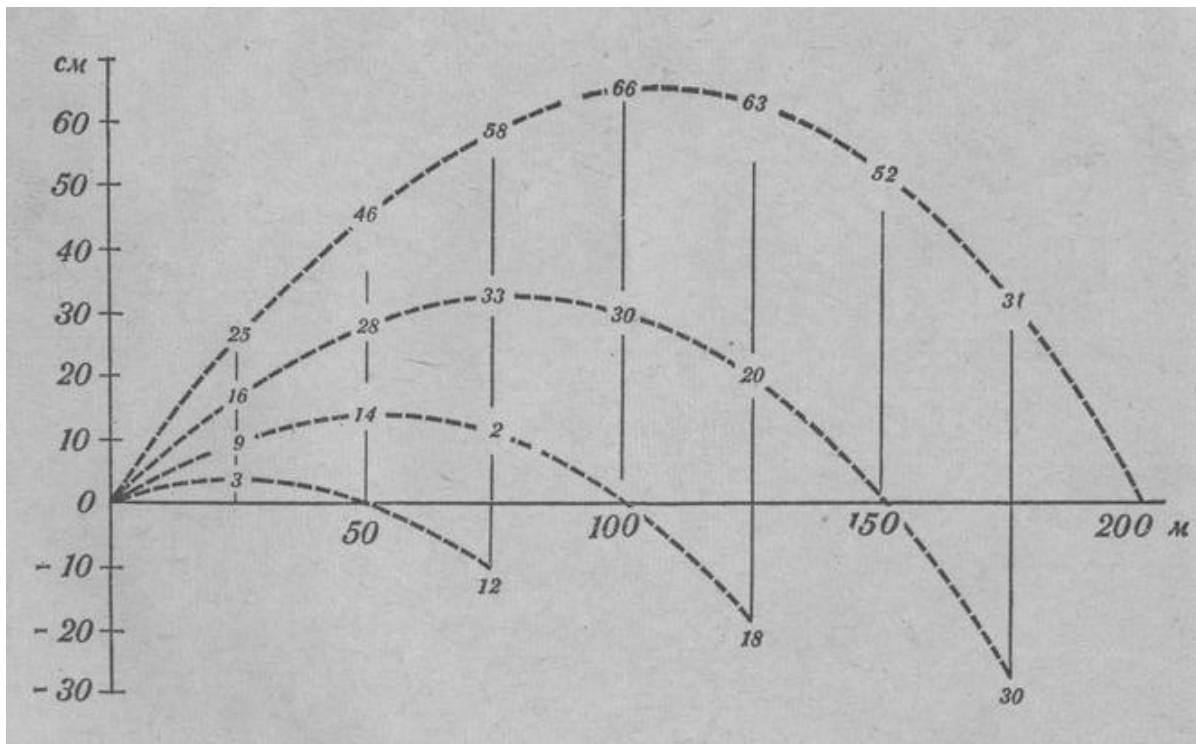


Fig. 54 - Excess of the bullet trajectory over the aiming line when shooting from a small-caliber rifle (at $V_0 = 300$ m/sec)

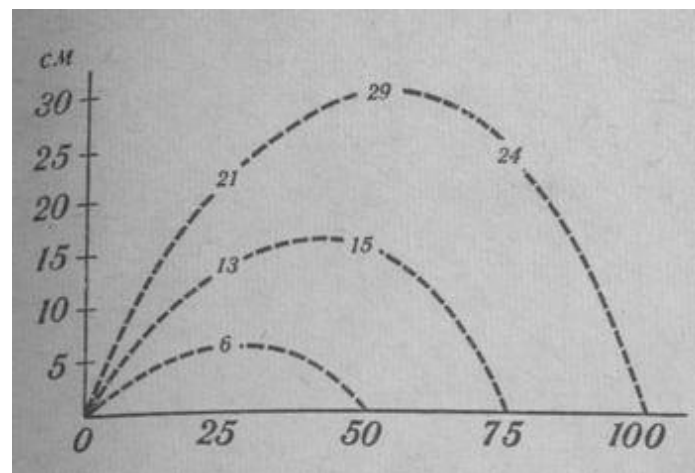


Fig. 55 - Excess of the bullet trajectory over the aiming line when shooting from a small-caliber pistol (at $V_0 = 210$ m/sec)

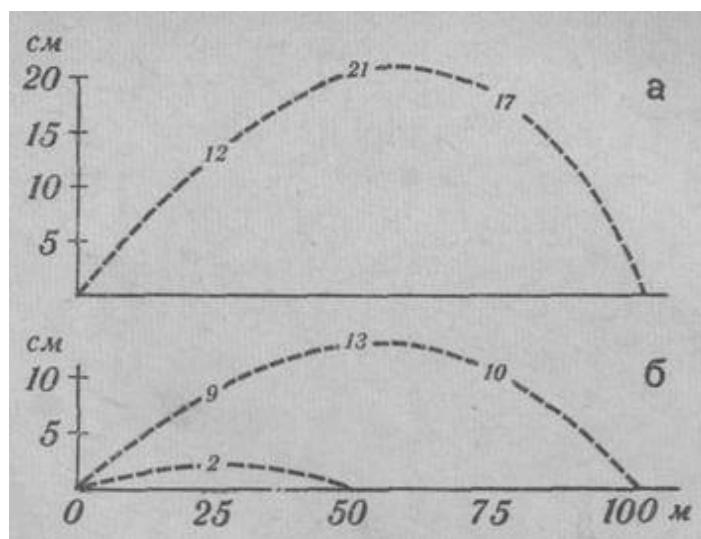


Fig. 56 - Excess of the bullet trajectory over the aiming line when shooting:

a - from a re-barreled revolver (at $V_0 = 260$ m/sec); b - from a PM pistol (at $V_0 = 315$ m/sec).

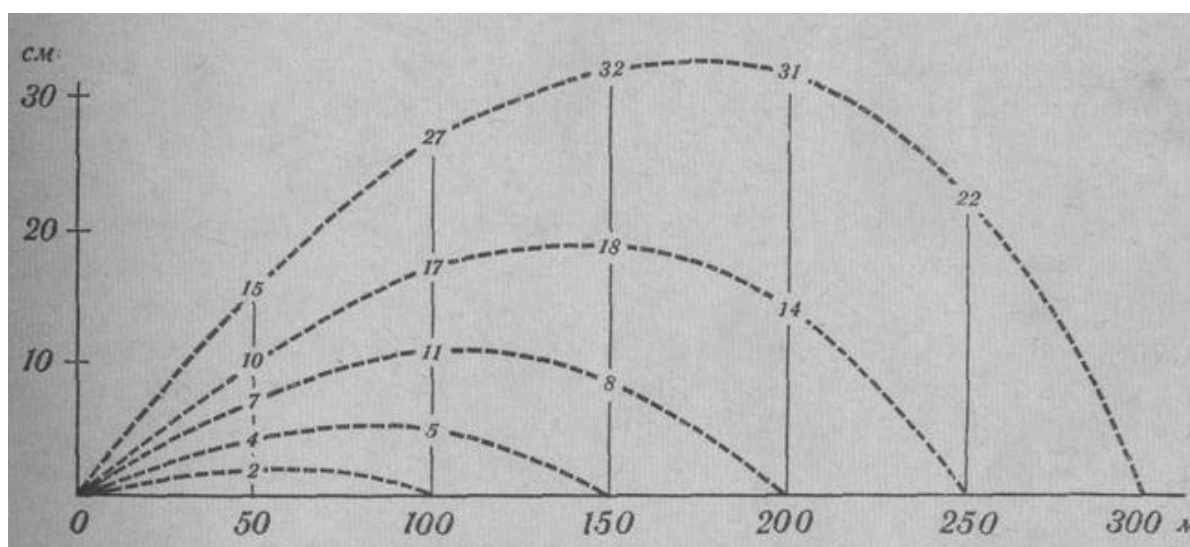


Fig. 57 - Excess of the bullet trajectory over the aiming line when shooting from a rifle with a 5.6 mm sport-hunting cartridge (at $V_0 = 880$ m/sec)

2.3.5 Dependence of the trajectory shape on the initial bullet velocity, its shape and transverse load

While retaining their basic properties and elements, bullet trajectories can differ greatly from one another in their shape: they can be longer and shorter, have different slopes and curvatures. These various changes depend on a number of factors.

Effect of initial velocity . If two identical bullets are fired at the same angle with different initial velocities, the trajectory of the bullet with the higher initial velocity will be higher than the trajectory of the bullet with the lower initial velocity (Fig. 58).

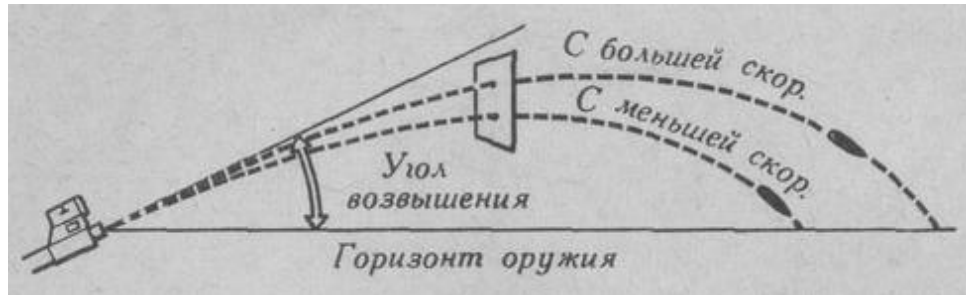


Fig. 58 - Dependence of the trajectory height and flight range of a bullet on the initial velocity

A bullet flying at a lower initial speed will need more time to reach the target, so under the influence of gravity it will have time to descend significantly further. It is also obvious that with an increase in speed, its flight range will also increase.

Influence of bullet shape . The desire to increase the range and accuracy of shooting required giving the bullet a shape that would allow it to maintain speed and stability in flight for as long as possible.

The condensation of air particles in front of the bullet's nose and the zone of rarefied space behind it are the main factors of air resistance. The nose wave, which sharply increases the bullet's braking, occurs when its speed is equal to or exceeds the speed of sound (over 340 m/sec).

If the bullet's speed is less than the speed of sound, it flies at the very crest of the sound wave, without experiencing excessive air resistance. If it is greater than the speed of sound, the bullet overtakes all the sound waves that form in front of its head. In this case, a head ballistic wave occurs, which slows down the bullet's flight significantly more, causing it to quickly lose speed.

If we look at the outlines of the bow wave and the swirls of air that arise when different shaped bullets move (Fig. 59), we can see that the pressure on the head of the bullet is less, the sharper its

shape. The area of rarefied space behind the bullet is less, the more its tail is beveled; in this case, there will also be fewer swirls behind the flying bullet.

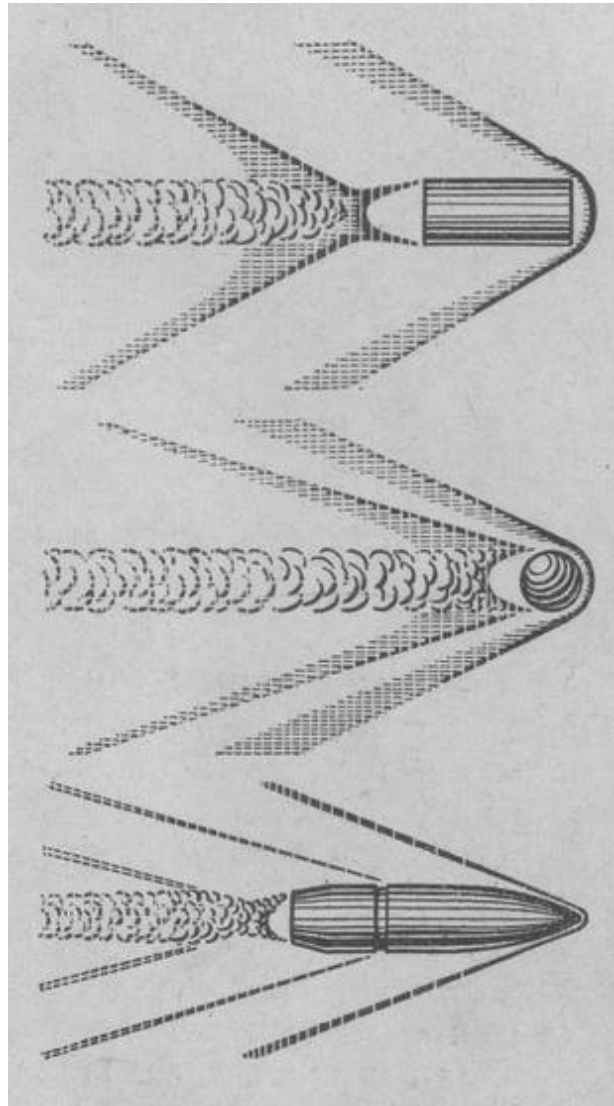


Fig. 59 - The nature of the outlines of the head wave that occurs when moving bullets of different shapes

Both theory and practice have confirmed that the most streamlined bullet shape is the one that follows the so-called curve of least resistance - cigar-shaped. Experiments show that the air resistance coefficient can vary by one and a half to two times depending only on the shape of the bullet's head.

Different flight speeds correspond to their own, most advantageous, bullet shape.

When shooting at short distances with bullets that have a low initial velocity, their shape has little effect on the shape of the trajectory. Therefore, revolver, pistol and small-caliber cartridges are loaded with blunt-pointed bullets: this is more convenient for reloading the weapon, and also helps to protect it from damage (especially un-jacketed ones - for small-caliber weapons).

Considering the dependence of shooting accuracy on the shape of the bullet, the shooter must protect the bullet from deformation, ensure that scratches, nicks, dents, etc. do not appear on its surface.

The effect of transverse load . The heavier the bullet, the more kinetic energy it has, and therefore the less air resistance affects its flight. However, the ability of a bullet to maintain its speed depends not simply on its weight, but on the ratio of its weight to the area that encounters air resistance. The ratio of the bullet's weight to the area of its largest cross-section is called **the transverse load** (Fig. 60).

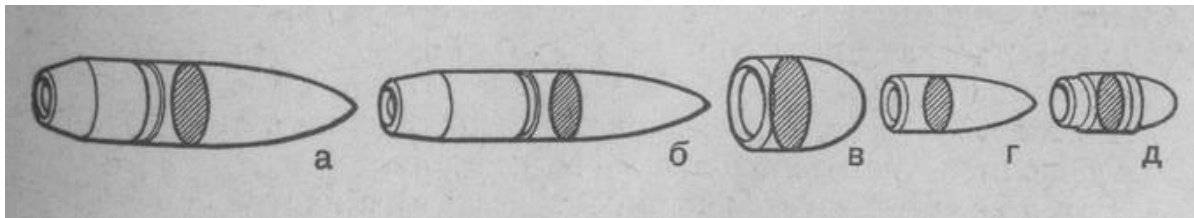


Fig. 60 - Cross-sectional area of bullets:

a - for a 7.62 mm rifle; *b* - for a 6.5 mm rifle; *c* - for a 9 mm pistol; *d* - for a 5.6 mm rifle for shooting at a "Running Deer" target; *d* - for a 5.6 mm rimfire rifle (long cartridge).

The greater the bullet weight and the smaller the caliber, the greater the transverse load. Consequently, with the same caliber, the transverse load is greater for a longer bullet. A bullet with a greater transverse load has both a greater flight range and a flatter trajectory (Fig. 61).

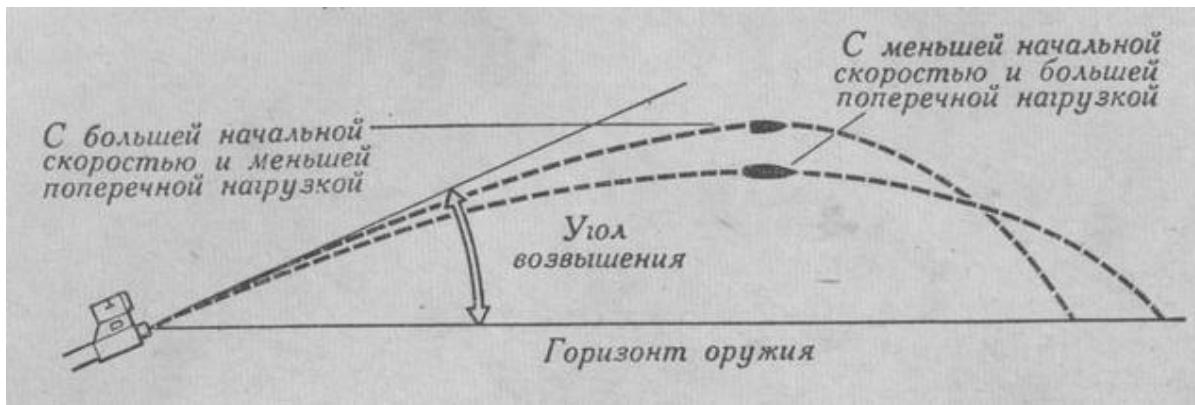


Fig. 61 - The effect of the bullet's transverse load on its flight range

However, there is a certain limit to increasing this load. First of all, with its increase (with the same caliber), the total weight of the bullet increases, and therefore the recoil of the weapon. In addition, an increase in the transverse load due to excessive elongation of the bullet will cause a significant tilting action of its head part backwards by the force of air resistance. This is the basis for establishing the most favorable dimensions of modern bullets. Thus, the transverse load of a heavy bullet (weight 11.75 g) for a service rifle is 26 g / cm^2 , a small-caliber bullet (weight 2.6 g) - 10.4 g / cm^2 .

The extent to which the transverse load of a bullet influences its flight can be seen from the following data: a heavy bullet with an initial velocity of about 770 m/sec has a maximum flight range of 5100 m, while a light bullet with an initial velocity of 865 m/sec has a maximum flight range of only 3400 m.

2.3.6 Dependence of the trajectory on meteorological conditions

Constantly changing meteorological conditions during shooting can have a significant impact on the flight of a bullet. However, certain knowledge and practical experience help to significantly reduce their harmful effect on shooting accuracy.

Since the distances of sport shooting are relatively short and the bullet flies through them in a very short time, some atmospheric factors, such as air density, will not have a significant effect on its flight. Therefore, in sport shooting, it is necessary to take into ac-

count mainly the influence of the wind and, to a certain extent, the air temperature.

Wind influence . Headwinds and tailwinds have little effect on shooting accuracy, so shooters usually ignore their effect. Thus, when shooting at a distance of 600 m, a strong (10 m/sec) headwind or tailwind changes the POI by only 4 cm.

A crosswind significantly deflects the bullet to the side, even when shooting at close range.

Wind is characterized by strength (speed) and direction.

Wind strength is determined by its speed in meters per second. In shooting practice, wind is distinguished as follows: weak - 2 m/sec, moderate - 4-5 m/sec and strong - 8-10 m/sec.

The strength and direction of the wind are practically determined by various local signs: with the help of a flag, by the movement of smoke, the swaying of grass, bushes and trees, etc. (Fig. 62).



Fig. 62 - Determining wind force by flag and smoke

Depending on the strength and direction of the wind, either a lateral correction of the sight should be made, or the point should be moved, aiming in the direction opposite to its direction (taking into account the deviation of bullets under the influence of the wind - mainly when shooting at figured targets). Tables 8 and 9 show the values of bullet deviations under the influence of a lateral wind.

Bullet deflection under the influence of crosswind when shooting from 7.62 mm rifles

Table 8

Firing range, m	Heavy bullet deviation (11.8 g), cm		
	light wind (2 m/sec)	moderate wind (4 m/sec)	strong wind (8 m/sec)
100	1	2	4
200	4	8	18
300	10	20	41
400	20	40	84
500	34	68	140
600	48	100	200
700	70	140	280
800	96	180	360
900	120	230	480
1000	150	300	590

Bullet deflection under the influence of crosswind when shooting from a small-bore rifle

Table 9

Firing range, m	Deviation, cm		
	light wind (2 m/sec)	moderate wind (4 m/sec)	strong wind (8 m/sec)
25	-	1	2
50	1.5	3	6
100	3	6	12
200	8	16	32

As can be seen from these tables, when shooting at short distances, the deviation of the bullets is almost proportional to the strength (speed) of the wind. From Table 8 it is also clear that when shooting from service and free rifles at 300 m, a crosswind with a speed of 1 m/sec blows the bullet to the side by one dimension of target No. 3 (5 cm). These simplified data should be used in practice when determining the amount of wind corrections.

An oblique wind (at an angle to the plane of fire of 45, 135, 225 and 315°) deflects a bullet twice as little as a side wind.

However, during shooting, it is of course impossible to make corrections for wind, so to speak, "formally" guided exclusively by the data in the tables. These data should only serve as source material and help the shooter navigate in difficult shooting conditions in the wind.

It is almost rare that on such a relatively small area of terrain as a shooting range, the wind always has the same direction, much less the same strength. Usually it blows in gusts. Therefore, the shooter must be able to time the shot to the moment when the wind strength and direction become approximately the same as during previous shots.

Flags are usually hung at the shooting range so that the athlete can determine the strength and direction of the wind. It is necessary to learn to correctly follow the readings of the flags. You should not rely entirely on the readings of the flags if they are attached high above the target line and the firing line. You also cannot orient yourself by flags installed at the edge of the forest, steep cliffs, ravines and hollows, since the wind speed in different layers of the atmosphere, as well as near uneven terrain and obstacles, is different. As an example, Fig. 63 shows approximate data on the wind speed in the summer on a plain at different heights from the ground. It is clear that the readings of flags installed on a high bullet receiving rampart or on a high mast will not correspond to the true force of the wind, which acts directly on the bullet. You must be guided by the readings of flags, paper ribbons, etc., installed at the same level at which the weapon is located during shooting.

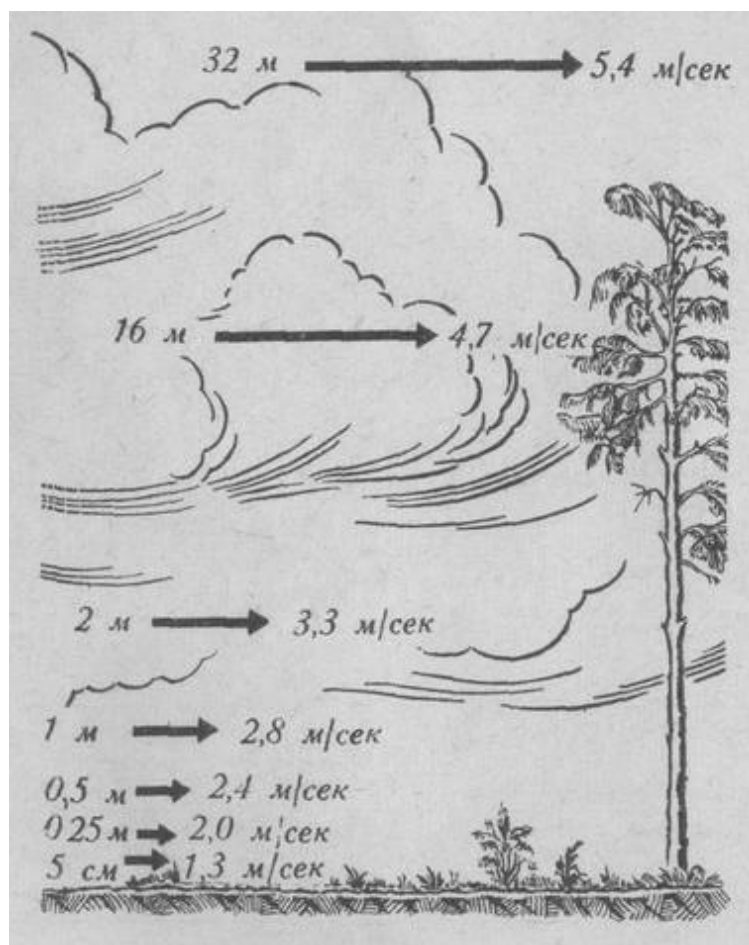


Fig. 63 - Approximate data on wind speed in summer at different altitudes on the plain

It is also necessary to keep in mind that the wind, bending around uneven terrain and obstacles, can create eddies. If flags are installed along the entire shooting distance, they often show completely different, even opposite wind directions. Therefore, it is necessary to try to determine the main direction and strength of the wind along the entire shooting route, carefully observing individual local landmarks on the terrain lying between the shooter and the target.

Naturally, to make accurate wind corrections, a certain amount of experience is needed. And experience does not come by itself. The shooter must constantly observe and carefully study the influence of wind in general and at a given shooting range in particular, systematically record the conditions under which shooting is conducted. Over time, he develops a subconscious feeling, gains experience that allows him to quickly navigate the meteorological sit-

uation and make the necessary corrections to ensure accurate shooting in difficult conditions.

Effect of air temperature . The lower the air temperature, the greater its density. A bullet flying in denser air encounters a large number of its particles on its way, therefore it loses its initial velocity faster. Consequently, in cold weather, at low temperatures, the firing range decreases and the STP decreases (Table 10).

The shift in the average point of impact when shooting from a 7.62 mm rifle under the influence of changes in air temperature and powder charge for every 10°

Table 10

Firing range, m	Height displacement of the STP, cm	
	light bullet (9.6 g)	heavy bullet (11.8 g)
100	-	-
200	1	1
300	2	2
400	4	4
500	7	7
600	12	12
700	21	19
800	35	28
900	54	41
1000	80	59

Temperature also affects the process of burning the powder charge in the gun barrel. As is known, with increasing temperature, the burning rate of the powder charge increases, since the heat consumption required to heat and ignite the powder grains decreases. Consequently, the lower the air temperature, the slower the process of increasing gas pressure. As a result, the initial speed of the bullet also decreases.

It has been established that a change in air temperature by 1° changes the initial velocity by 1 m/sec. Significant temperature fluctuations between summer and winter lead to changes in the initial velocity within 50-60 m/sec.

Taking this into account, for sighting in weapons, compiling the corresponding tables, etc., a certain "normal" temperature is adopted - $+15^{\circ}$.

Considering the relationship between the temperature of the powder charge and the initial velocity of the bullet, it is necessary to keep in mind the following.

During long-term shooting in large series, when the rifle barrel heats up strongly, one should not allow the next cartridge to remain in the chamber for a long time: the relatively high temperature of the heated barrel, transmitted through the cartridge case to the powder charge, will entail an acceleration of the ignition of the powder, which ultimately can lead to a change in the STP and "breakaways" upward (depending on the length of time the cartridge remains in the chamber).

Therefore, if the shooter is tired and needs some rest before the next shot, then during such a break in shooting the cartridge should not be in the chamber; it should be removed or even replaced with another cartridge from the pack, that is, an unheated one.

2.3.7 Bullet dispersion

Even under the most favorable shooting conditions, each fired bullet describes its own trajectory, slightly different from the trajectories of other bullets. This phenomenon is called **natural dispersion**.

With a significant number of shots, the trajectories in their totality form a **sheaf of trajectories**, which, upon meeting the target, produces a series of holes, more or less distant from each other. The area they occupy is called **the dispersion area** (Fig. 64).

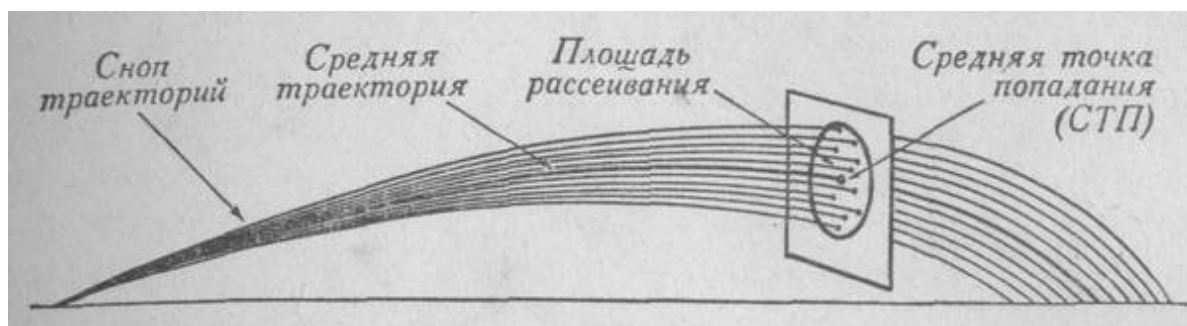


Fig. 64 - Trajectory sheaf, average trajectory, dispersion area

All the shots are located on the dispersion area around a certain point called **the dispersion center** or **the average point of impact** (**API**). The trajectory located in the middle of the sheaf and passing through the average point of impact is called **the average trajectory** . When making adjustments to the sight setting during shooting, this average trajectory is always implied.

For different types of weapons and cartridges, there are certain standards for bullet dispersion, as well as standards for bullet dispersion according to factory specifications and tolerances for the production of certain types of weapons and batches of cartridges.

With a large number of shots, the dispersion of bullets obeys a certain dispersion law, the essence of which is as follows:

- the holes are distributed unevenly over the dispersion area, most densely grouped around the STP;
- the holes are located symmetrically relative to the STP, since the probability of a bullet deviating in any direction from the STP is the same;
- the scattering area is always limited by a certain limit and has the shape of an ellipse (oval), elongated on a vertical plane in height.

By virtue of this law, the holes are generally distributed regularly over the dispersion area, due to which the same and definite number of holes are contained in symmetrical stripes of equal width, equally distant from the dispersion axes, although the dispersion areas may have different sizes (depending on the type of weapon and cartridges). The following serve as a measure of dispersion:

the median deviation, the core stripe, and the radius of the circle containing the best half of the holes (P_{50}) or all hits (P_{100}). It should be emphasized that the dispersion law is fully manifested with a large number of shots. In sport shooting in comparatively small series, the dispersion area approaches the shape of a circle, therefore the radius of the circle containing 100% of the holes (P_{100}) or the best half of the holes (P_{50}) serves as a measure of dispersion (Fig. 65). The radius of the circle containing all the holes is approximately 2.5 times greater than the radius of the circle containing their best half. During factory testing of cartridges, when shooting is carried out in small series (usually 20) of shots, the measure of dispersion is also the circle that includes all the holes - P_{100} (the diameter that includes all the holes, see Fig. 16).

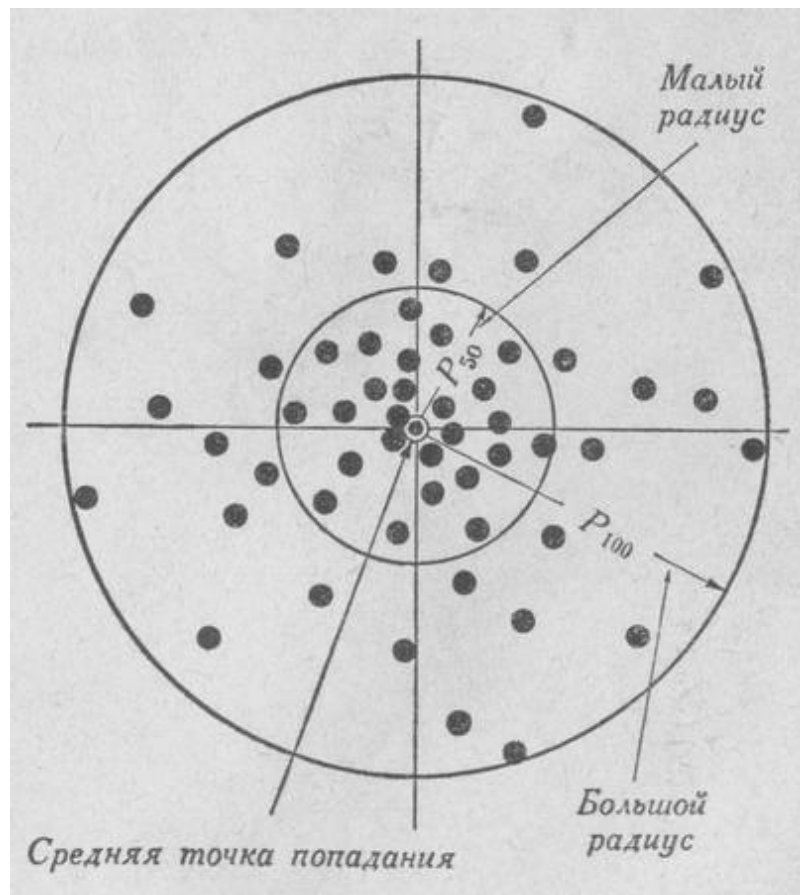


Fig. 65 - Large and small radii of circles containing 100 and 50% of hits

So, the natural dispersion of bullets is an objective process, acting independently of the will and desire of the shooter. This is partly

true, and demanding that all bullets hit one point from weapons and cartridges is pointless.

At the same time, the shooter must remember that the natural dispersion of bullets is by no means an inevitable norm, established once and for all for a given type of weapon and certain shooting conditions. The art of marksmanship consists in knowing the causes of the natural dispersion of bullets and reducing their influence. Practice has convincingly proven how important it is to reduce dispersion the correct adjustment of the weapon and the selection of cartridges, the technical training of the shooter and the experience of shooting in unfavorable meteorological conditions.

Section III.

TECHNIQUE OF PRODUCING ACCURATE SHOT

Making an accurate shot requires the shooter to perform certain actions: getting ready, aiming, holding his breath, and pulling the trigger. These elements are closely interconnected.

For an accurate shot, it is first necessary to ensure the greatest immobility of the weapon. The shooter's position should give the greatest degree of stability and immobility to the entire "shooter - weapon" system. The shooter must give the weapon a strictly defined direction - point it at the target. This is achieved by aiming.

We know that breathing is accompanied by rhythmic movement of the chest, abdomen, etc. To ensure maximum immobility of the weapon and maintain the direction achieved during aiming, you need to hold your breath while making a shot. To make a shot, the shooter must pull the trigger, and smoothly, without moving the weapon aimed at the target. But since it is impossible to achieve complete immobility when ready, the trigger must be pulled under conditions of greater or lesser oscillation of the weapon. Therefore, you need to pull the trigger not only smoothly, but also strictly in accordance with aiming. Let's look at each of these elements of making an accurate shot.

Chapter 1. Position

According to the rules of competitions, there are certain types of positions in shooting sports. When shooting from a rifle - lying down, kneeling and standing; when shooting from a pistol and revolver - only standing, holding the weapon in a freely extended hand.

Since shooting accuracy directly depends on the degree of immobility of the weapon, the most serious attention should be paid to choosing a position that ensures the greatest stability and immobility of the "shooter's body - weapon" system. In addition, performing modern shooting exercises often requires firing a large number of shots, and therefore, prolonged shooting. Therefore, it is very important to choose a position, a pose, in which holding the body with the weapon in the same position will require the most economical expenditure of physical strength and nervous energy.

Despite the abundance of possible options with particular differences in details, the manufacturing must ensure:

- the required degree of balance of the “shooter’s body - weapon” system;
- equilibrium of the system with the least tension of the shooter’s muscular apparatus;
- the most favorable conditions for the functioning of the sense organs, primarily vision and balance (vestibular apparatus);
- conditions for the normal functioning of internal organs and proper blood circulation.

Since each shooter has his own individual characteristics - a certain height, weight, body proportions, muscle development - naturally, there can be no template or universal recipe for the position. Therefore, the shooter must choose the most advantageous position for himself, taking into account his own build. However, it should not be forgotten that there are a number of restrictions and

requirements imposed by the competition rules on each type of position.

The most advantageous shooting position option sometimes takes a long time to find. Therefore, in order not to conduct fruitless searches, a young shooter should closely observe the shooting technique of leading shooters and study it thoroughly, adopting everything valuable and useful from them. This will help to achieve sports mastery faster. And let not individual temporary failures confuse the young athlete. If, for example, externally reproducing the position of a leading athlete, a beginner does not immediately achieve the desired results, then this is natural, since the externally copied form of the position cannot immediately correspond to its internal content, that is, the perfect coordination in the activity of many muscles that an experienced shooter has developed in the process of long training. However, the correct external form, rational posture will not be slow to make itself known, since it will contribute to the further, more correct and rapid formation of motor skills in the young shooter, coordination in the work of the motor apparatus, the qualities necessary to achieve the greatest stability of the "shooter - weapon" system. At the same time, one should not blindly copy one or another manufacturing option.

The position cannot be considered as something constant, unchangeable. It changes, reflecting views on the rational type of position in different periods of the development of shooting sports (see Fig. 112, 128, 145). Based on the changes that the position has undergone, it can be said with confidence that those versions of it that are currently considered the most rational will also become obsolete to some extent over time. Therefore, improving sports skills requires constant research.

Despite the fact that the issues of readiness are given a significant place in this book, this should not at all serve as a reason for overestimating its role in the overall complex of actions of the shooter when making an accurate shot. A good, rational readiness should be considered only as a means of achieving the greatest degree of immobility of the "shooter's body - weapon" system during shooting.

Since the shooter's muscular system and nervous system play a major role in ensuring the greatest immobility of the body when preparing to shoot, it is necessary to at least become familiar in general terms with the physiological foundations of the human motor system, as well as with the basics of the biostatics of the human body.

3.1.1 Some information about the human locomotor system

The human locomotor system is divided into passive and active. The passive system includes bones and ligaments that resist external forces acting on the body due to their physical properties. The active system is a system of muscles that move individual parts of the body relative to each other or fix them in a certain position.

In the implementation of any movement, in the work of each muscle, the nervous system, which controls all functions of the body, is necessarily involved.

Passive locomotor system . Bones and their joints form the solid foundation of the human body - the skeleton. It serves as a support for soft tissues, in particular for attaching muscles to it.

The movable connection of most bones allows them to move relative to each other. The muscles attached to the bones, contracting, fix individual parts of the skeleton or, conversely, set them in motion. Thus, the musculoskeletal system ensures the maintenance of various positions of the body in space, as well as all kinds of movements.

There are more than 200 bones, connected in various ways (Fig. 66). The basis of the skeleton is **the spinal column** , consisting of individual vertebrae. The spinal column has cervical, thoracic, lumbar and sacral curves, which make it elastic and flexible.

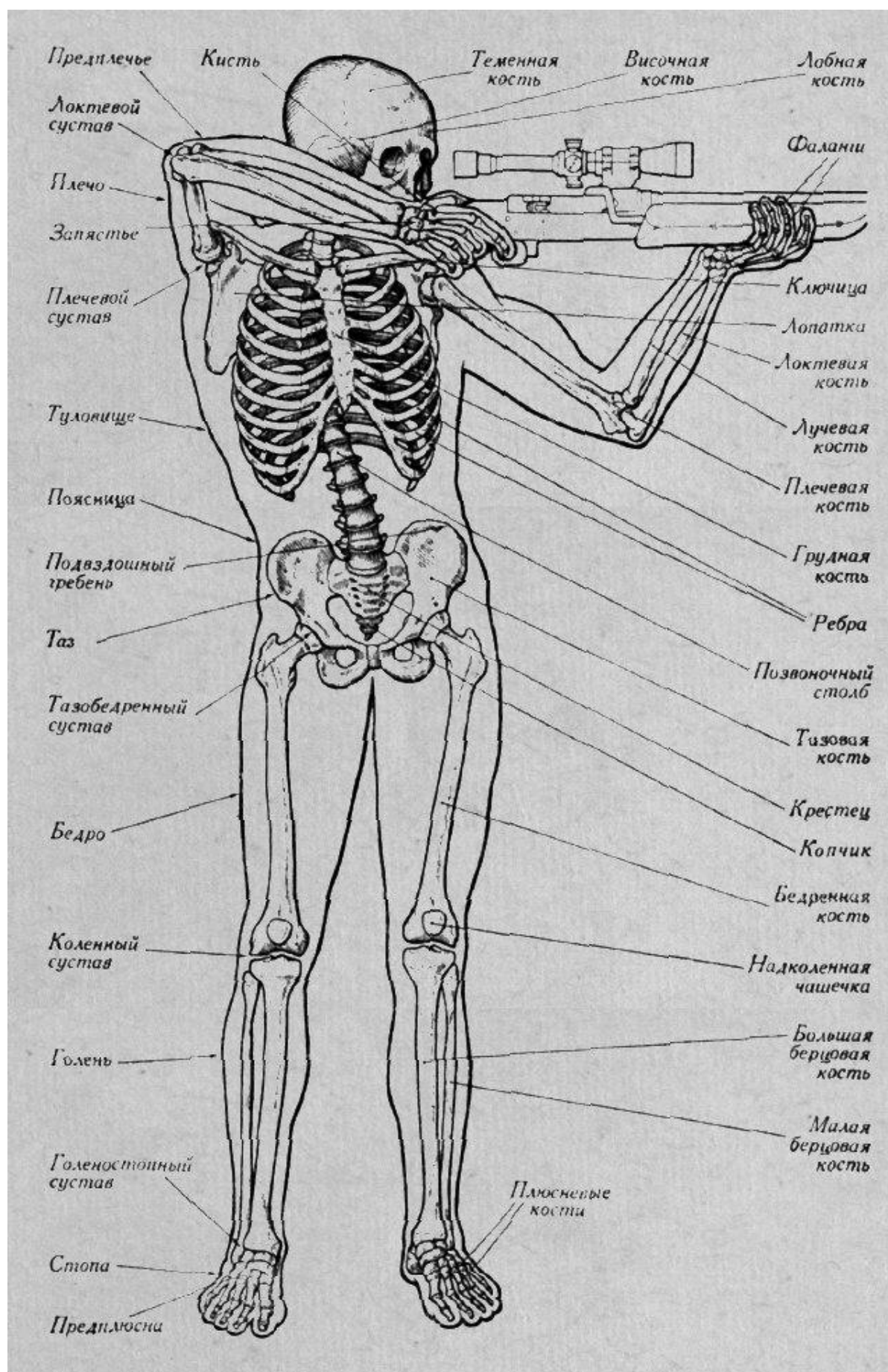


Fig. 66 - General view of the human skeleton

In the upper part of the back are two flat bones - the shoulder blades, attached to the spine and ribs only with the help of muscles. Each shoulder blade is connected to the collarbone, which at its other end is connected to the sternum. The shoulder blades and collarbones, encircling the upper part of the body, form the so-called girdle of the upper limbs, or **shoulder girdle** (Fig. 67).

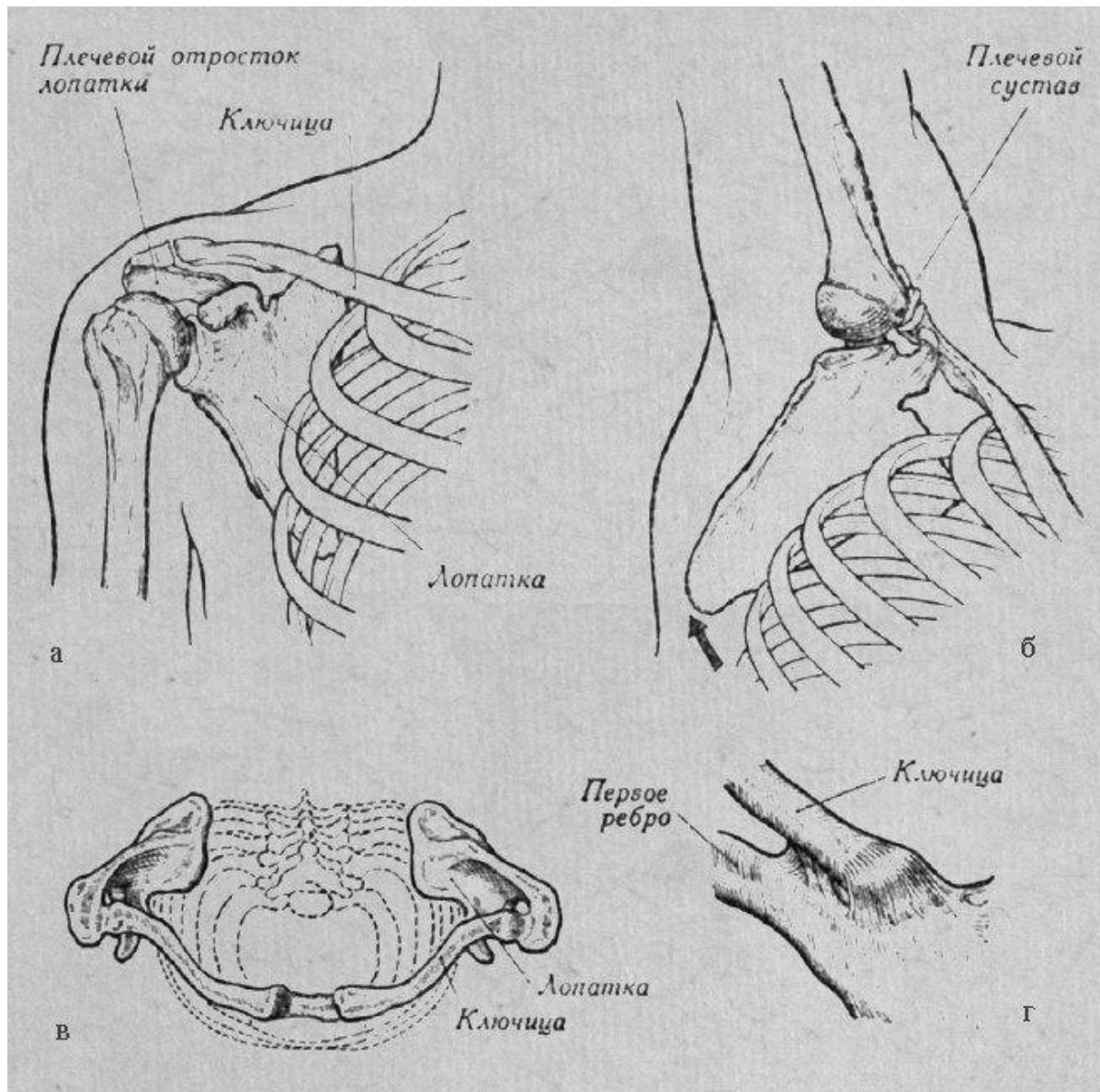


Fig. 67 - Bones of the shoulder girdle (according to observations of Professor M.F. Ivanitsky):

a - arm down; *b* - arm raised; *c* - general view of the shoulder girdle from above; *d* - sternoclavicular joint.

The lower limb girdle is the pelvis. It consists of the sacrum and two pelvic bones that are immovably connected to it. Both the shoulder blades and the pelvic bones have round sockets that accommodate the heads of the humerus and femur, respectively.

Bone connections can be continuous, semi-continuous and discontinuous, or **joints** . Most bones are connected to each other discontinuously, movably, in joints.

A small amount of mobility of the bones is achieved by means of elastic cartilaginous pads between them. Such cartilaginous pads are located, for example, between individual vertebrae. When the muscles on one side or the other of the spine contract, the cartilaginous pads are compressed and the vertebrae come slightly closer to each other (Fig. 68). In this way, the vertebrae, especially in the lumbar and neck areas, can tilt relative to each other. The entire spine allows for a significant range of motion and can bend strongly forward, backward, to the sides and twist. Along with flexibility, the spine has strength, especially when working under compression.

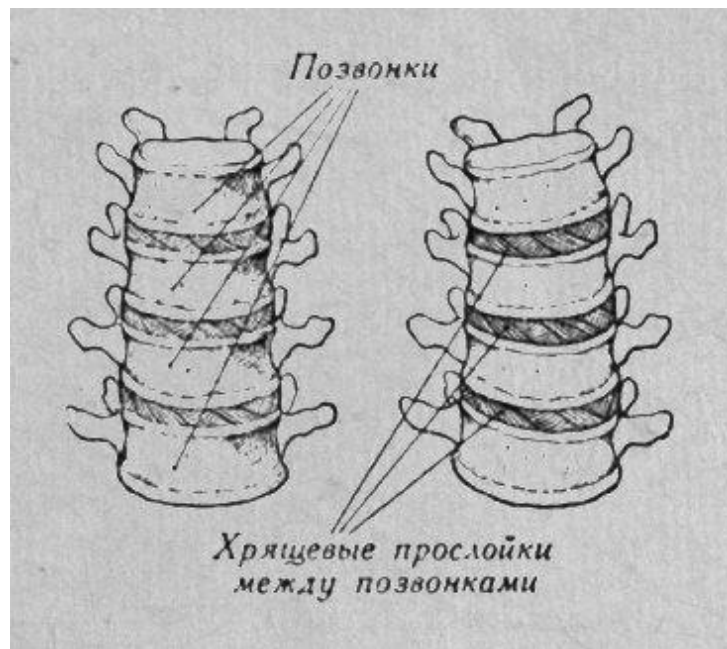


Fig. 68 - Continuous connection of bones (by means of cartilage)

Taking this into account, and most importantly, the peculiarity of the skeletal structure that the shoulder girdle is attached to the chest and spine mainly with the help of muscles, we come to the follow-

ing conclusion: holding, for example, when shooting while standing, a rifle that has a significant weight (up to 8 kg), only by straining the same muscles of the shoulder girdle is impractical.

The shooter should strive to give the body such a pose that would allow the weight of the weapon and the body to be shifted to a greater extent to the spine, so that the skeleton "works" on compression. This will allow holding the weapon with significantly less muscle tension.

The most mobile connections of bones are joints (Fig. 69). The bones in the joint are enclosed in a bag consisting of very dense connective tissue. In the thickness of the bag and around it are strong and elastic ligaments. The edges of the bag together with the ligaments are attached to the bones at some distance from their contact surfaces and hermetically close the cavities of the joint.

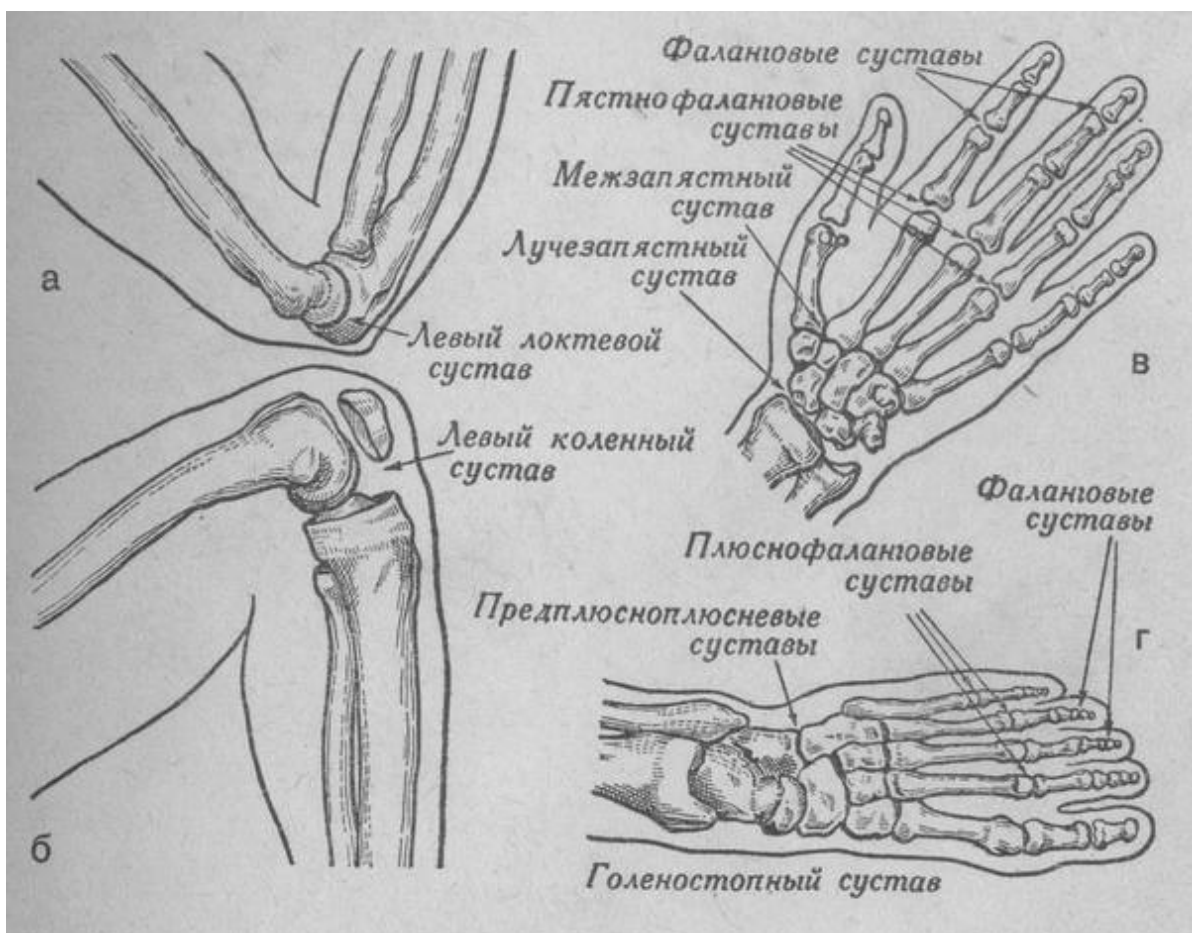


Fig. 69 - Discontinuous connections of bones - joints:

a - left elbow joint; б - joints of the left hand; в - left knee joint; г - joints of the left foot.

The nature of movements in different joints is not the same. Some joints allow movements only in one plane (for example, flexion and extension), others - in two mutually perpendicular planes (flexion, extension and abduction); others provide movement in any direction, for example, the shoulder and hip joints (flexion, extension, abduction and rotation). The range and direction of movement depend on the shape of the articular surfaces, as well as on the location of the ligaments that limit movement. Usually, comparing articular surfaces with the surfaces of geometric bodies of revolution (ball, cylinder, etc.), joints are classified by their shape (Fig. 70).

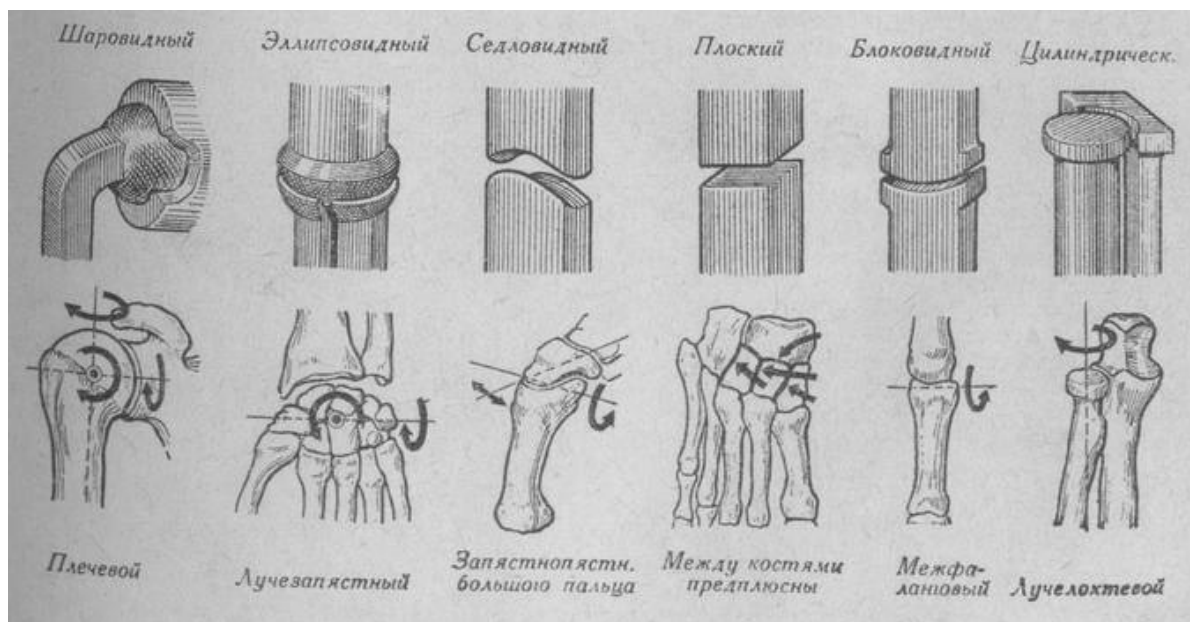


Fig. 70 - Diagram of the main forms of joints (according to Kahn)

Since each joint has a greater or lesser number of ligaments, one should strive to ensure that when preparing to shoot, the athlete takes such a pose in which the fixation of the movable links of the body in the joints is achieved not so much by the muscular apparatus, but by including strong and elastic ligaments in the work: due to their physical properties, they are practically tireless. The most effective inclusion of the ligament apparatus in the passive work ensures sufficiently rigid fixation of the joints with minimal muscular effort - this is one of the conditions for achieving the greatest immobility of the "shooter's body - weapon" system during shooting.

Active motor apparatus . Muscles whose ends are attached to the bones of the skeleton are called skeletal.

The entire skeletal musculature of a person, which holds the body in various positions or sets it in motion, has more than 600 muscles (Fig. 71, 72).

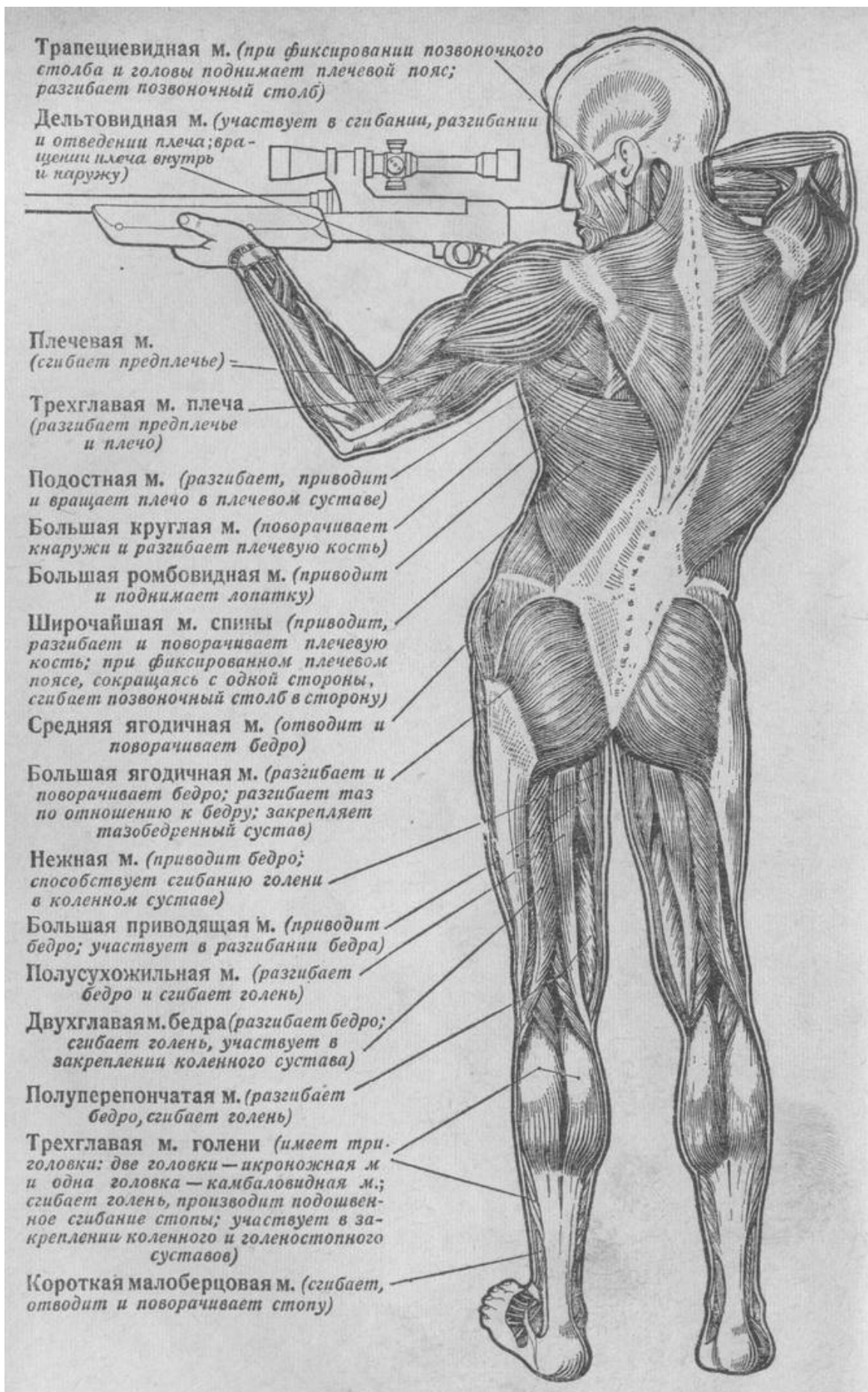


Fig. 71 - General view of human muscles from behind (while preparing to shoot at the "Running Deer" target)

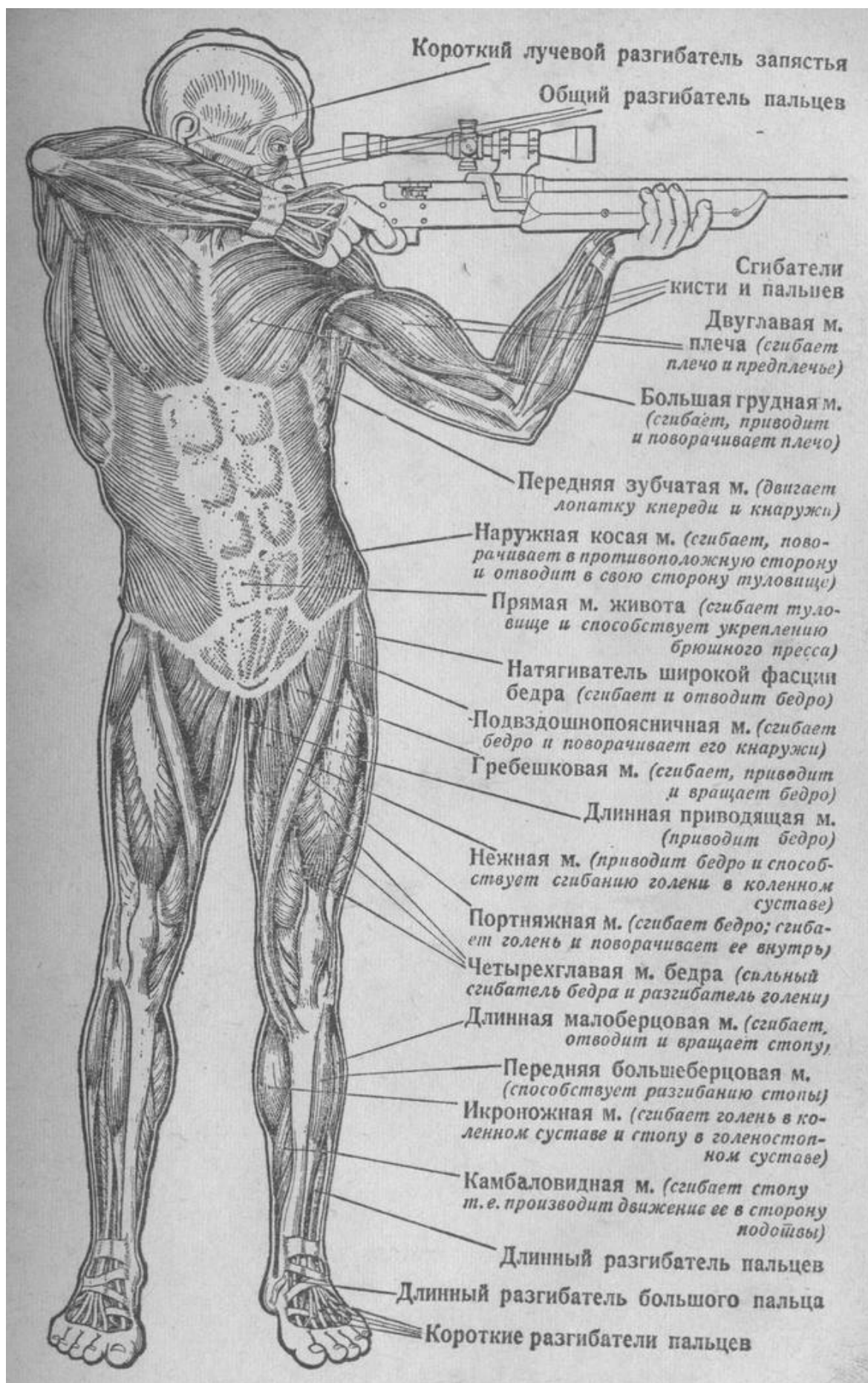


Fig. 72 - General view of human muscles from the front

As a result of muscle contraction and the tension that develops, the places of their origin and attachment come together, which entails either movement of the body and limbs or maintaining them in a certain position.

Skeletal muscles are covered with a thin elastic membrane called fascia. At the ends, the muscle passes into very strong white strands - tendons, which grow together with the periosteum. Usually, both ends of the muscle are attached to two adjacent bones, discontinuously connected to each other. However, in many cases, the tendons stretch very far, passing through two or more joints. These muscles are called multi-joint. By the way, such muscles are also the flexor muscles of the fingers. Not being completely isolated from other, adjacent muscles, they can cause some movement of both the hand and the forearm when contracting, that is, when performing work. This can happen, for example, in insufficiently trained shooters during the movement of the index finger when pressing the trigger.

Muscles are classified according to a number of features: external form, work performed, location in the human body, etc. (Fig. 73). One of the greatest physiologists, P. F. Lesgaft, proposed dividing muscles into two main types: strong and dexterous. Strong muscles usually have a large area of attachment to the bones. They can exhibit great strength with a relatively small range of motion and little tension, which is why they do not tire so quickly. Dexterous muscles, on the contrary, have a small area of attachment and are long. They are characterized by relatively low strength, act with great tension, which is why they tire easily. At the same time, they perform more delicate work.

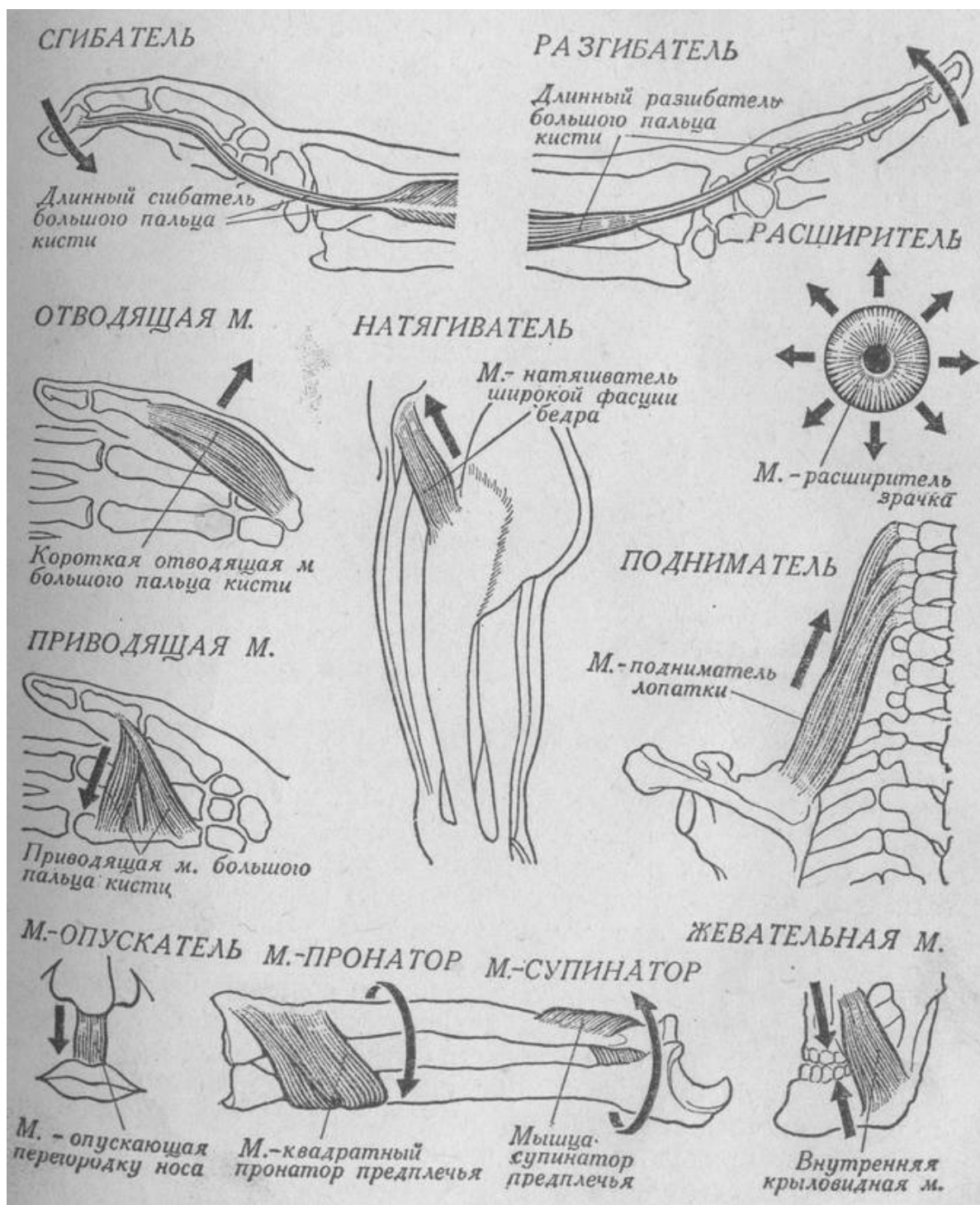


Fig. 73 - Classification of muscles (according to M.F. Ivanitsky)

It is quite obvious that the shooter's position when ready should be such that the fixation of the body's mobile links is achieved by engaging the strongest muscle groups; the dexterous muscles, on the contrary, should be loaded to the least degree and, thanks to this, placed in the most favorable conditions for their work.

By contracting, muscles take part in various movements of the body, directly opposite to each other. Muscles that take part in the same movement and perform common work in this case are called **synergists** .

Muscles that act in opposition are called **antagonists** . For example, muscles that flex the wrist are antagonists to muscles that extend the wrist.

Smooth movements are possible only with the coordinated work of antagonist muscles. During work, the muscles of one group perform an overcoming action, the other - a yielding one. Without the participation of antagonist muscles, synergist muscles could only perform jerky movements. It should be said that the movements of poorly trained people are noticeably different from the movements of trained people. Insufficiently trained antagonist muscles are included in the work too early, which gives the movements a somewhat abrupt, jerky character. Performing physical exercises helps the muscles become not only thicker, but also more elastic.

Each movement involves not one group of muscles, but several groups acting in concert. Moreover, many muscles are capable of acting in separate parts, either as synergists or as antagonists.

The ability to control a muscle or even a separate part of it in isolation comes through training. This is especially important for a shooter. Training can develop the ability to contract only the muscles that are necessary to perform a given movement, and keep other muscles that are not directly related to performing this movement relaxed.

The work performed by muscles during contraction is divided into two types - static and dynamic.

Static muscle work is carried out by fixing (fastening) the moving parts of the body in the joints in one position or another. During static work, the muscles are tense for a long time.

Dynamic muscle work is performed when performing movements by individual parts of the body. Muscle tension during such work alternates with relaxation, contraction - with stretching.

In the intervals between individual contractions, the muscle rests, which helps restore the state it had before its contraction, and the muscle again becomes fully functional. If any muscle works continuously, fatigue quickly sets in; prolonged contraction of the muscle can bring it to a state of complete impotence.

When preparing to shoot, when the shooter needs the greatest immobility of the body, the muscles perform static work, that is, the least advantageous in terms of their fatigue. Therefore, it is necessary to pay great attention to the choice of the shooting rate, especially long ones, so that the breaks between the next aiming and butting (or raising the hand when shooting from a pistol) would give the muscles the opportunity to restore their performance to the greatest extent.

Properties and structure of muscle and nervous tissue . The basic condition of life is the interaction of the organism with the environment. Such interaction is carried out due to the property of living matter to react to external influences. The process that occurs in the organism under the influence of the external or internal environment is called the excitation process. This process underlies any movement performed by the organism.

Nervous tissue has the property of excitability and conductivity, that is, when irritants act on it, it comes into a state of excitation and conducts this excitation along the nerve fiber. Muscular tissue is distinguished by the ability to contract, shortening in length and increasing in thickness, and as a result, develop tension.

In the body of a living organism, a distinction is made between striated and smooth muscle tissue.

All skeletal muscles are formed from striated muscle tissue (Fig. 74). Contraction of striated muscle tissue occurs due to shortening of the dark areas of its fibers.



Fig. 74 - Striated muscle fibers

The structural unit of a muscle is a muscle fiber. With a diameter of only 0.01-0.1 mm, a muscle fiber sometimes reaches a length of 10-12 cm. Each muscle consists of many thousands of fibers.

Smooth muscle tissue is found primarily in the walls of internal organs.

Muscles are closely connected to the nervous system. This connection is two-way, carried out by means of the centrifugal and centripetal nerves (see below); numerous endings of both are located in the thickness of each muscle.

Nervous tissue plays an exceptionally important role in a living organism; it forms the nervous system, which controls all vital functions of the organism, ensures its interaction with the environment, and regulates the functional activity of all organs.

The structural unit of the nervous system is the neuron - a nerve cell with all its processes (Fig. 75). Numerous short processes - dendrites and one long process (in humans - up to 1 m) - the axon - extend from the body of the nerve cell. The nerve cell's dendrites touch other nerve cells, making contact with them, the so-called synapse. Thanks to such synaptic contacts, interconnection in the nervous system is ensured. The axon connects the body of the nerve cell with a muscle or some other organ.

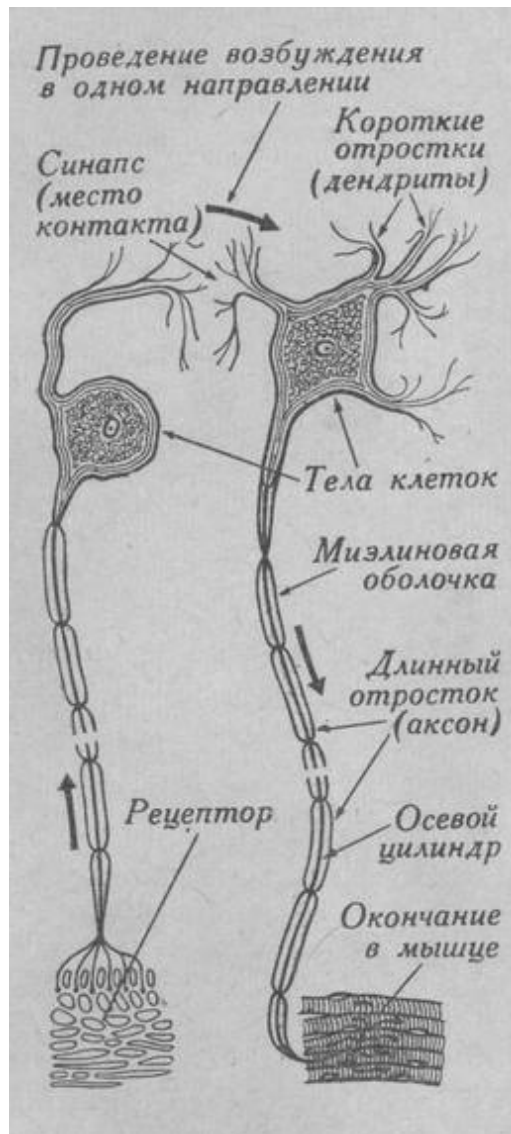


Fig. 75 - Nerve cells with processes:

a - centripetal (sensory neuron); *b* - centrifugal (motor) neuron.

At its final section, the axon branches extensively, supplying nerve endings to a whole group of muscle fibers or tissue of other organs.

There are three types of neurons.

Centripetal , or **sensory** , neurons; their endings in muscle, skin and other organs are connected with perceiving nerve instruments - receptors, which react to stimuli coming from the external or internal environment. The excitation arising in the receptors is transmitted along the sensory neurons to the corresponding parts of the central nervous system.

Centrifugal , or **motor** , neurons (motor neurons); the bodies of these nerve cells are located in the central nervous system (in the spinal cord or brain), and their axons extend far from them to muscles or other organs. Motor neurons transmit excitation along their axons at high speed (up to 120 m per second) from various parts of the central nervous system to the muscles, which causes contraction of muscle fibers.

Interneurons are located entirely in the central nervous system and provide the interconnection of sensory and motor nerve pathways with each other, as well as the connection between different areas of the central nervous system.

A motor neuron and its associated group of muscle fibers (120-160) constitute a motor **neuromuscular unit** (Fig. 76). Such a motor unit works as a single whole: excitation transmitted by a motor neuron sets this entire group of fibers in motion. Each muscle is connected to several hundred or even thousands of motor neurons. Under different conditions of activity of the nerve centers, a different number of such motor units are set in motion, which mainly regulates the degree of development of muscle force in response to the current stimulus.

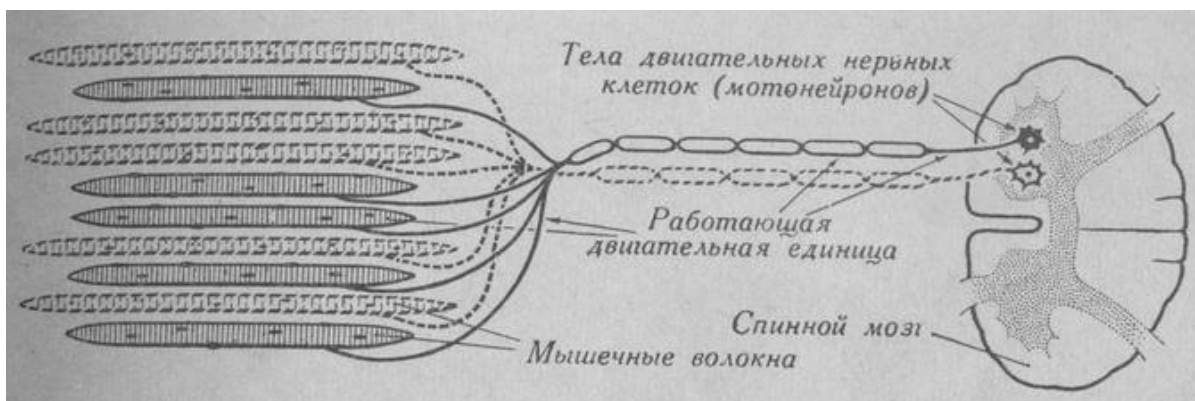


Fig. 76 - Diagram of the structure of motor neuromuscular units (working and at rest)

Excitation in nerve and muscle cells has the character of a rapidly increasing and then gradually falling wave. This wave of excitation is called an impulse. In natural conditions of the organism's life, there are not single impulses, but series of them. Excitation impulses going to the muscle always follow one another at high speed (in the human body - up to 100 per second), due to which

the muscle fiber does not have time to relax after each contraction. This leads to the merging of individual contractions into one long one (tetanus). These are the usual contractions of skeletal muscles that we observe during any movements of the body or when its mobile links are fixed in the joints.

If smooth muscles, which have comparatively low excitability, contract slowly (about 3 cm per second), then striated muscles, on the contrary, are easily excited and the contraction process in them occurs at high speed (about 6 m per second). It should be borne in mind that as a result of training, not only the strength of the skeletal muscle increases, but also the speed of its contraction. Contraction and relaxation of striated muscle tissue, as a rule, is a voluntary process, that is, subject to our will.

The nervous system of the body is divided into peripheral and central.

The peripheral nervous system includes numerous nerves, a kind of conducting nerve pathways, located in all parts of the body and connected to the central nervous system.

The nerve is a round or flattened cord of white color in appearance. It consists of numerous nerve fibers united into bundles. According to the function of the fibers, nerves are divided into sensory (centripetal), motor (centrifugal) and mixed.

Sensory nerves carry impulses from receptors of various organs and tissues to the central nervous system. With the help of this group of nerves, the central nervous system receives "information" about changes occurring in the environment surrounding the body or within it.

Motor nerves consist of numerous long processes of motor nerve cells; they transmit motor impulses - "commands" - from the central nervous system that cause contraction of muscle fibers.

Mixed nerves . consist of sensory and motor nerve fibers. The overwhelming majority of nerves of the peripheral nervous system are mixed. Excitation impulses following one nerve fiber do not pass to neighboring fibers. Therefore, each series of impulses al-

ways arrives strictly at the destination, exactly at a certain "address".

Due to the low consumption of chemicals during excitation, the nerve fibers that make up the peripheral nervous system are practically tireless.

The central nervous system is a huge collection of nerve cells and consists of **the brain** , located in the cranial cavity, and **the spinal cord** , located in the spinal canal.

It is important to know that the nervous system carries out its work on the principle of the so-called **reflex** (reflex - reflected action). Any response of the body to irritation coming from the external or internal environment, carried out with the participation of the central nervous system, is called a reflex.

The basis of any reflex is the transmission of excitation impulses from the receptor to the executive organ (muscle, gland, etc.) through a system of neurons connected to each other. The path along which excitation impulses run, causing reflex actions, is called a reflex arc.

In any reflex arc, a number of sequentially connected links can be identified (Fig. 77). The first link of the reflex arc is the receptive nerve endings - receptors located in the sense organs and in all other organs of the body: muscles, glands, heart, lungs, etc.; the second is the centripetal (sensory) nerve, carrying excitation from the periphery (from the receptors) to the central nervous system; the third is some part of the central nervous system where excitation undergoes a complex change; the fourth is the centrifugal (motor) nerve, carrying excitation from the central nervous system to one or another muscle (organ); the fifth link is the ending of the centrifugal nerve in the executive organ, producing a response.

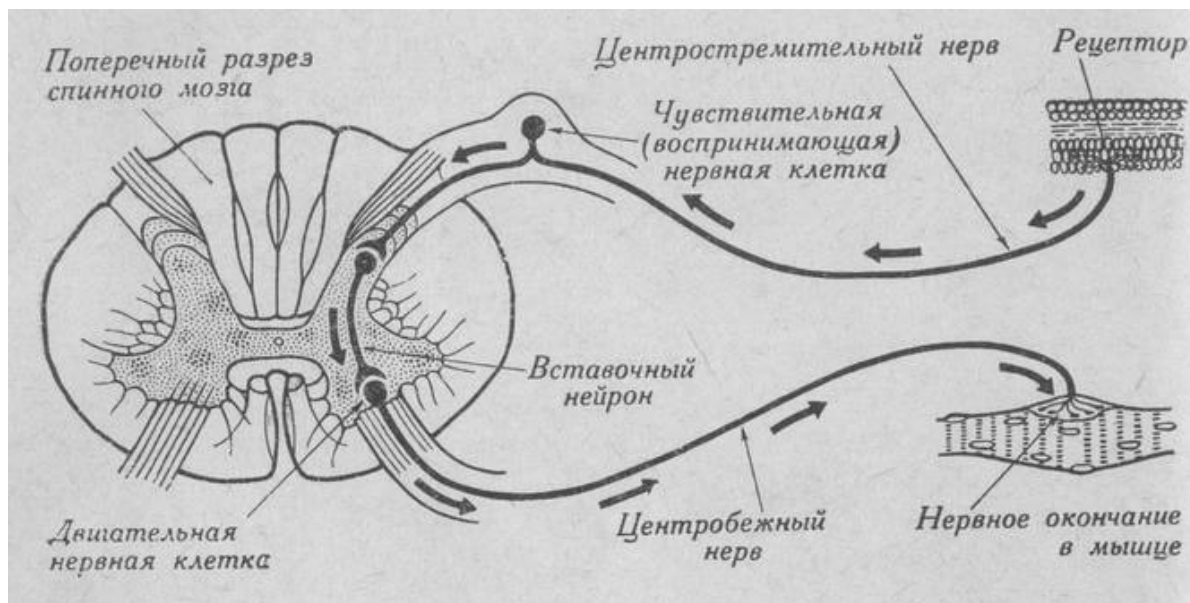


Fig. 77 - Reflex arc diagram

At the same time, when performing any movement, **a ring reflex connection** is characteristic. In the process of performing a movement, in order to perform it accurately, it is necessary to repeatedly make intermediate corrections, which are carried out by means of feedback, carrying information from the executive organ (muscle) to the central nervous system about the actual performance of this movement. The reflex arc itself is closed, as it were, turning into a reflex ring (see Fig. 80). This important mechanism of movement control was discovered by the Soviet physiologist N.A. Bernstein.

Passing through different sections of the central nervous system, each reflex arc, thanks to intercalary neurons, is connected with the highest section of the central nervous system - the cerebral cortex, therefore the latter can "intervene" in the implementation of any reflex act and accordingly regulate its course.

In the daily life of the organism, two main processes - excitation and inhibition - constantly interact in the cells of the central nervous system; they are closely related, constantly coexist and replace one another. The continuous change and interaction of the excitation and inhibition processes determine the execution of any coordinated movement (Fig. 78). Thus, the flexion of the index finger when pressing the trigger occurs due to the excitation of the nerve centers that send nerve impulses to the muscles - the flexor of the finger, and the simultaneous inhibition (partial) of the centers

associated with the extensor muscles. If only the excitation process existed, the coordinated activity of the organism, all sorts of movements performed by it, would be impossible, since the excitation process in this case would cause contraction of not only the flexor muscles, but also the extensor muscles; with such joint work of the antagonist muscles, flexion of the finger, as well as any other movement, would be generally impossible to perform.

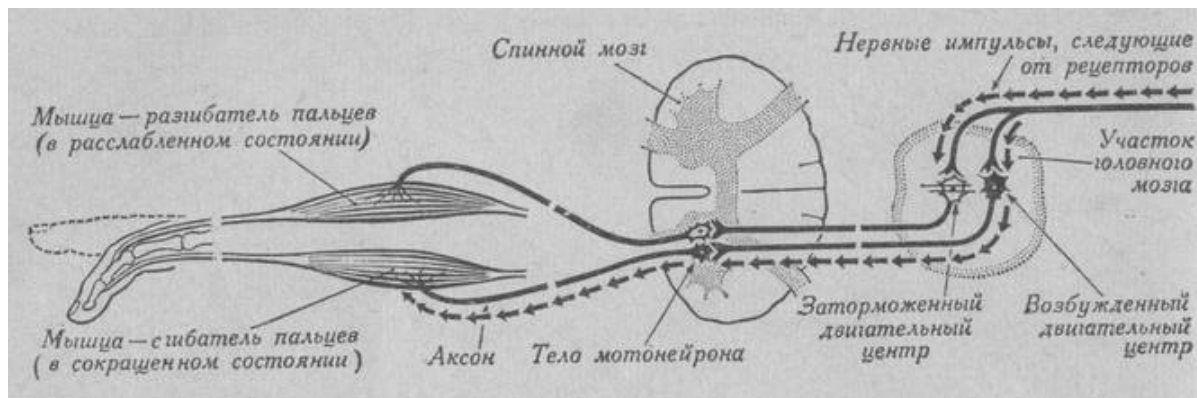


Fig. 78 - Interaction of excitation and inhibition processes in the central nervous system when performing any movement

In addition to its enormous importance in coordinating the activity of nerve centers (and therefore in coordinating movements), inhibition also plays an important protective role, protecting nerve cells from exhaustion, which can occur with prolonged and strong excitation.

The processes of excitation and inhibition in the nerve centers have a certain mobility and variability in the replacement of each other, obeying certain laws. However, it is firmly established that in the process of training, a higher mobility of the processes of excitation and inhibition is formed, which is why the reaction speed of a trained person is significantly higher than that of an untrained person.

The speed and accuracy of any motor reaction also largely depends on the sensitivity of the analyzers (sense organs) involved in regulating movement, primarily the motor and visual analyzers. Thus, the inevitable swaying of the hand during aiming, all other things being equal (shooting a revolver and a pistol) will be the least in the case when the sensitive devices - receptors will promptly "inform" the central nervous system about the slightest

changes in the position of the hand, after which "commands" will be sent from the corresponding motor centers of the brain to the nerve motor cells responsible for muscle contraction, exciting or inhibiting some or others and thereby regulating the position of the hand. Consequently, the higher the accuracy of the "work" of the sense organs, the finer their discriminative ability, the faster and more accurately the analysis of the received irritation occurs in the central nervous system, due to which the organism can respond to it more promptly and accurately, in this case - with an appropriate movement of the hand.

Analyzers . According to the teachings of I.P. Pavlov, all sense organs are analyzers. Each analyzer is a single system consisting of three sections: peripheral - the perceiving apparatus (receptors); the centripetal nerve pathway, along which nervous excitation is transmitted from the periphery to the center; the final brain section, located in the cerebral cortex. The cerebral cortex concentrates the brain ends of all analyzers. In this regard, the highest analysis of stimuli occurs in the cerebral cortex, where nervous excitation received from a sense organ is transformed into a sensation. Each sense organ - analyzer perceives only a certain type of irritation.

Thus, all organs have receptive nerve endings, or receptors, which send centripetal nerve impulses to the central nervous system. Some receptors are located inside the body and perceive stimuli arising in the internal organs, others are located near the surface of the body and perceive external stimuli. Receptors, due to the peculiarities of their structure, are specialized, adapted to excitation only by certain stimuli: some are excited by irritation with light, others - by sound, etc. Among the specialized ones there are also receptors located in the vestibular apparatus, muscles and tendons, which signal with each change in body position and change in tension in the muscles and tendons. The maintenance of body balance and regulation of skeletal muscle contraction largely depend on the work of these analyzers, and therefore they should be of the greatest interest to shooters.

The vestibular analyzer , the organ of balance, ensures a certain position of the body in space and the maintenance of its equilibrium. The peripheral section of this analyzer, the vestibular apparatus, is located in the temporal part of the head, in the inner ear

(Fig. 79). It consists of the otolith apparatus and semicircular canals. The otolith apparatus consists of two sacs, on the inner surface of which there are sensitive cells supplied with hairs. On the hairs there are small lumps of lime crystals - otoliths. Any change in the position of the head changes the tension of the hairs and thereby excites the endings of the nerve fibers of the receptors associated with the hairs. The threshold for distinguishing the tilt of the head and body to the side by the vestibular apparatus is 1° , forward and backward - $1.5-2^\circ$. Impulses coming from the otolith apparatus cause reflex reactions that help maintain the balance of the body. From one of the sacs of the otolith apparatus, three semicircular canals filled with liquid - endolymph - extend in three mutually perpendicular planes. With any movement of the head, the liquid in them produces pressure on the sensitive cells connected with the endings of the nerve fibers by its vibration. The resulting impulses cause reflex reactions that lead to the maintenance of the body's balance during movement. Thus, any change in the position of the head entails the excitation of the receptors of the otolith apparatus.

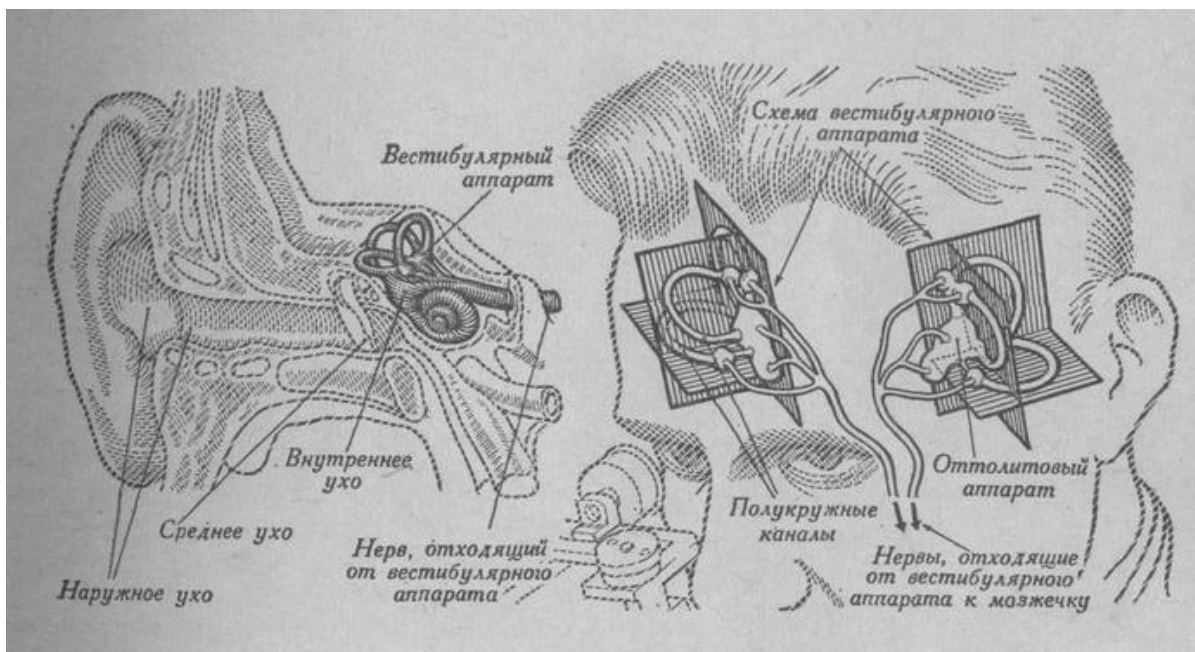


Fig. 79 - Scheme of the vestibular apparatus

The motor (kinesthetic or joint-muscular) analyzer ensures the regulation of skeletal muscle contraction, thereby playing a key role in the coordination (coherence) of movements.

The peripheral part of the motor analyzer - proprioceptors - are embedded in the thickness of muscles, tendons and ligaments of joints. There are several types of them, differing in their structure. Most proprioceptors are branched endings of a sensory nerve, intertwining a muscle or tendon fiber in a spiral. Another, most common type of proprioceptor is a complexly structured special organ called a muscle spindle (Fig. 80); these spindles are in most cases located between muscle fibers, less often - inside tendons. Signals from proprioceptors, following along the centripetal (sensory) nerve fibers, and then along the intercalated neurons, reach various parts of the central nervous system, they also reach the cerebral cortex, causing a sensation called **muscle sense**, which, as I.M. Sechenov pointed out, accompanies any movement of the body links and a change in their relative position. Based on signals coming from proprioceptors (in combination with signals coming from receptors of the vestibular, visual and other apparatuses), the central nervous system continuously corrects and coordinates the activity of the motor apparatus (which will be discussed in detail below).

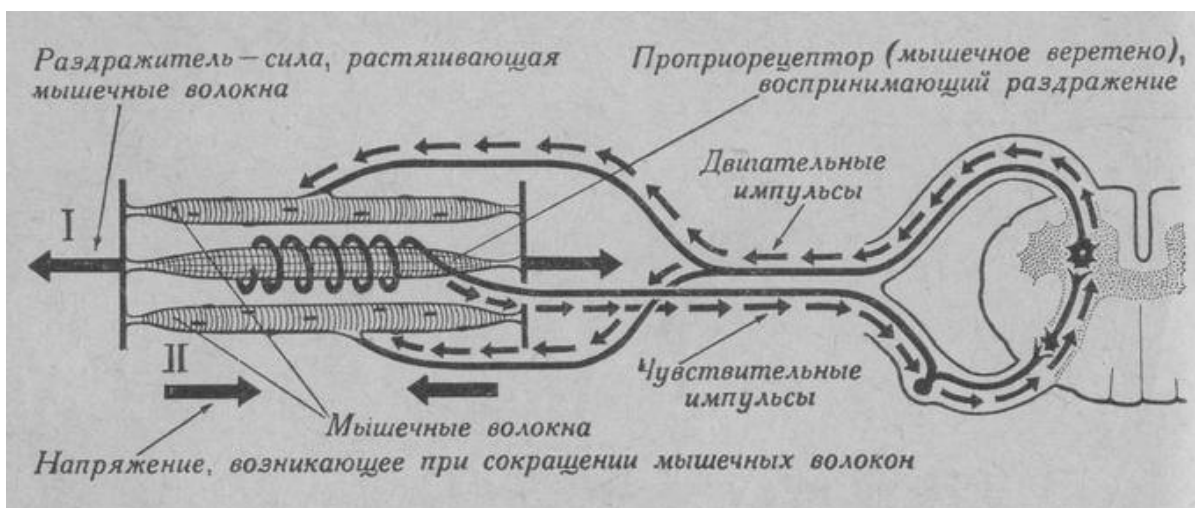


Fig. 80 - Scheme of peripheral (spinal) regulation of muscle tone

Incidentally, it should be noted that, according to research data (M.A. Itkis), the accuracy of reproduction of movements in the shoulder, elbow and ankle joints in shooters does not differ significantly from the ability to differentiate movements by people who do not engage in sports. Thus, the accuracy of reproduction of the standing position as a whole without the direct participation of vision (with closed eyes) after 30-60 seconds after aiming decreases

by an average of 95%, including in many experienced shooters. The data obtained indicate that the joint-muscle sensitivity of shooters is at an insufficiently high level (see Fig. 96) and that it must be developed in every possible way with the help of special preparatory exercises.

The coordinated, precisely adjusted activity of the motor apparatus is possible due to another property of the central nervous system - the interaction of nerve impulses coming from different analyzers on their common terminal motor pathways. The fact is that in the central nervous system there are several times more sensory neurons than motor neurons; therefore, motor impulses coming from different nerve centers to the muscles converge on common terminal pathways, which are the motor neurons of the spinal cord. Thus, impulses from the cerebral cortex, the vestibular apparatus, various parts of the central nervous system, etc. converge on the same motor neuron, the long process of which is the terminal and efferent nerve pathway to the muscle fibers (Fig. 81). Impulses coming along different motor pathways "compete" with each other for possession of this last nerve pathway to the muscle (E.K. Zhukov). In this case, reflexes are subordinated depending on their importance at the given moment for the organism, and other, less important reflexes are inhibited. Due to this property of the central nervous system, the organism has the ability to promptly respond with various movements to numerous stimuli coming from the external or internal environment.

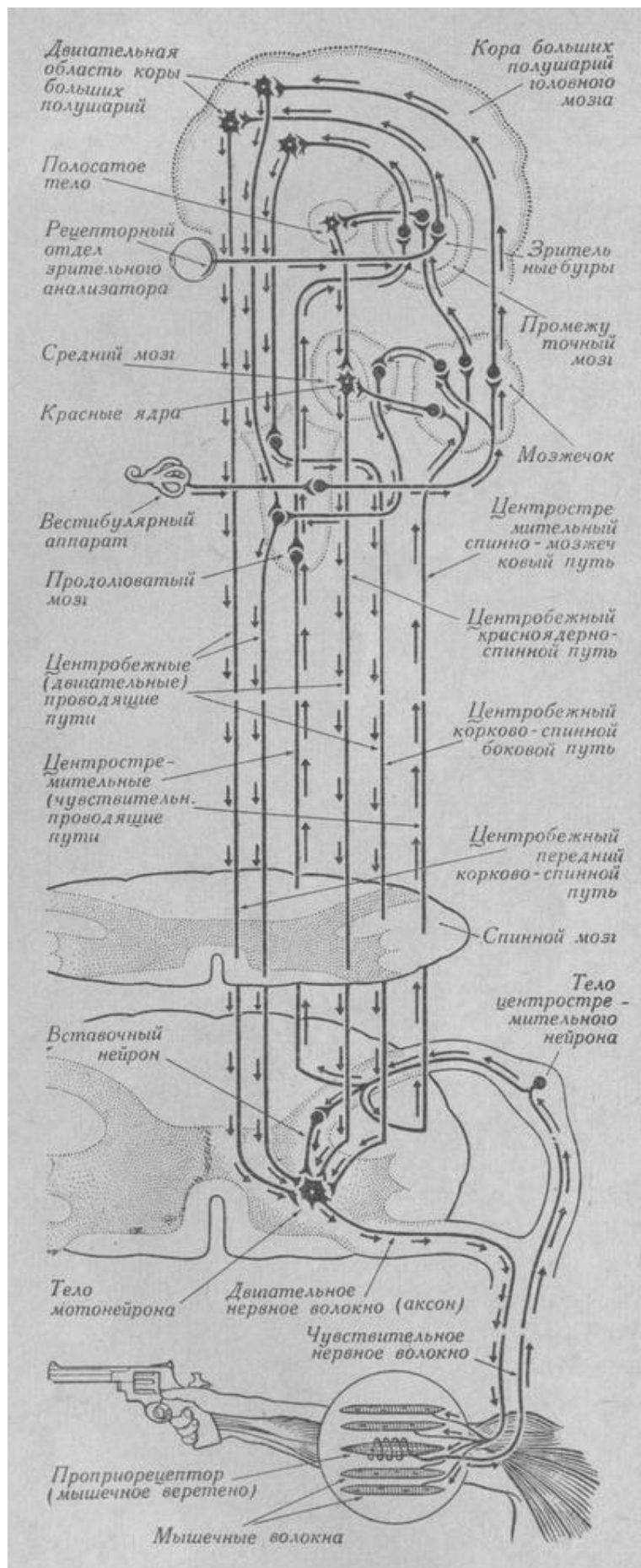


Fig. 81 - Schematic representation of the main links of the nervous mechanism of movement control

So, we have become familiar with the human motor apparatus in general terms. In order to have a complete picture of the nervous mechanism of movement control, Fig. 81 shows a diagram of the conducting nerve pathways along which signals received by the motor, visual and vestibular analyzers are transmitted through the central nervous system to the executive organs - skeletal muscles, which, by contracting, produce this or that movement or hold the human body in a certain pose.

Now we can move on to considering issues related to the activity of the human motor system to ensure the most immobile position.

The main features of the activity of the motor apparatus to maintain the body posture unchanged . All kinds of movements performed by a person can be conditionally divided into voluntary and involuntary.

The most complex movements that play a major role in everyday and work activities of a person are voluntary, consciously performed. Thus, during shooting, voluntary movements performed by our will are: raising and lowering the weapon, reloading it, pressing the trigger, etc. Involuntary, relatively simple movements play an auxiliary role in the motor activity of the body. These include, for example, various protective and orienting reflexes: turning the head in the direction of an unexpected shot, blinking, jerking the hand away from painful stimuli. At the same time, more complex movements, carried out by the work of many nerve centers of the brain and spinal cord, can also be involuntary - movements that protect the body from falling. For example, such involuntary movements during shooting are the continuous large or small oscillations of the shooter's body during aiming. We will dwell on this group of movements associated with maintaining posture, maintaining body balance, that is, movements that determine stability and the greatest possible degree of immobility of the shooting position, in a little more detail.

In the process of evolutionary development of animals and humans, a certain position of the head and body in space gradually

emerged and became fixed, ensuring the correct orientation of the organism in the environment. The need to maintain balance and the correct normal position of the body led to the fact that the activity of all skeletal muscles became very coordinated, strictly coordinated, aimed at maintaining a certain pose.

Maintaining a normal posture is ensured by the fact that skeletal muscles, which have the ability to shorten and stretch, are always, even when the body is motionless, in a state of some, so to speak, preliminary involuntary tension. This state of constant tension is called **muscle tone**. Due to the presence of muscle tone, a certain mutual arrangement of various parts of the body is maintained in animals and humans. Muscle tone is basically a reflex to stretching. The force of gravity of the body, under the action of which the body tends to fall, and its moving links to move downwards, causes continuous stretching of the skeletal muscles; this causes irritation in the proprioceptors of the muscles and tendons, sending impulses to the central nervous system, in response to which a long-term tireless tension of the skeletal muscles occurs - muscle tone. Skeletal muscle tone is a reflex phenomenon associated with the activity of many parts of the central nervous system. Changes and regulation of tone depend to a large extent on impulses - signals from the receptors of the vestibular apparatus, the organs of vision and from the skin surface, which are transmitted along the centripetal conducting nerve pathways to various parts of the central nervous system; the latter, with the participation of the cerebral cortex, regulate the tonic activity of skeletal muscles (see Fig. 81).

In the process of gradual development in the human body, a group of tonic reflexes arose and became established, aimed at maintaining the body's balance when there is a threat of its disruption and at restoring the normal posture in cases where the balance has already been disrupted. This group of reactions was called **the adjusting tonic reflexes**. These include: postural reflexes that occur when the position of the head in space and in relation to the body changes; straightening reflexes that occur when the normal posture of the body is disrupted. All these complex reflexes consist of an involuntary, automatic redistribution of muscle tone in the limbs, neck and body.

However, due to such a continuous redistribution of tension in the flexor and extensor muscles, the continuous action of the muscles in opposition to external forces, the human body cannot be completely motionless; it constantly experiences some vibrations. Naturally, the shooter should be interested in those conditions under which the vibrations of the body under the action and opposition of the muscles will be the smallest.

In maintaining the body's balance, and consequently the magnitude of its oscillations, the activity of the vestibular apparatus, in the receptors of which nerve impulses arise when the position of the head changes, is of great importance, as already mentioned.

Consequently, when the tilt of the head and body changes, a number of reflexes arise aimed at restoring the original, normal position. As soon as a person, even without changing the position of the body, tilts his head, impulses will immediately begin to follow from the vestibular apparatus, affecting the change in muscle tone, that is, the tension of certain muscle groups.

From this we can draw an important conclusion that the shooter's body, when ready to shoot, will experience a significantly smaller range of oscillations when the head position is normal, without tilting to one side or the other. In this case, the threshold for distinguishing the tilt of the body, the "sensitivity" of the vestibular apparatus will be the greatest.

The importance of the vestibular apparatus in ensuring the stability of a particular shooting position is very great. The more developed and trained the organ of balance is, the better its relationship with the work of the skeletal muscles aimed at maintaining the body posture unchanged. On this subject, Professor A.N. Krestovnikov wrote ("Human Physiology". Ed. by A.N. Krestovnikov. Phys., 1954):

"In addition to these data, showing a high degree of stability of the vestibular apparatus in the representatives of figure skating, one can point to a high degree of shooting accuracy in them (Kasyanov), which is associated with high static stability. N.A. Panin was not only a world champion in figure skating, but also a brilliant marksman."

Postural reflexes are realized by irritation of the muscles and tendons of the neck, as well as receptors of the skin in the neck area, which are called **cervical-tendon tonic postural reflexes** .

From what has been said, the shooter should also draw the appropriate conclusion for himself: when preparing to shoot, one should not excessively stretch his head towards the sight, throw his head back, press his cheek against the butt of the rifle with great force, that is, excessively strain the muscles of the neck and their tendons, so as not to cause strong irritation of the receptors located in them, and in connection with this, the emergence of a flow of impulses that will lead to a reflex redistribution of the tone of the skeletal muscles and an increase in vibrations, swaying of the body.

It should also be remembered that in maintaining balance and the immutability of the body's posture, impulses from the muscles and tendons during their stretching are of particular importance (see Fig. 80); continuously signaling the position of the body in space, the muscles, tendons and joints have a huge influence on the redistribution of muscle tone, and therefore significantly affect the degree of body sway. Therefore, when choosing one or another version of the position for yourself, you should strive to ensure that the fixation of the movable links of the body, as well as holding the whole body in one or another posture, is achieved with the least involvement of the active muscular apparatus in the work. This can be achieved if the muscles fix the joints so that the bones rest on each other and are fixed mainly due to the ligamentous apparatus (see below).

With a smaller number of intensively functioning muscle groups during the preparation, an excessive flow of sensory and motor nerve impulses will be prevented, which will improve the prerequisites for maintaining the body in an unchanged position, with the least range of oscillations.

In conclusion, let us dwell on one more possible method of reducing involuntary body vibrations when ready, used by some top-class shooters who have achieved a very high degree of training in controlling their motor apparatus. This method is based on conscious intervention in the course of involuntary motor reactions, the

possibility of which is well known. For example, a person periodically blinks without even noticing it; such an involuntary movement of the eyelid is usually performed unconsciously, automatically. However, at any moment, a person can take control of this movement under the consciousness, and it then becomes voluntary: one can close one's eyes or, conversely, deliberately not blink. Respiratory cycles are involuntary, but at any moment a person can consciously hold one's breath, not breathe. The body responds to a sharp painful stimulus with an involuntary movement; expecting such a repeated painful stimulus, a person can force himself to react to it much weaker. While standing, the body, under the action and counteraction of muscles, continuously sways involuntarily; but if desired, by taking control of such a movement with consciousness, it is possible to some extent to control it. This feature is used by some leading shooters to reduce involuntary vibrations of their body with the weapon during shooting.

Reducing the range of involuntary body oscillations by some suppression of them by voluntary active counteraction is possible with finely differentiated, extremely precise control of the motor apparatus, based on a highly developed muscular sense, when the shooter feels every movement of his body and the movement of the weapon. Of course, such a method of controlling one's motor apparatus is possible with a very high level of training of the athlete and the developed high sensitivity of various analyzers. Premature attempts to use such a method by insufficiently trained shooters, as a rule, lead to the opposite results due to the inclusion of muscles in the work inappropriately and the appearance of a feeling of general stiffness of movements. However, under any circumstances it should be remembered that a highly developed muscular sense is always a good assistant in achieving the greatest immobility of the "shooter's body - weapon" system. Therefore, one should strive to develop it in every possible way, so that during the preparation there are no individual overly tense muscle groups and no powerful centripetal impulses arise from this overstrain, which can, so to speak, drown out weaker signals coming from other, less tense muscles, which to some extent distorts the "information" coming to the cerebral cortex from the motor analyzer, and ultimately has a negative effect on the stability of the body when prepared for shooting.

The negative effect of tilting the head, straining the muscles and tendons of the neck, overstraining individual groups of skeletal muscles is manifested not only in the redistribution of muscle tone, increasing the oscillations of the entire system; the resulting powerful flows of centripetal impulses, continuously and for a long time following from the receptors to the central nervous system, lead to strong and comparatively rapid fatigue of both the motor nerve centers and the shooter's muscular apparatus, which has a negative effect on the quality of shooting, especially such as "standards", the execution of which requires a long time. Therefore, the shooter must strive to create the most favorable conditions for the functioning of the motor apparatus without overloading it with excessively long static work during the production of each shot.

These are the general, elementary facts about the locomotor system, without which it is very difficult, if not impossible, at the current level of development of shooting sports to competently solve practical issues related to choosing the right and promising variant of the gun. Of course, the above material about the human locomotor system is very concise. Therefore, it is highly desirable that the shooter does not limit himself to the above, but refers to special textbooks on human anatomy and physiology.

3.1.2 Some information about the statics of the human body

The human body, like any physical body, is affected by two external forces - the body's gravity (the effect of the earth's attraction) and the reaction force of the support (the counteraction of the body's pressure on a solid support). The body's gravity always passes through its center of gravity and is directed perpendicular to the horizontal plane; the reaction force of the support is directed opposite to the gravity and equal to it.

From the point of view of general physical laws, in order to maintain the equilibrium of an unchanging body, it is necessary that the external forces acting on it be balanced. If, fulfilling these requirements, we were to cast, say, a figure of a shooter in a ready pose from bronze or plaster, it would, of course, be sufficiently stable, and the pose would be unchangeable. But the human body is a complex system consisting of many moving links that tend to move downwards under the action of their own gravity. In order to maintain the mutual arrangement of the moving links of a living body in a particular pose and ensure their sufficient immobility, a certain counteraction of internal forces is required. Such internal forces in the body are mainly the force developed by the muscles and the tension force of the ligaments.

Below we will consider some issues of interaction of external and internal forces, with the help of which the moving parts of the human body are fixed, his posture is maintained unchanged and, in connection with this, the relative immobility of one or another type of shooting position is ensured.

In the statics of the human body, there are two main types of equilibrium: stable and unstable, which are determined by the location of the body's center of gravity relative to the support area.

A stable equilibrium is one in which a body, taken out of a state of equilibrium and then left to itself, returns to its original position. This type of equilibrium occurs in cases where the center of gravity of the body is below the support area, for example when hanging (Fig. 82, a).

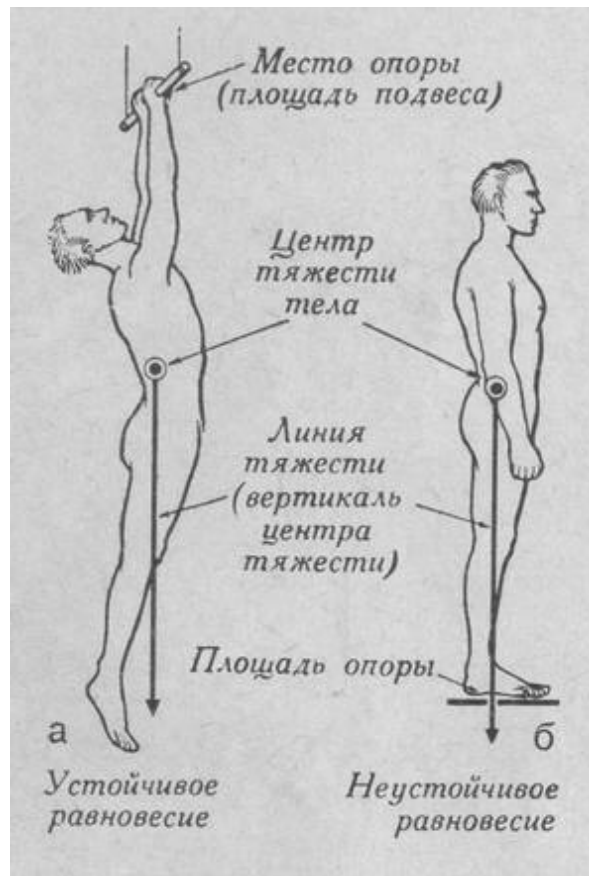


Fig. 82 - Types of equilibrium of the human body

An unstable equilibrium is one in which the center of gravity of the body is above the support area (Fig. 82, b). In this case, the body taken out of the state of equilibrium does not return to its original position.

Consequently, the human body in a shooting position - standing, kneeling, and even lying down - is in an unstable equilibrium, since the body's center of gravity is above the support area.

The main condition for maintaining any type of body balance is the passage of the line of gravity (the vertical of its common center of gravity) inside the support area. If the line of gravity goes beyond the support area, then the body in case of unstable balance does not return to its original position and falls.

However, being in an unstable equilibrium, a body can have different degrees of stability, depending on the position in which it is located, since the degree of stability of a body is determined by: the height of its center of gravity above the support area, the size of

the support area itself; the degree of distance of the line of gravity from the boundaries of the support area.

Since the equilibrium is disturbed at the moment when the line of gravity of the body goes beyond the support area (Fig. 83), it is obvious that with an unchanged support area the body will lose stability as the height of the center of gravity above the support area increases. With an increase in the support area with an unchanged height of the center of gravity, the stability of the body increases. An essential moment determining the degree of stability of the body is also the passage of the line of gravity in relation to the boundaries of the support area; the closer the line of gravity approaches the edge of the support area, the less opportunity it has to move in this direction without the risk of disturbing the equilibrium of the body.

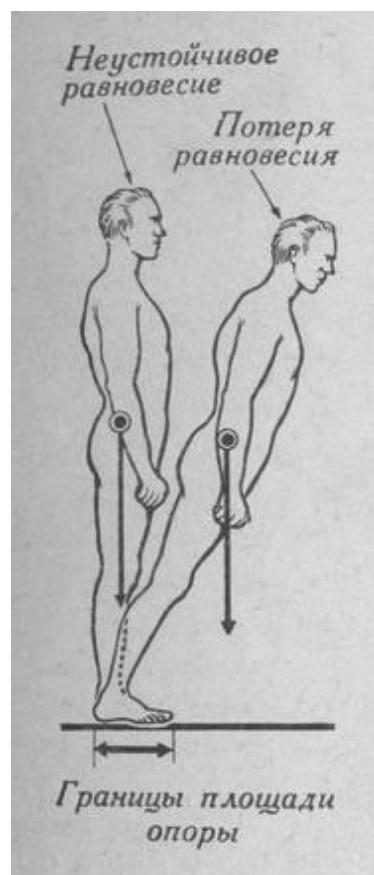


Fig. 83 - Unstable equilibrium and loss of balance

It is well known, for example, that the least stable position is the standing position. Its low stability is due to the fact that with a small support area, the body's center of gravity is relatively high above it.

With the same height of the center of gravity and the same support area, the standing position will have varying degrees of stability, depending on how the shooter places the weight of his body - whether he throws his body back, standing on his heels, which entails the displacement of the line of gravity to the boundaries of the support area, or stands straight, placing the weight on the middle part of each foot and thereby bringing the line of gravity closer to the center of the support area. In this regard, there is an indicator called the <angle of stability>, which is formed by two straight lines - the vertical of the common center of gravity and the straight line going from the common center of gravity to one or another boundary of the support area (Fig. 84).



Fig. 84 - Front and side stability angles in a wide-legged stance

Thus, the height of the center of gravity of the body above the support area, the size of the support area, the passage of the line of gravity in relation to the boundaries of the support area (or the angle of stability) are those external factors that determine the degree of stability of the body.

First of all, let us consider the question of the center of gravity of the human body. Since the body consists of individual links, its

overall center of gravity is defined as the center of gravity of the system of bodies. Since the individual parts of the human body are connected to each other movably, the overall center of gravity does not have a fixed position and moves with every change in the position of its individual parts. Therefore, each pose or position of the body in a state of equilibrium corresponds to a different location of its overall center of gravity (Fig. 85).

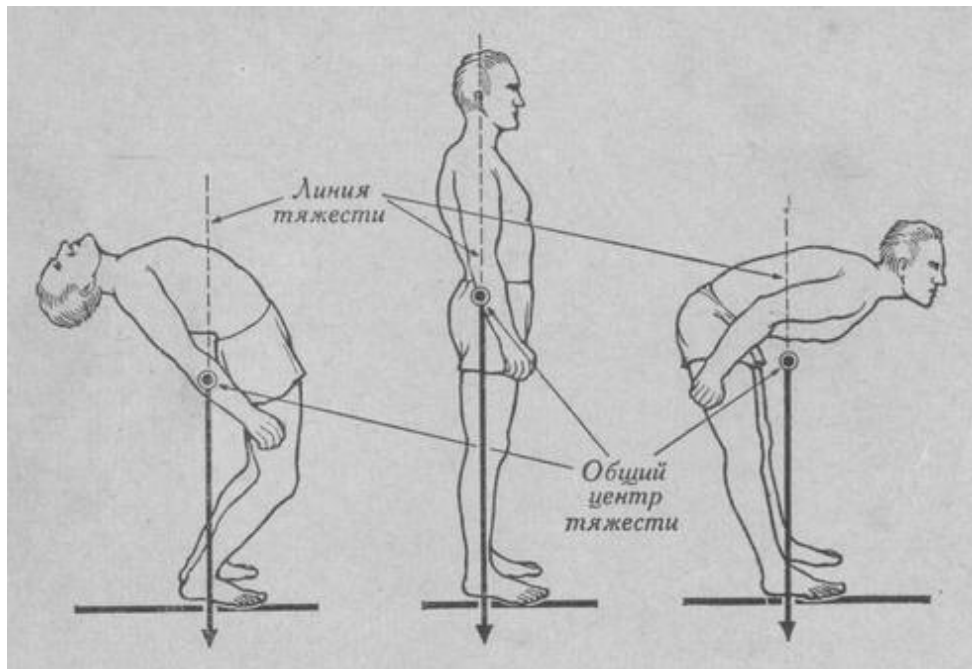


Fig. 85 - Location of the general center of gravity of the body in various poses

The general center of gravity of the human body moves even in the same position of the body due to breathing, blood circulation and filling of the abdominal organs; therefore, it is very difficult to achieve absolute accuracy in determining the location of the general center of gravity of a living organism.

In fact, the shooter does not need to precisely determine the location of the general center of gravity of his body. Knowing the influence of the location of the center of gravity above the support area on the degree of body stability in a particular position, the shooter should only strive to ensure that the weight of the body is distributed more or less evenly on its support surfaces (the feet of both legs), when preparing to shoot while standing or when shooting from a knee, be above the support area limited by the foot of the

left leg, the knee and heel of the right leg at a sufficient distance from its boundaries.

The situation is quite different with the support area. Since the support area is not only the supporting surfaces of the body - the feet, but also the area enclosed between them, the shooter can, for example, in a standing position, by placing his feet differently, decrease or increase the support area and thereby change the conditions of stability of his body (Fig. 86). Of course, increasing the body support area due to a wide spacing of the feet when stance for slow shooting while standing cannot significantly increase the stability of the body as a whole, since the angle of stability in this case increases only in one direction; however, when stance for shooting at the "Running Deer" and "Running Boar" targets and high-speed pistol shooting at silhouettes, a wider spacing of the feet is simply necessary, since with an increase in the angle of stability in the direction of the plane of shooting, the stability of the "shooter's body - weapon" system increases significantly when quickly raising the weapon.

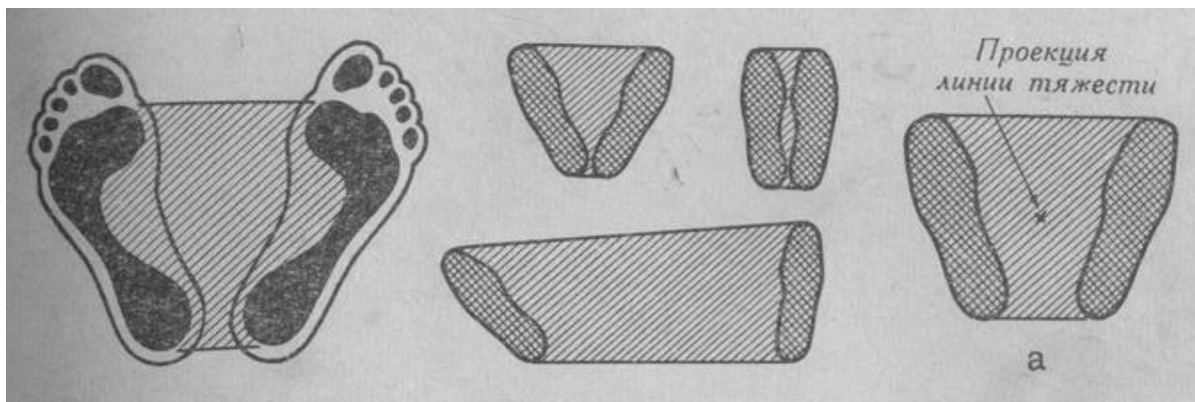


Fig. 86 - Change in the area of body support depending on the position of the legs

When considering the question of the stability of a living body in one position or another, one cannot limit oneself, as has already been said, to applying to it only the general laws of mechanics that determine the equilibrium of physical bodies in general; under equal conditions - the same support area, almost the same location of the general center of gravity and the same distance of the line of gravity from the boundaries of the support area - the human body can occupy completely different positions and actually have different stability (Fig. 87).

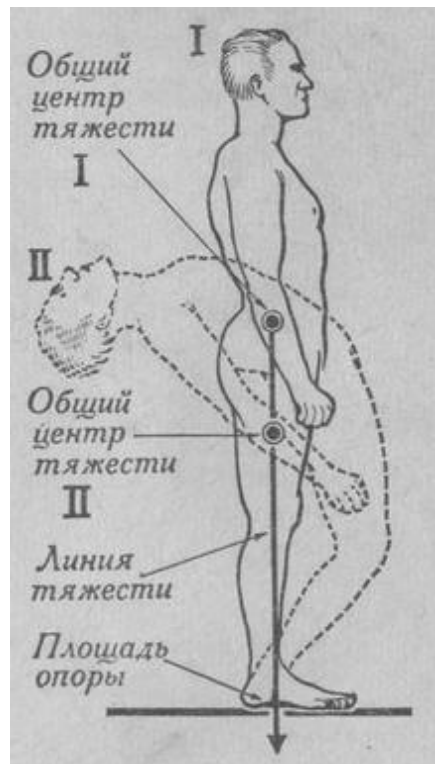


Fig. 87 - An example of different body positions with the same support area, almost the same location of the common center of gravity and the same passage of the body's line of gravity

As can be seen from the figure, the distinctive feature of these two body positions is that maintaining their balance is achieved by completely different work of the internal forces of the body.

If the muscles are relaxed, each link of the body will move its center of gravity downwards, and consequently the overall center of gravity of the body will also move; the line of gravity will go beyond the area of support, and the body will fall. Therefore, the peculiarity of the statics of a living body consists precisely in the fact that it is possible to maintain its equilibrium only under the condition of the operation of the motor apparatus, the tension of the muscles and the passive resistance of the ligaments of which counteract the gravity of one or another moving link (Fig. 88). As we see, the force of gravity of one or another moving link, applied to its center of gravity, tends to move it downwards. In this case, a moment of force is formed, which rotates this link relative to the axis of rotation of the joints. The counteraction to this moment of force is the static work of the muscles and the resistance of the ligaments.

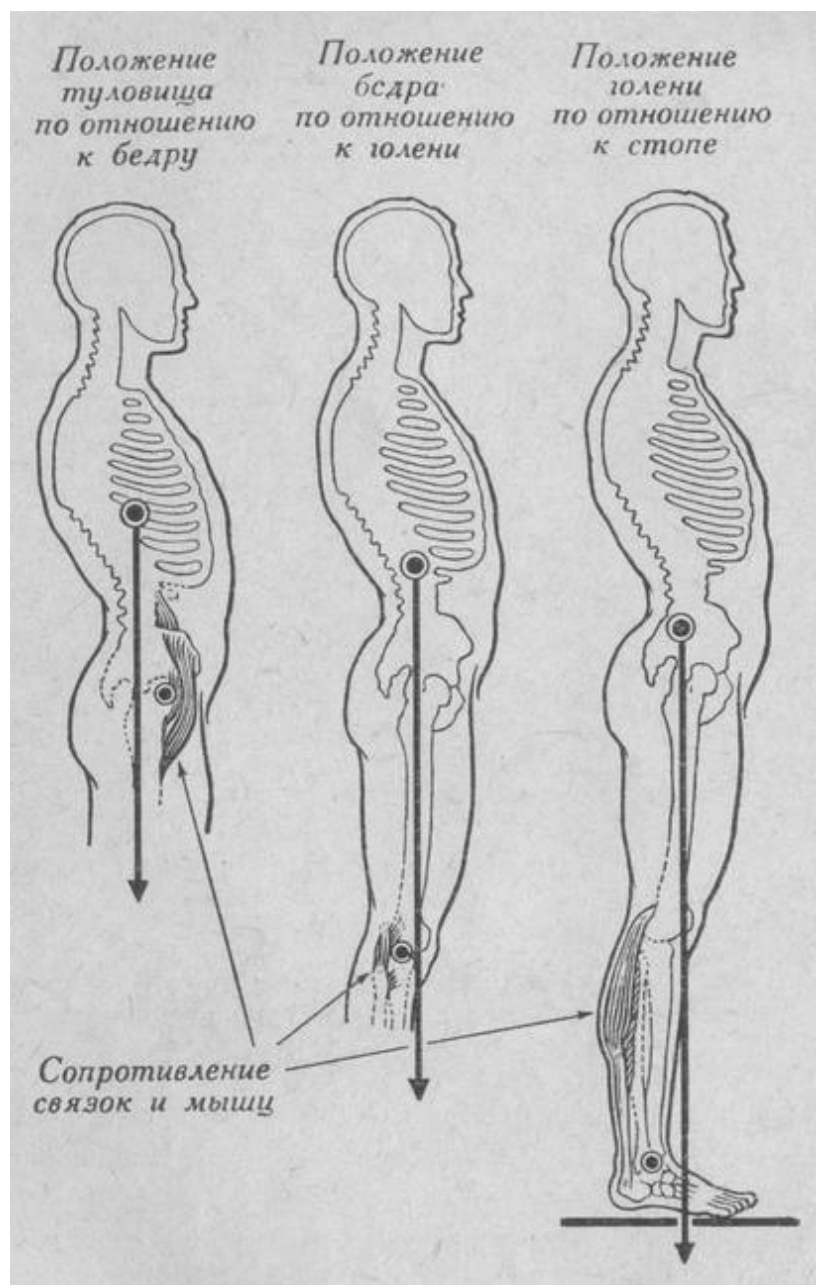


Fig. 88 - Balance of various parts of the body during a stand

Since muscle tension, by its physiological nature, cannot be strictly constant, the action of gravity and the counteraction of the muscles cannot create absolute immobility of the body, which is why it constantly sways more or less.

Therefore, the shooter always faces the task of choosing a shooting position in which body balancing would require the least expenditure of muscular effort and maximum involvement of the passive ligamentous apparatus, since under such conditions the body will be less subject to vibrations. From these positions, we will consider

in general terms the state of body balance in the least stable position, that is, in a standing position.

There are three main types of standing positions: anthropometric ("normal position"), calm ("comfortable posture") and tense ("war position").

In **the anthropometric position** (Fig. 89, a) the vertical of the general center of gravity coincides with the transverse axes of the hip, knee and ankle joints. In this case, the ligamentous apparatus plays a significantly smaller role in strengthening the joints than the muscles; the body parts - the pelvis, thigh, shin, foot - are in a state of some unstable equilibrium, which entails their inevitable, rather significant swaying; the muscle groups that secure the joints are tense, sometimes in front, sometimes behind these joints. In this standing position, when the fixation of the movable body parts in the joints is based mainly on the work of the muscles, the swaying is more noticeable than in other types of standing.

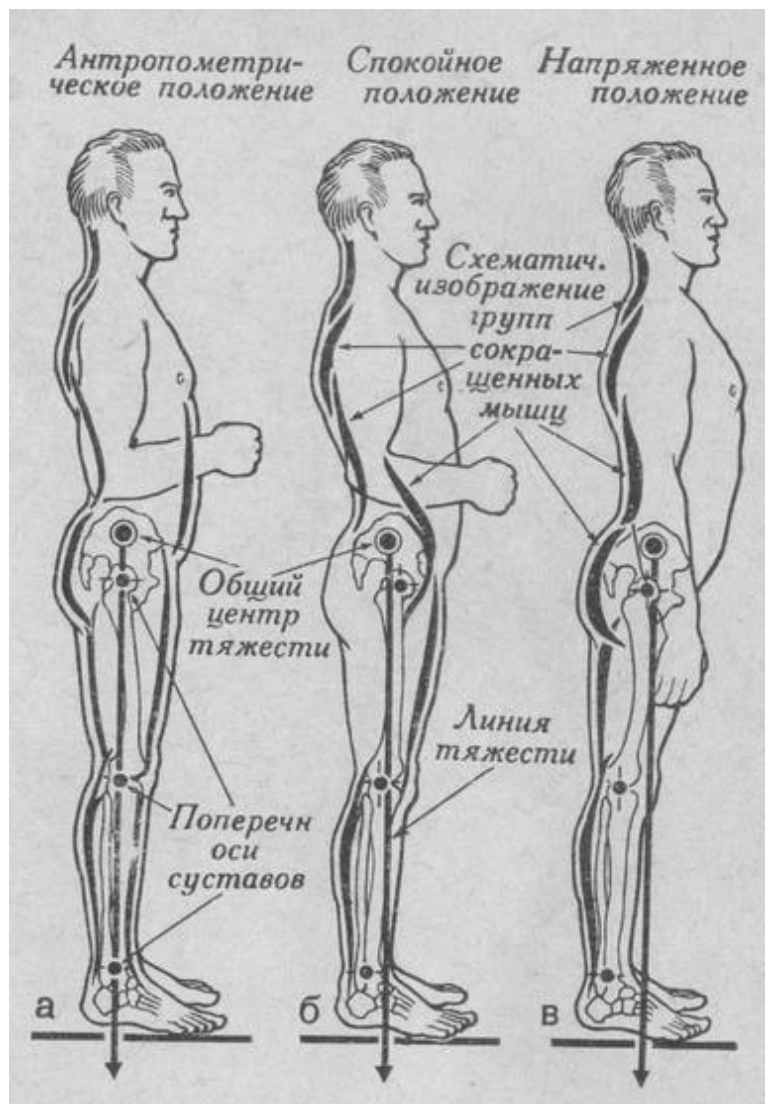


Fig. 89 - Basic types of body positions while standing

In a **calm position** (Fig. 89, б), the vertical of the general center of gravity passes behind the transverse axes of the hip joints. Strengthening of the pelvis relative to the thigh is facilitated by muscles and ligaments; a special role is played by the iliofemoral ligament (see Fig. 92), which is so strong that, when stretched, it can even withstand the weight of the torso without the participation of muscles. Strengthening of the knee joints is carried out by ligaments and muscles located behind these joints. Strengthening of the ankle joints (when the shin is tilted forward) is facilitated by the structure of the joints themselves (the shape of the talus).

In a **tense position** (Fig. 89, в), the vertical of the center of gravity passes in front of the transverse axes of the hip, knee and ankle joints. Therefore, in order to protect the body from falling, the mus-

cles located on the back surfaces of these joints must be in a tense state all the time.

Comparing the work of muscles in different types of standing positions, we can conclude that the condition of the least expenditure of muscular effort on the part of the body to maintain balance corresponds to a calm position. Consequently, the variant of the body posture in a standing position, in which the vertical of the center of gravity passes behind the transverse axes of the hip joints, in front of the knee and ankle joints, that is, when the body is thrown back, and the pelvis is pushed forward, should be the fundamental basis for the position for shooting while standing. The shooter must inevitably come to this conclusion because the strengthening of the main joints of the body is achieved not so much by the work of the muscles, as by the inclusion of the ligamentous apparatus in the work; this contributes to better fixation of the movable links of the body in the joints, and, consequently, to achieving the greatest staticity of the shooter's body posture as a whole, with the least expenditure of muscular effort.

However, when preparing to shoot, when it is necessary to support the weapon in the air, the muscular system experiences significantly greater tension, not only due to the increase in the overall combined weight of the shooter's body together with the weapon, but also because the weapon, like any load, significantly changes the entire loading pattern of the muscular system.

The shooter holding the weapon, i.e. the load, together with it represents a single system with a common center of gravity (Fig. 90). Since the entire system is in equilibrium only if its line of gravity passes through the support area, holding the load inevitably causes a significant change in the position of individual body parts, i.e. their compensatory movement associated with the need to create some counterweight to the weapon; this significantly changes the entire pose of the shooter, as a result of which, when ready to shoot, his body acquires an asymmetrical and somewhat unnatural pose. Maintaining the balance of the body under these conditions, in turn, requires an unusual, significantly greater load on the muscles and ligaments that strengthen the movable links of the body at the joints. Therefore, below we will consider some issues related to the work of those muscles and ligaments that play a decisive role

in fixing the joints, as well as the mutual arrangement of the movable links of the body in which their fixation requires the most economical work of the muscular apparatus.

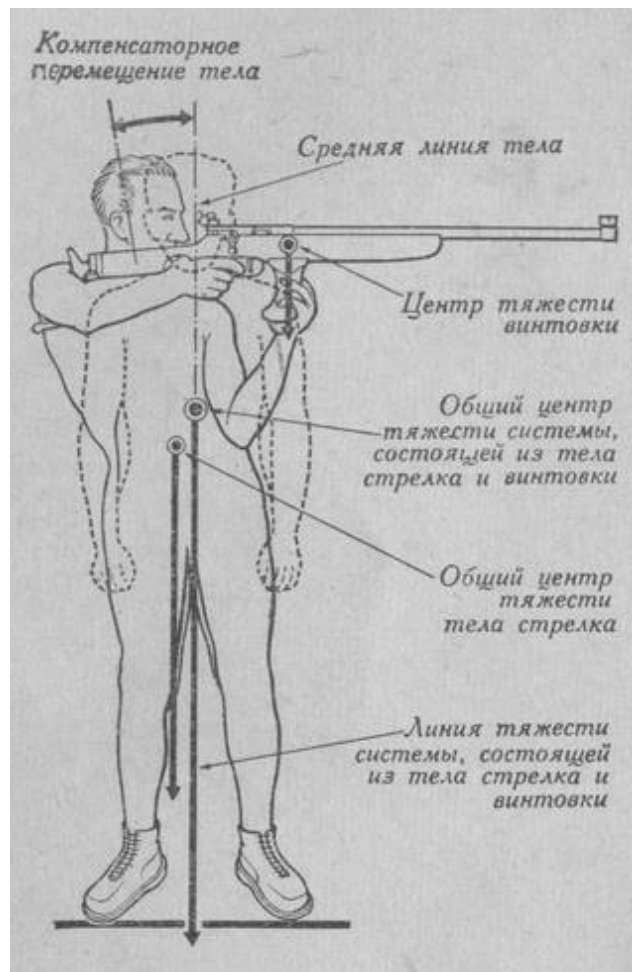


Fig. 90 - Location of the common center of gravity of the "shooter's body - rifle" system

Let us first of all dwell on some features of static muscle work, which is of great practical importance for the shooter when choosing one or another position.

Possessing elasticity, the ability to shorten and stretch, a muscle in a living organism, as has already been said earlier, always has a constant involuntary tension, tone. Despite this, there are two main states of muscle - contracted and relaxed, caused in the first case by the state of excitation (work), and in the second - by the state of rest. Being in a state of contraction or relaxation, a muscle, in turn, can be shortened, stretched or be in an intermediate state (Fig. 91), depending on the relative position of the moving links of the

body to which it is attached, that is, depending on the convergence or distance of the places of its attachment to the bones. It turns out that the traction force of a muscle, arising during its contraction under the action of motor nerve impulses, largely depends on the length of the muscle at the moment of its static work, on how much it is stretched, like an elastic, flexible body. In many cases, as numerous medical studies show, the traction of a muscle in a stretched state increases more than one and a half times. Consequently, during static work of the muscles that secure the movable links in the joints, it is necessary to strive to ensure that the main muscle groups that perform the holding work are in a stretched state when ready to shoot; in this case, the same working effect will be achieved by a significantly smaller number of functioning motor nerve cells and muscle fibers associated with them.

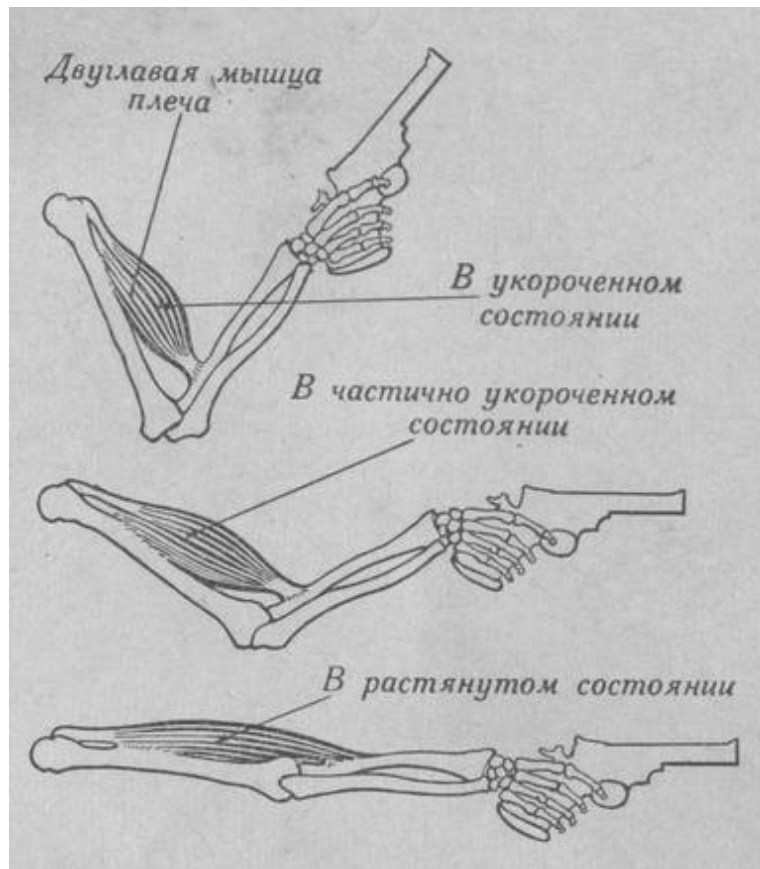


Fig. 91 - Schematic representation of the stretched and shortened state of muscles

Let us now consider, taking into account all that has been said above, some issues concerning the fixation of joints.

The hip joint (Fig. 92), which has a spherical shape, is one of the most mobile in the human body. The strongest ligament, which plays a very important role in strengthening the joint when the body is standing, is the iliofemoral ligament. The pubocapsular ligament is less strong, but when the body is standing, it is also included in the passive work and helps to strengthen the joint. Flexion and extension in the joint are possible in a large range, and it is characteristic that flexion is possible by about 105° , and extension - only 15° , which is due to the peculiarity of fixation of the joint by the ligamentous apparatus. This means that fixation of the joints can be achieved best with the pelvis pushed forward.

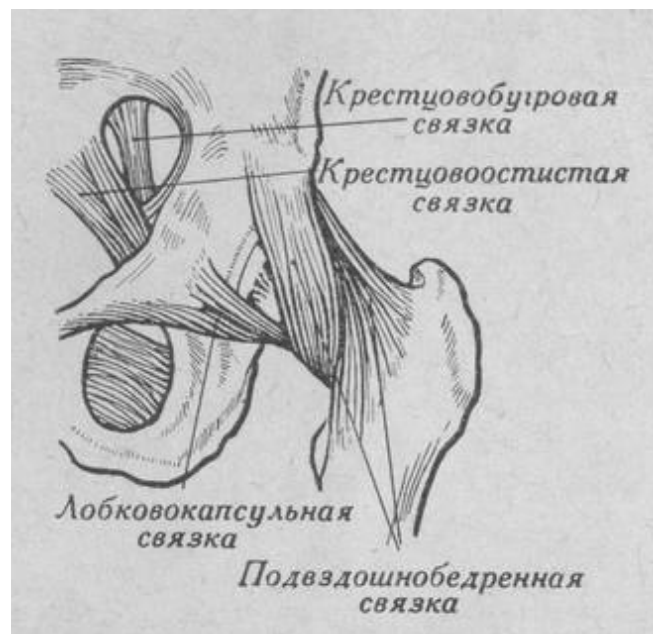


Fig. 92 - Hip joint (left, front view). Ligament arrangement diagram

The following muscles are mainly involved in fixing the joint in this position: rectus femoris, iliopsoas, and sartorius.

The knee joint (Fig. 93) is characterized by very high mobility around its transverse axis. The strongest ligaments are the popliteal oblique and cruciate ligaments. Characterized by a high degree of flexion, hyperextension in the joint from the middle position is possible only by $10-12^{\circ}$, which is prevented by a strong ligamentous apparatus. Therefore, the knee joint is best fixed by the ligamentous apparatus in a position of some hyperextension, that is, when the vertical of the body's center of gravity passes in front of its transverse axis. In this case, the following muscles participate in fixing the joint: gastrocnemius and popliteal.



Fig. 93 - Knee joint (left, rear view). Ligament arrangement diagram

The ankle joint (Fig. 94), having a block-like shape, has relatively high mobility. The joint is strengthened by a large number of ligaments located on its inner and outer surfaces. The most powerful inner ligament is the deltoid. The best fixation of the ankle joint is achieved when the shin has a slight forward tilt, since in this case the shape of the talus itself contributes to the fixation of the joint. In addition, with an inclined position of the shin, the powerful triceps surae muscle, especially the soleus muscle, is better included in the work. The following muscles also participate in strengthening the ankle joint: posterior tibialis, long peroneus, short peroneus, long flexor of the fingers, long flexor of the big toe. Therefore, the ankle joint is well fixed when the vertical of the center of gravity passes in front of its transverse axis.



Fig. 94 - Joints of the foot (left inner surface). Diagram of the location of the ligaments

The foot (see Fig. 94) consists of many joints, reinforced by a large number of ligaments; it is the supporting and spring apparatus of the human body. The foot is an arched structure with internal, external and transverse arches (Fig. 95). The arches are important in distributing the weight of the body over a large surface when standing, and also in softening the shocks when moving.



Fig. 95 - Arches and support triangle of the foot

Taking into account the structure of the foot, we can assume that the support points of the arches are: at the back - the tubercle of the calcaneus, and at the front - the head of the first and fifth metatarsal bones, which form the so-called support triangle (see Fig. 95).

A distinction is made between the full support surface of the foot and the "active" one. The first, visible on the footprint, is larger than the "active" one, since its soft parts do not directly participate in supporting the weight of the body. If the foot is shod in a boot, then the "active" support surface increases significantly. In this regard, it is appropriate to say that the shooter must pay due attention to his footwear, ensuring that the heel and boot are not worn out, and the soles are not warped and the toes are not bent upward, since under such circumstances the "active" support surface of the foot decreases.

The support area when standing with your heels together will be greatest when your feet are positioned at an angle to each other. When your feet are apart, the greatest support area for your feet is achieved by positioning them more parallel. However, you should keep the following in mind.

From the point of view of the structure of the arches of the foot and the method of strengthening them, it is extremely disadvantageous to load the inner arch when standing, as it is more easily subject to flattening, since, on the one hand, the inner arch includes more bones, and therefore joints, and on the other hand, it is strengthened almost exclusively by muscles. Research by E.A. Kotikova showed that with an increase in the angle of toes, as well as with an increase in the spread of the feet to the sides, the load on the inner arch increases.

Therefore, when preparing for slow shooting while standing with a rifle or pistol, you should not spread your legs wide apart and place your feet at a large angle relative to each other.

The placement of the feet in a standing position is also in a certain relationship with the degree of joint-muscular sensitivity, which determines the athlete's ability to be uniform in reproducing his position when ready for each shooting. Fig. 96 shows the results of a

simple experiment conducted by the author - multiple combined contours of the feet of leading athletes when ready for shooting standing from a rifle and a pistol. Looking at these combined "traces", we can draw the following conclusions:

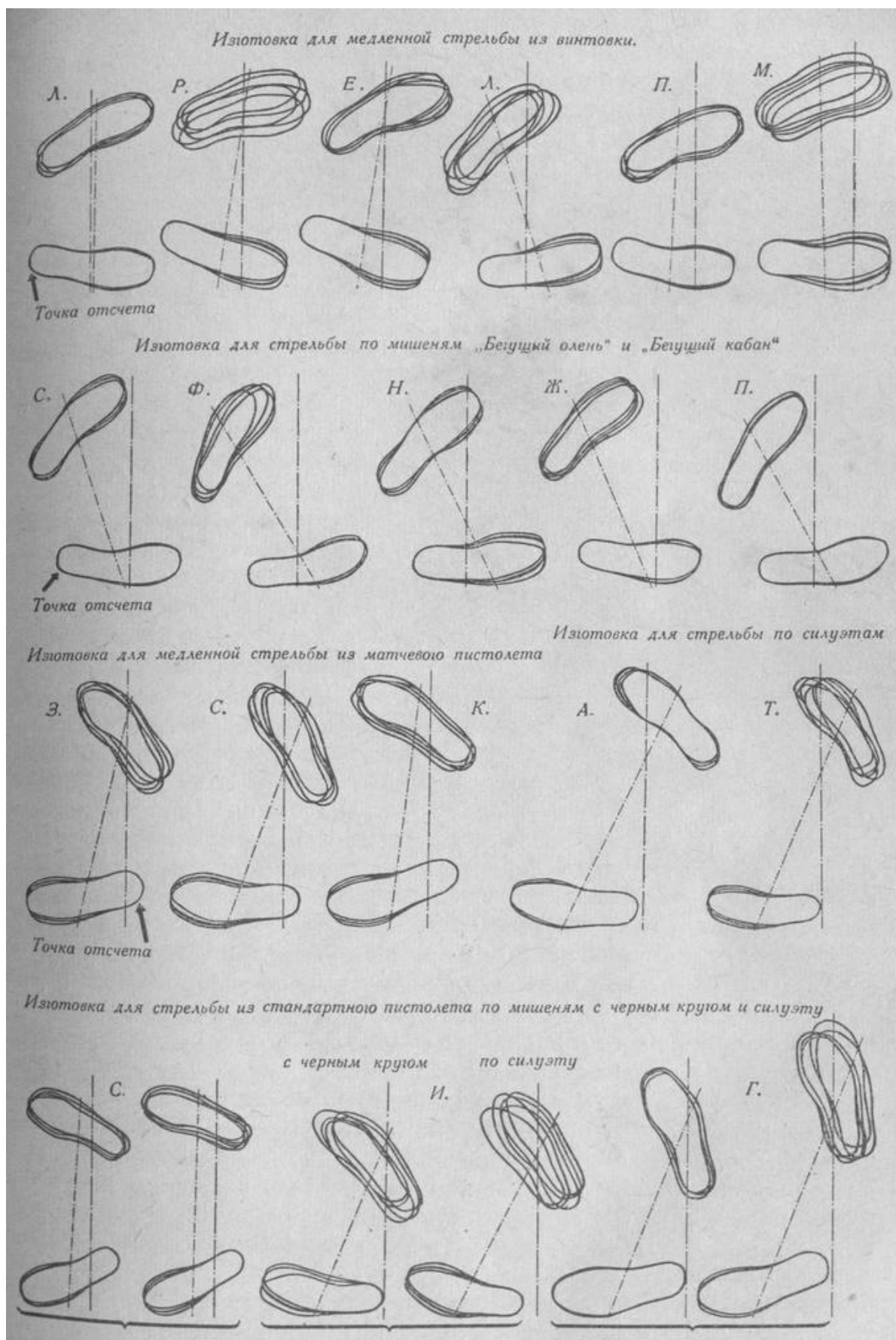


Fig. 96 - Multiple combined "traces" - foot contours when preparing

to shoot standing from a rifle and pistol of some leading shooters

— the degree of accuracy of matching "traces" is lower for shooters using a position with a wider leg spacing. This is especially noticeable in the pistol group when switching from shooting at a target with a black circle to shooting at a silhouette, accompanied by a wider leg spacing;

— when in a position characterized by a large angle of body rotation relative to the plane of fire, the degree of accuracy of combining "traces" is reduced mainly in relation to the stability of maintaining the same angle of body rotation;

— the most developed muscle memory was found in the group of athletes who specialized in shooting at the "Running Deer" and "Running Boar" targets. This, it must be assumed, is due to training in repeatedly leash the rifle to the right and left, which contributes to the development and development of a highly developed muscle sense and muscle memory;

— the greatest accuracy of combining "traces" is observed among representatives of the older generation of leading shooters, namely among those who at one time attached great importance to the issue of stability in the placement of the feet during preparation and systematically made notes on the floor at a certain stage of their technical training or traced the outline of their feet on the firing line;

— in general, the muscle memory of sports shooters for restoring their shooting position while standing (in relation to the relative position of the legs and maintaining the angle of rotation of the body relative to the target) is lower than previously assumed. Incidentally, this was a big surprise for many shooters who took part in the experiment.

From all that has been said above, the following conclusions can be drawn: firstly, muscle memory when reproducing one's position is directly dependent on the degree of special training of the shooter; secondly, athletes (especially those with insufficiently developed muscle memory) are not recommended to move from their place at the firing line during the firing of a series of shots.

Let us now consider some features of fastening the shoulder girdle and joints of the upper limbs, which should be taken into account when choosing the most advantageous position when shooting from a pistol and revolver.

The shoulder girdle , as already noted, consists of four bones - two shoulder blades and two collarbones; the shoulder blades are attached to the body only by muscles (Fig. 97). Due to this, the shoulder girdle (primarily the shoulder blades) has a certain mobility relative to the body (chest); the arms are attached to this system, which is mobile relative to the body.

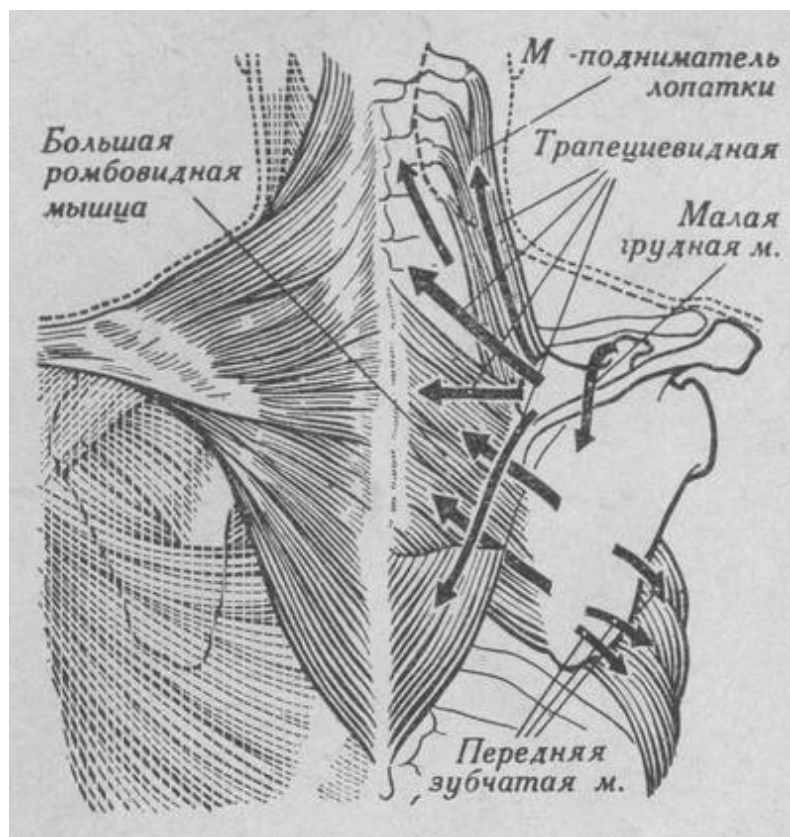


Fig. 97 - Attachment of the scapula to the body

Therefore, in order to achieve the most immobile fixation of the arm in one position or another, it is important to achieve not only the best fixation of its movable links in the joints, but also the best fixation of the shoulder blade - the base to which the arm is attached, since with all movements of the shoulder girdle (shoulder blade and collarbone), the position of the arm necessarily changes.

Slight abduction (lifting) of the arm and its maintenance in this position are accomplished mainly by the deltoid muscle; in this case, the scapula is slightly displaced by its lower angle outward (see Fig. 99, c). However, further abduction of the arm to a horizontal level is accompanied by the work of the muscles that move and rotate the scapula; in this regard, maintaining the abducted arm at a horizontal level is accomplished not only by the deltoid and other muscles, but by the muscles that secure the scapula - the large rhomboid, trapezius, anterior serratus, etc. (Fig. 98). From this, athletes shooting from a pistol should draw a very important conclusion for themselves: it is significantly more advantageous to maintain the arm at a horizontal level in the case when the body is thrown to the side opposite to the outstretched arm, since in this case the scapula is less displaced by its lower angle outward (Fig. 99); in this case, less tension is required from the muscles that rotate and secure it.

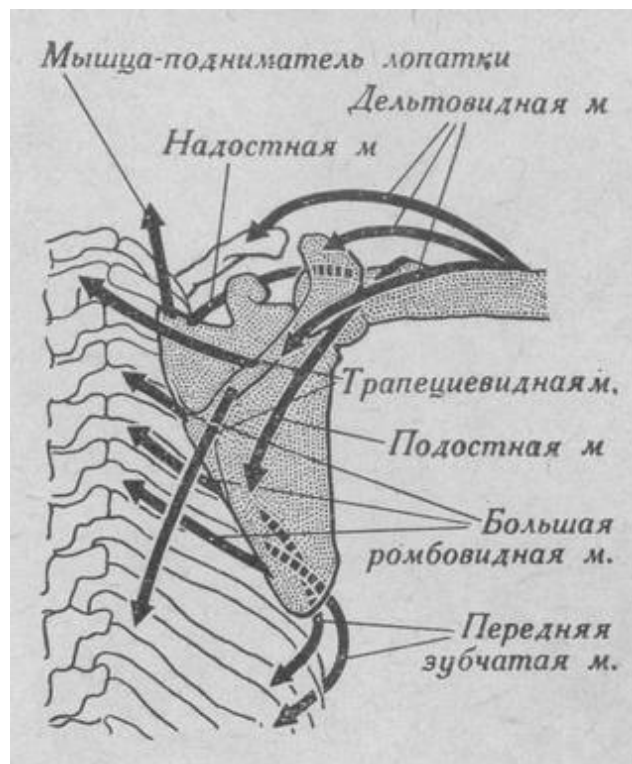


Fig. 98 - Fixation of the scapula while holding the humerus at a horizontal level

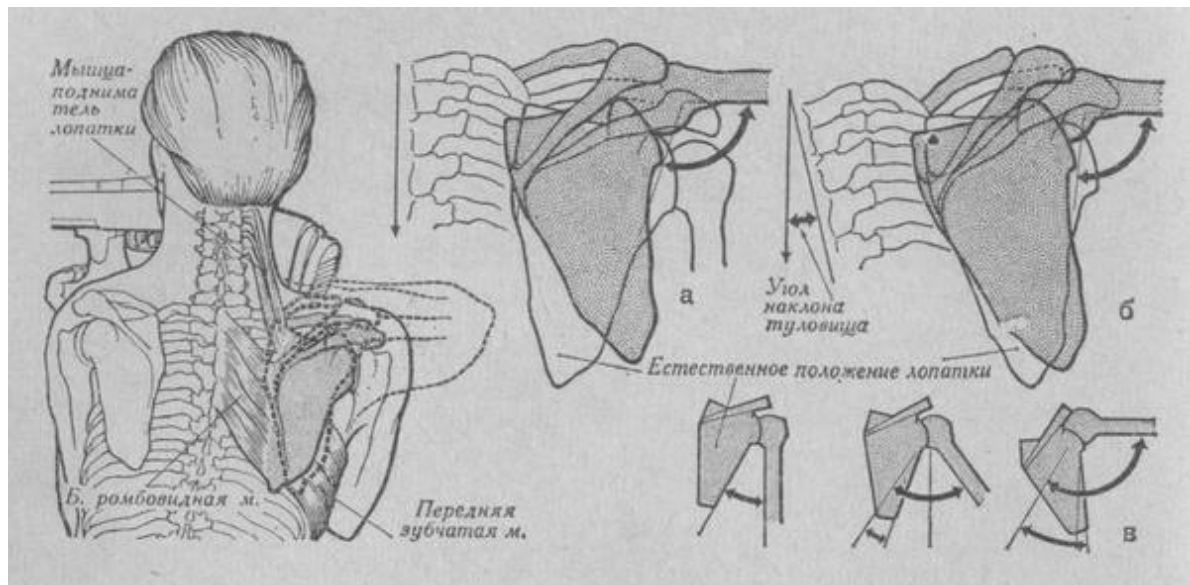


Fig. 99 - Different degrees of scapula movement:

a - with the torso straightened; *b* - with the torso tilted to the side; *c* - rotation of the scapula when raising the arm.

The shoulder joint is spherical in shape and is the most mobile joint in the human body. One of the features of this joint is that it has the weakest ligamentous apparatus, represented by only one coracohumeral ligament, which, moreover, does not play a significant role in fixing the joint; therefore, fixing the shoulder joint when the arm is abducted and held horizontally is carried out by the work of the muscles: deltoid, supraspinatus, infraspinatus and upper bundles of the pectoralis major muscle. The deltoid muscle plays the most significant role in the work. It consists of three parts: the anterior (clavicular), originating from the outer end of the clavicle; the middle (acromial), originating from the acromial process of the scapula; the posterior (spine), originating from the scapular spine (Fig. 100).



Fig. 100 - Diagram of the arrangement of muscles that secure the humerus in the shoulder joint

The most favorable conditions for the deltoid muscle to work when ready to shoot a pistol are also created when the body is tilted to the side opposite the outstretched arm; in this case, the muscle performs static work, being in a stretched state, since its attachment points are more distant from each other. This is confirmed by the data obtained when recording biocurrents following from these myograms; the performance of the same static work requires a flow of motor impulses of varying strength, and, consequently, a different degree of muscle tension. Depending on the degree of abduction of the arm to the side, the conditions for the work of the muscles that fix the shoulder joint also change significantly. It is most advantageous to fix the arm at a slight angle to the shoulder line or when its axis coincides with the shoulder line (see Fig. 101).

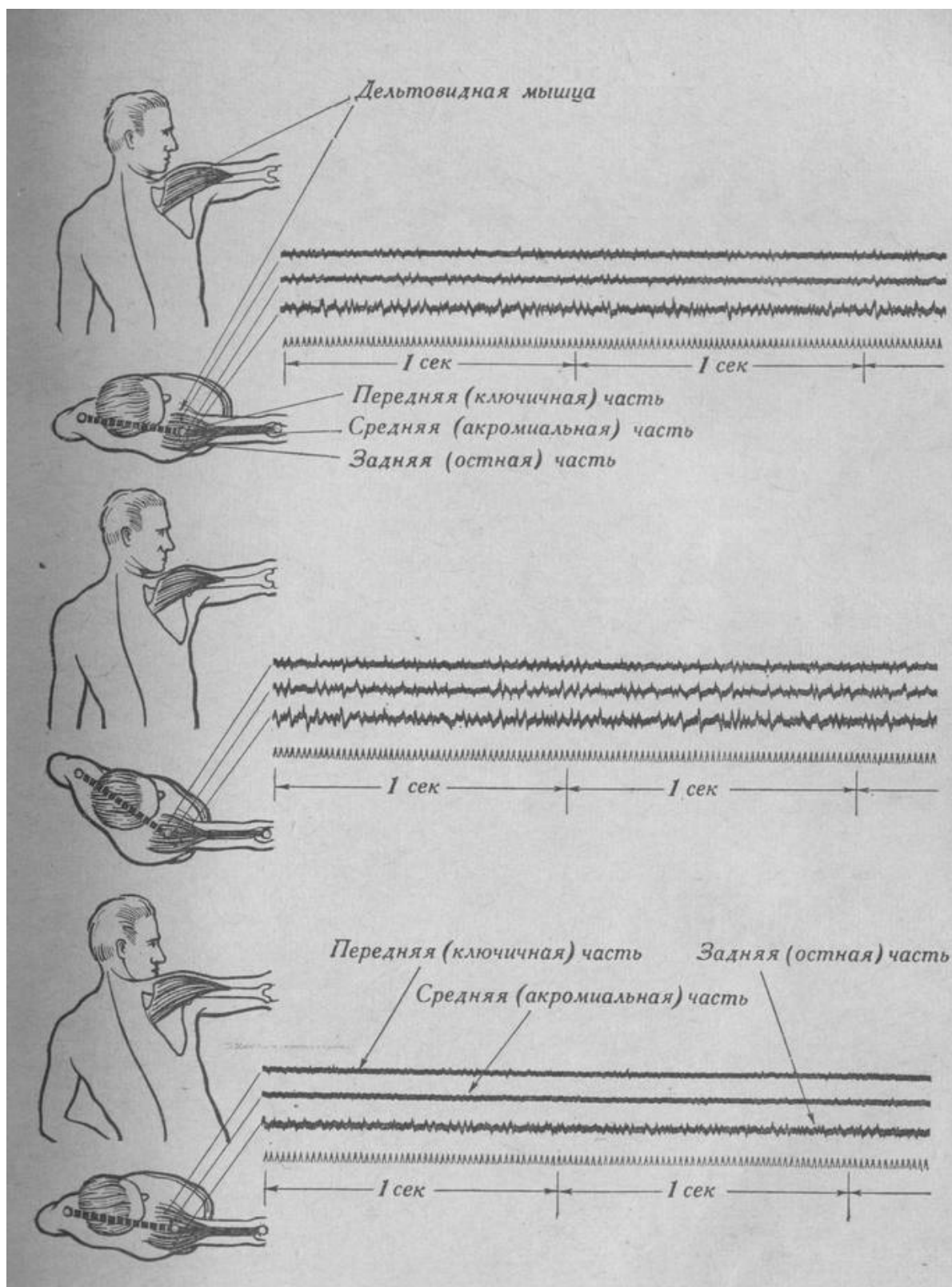


Fig. 101 - Electromyogram (recording of biocurrents) of the working deltoid muscle with varying degrees of torso tilting to the side and different positions of the humerus relative to the torso (recording made by the author using the method of E.G. Kotelnikova and Yu.Z. Zakharyants)

The elbow joint (Fig. 102) is complex, as it includes the humero-ulnar and radio-ulnar joints. The main, fundamental is the humero-ulnar joint, which has a block-like shape with one axis of rotation passing transversely, in connection with which the main movement is carried out in it - flexion and extension of the forearm. Extension of the forearm at the elbow joint can be performed until the olecranon of the ulna rests against the bottom of the olecranon fossa of the humerus; this corresponds to a straightened position of the arm with some hyperextension in the elbow joint, in which the ulna acquires a fixed position. The elbow joint is strengthened by many ligaments, of which the lateral ulnar and annular play the most significant role in strengthening the joints. The elbow joint, not distinguished by a variety of movements, is comparatively poorly equipped with muscles. However, in its strengthening, numerous muscles are of significant importance, which, passing near the elbow joint with an extended or hyperextended arm, better secure the joint. These muscles are the triceps, ulna, elbow extensor of the wrist, brachioradialis, etc.

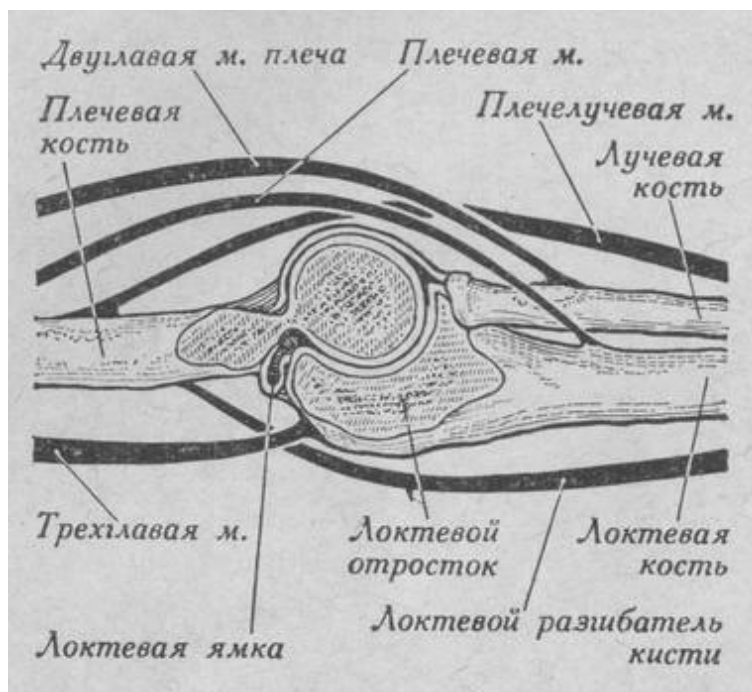


Fig. 102 - Schematic representation of the elbow joint of the right arm (side view-outside)

The joints of the hand (Fig. 103) consist of the radiocarpal and intercarpal joints. Both of these joints consist of many irregularly

shaped bones connected to each other by a large number of ligaments.

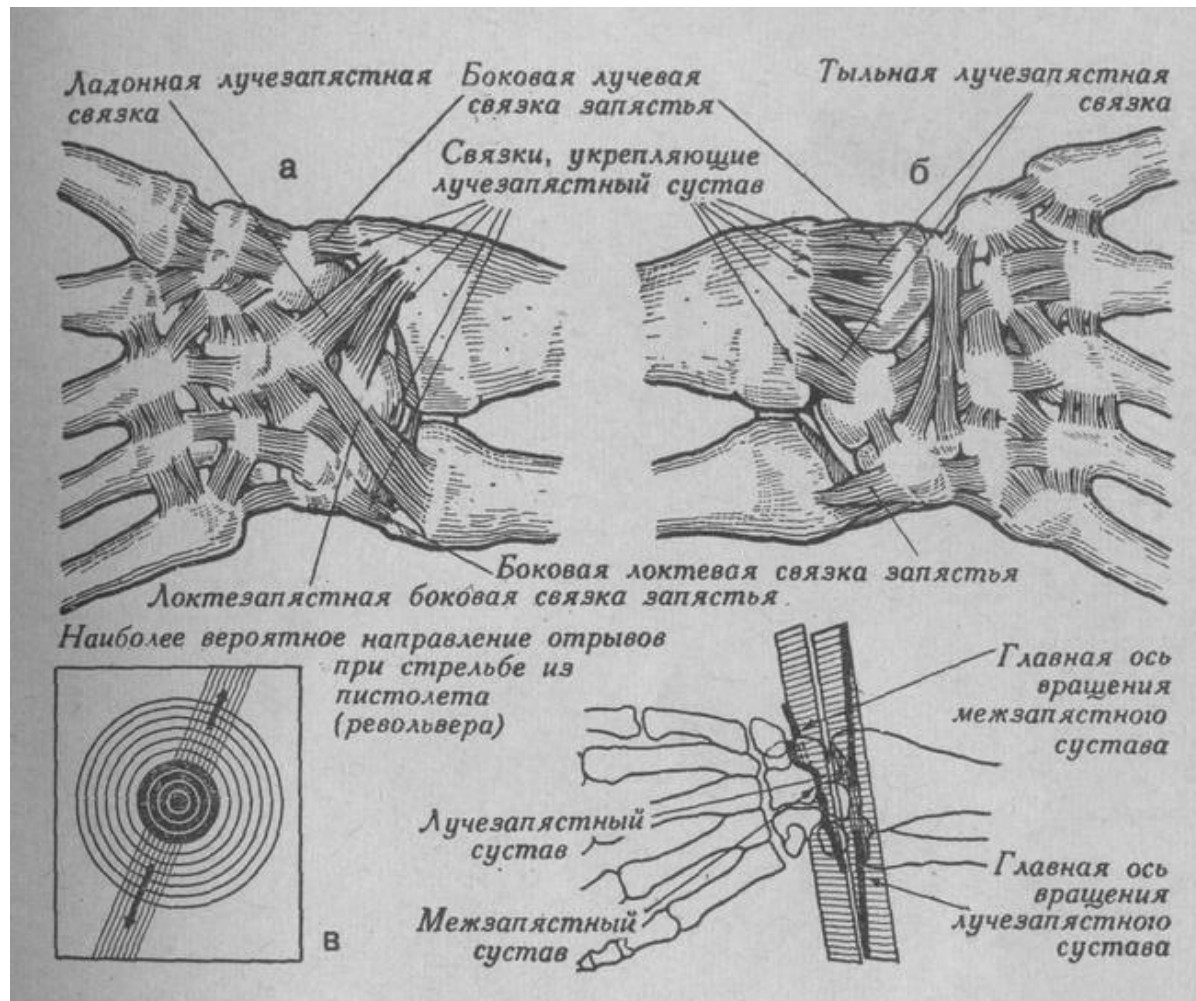


Fig. 103 - Joints of the hand

The joints are strengthened by strong ligaments, the most powerful of which are: the lateral ligaments of the wrist, the radial and ulnar. It should be borne in mind that the ligamentous apparatus strengthens these joints unevenly in all directions, due to which there are main axes of rotation of these joints, around which the movement of the hand is performed more freely. The main axes of rotation of the radiocarpal and intercarpal joints are in different planes and have different directions (Fig. 103, c), due to which the hand has greater freedom of movement in the direction shown in Fig. 103, d. Naturally, this feature of fixing the joints of the hand by the ligamentous apparatus will make itself felt more with a slight downward tilt of the hand. The multi-articular muscles passing near the joints of the hand participate not only in the movement of the

hand and fingers, but also in strengthening the joints. Therefore, in order to better fix the joints of the hand when shooting from a revolver and pistol, the handle should be grasped tightly with the fingers.

The hand as a whole (Fig. 104) consists of a large number of bones, movably connected to each other. The joints of the hand are strengthened by a complex ligamentous apparatus. The central bone to which the greatest number of ligaments are attached is the capitate, located in the middle of the wrist. Therefore, it is quite obvious that it is desirable to support the rifle with the left hand in such a way that the main load falls on this, central, part of the hand. In addition, it should also be borne in mind that the palmar ligamentous apparatus of the hand is more powerful than the dorsal ligaments of the hand; taking into account this feature of the structure of the hand, it is much more advantageous to support the rifle in such a way that the palmar ligamentous apparatus and the ligaments of the intercarpal joint are included in passive work to the greatest extent (see Fig. 103).

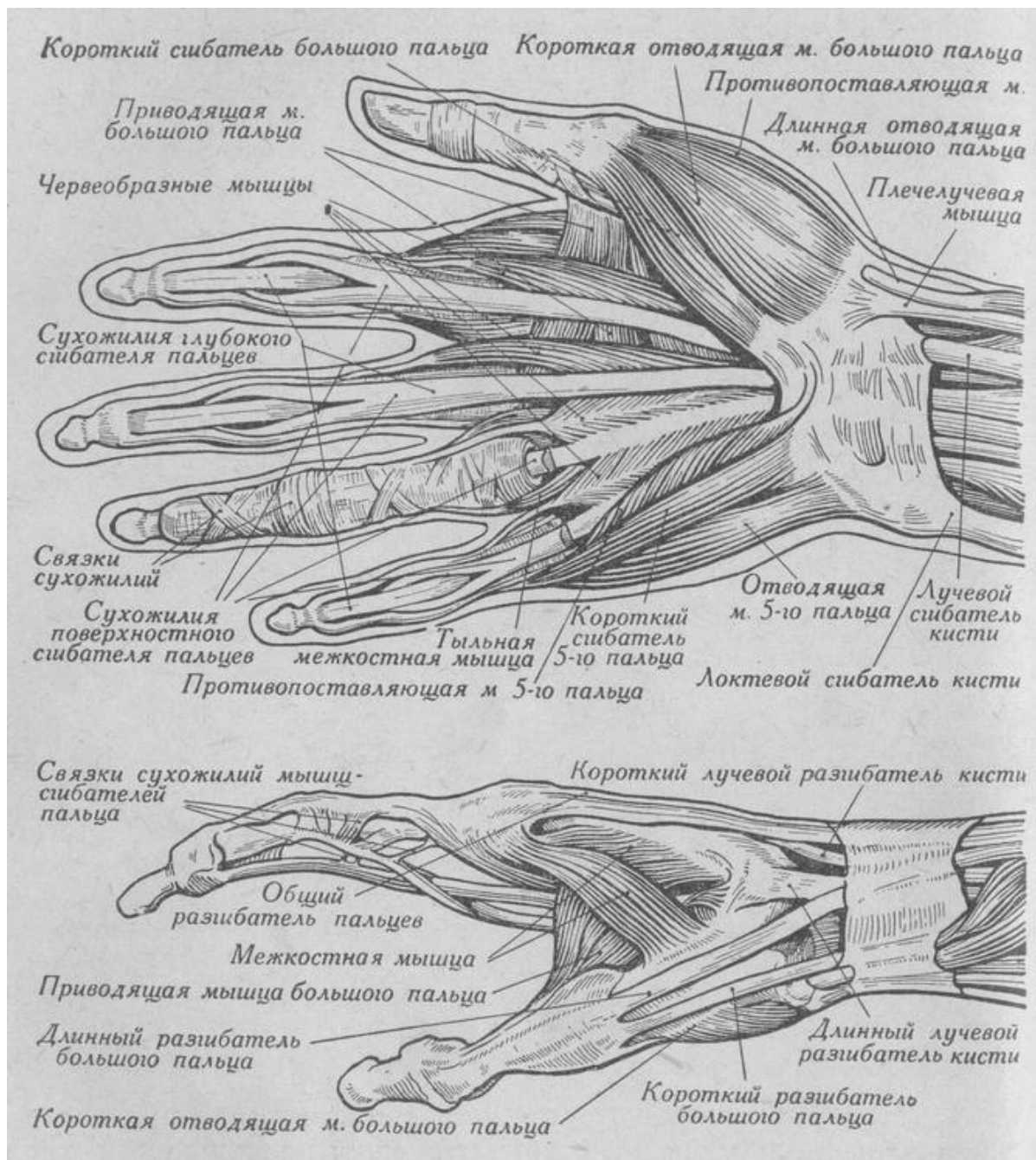


Fig. 104 - Muscles of the hand (palmar side)

Let us now consider some features of the location and passage of muscles in the hand that carry out finger movement.

The flexor muscles of the fingers are: the superficial flexor of the fingers, the deep flexor of the fingers and the long flexor of the thumb (Fig. 105). All of these muscles are multi-joint, originating from the humerus and forearm and passing by many joints of the hand and wrist.

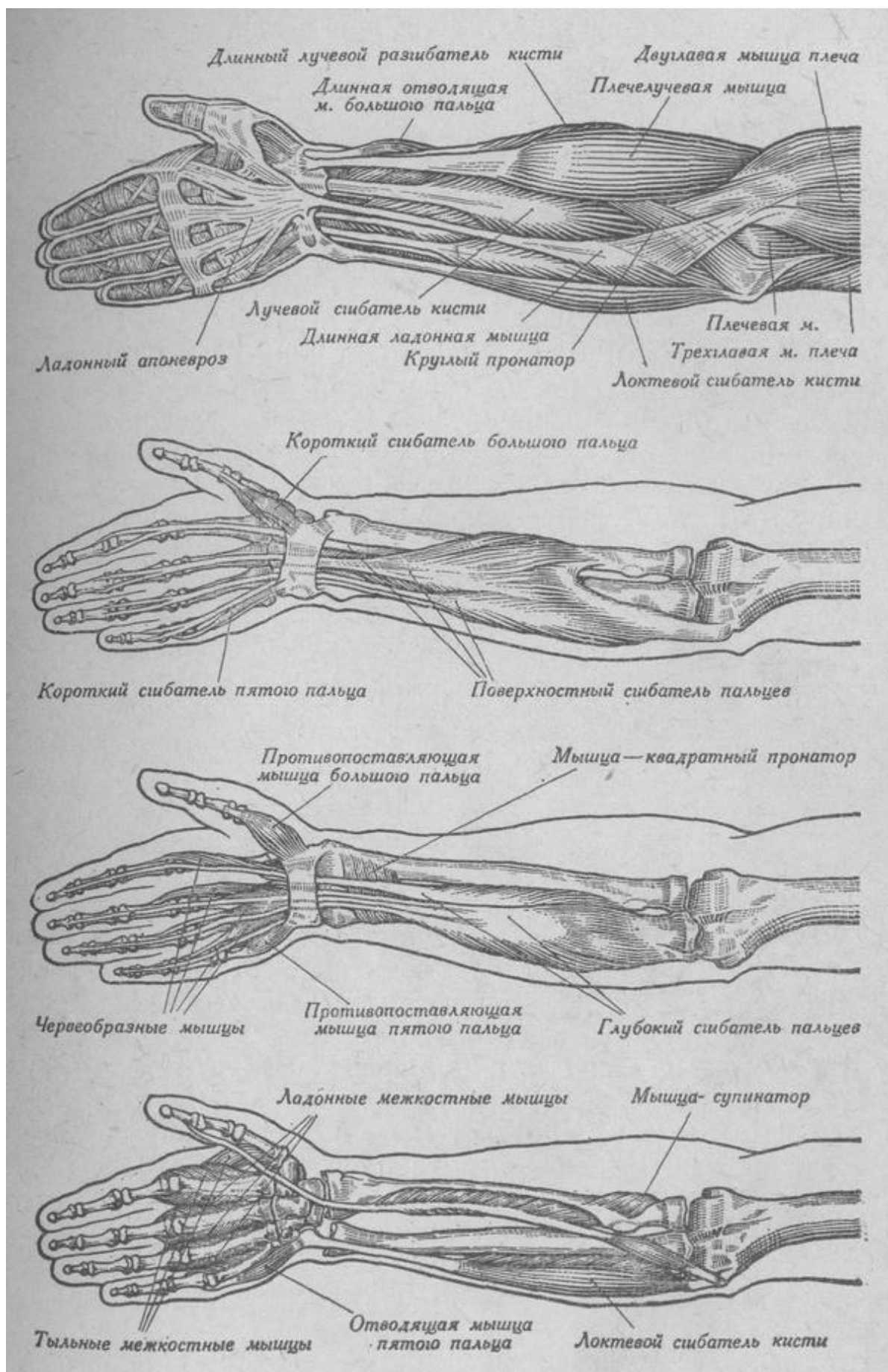


Fig. 105 - Forearm muscles; finger flexor muscles

The belly of each of these muscles is located on the forearm. Of greatest interest to the shooter are the muscles - the superficial and deep flexors of the fingers; we will dwell on some of their features below.

The superficial flexor digitorum muscle has four long, thin, and strong tendons that go to each of the four fingers (except the thumb). In fact, it consists of four separate muscles that have one common origin (see Fig. 105) and different attachment sites - the middle phalanges of each finger. The function of this muscle is to flex the middle phalanges of the fingers; at the same time, it causes movement in all the joints of the hand. Consequently, the movement of the fingers under the action of these muscles can cause some movement of the hand as a whole. When the arm is straightened at the elbow joint, that is, when the forearm is extended, the tone of this muscle increases, since it begins to work while stretched, which helps to better strengthen the joints of the hand with less muscular effort.

The muscle - the deep flexor of the fingers is similar in structure to the superficial flexor of the fingers - it also has a belly, but located closer to the surface of the ulna; four tendons also come from it. They pass through the splits of the tendons of the superficial flexor of the fingers and are attached to the nail phalanges of each of the four fingers (except the thumb). This muscle can also flex the hand in all its joints. The deep flexor of the fingers differs functionally from the superficial in that it can also flex the nail phalanges. However, in practice, a very limited circle of people can perform isolated flexion of the nail phalanx of the finger; for most people, it is much easier to flex the nail phalanx by fixing the second phalanx on some support. Usually, these two muscles work together to flex the fingers, involving both the nail and middle phalanges in the movement. Taking into account this feature of the work of the muscles - flexors of the fingers, pistol shooters, when fitting an orthopedic grip, should make such a groove for the index finger so that both the nail and middle phalanges do not touch the grip, otherwise, when pressing the trigger with the nail phalanx, the middle phalanx will press on the side of the grip and disrupt the aiming of the weapon.

Looking at Fig. 104 and 105, it is easy to notice that the tendons of the finger flexor muscles pass as a group through the carpal tunnel (Fig. 106), then fan-shaped on the hand towards the fingers. Such a fan-shaped arrangement of the tendons causes not only flexion, but also adduction, bringing the fingers closer together when the fingers are spread apart, "splayed". From this, the pistol shooter should draw a conclusion for himself: the adjustment of the orthopedic grip should be done so that the fingers are not spread too far apart when grasping the grip with the hand, since the bending of the index finger when pressing the trigger will be accompanied to a certain extent by the movement of the remaining fingers, caused by some bringing them together. For the same reason, when adjusting the grip, you should not allow the index finger to move too far away from the others, since at the same time as it bends when you press the trigger, it will be brought toward the middle and other fingers, which can also cause some movement of the entire hand at the most crucial moment of the shot.

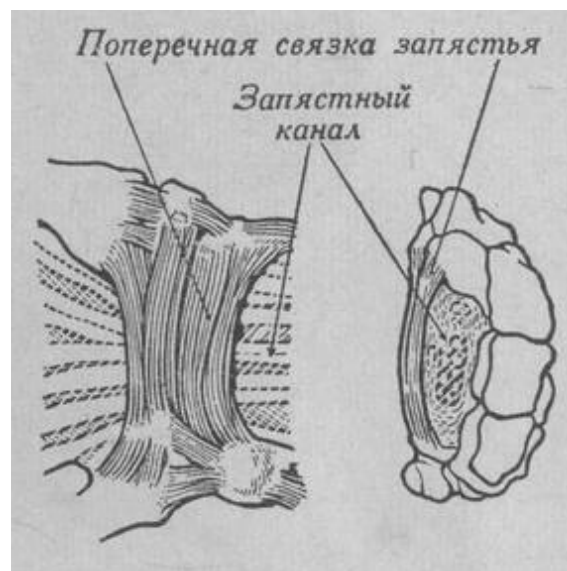


Fig. 106 - Schematic representation of the carpal tunnel

It has already been said above that the tendons of the finger flexor muscles pass through the carpal tunnel to the fingers. This feature of the hand structure should also not go unnoticed by the sportsman-shooter.

Although the best fixation of the wrist and intercarpal joints when holding the pistol can be achieved by tilting the hand significantly downwards, which maximally involves the ligaments of the wrist

joint in passive work, one should not abuse excessive tilting of the hand (Fig. 107), since this will cause some pinching of the flexor tendons of the fingers in the carpal tunnel. As a result, when the index finger moves, the other fingers will involuntarily be involved in the movement, as a result of which the stability of the weapon when pressing the trigger will be disrupted.

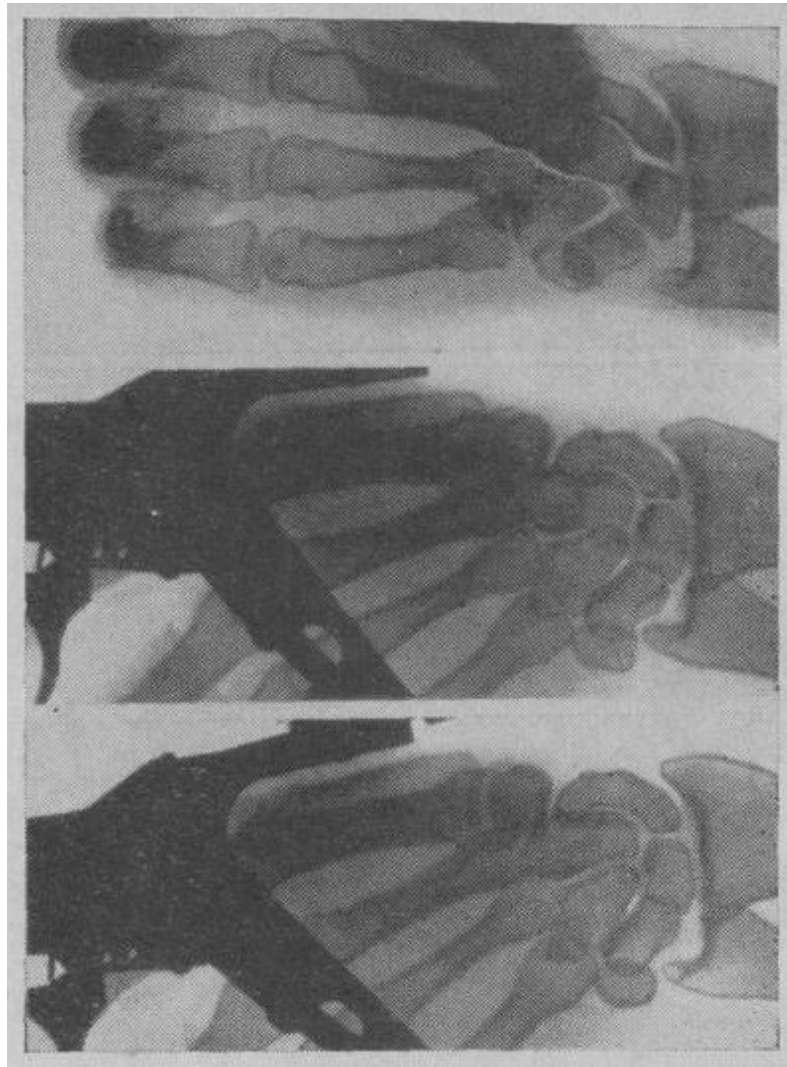


Fig. 107 - X-ray of the joints of the hand when ready to fire a pistol: *top* - hand without tilt; *middle* - tilt of the hand when ready; *bottom* - maximum downward tilt of the hand.

It is also not necessary to use a grip with an excessive downward tilt of the wrist because strong adduction (tilt) of the wrist itself is only possible with increased work of the muscle - the elbow flexor of the wrist (Fig. 108), which results in individual long breaks during shooting.

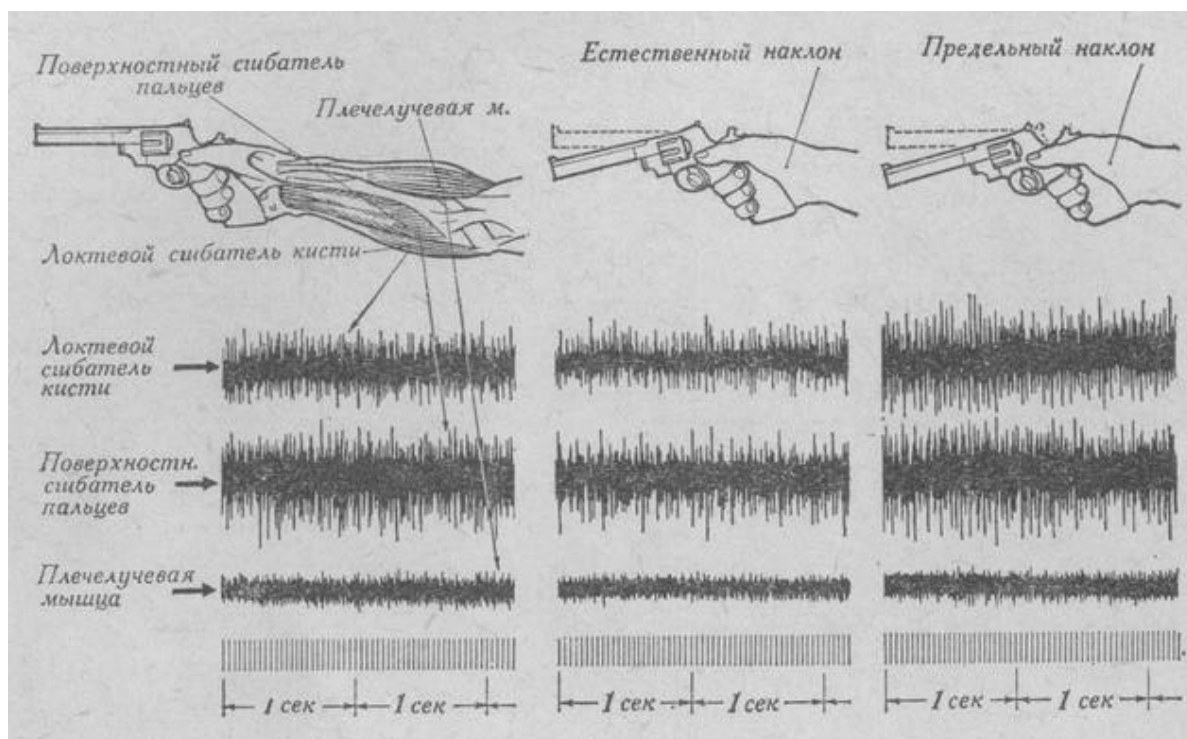


Fig. 108 - Electromyogram (recording of biocurrents) of the working muscles of the forearm during a grip with different downward tilt of the hand

The movement of the fingers is also carried out by the muscles of the hand itself (see Fig. 104), relatively powerful and short, located on the palmar surface; they set the thumb and little finger in motion. Since these muscle groups are not very loaded with the nature of the work that they do when holding a pistol in the hand, they should serve as those support points on the palm to which the grip and support cap can fit best and most safely for the quality of shooting. The most "dangerous" area of the palm when shooting from a pistol and revolver is the place where the tendons of the flexor muscles of the index finger pass (see Fig. 104, 105). The fit of any bump or bulge on the grip in this place can to some extent affect the stability of the weapon in the hand, leading to some displacement of it. Therefore, a sports shooter should carefully study the topography of his palm and take into account the features of its structure before choosing a grip and adjusting the pistol handle to his hand.

The muscle - the common extensor of the fingers (see Fig. 104) originates on the humerus; in the middle of the forearm it passes into a tendon, which diverges into separate tendons attached to

the back surface of the phalanges of the fingers (except for the thumb, which has its own extensor). The location and features of the work of the common extensor of the fingers are such that when the hand is bent, the fingers are simultaneously slightly straightened, which is due to an increase in the tone of the muscle - the common extensor of the fingers. This, in turn, requires more intense work of the muscles - the flexors of the fingers as a counter-action, since the handle of the pistol must be grasped tightly. Therefore, you should strive to use a grip in which the hand is in a normal position - not adducted or abducted to the side.

When the fingers are at rest, they are slightly bent (Fig. 109); this is due to the fact that the finger flexor muscles and their tone are generally stronger than the general finger extensor muscle. Some leading pistol shooters successfully use this feature when pulling the trigger. Using a very light trigger (sneller) with a tension of 15-30 g, they do not engage the muscles that bend the index finger to overcome its tension, but, on the contrary, completely relax them, which causes the finger to bend itself due to the increased tone of the finger flexor muscles, thereby overcoming the tension of the trigger.



Fig. 109 - Natural and tense position of the index finger

The upper limb as a whole, when the muscles are holding, is best secured in the joints when the body is tilted slightly to the left, the

right part of the shoulder girdle is slightly raised up and brought forward, the arm, extended at the elbow joint, is located somewhat to the left of the shoulder line. In this case, the most favorable conditions are created for the static work of the muscles: trapezius, large rhomboid, anterior serratus, deltoid, supraspinatus, infraspinatus and upper bundles of the large pectoral muscle. In addition, with this position of the hand, the ligamentous apparatus of the elbow and wrist joints operates most effectively.

So, we have become familiar with the human motor system in general terms; we also have some information about its statics. Taking this data into account, we will consider various types of shooting positions for a rifle and a revolver pistol.

3.1.3 Types of preparation for shooting from a rifle

Shooting position lying down

The shooting position in the prone position should ensure: firstly, good stability of the rifle with the least strain on the shooter's muscular system; secondly, the shooter's body remains in the same position for a long time during shooting; thirdly, a position of the head that will create the most favorable conditions for the eye to work during aiming.

The difficulty in choosing the correct position for yourself is that the requirements set out above, while being in a certain relationship, are at the same time in some contradiction with each other. Thus, with an increase in the angle of the body's rotation to the left, the conditions for breathing improve and the conditions for the aiming and work of the eye during aiming worsen; as the left hand is extended as far forward as possible, the position becomes lower and, naturally, more stable, and on the other hand, the conditions for aiming worsen; when lying slightly on the left side, the conditions for breathing improve, but at the same time the load on the left hand increases, which entails rapid fatigue of its muscles.

Based on this, the shooter must, strictly in accordance with the characteristics of his physique, find the most acceptable option for his position.

Practice has shown that it is best to turn the body in relation to the shooting plane at an angle of 12-20° (Fig. 110). With such a turn, its position will be comfortable, the chest is not very constrained, which is why breathing is relatively free; at the same time, quite favorable conditions for aiming and aiming will be created. In order to create even more favorable conditions for breathing, it is best to lie down not "flat" - on the stomach, but slightly on the left side.

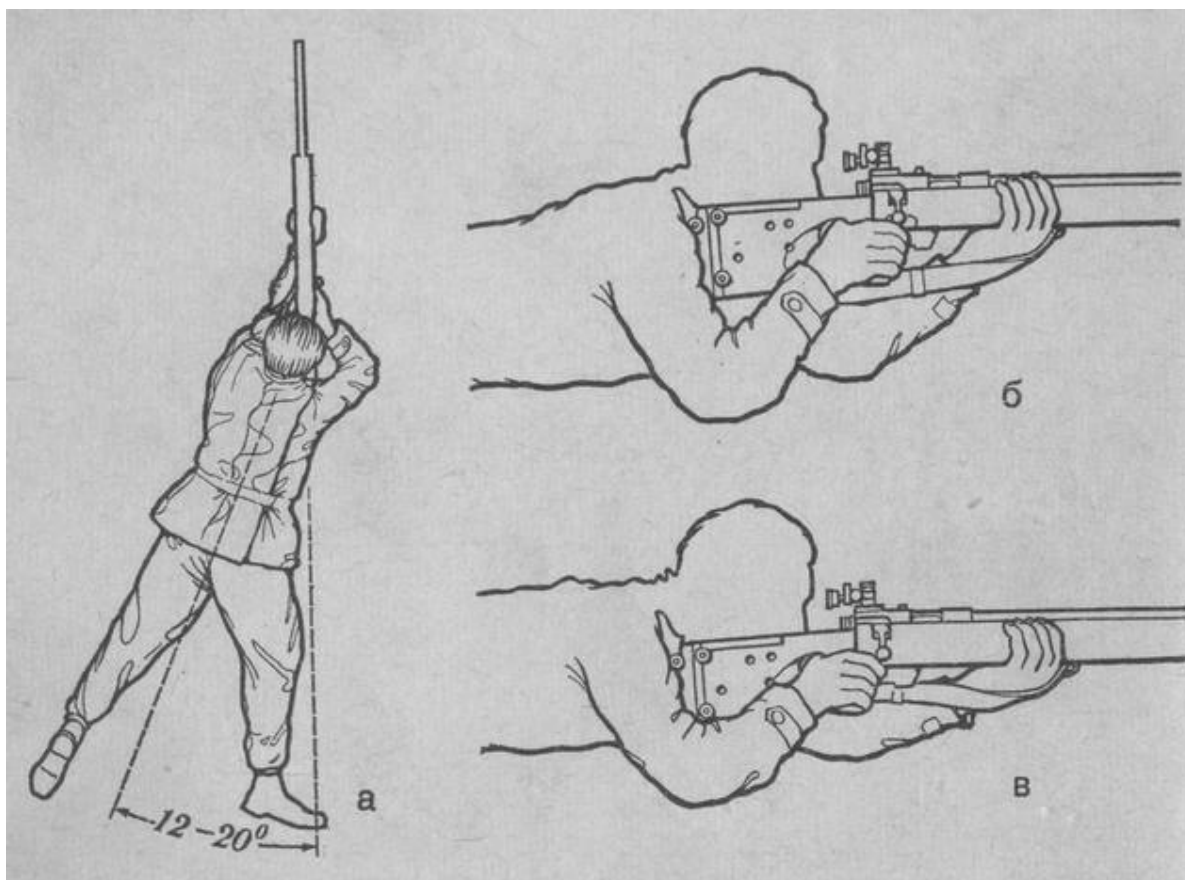


Fig. 110 - Position for shooting from the prone position (top and side views)

The legs should be spread out to the sides without tension. To make the muscles less tense, it is best to position the legs so that the left one rests its toe on the ground and the right one is slightly bent at the knee joint.

The left hand, which bears the entire weight of the rifle, should be bent at the elbow and extended forward, within the limits, of course, permitted by the competition rules (the distance between the back of the left hand and the level of the elbow is no less than 15 cm) (Fig. 110). With this position of the left hand, the position becomes the most stable, since the vibrations of the hand and body move the rifle relatively less.

The gun sling should firmly connect the left hand and the rifle into one whole, into a single rigid system. When used correctly, the sling forms a rigid triangle consisting of the forearm, shoulder and sling, which should act as an artificial rest for the rifle, freeing the muscles of the left hand from the need to hold the rifle in the air.

Naturally, the degree of tension of the sling, which provides a certain rigidity of the triangle, i.e. the strength of the rest, is of great importance; therefore, when preparing to shoot, you need to carefully adjust the sling - tighten or loosen it. If the sling is weakly tensioned, then the system consisting of the hand and the rifle will not be strong enough, and therefore stable; if the sling is too tight, then blood circulation in the hand is disrupted, which usually causes rhythmic oscillation of the rifle (pulsation), and also quickly causes pain in the hand.

During shooting, you must carefully ensure that the belt does not slip off your hand and that its tension does not change. In order to prevent the belt from slipping onto the jacket sleeve, according to the rules of the competition, it is allowed to attach a special hook. It is desirable that the shooter remembers the length of the adjusted belt (the place where the sling swivel is attached to the fore-end) and constantly maintains it.

The left hand should freely and effortlessly grasp the fore-end of the rifle stock. The wrist should not be bent too much. The rifle should not rest on the fingers, but on the palm, closer to the thumb. The elbow of the left hand should be approximately under the rifle, slightly to the left of the shooting plane (Fig. 111).

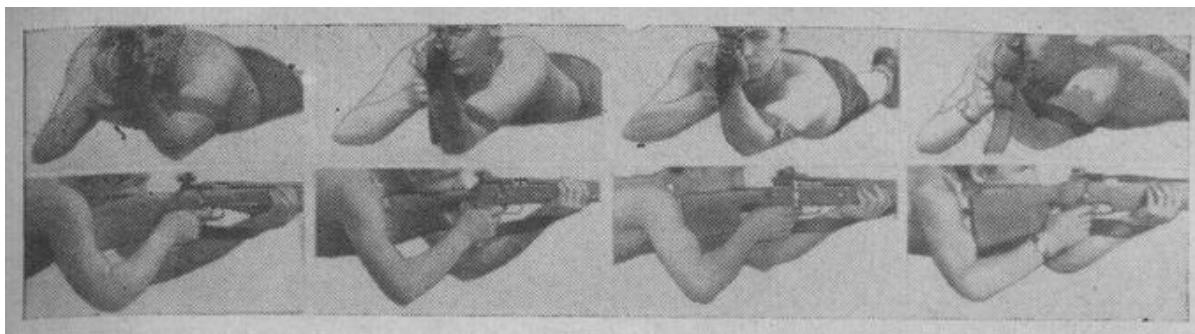


Fig. 111 - Hand position when ready to shoot prone

The butt of the rifle must be pressed firmly and uniformly against the right side of the chest (when shooting, the shooter presses the butt of the rifle against the right side of the chest. However, in the future, the author will use the generally accepted expression "press the butt against the shoulder") in the area of the large pectoral and deltoid muscles. When preparing and firing a shot, the muscle

group of the shoulder and the right side of the chest must be relaxed.

When preparing to shoot, the head should be held as straight as possible in order to look at the target directly in front of you, thereby creating the most favorable conditions for the eye to work when aiming. It is also necessary to avoid tilting the head to the right or tilting it too much downwards in order to avoid squinting or looking at the sights and the target from under the brow. Creating conditions for uniform aiming also requires that the position of the head be sufficiently fixed and uniform. To do this, you need to press your cheek (but without much effort) against the comb of the butt. You should not stretch your head forward closer to the sight; you should also not tilt your head back excessively; excessive tension in the neck muscles and, as a result, some shaking of the head make aiming difficult.

The right hand grasps the pistol grip of the stock with a slight effort. The index finger should not participate in the grasp; there should be a gap between it and the stock, which is necessary to be able to press the trigger freely without touching the grip (which will be discussed in more detail below).

The elbow of the right hand should not be brought close to the body or pulled away from you with tension. Having grasped the handle of the stock with the hand, the elbow should be lowered to the ground with a free, natural movement. At the same time, there should be no additional muscle tension in the right hand, as well as difficulty in moving the index finger when pressing the trigger.

To shoot accurately, it is not enough to just take a comfortable and stable position; before shooting, you need to check the correctness of the position in relation to the target in order to avoid excessive muscle tension, which will negatively affect the magnitude and nature of the rifle's oscillations. In order to correctly orient the "shooter's body - rifle" system, you need to get ready, close your eyes, hold your breath and point the rifle in the direction of the target. If, upon opening your eyes, the shooter finds that the "level" front sight is located away from the target, he should, without lifting his left elbow from the ground, slightly rise and change the angle of the body so that the "level" front sight is in close proximity to the

aiming point. In this case, the aiming should be corrected not by moving your hand, but by turning your body to the right or left.

If the "level" front sight is above or below the aiming point, the shooter should either move the butt hook up or down without moving the elbows, or move the body slightly forward or backward. The body position relative to the target will be correct if the "level" front sight moves vertically along the target when breathing.

These are the general requirements for a typical shooting position in the prone position. Let us now consider the shooting position in the prone position, used by the best of their time and by the current leading shooters (Figs. 112-117). Looking through the material, covering a period of almost a quarter of a century, we can draw certain conclusions about the changes in this type of position. One of the main ones is the conclusion that the position cannot be considered as some kind of constant standard pose. Gradually improving, it is modified in accordance with the views on its rational form at a particular stage and level of shooting technique development. The fact that the position does not remain unchanged, but undergoes serious changes as the skill of each athlete working on himself develops, with the onset of athletic maturity, is evident from the photographs shown in Fig. 112, and, to. Therefore, in order to avoid making mistakes in the search for something new, sometimes it is necessary, for the benefit of the matter, to look back, critically examine and follow the changes that occur in the shooting position.



Fig. 112 - Top view of the prone shooting position of the leading athletes of the period 1946-1961:

a - N. Bogdanov; б - V. Iodko; в - E. Marivyal; г - P. Avilov; д - B. Pereberin; е - V. Kryshnevsky; ж - V. Borisov; з - A. Bogdanov; и - S. Evdokimov; к - V. Lukyanchuk; л - M. Itkis;

m - I. Novozhilov; *n* - Sh. Kveliashvili; *o* - G. Krylov; *p* - T. Lomova; *r* - E. Donskaya; *s* - E. Zakharchenko; *t* - Z. Zelenkova.

Fig. 112, a shows the position of N. Bogdanov, formerly one of the leading sports shooters in our country. His position (called **the usual sports position**) can be considered a classic of the period 1936-1950. It is characterized by a large angle of rotation of the body, significant spreading of the legs to the sides and pressing the heels to the ground. The positive side of this position is that the weight of the body is relatively evenly distributed on both elbows, due to which the left arm is not very overloaded and therefore does not tire so quickly. However, in this position breathing is difficult, since the shooter lies with all the weight of the body on the stomach and partly on the chest, which is why each breathing cycle has to be done with effort, which inevitably leads to shallow, superficial breathing. The disadvantages of the usual sports position also include an unsuccessful, forced position of the legs, since straightening them and pressing the heels to the ground requires significant muscle tension in both legs. As a result of many years of training, N. Bogdanov achieved good stance, thanks to which, despite the unnatural position of the body (mainly the legs), he could still conduct prolonged shooting without experiencing any obvious discomfort.

However, over time, due to its inherent shortcomings, the usual sports position, so widespread in the recent past, has been almost completely replaced by more advantageous versions.

Let us now consider the position of the body of the sportsman-shooter E. Meriväli (Fig. 112, c), who used a completely different type of stance in those years. His stance can also be considered classical, but of a different type, the so-called **Estonian stance** . This type of stance became widespread in the West in the 1930s. It was first used by the famous Estonian shooter Rull. In the Estonian stance, the legs are freely spread out to the sides, with the left leg resting with its toe on the ground, and the right leg strongly bent at the knee joint and lying flat. The positive side of this stance is that the chest is not very constrained, which makes the shooter's breathing freer and deeper. This stance is also advantageous for high-speed shooting, since the athlete, using the knee of the right leg as a support, has the opportunity to act more freely and quickly

with the right hand when reloading the rifle. The disadvantage of the Estonian position is the need to lie on the left side, which puts a lot of strain on the left arm, which is already under a lot of strain under the weight of the rifle. True, as a result of many years of training, E. Meriväli and other shooters with well-developed arm muscles managed to achieve stability of the weapon during such long shooting sessions as "standards" with this position, but achieving this required an unreasonably large expenditure of time on training and practice. Due to these shortcomings, the Estonian position in its pure form is also very rarely used today.

Taking into account all the pros and cons of the sport and Estonian stances, in the period 1952-1957, some intermediate variant between them was considered the best type of stance. The most successful at that time was the stance used by A. Bogdanov (Fig. 112, z), M. Itkis (Fig. 112, l), V. Kryshnevsky (Fig. 112, e), in its external form somewhat resembling the previously described sport stance, but significantly differing from it in its internal content. These stance variants were characterized by a smaller angle of rotation of the torso, a relaxed position of the left leg, resting the toe on the ground, and a slight bend of the right leg at the knee joint; the shooter's torso lay slightly on its left side, which ensured relatively free breathing. All this taken together created more favorable conditions for the shooter's body to remain in the same position for a long time, without causing great muscle tension and thus general premature fatigue.

The stance of the leading shooters of the period 1958-1961 was characterized by a significantly smaller angle of torso rotation compared to previous variants, and, consequently, improved conditions for the eye during aiming; a more favorable position of the legs in relation to the minimum load on the muscular apparatus; less tilt of the torso to the left side and, as a result, less overload of the left arm. In general, the stance of leading shooters in its fundamental scheme became more uniform, differing only in details reflecting the individual characteristics of a particular shooter.

The position of the group of leading shooters from the period 1969-1972 (Fig. 113) is characterized by an even smaller angle of rotation of the body relative to the plane of shooting and a relaxed position of the legs.

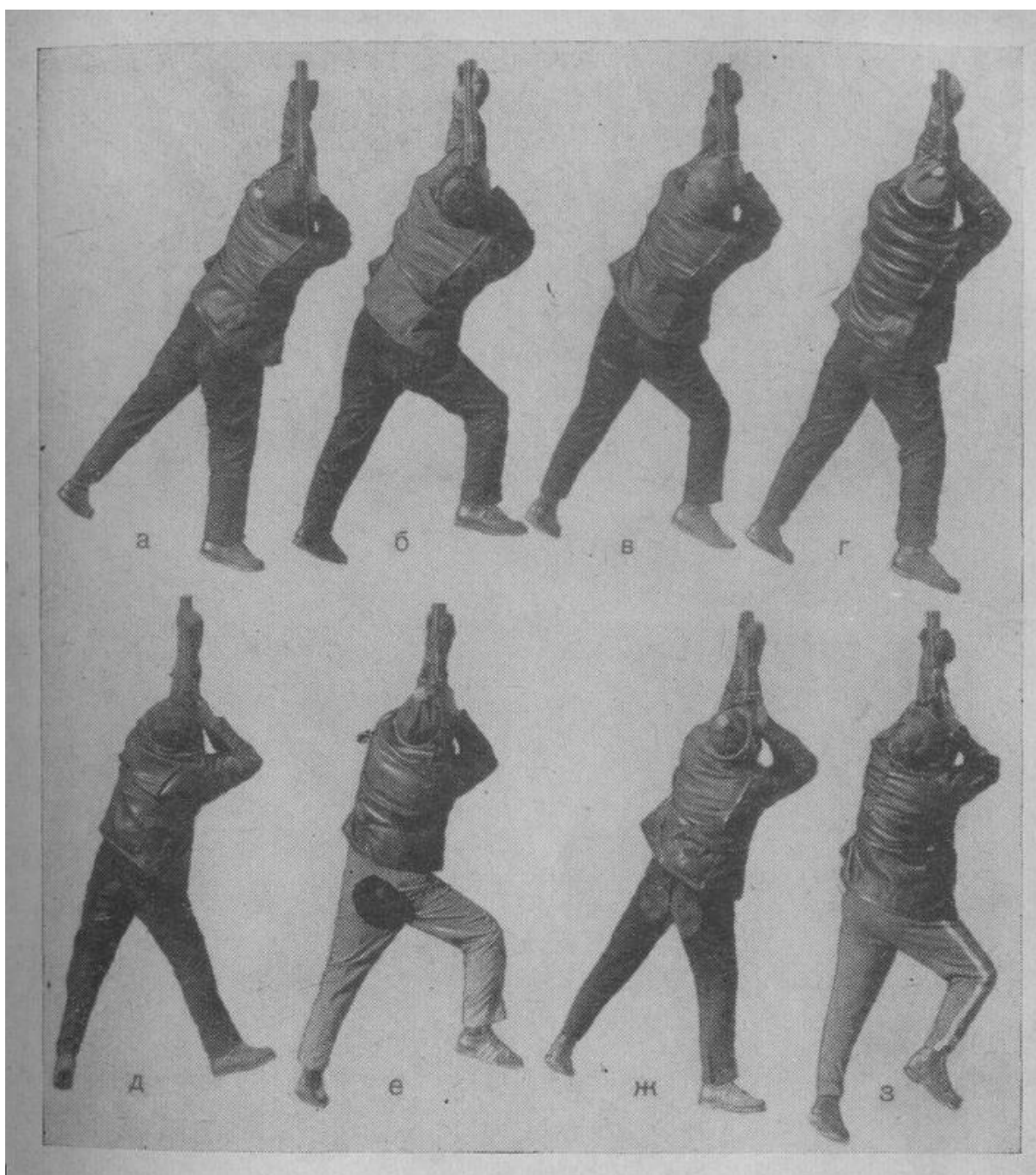


Fig. 113 - Top view of the leading athletes of 1972 in the prone shooting position:

a - V. Parkhimovich; *b* - V. Raskovalov; *c* - N. Raschetnov; *g* - V. Agishev; *d* - G. Lushchikov ; *e* - V. Kornev; *g* - V. Yezhov; *h* - O. Lapkin.

As can be seen from the above material, even in such a well-developed, seemingly perfected type of position as for shooting prone, significant changes occur. After all, the indicator - the angle of rotation of the body is very important; together with a change in the angle of rotation, the aiming and positioning of the head im-

prove, which creates more favorable conditions for the work of the eye during aiming, etc.

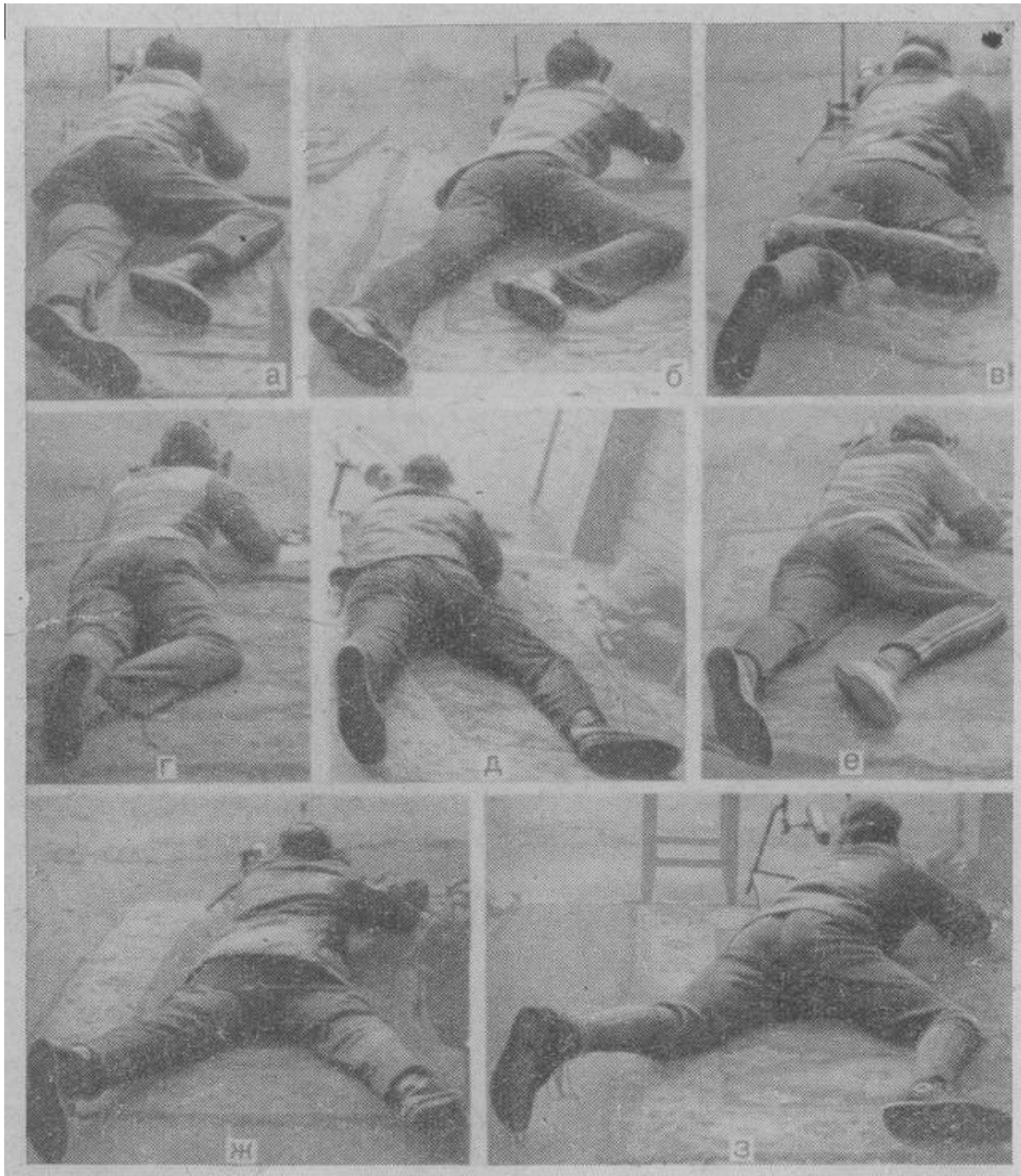


Fig. 114 - Prone shooting position of leading foreign shooters in 1972:

a - D. Wiger (USA); *b* - D. Reiter (USA); *c* - E. Vogd (Switzerland); *d* - D. Bashem (USA);
d - B. Hartstein (FRG); *e* - W. Bird (USA); *g* - P. Gorevsky (GDR); *h* - G. Kusterman (FRG).

Looking at Fig. 115, 116, 117, we see that the shooting position in the prone position, depending on the position of the left hand on the rifle fore-end, can be divided into two main groups: low and high.

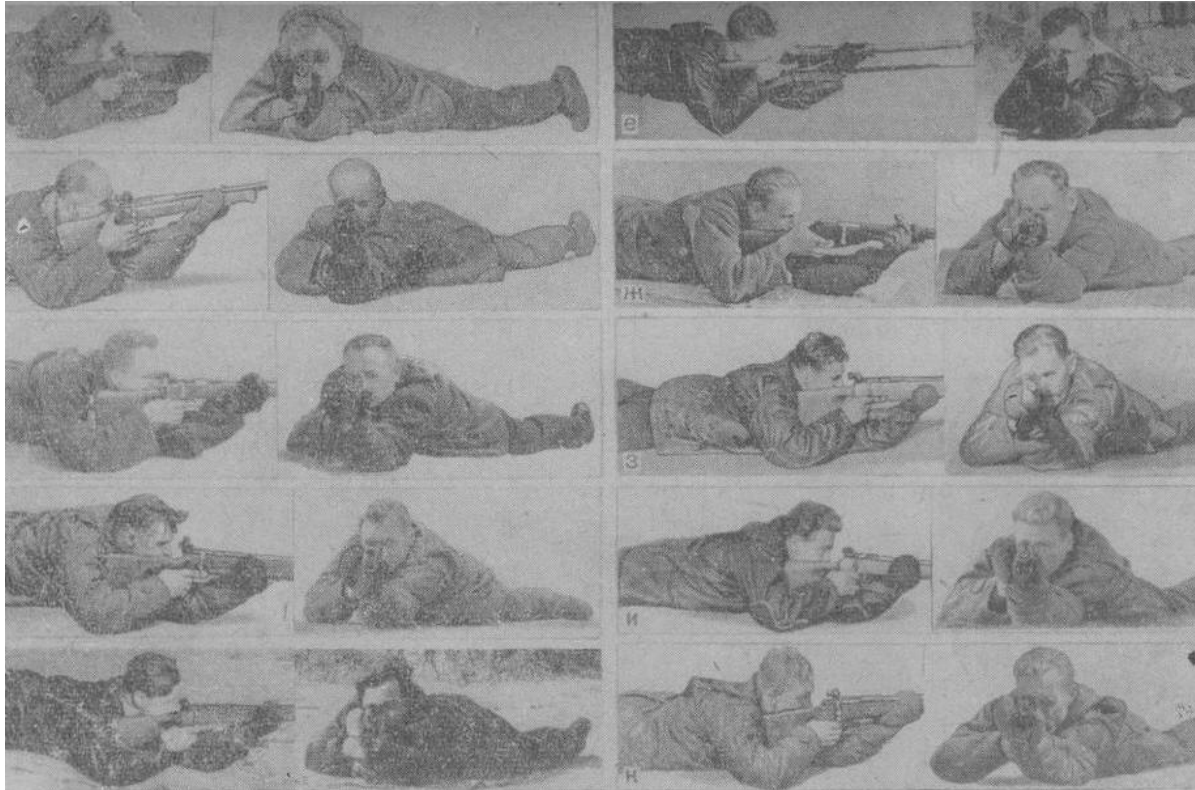


Fig. 115 - Shooting position prone (side and front views) of leading athletes of 1950-1961:

a - Z. Zelenkova; *b* - E. Merivyali; *c* - V. Kryshnevsky; *g* - B. Pereberin; *d* - V. Iodko; *e* - G. Kupko; *g* - I. Novozhilov; *h* - V. Borisov; *i* - A. Erdman; *k* - A. Bogdanov.

In the low position (Fig. 116, d, e; Fig. 117, a, b, c, d, i), the shooter extends his left arm (hand) far forward, as far as permitted by the competition rules (see Fig. 110). The positive side of the low position is its higher degree of stability. The disadvantage is the greater load on the left hand; in addition, the shooter has to look from under his brows while aiming, which puts the work of the eye at a disadvantage. The most successful variants of the low position (in terms of head positioning) are the position of A. Erdman (Fig. 115, i), G. Luschikov (Fig. 116, d), D. Reiter, V. Rülle (Fig. 117, c, i).



Fig. 116 - Shooting position prone (side and front views) of leading athletes of 1972:

a - N. Pestanov; *b* - V. Kornev; *c* - O. Lapkin; *g* - G. Lushchikov; *d* - A. Gerasimenko; *e* - V. Raskovalov; *g* - V. Agishev; *h* - N. Raschetnov; *i* - V. Yezhov; *k* - V. Parkhimovich.

In the high position (Fig. 115, *b*, *c*; 117, *d*, *e*, *h*), the shoulder and forearm form a more acute angle. The positive aspects of this position include the load on the left arm not being as great as in the first case. However, the stability of the high position is somewhat worse. Successful options are the positions of V. Kryshnevsky (Fig. 115, *c*), E. Burgen, P. Sandor (Fig. 117, *g*, *d*).



Fig. 117 - Prone shooting position of leading foreign shooters in 1972:

a - D. Wiger (USA); *b* - D. Basham (USA); *c* - D. Foster (USA); *d* - D. Reiter (USA); *d* - P. Sandor (Romania); *e* - R. Poer (Czechoslovakia); *g* - E. Bürgen (Switzerland); *h* - Klinger (FRG); *i* - W. Rülle (FRG);
k - G. Kustermann (FRG); *l* - E. Vogt (Switzerland).

If we compare the stance options of leading athletes in relation to the position of their left hand when shooting prone (see Fig. 115, 116, 117), we can draw the following conclusions.

In the period 1950-1961, leading athletes used a variety of stances, with some predominance of the high stance. In many

cases, the head position was not very successful - tilted downwards or to the left (Fig. 115, c, d, f, j).

The stance of our leading athletes of 1972 (Fig. 116) is more uniform, and the high stance is not used at all. The most widespread, along with the low stance, are intermediate variants - between the high and low stance. This stance is used by V. Parkhimovich, V. Kornev, O. Lapkin, N. Raschetnov (Fig. 116, k, b, c, z). At the same time, despite the fact that their stance is basically low, their head position is very successful - they aim almost straight ahead.

The stance of leading foreign athletes in 1972 (Fig. 117) is distinguished by a great variety of variants used. Observations of a wider range of foreign athletes who competed in international competitions in Moscow in 1972 allow us to say, for example, that American shooters, as a rule, use a very low stance. At the same time, many foreign athletes still use a high stance, and some of them quite successfully.

Considering the positive and negative aspects of low and high stances, with different leg placements and body rotation angles relative to the target, one thing can be said - all of them are good to one degree or another if they are taken by shooters not by chance, but taking into account the characteristics of their physique, they provide reliable stability of the weapon and less fatigue for the athlete throughout the entire duration of the exercise.

To sum up everything that has been said, the following can be stated. When preparing to shoot prone, the angle of rotation of the body relative to the plane of shooting should be small, within 12-20°; the left leg should be straightened, resting the toe on the ground, and the right leg should be arbitrarily bent; you should lie down with a slight tilt to the left side, but so that there is no excessive overload of the left arm; the position should be low, if possible, for which the left hand should be extended further forward; the back of the butt should be rested closer to the neck; the position of the head should be such that, as far as possible, you look at the target straight ahead.

These are the considerations that young shooters should be guided by when searching for the most rational position for them-

selves.

Kneeling shooting position

In order to find a rational position for shooting from a kneeling position (Fig. 118), it is necessary to: distribute the weight of your body on the support points so that the left leg, which serves as a support for the left hand with the rifle, bears the least weight load; despite the unnatural position, achieve the fixation of the moving parts of your body with the least tension of the muscular system, especially ensuring that there is no overload of individual muscle groups, which will inevitably lead to an increase in the amplitude of the rifle's oscillations and a violation of the stability of the nature of these oscillations; find a position that ensures such a positioning of the head, which will create the most favorable conditions for the work of the eye during aiming. Based on these requirements, the shooter must look for the most acceptable position for himself, strictly in accordance with the features of his physique.

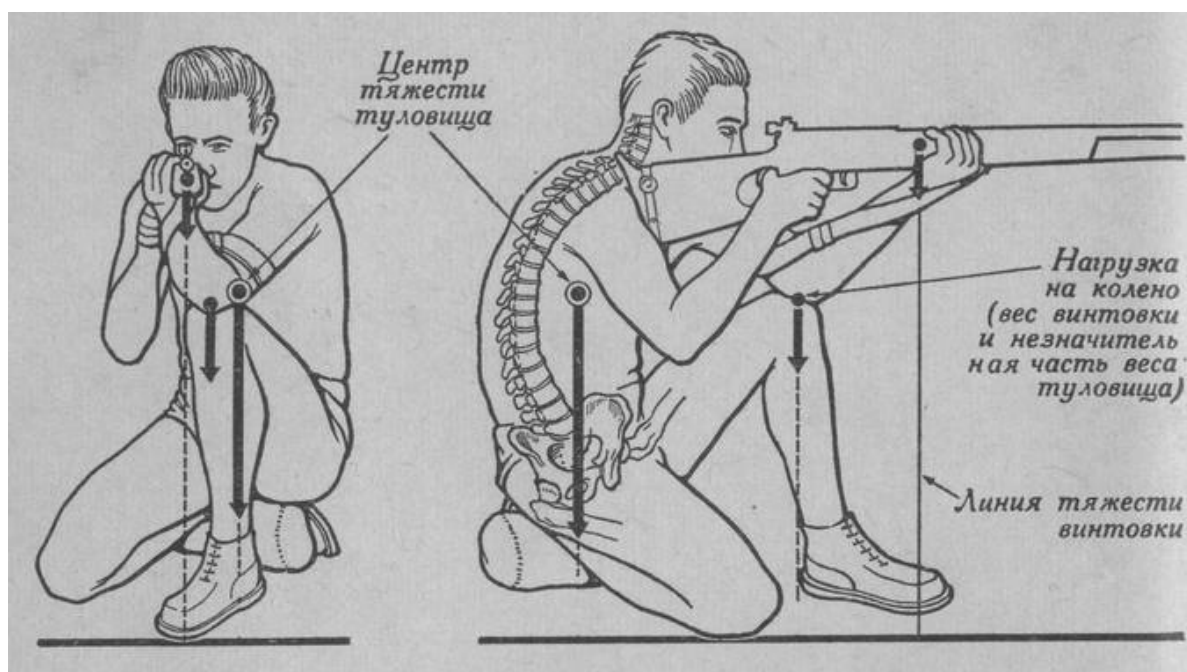


Fig. 118 - Typical position for shooting from a kneeling position

The stability of the stance depends first of all on the correct mutual arrangement of the supporting surfaces of the body - the foot of the left leg, the knee and the toe of the right leg, which limit the area of

support of the body. Practice in recent years has proven that the most convenient and at the same time sufficiently stable stance is one in which the supporting surfaces of the body create a support area in the form of a triangle formed and limited by such an arrangement of the legs, in which the right leg makes an angle of 55-65 ° with the shooting plane; the left leg should be extended forward within half a step and bent at the knee joint so that the shin is approximately in a vertical position; the foot of the left leg should be placed to the shooting plane at an angle of 35-55 ° (Fig. 119): with such a turn of the foot to the right, the ankle joint is better secured, which also contributes to better securing of the left leg as a whole.

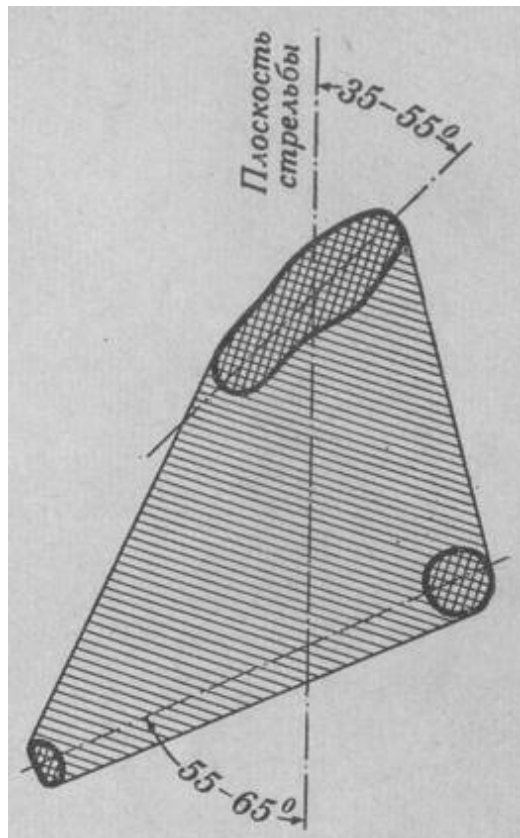


Fig. 119 - The relative position of the body's supporting surfaces, limiting the support area when prepared for shooting from the kneeling position

Of particular importance in the kneeling shooting position is the location of the overall center of gravity of the system <shooter's body - weapon> over the support area, or practically (what the shooter encounters) - the distribution of the system's weight on the support surfaces of his body. It would seem that, according to the general

laws of mechanics, the most stable position should be the one in which the overall center of gravity of the system is located above the center of the body's support area, that is, when the shooter distributes his weight with the rifle more or less evenly on each of the three support surfaces. However, as shooting practice shows, it is possible to achieve a stable position that ensures the least vibrations of the rifle only if the weight load falls unevenly on each of the three support surfaces of the body, and to the greatest extent on the heel of the right foot (in reality, on the bolster-bag, which is discussed below). In this case, the conditions of the system's equilibrium will still be met, since the overall center of gravity will not go beyond the body's support area, but at the same time, the left leg will bear a relatively small weight load, its muscles will not be overly tense, which will create the most favorable conditions when using the left knee as a reliable and relatively motionless support for the left hand with a rifle.

Due to the large weight load on the shin and foot of the right leg, for convenience and the ability to conduct prolonged shooting, the competition rules allow placing a support under the ankle joint of the right leg, which is a small bolster-bag with sawdust, cotton wool, tow, etc. This support should take the greatest possible weight load on the right leg, and thereby free the muscles of the foot and shin from work.

The bag should not be too hard and tightly packed, so that the shooter can give it a shape that would ensure the creation of a comfortable and good support for the leg with a large contact area (Fig. 120); the correct use of the bag significantly contributes to protecting the leg from impaired blood circulation and the premature occurrence of pain during prolonged shooting.

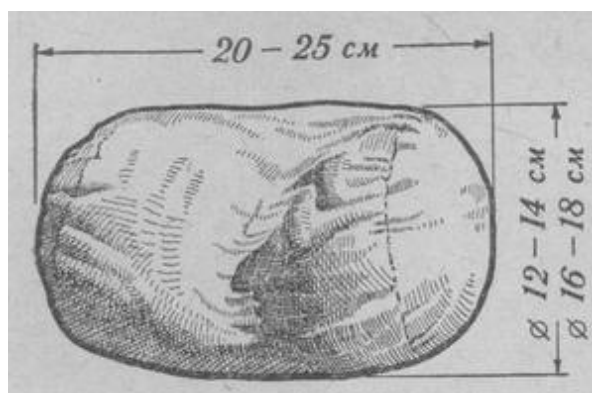


Fig. 120 - Roller-bag

The left hand, which bears the weight of the rifle, as in the prone position, should be bent at the elbow and extended forward; the shoulder and forearm should form an angle of 90-110° (Fig. 121). The left hand should not be extended excessively forward, since such a position of the hand will entail a significant downward tilt of the head and, as a consequence, aiming from under the brow, which quickly tires the eyesight.

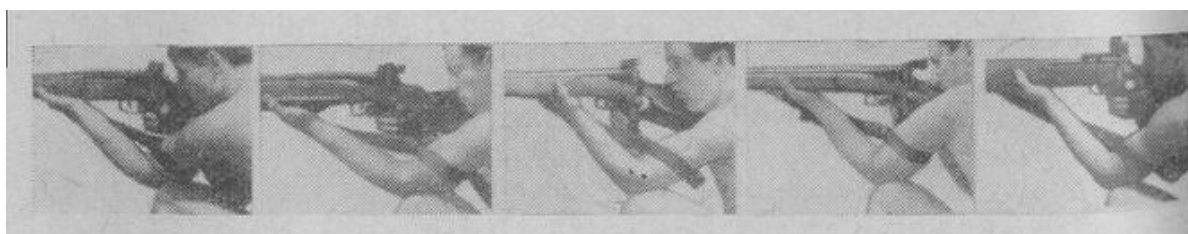


Fig. 121 - Position of the left hand when ready to shoot from the knee

The gun sling should be used in the same way as when shooting prone; it should firmly connect the left hand and the rifle into a single rigid system to ensure the greatest possible rifle stability. The tension of the sling, as when shooting prone, is of great importance. It is especially important to ensure that the sling is not too tight; an overtightened sling, disrupting blood circulation in the hand, significantly increases pulsation, which sharply disrupts the stability of the rifle and increases the dispersion of bullets. Many shooters change the length of the sling when switching from prone to kneeling shooting, most often shortening it. Some athletes move the sling swivel 3-7 cm closer to the trigger guard (when shooting from a random rifle) before adjusting the length of the sling. This movement of the sling swivel provides better fixation of the left hand on the rifle fore-end.

The left hand should grasp the rifle fore-end without force; the rifle should rest on the palm of the hand, not on the fingers.

The elbow of the left hand should be approximately under the rifle or slightly to the left of the shooting plane (Fig. 122). The left hand should not be turned toward the chest so that the elbow is to the right of the shooting plane, as some shooters do, based on the erroneous reasoning that with such a position of the elbow the area of its contact with the knee is larger, and therefore the stability of the hand with the rifle is supposedly increased. When the left hand is turned, the muscles that strengthen the shoulder joint and shoulder blade are strongly strained, which causes a slight tremor of the rifle, alternating with unexpected sharp deviations, in which the dispersion of bullets increases, especially horizontally, and distant breakaways of individual bullets appear to the side.

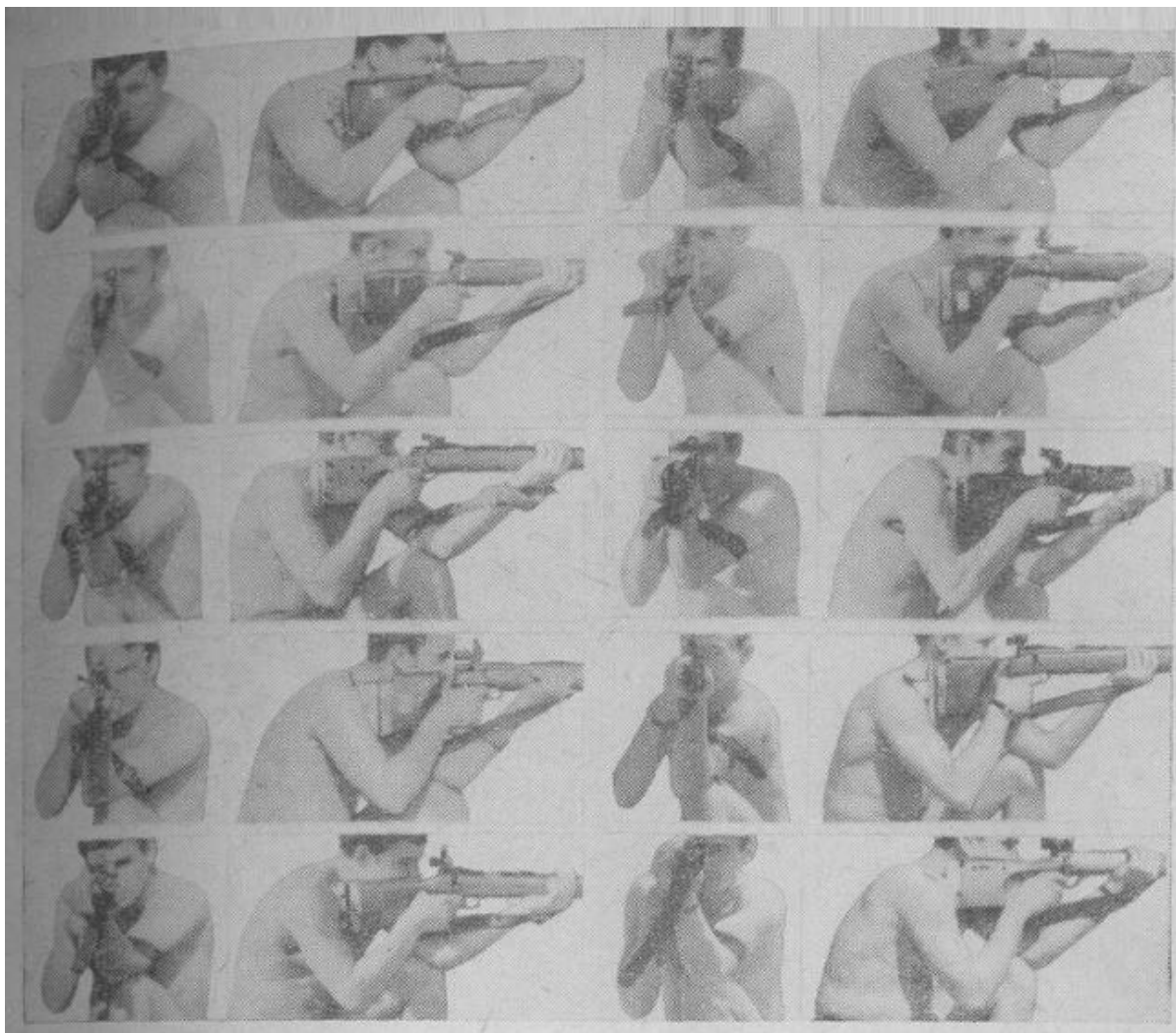


Fig. 122 - Mutual arrangement of hands of leading athletes when

ready to shoot from the kneeling position

The support for the left elbow should be the upper middle (or right) part of the left kneecap (see Fig. 122). The degree of stability of the left hand with a rifle depends to a large extent on whether the shooter can successfully select the appropriate place to support the elbow on the kneecap.

When supporting the left hand with a rifle, it is necessary to strive to ensure that the weight load falling on the left knee acts along the shin, but not anywhere to the side and thus does not have an overall tipping effect on the left leg.

The butt of the rifle should be pressed against the right side of the chest without much effort; the muscles of the shoulder girdle should not be strained or the shoulder should be moved forward; shooting accuracy depends to a large extent on the shooter's ability to relax this entire group of muscles.

The torso should be positioned so that it is oriented relative to the target not with the left side, but, as far as possible, with the chest forward. Incidentally, the torso turns with the chest forward as the legs come closer, that is, when choosing a place of support for the right knee closer to the foot of the left leg. With this position of the torso, the tension of the muscles of the right part of the shoulder girdle decreases. In addition, with the torso positioned with the chest forward, the position of the head becomes incomparably better. Do not overuse the forward bend of the torso. When preparing, you need to stoop slightly and bend the torso in the back (Fig. 123); in this case, the weight of the torso will be largely perceived by the spinal column, due to which the load on the left leg will decrease. In addition, when bending the torso, you can achieve such an optimal tension of the back muscles, at which it is easy to control their work.

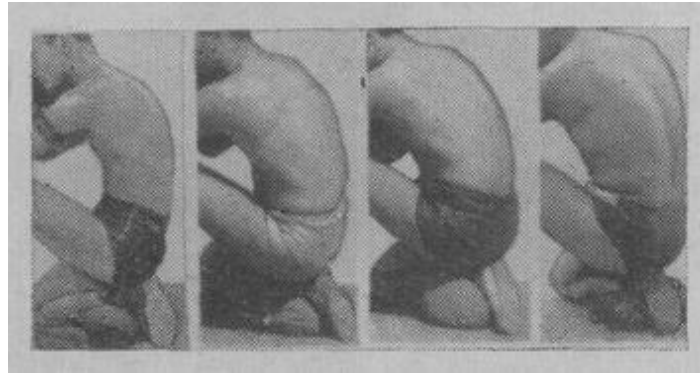


Fig. 123 - Back bending, which helps transfer the weight of the body to the spinal column

The position of the head should be as natural as possible - its tilt should be as small as possible, so that during aiming you do not have to squint and look from under your brows, which entails, as already mentioned, rapid fatigue of the eyes.

You should also avoid stretching your head forward or throwing it back: tension in the neck muscles will lead to instability of the position.

The right hand should not play any special role in holding the rifle. Therefore, its muscles should be relaxed as much as possible, so that their tension is not transmitted in the form of trembling and jolts to the rifle and does not increase its vibrations.

The right hand should grasp the buttstock neck in the same way as when positioned prone, i.e. with a little effort. When grasping the buttstock grip (neck), the index finger should not touch it; there should be a gap between them so that the finger movement is not hindered when pressing the trigger.

The elbow of the right hand, after grasping the neck of the butt with the hand, should be lowered freely downwards and held at an angle of 10-25° in relation to the body; the elbow should neither be raised nor pressed towards oneself; in both cases, excessive tension in the muscles of the shoulder girdle will arise, which will also lead to increased oscillation of the rifle.

The correctness of the adopted position in relation to the target is verified by the same principle as when positioned prone. If, when preparing to shoot, the athlete discovers that the rifle barrel is di-

rected somewhere away from the target, to the right or left of it, he must change the angle of the body so that the "level front sight" when put to the butt is in close proximity to the aiming point. To do this, the shooter must slightly rise and simultaneously shift all three points of support by a certain angle: the toe and knee of the right leg, the foot of the left leg. If the "level front sight" is higher or lower than the aiming point, the shooter must, without changing the position of the right leg, slightly move the foot of the left leg forward or backward, or slightly move the wrist of the left hand on the fore-end of the rifle (when shooting from service and sport rifles), or lower or raise the back of the butt with the hook (when shooting from a free rifle).

These are the general requirements for a kneeling shooting position for a shooter with a proportional build.

In the position that the shooter takes when preparing to shoot from the kneeling position, the ratio of the length of the body, arms and legs takes on a much greater significance than in any other type of position.

Therefore, let us now consider the issue of choosing a position for shooters with a disproportionate body type.

If a shooter with a disproportionate build decides to imitate the stance of a shooter with a proportional build, that is, to externally copy the relative positions of the torso, arms and legs, then when preparing to shoot from a kneeling position, the rifle will be directed to a greater or lesser extent either above or below the target (Fig. 124, a). In order to change the angle of inclination of the rifle in relation to the horizontal plane, any shooter, including those with a disproportionate build, has at their disposal many techniques that are conditioned by the specific posture of the body when preparing to shoot from a kneeling position. Such techniques include: moving the foot of the left leg closer to you or further away from you; moving the elbow of the left hand behind the kneecap or placing it on it; increasing or decreasing the angle of the bend of the left arm at the elbow joint, that is, changing the place where the left hand grasps the fore-end of the rifle closer to you or further away from you; changing the height of the stop (bag-roller); changing the relative position of the supporting surfaces of the body - both legs;

changing the degree of bending of the body in the back; finally, changing the butt by moving the butt of the gun down or up (see Fig. 124).

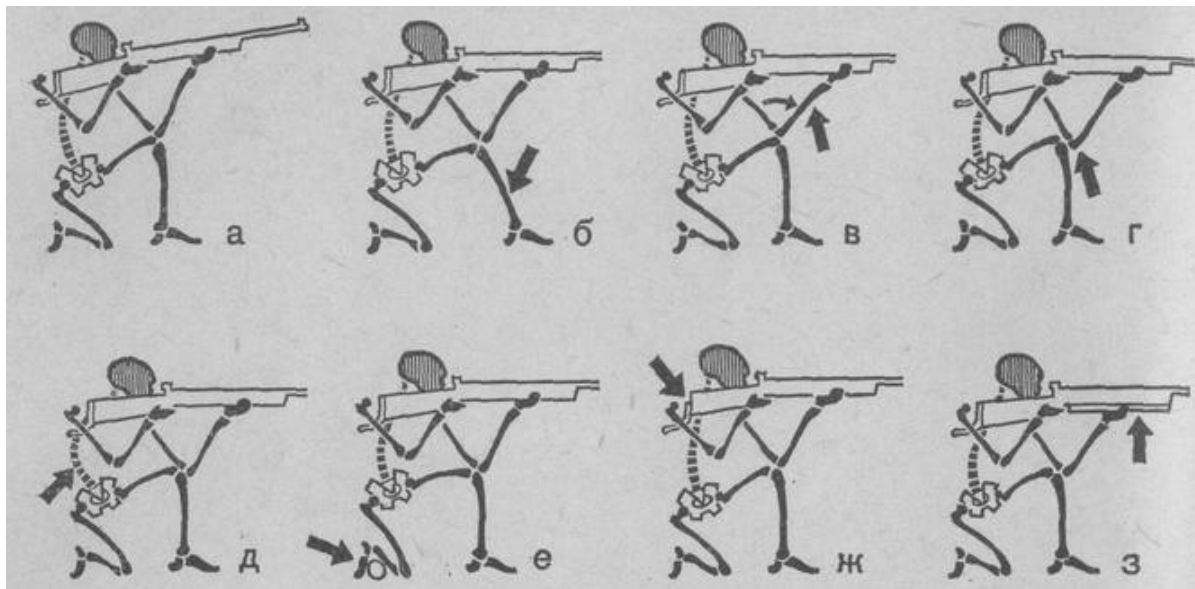


Fig. 124 - Some techniques for changing the position of the rifle in the horizontal plane

From all this it becomes obvious that for every shooter, regardless of whether he is proportionally built or disproportionately built, there is not one, but many patterns and options for preparation, many of which he can successfully apply for himself.

This raises the question: what is the most important thing in kneeling position, what should be taken into account when changing the relative positions of individual parts of the body in search of the most stable position? The answer to this question can be found by turning to the practice of the best shooters who have achieved the highest and most stable sports results in kneeling shooting.

Despite the differences in height, weight, proportionality of the physique, the overwhelming majority of leading athletes, whose stance in appearance differs noticeably from one another in detail, adhere to the following principle: firstly, to sit on the right leg so that the weight of the body falls mainly on the heel, and consequently on the bolster-bag: this relieves the left arm and left leg from excessive load; secondly, to position the supporting surfaces so that the body is oriented in relation to the target to the greatest extent with the chest forward, which helps to reduce the tension of the

muscles of the right part of the shoulder girdle and creates conditions for a more natural positioning of the head.

In light of the above requirements, let us consider the position for shooting from the kneeling position, which was and is used by our best shooters in the period 1955-1972.

If you look from above, in plan, at a shooter who has taken a kneeling shooting position, you will immediately see that his position is largely determined by how he positions the supporting surfaces of his body on the ground (Fig. 125). Therefore, the shooter's "traces", that is, the outline of the imprints on the ground of the supporting surfaces of his body, and the position of the rifle in relation to these "traces" are one of the characteristics by which one can, to a certain extent, judge the advantages and disadvantages of one or another variant of the position.



Fig. 125 - A shooter positioned for shooting from a kneeling posi-

tion (top view) and a diagram of the relative positions of the supporting surfaces of his body

Let's go back a little and look at some elements of the preparation of leading shooters from 1954-1956 (Fig. 126).

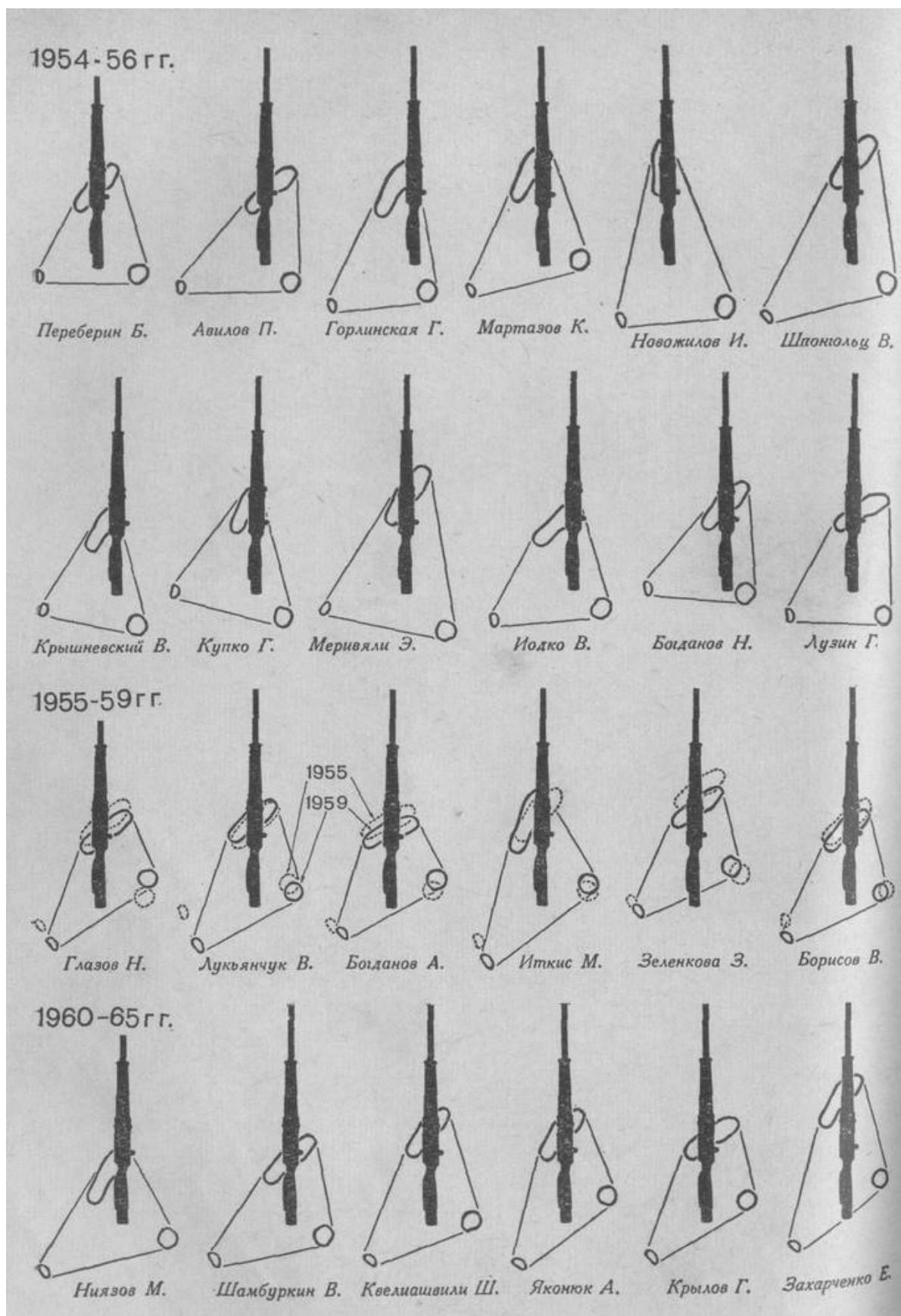


Fig. 126 - "Traces" - the relative position of the supporting surfaces

of the body and the rifle when leading athletes are prepared for shooting from the kneeling position (1954-1965)

The shooting position for kneeling in that period was replete with various variants, among which, along with very advantageous ones, there were quite a lot of outdated ones, characterized by a relatively uniform distribution of the body weight on three supporting surfaces of the body, the external sign of which is a significant tilt of the body forward and to the right. Over time, the shortcomings in the position turned into a serious brake on the further athletic growth of their owners, and, despite the fact that some shooters, due to habit, found it difficult to part with the previous position, which in the past had repeatedly ensured them athletic success, they were forced to rebuild it. The fact that serious changes occur in the position of many shooters over time is convincingly shown in Fig. 128. In these photographs, deliberately from the past, as an example, the position of two outstanding athletes who left a bright mark in the history of shooting sports is given - A. Bogdanov and M. Itkis. Already world and European champions, they continued to experiment and make significant changes to their shooting technique, particularly to their position.

Let us now consider the "traces" of the shooting position from the knee of the leading athletes of the period 1958-1961 (see Fig. 126). As we see, their position is, in principle, much more uniform. It is mostly characterized by: transferring the largest part of the body weight to the heel of the right leg (bag-roller); holding the body with a minimal forward tilt, which created the most favorable conditions for free balancing of the left hand with the rifle; bringing the support of the right knee closer to the foot of the left leg, and hence the position of the body with the chest forward to the greatest extent.

The stance of leading shooters of the period 1969-1972 (Fig. 127) is already distinguished by the use of a slightly different scheme - a gradual rejection of the stance variants built on the principle of free balancing of the left hand with the rifle and a transition to stance variants with a tighter butt. This stance scheme is characterized by the same transfer of a significant part of the body weight to the heel of the right foot, the same convergence of the legs, but the

body already has a greater forward tilt, due to which a slightly greater load falls on the left arm and left leg.

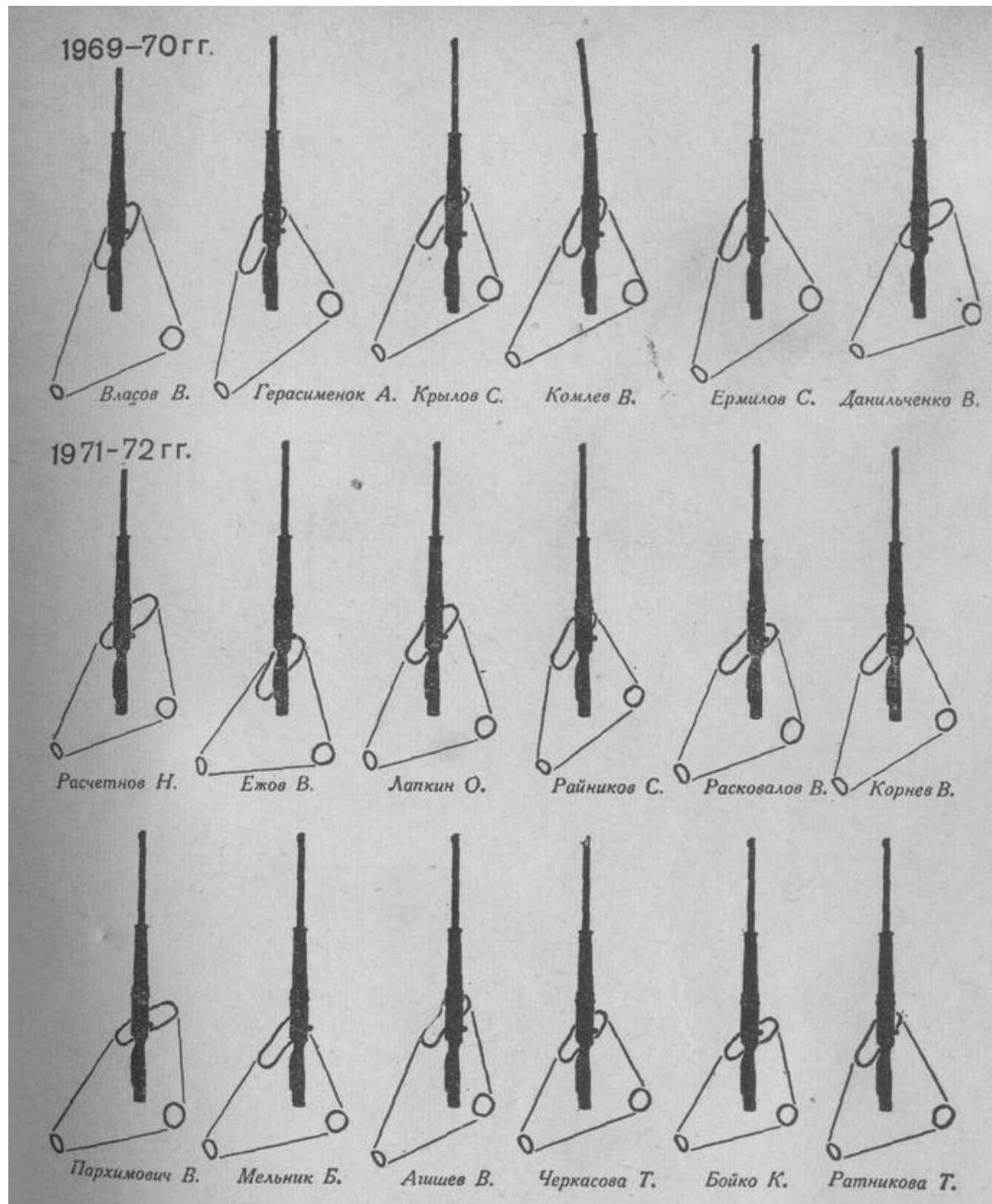


Fig. 127 - "Traces" - the relative position of the supporting surfaces of the body and rifle when shooting from the kneeling position by leading athletes from 1969-1972.

Above we have considered the "traces" of shooters, which are a certain static characteristic of the position they use. However, it is of course impossible to judge a shooter's position based on "traces" alone, since it is determined not only by the correct mutual arrangement of the supporting surfaces, body and distribution of the weight load, but also by the position of the hands, the position of the head, the butt, etc.

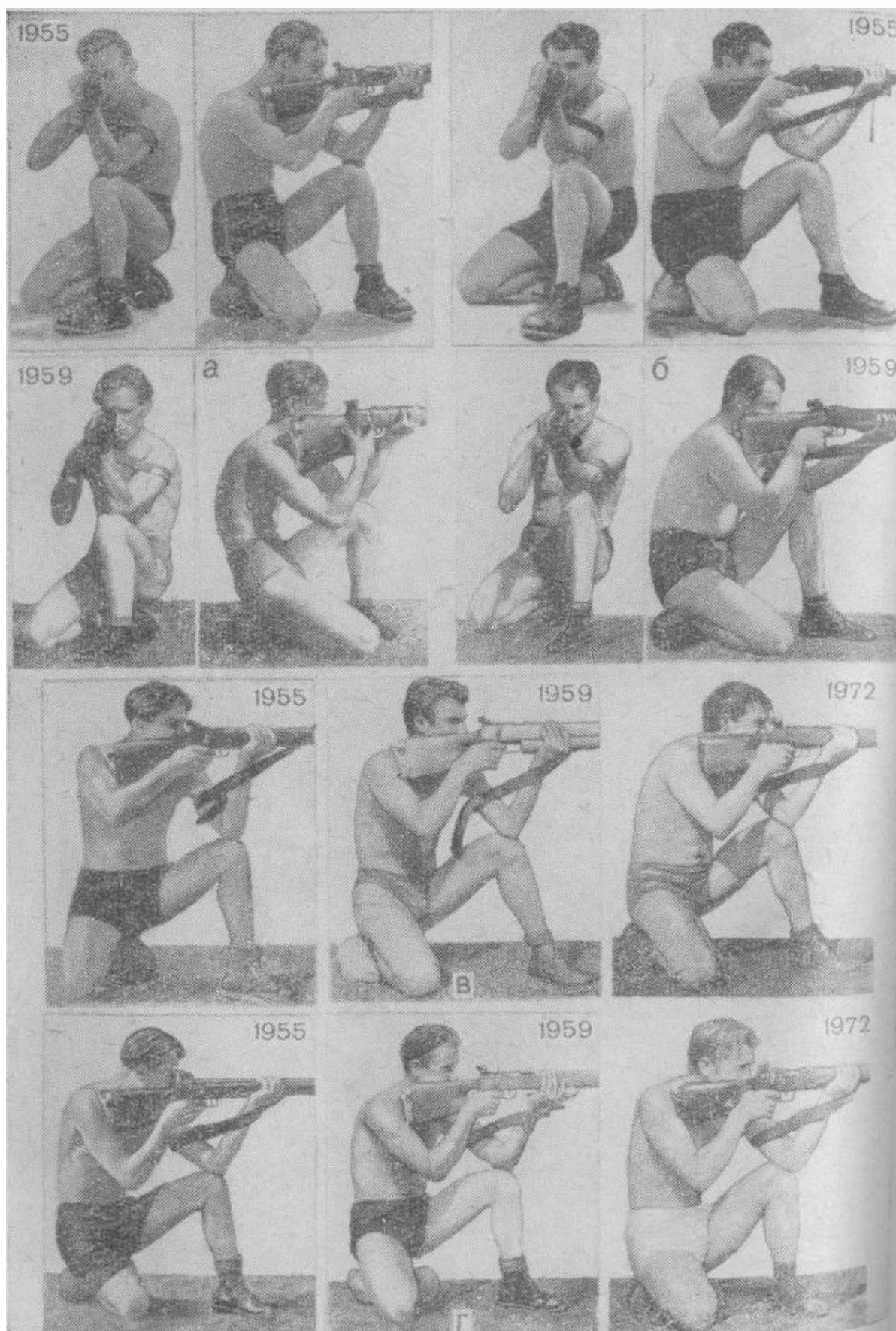


Fig. 128 - Examples of changes occurring in the kneeling shooting

position of famous shooters as their athletic skills grow: *a* - A. Bogdanov; *b* - M. Itkis; *c* - S. Evdokimov; *d* - V. Belokurov.

In Fig. 129, 130, 131 the shooting position from the kneeling position of leading Soviet and foreign athletes is shown for comparison. Based on the requirements set out above, which are imposed on the modern position, it is possible to determine without much difficulty the advantages (and there are, of course, more) and disadvantages of each of the given variants. Let us now examine some of them in more detail.

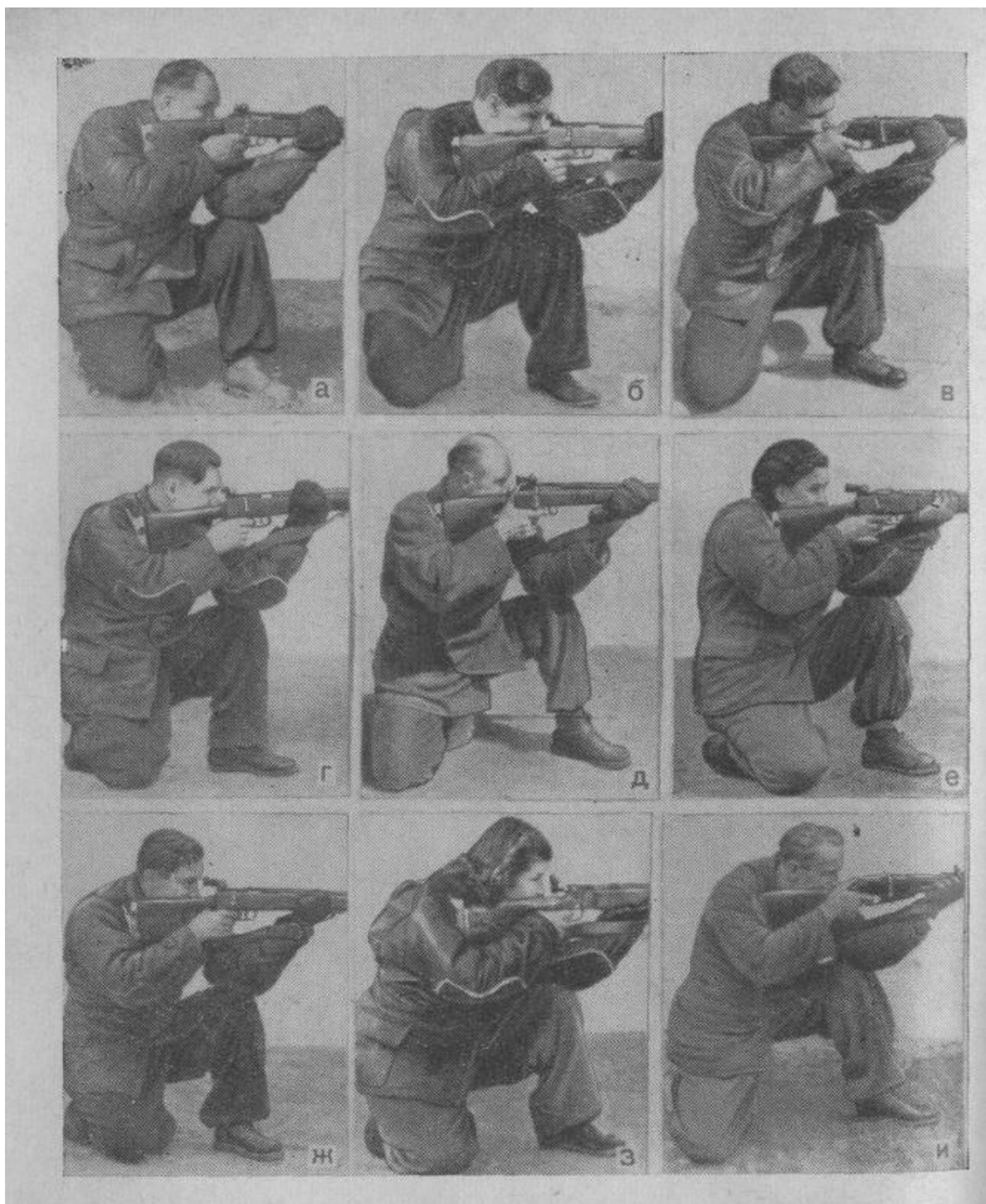


Fig. 129 - Shooting position from the kneeling position (side view)
of leading athletes of 1950-1955:

a - P. Avilov; *b* - V. Iodko; *c* - G. Kupko; *g* - B. Pereberin; *d* - E. Merivyali; *e* - A. Gaage; *g* - V. Borisov;
z - G. Gorlinskaya; *i* - I. Novozhilov.

Fig. 129-I, a shows the position of A. Bogdanov, the "founder" of our version of the position for shooting from the kneeling position,

built on the principle of free balancing of the rifle. This type of position was very popular in 1955-1962 (see Fig. 129-I, c, d, e, h, i). A characteristic feature of this position is a vertical, almost without tilting, position of the body, and with a significant bend in the back, due to which the left leg and left arm are loaded to the least extent. The gun sling, as a rule, is not tightly tightened. The butt is very loose, the hook of the butt is lowered down, the rifle is held in the shoulder only by the hook passing under the armpit. The rifle's oscillations in this position are smooth, the rifle slowly sways and periodically stops (depending, of course, on the athlete's level of training). It should be said that various versions of this position for shooting from the kneeling position are still successfully used by both our and foreign athletes. Therefore, various versions of the position, built on the principle of more or less free balancing of the rifle, should not be "deprived of the right to citizenship" even now.

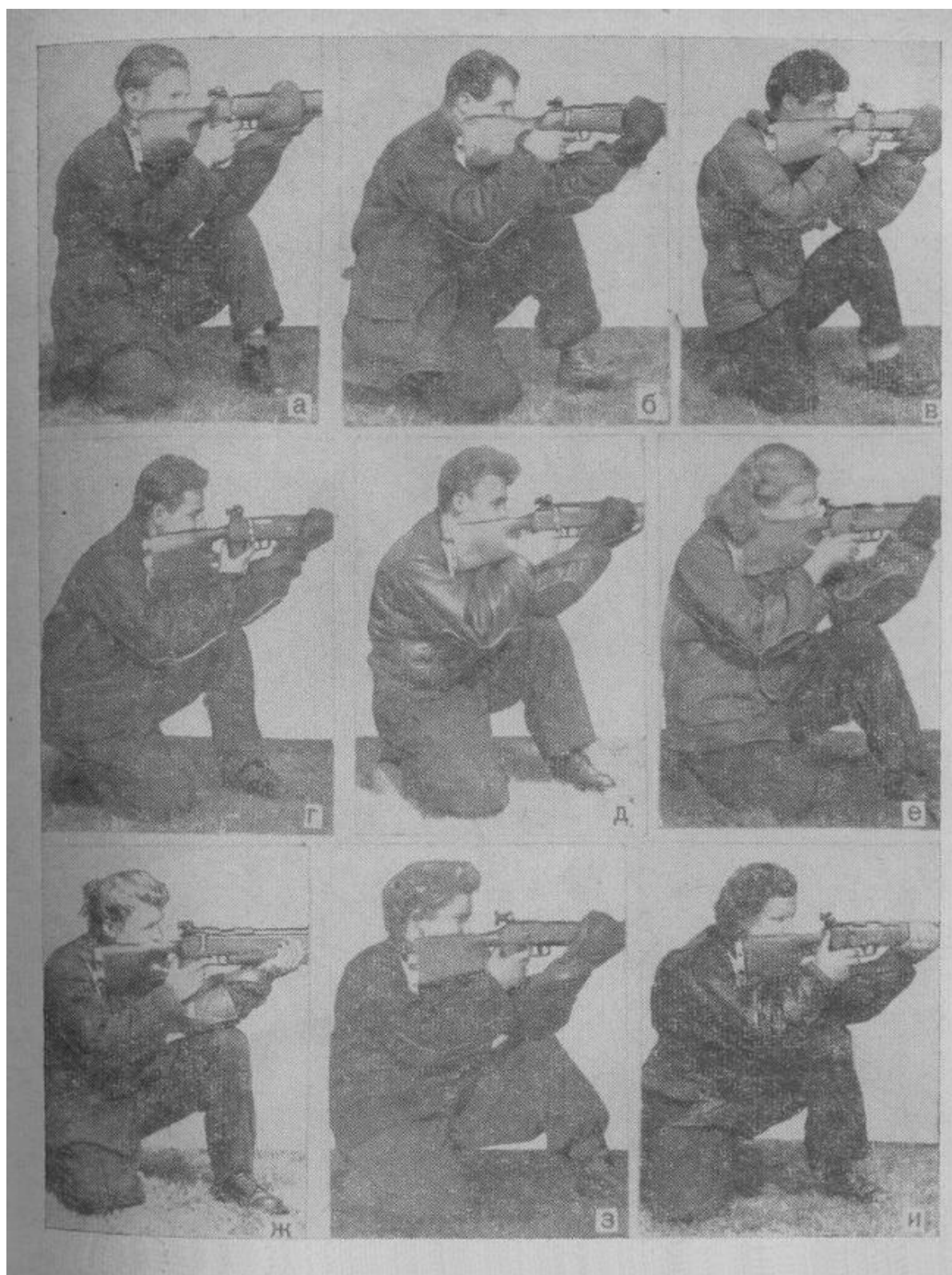


Fig. 129-I - Shooting position from the kneeling position (side view)
of leading athletes of 1955-1961:

a - A. Bogdanov; *b* - M. Itkis; *c* - Sh. Kveliashvili; *g* - M. Niyazov; *d* - G. Krylov; *e* - Z. Ze-
lenkova; *g* - T. Lomova;
h - E. Zakharchenko; *i* - E. Donskaya.

The stance of our leading shooters of the period 1971-1972 (Fig. 130), as we see, is quite uniform in its basic scheme. The overwhelming majority use a stance that is distinguished by greater composure, with a tighter butt. In this variant, the torso has a greater forward tilt, due to which, despite the significant bend of the torso in the back, a somewhat greater load falls on the left arm and left leg. In such variants of the stance, the belt is tightened relatively tightly, the butt rests closer to the neck, the grip (neck) of the butt is quite tight, the muscles of the right hand are more tense, which is associated with the need to ensure a relatively tight resting of the butt on the shoulder. Here, of course, there is no longer free balancing of the rifle, it experiences frequent small and relatively uniform vibrations. With this position, while losing somewhat in terms of loading the left hand and left leg, and positioning the head, the shooter wins in that the position becomes lower in nature, in particular, in terms of the position of the left hand, it approaches the prone position more closely.



Fig. 130 - Shooting position from the kneeling position (side view) of leading athletes of 1971-1972:

a - V. Parkhimovich; b - V. Kornev; c - G. Lushchikov; g - V. Raskovalov; d - O. Lapkin; e -

B. Melnik; *g* - A. Gerasimyonok;
h - V. Avilov; *i* - R. Lustberg.

It should be noted that the position with a tight butt and greater concentration is not new: very close variants have long been successfully used by such famous shooters as M. Itkis, M. Niyazov, V. Shamburkin and others (see Fig. 129-I, b, g), and at a time when the position based on the principle of free balancing of the rifle was very widely used. These athletes used the position, which was unusual at that time, because they considered it the most suitable for themselves.

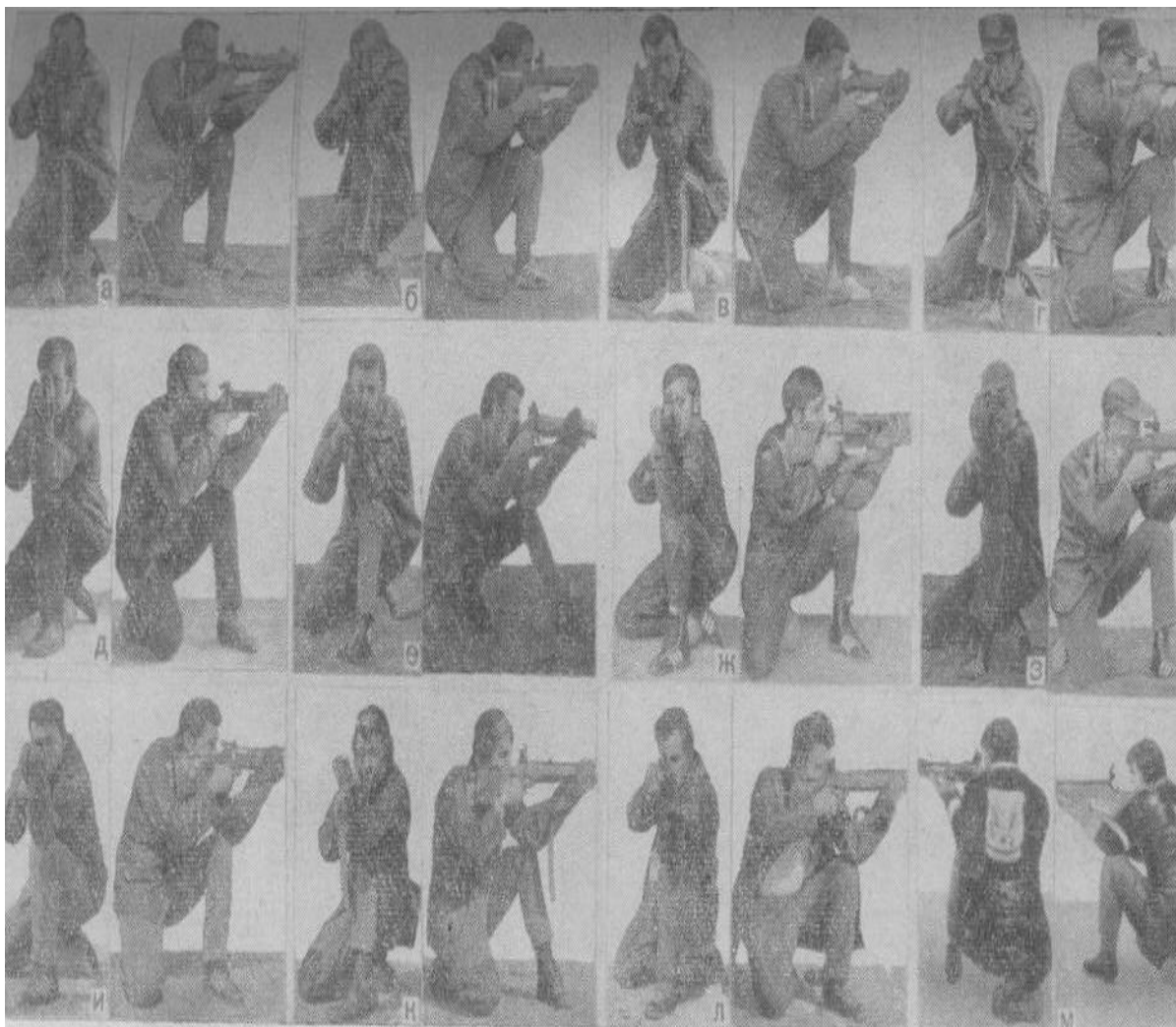


Fig. 131 - Kneeling shooting position (side view) of leading foreign athletes in 1972:

a - D. Foster (USA); *b* - D. Reiter (USA); *c* - D. Basham (USA); *d* - D. Wiger (USA); *d* - R. Poer (Czechoslovakia); *e* - G. Kusterman (FRG); *g* - B. Klinger (FRG); *h* - W. Rühle (FRG); *i* - P. Sandor (Romania); *k* - E. Vogt (Switzerland); *l* - E. Bürgen (Switzerland); *m* - M. Thompson (USA, 1970).

So, we have considered two types of shooting positions from the kneeling position, built to some extent on a fundamentally different basis. Which of them should be given preference at the present time? There can be only one answer: any version of the position is equal and good, if it is not the result of blind imitation and a tribute to fashion, but is taken into account the features of one's physique and is built on a fundamentally correct basis.

When comparing the data from 1954-1972, it is clear that the overwhelming majority of changes in the stance occur in the direction of: transferring most of the body weight to the heel of the right leg (bag-roller); fixing the body and partially unloading the left leg due to the bend in the back; bringing the legs closer together and, due to this, orienting the body with the chest forward; choosing a pose in general in which holding the body requires the least muscle tension, without overloading individual muscle groups.

In this direction, young shooters should search for the most advantageous position for shooting from the kneeling position, avoiding extremes, in particular excessive forward tilt of the body and, in connection with this, excessive loading of the left arm and left leg.

Standing shooting position

The shooting position for standing is the least stable compared to other types. The lower stability of the position is due, firstly, to the fact that the general center of gravity of the "shooter's body - rifle" system is significantly higher above the support area, and the support area itself is much smaller, since it is limited only by the feet of both legs and the area between them. Secondly, when shooting standing, the muscular system is more tense, which is necessary to secure the moving parts of the body and hold it in a vertical position; at the same time, the action and reaction of the muscles cannot create absolute immobility of the body, due to which it sways more or less. Therefore, shooting standing is the most complex and difficult exercise in shooting sports.

The difficulties in choosing a position for oneself primarily lie in the fact that the shooter, being in such an unstable position, the main-

tenance of which in itself requires significant muscular effort, must also hold the rifle, that is, a fairly large load, which further increases muscle tension (moreover, the rifle's center of gravity is at a significant distance from the shooter's body midline, see Fig. 90). As is known, maintaining the balance of the "shooter's body - rifle" system requires a certain compensatory deviation of the torso to create a counterweight for the rifle. And such a deviation of the torso (provided that the overall center of gravity is maintained above the center of the support area) changes the entire pose of the shooter, making the position of his body asymmetrical, which, in turn, changes the pattern and degree of loading of the muscular system.

What kind of posture should a shooter adopt to ensure that holding a rifle while standing while ready to shoot requires less muscular effort?

It is quite obvious that the closer you bring a load to yourself, the easier it is to hold it in the air. However, this is hindered by the large linear dimensions of the load - the rifle (the large distance between its center of gravity and the buttstock); bringing the center of gravity of the rifle closer to you inevitably causes a greater deviation of the shooter's body to the side, causing it to take an increasingly asymmetrical pose. But, despite such an unnatural pose, the shooter benefits from the fact that, together with bringing the center of gravity of the rifle closer to you, the moment of its gravitational force decreases, and, consequently, the tension of the muscles of the shoulder girdle and back, which counteract the torso from tipping over to the side, also decreases (Fig. 132, right).

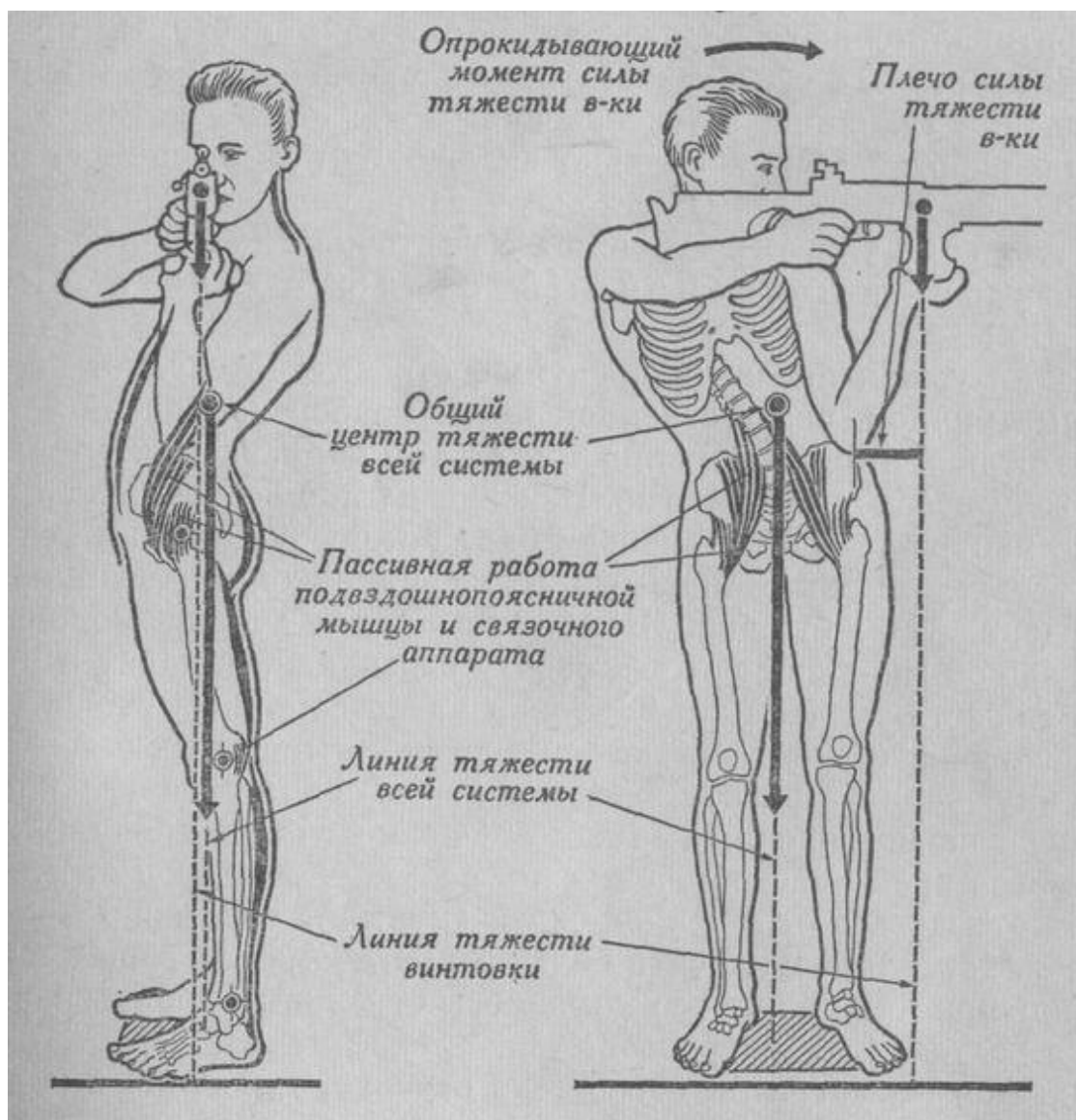


Fig. 132 - Scheme of the position with the body bent to the right - to the side and at the back

Let us now consider from the side the figure of a shooter who does not hold his body straight, but, on the contrary, with a large bend in the back, when the torso is abducted and the pelvis is brought forward; in this case, the vertical of the general center of gravity of the entire system passes behind the transverse axes of the hip joints. In such a pose, strengthening of the torso in the hip joints is achieved not so much by the work of the muscles, as by the inclusion of strong ligaments in the passive work; moreover, the rigid fixation of the torso is facilitated by the very weight of the torso with the rifle, which is also transferred to the spinal column, that is, the skeleton (Fig. 132).

Therefore, as practice has shown, the shooter should not be afraid of an asymmetrical, unnatural pose; the selection of the most stable position should be carried out in the direction that gives the body the necessary bend. The lateral bend ensures the movement of the rifle's center of gravity closer to the midline of the body, which helps to reduce muscle tension that occurs when holding the rifle. The bend of the body in the back makes it possible to include the ligamentous apparatus in work to the greatest extent and shift the weight of the body and rifle to the spinal column.

The latter circumstance - unloading the muscles due to the greatest involvement of the ligaments in the work and transfer of the weight of the body and the rifle to the spinal column - is the reason that at one time forced many leading masters of shooting sports to abandon their previous "straight" stance and move to a new one, characterized by a large bend of the body to the side and in the back. It was with this stance that shooters managed to achieve outstanding results in shooting while standing.

However, despite the arch of the shooter's body, the torso at the waist will not yet be sufficiently rigidly fixed; therefore, the position for shooting standing should also provide for additional fixation of the torso at the waist and in the joints of the legs. As the practice of the best shooters shows, in order to fix the torso more at the waist, it is necessary to "twist" it, that is, to turn it somewhat in the longitudinal axis (see Fig. 136). This technique to an even greater extent includes the ligamentous apparatus, as well as the abdominal muscles, which contributes to its more rigid fixation at the waist and in the joints of the legs.

"Twisting" of the body and thus additional fixation of it at the waist will take place when the shooter stands sideways to the target. To do this, the legs must be positioned so that the plane of shooting intersects both feet approximately in the middle (see Fig. 133).

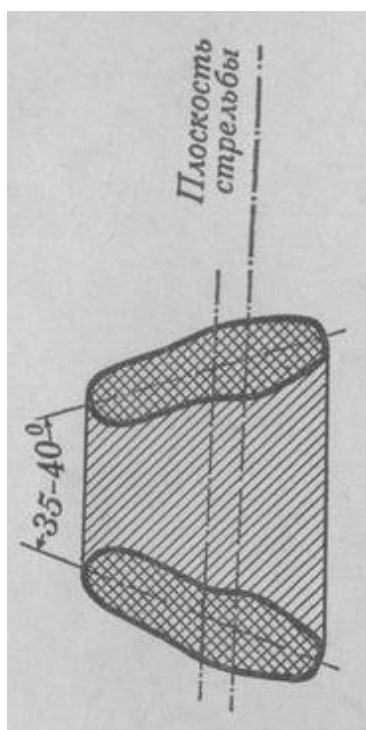


Fig. 133 - The relative position of the supporting surfaces of the body - the feet of both legs, limiting the support area when ready to shoot while standing

Stability in the stance depends to a large extent on the correct mutual arrangement of the supporting surfaces of the body - the feet of both legs. The most stable and convenient stance is one in which the feet create a support area in the form of a trapezoid formed by such a positioning of the legs that the distance between the feet is slightly less than the width of the shoulders, and the toes are slightly spread apart (Fig. 133). This positioning of the legs is especially convenient, since it simultaneously creates both a comparatively large support area and favorable conditions for the work of the feet. Therefore, when stanced for shooting while standing, the legs should not be too close together, since a very narrow position will reduce the support area, which will entail some loss of stability. The legs should also not be placed wide apart, since this creates unfavorable conditions for the work of the inner arches of the feet and causes excessive tension in the leg muscles that secure the hip joints.

The stability of the stance is also directly dependent on the location of the common center of gravity of the "shooter's body - rifle" system over the support area. In order for the stance to be stable, the

shooter must strive to distribute the weight of his body with the rifle evenly on both legs. In addition, the load should fall on the middle part of the foot or somewhat closer to the toes. With such a distribution of the body weight with the rifle on the support surfaces (both feet), the line of gravity of the body passes through the middle of the support area, which makes the stance the most stable, since the angle of stability in the transverse and longitudinal planes will be relatively the same. At the same time, the muscles of both legs are relatively evenly loaded, which creates the most favorable conditions for their synchronous work.

The degree of tension of the ligaments that strengthen the knee joints is of great importance for the stability of the stance. You should not intentionally relax the knee joints, or, as they say, stand on half-bent legs. You should also not create different muscle tension in both legs - keep one straight and the other half-bent: an insufficiently fixed position of the knee joints will entail excessive tension in individual muscle groups of the legs and, as a result, swaying of the body as a whole. At the same time, you cannot abuse excessive tension in the leg muscles, artificially straightening them, over-bending them at the knee joints, since this is accompanied by great tension in the rectus femoris, gastrocnemius and anterior tibialis, which ultimately leads to a deterioration in the stability of the stance and premature fatigue of the muscles when shooting.

Finally, to complete the consideration of the so-called "power scheme" of the shooting position while standing, it is necessary to dwell on the position of the left hand and the loading of its muscles when holding the rifle.

To make the rifle as immobile as possible, it is necessary to position the left hand so that it serves as a support, a kind of bracket. This is possible if holding the rifle does not cause significant tension in the arm muscles. Therefore, the left hand supporting the rifle should be bent at the elbow joint at such an acute angle that the forearm is positioned as vertically as possible (Fig. 134).

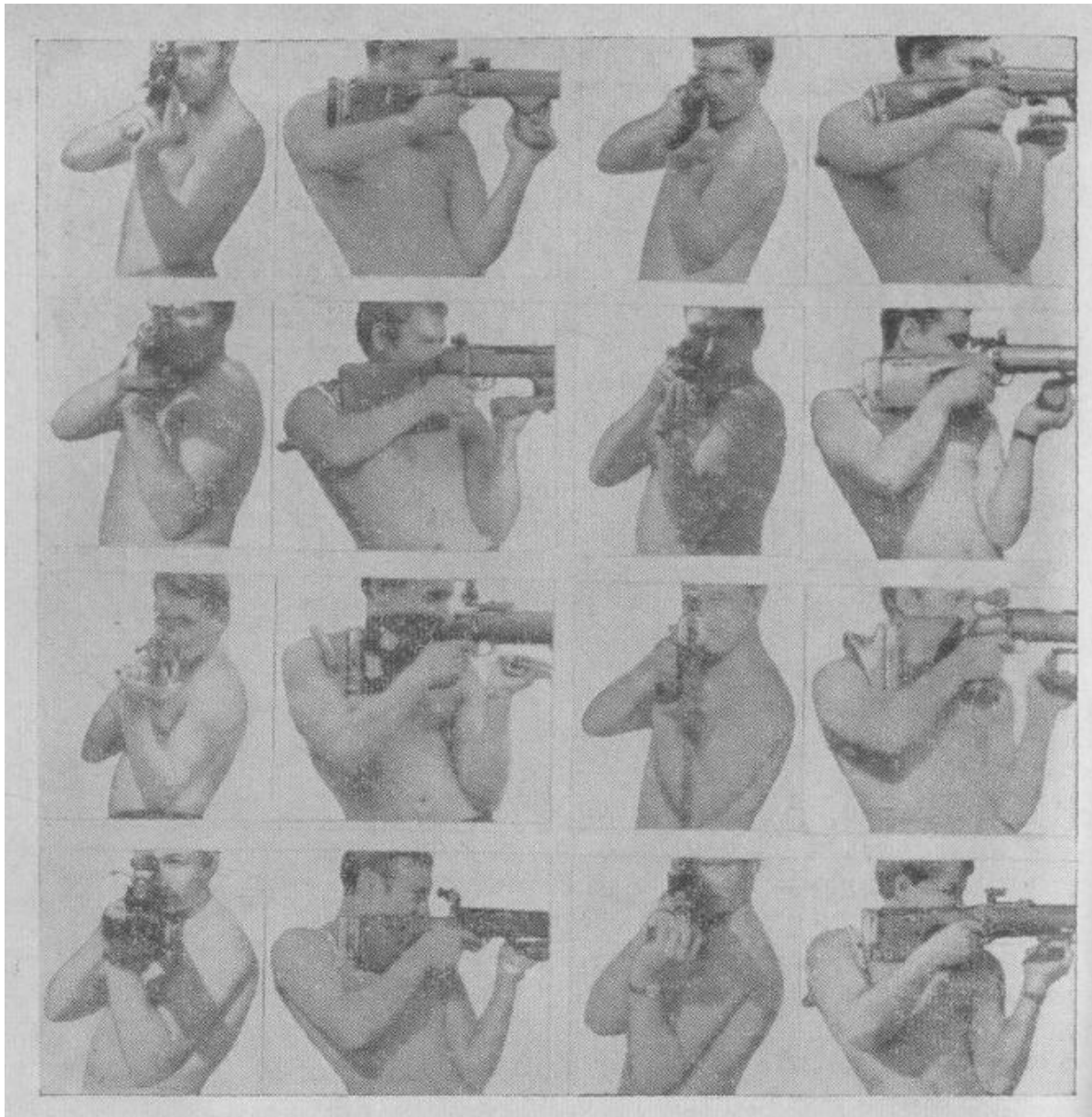


Fig. 134 - Hand positioning for leading athletes for standing shooting

The left hand can serve as a stable support when its elbow has a sufficiently reliable support. Therefore, in order to give stability to the rifle, it is very important to choose the place where the left hand rests on the body.

The elbow of the left arm should be rested on the iliac crest of the pelvis or positioned slightly to the right of it, resting on the oblique abdominal muscle (see Fig. 134). For shooters with a long torso or short arms, when shooting from a service or sport rifle, it is more advantageous to use a position in which the upper part of the left

arm is pressed to the chest by the weight of the rifle and held there (despite the absence of an elbow rest) due to friction.

The left hand wrist should be used to support the rifle in a completely different way than when shooting prone or from a kneeling position. There are many different options for the wrist position when supporting the rifle. The shooter should choose any of them based on his body type, the position used, and also on the features of the wrist structure that will put it in the most favorable working conditions.

When shooting standing from a service, sport and air rifle, taking into account the practice of the best shooters, it is most advantageous to support the rifle as shown in Fig. 135, a, b, c.

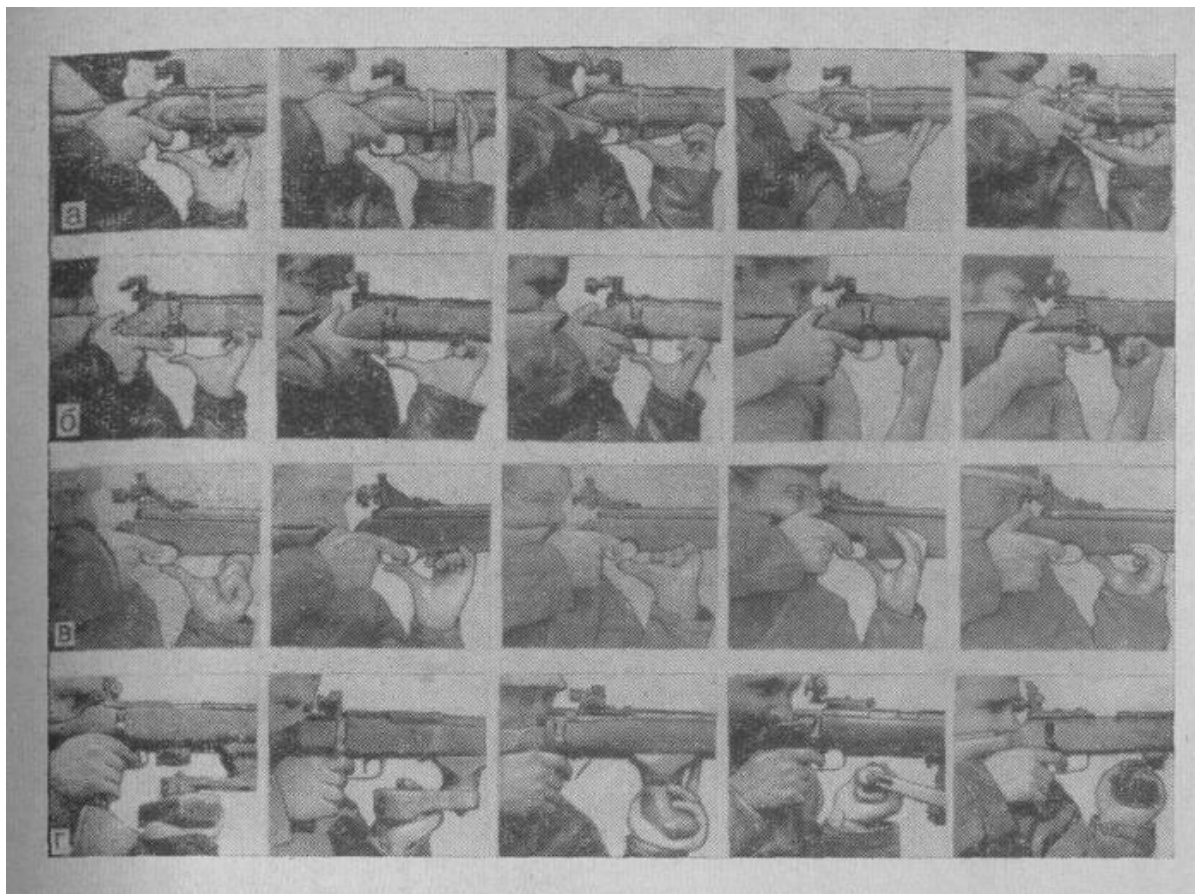


Fig. 135 - Methods of supporting various rifles when shooting standing:

a - service; *b* - sport; *c* - pneumatic; *d* - free.

When shooting from a free rifle, it is permitted to use a "champignon". The design of the "champignon" must allow chang-

ing its height and angle of rotation, which makes it possible to create better conditions for supporting the rifle. When shooting standing from a free rifle, it is most advantageous to use a "champignon" and support the rifle as shown in Fig. 135, g. With such methods of supporting a free rifle, the fixation of the hand in the wrist is carried out not by muscle tension, but mainly by tensioning the ligaments that strengthen the joints of the hand. In addition, as a result of the action of the rifle's gravity, the most favorable conditions for fixing the left hand as a whole are created.

Above we have considered the "power scheme" of the shooting position while standing. It is quite obvious that regardless of the shooter's desire, holding the body in a standing position inevitably requires a certain tension of many muscle groups and tension of the ligaments that ensure the fixation of the moving parts of the body in the joints: muscle groups of both legs, abdominal muscles, lower back, part of the back, shoulder girdle, left chest, left arm, etc. Therefore, the shooter faces the task of partially reducing the tension of these muscle groups by maximally including the ligaments that strengthen the joints, as well as creating conditions for the most favorable coordinated work of the flexor and extensor muscles, the action and counteraction of which ensures that the shooter's body with a weapon is held in a certain pose, in this case, in a standing position.

If we are talking about relaxing the muscular system when shooting standing, then this should concern that relatively small group of muscles that do not directly participate in keeping the shooter's body in a vertical position with the rifle aimed at the target. This group includes the muscles of the right chest, the right shoulder girdle, the muscles of the neck, etc. These are the muscles that should be relaxed as much as possible.

Unlike the prone and kneeling positions, the rifle butt should rest with its middle part not on the right side of the chest, but on the shoulder joint or the deltoid muscle of the right arm. When shooting from a free rifle, the butt with the hook should be moved down. The shooter should be especially careful that the muscles of the right side of the shoulder girdle are not excessively tense and that the right shoulder is not brought forward with tension.

The head should be held straight, without tilting, so that the cheek rests on the comb of the butt without much effort. As in the prone and kneeling positions, you should not stretch your head forward closer to the sight or throw it back: the position of the head should be as natural as possible, the neck muscles should not be overly tense.

The right hand is intended to play the same role as when shooting from a kneeling position - to hold the rifle in a certain position and to press the trigger. Since when ready to fire standing there is no rigid connection between the shooter and the rifle by means of a gun sling and the freely balanced rifle is not in a sufficiently fixed position, it is necessary to strive to ensure that the muscles of the right hand are as relaxed as possible; tension in the muscles of the hand and the resulting tremors and jolts will be transmitted to the rifle, disrupting its stability.

The right hand should grasp the buttstock, as when shooting prone and from a kneeling position, with a little effort.

The elbow of the right hand after the aiming position should be held freely at an angle of 20-40° to the body (see Fig. 134). In this case, special care must be taken to ensure that the position and height of the elbow do not change from shot to shot. Very often, inexperienced shooters, having raised their elbow high at the beginning of shooting, gradually lower it down without noticing it, thus changing the aiming position, which ultimately leads to both an increase and a change in the nature of the rifle's oscillations.

The correctness of the adopted position in relation to the target is verified by the same principle as when shooting prone and from a kneeling position. If, when preparing to shoot while standing, the shooter finds that the rifle barrel is directed away from the target, he must change the direction of the barrel not by moving his arms or rotating his torso at the waist, but by turning the "shooter's body - rifle" system so that the "level front sight" when aimed is in close proximity to the aiming point. To do this, the shooter moves the feet of both feet at a certain angle in relation to the shooting plane in one direction or another. If the "level front sight" when aimed is higher or lower than the aiming point, it is necessary, without changing the position of the left hand, to slightly change the aiming

position by slightly raising or lowering the rifle butt (when shooting from a service rifle) or by lowering or raising the butt cap (when shooting from a sport, air and free rifles).

These are the general requirements for a typical shooting position while standing.

Let us now consider the position currently used by leading athletes when shooting standing.

First of all, let's look at how the shooters position the feet of both legs, which limit the area of support for the body when ready to shoot (Fig. 136). And here, as in the kneeling position, we see that the shooter's "footprints" and the location of the rifle in relation to the "footprints" are also one of the characteristics by which one can, to a certain extent, judge the advantages and disadvantages of one or another shooting position.

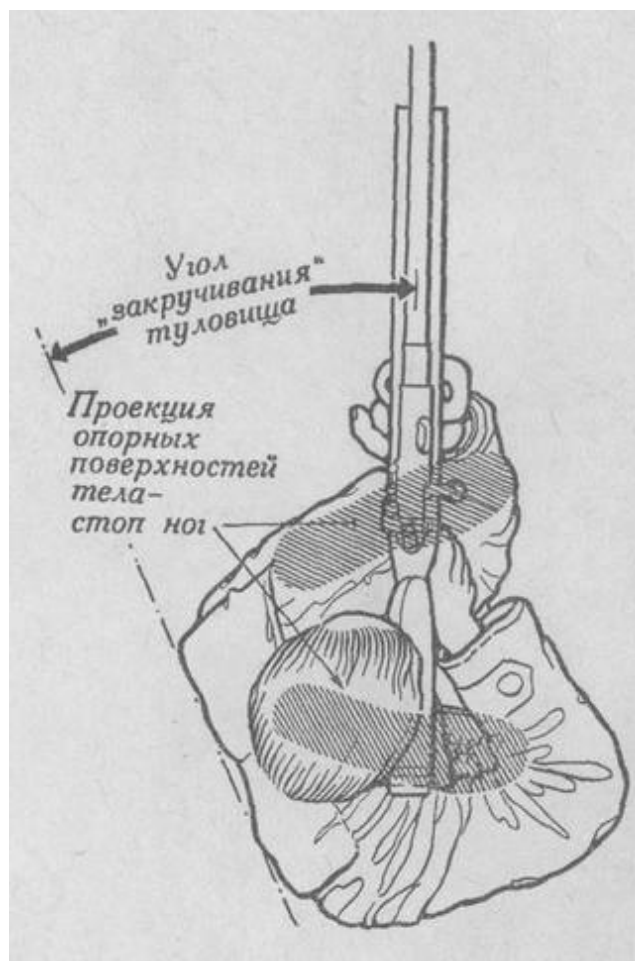


Fig. 136 - Standing shooting position (top view) and diagram of the relative positions of the body's supporting surfaces

In Fig. 137, 138 for comparison purposes "traces" are shown, from which it is evident that each shooter uses his own version of the stance, in some cases noticeably different from others in the relative position of the legs, the degree of bending of the body to the right-side and in the back, as well as the degree of "twisting" in the lower back. However, as already noted, it is impossible to judge the shooter's stance only by these data, since it is determined not only by the correct relative position of the supporting surfaces of the body and the degree of bending of the torso, but also by the position of the hands, the position of the head, the butt, etc. Therefore, below we will consider, taking into account the compliance with modern requirements, the stance for shooting while standing, used by the leading shooters of the country in the period 1955-1972.

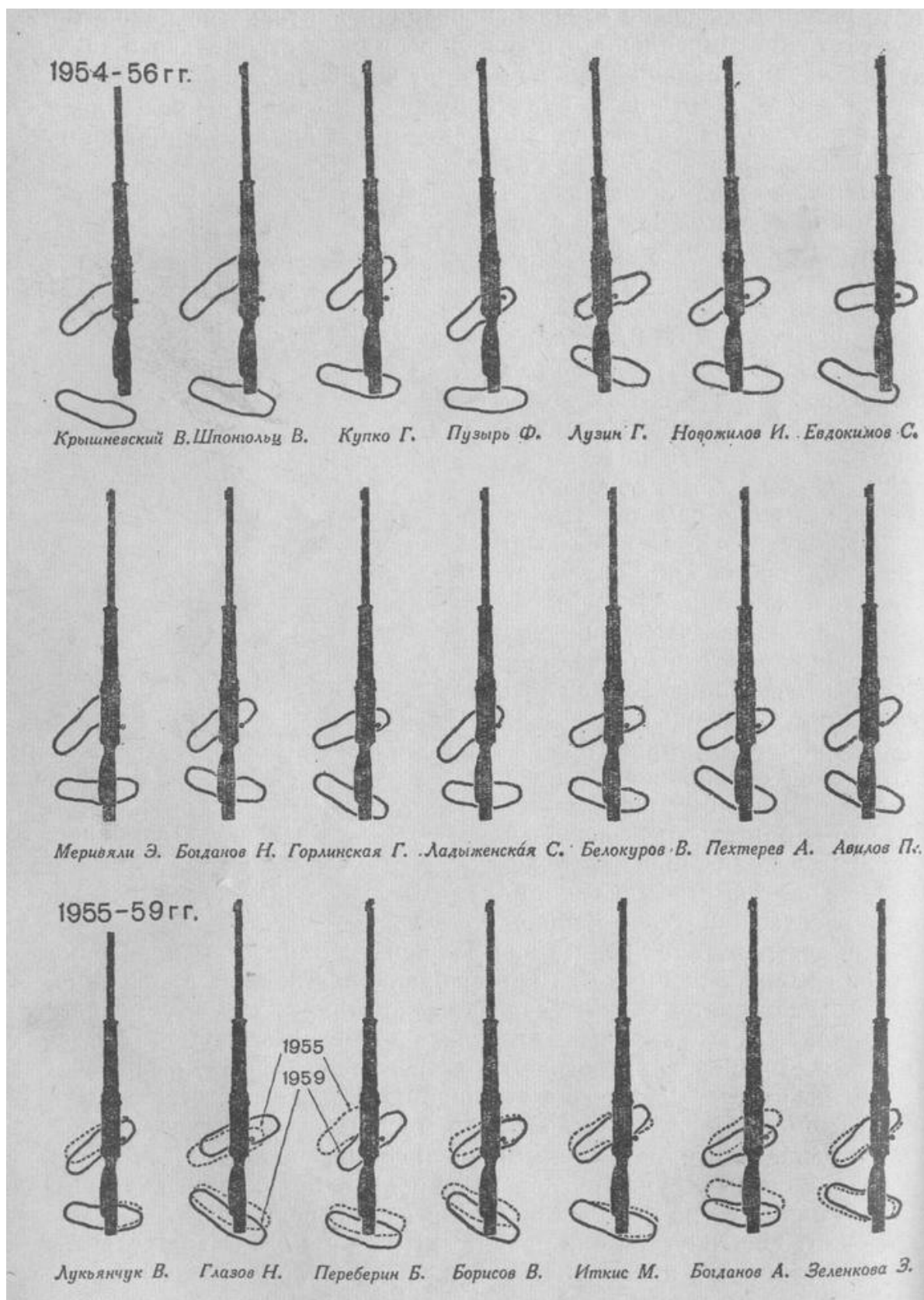


Fig. 137 - "Traces" - the relative position of the supporting surfaces of the body and rifle when shooting leading shooters standing (1954-1959)

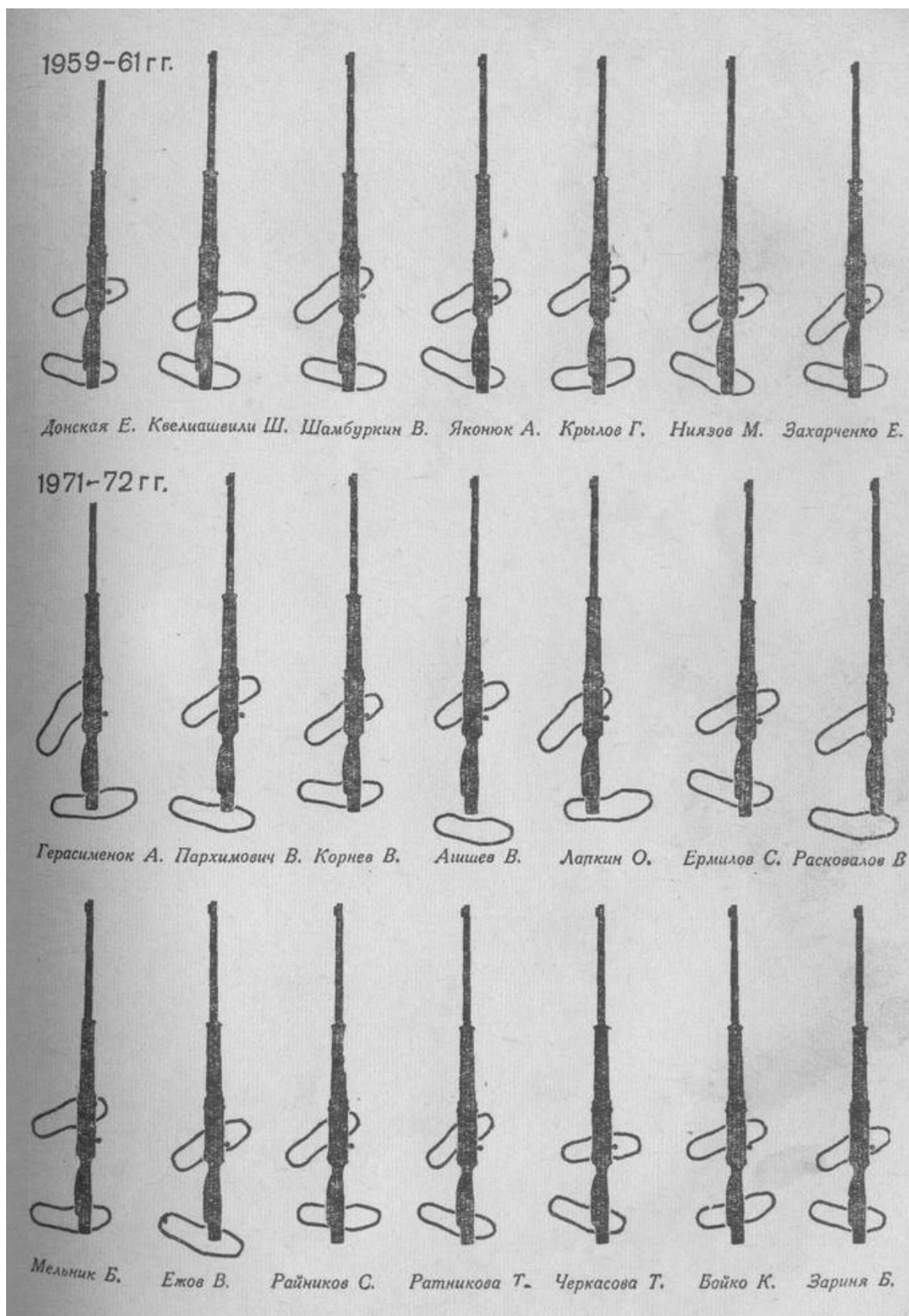


Fig. 138 - "Traces" - the relative position of the supporting surfaces

of the body and rifle when shooting leading shooters standing
(1971-1972)

Looking through the material provided (Fig. 139), relating to the period 1950-1956, the abundance of various, including unfavorable, variations of stance is especially striking. Here, along with successful variations, one can find a stance characterized by a slight bend in the body at the waist, an excessively straightened torso, an unsuccessful positioning of the head, left hand, etc.

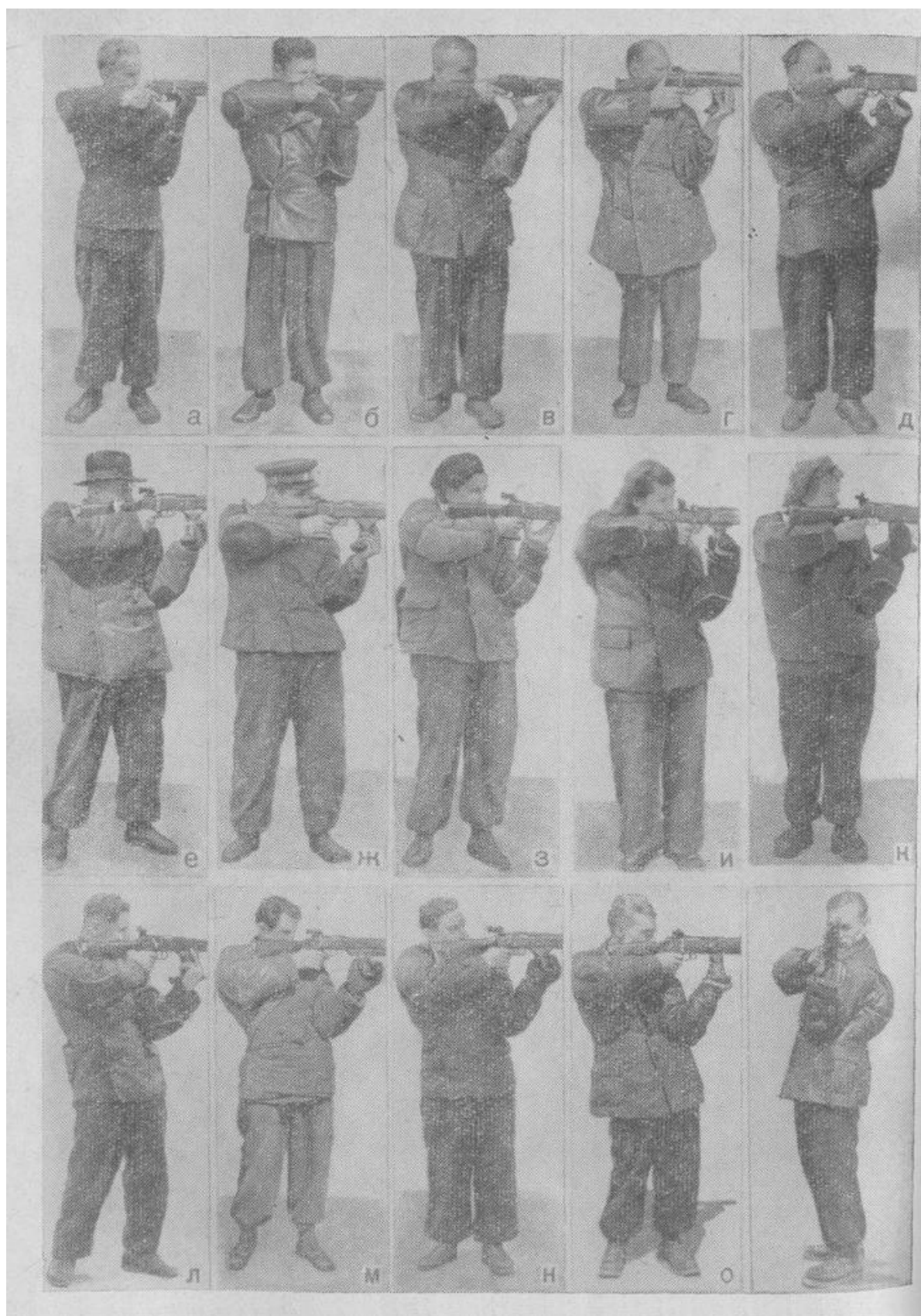


Fig. 139 - Standing shooting position (side view) of leading athletes of 1950-1956:

a - I. Novozhilov; *b* - G. Kupko; *c* - G. Luzin; *g* - E. Merivyal; *d* - P. Avilov; *e* - V. Krysh-

nevsky; *g* - N. Prozorovsky; *h* - A. Gaage; *i* - G. Gorlinskaya; *k* - Z. Zelenkova; *l* - B. Pereberin; *m* - M. Itkis; *n* - V. Borisov; *o* - A. Bogdanov.

First of all, it should be noted that nowadays you will no longer find among leading athletes people who use a stance characterized by a straightened body position, with a small compensatory displacement of the torso to the right and side and a bend in the back.

If such a position with an excessively straightened body at a certain stage of the development of shooting sports was still justified to some extent when shooting from a rifle with a small weight, then when shooting from a heavy free rifle it cannot create the necessary conditions to ensure the proper stability of the weapon throughout the entire shooting, and has recently been completely displaced. Shooters who used a position distinguished by an excessively straightened body were either forced to significantly rebuild their position in order to remain among the leaders, or to give way to athletes using more advantageous options for the position.

Let us now consider the shooting position for standing shooters of the period 1958-1961 (Fig. 140); we see that their position is, in principle, more uniform, it is characterized in the overwhelming majority by a comparatively close placement of the legs; orientation of the body so as to stand with the left side to the target, leaning the body to the right; bending the body in the back (moving the pelvis forward); some "twisting" of the body towards the waist.

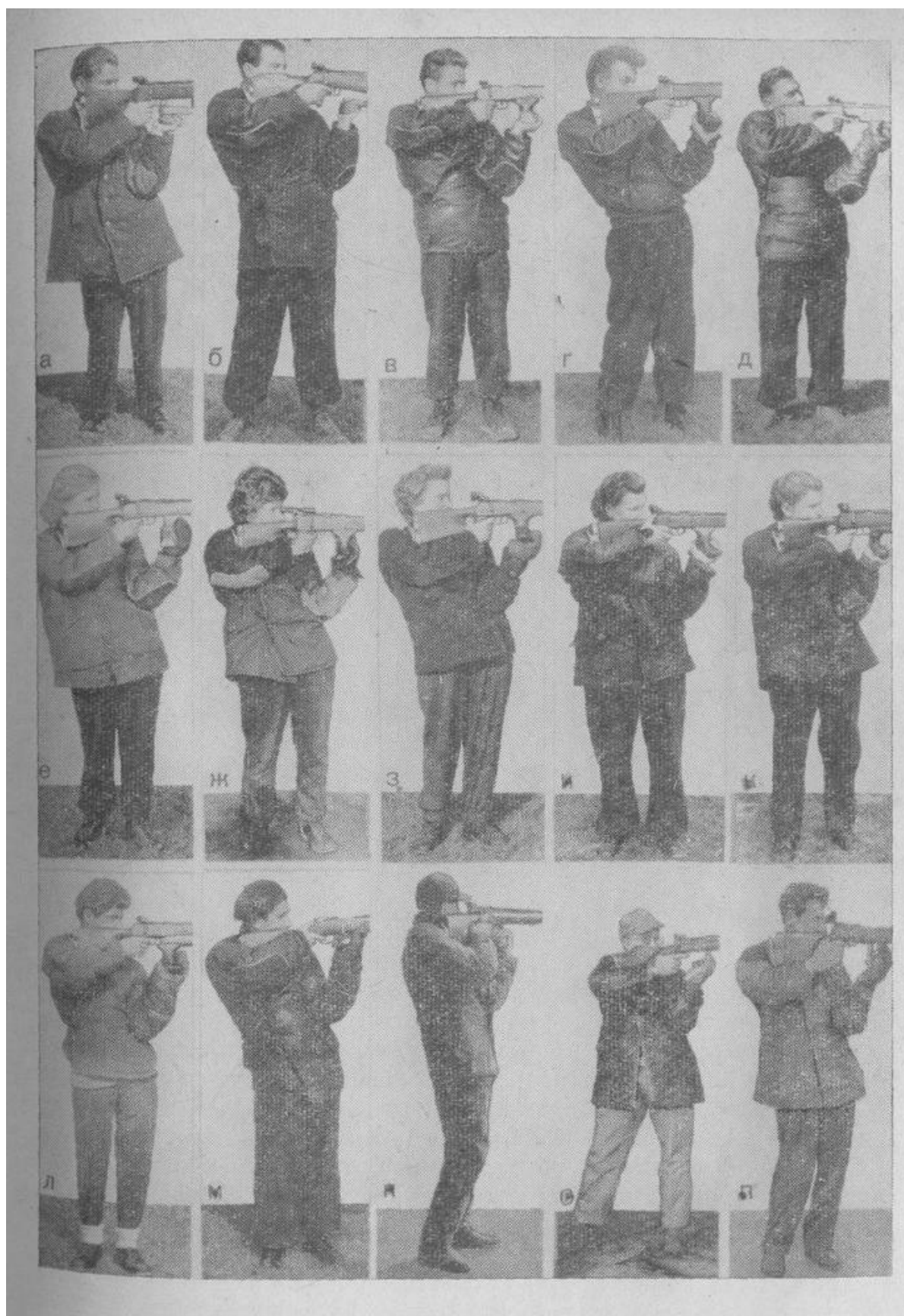


Fig. 140 - Standing shooting position (side view) of leading athletes of 1958-1961:

a - A. Bogdanov; *b* - M. Itkis; *c* - A. Erdman; *g* - G. Krylov; *d* - V. Borisov; *e* - Z. Zelenkova; *g* - K. Boyko; *h* - E. Zakharchenko; *i* - E. Donskaya; *k* - T. Lomov; *l* - Sh. Kveliashvili; *m* - N. Meytin; *n* - Illonen (Finland); *o* - Wright (USA); *p* - Antonescu (Romania).

Among foreign athletes during this period, the "one-legged stance" was very common - a position in which most of the body weight with a rifle was transferred to the left leg.

The position of the leading shooters of the period 1968-1972 (Fig. 141, 142) is also characterized by a significant bend of the body in the back and to the right and sideways. The obvious advantage and prospects of the position, built on this principle, are confirmed by the outstanding and stable results achieved by athletes in recent years. Of course, at first, the shooter, giving the body such an unnatural pose, experiences certain inconveniences and even feels pain in the lower back. As training progresses, the feeling of inconvenience gradually disappears and the athlete is rewarded a hundredfold for his efforts, acquiring a position that allows him to give the weapon the greatest immobility.

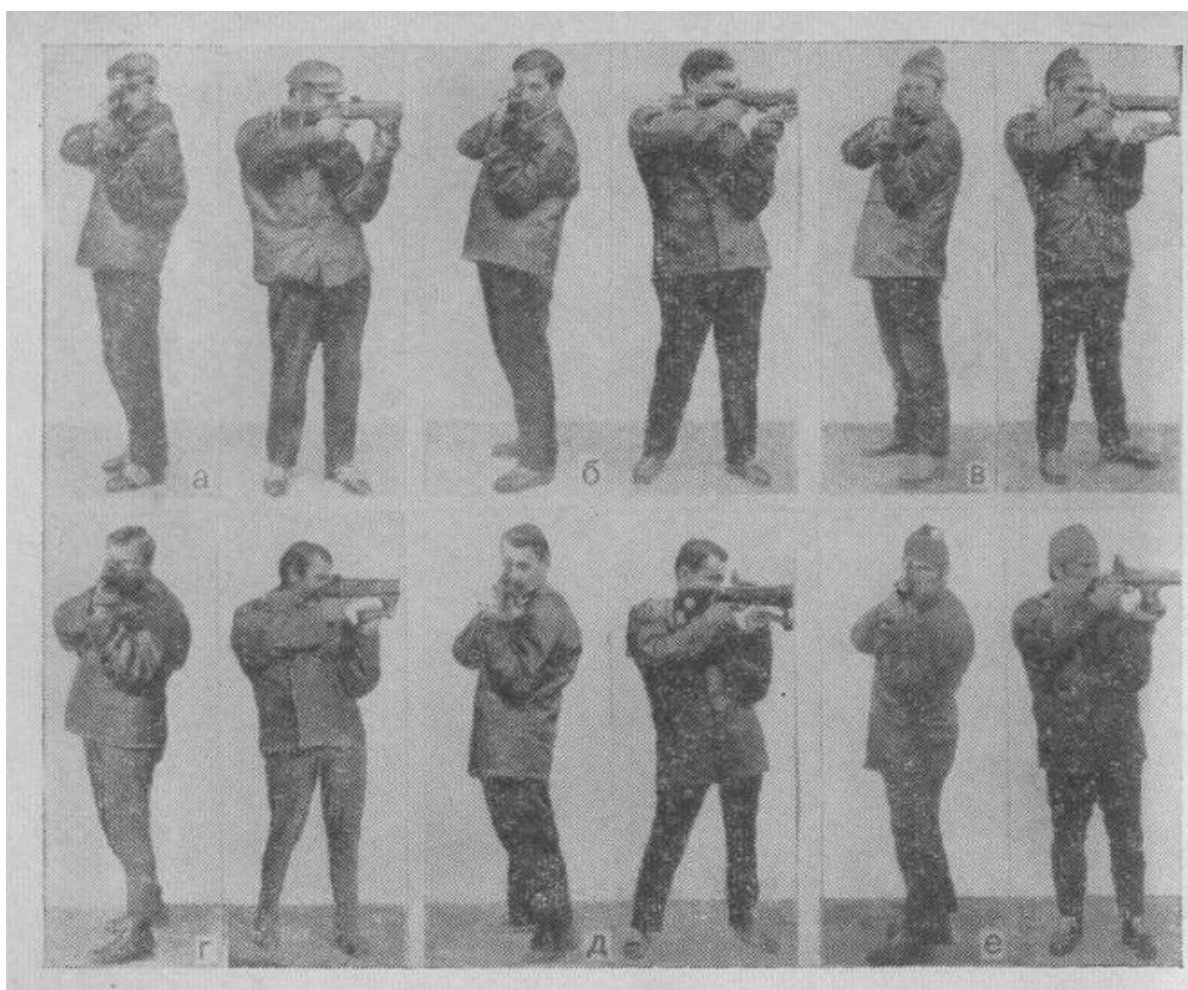


Fig. 141 - Standing shooting position (side view) of leading athletes of 1971-1972:

a - V. Kornev; *b* - V. Parkhimovich; *c* - A. Gerasimenko; *g* - B. Melnik; *d* - V. Agishev; *e* - V. Avilov.



Fig. 142 - Standing shooting position (side view) of leading athletes of 1971-1972:

a - R. Lustberg; *b* - V. Yezhov; *c* - V. Konyakhin; *g* - G. Lushchikov; *d* - K. Boyko; *e* - T. Ratnikova; *g* - T. Cherkasova; *h* - B. Zarinya.

At the same time, in contrast to the previously used variants, the stance of modern leading shooters is distinguished by a wider placement of the legs. In general, a clear tendency has emerged to move away from the principle of stance built on "balance" to a somewhat "powerful" stance variant.

The stance of leading foreign shooters (Fig. 143, 144) is characterized by a great variety of variants used and a great contrast in terms of their advantages and disadvantages. Observations of a wide range of foreign shooters in 1972 allow us to conclude that now the overwhelming majority of them use a stance with a wider leg spacing, but already with the weight load distributed evenly on

both legs; the stance "with a stand on one (left) leg" is used in isolated cases, mainly among Romanian athletes.

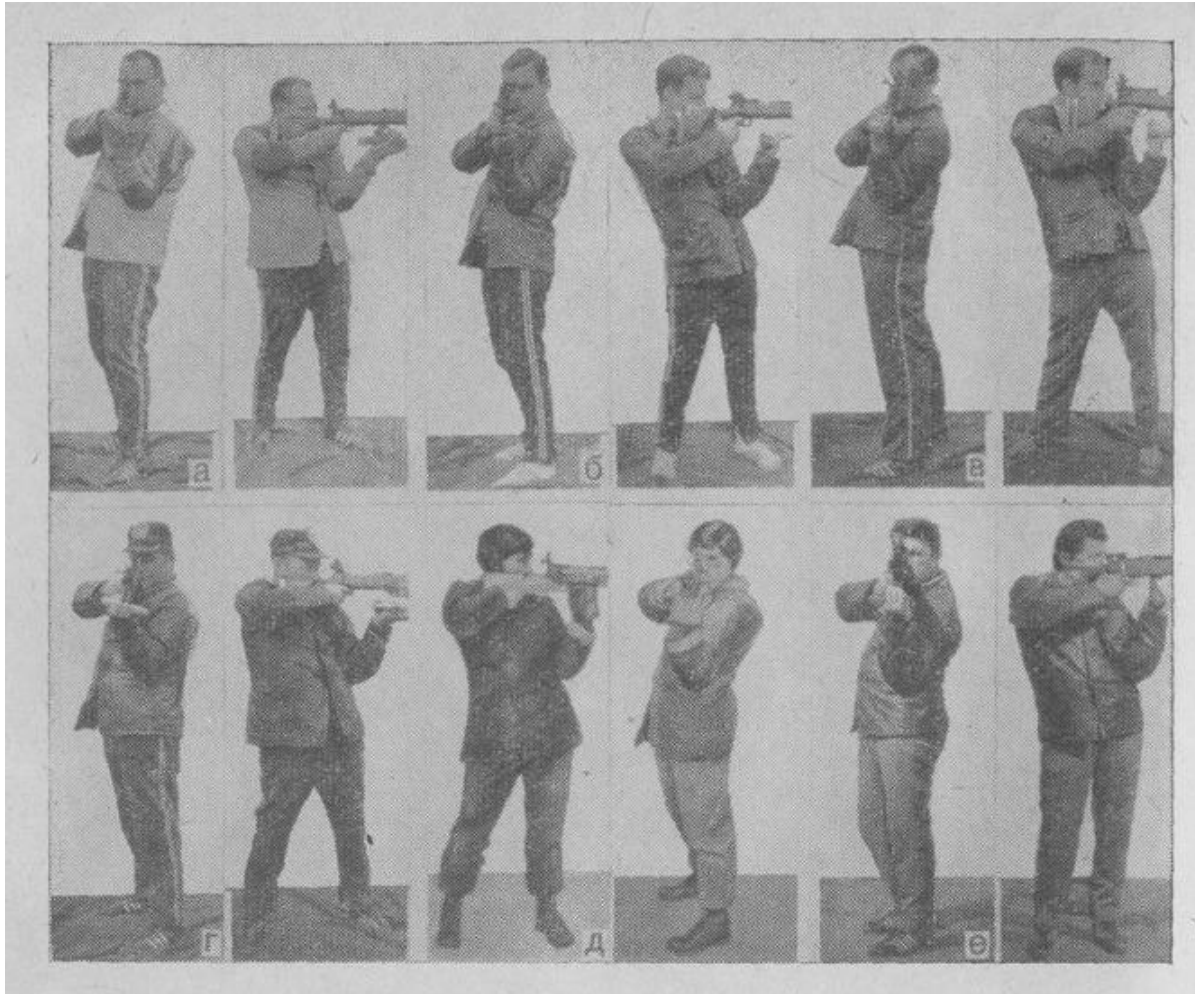


Fig. 143 - Standing shooting position (side view) of leading foreign athletes in 1972:

a - D. Foster (USA); *b* - D. Basham (USA); *c* - D. Reiter (USA); *d* - D. Wiger (USA);
d - M. Thompson (USA); *e* - P. Sandor (Romania).



Fig. 144 - Standing shooting position (side view) of leading foreign athletes in 1972:

a - G. Kusterman (FRG); б - B. Klinger (FRG); в - R. Poer (Czechoslovakia);
 г - W. Rülle (FRG); д - E. Vogt (Switzerland); е - E. Bürgen (Switzerland).

Let us now follow the changes that have occurred in the stance of some leading shooters. From Fig. 145 it is evident that the shooters' stance mainly undergoes changes in the direction of an even greater bend of the body in the back and to the right and sideways, a freer, more natural position of the head and a decrease in the tension of the neck muscles, as well as relaxation of the muscles of the right part of the shoulder girdle - due to a greater lowering of the hook of the back of the head and the use of a freer support, accompanied by a lowering of the elbow of the right arm down. If we add to this the previously noted desire of many shooters to give the forearm of the left hand an even more vertical position, so that the left hand as a whole better performs the role of support for the rifle and its muscles are less tense, then all this taken together consti-

tutes those fundamental changes that occur in the stance for shooting while standing.

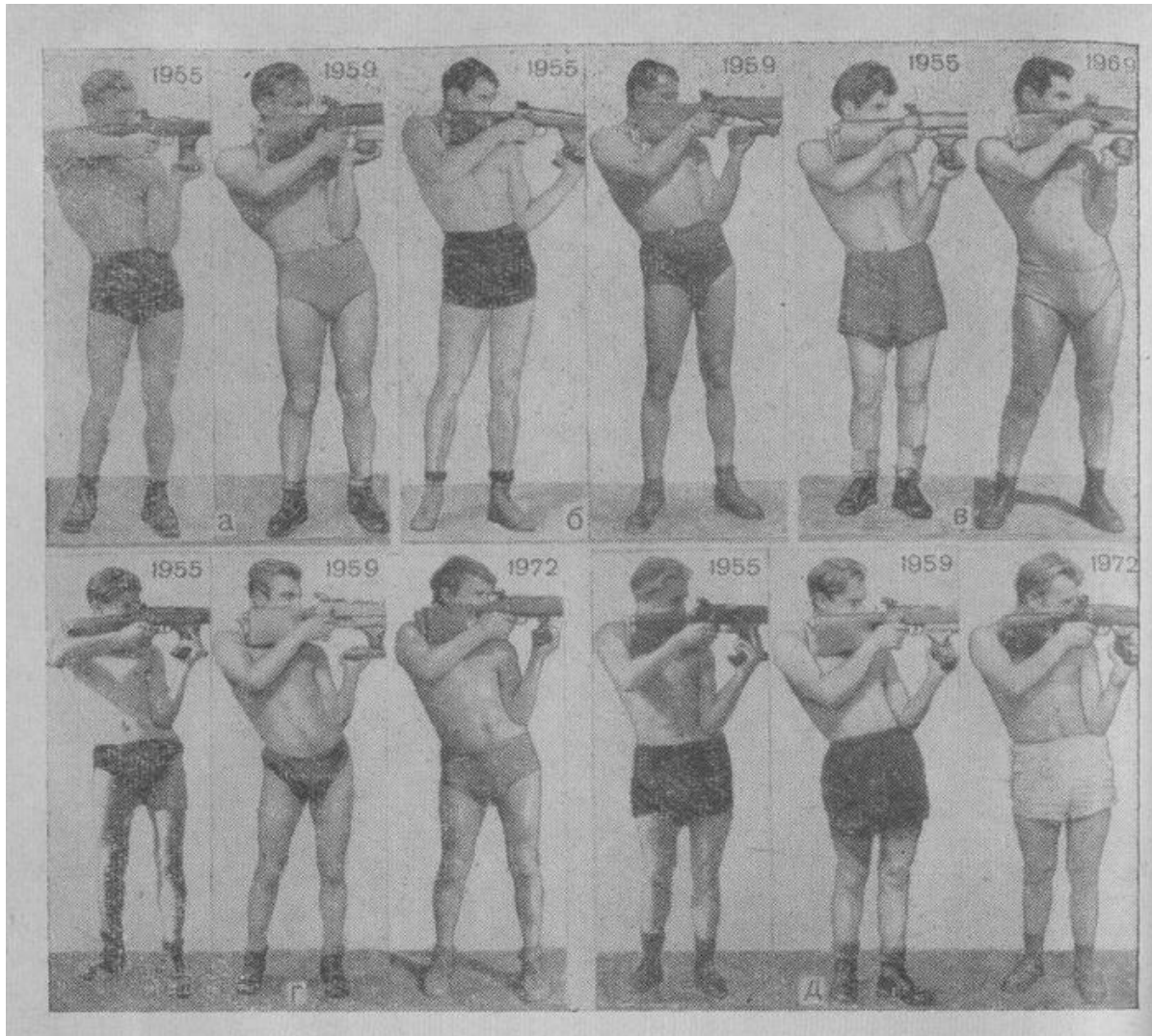


Fig. 145 - Examples of changes occurring in the standing shooting position of famous athletes as their athletic skills grow: *a* - A. Bogdanov; *b* - M. Itkis; *c* - Sh. Kveliashvili; *d* - S. Evdokimov; *e* - V. Belokurov.

Of course, the process of readjusting the position will always occur, since further progress is unthinkable without searching for the best. If any shooter analyzes both his position and his shooting technique, he will certainly find a number of "little things" that to some extent prevent him from improving his sports results. Elimination of individual shortcomings and unsuccessful shooting techniques is one of the potential opportunities that a shooter has in further improving his sports skills.

Above we have considered some variants of the leading shooters' stance and the changes that have occurred in it in recent years. Based on this data, we can conclude that at present the stance for shooting standing up should be distinguished by a not very wide placement of the legs, orientation of the support surfaces along the plane of shooting, a significant bend of the body in the back due to the pelvis being brought forward, a large compensatory movement of the body to the right and sideways, a certain "twisting" of the body in the lower back, the most vertical position of the left forearm, a free position of the head with minimal tension in the neck muscles, a not very tight butt and the greatest possible relaxation of the muscles of the right part of the shoulder girdle.

It is on this fundamental basis that young shooters should search for the most advantageous shooting position for themselves while standing.

Shooting position for the "Running Deer" and "Running Boar" targets

The position for shooting at these moving targets is significantly different from the normal standing position used in slow target shooting.

If in the usual position for shooting while standing the shooter should strive to achieve the greatest immobility of the rifle, practically not limiting himself to the time for making each shot, then the position for shooting at the "Running Deer" and "Running Boar" should allow the shooter to smoothly lead (move) the rifle horizontally, that is, to follow the moving target and maintain a lead between the "level front sight" and the target by a certain amount. At the same time, unlike the usual slow shooting, it is necessary to make one or two shots at the "deer" in a short period of time, since the target moves and is visible in the run window for only 4 seconds, and the "boar" when running at low speed - 5 seconds, and at high speed - only 2.5 seconds.

Consequently, the position for shooting standing at moving targets must satisfy the basic requirement - to ensure a short-term smooth

horizontal movement of the rifle in both directions of the target's movement (right and left). This requires a completely different, fundamentally different scheme of the muscular system's work compared to the position for ordinary sport shooting.

Smooth slewing of the rifle is possible, naturally, with a smooth rotational movement of the body around its longitudinal axis, which, in turn, is possible only if the muscles that perform the rotation contract and stretch freely, without encountering much, excessive resistance and inhibition. Therefore, unlike the usual position for shooting while standing, which provides for rigid fixation of the joints, when stance for shooting while standing at moving targets, it is necessary to strive to ensure that the body links moving relative to each other are not very rigidly fixed in the joints, and primarily in the ankles, knees and hips. The shooter's choice of a particular pose during stance must be subordinated to satisfying these requirements.

To give the body the necessary flexibility, and therefore to ensure smooth rotational movement of the body when guiding the rifle, one must try to keep it straight, with the least compensatory movement to the side and bending in the back; in a straightened position, the body will not be rigidly fixed in the lower back (hip joints).

At the same time, there is no need to worry that holding the rifle will cause great tension in the muscles of the back and shoulder girdle: due to the short-term nature of aiming and firing, such short-term muscle tension cannot significantly affect the stability of the rifle.

But with the body straightened, the rifle's center of gravity is at a considerable distance from the vertical of the body's center of gravity. Therefore, maintaining the conditions of equilibrium of the shooter's body with the rifle requires, first of all, an increase in the support area. This is all the more necessary in connection with the fact that when a target appears, the shooter has to quickly raise the rifle and aim it, changing the initial position to the ready position for shooting, which is accompanied by a quick and sharp movement of the body (Fig. 146).

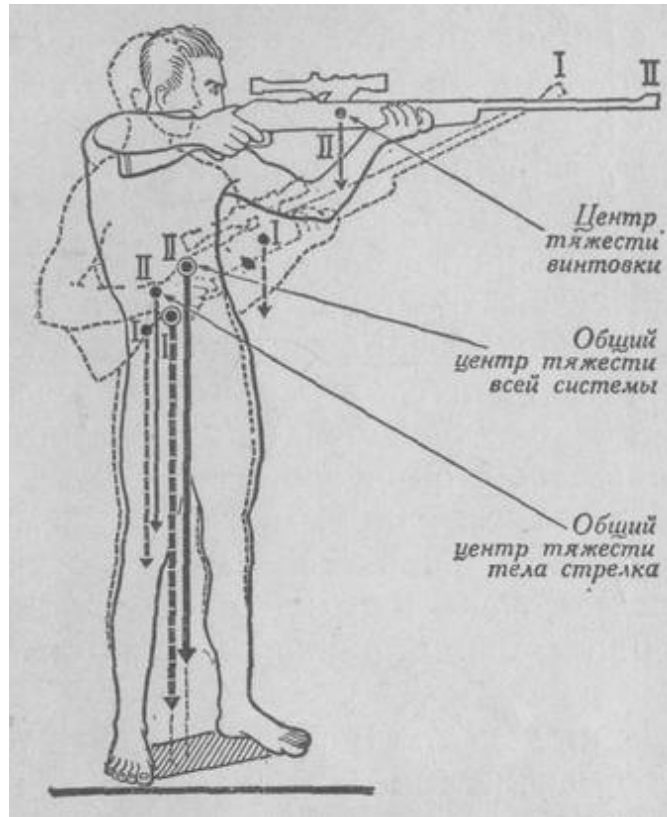


Fig. 146 - Shifting the overall center of gravity during quick "snap" application

The most stable and comfortable position is one in which the feet create a support area in the form of a trapezoid, formed by their arrangement in which the distance between the feet is equal to or greater than the width of the shoulders: in this case, as practice has shown, the foot of the left leg should be to the left of the shooting plane, and the foot of the right leg should be crossed by the shooting plane approximately in the middle or by one third - closer to the heel (Fig. 147).

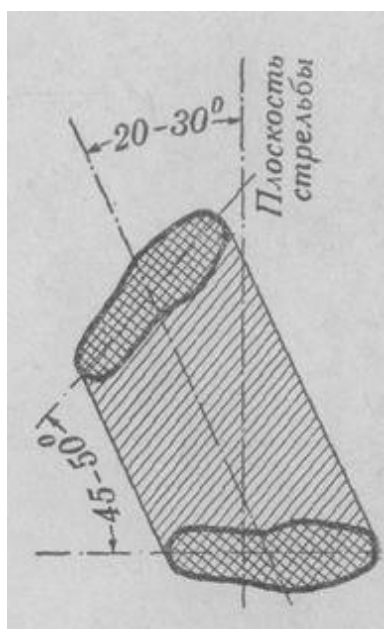


Fig. 147 - The relative position of the supporting surfaces of the body - the feet of both legs, limiting the support area when ready to shoot standing at the "Running Deer" and "Running Boar" targets

This position of the legs creates a fairly large support area, which allows the shooter to better maintain balance when guiding the rifle. In addition, the position of the legs not along the plane of shooting, but with a turn to it at an angle of 25-30° eliminates the preliminary "twisting" of the body, due to which the body in the lower back (in the hip joints) will not be rigidly fixed by excessive muscle tension and ligament tension. At the same time, the shooter can equally successfully guiding the rifle in both directions - both to the right and to the left.

The "power scheme" of the standing position for shooting at moving targets includes a larger group of tense muscles than in the usual position for slow shooting while standing, since it also includes muscle groups of both arms and muscles that strengthen the shoulder girdle, which is associated with the need to support the rifle at weight and tightly.

The left arm supporting the rifle should be bent at the elbow so that the shoulder and forearm form an obtuse angle. The elbow should be pulled forward from the body and be significantly to the left of the shooting plane (Fig. 148-149). This makes the "rifle - body - left arm" system more rigid. The elbow should not be pulled excessively to the left, as the rifle will "peck" downwards and fall through;

if, on the contrary, the left elbow is placed closer to the shooting plane, more vertically, the rifle will jump up in sharp jerks during the lead.

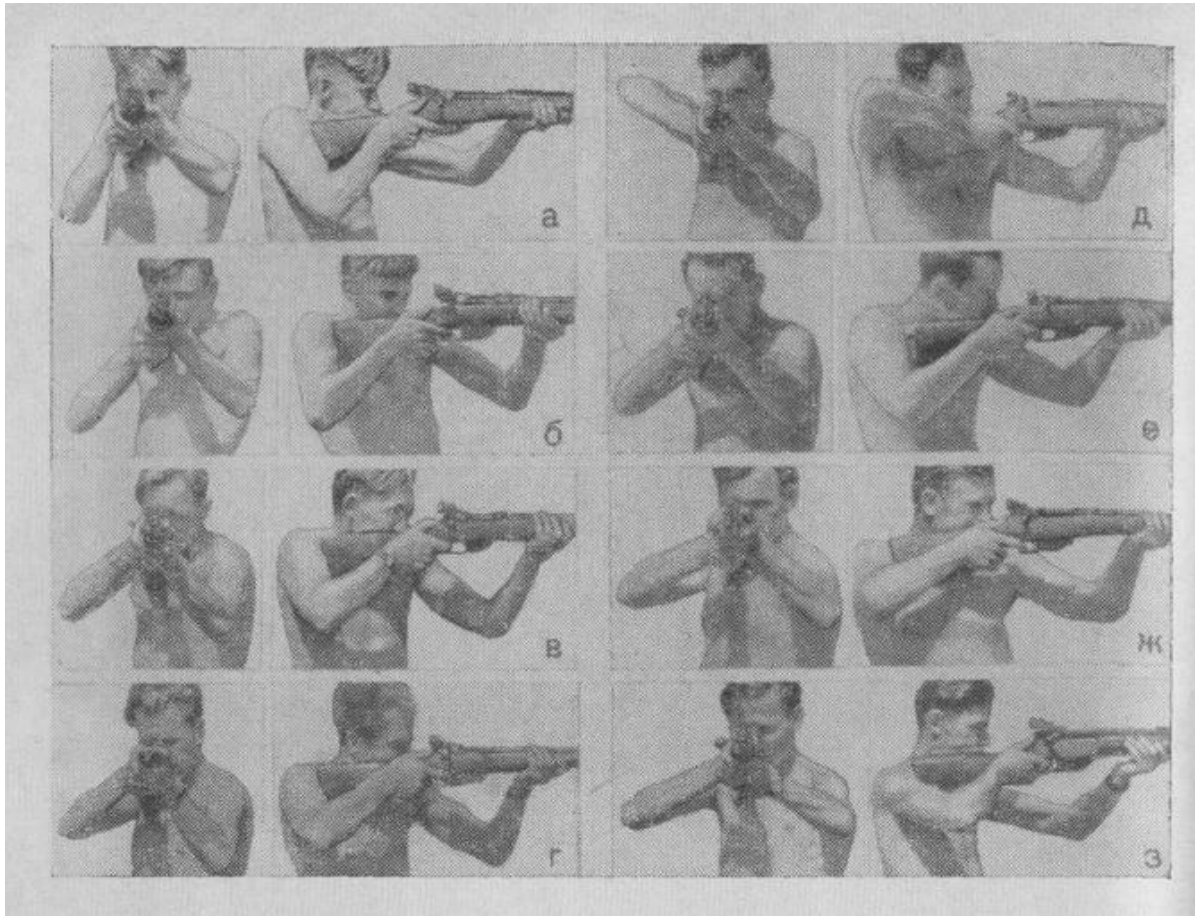


Fig. 148 - Hand position of leading athletes when ready to shoot at the Running Deer target, 1958-1961.

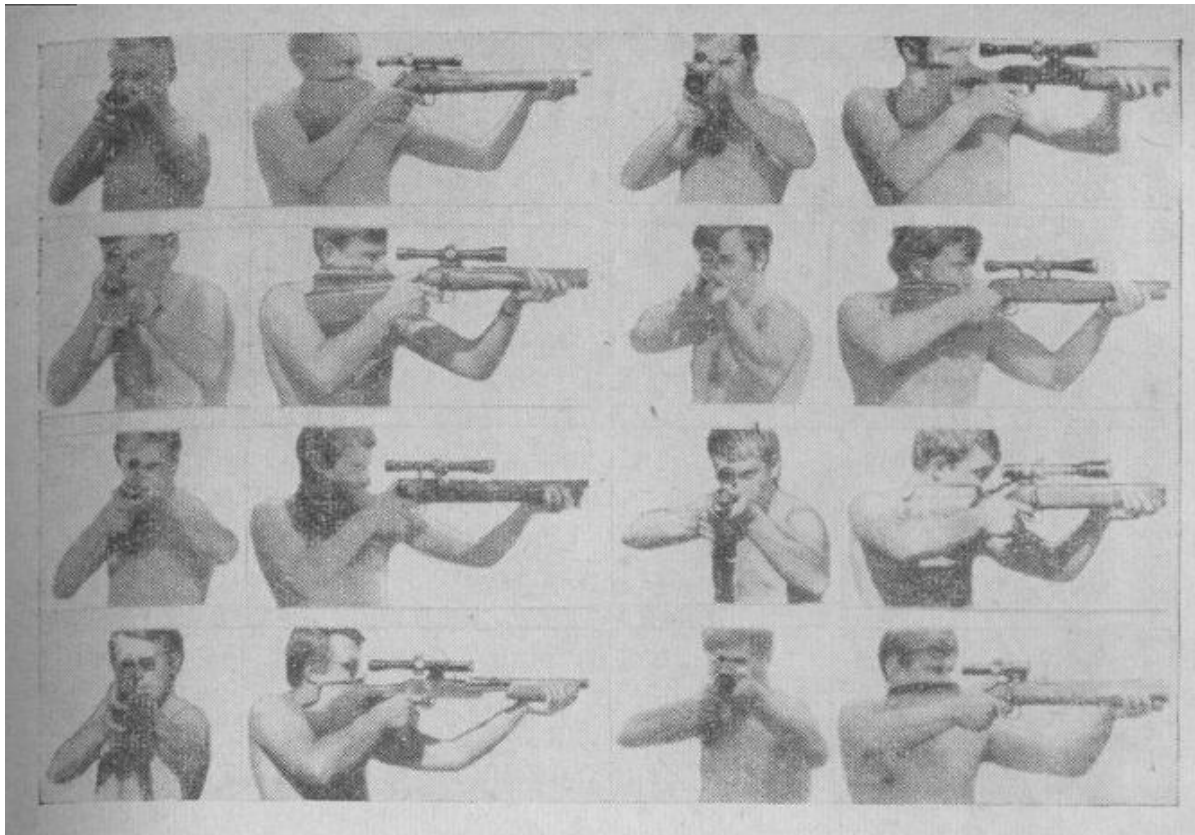


Fig. 149 - Hand position of leading athletes when ready to shoot at the "Running Boar" target, 1971-1972.

The left hand should not grasp the rifle fore-end too tightly, using all fingers; the rifle should be supported so that it rests not on the fingers, but on the palm. When grasping the fore-end, the hand should not be extended too far forward, since with an excessively extended left hand, the vertical oscillations of the rifle increase, the same will happen with a close grasp of the fore-end. The left hand, especially when shooting from a rifle with a movable fore-end, should perform the work mainly of holding the weapon in a horizontal position, but at the same time slightly pressing the rifle to the shoulder. If the left hand presses the rifle to the shoulder with force, then the smoothness of the leash will be disrupted - it will move jerkily and with vertical oscillations during the leash.

The head should be held so that the cheek is pressed tightly against the comb of the butt; with this position of the head it is much easier to achieve uniformity in the butt. At the same time, fixing the butt with the cheek should be achieved with the slightest tilt of the head; its position should be as natural as possible. Therefore, you should not stretch your head forward or tilt it back exces-

sively, so as not to create unnecessary tension in the neck muscles.

The butt should be tight. To do this, the right hand should press the butt firmly against the shoulder notch (Fig. 150): the rifle should be held in a horizontal position mainly with the right hand and cheek, pressed tightly against the comb of the butt.



Fig. 150 - Position for shooting at the "Running Deer" and "Running Boar" targets (top view) and the diagram of the relative positions of the feet of both legs

The right arm should be held half-lowered so that it is at an angle of 30-50° to the body. This position of the arm is due to the fact that it ensures not only uniform and quick aiming, but also quick reloading of the rifle (when shooting double shots at the "Running Deer" target) with economical movements of only one forearm.

The ability to perform such work with the right hand also requires a tight grip on the buttstock: a tight grip allows you to quickly and

confidently insert the buttstock and firmly rest it against your shoulder.

Due to certain specific features of performing exercises when shooting at the "Running Deer" and "Running Boar", when in one case it is necessary to make single and double shots, and in the second - to shoot at a target moving at different speeds - low and high, below we will separately consider some elements of the position for shooting while standing at various moving targets.

When preparing to shoot at the Running Deer target, a tight butt position takes on special significance, since shooting is carried out with double shots (doublet), when it is necessary to quickly reload the rifle without lifting the butt from the shoulder, since two shots must be fired within 4 seconds.

The grip of the buttstock with the right hand should not interfere with the rapid reloading of the rifle when firing double shots; therefore, it is desirable that when gripping the buttstock, the thumb should lie not across, but along the buttstock (see Fig. 148).

When positioned for shooting at the "Running Boar" target, the angular speed of rotation of the body is different, which leaves its mark on the shooter's position. If, when shooting at a "deer" and "boar" at a low speed of movement, the rifle is held mainly with the right hand and cheek, tightly pressed to the butt, and the left hand mainly only supports the weapon, then when shooting at a "boar" at a high speed of movement, a more collected position is needed, distinguished by greater rigidity in fixing individual links; with this type of shooting, the left hand must not only support the rifle to maintain its horizontal position when aiming, but also to a certain extent press the butt to the shoulder.

The right hand should grasp the buttstock tightly, squeezing it firmly with all fingers (except the index finger, which lies on the trigger) (see Fig. 149).

The correctness of the adopted position in relation to the target is verified somewhat differently than in normal slow shooting. In order to position correctly, the shooter must orient the "level front sight" in the direction of the middle part of the open section (running win-

dow) of the combat shaft, and then smoothly move the rifle in both directions - to the right and to the left. If it is discovered that the movement in both directions is not done with equal ease, it is necessary to move the feet of both legs at a certain angle.

These are the general requirements for a typical shooting position for the "Running Deer" and "Running Boar" targets.

Let us now consider the position of leading athletes in this type of shooting, and first of all the "footprints" - the position of the standing feet (Fig. 151).

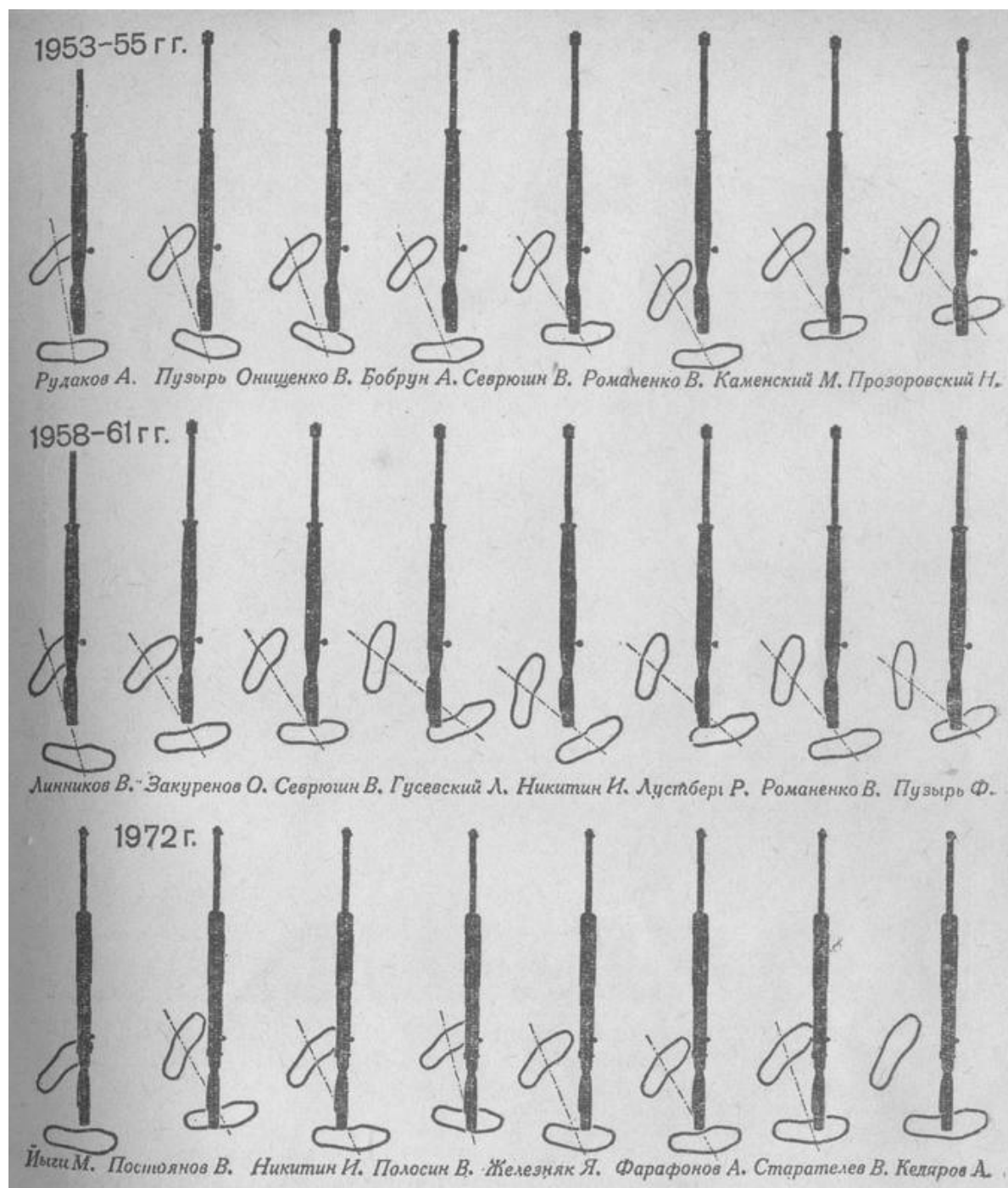


Fig. 151 - "Traces" - the relative position of the legs and the rifle when leading athletes are ready to shoot at moving targets

The stance of leading shooters in the period 1953-1955 is generally characterized by a small angle of rotation of the body relative to the target (on average 25-30°). In those years, shooting at the "Running Deer" was still a new exercise for us, the technique of performing it had not yet been sufficiently studied and mastered. The ranks of the "deer shooters" were replenished mainly with

shooters - in the recent past, standardists. Naturally, not having sufficient experience in conducting such an unusual shooting at that time, the former standardists could not completely abandon the usual position for slow shooting while standing, which to one degree or another left its mark on the new type of stance.

The stance of leading athletes from 1958-1961 is distinguished by a greater turn of the feet relative to the target (on average, the angle of turn is 40-45°). In search of a more advantageous stance, athletes followed the path of creating more favorable conditions for a smooth leash of the rifle to the right and left. To do this, it was necessary to loosen the body in the hip joints, that is, to use a stance with a straightened body and without preliminary "twisting" it in the lower back. Of course, such stance options were a big step forward compared to the previous ones.

The leading athletes of the period 1971-1972 again switched to using a stance with a small angle of rotation of the feet relative to the target (on average, the angle of rotation was 25-27°). At first glance, it may seem that there has been a return to the old, outdated, stance scheme of the 1950s. But this is not so at all: if you judge not only by the "traces", but also look closely at other elements of the stance (see Fig. 148, 149, 152, 153), then it is clear that in terms of its perfection and refinement it cannot be compared with the old versions. In this case, reducing the angle of rotation of the feet is a natural process of further improvement of the stance, aimed primarily at creating favorable conditions for performing new exercises - shooting at the "Running Boar" target.

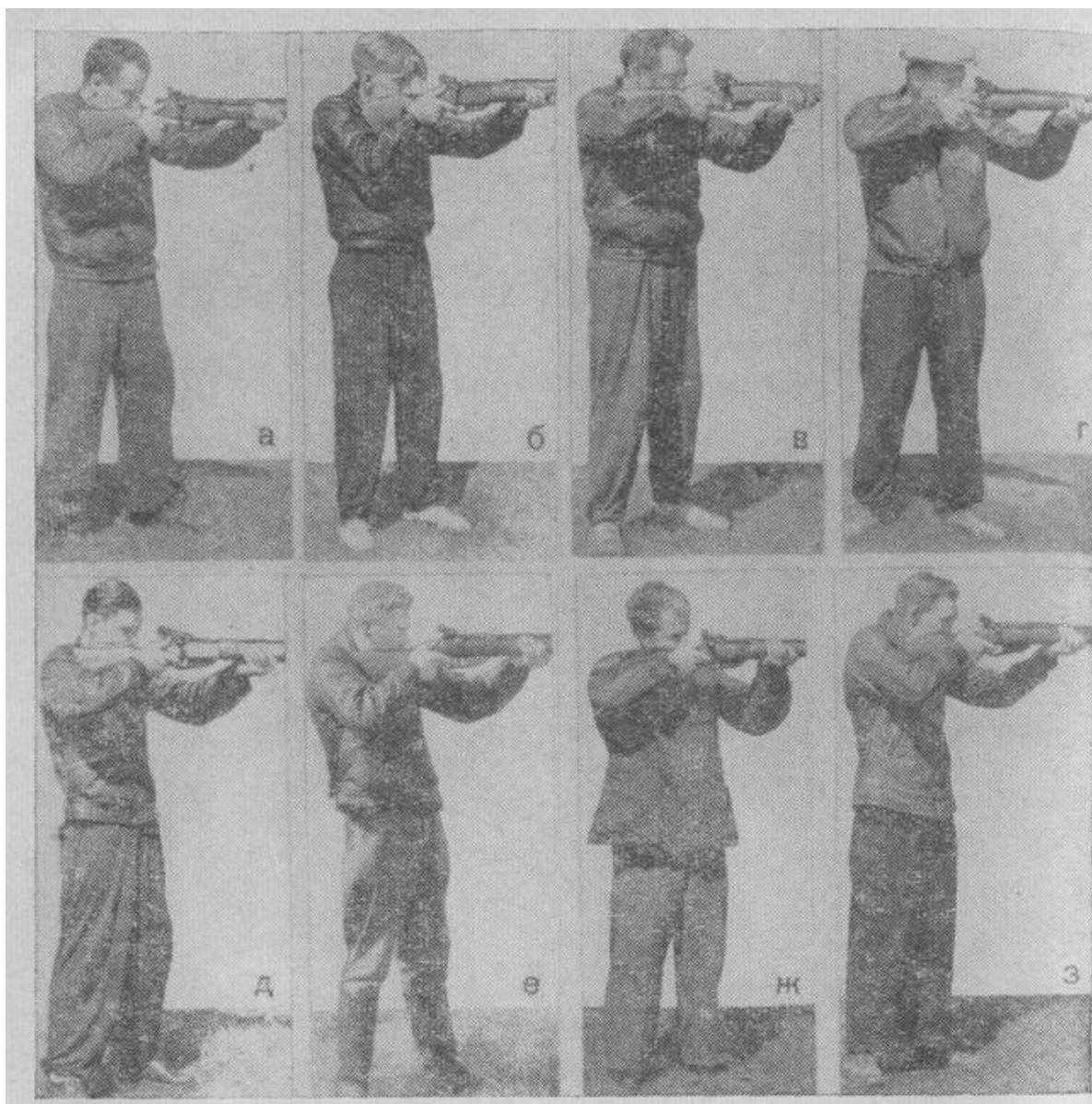


Fig. 152 - Leading athletes positioned for shooting at the "Running Deer" target (side view), 1955-1961:

a - V. Romanenko; *b* - I. Nikitin; *c* - O. Zakurenov; *g* - V. Linnikov; *d* - L. Gusevsky; *e* - R. Lustberg;
g - V. Sevryugin; *h* - V. Sokolov.

If when shooting at a "deer" it is allowed to raise the rifle and start aiming at the antlers visible behind cover, then when shooting at a "wild boar", especially at high speed, the shooter has significantly less time to perform the same actions; in this regard, the position must have greater stability in the direction of the plane of fire, greater composure and rigidity of the "rifle - body - left hand" system. The position will meet these requirements if the center of gravity of the rifle is brought closer to the midline of the body, for

which it is necessary to stand more sideways to the target. The transition to such a position occurred also because many "deer hunters" began to use a rifle with a movable fore-end, which is much easier to reload if you stand more sideways to the target.

Fig. 153 and 154 show the stance variations of the leading Soviet and foreign sportsmen of the present time. Comparing them, it is easy to notice that all these shooters, as a rule, hold their torsos straight, thus achieving the least rigid fixation of the movable parts of the body in the ankle, knee and hip joints. Most shooters do not extend their left arm very far forward; almost all grasp the rifle with their left hand in the same way. The left elbow, as a rule, is located significantly to the left of the shooting plane. The almost identical positioning of the head, distinguished by the tight resting of the cheek on the butt, attracts attention. The grip of the rifle with the right hand is also uniform: when shooting at the "Running Deer" target, almost all shooters place their thumb along the neck of the butt, which allows for faster reloading of the rifle.

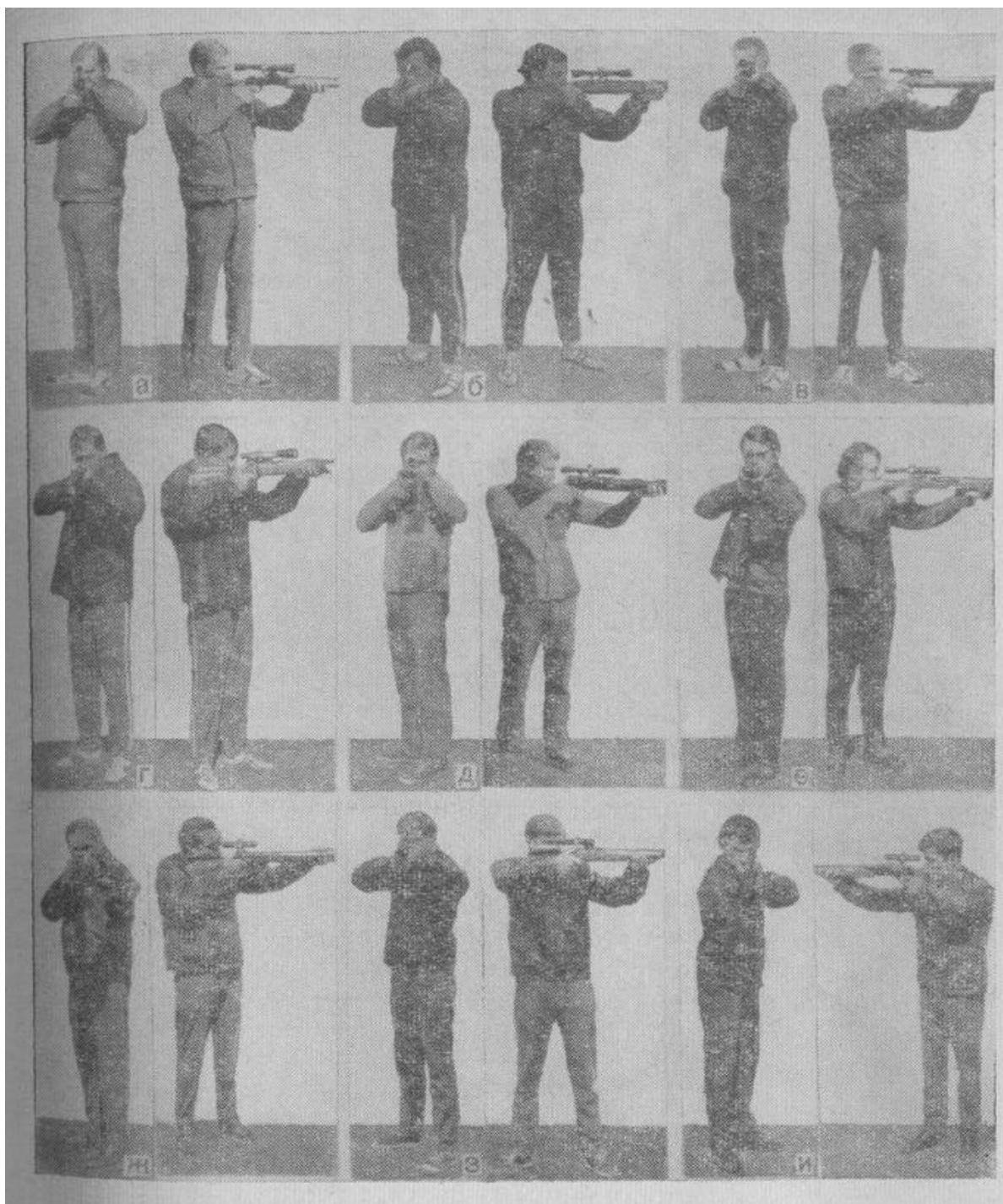


Fig. 153 - Leading athletes positioned for shooting at the "Running Boar" target (front and side views), 1971-1972:

a - V. Postoyanov; *b* - Ya. Zheleznyak; *c* - I. Nikitin; *g* - A. Kedyarov; *d* - V. Polosin; *e* - M. Jõgi; *g* - A. Butsis;
h - A. Farafonov; *i* - G. Tavdidishvili.

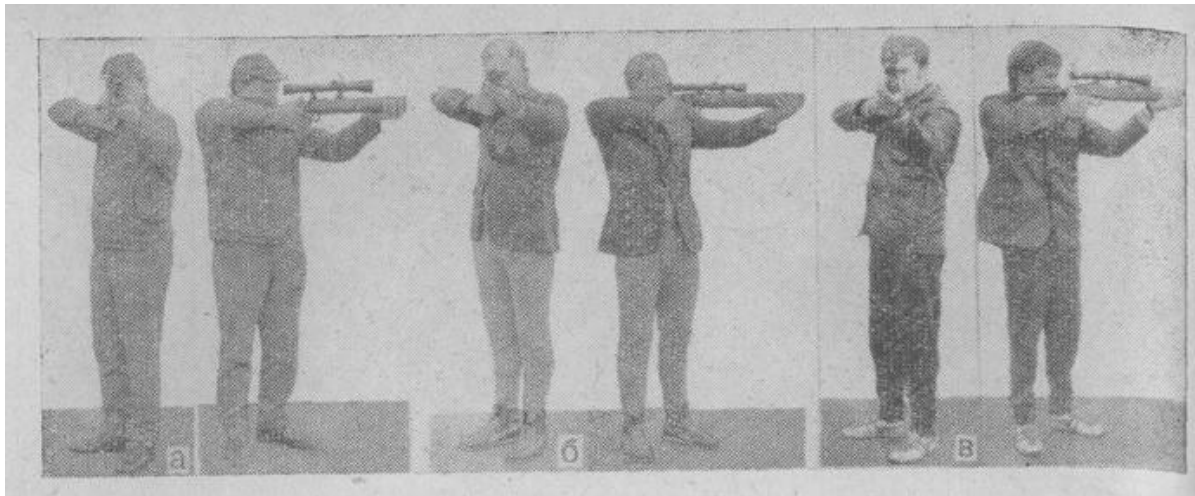


Fig. 154 - Leading foreign athletes preparing for shooting at the "Running Boar" target, 1972:

a - G. Gaard (Sweden); b - K. Karlsson (Sweden); c - D. Szabo (Hungary).

If we summarize everything that has been said previously regarding the changes that have occurred recently in the stance of leading shooters at moving targets, we can say that they mainly occur in the direction of reducing the angle of rotation of the body relative to the target, caused by the desire to increase the stability of the stance in the direction of the shooting plane and to create a more rigid attachment of the left hand to the rifle and the body.

Having examined the position of leading shooters at the "Running Deer" and "Running Boar" targets, the most promising options should be considered to be those characterized by: a slight turn of the body to the left relative to the plane of shooting; a straightened body with a minimal movement of the torso to the back; a tight grip of the buttstock with the right hand; a tight butt; general composure due to the tension of the back and shoulder girdle muscles.

These are the basic conditions that young shooters should be guided by when searching for the most advantageous position for themselves.

3.1.4 Types of preparation for shooting from a pistol (revolver)

Slow firing position for a pistol (revolver)

The position for shooting a pistol (revolver) has a number of fundamental differences from the position for shooting a rifle. If when shooting a rifle, the stability of the weapon is to some extent achieved by the shooter resting the hand supporting the weapon on the ground, knee or body, then when shooting a pistol (revolver) there is no possibility of using any support: the weapon must be held suspended, in a freely extended hand. In addition, if when shooting a rifle the shooter performs all actions with two hands - one supports the weapon, and the other pulls the trigger, then when shooting a pistol (revolver), supporting the weapon and pulling the trigger are done with the same hand.

The difficulty of choosing a position that creates the greatest immobility of the weapon is primarily due to the fact that holding an outstretched arm with a pistol in the air requires significant muscle tension, the action and reaction of which in itself can no longer ensure the immobility of the system consisting of an arm with a load (pistol), in connection with which the weapon with the arm experiences more or less oscillation.

In addition, when holding the pistol in the air, the trigger must be pulled with the index finger of the same hand, which is why the finger flexor muscles can move the hand from its motionless position and displace the weapon. Therefore, in search of the most advantageous and stable position in general, the shooter should be guided by the following:

- 1) holding an outstretched arm with a weapon must be achieved by engaging the most powerful muscle groups that secure the movable links of the arm in the joints; by creating favorable conditions for the work of these muscles;
- 2) the relative position and degree of fixation of individual links of the right hand should be such that the most favorable conditions

will be created for the isolated work of the muscles - the flexors of the index finger when pressing the trigger (without involving other muscle groups in this work that can move the weapon).

Considering the primary importance of fixing the outstretched arm with a load (pistol) in the shoulder joint, let us consider two options for loading and working the muscles that fix the arm.

Let us assume that the shooter takes away (raises) the arm with the load (pistol) with a simple and natural movement to the level of the eyes and fixes it in this position, trying to keep the body straight (Fig. 155). The fixation of the arm in the shoulder joint, as is known, is achieved by the static work of the deltoid, supraspinatus, infraspinatus muscles and the upper bundles of the pectoralis major muscle (see Fig. 100). Considering that the general center of gravity of the arm with the pistol is at a significant distance from the place where the arm is fixed - the shoulder joint, the muscles have to counteract a large moment of forces tending to lower the arm with the pistol. In this case, these muscles perform a lot of static work, being in a shortened state, that is, being placed in the most unfavorable conditions. In addition, when holding the arm in this position, significant work is also performed by the muscles that strengthen the scapula - the rhomboid, trapezius, anterior serratus, etc.

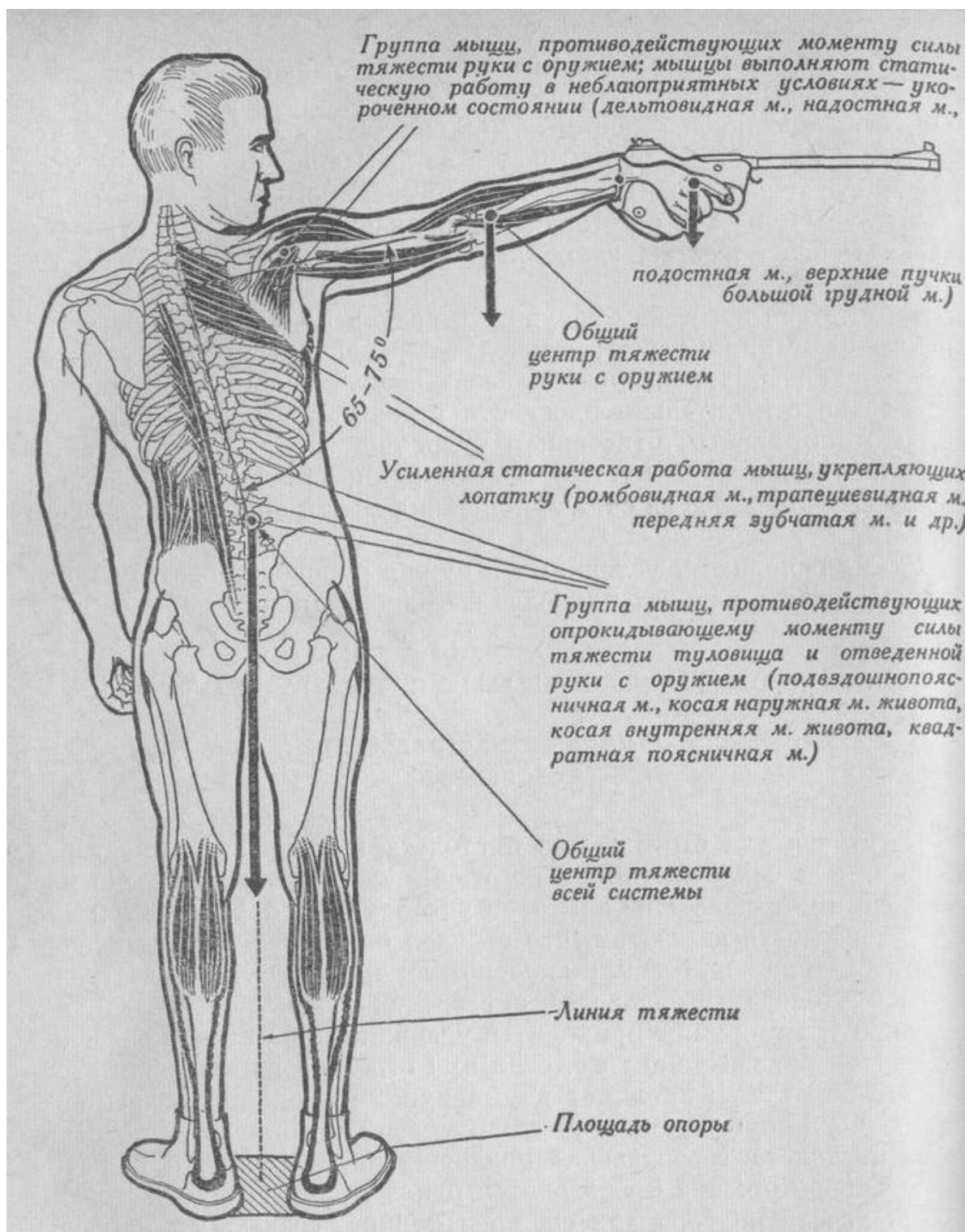


Fig. 155 - Scheme of the position with the shooter's body excessively straightened

At the same time, holding the body in a straight position with a rigidly fixed arm requires tension in the back muscles to counteract the significant moment of gravity of the arm with the weapon, which tends to tip the body to the right and sideways.

Let us now assume that the shooter, when ready, leans his body to the side opposite to the outstretched arm (Fig. 156). In this case, the arm is better secured in the shoulder joint by the deltoid, supraspinatus and infraspinatus muscles, since they perform static work while in a stretched state, that is, they are placed in the most advantageous conditions (see p. 103). It is quite obvious that in such a pose it is much more advantageous to secure the arm in the shoulder joint. In this case, the muscles that strengthen the scapula will also be much less tense (see p. 109). Naturally, the tension in the back muscles that counteract the tilt of the body is also reduced, since the compensatory movement of the body to the left balances the weight of the outstretched arm with the weapon.

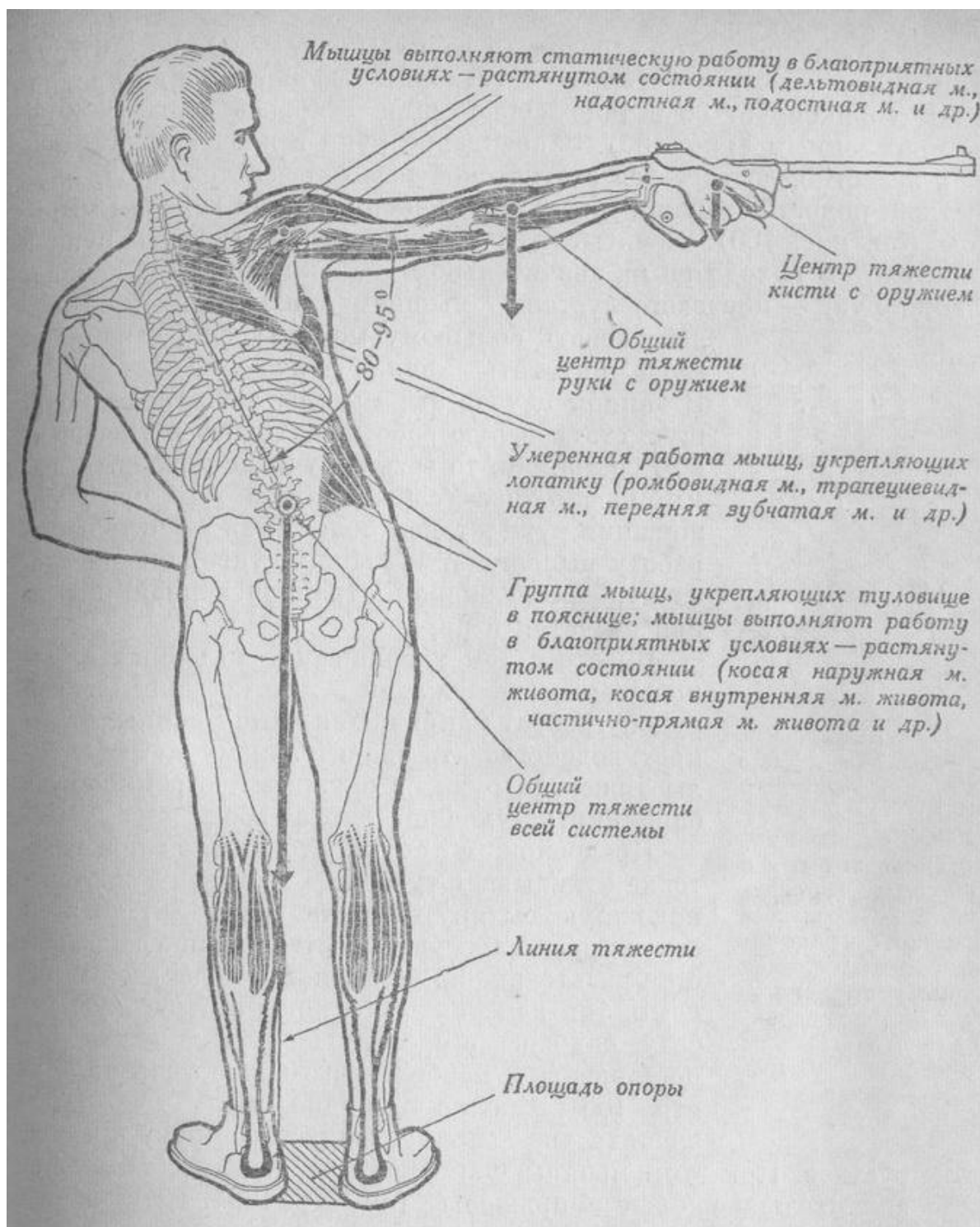


Fig. 156 - Scheme of preparation when moving the body to the left and side

These circumstances predetermine the generally asymmetrical pose of the shooter when ready to fire a pistol, characterized by a bend in the body with the torso shifting to the left.

The stability of the stance as a whole, as in shooting standing from a rifle, largely depends on the correct mutual arrangement of the supporting surfaces of the body - the feet of both legs. The most stable and at the same time comfortable stance is one in which the distance between the feet is approximately equal to or slightly narrower than the width of the shoulders, and the feet are naturally spread apart without tension. In this case, you should stand with your right side to the target with a small angle of rotation of the body to the right in relation to the plane of shooting (Fig. 157).

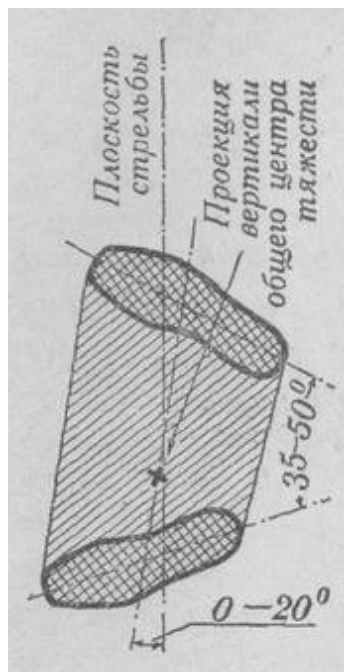


Fig. 157 - The relative position of the support surfaces - the feet of both legs, limiting the support area when prepared for slow shooting from a pistol (revolver)

In addition to the size of the body support area, the stability of the stance depends on the location of the overall center of gravity of the shooter's body with the weapon over the support area. Due to the fact that when stanced for shooting a pistol, a significant compensatory movement of the torso to the side is dictated not so much by the need to balance the extended arm with the weapon, but by creating favorable conditions for the work of the muscles to secure the scapula and arm in the shoulder joint, the overall center of gravity of the system should be located slightly to the left of the support area. Therefore, in order for the stance to be correct and sufficiently stable, the shooter should, with the torso tilted to the left, distribute the overall weight of the system so that a slightly

greater load falls on the left foot; in addition, the load falling on each leg should be in the middle of the foot or slightly closer to the toes. The shift of the overall center of gravity slightly to the left over the support area, in fact, dictates a wider spacing of the legs compared to the stance for shooting standing with a rifle.

In order to keep the shooter's body in a standing position with the least expenditure of muscular effort, when preparing to shoot a pistol, the body should be slightly tilted back and the pelvis should be pushed forward (see p. 101). This will create the most favorable conditions for securing the shooter's body in the leg joints.

As with shooting standing from a rifle, you should not intentionally relax the muscles that fix the knee joints. At the same time, you should not hyperextend your legs at the knee joints, straightening them to failure. It is also not recommended to create different tensions in the muscles that fix the knee joints - keep one leg straight and the other relaxed: this does not contribute to the coordinated work of the muscles to maintain balance of the body, which inevitably causes the shooter to sway significantly.

Let us now consider the position of the right hand (Fig. 158). As the long-term practice of the best shooters has shown, high results in pistol and revolver shooting can only be achieved with a fully straightened arm. This is dictated not only by the need to maintain a constant, identical distance between the shooter's eye and the sighting devices, that is, to create conditions for uniform aiming: with a straightened arm, due to the structural features of the elbow joint, the movable links - the forearm and shoulder - are more rigidly fixed to each other and the arm becomes as if one whole, which helps to reduce the oscillation of the weapon. A straightened arm resists the recoil of the weapon much better and more uniformly, due to which the angle of departure during recoil becomes more stable, which increases the accuracy of shooting.

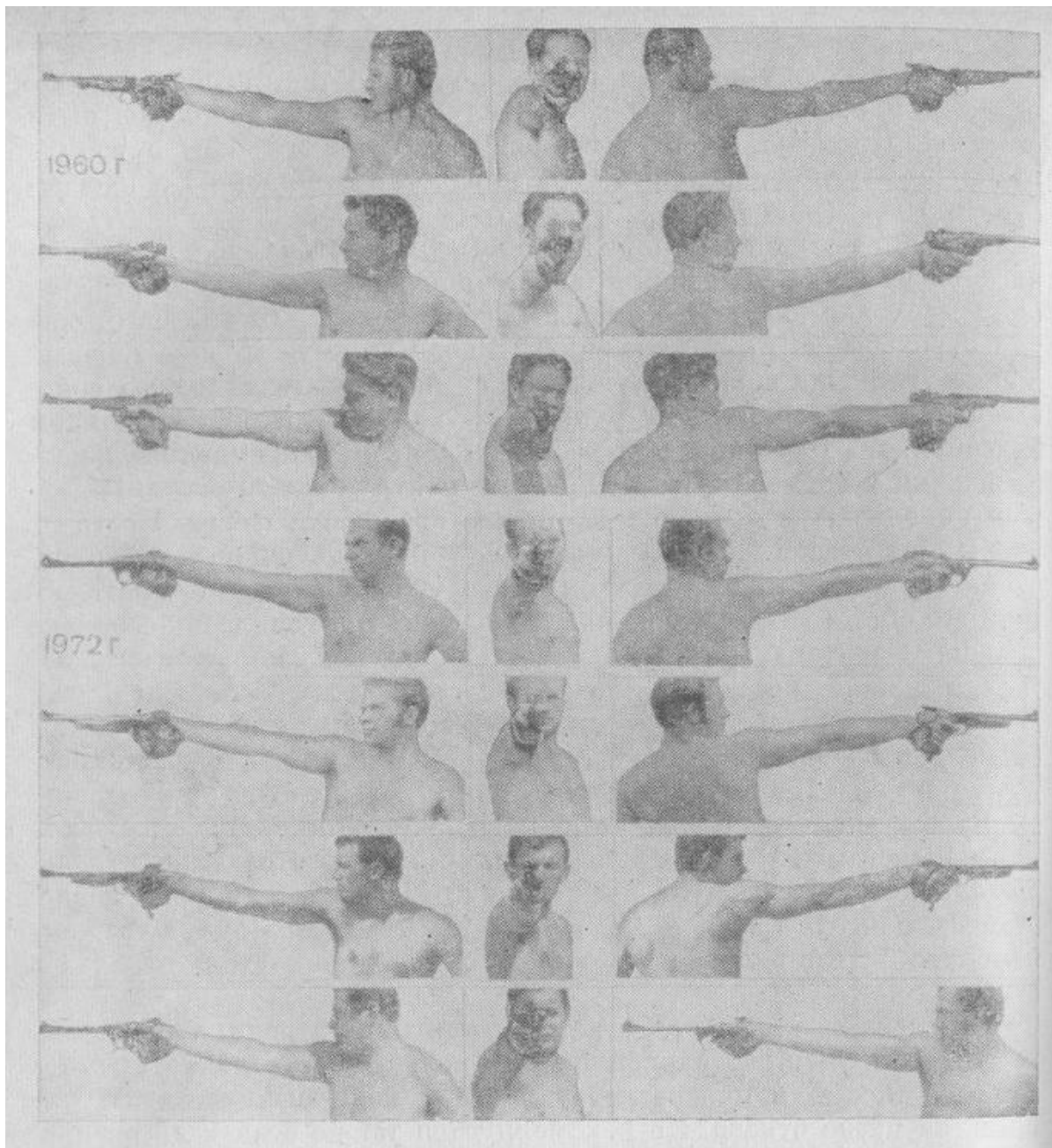


Fig. 158 - Position of the right hand and head position of leading athletes when shooting from a free pistol

The right straight arm, as practice in recent years has shown, is best held so that it is slightly to the left of the shoulder line (see Fig. 163). With this position of the arm relative to the body, fairly favorable conditions are created for the static work of all parts of the deltoid muscle (see Fig. 100).

The grip, that is, the way the hand holds the pistol or revolver handle (see Fig. 159-162), is of great importance: the slightest changes in the force of the fingers gripping the handle, the depth of

the grip in the hand, the position of the fingers and palm in relation to the handle - will immediately and most negatively affect the accuracy of shooting. That is why some experienced shooters say that a well-practiced and uniform grip is half the success in shooting from a pistol and revolver.

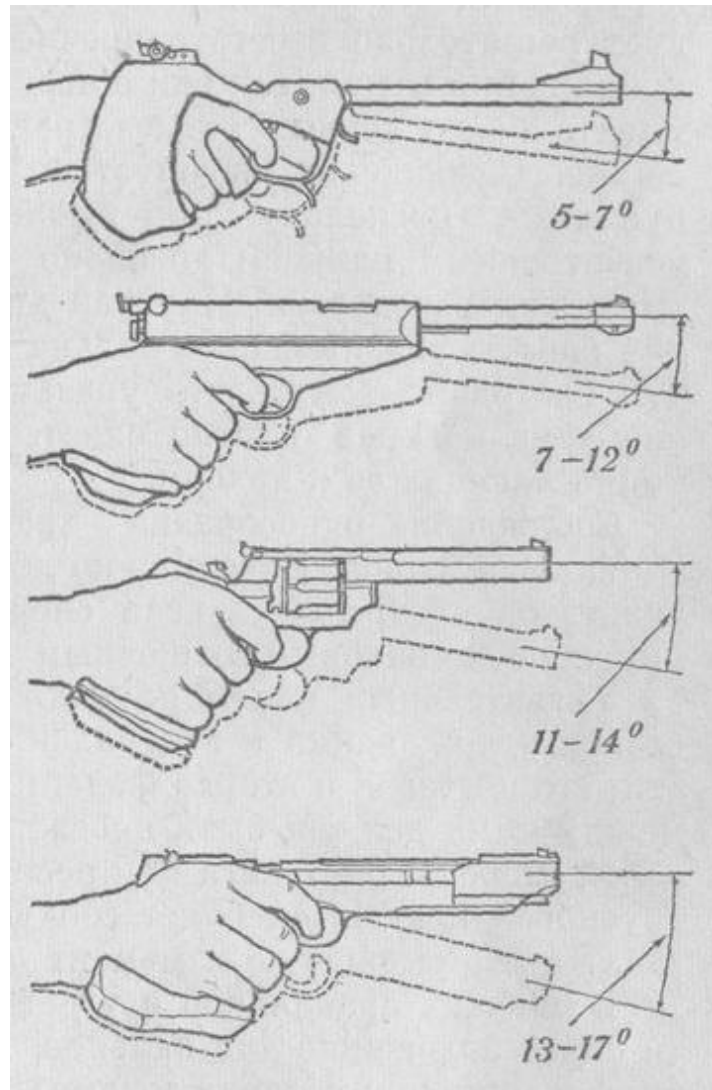


Fig. 159 - The degree of downward tilt of the hand when holding a pistol and revolver
(the outline shows the maximum downward tilt of the weapon)

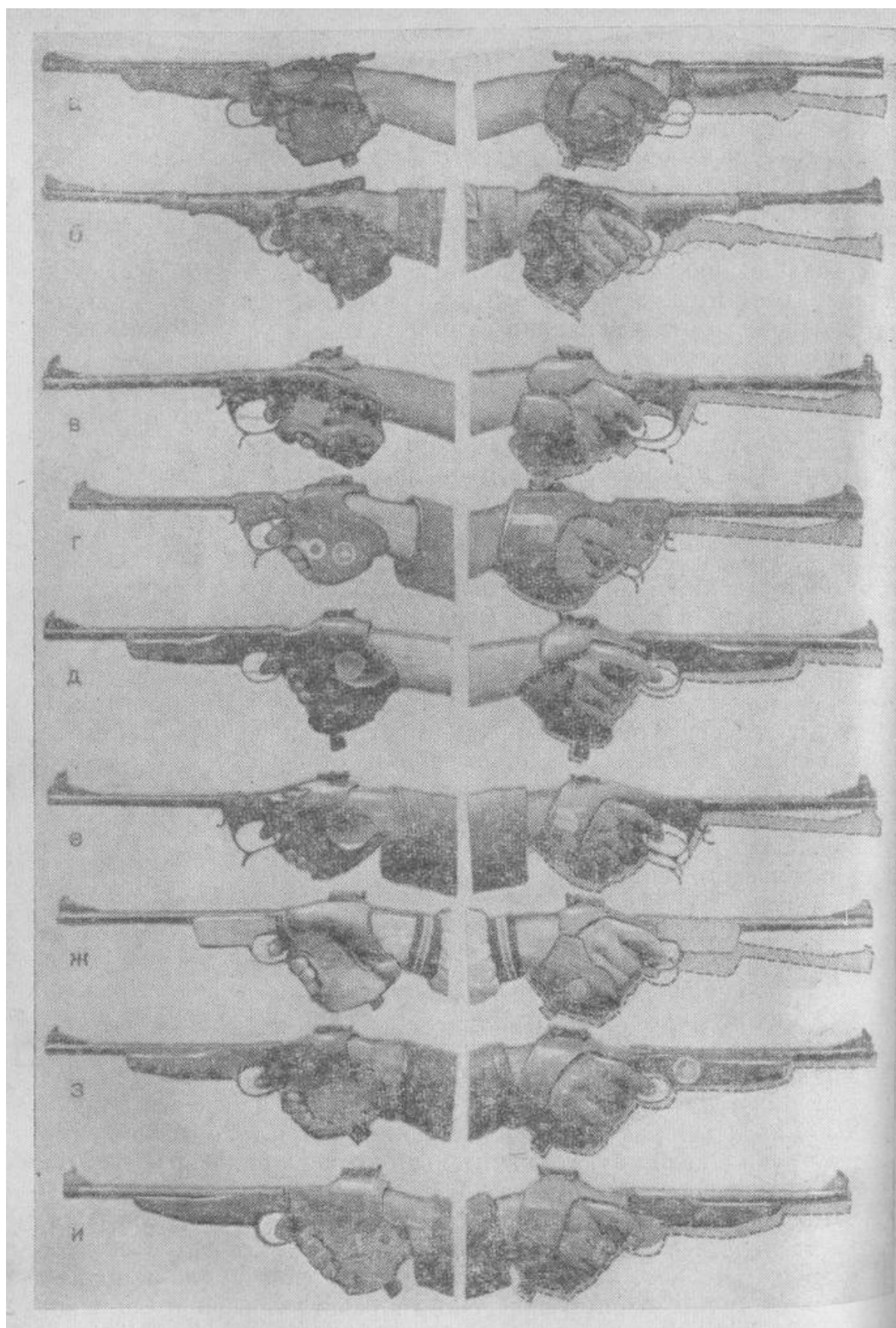


Fig. 160 - "Grip" - holding the handle of any pistol with the hand

(the dotted line shows the maximum downward tilt of the weapon):

1959-1961: *a* - M. Umarov; *b* - A. Gushchin; 1971-1972: *c* - G. Kosykh; *g* - V. Stolypin;
d - G. Zapolskikh; *e* - B. Ermakov; *g* - A. Udachin; *h* - E. Rasskazov; *i* - K. Mityushin.

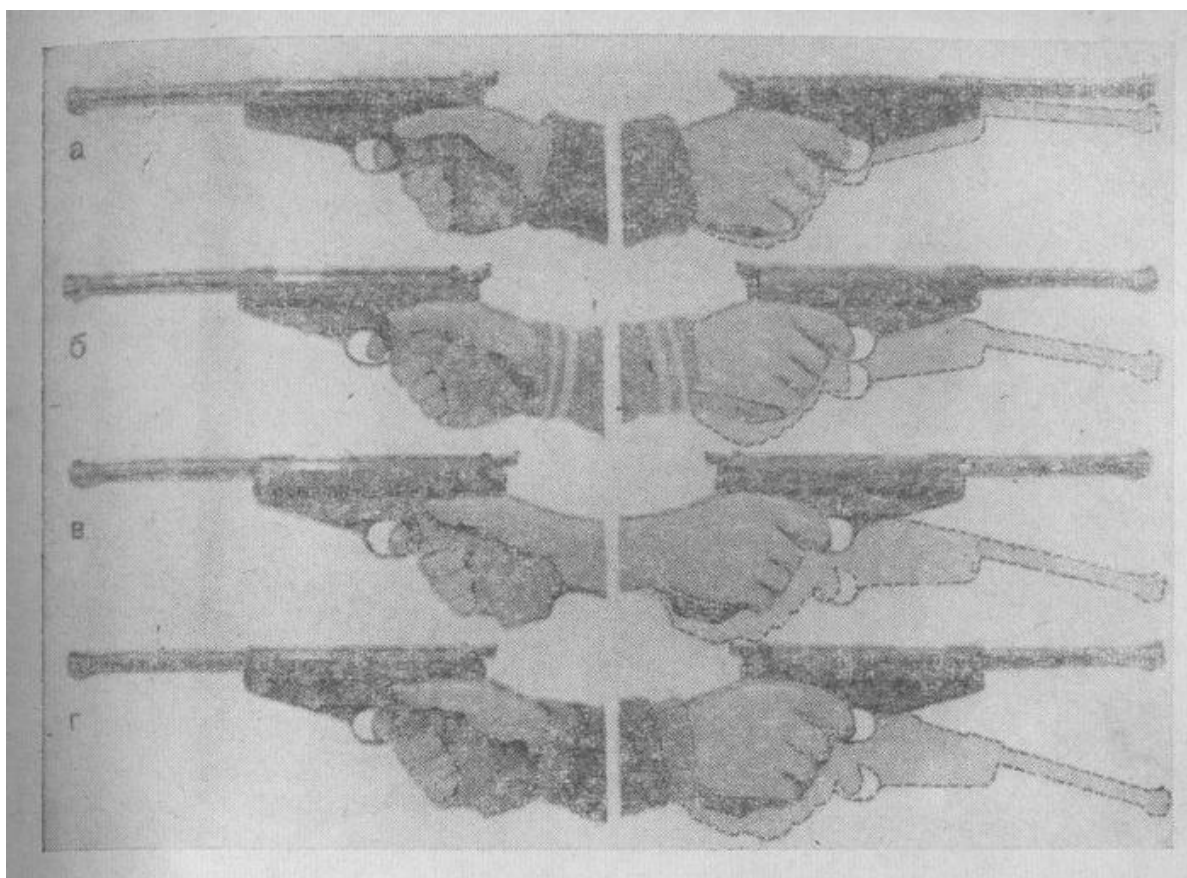
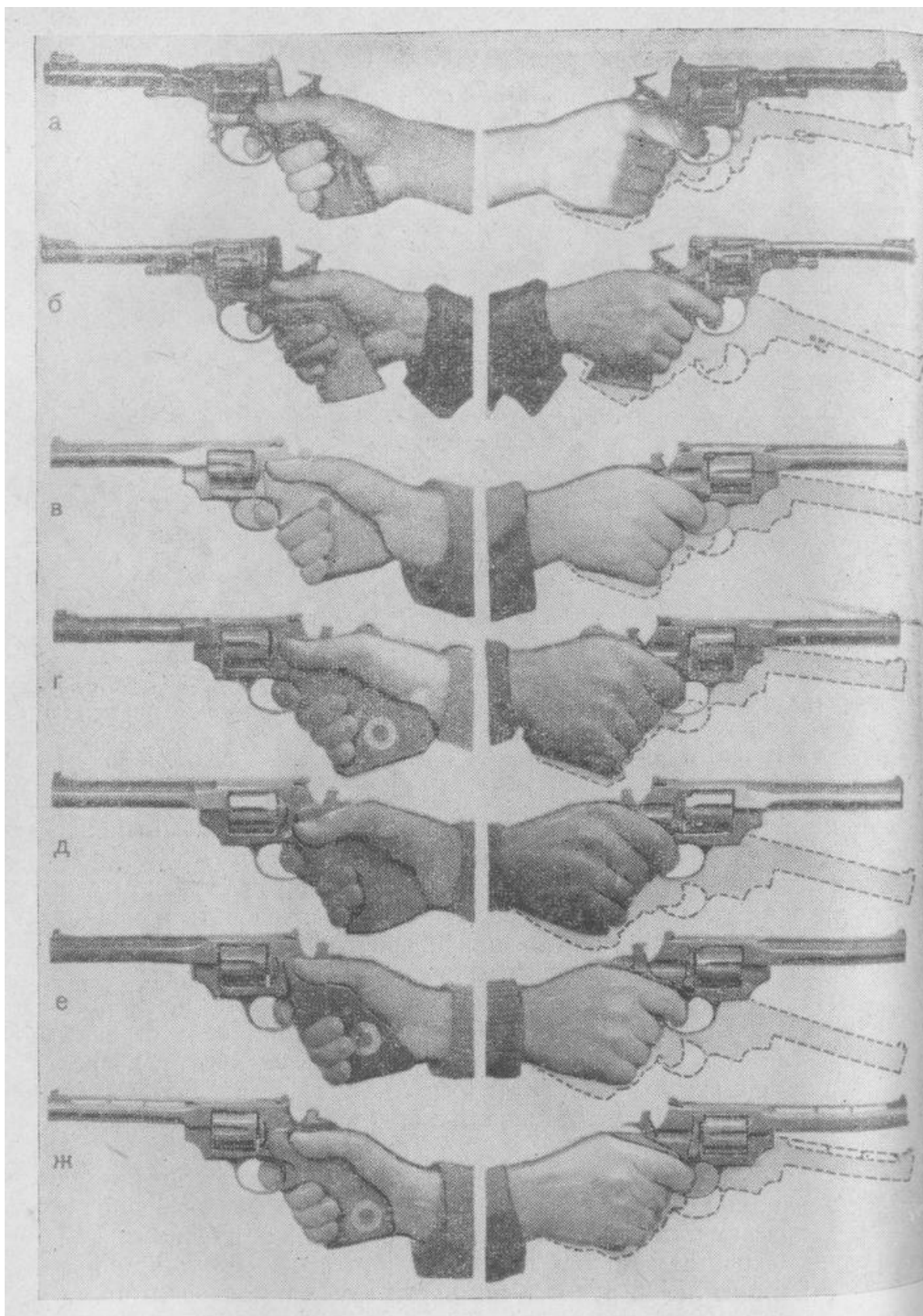


Fig. 161 - "Grip" - holding the handle of an air pistol with the hand, 1972:

a - G. Kosykh; *b* - G. Zapolskikh; *c* - B. Ermakov; *d* - V. Stolypin.

Since when shooting from a match pistol, shooters are allowed to use an orthopedic grip, which makes it easier to maintain a uniform grip (in the sense of the position of the hand in the grip), and also since when shooting with a small-caliber cartridge the recoil force is relatively small and the angles of departure change relatively little with a non-uniform grip, below we will consider the grip when shooting from a sport revolver (see Fig. 162), where its importance is especially great.



Rice. 162 - "Grip" - holding the handle of a revolver with the hand:

1960: *a* - M. Umarov; *b* - E. Khaidurov; 1972: *in* - V. Stolypin; *g* - A. Egrishin; *d* - A.

Udachin; *e* - V. Terentyev; *g* - K. Mityushin.

The correct grip, as is known, requires such a placement of the revolver handle in the hand, in which it is grasped and held on the left - by the thumb, on the right and in front - by the middle, ring and little fingers and rests with the back of its part on the flesh of the palm.

When gripping, it is best to keep the thumb straight and pointing along the barrel (but so that it does not touch the cylinder); in this position, it better fulfills its role in grasping and securely holding the handle in the hand. If, when gripping, the thumb is held bent and lowered down, as inexperienced shooters often do, then in addition to generally worsening the grip of the handle with the hand, the tension in the muscles of the thumb will increase the shaking of the weapon.

The fingers - the middle, ring and little fingers - which play the main role in holding the revolver in the hand, should tightly grasp the handle; at the same time, they should all touch each other (see p. 116). The upper one - the middle finger - should rest either on the bracket or on the projection of the handle under the bracket, so that, firstly, the weight of the weapon is better perceived by the fingers, and secondly, it is possible to use the bracket or the projection of the handle as a limiter for the fingers, which will contribute to their uniform position on the handle.

The grip - in general, should be tight; the muscles - the flexors of the fingers should be sufficiently tense; they strengthen the joints of the hand, in addition, the increased tone of these muscles is a better guarantee against unexpected, convulsive twitches and jerks, which usually abruptly displace the weapon. At the same time, an excessively tight grip, excessive muscle tension should be resolutely avoided, since in such a case the weapon will experience increased continuous trembling after the first shots. An excessively weak grip on the handle is also completely unacceptable, since with such a grip it is impossible to overcome the rather large tension of the trigger with the index finger without displacing the revolver. A tight grip just creates the conditions for the work of the index finger when pressing the trigger due to the fact that the index finger has a reliable support from the fingers tightly grasping the handle of the revolver and pressing it to the palm.

Maintaining a uniform grip requires grasping the handle with the same force. It is impossible to achieve high and stable results in shooting if the athlete does not learn to hold the weapon with the same muscular effort.

The index finger should not take any part in holding and securing the pistol or revolver in the hand; its nail and second phalanges should not touch the weapon - there should be a gap between them. If the finger touches the side of the pistol or revolver, then together with pressing the trigger it will press on the weapon from the side, which will lead to its displacement at the moment of firing.

In search of a correct and comfortable grip, you should find a position for your fingers, as well as a place for the grip to rest on your palm, in which the flexor muscles of the index finger would not involuntarily engage nearby muscles when pressing the trigger. Otherwise, the shooter will not be able to achieve accurate shooting, since the work of the index finger will inevitably be accompanied by a shift of the weapon to the side.

The grip should be deep, that is, such that the hand is positioned on the handle as high as possible, closer to the axis of the barrel bore; with a deep grip, the arm of the pair of forces formed during the recoil of the weapon is significantly smaller, which is why the displacement and toss of the weapon during firing is also less.

Let us now consider the question concerning the fixation of the hand in the wrist and, in connection with this, the degree of inclination of the hand in relation to the forearm.

It is well known that it is difficult to hold a hand with a load (a pistol or a revolver) without any tilt relative to the forearm, since the fixation of the hand in the joints is achieved here mainly by the work of the forearm muscles; significant tension of these muscles entails their rapid fatigue and, as a consequence, trembling of the hand with the weapon. It is quite obvious that it is much easier to fix the hand in the wrist when it is tilted downwards, since in this case the joints of the hand are fixed not only by muscles, but also by the ligamentous apparatus, and the greater the tilt, the more the ligaments are involved in the work. However, despite the obvious advantage of tilting the hand downwards, an excessively large tilt, to

the point of failure, when grasping and holding a weapon also has its negative sides, since it requires increased work of the muscles that flex the hand (see Fig. 108). In addition, with an excessive tilt of the hand downwards, the flexor muscles of the index finger are put in unfavorable working conditions.

Therefore, in search of the most advantageous grip for himself, the shooter should adjust the handle of the revolver or pistol so that the hand has a downward tilt, but not to the limit, and is at such an angle in relation to the forearm, at which: the tilt will be natural, without significant tension of the muscles that bend the hand; the ligamentous apparatus of the joints of the hand will be sufficiently included in the work.

It should be borne in mind that the degree of freedom of the wrist tilt in shooters may be different, depending on the development and elasticity of the ligamentous apparatus. Therefore, relying on the practice of the best shooters, when determining the degree of downward tilt of the wrist, it is necessary to proceed from the fact that between the direction of the barrel when ready and its direction when tilting the wrist to the limit, the angle should be within the range: for a match pistol - 5-7 °, for an air pistol - 7-12 °, for a revolver - 11-14 ° (Fig. 159).

Fig. 160, 161, 162 show the grip of the best pistol and revolver shooters. As we can see, the leading shooters do not tilt their wrists down to the limit. However, the degree of freedom of the wrist tilt is different for them.

The correct grip should also provide for such a position of the hand with a pistol or revolver, in which the barrel of the weapon will be in the same vertical plane with the forearm, as if being its continuation. With such a position of the weapon, the hand as a whole will resist recoil much better and more uniformly.

Above we have considered the "power scheme" of the position for shooting from a pistol and a revolver. It is clear that this type of position for shooting requires, regardless of the athlete's desire, the tension of many muscle groups and the inclusion of the ligamentous apparatus in the work, which ensure the proper fixation of the shooter's moving parts of the body in the joints. These include

muscle groups of both legs, the lower back, the right part of the shoulder girdle and partially the back muscles - all muscle groups that strengthen the arm in the shoulder joint, the muscles of the hand that strengthen the hand in the wrist, as well as the muscles - flexors of the fingers of the right hand.

In relation to the work of these muscle groups, the shooter faces the task of reducing their tension, economically using muscle energy by including to the greatest extent in the work the strong ligaments that secure the moving links of the body in the joints.

The remaining muscle groups of the musculoskeletal system that do not directly participate in holding the shooter's body in a standing position and holding the hand with the weapon should be relaxed as much as possible. These muscle groups include: the muscles of the left arm, the pectoral muscles, the muscles of the neck, the muscles of the left part of the shoulder girdle, etc.

The left hand when ready to shoot a match pistol and slow fire a revolver should be freely lowered down - the hand is placed in the pocket of the shooting jacket or hooked with the thumb on the pocket or belt. In this position, the muscles of the left arm, left part of the chest and shoulder girdle are most relaxed. The hand can also be placed behind the back, but this option is less successful, since in this position the muscles of the arm and left part of the chest are somewhat tense. Even less successful is the akimbo position, resting the left hand or fist on the lower back: holding the left hand in this position requires excessive tension of the muscles of the left part of the shoulder girdle.

The head should be kept turned to the right, without tilting it down significantly or leaning it back - its position should be as natural as possible. The head should be turned so that, if possible, you can look at the target straight ahead, which will create favorable conditions for the eye to work during aiming. This circumstance is especially important during prolonged shooting. Turning the head and holding it in this position should not be accompanied by excessive tension in the neck muscles. It should be remembered that the natural position of the head, without tilting to one side or another, and the least tension in the neck muscles create the most favorable conditions for the work of the vestibular apparatus, and, conse-

quently, for the coordinated work of the muscles to maintain the body posture unchanged (see p. 92).

The correctness of the adopted position in relation to the target is verified according to the same principle as when shooting from a rifle.

If, when raising his hand with a pistol, the shooter discovers that the barrel of the weapon is directed somewhere away from the target, to the right or left of it, he must change the direction of the barrel not by moving his right hand, but by turning his entire body in relation to the target, by rearranging his feet.

Before shooting, the correctness of the grip should be checked, mainly with regard to the position and operation of the index finger and the degree of tightness of the grip. If the weapon moves along with the movement of the index finger, the position of the index finger should be checked, the grip generally reviewed and slightly changed.

These are the general requirements for a typical setup for slow shooting from a pistol and revolver.

Let us now consider the position used by leading shooters with a match pistol and revolver, and first of all, how they position the supporting surfaces of the body - the feet of both legs, which limit the area of support of the body when in position (Fig. 163).



Fig. 163 - Slow firing position with a pistol (top view)

In Fig. 164, for comparison, "traces" are shown, from which the following can be seen.

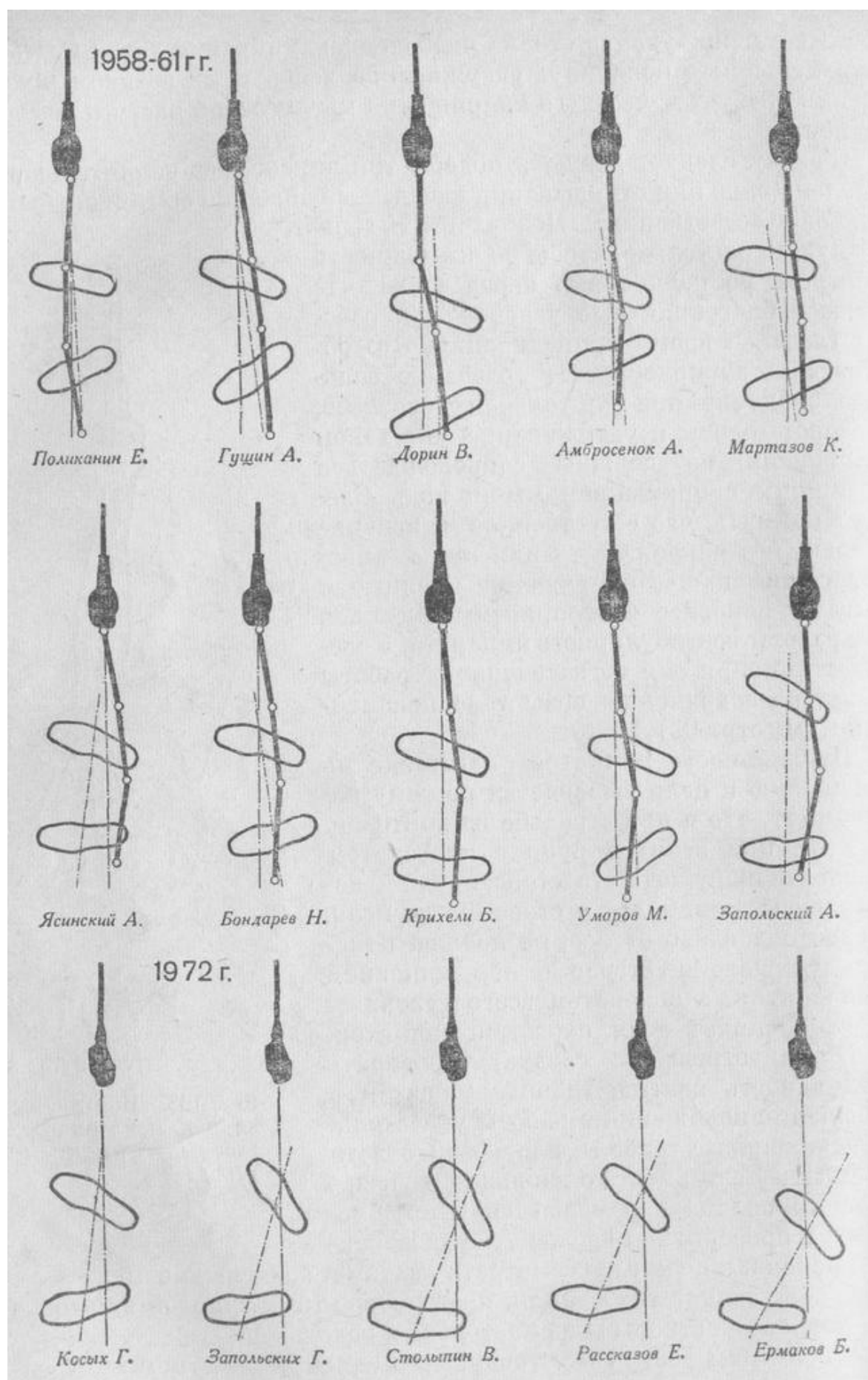


Fig. 164 - "Traces" - the relative position of the leading athletes' feet during slow pistol shooting (1958-1972)

The position of leading shooters in the period 1958-1961 was distinguished by the variety of options used. Both very wide and slightly spaced positions were used. At the same time, leading athletes of that period stood almost identically, sideways to the target - the line passing through the centers of the support surfaces almost coincided with the direction of the shooting plane for all of them.

Leading shooters of the period 1971-1972 use more uniform variants of the stance, characterized by a slightly different orientation of the feet relative to the target, at a certain angle to the plane of shooting. This positioning of the feet is dictated by the use of variants of the stance now with a slightly different fundamental scheme in relation to holding the right hand.

Looking at the "traces" in combination with other projections of the axes of the moving links of the body, we see that many leading shooters, as in earlier versions of the stance, somewhat "twist" the body at the waist, turning it slightly to the right - the line of the shoulders is turned to the right relative to the line passing through the centers of the supporting surfaces of the body - the feet. This indicates that the shooters strive to even better, more rigidly, fix the body in the hip joints by engaging the oblique abdominal muscles and the ligamentous apparatus of the joints.

Let us now consider (from above) the position of the right hand of the leading shooters. As can be seen from Fig. 165, they all, without exception, completely straighten their right hand.

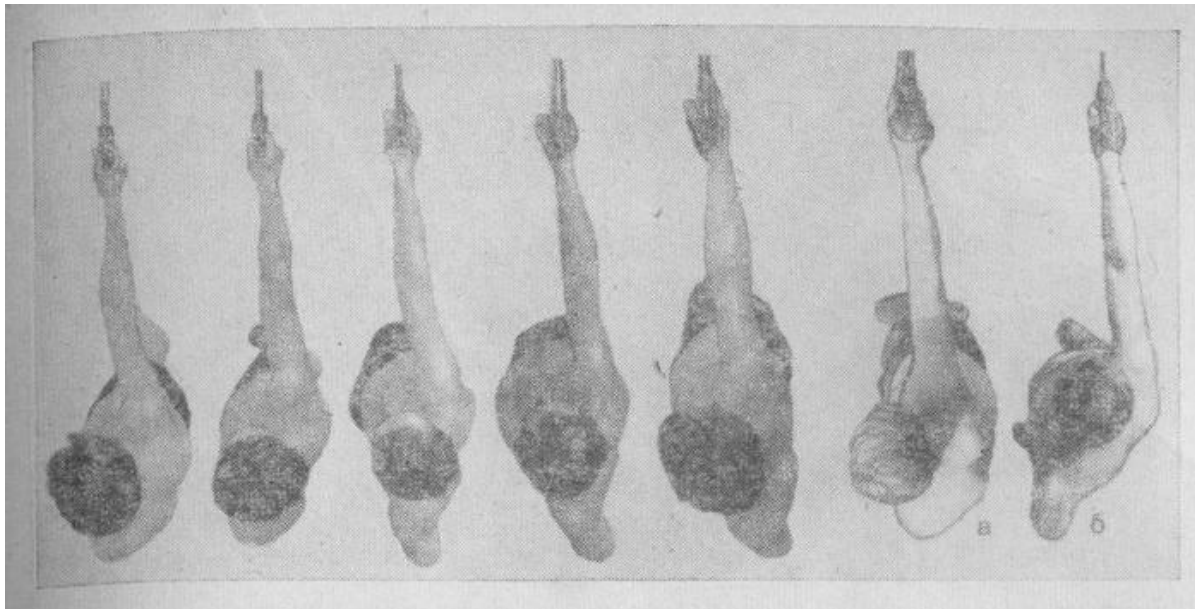


Fig. 165 - Position of leading athletes during slow shooting from a free pistol (top view), 1958-1972:

a - V. Stolypin (1960); *b* - V. Stolypin (1972).

The position of shooters from the period 1958-1961 is characterized by the fact that the angle formed by the line of the shoulders and the line running along the right arm was relatively small or absent altogether, that is, the right arm was, as it were, a continuation of the line of the shoulders (see Fig. 164, 165). This indicates that most leading shooters of that period sought (and quite reasonably) to create, first of all, the most favorable conditions for the work of the muscles (primarily the deltoid), holding the arm in a horizontal position in the shoulder joint.

Leading shooters of the 1971-1972 period use variants of the position, notable for the fact that the shoulder line forms a significantly larger angle with the line running along the right arm compared to previous variants. Of course, when holding the arm at such an angle to the shoulder line, the conditions for the work of the muscles that secure the arm in the shoulder joint are somewhat worse. However, one important circumstance must be taken into account here: now the physical fitness of an athlete-shooter in general, and general and special endurance in particular, have increased so much that they cannot be compared with previous times. Therefore, to some extent losing out compared to previous variants of the position in creating conditions for the work of the muscles that hold the arm in the shoulder joint, modern variants of the position

are much better in a freer position of the head with a smaller turn to the right, which creates incomparably better conditions for the work of the eye during aiming.

In Fig. 166, 167, the leading shooters' stance for pistol shooting is shown for reference. Looking through the given variants, it is not difficult to determine, from the point of view of modern requirements, the advantages and disadvantages of this or that shooter's stance.

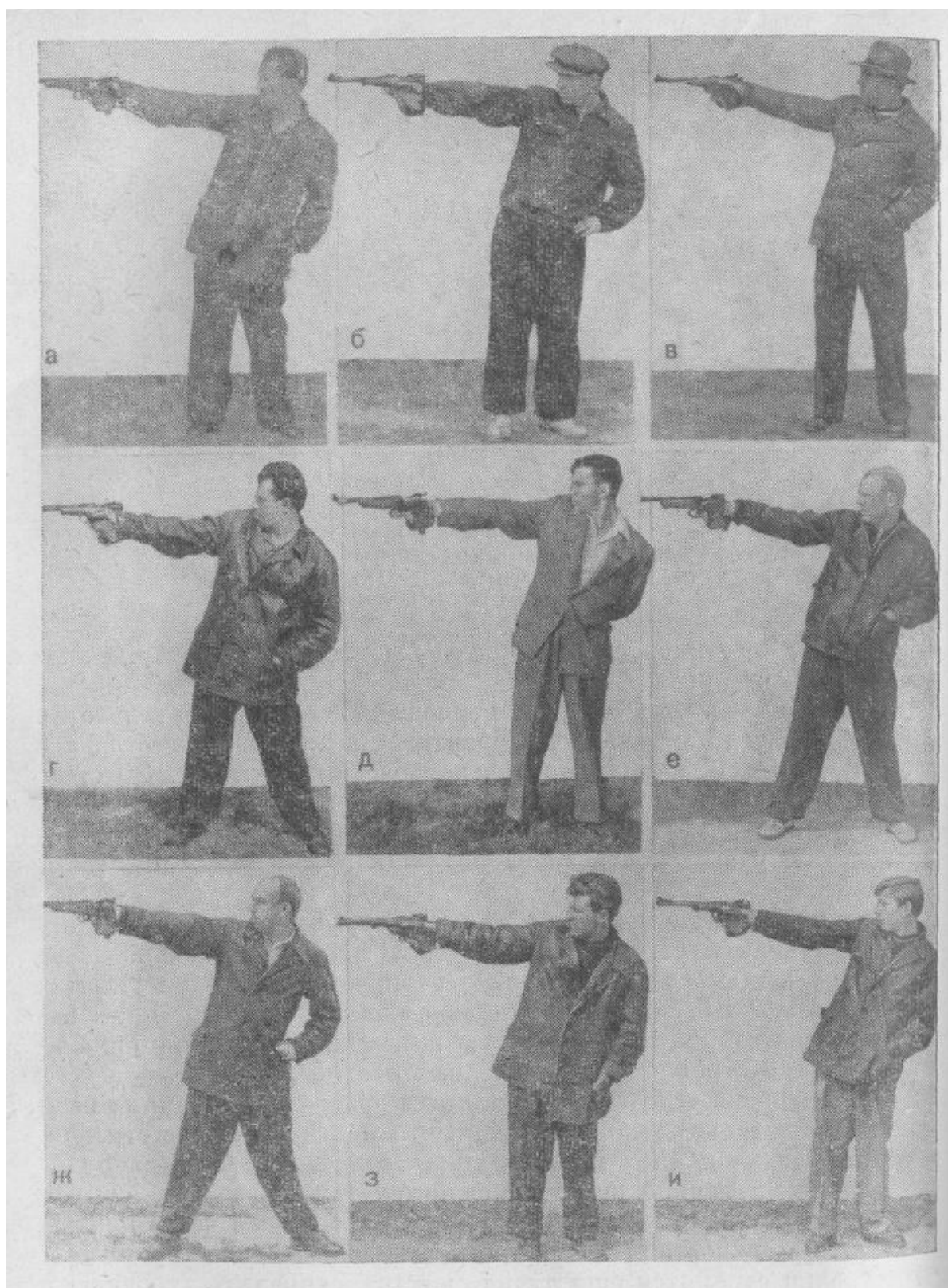


Fig. 166 - Position of leading athletes in free pistol shooting (side view), 1958-1961:

a - M. Umarov; *b* - A. Gushchin; *c* - A. Yasinsky; *g* - A. Zapolsky; *d* - E. Polikanin; *e* - K. Martazov; *g* - V. Demin;
h - A. Ambrosenok; *i* - V. Stolypin.

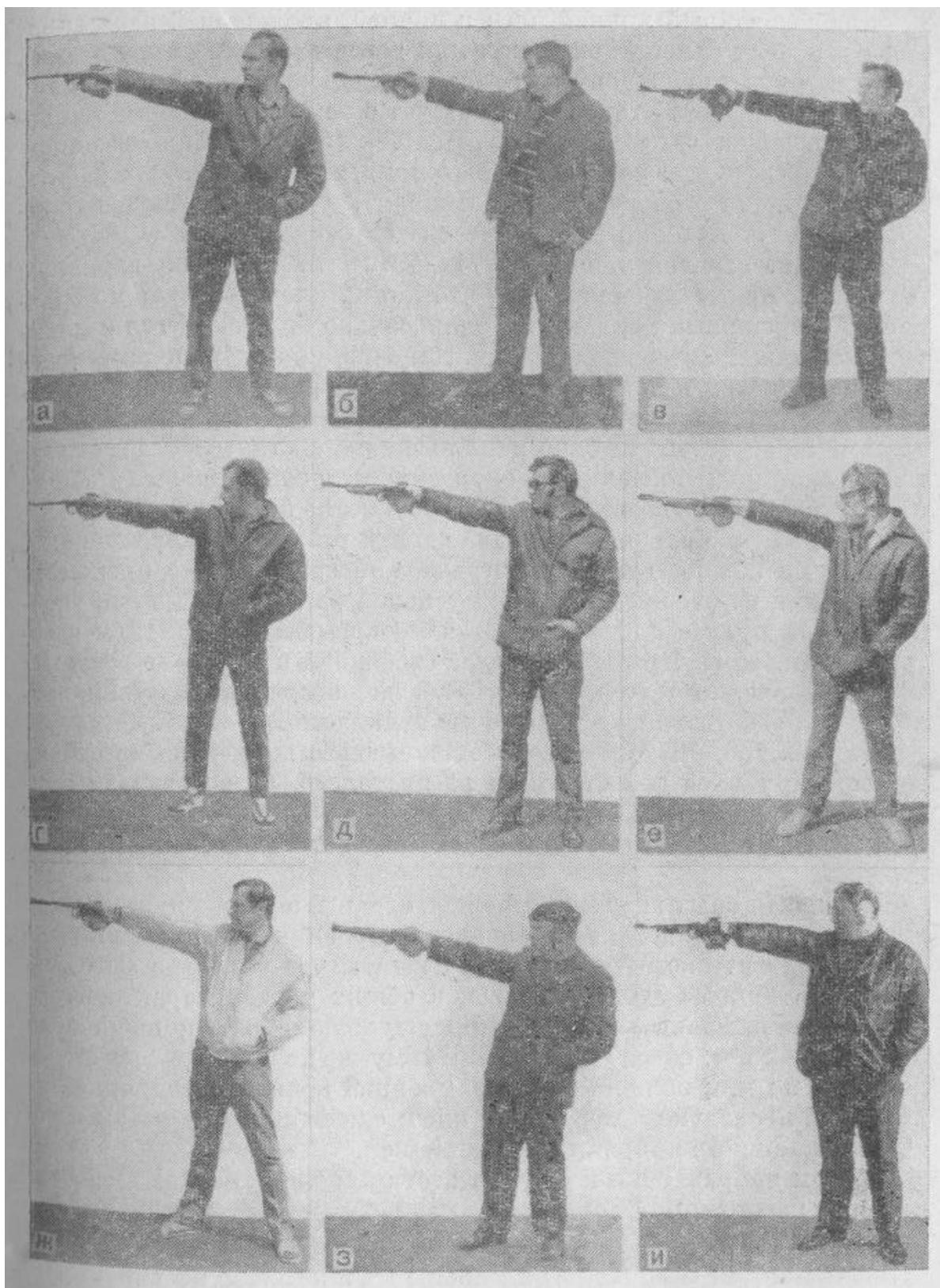


Fig. 167 - Position of leading athletes in free pistol shooting (side view), 1971-1972:

a - G. Kosykh; *b* - V. Stolypin; *c* - G. Zapolskikh; *g* - B. Ermakov; *d* - E. Rasskazov; *e* - M.

Papava;

g - A. Udachin; *h* - K. Matyushin; *i* - G. Khromada (Czechoslovakia).

Taking into account the experience of the country's leading shooters, as well as the anatomical features of the structure of the human body's musculoskeletal system, it can be considered that the most advantageous and promising position will be the one that is generally characterized by: a significant tilt of the body to the left; a narrow placement of the legs, which also ensures that the shooter's body is positioned sideways to the target; a fully straightened right arm, oriented slightly to the left of the shoulder line; a free turn of the head without excessive tension in the neck muscles.

This is the direction in which you should search for the most advantageous preparation for yourself.

Preparation for rapid shooting with a pistol at silhouettes

The position for rapid shooting with a pistol at silhouettes differs quite significantly from the position for slow shooting at a round target. If, when positioned for slow shooting, the athlete must strive to achieve maximum immobility, practically not limiting himself in time for each shot, and make a series of shots at the same target, then the position for rapid shooting at silhouettes must allow the shooter to raise his hand with the pistol in a very limited time, and then move it horizontally to shoot at each of the five silhouettes, spending 8, 6 and 4 seconds on a series of 5 shots.

Therefore, the position for rapid shooting at silhouettes must meet the following requirements: have increased stability in the direction of the plane of shooting, so as to allow the hand with the pistol to be raised quickly and confidently, without significantly disrupting the body's equilibrium conditions; ensure rapid horizontal movement of the pistol after the shot, followed by short stops at each silhouette separately to fire the next shot.

The difficulty of choosing the right position for yourself is connected with the fact that it includes elements of dynamism - the need for repeated alternation of the greatest immobility of the "shooter's

body - weapon" system with subsequent movement of individual parts of the body to adopt a new position for shooting at the next silhouette.

This circumstance - multiple alternation of immobility of the entire system with its subsequent movement when moving to the next silhouette - requires a slightly different scheme of loading the motor apparatus compared to the position for ordinary slow shooting. Obviously, the position for rapid shooting at silhouettes must have two main properties: increased rigidity and at the same time sufficient flexibility, elasticity of the shooter's body as a whole.

The practice of recent years has firmly established that the transition from one silhouette to another should not be accomplished by an isolated movement of only one right hand with a pistol, but by a quick, smooth rotational movement of the body with the hand firmly fixed in the shoulder joint. The undoubted advantage of this method of transition from one silhouette to another is that it significantly better preserves uniformity in the relative position of the pistol, hand and head during movement, stopping and preparation for the subsequent shot. Therefore, the position should have such a degree of rigidity of the fastening of the movable links of the upper part of the body that sufficiently ensures the unchanged relative position of the hand, body and head (Fig. 168).



Fig. 168 - Rotational movement of the torso with the arm rigidly fixed to it at the shoulder joint when moving from one silhouette to the next

In order for the transition from the first silhouette to the subsequent ones to be accomplished with a quick and sufficiently smooth movement, the rotation of the upper body (torso, head and hand with the pistol) must be accomplished by the work of the leg muscles (Fig. 169). Therefore, in contrast to the position for slow shooting, which requires rigid fixation of the body in the leg joints, when preparing for shooting at silhouettes, it is necessary to strive to ensure that the torso is not very rigidly fixed, primarily in the hip joints, and in connection with this has the necessary flexibility and elasticity.

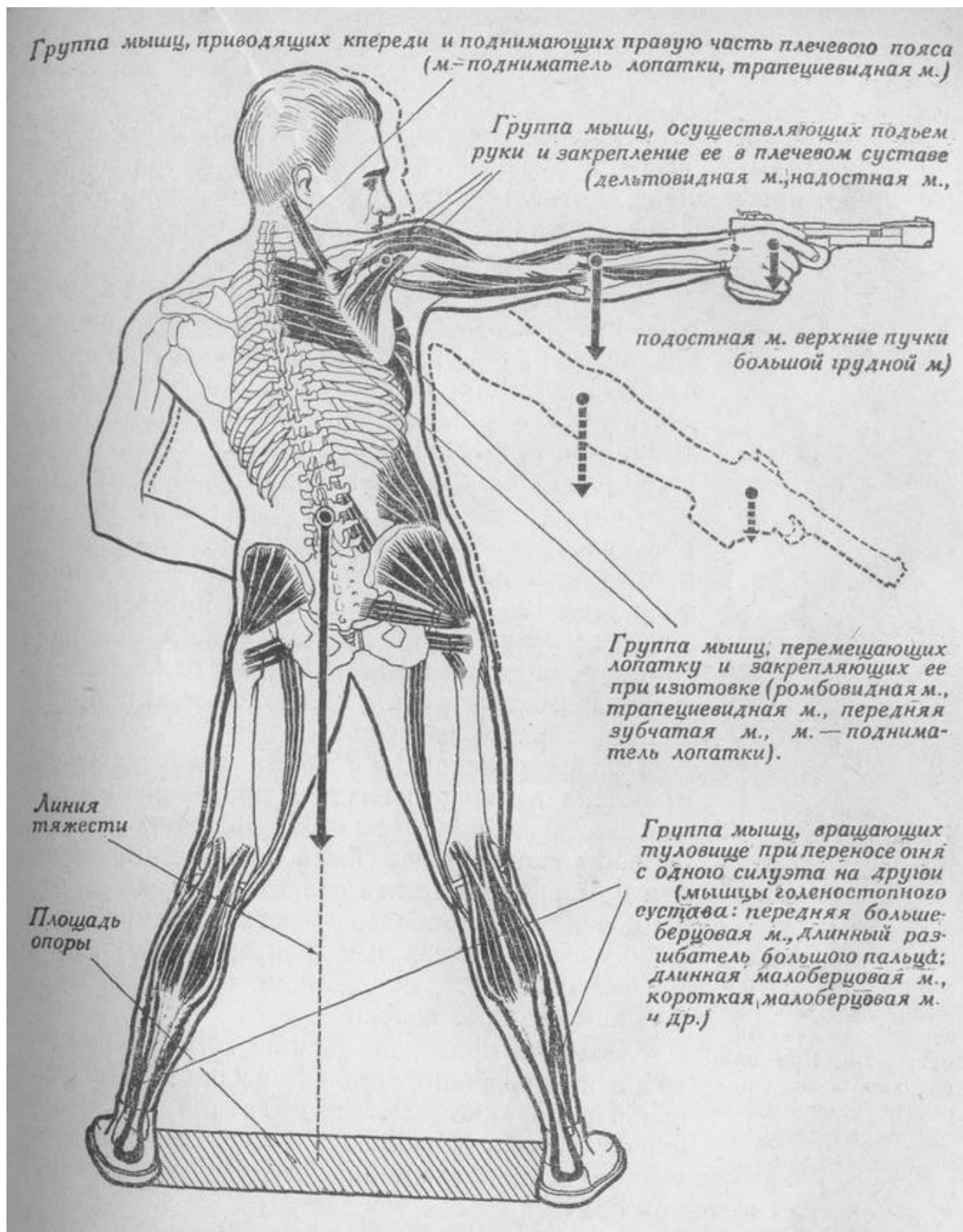


Fig. 169 - Scheme of preparation for rapid shooting at silhouettes

The shooter's choice of the most advantageous position for himself should be subordinated to the satisfaction of the requirements of rigid fastening of the movable links of the upper part of the shooter's body and imparting the necessary flexibility to the body as a whole. Taking these requirements into account, we will con-

sider a typical position for rapid shooting from a pistol at silhouettes.

When standing, the shooter's body should not be fully straightened - the torso should be slightly tilted to the side opposite the outstretched arm with the pistol, that is, to the left, which is dictated by the need to create favorable conditions for the work of the muscles that secure the shoulder blade and right arm in the shoulder joint. In order for the shooter's body to have sufficient flexibility in the lower back, the legs should be placed wide enough: with a wide placement of the legs, the hip joints are fixed less rigidly.

The placement of the legs should also provide for an increase in the stability of the position in the direction of the shooting plane. The transition from the initial position to the shooting position is accompanied by a quick rise of the hand with the pistol and, in connection with this, some inevitable compensatory movement of the body to the left (see Fig. 169).

The most stable and comfortable position is one in which the feet create a support area in the form of a trapezoid formed by such a placement of the legs, in which the distance between the feet is somewhat greater than the width of the shoulders, and the feet are naturally spread apart. In this case, as practice in recent years has shown, one must stand with the right side to the target and position the feet relative to the middle silhouette so that the line drawn through the centers of the feet, in its direction, approximately coincides with the plane of shooting or passes somewhat to the right (Fig. 170).

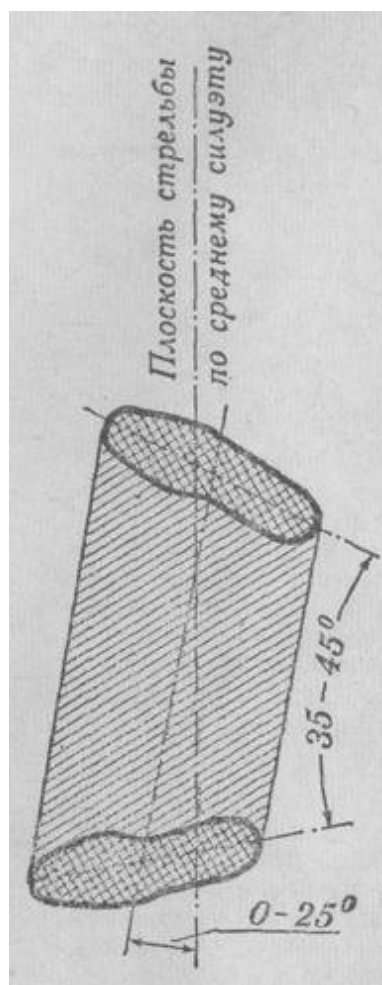


Fig. 170 - The relative position of the supporting surfaces of the body - the feet of both legs when ready for rapid shooting at silhouettes

The weight of the entire body with the pistol should be distributed evenly on both legs or so that the left foot bears slightly more load than the right.

The smoothness of the rotational movement of the body when moving to the next silhouette largely depends on the shooter's distribution of his body weight on the supporting surface of each foot, as well as on the degree of rigidity of the legs in the joints. You should stand so that during the initial position, before shooting (on the average silhouette), the load falls in the middle of each foot or slightly closer to the heels; with such a distribution of the load, the ankle joints are less rigidly fixed. The legs should be straightened when standing, but without excessive tension. Only with not too rigid fixation of the legs in the joints will conditions be created for

the coordinated work of the leg muscles participating in the implementation of a smooth rotational movement of the body.

The "power scheme" of the stance for high-speed shooting at silhouettes includes a significantly larger group of tense muscles than during slow shooting, which is dictated by the need to more rigidly secure all the moving parts of the upper body together.

In order for the body and the forward right arm to be as if one whole, the right arm must be firmly secured in the shoulder joint. The greatest rigidity will be achieved if, together with the body being thrown to the left, the right part of the shoulder girdle rises upward and is brought forward (Fig. 171, 172). In this case, the right arm should be held so that the line running along the arm forms an angle of $12-25^{\circ}$ with the shoulder line (see Fig. 175); with this position of the right arm relative to the shoulder line, it is better to quickly raise the arm with the pistol without any deviations to the sides when firing the first shot.

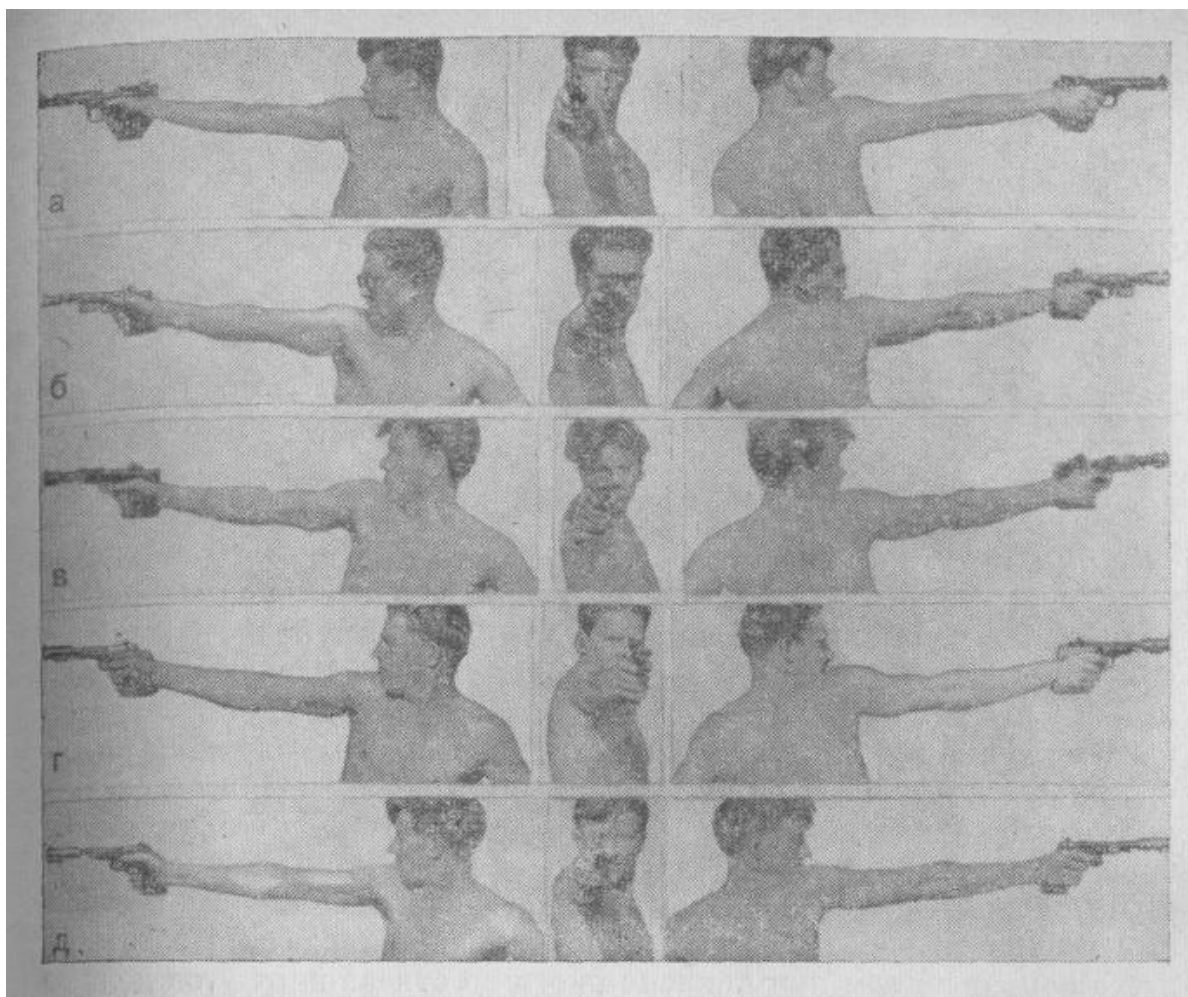


Fig. 171 - Position of the right hand and head position of leading athletes when shooting from a self-loading pistol at silhouettes, 1958-1961.



Fig. 172 - Position of the right hand and head position of leading athletes when shooting from a self-loading free pistol at silhouettes, 1971-1972.

The right arm should be fully extended and hyperextended at the elbow joint so that it is fully engaged. The muscles of the right arm

should be more tense than when ready for slow shooting, to ensure the most rigid fixation of the moving links - the shoulder, forearm and hand - between themselves; the arm should be as if one whole.

The grip should in principle be the same as for normal pistol and revolver shooting, but even tighter, in order to better ensure uniformity in the position of the pistol in relation to the hand as a whole when moving to the next silhouette.

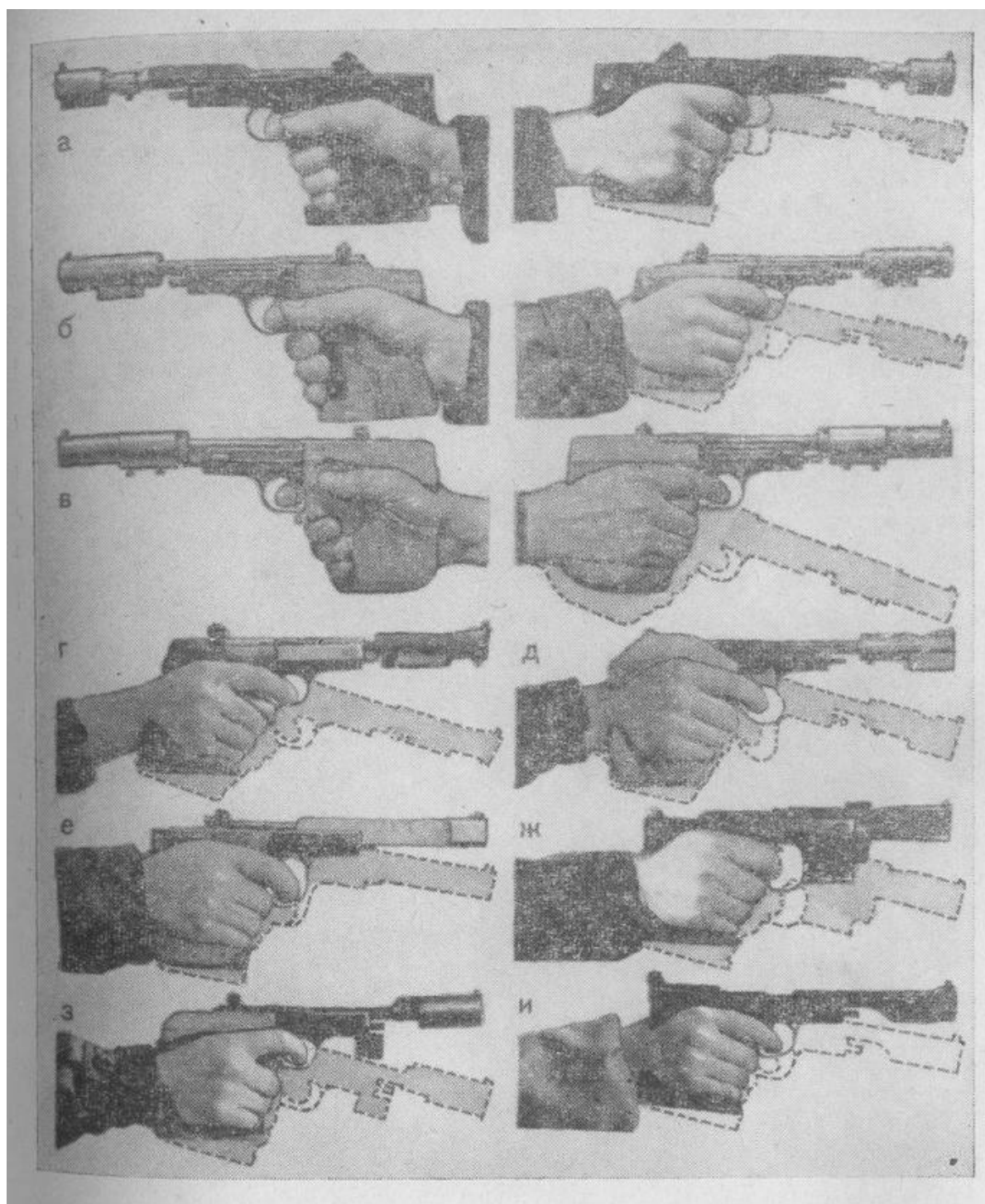
The index finger, as in normal pistol and revolver shooting, should not take any part in holding and securing the pistol in the hand; its nail and second phalanges should not touch the pistol - there should be a gap between them.

The grip should be deep. When adjusting the semi-orthopedic grip, the shooter should be guided by the fact that the hand on the grip is as high as possible, closer to the barrel axis. With a deep seating of the grip in the hand, the shoulder of the pair of forces generated by the recoil of the weapon will be less, which is why the displacement of the pistol during the shot will also decrease. This is of great importance especially in high-speed shooting, in which the shooter has limited time to align the front sight in the slot when firing at the next silhouette.

The right hand, unlike the position for normal pistol and revolver shooting, should not be tilted down too much. Its fixation in the wrist should be carried out mainly by the work of the arm muscles, and not by the ligamentous apparatus of the joints of the hand. The angle of the hand in relation to the forearm should be set for yourself so that further tilt does not lead to even a slight relaxation of the fingers gripping the pistol grip, otherwise the grip will not be tight enough. A small angle of the hand also contributes to freer movement of the index finger when pressing the trigger, which is very important in connection with the large amplitude of finger movement in this type of shooting. In addition, a small tilt of the hand is also necessary so that the shooter can more freely operate the hand during the final, so to speak, "fine" aiming of the pistol just before the shot. Despite the fact that the transition from silhouette to silhouette, i.e. rough aiming, is performed by moving the body with the right hand firmly attached to it, and more precise aiming is

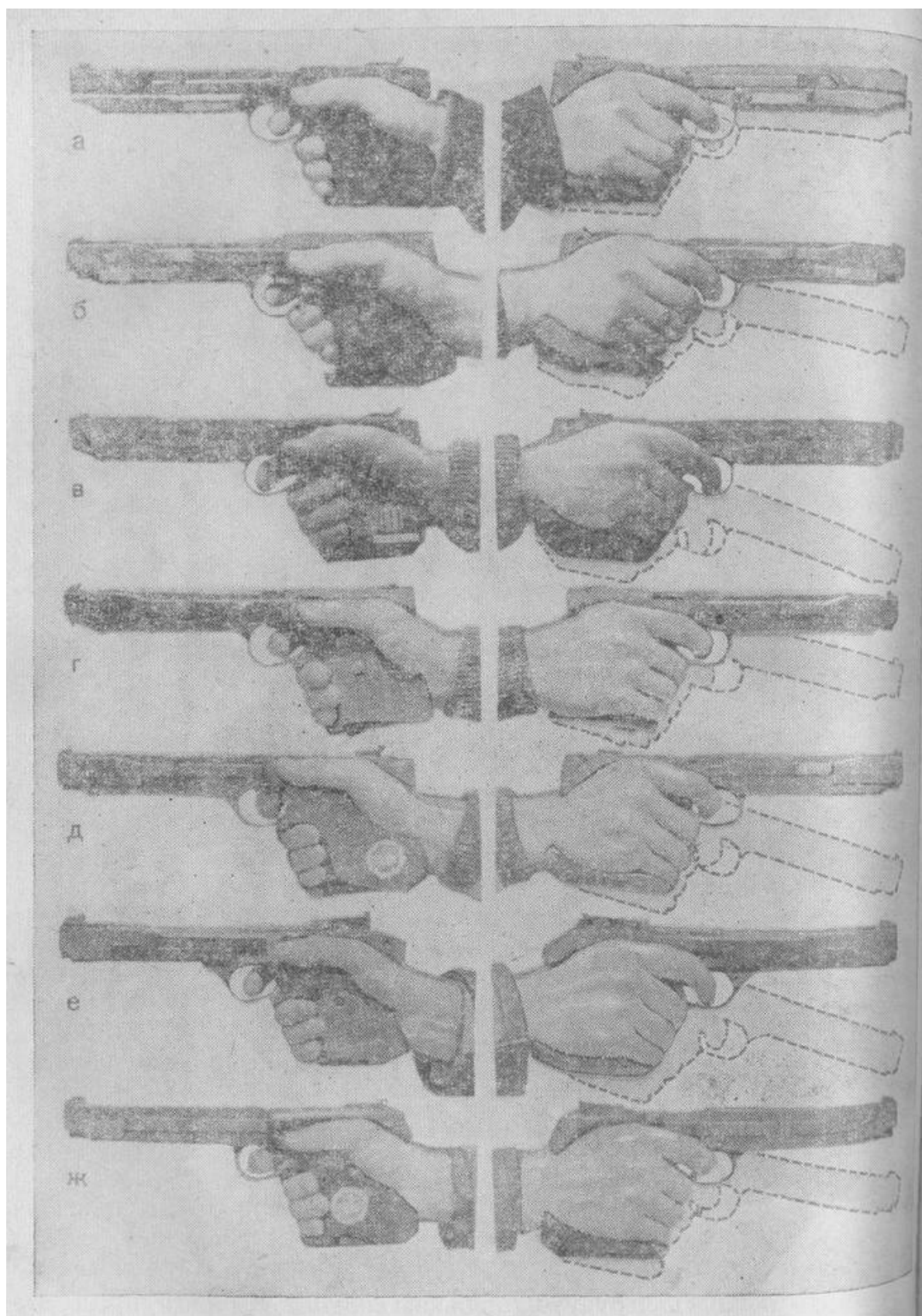
performed by moving the arm in the shoulder joint, it is still necessary to slightly clarify the position of the front sight in the notch just before the shot by a slight movement of the hand, which is easier and better to do when the hand is secured not by a passive ligamentous apparatus, but by muscles, the work of which can be controlled more quickly and accurately in those tenths of a second that the shooter has at his disposal for the final clarification of the position of the front sight in the notch. Between the direction of the barrel when ready and its direction when the hand is tilted down as far as possible, the angle should be within 13-17° (see Fig. 159).

Fig. 173, 174 shows the grip of leading shooters, which also shows the degree of freedom of downward tilt of the wrist.



Rice. 173 - "Grip" - holding a pistol with the hand (the dotted line shows the maximum downward tilt of the weapon), 1958-1961:

a - A. Zabelin; *b* - A. Kropotin; *c* - E. Khaidurov; *g* - E. Cherkasov; *d* - A. Yasinsky; *e* - A. Spivakov; *g* - A. Nasonov;
h - P. Sheptarsky; *and* - R. Suleymanov.



Rice. 174 - "Grip" - holding a pistol with the hand, 1971-1972:

a - R. Suleymanov; b - Yu. Alekhine; c - I. Bakalov; g - A. Kuzmin; d - S. Frantsevsky; e - A. Spivakov; g - V. Terentyev.

The correct grip should provide for such a position of the hand in relation to the forearm, in which the barrel of the gun and the forearm are in the same vertical plane. In this case, the hand as a whole significantly better and more uniformly counteracts the recoil of the weapon, which is especially important in high-speed shooting.

Earlier, when considering the stance for slow shooting from a match pistol and revolver, we drew attention to the need to relax those muscle groups that do not directly participate in holding the shooter's body in a standing position and fixing the right arm in the shoulder joint: the muscles of the left arm, the left part of the shoulder girdle, the muscles of the neck, etc. However, when stance for rapid shooting at silhouettes, the situation is somewhat different, since many of these muscle groups are related to the "power scheme" of the stance. The left hand should not be kept relaxed. It is best to freely lower it down when stance, put the hand in the pocket of the shooting jacket or trousers.

The head should be turned strongly to the right: it should rest with the cheek and part of the chin on the deltoid muscle of the right arm or the collarbone. At the same time, there is no need to be particularly afraid that the neck muscles will be more tense than usual; in a position that has elements of dynamism, as well as in the high-speed nature of shooting, the decisive factor is not the degree of tension in the neck muscles, but the fixed position of the head, which is extremely necessary to maintain uniformity in the relative positions of the pistol, arm and head. These considerations should be used when determining the degree of rotation and tilt of the head, partly even neglecting the requirement for any position regarding the free position of the head with the least tension in the neck muscles. In any case, in order to avoid excessive tilting of the head and excessive tension in the neck muscles, it is necessary to try different variations of the position, and to begin the search not by tilting the head and touching the right hand with the cheek, that is, adjusting the position of the head in relation to the hand, but, on the contrary, by raising the right part of the shoulder girdle and moving it forward and upward so that it touches the right cheekbone, especially since this position of the right part of the shoulder girdle is most advantageous for achieving rigidity in fixing the hand in the shoulder joint.

The correctness of the adopted preparation is verified in two ways: 1) by the middle and first silhouettes, 2) only by the first silhouette.

In the first case, in order to avoid excessive "twisting" of the body at the waist when moving to the last silhouettes, one should prepare according to the middle silhouette and accordingly orient the position of the legs so that there is no preliminary "twisting" of the body. After this, the correctness of the preparation is verified according to the first silhouette. If, when raising the hand with the pistol, it is discovered that the barrel of the weapon is directed somewhere away from the center of the silhouette, it is necessary to change the direction of the barrel not by moving the hand in the shoulder joint, but by turning the body with a rigidly fixed hand due to a greater or lesser twisting of it at the waist.

The method of checking the position according to the first silhouette is determined by the enormous influence of the correct execution of the first shot on the subsequent shooting of the entire series. The difficulty in making the first shot is connected with the fact that the path covered by the right hand when raising the gun is significantly greater than the path of the hand when moving from one silhouette to another. Therefore, it is advisable to create the most favorable conditions for the first shot, as it is decisive in the shooting of the entire series. The correctness of the adopted position according to the first silhouette is checked in the usual way: if, when raising the hand with the pistol, the shooter finds that the barrel of the weapon is directed somewhere away from the center of the silhouette, he must change the direction of the barrel not by moving the hand, but by turning the whole body in relation to the silhouette by rearranging the feet.

Each of these methods of adjusting the position has its positive and negative sides. Therefore, the shooter practically has to choose one of them himself.

Before shooting, you should also check the correctness of the grip applied in relation to the tightness of the grip, and mainly the work of the index finger. If, when raising the hand, the front sight in the slot clearly moves to the side, and when moving the index finger, the pistol moves, you need to review the position of the index finger, as well as the grip - the degree of tightness of the grip.

These are the general requirements for a typical setup for rapid pistol shooting at silhouettes.

Let us now consider the relative position of the supporting surfaces of the body - the feet, which limit the area of support of the body when prepared for shooting at silhouettes (Fig. 175).



Fig. 175 - Position for rapid shooting at silhouettes (top view)

In Fig. 176, for comparison, the "traces" of the shooters and a schematic representation of the mutual arrangement of the links of the right arm in relation to the line of the shoulders are shown, from which the difference in the used variants of the stance is visible, differing from each other: in the width of the placement of the legs,

their different orientation in relation to the targets; the degree of "twisting" of the body at the waist, as well as the size of the angle formed by the line of the shoulders and the axial line of the shoulder part of the right arm.

1958-61 г.г.



Насонов В.



Крихели Б.



Волинский Г.



Кропотин А.



Шептарский П.



Забелин А.



Сорокин В.



Хайдунов Е.

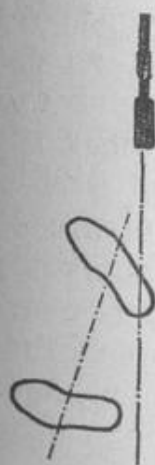


Калиниченко Н.



Черкасов Е.

1972 г.



Сулейманов Р.



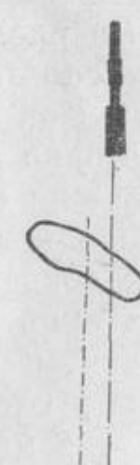
Алехин Ю.



Кузьмин А.



Торшин В.



Бакалов И.

Fig. 176 - "Traces" - the relative position of the supporting surfaces of the body (feet) and the schematic relative position of the links of the right hand in relation to the line of the shoulders when ready for rapid shooting from a pistol at silhouettes
(the given orientation is on the average silhouette)

Looking at the "traces" in combination with the projections of the shoulder line and the links of the right arm (see Fig. 176), it is easy to notice that the overwhelming majority of leading shooters strive to orient their feet in relation to the target in such a way as to avoid excessive "twisting" of the body at the waist (the shoulder line is parallel to the line passing through the centers of the supporting surfaces of the body). Taking into account also the presence of a certain angle during the preparation between the shoulder line and the line passing along the right arm, we see that the majority of our leading shooters, especially recently, do not stand strictly sideways to the middle silhouette, but orient their feet so that the line passing through the centers of the supporting surfaces is deviated slightly to the right of the plane of shooting. And indeed, the absence of preliminary "twisting" of the body at the waist creates the necessary conditions for the shooter to smoothly rotate the body with the arm when moving from silhouette to silhouette.

Let us now consider the position of the right hand of leading shooters when ready to shoot. As can be seen from Fig. 177, all the best shooters without exception, when shooting quickly from a pistol at silhouettes, completely straighten their right hand, hyperextending it at the elbow joint, which indicates a more tense state of the arm muscles compared to slow shooting from a pistol. It is also noteworthy that all shooters, as a rule, have their right hand moved to a greater extent to the left of the shoulder line than during slow shooting. Such fixation of the hand also requires more significant work of the muscles of the shoulder girdle. In order to put the muscles that fix the arm in the shoulder joint in an advantageous condition, most leading shooters, when ready, lean their torso to the left and raise the right part of the shoulder girdle upward so that the collarbone or deltoid muscle touches the right cheekbone.

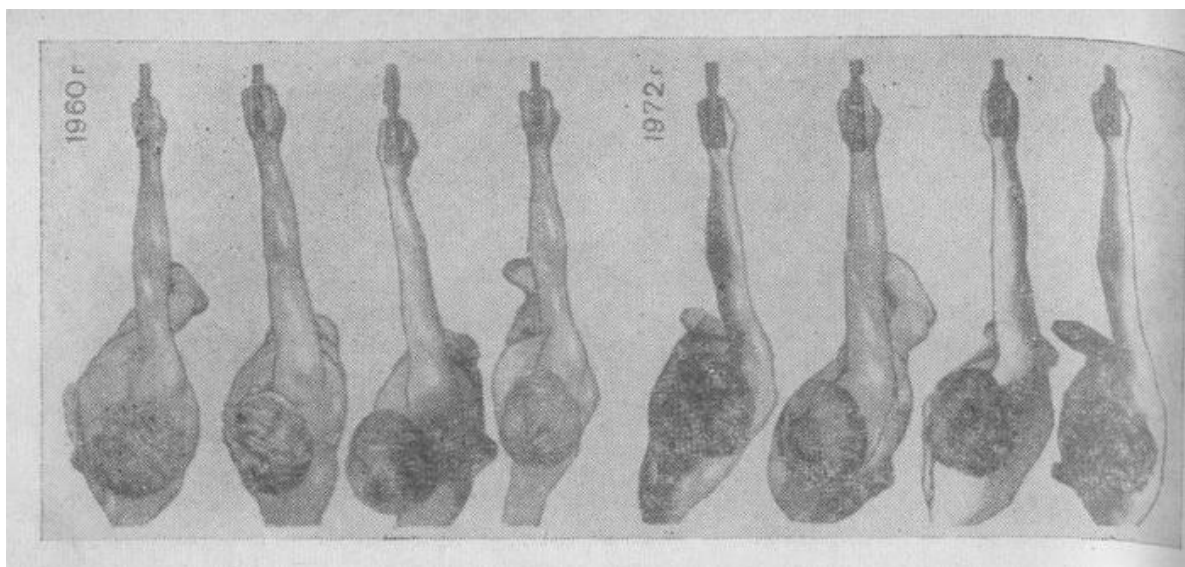


Fig. 177 - Position of leading athletes in rapid pistol shooting at silhouettes (top view)

For comparison, Fig. 178, 179, 180 show the stance of leading athletes in rapid pistol shooting at silhouettes. As we can see, in recent years there have been no significant changes in the basic stance scheme for this type of shooting. Compared with the variants of 1958-1961 (among which, by the way, there are many good ones that fully meet modern requirements), in general, the stance of our leading athletes of 1971-1972 has become more uniform and is distinguished by a slightly larger angle of body rotation to the right relative to the plane of shooting, as well as an insignificant increase in the angle between the shoulder line and the line running along the right arm. There is also no significant difference in the stance of our athletes and leading foreign athletes (see Fig. 180), with the exception of the fact that foreign shooters hold their right arm at a smaller angle to the shoulder line when stance (in connection with which, naturally, they become more sideways to the plane of shooting) compared to our athletes. In the overwhelming majority of cases, the presented variants of the preparation of our leading and foreign shooters of the period 1971-1972 were constructed taking into account the specific requirements that the very nature of this high-speed type of shooting with the transfer of fire from one silhouette to another places on the preparation.

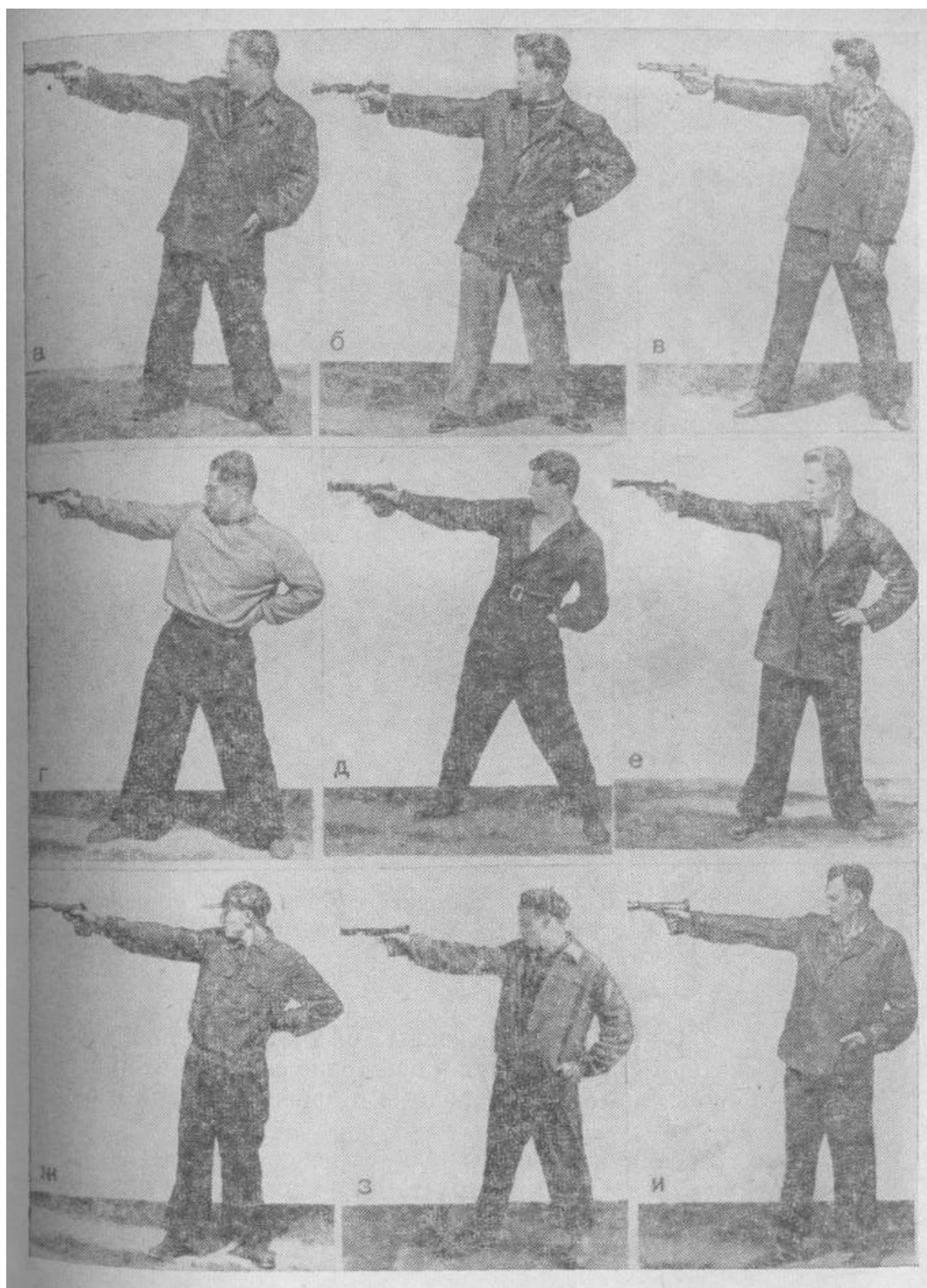
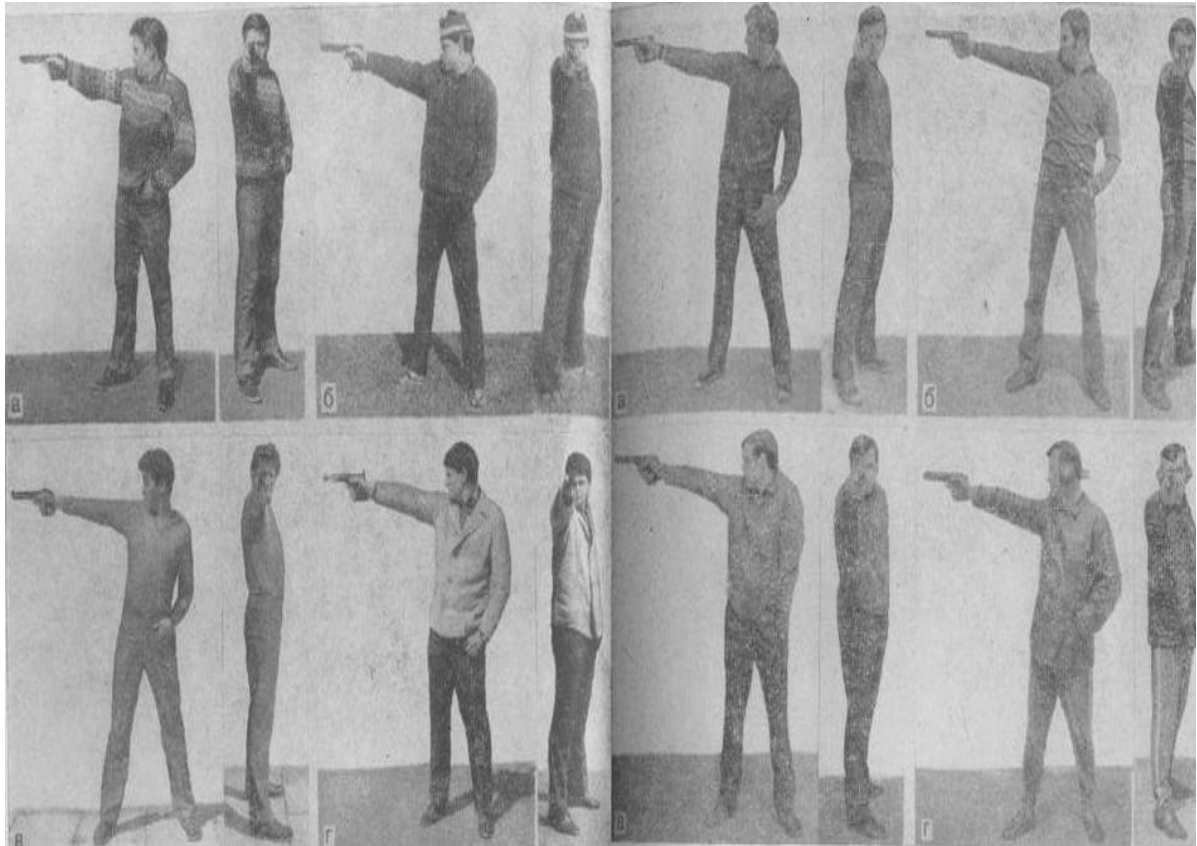


Fig. 178 - Position of leading athletes in rapid pistol shooting at silhouettes (side view), 1958-1961:

a - A. Kropotin; b - A. Zabelin; c - E. Khaidurov; g - N. Kalinichenko; d - E. Cherkasov; e -

V. Sorokin;
g - V. Nasonov; *h* - R. Suleimanov; *i* - B. Krikheli.



Rice. 179 - Preparation of leading Soviet athletes for high-speed pistol shooting in silhouettes, 1971-1972:

on the left *a* - R. Suleymanov; *b* - V. Torshin; *c* - I. Bakalov; *g* - Yu. Alekhine; on the right is S. Frantsevsky; *b* - A. Kuzmin; *c* - V. Terentyev; *Mr.* V. Spivakov.

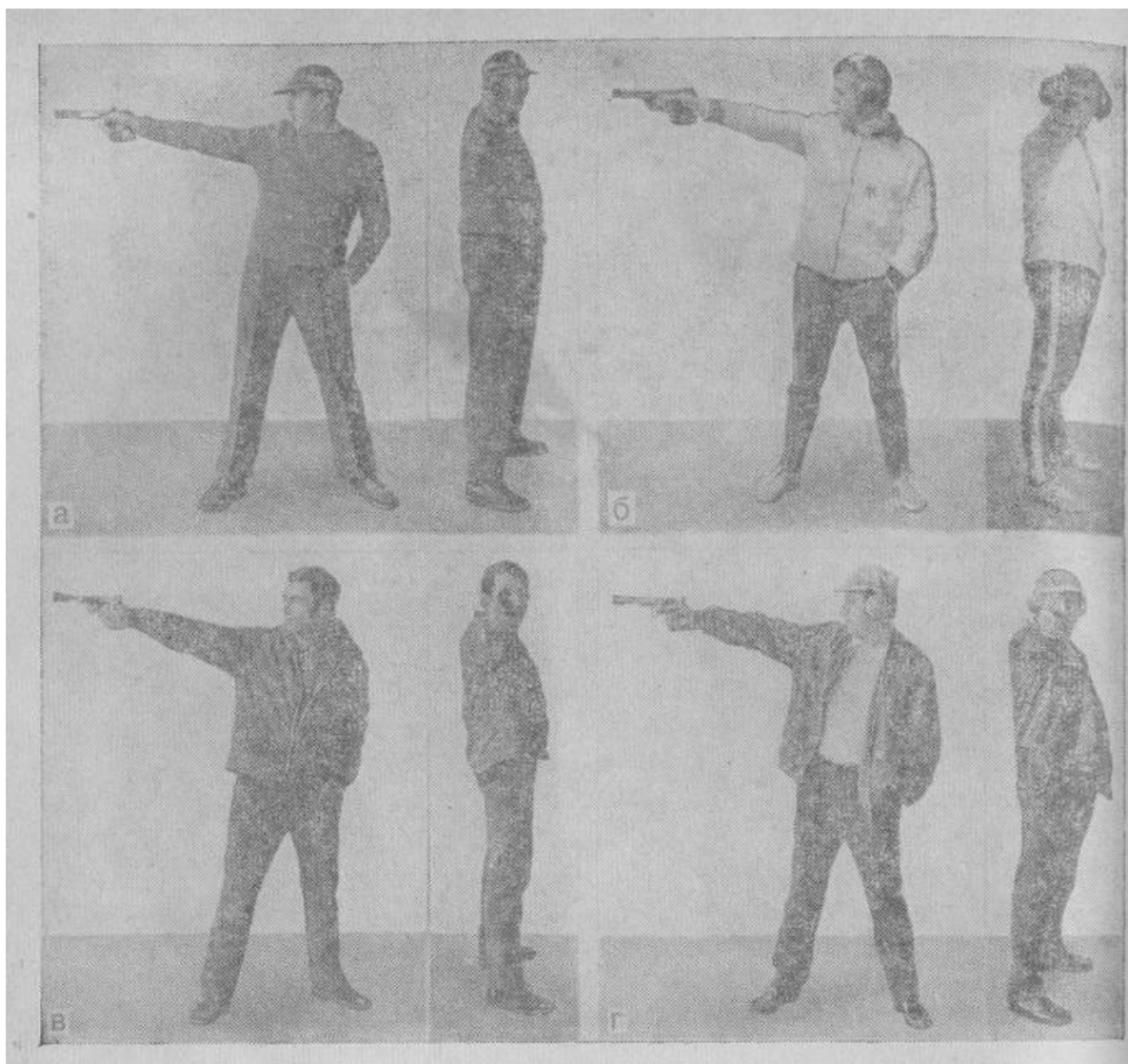


Fig. 180 - The position of leading foreign athletes in rapid pistol shooting at silhouettes, 1971-1972:

a - J. Zapendzki (Poland); *b* - E. Mazurat (FRG); *c* - M. Rosca (Romania); *d* - I. Tripsa (Romania).

Young shooters should be guided by the general requirements for a typical stance for rapid pistol shooting at silhouettes when searching for the most suitable stance option for themselves.

Some features of the preparation for shooting from a revolver and a small-caliber sport (standard) pistol by silhouette

The shooting position for a large-caliber pistol (revolver) and a small-caliber sport (standard) pistol at a silhouette differs in some

details from the previously considered types of shooting position for slow shooting from a random pistol at a target with a black circle and rapid shooting from a multi-shot pistol at silhouettes. This difference is due to the fact that rapid shooting at a silhouette (3 sec. per shot) does not require such a large and prolonged physical load as slow shooting from a random pistol or revolver, associated with holding the weapon in the air for a long time. There is also no need for increased rigidity of the position as a whole, characteristic of rapid shooting from a self-loading pistol at silhouettes, dictated by the need to transfer fire from one silhouette to another not by an isolated movement of the right hand at the shoulder joint, but by a rotational movement of the body and the right hand, rigidly fixed to it.

The position for an accelerated shot at the silhouette must satisfy the following basic requirements: have increased stability in the direction of the plane of fire; allow the shooter to quickly, smoothly, without deviations to the sides, raise his hand. The choice of one or another position should be subordinated to the satisfaction of these fundamental requirements.

In order for the position to have increased stability in the plane of shooting and for the rapid raising of the hand with the weapon when moving from the "ready" position to the final position for shooting not to be accompanied by significant swaying of the body due to the movement of the overall center of gravity of the entire system, the feet should be placed 5-10 cm wider than in their usual position for slow shooting from a revolver (pistol) at a target with a black circle (Fig. 181).

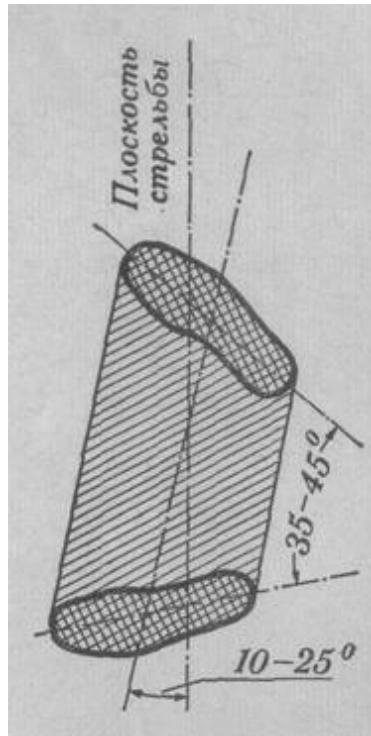


Fig. 181 - The relative position of the supporting surfaces - the feet when ready for rapid shooting from a revolver (pistol) at the silhouette

The position of the right hand should not differ in principle from the usual position when shooting - the arm should be fully straightened and hyperextended at the elbow joint. However, the fixation of the arm in the shoulder joint should be somewhat different compared to the position for slow shooting. Since accelerated shooting is generally a fast exercise, in which the shooter can spend no more than 3 seconds processing each shot, and the weight of a revolver and a standard small-caliber pistol is noticeably less than the weight of arbitrary pistols for slow shooting, the decisive factor is not the economical use of physical strength, not the relief of the work of the muscles that fix the arm in the shoulder joint, but the creation of the most favorable conditions for an unimpeded smooth rise of the arm without any unnecessary inhibition on the part of individual muscle groups (Fig. 182).

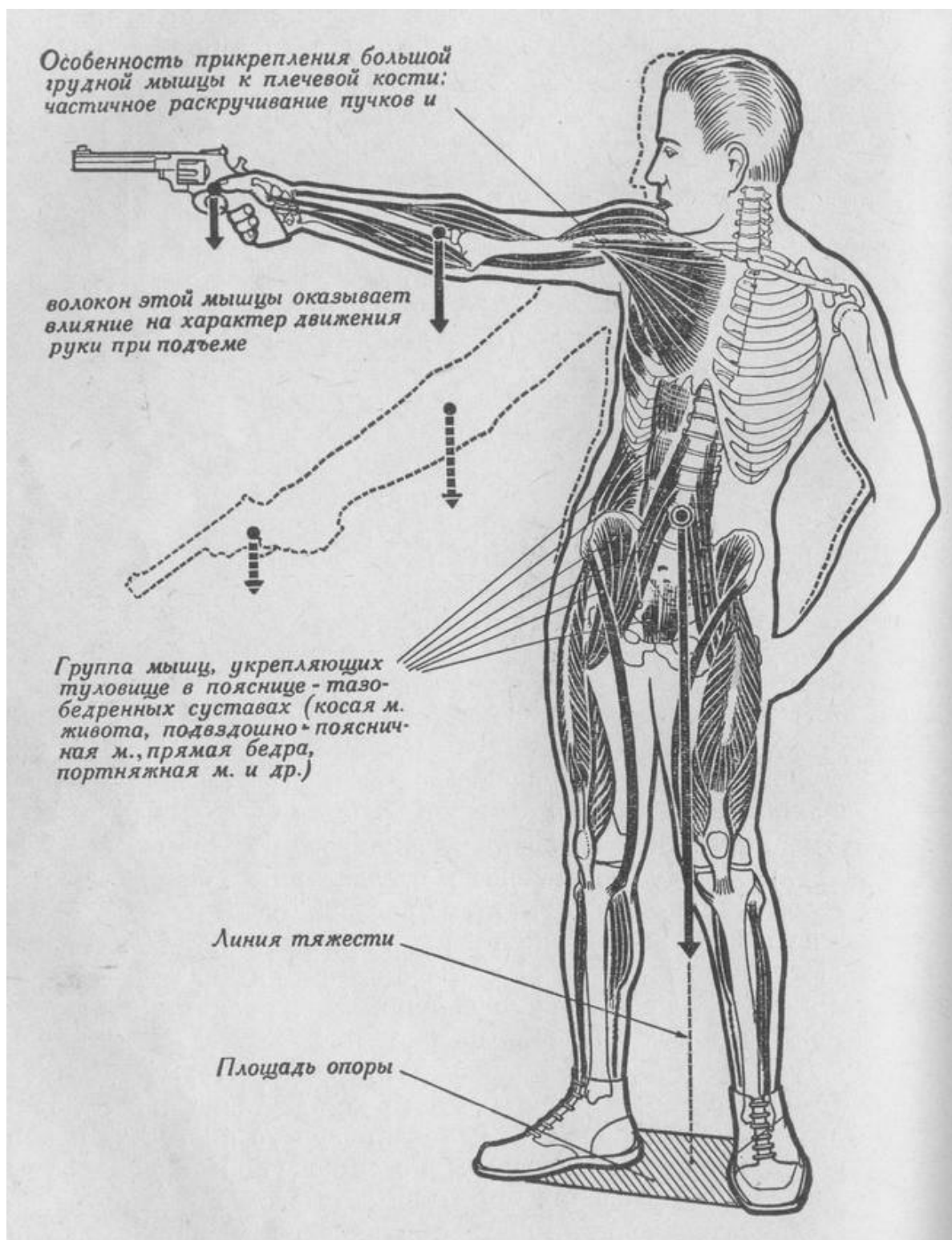


Fig. 182 - Scheme of preparation for rapid shooting from a revolver (pistol) at the silhouette

The condition for the free, smoothest movement of the right hand when raised to a horizontal level corresponds to such an orientation of its shoulder part in the shoulder joint, in which the straight-

ened arm with the weapon aimed at the target is at a significant angle to the line of the shoulders, that is, when the shooter turns the body slightly to the right in relation to the plane of shooting (Fig. 183).



Fig. 183 - The position of the arm in which fixing its upper arm in the shoulder joint allows the most unhindered raising of the arm to the horizontal

The pistol grip should be adjusted so that the right hand, as when firing series of shots at silhouettes, is not tilted down too much; its fixation in the wrist should be achieved mainly by the work of the muscles, and not by the ligamentous apparatus (see p. 117). Between the direction of the barrel when ready and its direction when

the hand is tilted down to its maximum, the angle should be within 12-14°. As an illustration of this, Fig. 184 shows the grip - holding the pistol with the hand by leading female shooters, whose position is shown in Fig. 185.

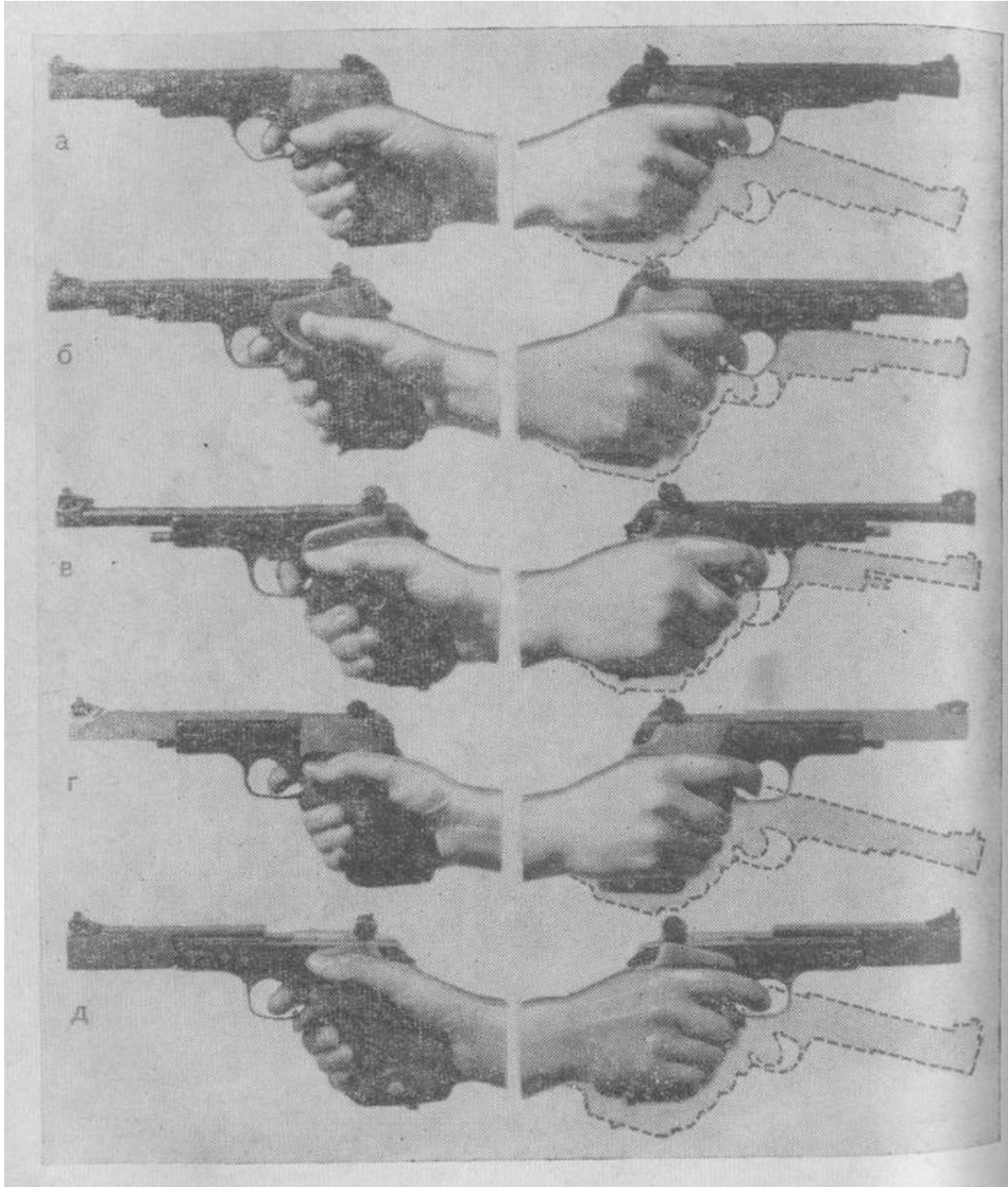


Fig. 184 - "Grip" - holding a standard pistol with the hand by leading female shooters (the dotted line shows the maximum downward tilt of the weapon), 1971:

a - N. Stolyarova; б - I. Ivanova; в - N. Ibragimova; г - O. Kudryavtseva; д - G. Dmitrieva.

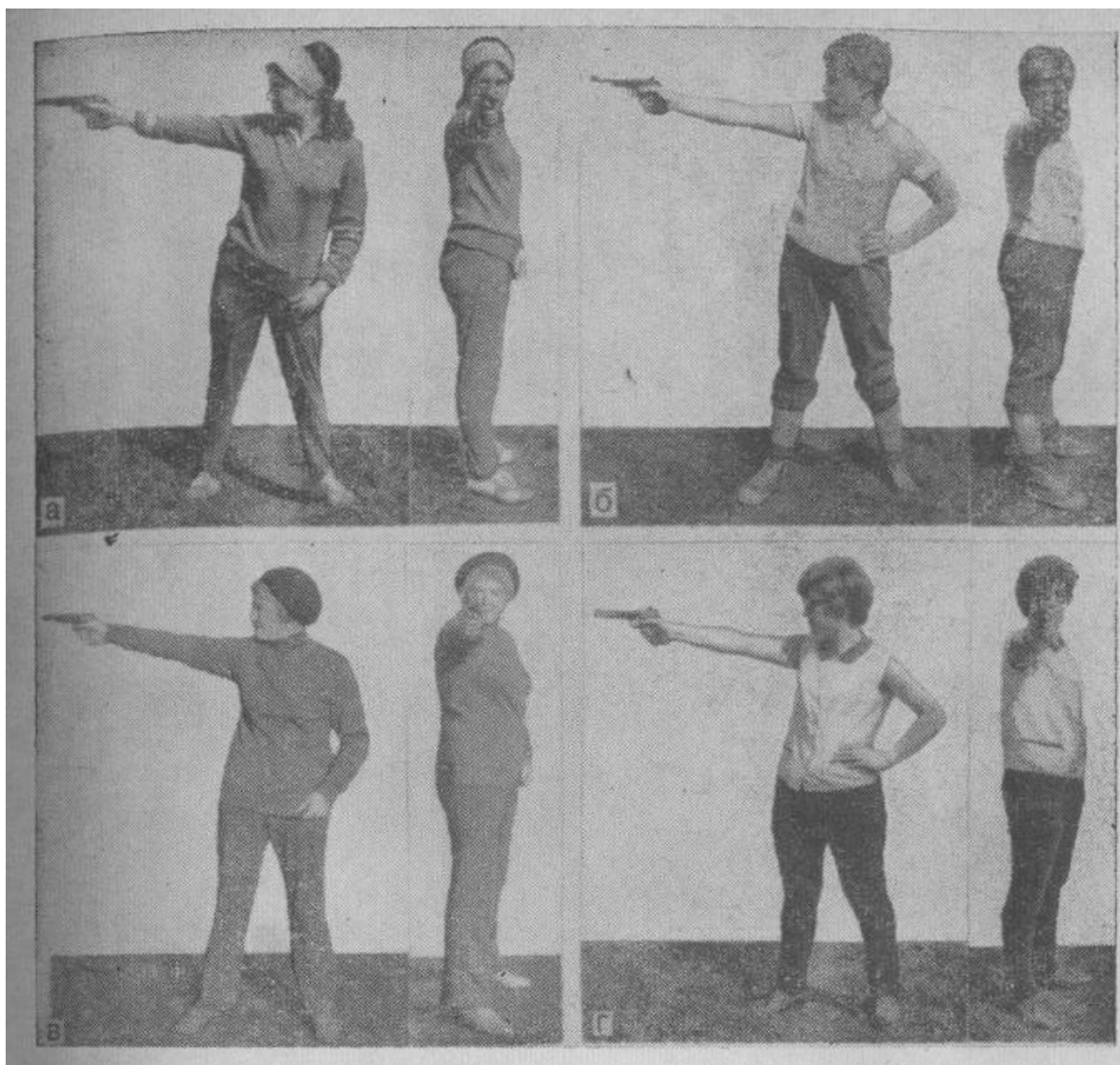


Fig. 185 - Position of leading female shooters when shooting from a pistol at a target with a black circle and at a silhouette, 1971:

a - N. Stolyarova; b - N. Ibragimova; c - I. Ivanova; d - O. Kudryavtseva.

Let us now consider the combined "footprints" of some leading shooters, the relative positions of their feet when in a position for slow shooting from a revolver or small-caliber pistol and when in a position for rapid shooting at a silhouette. As can be seen from Fig. 186, the difference in the position of the feet of each of these shooters lies not only in the fact that when switching to a position for rapid shooting, the legs are placed more widely. It is also noteworthy that in doing so, the overwhelming majority of leading shooters change the orientation of the feet in relation to the target - they turn their body slightly to the right, hold their right hand at a large angle to the line of the shoulders, which, in general, is a sure

sign of a change in the nature of the attachment of the hand in the shoulder joint.

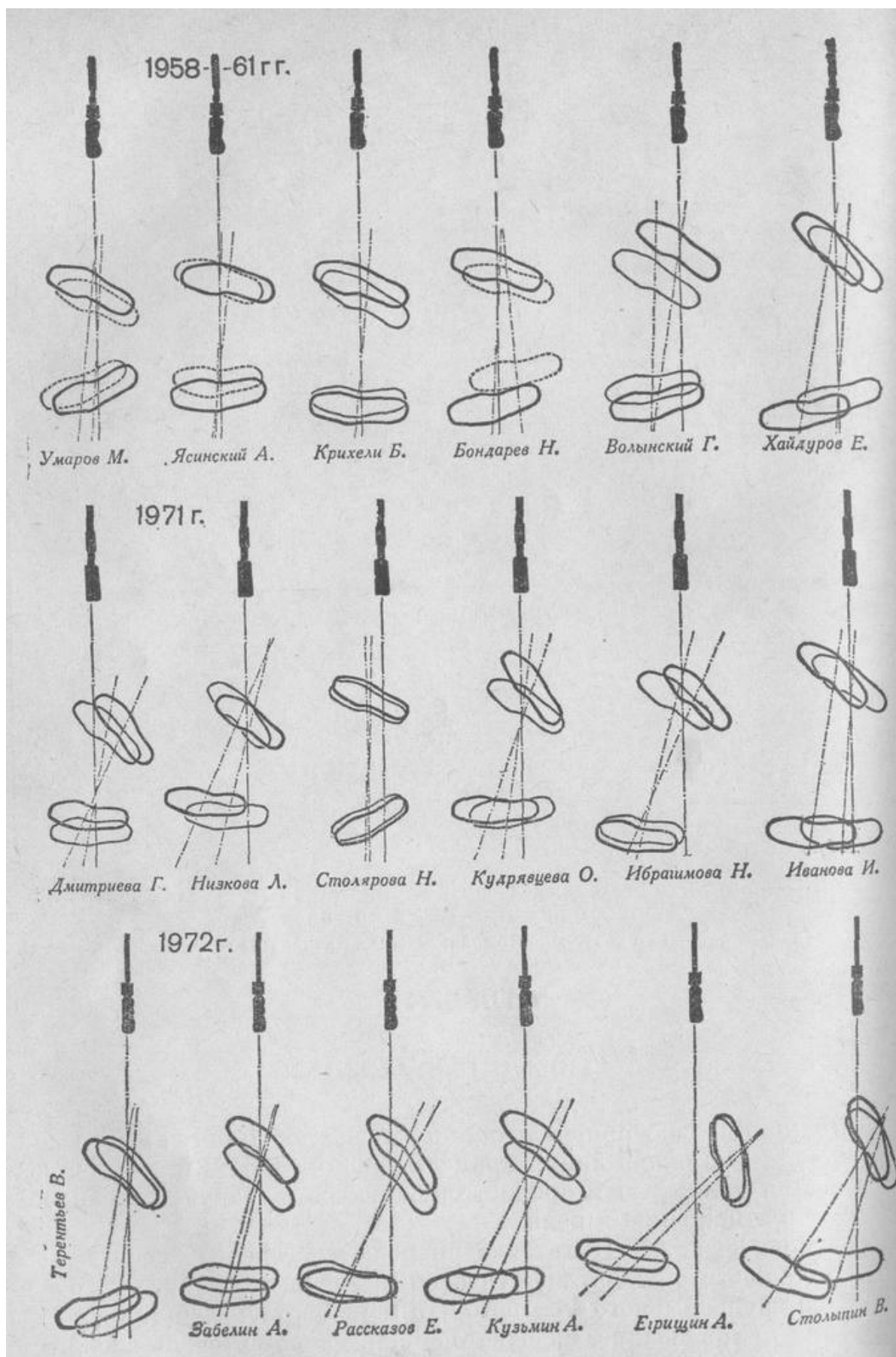


Fig. 186 - "Traces" - the relative position of the supporting surfaces

when prepared for slow shooting from a revolver (pistol) - a dotted line - and for accelerated shooting at the silhouette - a solid line

Therefore, the main difference between the position for slow shooting at a target with a black circle and accelerated shooting at a silhouette is a wider spacing of the legs, a slightly rightward turn of the body, fixing the right arm in the shoulder joint, mainly due to more intense muscle work. These considerations should guide the shooter when choosing and polishing the most advantageous position option for himself, controlling himself and consciously changing the position to the necessary extent each time when switching from slow shooting at a target with a black circle to accelerated shooting at a silhouette.

* * *

From all that has been said in this chapter it is clear that the shooting positions used by leading shooters, along with many common basic features inherent in them, at the same time differ quite sharply from each other in detail. And, despite the differences in detail, the various paths that shooters-athletes took in search of the most advantageous position for themselves, the end result was one - the achievement of high sports results. Achieving the heights of sports mastery was a consequence of the fact that the strongest shooters, conducting continuous searches, in most cases built their position on a fundamentally correct basis as a whole, and in detail - in accordance with their individual characteristics: physique, physical development, type of nervous system, their taste and character.

Chapter 2. Aiming

Basically, aiming consists of the shooter placing the sight, the top of the front sight and the aiming point on the same line, thereby giving the weapon the appropriate direction in relation to the target.

However, since the position cannot ensure absolute immobility of the weapon, in practice, aiming must be done under conditions of continuous greater or lesser oscillation of the weapon. Therefore, aiming, aiming the weapon, is a very complex visual-motor process that requires high visual-motor coordination of the shooter's actions, during which he must not only visually perceive the violation in the relative position of the sighting devices and the target, but also move the weapon with appropriate movements and restore its direction relative to the target.

It is obvious that when shooting from a pistol (revolver), characterized by significant oscillations of the hand with the weapon, the aiming process is dominated by a motor process, in which the visual analyzer acts mainly as a kind of corrector, signaling about the deviation of the hand with the weapon in one direction or another. This is followed by impulses from the corresponding parts of the central nervous system to the muscle groups, aimed at restoring the position of the hand with the weapon relative to the target.

When shooting a rifle from firing positions that ensure maximum stability of the weapon, the main role is played not by the motor, but by the visual side of the aiming process - the clarity of the eye's perception of the contours of the sighting devices and their relative position relative to the target, the discriminating ability of the visual analyzer.

Below we will consider this - the visual side of the aiming process.

3.2.1 Aiming Features

An essential condition for correct aiming should be such a mutual arrangement of the sighting devices (regardless of the type of sights) that a "level front sight" is maintained.

When aiming with an open sight, a "level front sight" is a visible arrangement of the sighting devices in which the front sight is in the middle of the sight slot, and the top of the front sight is at the same level as the upper edges of the slot (Fig. 187, a).



Fig. 187 - The relative position of the sighting devices, called "flat front sight":

a - open sight; *b* - diopter sight; *c* - optical sight.

When aiming with a diopter sight, the "level front sight" will be the alignment of the top of the rectangular front sight (or the center of the hole in the ring front sight) with the center of the diopter hole (Fig. 187, b).

When aiming with an optical sight, the condition of maintaining a "level front sight" will correspond to the passage of the eye's line of sight strictly along the main optical axis of the sight (Fig. 187, c); for this, it is necessary to ensure that the sight's eyepiece is not darkened when aiming.

In order to perform the action of aiming, the shooter must aim the "level front sight" under the lower edge of the "apple" of the target (Fig. 188). When aiming at a target with a black circle, sports shooters do not bring the "level front sight" right up to the lower edge of the "apple" of the target, but leave a small gap between them (the size of the gap will be discussed below). This is the scheme of correct aiming.



Fig. 188 - Aiming - aiming the "flat front sight" under the lower edge of the target's "apple"

If the shooter does not observe the main condition of correct aiming (keeping the front sight level), but allows the front sight to "play" due to inaccurate aiming, i.e. positions it differently in the sight slot, then accurate shooting does not work, since the bullets deviate each time in the direction where the front sight is held in the slot (Fig. 189).

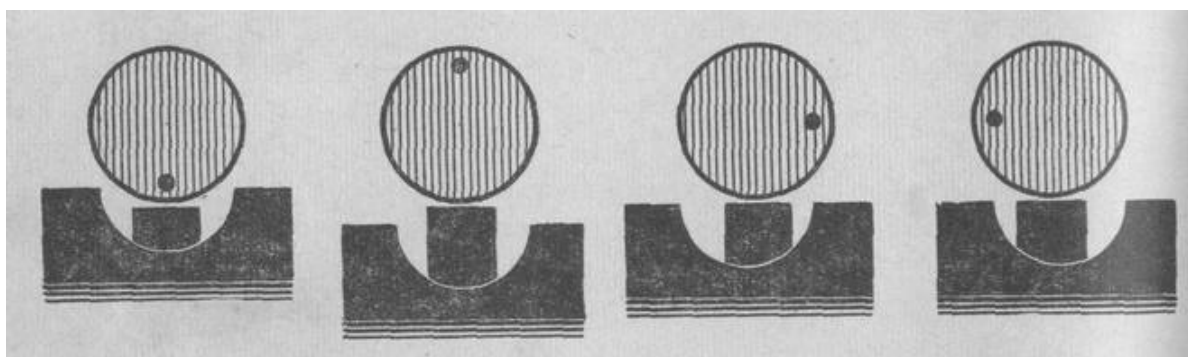


Fig. 189 - Bullet deviation to the side when "playing" with the front sight

It should be borne in mind that incorrect placement of the front sight in the sight notch, i.e. an "uneven front sight", leads to angular displacements of the weapon, which entails significant deviations of the bullets from the target center. At the same time, even sharply noticeable deviations of the "even front sight" from the aiming point do not significantly reduce the shooting results (Fig. 190). Thus, the accuracy of aiming depends on the shooter's ability to always maintain a "even front sight" and align its top with the lower edge of the target's "apple" (with the aiming point).

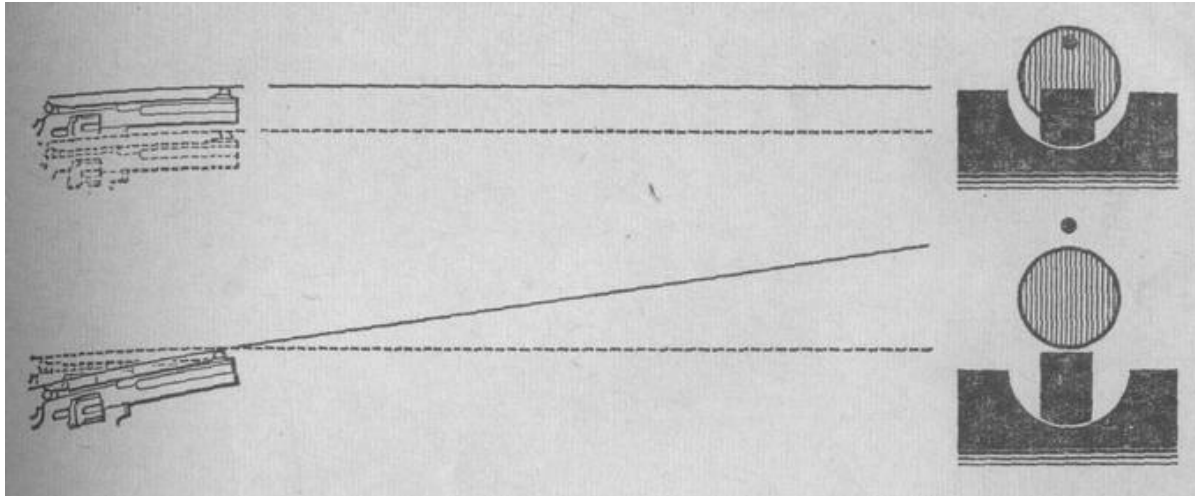


Fig. 190 - Bullet deflection when the weapon is shifted:

a - parallel; *b* - angular.

At first glance, the aiming scheme described above seems simple and clear. But when the shooter wants to implement it in practice, he will encounter many difficulties during shooting.

The main practical difficulties that arise for the shooter during aiming are due to the structural features of the eye and its operation as an optical apparatus during the aiming process.

3.2.2 The eye and its work during aiming

The aiming process in the types of preparation that ensure maximum immobility of the weapon, as is known, places very high demands on vision, since the uniformity and degree of aiming accuracy are directly dependent on visual acuity and the conditions that determine them. Therefore, the shooter must have a good understanding of some optical properties of the eye in order to know to what extent and under what conditions optical imperfections of the eye (see below) can have the least effect on the accuracy of aiming.

The human visual analyzer (organ of vision) (Fig. 191) allows us to quite accurately distinguish colors, shapes, sizes, levels of illumination, and the location of objects in the world around us.

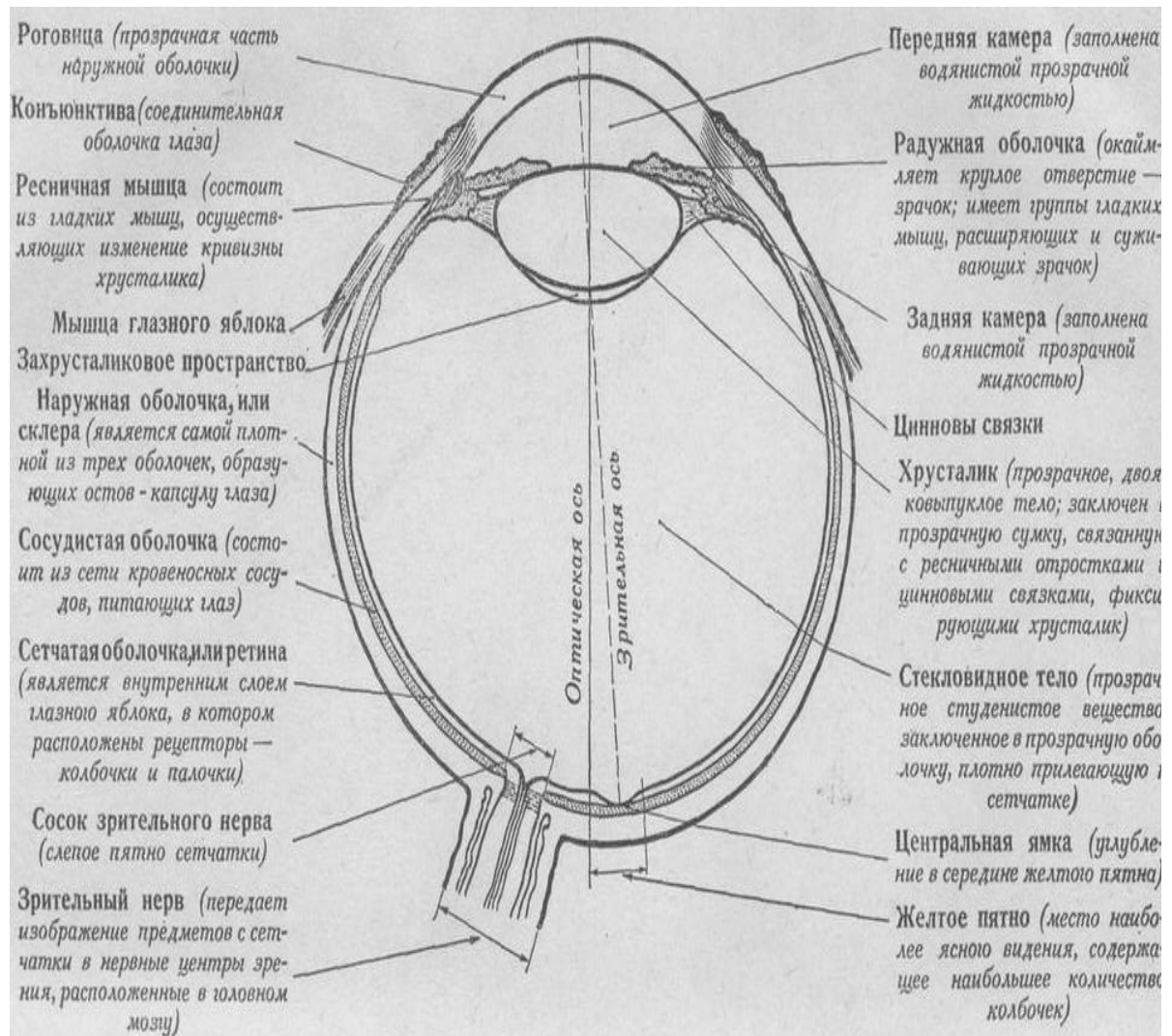


Fig. 191 - Horizontal section of the human eye (right eye)

The light-refracting apparatus is located in the front part of the eye, facing the light; it is a system of refractive media and surfaces, including the cornea, the lens, the aqueous humor, and the vitreous body filling the cavity of the eye. (The light-refracting apparatus also includes the iris, which has an opening in the middle - the pupil.)

The degree of illumination, shape and location of objects around us are perceived by the internal light-sensitive membrane - the retina, or retina, connected via the optic nerve to the corresponding section of the cerebral cortex. To obtain correct visual perception of any object, its image on the retina must be clear. This is achieved due to the ability of the eye to adapt its light-refracting system and thereby receive a clear image on the retina from objects at different distances from it.

The role of the photographic lens in our eye is played by the crystalline lens, which is a transparent biconvex body resembling an ordinary lens. With different distances of the observed objects, the curvature of the crystalline lens reflexively changes, due to which the optical system of the eye very quickly adapts to the perception of objects located at different distances from us. As a result, the image of the object on the retina is sharp, which allows us to correctly and clearly perceive the shape and outlines of the objects around us. This ability of the eye to adapt to viewing objects at different distances by changing the curvature of the crystalline lens is called accommodation.

Consequently, the human eye is designed in such a way that it cannot simultaneously clearly see objects that are at different distances from it. Therefore, it is quite obvious that when aiming, it is not possible to simultaneously see the sighting devices and the target, which are at different distances from the shooter's eye, with the same clarity. Keeping this in mind, when aiming, one should not strain one's eyesight excessively in vain attempts to see everything clearly at the same time.

A normal eye in a state of rest is set to perceive distant objects, so to speak, to infinity. In order to switch to the perception of objects located close by, a certain muscular effort is required to change the curvature of the lens. The mechanism of accommodation is that the ciliary muscle reflexively contracts, as a result of which the lens takes a convex shape, thereby increasing its refraction

In this regard, one should not abuse the excessively frequent shifting of the gaze from one point of clear vision to another during aiming - from the notch and front sight to the target and back (as young shooters sometimes try to do), since in such cases prolonged muscular efforts lead to rapid and significant fatigue of the eye muscles. For the same reason, the shooter should not aim for a long time (see below), and in the intervals between the next aiming, concentrate his gaze on some object; it is best to look into the distance with a "scattered gaze" and thus give the eye muscles a rest.

When the intensity of natural light changes, the sensitivity level of the eye changes and the eye adapts (adapts) to the different

amount of light entering it. The pupil of the eye, an opening in the middle of the iris, plays a role similar to the diaphragm in a photographic camera. Under the action of the muscles, the diameter of the pupil can become narrower and wider; this regulates the amount of light entering the eye, and also improves the depth of focus of the image of an object on the retina when the pupil narrows.

The question of the pupil's reaction speed to changes in lighting deserves attention. It turns out that the pupil constricts much faster when switching to high brightness than it expands again when entering conditions of lower brightness. Thus, according to Reeves, the constriction of the pupil to a stable level continues for about 5 seconds, and for reverse expansion after the cessation of light irritation - about 3 minutes. From this, the shooter should also draw the appropriate conclusions: in order to maintain the "working capacity" of the eye, without reducing the accuracy of aiming, one should not look at brightly lit objects before or during shooting, and especially not expose the eye to sharp transitions from light to shadow; in between shots, you do not need to rest with your eyes closed; between shots, you need to give the eye a rest; for this, it is best to look at distant, monochromatic, dim surfaces of gray, green, blue color

It was said above that the degree of accuracy of visual perception of the shape and outlines of objects around us depends on the clarity of their images on the retina. It is necessary to know that due to optical imperfections of the eye, the images of objects on the retina do not have completely sharp, but rather blurred boundaries; as a result, there is some limit to the distinctive sensitivity of the eye, which determines visual acuity. It should be borne in mind that visual acuity itself is not constant and is a variable value, depending on the extent to which and under what circumstances optical imperfections of the eye affect. Therefore, the shooter needs to know, at least in general terms, about the conditions that affect visual acuity and thereby the degree of aiming accuracy.

The eye, as an optical instrument, is subject to the phenomena of aberration and diffraction of light.

Spherical aberration is that the light rays falling on the crystalline lens (which is a kind of spherical lens) are refracted differently and

do not focus at one point, since the outer rays are refracted more strongly than the central ones (Fig. 192). As a result, a beam of parallel rays falling on the eye is focused on the retina not as a clear image, but as a circle of light scattering. The circle of light scattering from spherical aberration is the larger, the larger the pupillary opening. It is quite obvious that the sharpness of the image will increase if the outer rays are eliminated. Consequently, with a decrease in the pupil opening, the sharpness of the image of the object on the retina increases.

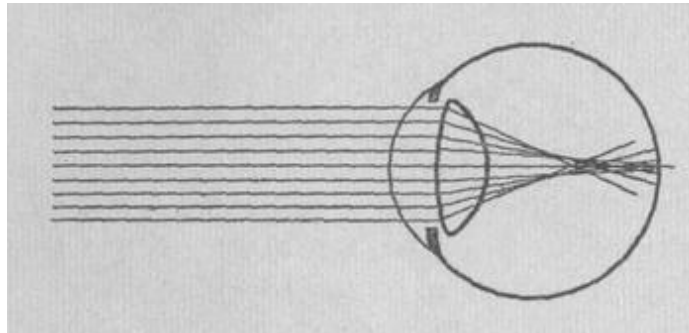


Fig. 192 - Phenomenon of spherical aberration

To what extent spherical aberration can interfere with seeing objects clearly and how image sharpness depends on the size of the pupillary opening, the shooter can see for himself with a simple example. Small landmarks and objects, difficult to distinguish at a great distance in cloudy weather, become incomparably better distinguishable if you look at them through a small diopter opening, which in this case plays the role of an artificial pupil.

The phenomenon of light diffraction consists in the fact that light rays, passing through small openings, in particular through the pupil, are bent (Fig. 193) and produce an image on the retina not in the form of one clear point, but in the form of a circle, bordered by a number of concentric light rings of decreasing brightness. This occurs due to the wave nature of light. Diffraction rings around the images are noticeable only at very small pupil sizes and will be larger, the smaller the pupil opening, which is, as we see, a certain opposite of spherical aberration. The phenomenon of diffraction makes itself felt in sunlight from the front, when the sun shines into the eyes, or in bright sun glare on the surface of sighting devices, when they strongly reflect, etc.

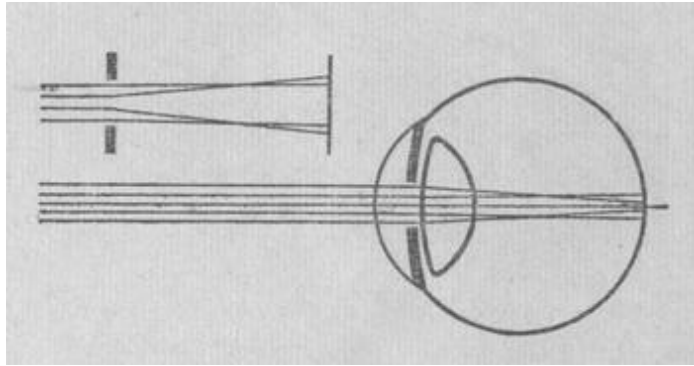


Fig. 193 - Phenomenon of light diffraction on the pupil

The work of the eye as an optical apparatus is to a certain extent harmed by the light scattering that occurs in it. Light rays on their way to the retina, passing through the ocular media that do not have absolute transparency - the lens and the vitreous body, are scattered in them. Light scattering inside the eye also occurs because light rays are reflected from the back layers of the retina. The effect of light scattering is manifested in a more or less noticeable radiance and a weak luminous haze covering the field of vision. Light scattering is especially noticeable when examining brightly lit objects, especially against a dark background, or when bright light hits the eyes directly. Light scattering in the ocular media is also attributed to those light halos around objects, due to which the clarity of their images on the retina is lost.

Light halos are especially noticeable when the target is illuminated by bright sunlight - then its white background strongly reflects and causes significant light scattering in the eye environment. Under its blinding effect, the eye perceives the target's "apple" as a gray spot with fuzzy edges, and the sighting devices - with a fuzzy outline

Thus, the light scattering from spherical aberration is greater, the larger the pupil opening, and from diffraction is greater, the smaller the pupil opening, which does not allow eliminating them. As a result of this inverse dependence of the effects of aberration and diffraction on the pupil size, the best conditions for clear visual perception correspond to a certain average pupil opening size - about 3 mm in diameter.

Taking this into account, depending on the lighting conditions that affect the size of the pupillary opening, the shooter should strive to create the most favorable conditions for the eye to work, protecting

it from the effects of light with visors, smoked glasses or light filters. It is also necessary to ensure that the sighting devices do not shine and thus do not blind the eyes - they must be blackened with soot

It should also be known that aberration causes the phenomenon of light irradiation, which manifests itself in overestimation of the sizes of light areas on a dark background. In Fig. 194, the black and white stripes are absolutely identical, but the white gap seems larger than the black one. The irradiation effect is greater, the greater the brightness of the luminous or illuminated surface. Consequently, when the degree of illumination of the white field of the target changes, the same in its true size gap between the lower edge of the target's "apple" and the front sight is perceived by the eye differently. Taking this into account, when shooting with a rectangular front sight, the athlete should strive to shoot under the same lighting conditions.

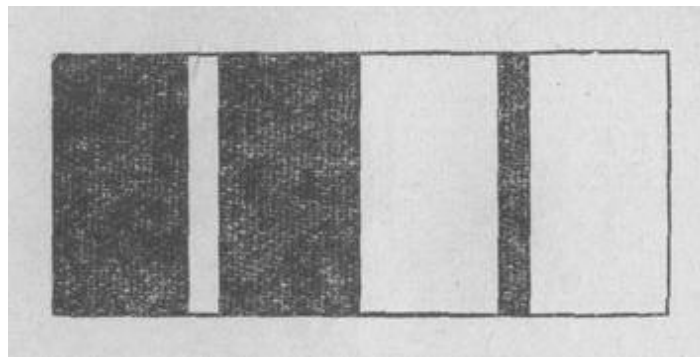


Fig. 194 - Phenomenon of light irradiation. The white gap appears larger than the black one of the same size.

Optical imperfections of the eye - myopia, hyperopia and astigmatism - also prevent the correct focusing of the optical system of the eye and obtaining clear images of objects on the retina.

If the eye is designed in such a way that the rays falling on it in a parallel beam, without any accommodation effort, are focused precisely on the retina, we say that such an eye is normal (Fig. 195, a).

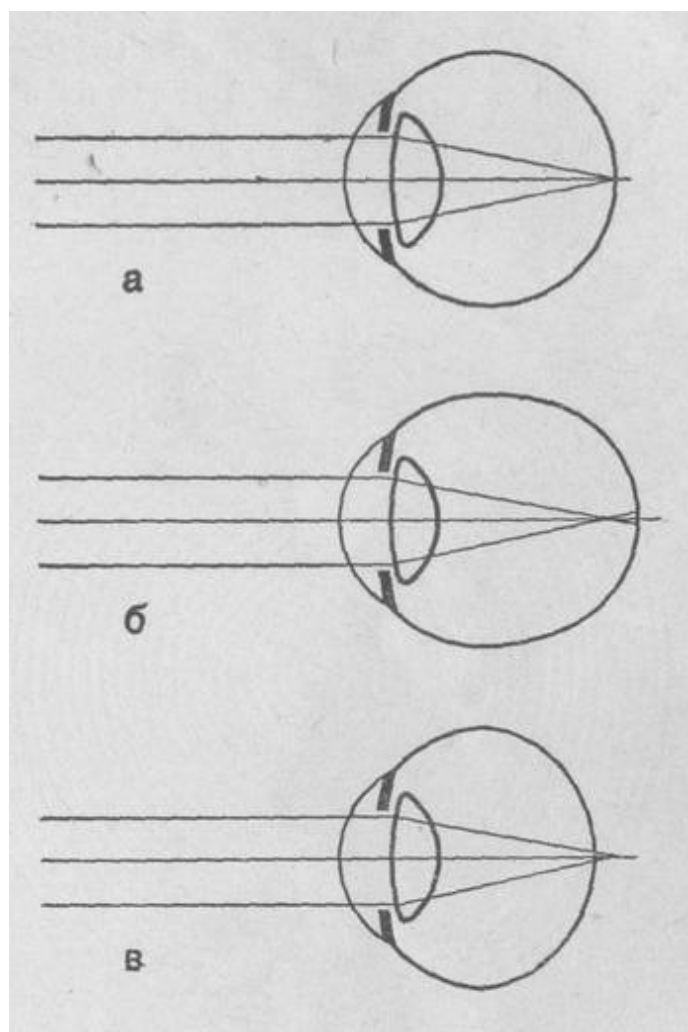


Fig. 195 - Scheme of refraction of rays in the normal (*a*), nearsighted (*b*) and farsighted (*c*) eye

An eye is considered nearsighted if the rays falling in a parallel beam are focused in front of the retina (Fig. 195, *b*). Nearsightedness is caused either by the excessive length of the eyeball or by the high refractive power of the eye, and sometimes by both together. Nearsightedness is relatively easy to correct with the help of optics. Many famous shooters suffer from significant nearsightedness, but this defect of vision, corrected by the appropriate selection of glasses, does not prevent them from achieving record-breaking sports results.

An eye is considered farsighted if the rays falling on it are focused behind the retina (Fig. 195, *c*). This may be due to either a weak refractive power of the eye, or because the eyeball is too short, or both. In such a case, in order to focus the rays on the retina, they must come in a converging beam before entering the eye, which is

why a farsighted eye sees close objects the worst. Such an eye is less amenable to correction with glasses, which are of relatively little help. Shooters suffering from age-related farsightedness have a very poor view of sighting devices; a typical complaint of farsighted people is the merging of the slit; therefore, as a rule, farsighted people shoot poorly from weapons with open sights.

A blurry, fuzzy image of objects on the retina can also be a result of astigmatism of the eye

An astigmatic eye is one in which the refractive surfaces of the cornea and lens do not have a regular spherical shape. Parallel rays falling on the eye cannot produce a clear focal image on the retina, since their refraction in different meridians of the eyeball occurs at different angles. As a result, the light-refracting apparatus of the eye has not one main focus, but several, located at different distances from the retina, therefore the image on it is blurred and irregular (Fig. 196).

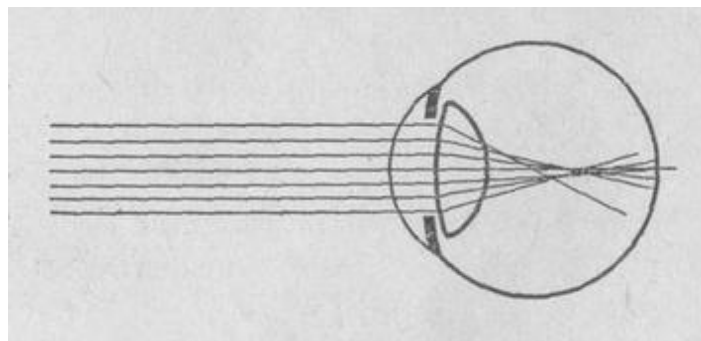


Fig. 196 - Scheme of refraction of rays in an astigmatic eye

It is easy to verify the presence or absence of astigmatism using the table of Professor S.V. Kravkov (Fig. 197). To do this, you need to look with one eye from a distance of best vision (approximately 30 cm) at a disk on which concentric circles are applied close to each other. If astigmatism is present, only individual sectors of the disk will be clearly visible at a time, while the rest of its area will appear blurry.

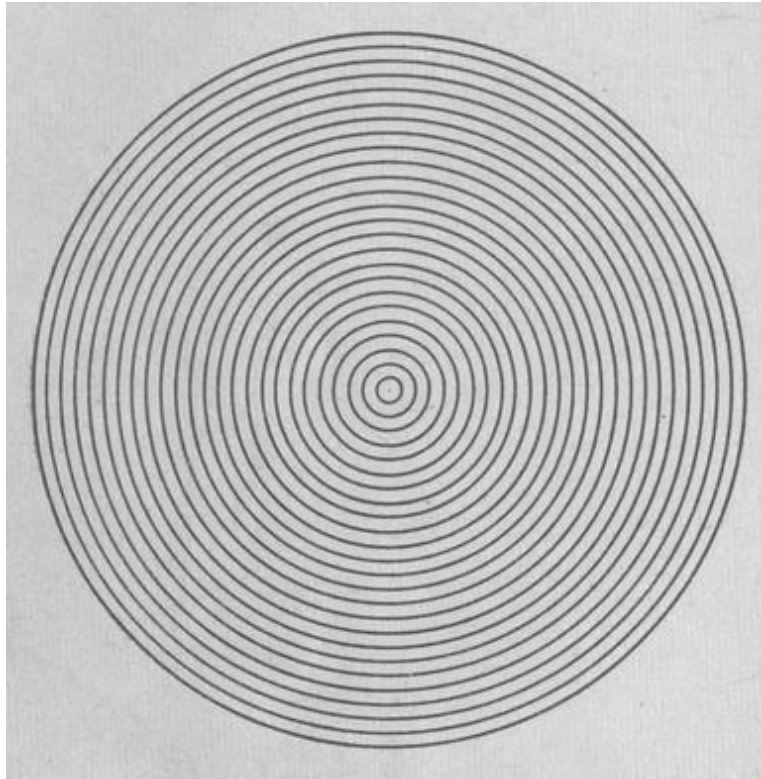


Fig. 197 - Table for detecting astigmatism

The presence of astigmatism should to a certain extent determine the choice of the type of sighting devices. If, for example, when checking the shooter's eyes, it turns out that he sees the upper and lower sectors of the disk unclearly, blurrily, it is inappropriate to recommend him a rectangular front sight: using it, he will not be able to aim uniformly; in such a case, it is better to use a ring front sight

Even with minor vision defects, glasses must be used when shooting: the load associated with aiming will greatly tire the vision, which can lead to its further deterioration. It should be borne in mind that selecting glasses for shooting in the usual way, that is, in office conditions, is not entirely suitable. It is advisable to check the glasses immediately at the shooting range in order to clearly see targets at a great distance. Moreover, such a selection is associated with determining not so much the diopter of the glasses, as the quality of their grinding, since all defects will quickly make themselves known during such a check.

When using glasses (or smoked lenses), it is necessary to ensure that the line of sight passes perpendicular to the surface of the glass and through its center, since the central part of the glass is

usually processed much better. For this purpose, during shooting, a special frame or monacle is recommended, allowing you to hold the glasses perpendicular to the line of sight, without requiring a change in the usual position of the head when preparing

It is necessary to dwell on one more feature of the eyes, which is of great importance in aiming - monocular and binocular vision.

Vision with one eye is called monocular, and with two eyes - binocular. Having two eyes does not always mean that a person has binocular vision. There are cases when one eye, which sees worse, is switched off from the act of vision and a person actually uses only one eye, the better one. The predominance of one eye over the other also occurs when both eyes have the same visual acuity. The eye that a person prefers to use is called the dominant or guiding eye. There is a simple technique that allows you to determine whether both eyes are equal

To determine the guiding eye, the shooter needs to hold his hand at some distance, fold his fingers into a ring and look through it at some small object so that he can see it with both eyes (Fig. 198). Then, closing his eyes one by one, he needs to watch whether the object leaves the ring or remains in it. The guiding eye is the one with which the shooter sees the object undisplaced, remaining in the ring. For most people, the guiding eye is the right one.

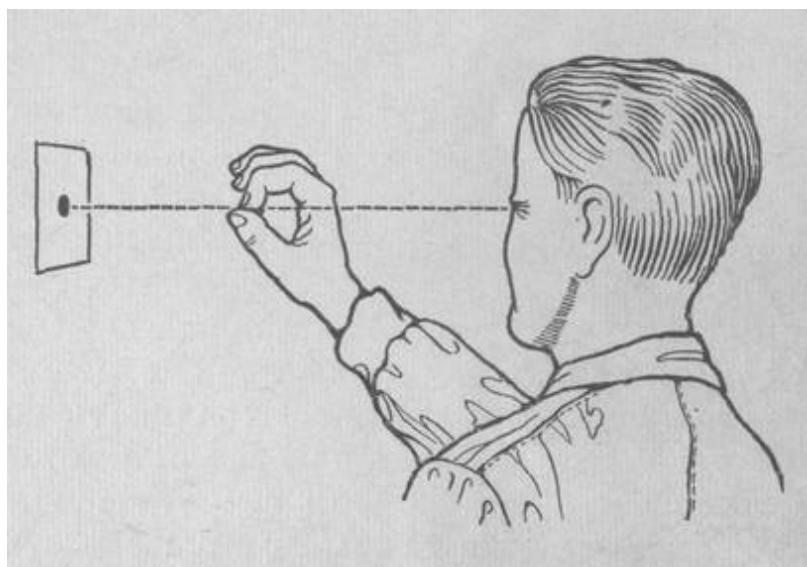


Fig. 198 - Determining the guiding (dominant) eye

If during initial training the shooter was usually asked to close his left eye when aiming and aim the weapon at the target with his right eye, then later on there is no need at all to maintain this training technique of closing the eye, since it has its own major drawbacks.

The first disadvantage is the tension associated with squinting the left eye, which is burdensome for many, especially for novice shooters. Another disadvantage is that squinting one eye is almost always accompanied by greater or lesser tension in the muscles of the eyelids and pressure of the eyelid of the other, aiming eye on the eyeball; the latter affects the light-refracting apparatus. The third point is the involuntary dilation of the pupil of the open eye in response to covering or squinting the other. Research conducted by N.A. Kalinichenko (1968) shows that closing one eye with the eyelid causes a reflex decrease in the visual acuity of the other eye (open) by an average of 20%, to a greater extent than with simple darkening. Therefore, isolating the left eye during aiming by squinting it is completely unacceptable, since it significantly reduces the visual acuity of the right, aiming eye. Based on this, it is best to turn off the second eye not by physical means - by squinting, but by psychologically suppressing the visual impressions of the open, non-aiming left eye.

With binocular aiming, the sighting line is sighted as usual - with one eye. Consequently, this technique does not contain anything fundamentally new; the shooter does not need to relearn or retrain - he simply should not close one eye while aiming (Fig. 199).

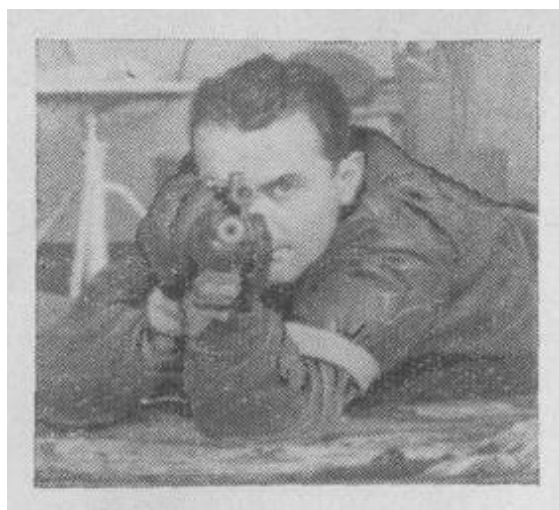


Fig. 199 - Binocular aiming - the shooter does not close his left eye

Binocular aiming has a number of major advantages: the shooter does not have to expend additional effort associated with squinting, which is very important during prolonged shooting; binocular visual acuity is higher than monocular, since the sensory impulses coming from the receptors of both eyes together cause greater excitation of the corresponding parts of the central nervous system; with such aiming, brain cells become less tired, since more natural conditions are created for their activity

However, some shooters for many reasons still cannot aim with both eyes open. One of these reasons is that during long shooting sessions that require intense visual work, the target begins to double, which makes it simply impossible to aim with both eyes. Therefore, as studies have shown (Kalinichenko N.A., 1968), in cases where it is necessary to exclude the left eye from the act of aiming, it is best to use a narrow strip of translucent light plastic, which deprives the left eye of the opportunity to see the target.

All movements of the eyeball, as well as holding it in place when the gaze is fixed on an object, are performed by three pairs of muscles. Due to a certain tension of these muscle groups, the eye is always, including during aiming, in a state of externally imperceptible, small vibration, trembling. During aiming with a rifle, the shooter is forced to tilt his head slightly down and to the right, the eyeball turns accordingly up-inward and is held in such a least advantageous position, which requires combined and increased work of all three muscle groups (Fig. 200). When the oculomotor mus-

cles are tired, the involuntary trembling of the eyeball increases significantly, which worsens the accuracy of aiming. Therefore, such a position is important, in which the position of the head will be the most natural, with the smallest tilt, so that the shooter does not look at the target from under his brows and does not squint.

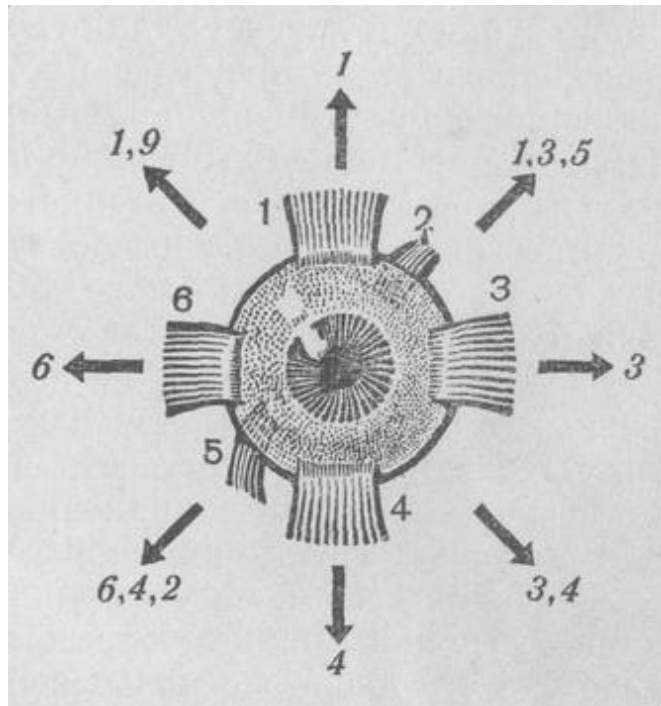


Fig. 200 - Muscles of the right eye (diagram by V.P. Vorobyov): arrows indicate the direction of movement of the eyeball during muscle contraction

A few words about visual acuity and the degree of aiming accuracy. The shooter is mainly interested in the degree of distinguishing sensitivity of the eye and the visual acuity that depends on it, as well as the degree of aiming accuracy that the eye can provide

Visual acuity is usually characterized by the minimum gap between two objects that we are able to see. Based on this, visual acuity is considered normal when the eye distinguishes two points visible at an angle of one minute.

However, in reality, the actual visual acuity of a normal eye can be significantly higher than the medical norm. Research has shown that a normal human eye, under normal lighting, can see separately objects located within 40 arc seconds of each other. The eye can quite clearly distinguish, for example, the gap between the top

of the front sight and the bottom edge of the target's "apple" at a distance of 50 m - 8.6 mm, at a distance of 300 m - 5.6 cm. The eye of a trained shooter can distinguish a much smaller gap between two objects. Research has shown (Kalinichenko N.A., 1968) that the visual acuity of rifle shooters significantly exceeds the medical norm of 1 conventional unit, and on average, when tested on the standard Sivtsov chart at a distance of 5 m, is 1.840 for the right eye, 1.783 for the left, and binocular visual acuity is 1.880 conventional units. Many experiments confirm that visual acuity can be significantly increased during training. With increasing shooting experience, visual acuity also increases. Consequently, sport shooting has a training effect on visual functions.

Finally, it should be said that with intense work the eye reduces its performance, both its motor and light-perceiving apparatus. With continuous fixation of the gaze on some object, the eye has the greatest visual acuity for several seconds, after which the clarity of the image of the object on the retina, its clear vision gradually decreases. Therefore, in no case should you "take aim". Long but steady shooting does not tire the eyesight as much as one "aimed" shot. In a minute of aiming without blinking, visual acuity deteriorates by half (Kalinichenko N.A., 1968). Research conducted by N.G. Medvedeva (1964) showed that the moment of intense aiming causes eye fatigue, manifested as a temporary loss of individual areas of the visual field. Moreover, shooters should be especially careful not to "take aim" in bright light: it contributes to the rapid formation of "blind spots" (disappearing 5-10 minutes after the end of active training).

Therefore, the shooter should not get carried away with excessively long aiming, since after 15-20 seconds the eye stops noticing inaccuracies in aiming. Relying on the imaginary well-being with aiming, the shooter makes gross errors without noticing it. If we count the time from the moment the vision is focused on specifying the size of the gap between the top of the front sight and the lower edge of the "apple" (or the annular gap - when shooting with a ring front sight), then the aiming process should not exceed 5-8 seconds.

3.2.3 Aiming

Aiming with open sights . As stated above, in order to aim correctly, the shooter must place the front sight in the middle of the sight slot, and its top level with the upper edges of the slot, that is, maintain a "level front sight" and bring it under the lower edge of the target's "apple" (Fig. 201).

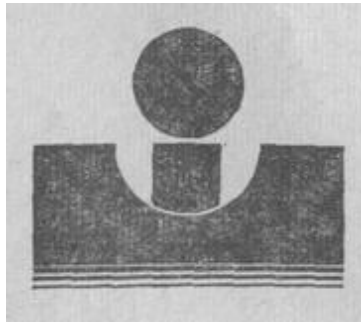


Fig. 201 - Sighting diagram with open sights

We already know that the eye cannot simultaneously clearly see objects located at different distances from it (in this case, the sight notch, the front sight and the target "apple"). This means that if you clearly see the front sight, then the target and the sight notch will be perceived by the eye as blurry; if you focus your vision on the target, the front sight and the sight notch will become blurry.

Some athletes, when aiming, "run" their gaze from the front sight to the slit, then to the third object - the target, doing this quickly and several times until they combine all three points on one straight line. This method of aiming quickly tires the muscular apparatus of the eye, and it can be recommended for the initial form of aiming training, and then only at first. After all, it is very difficult for a shooter to conduct, for example, high-speed shooting, when he is limited by time. The same applies to shooting while standing, when the athlete also does not have the opportunity to align and clarify the position of the front sight in the slit for a long time. Therefore, when aiming, the athlete must sacrifice something and strive to clearly and sharply see only one of three objects: either the front sight, or the slit, or the target.

Most sportsmen, when shooting from a rifle, try to see the front sight sharply, being forced to neglect the sharpness of the image of both the sight notch and the target "apple" (Fig. 202). At the same time, one should not be confused by the fact that the sight notch is perceived as unclear and as if double - its lower part is blacker,

and the upper part is grayish, foggy. It is necessary to remember once and for all the location of the front sight in the blurry notch and to place its top at the level of either the blacker part of the sight notch or the lighter one. The main thing is to achieve uniformity in aiming.

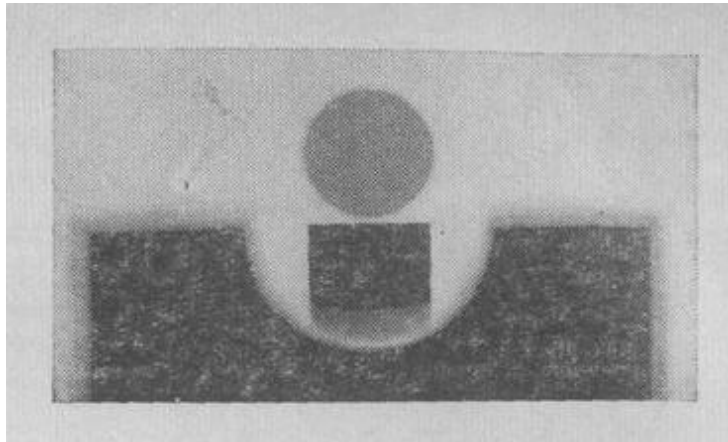


Fig. 202 - Schematic representation of the eye's perception of the slit, front sight and "apple" of the target when the gaze is focused on the front sight

Of great importance is the ability to leave a correct and uniform gap between the top of the front sight and the bottom edge of the target's "apple". When shooting from a rifle, the gap should be as thin as the shooter's visual acuity allows. It is necessary to bring the top of the front sight under the target's edge until the eye fixes both the thin gap between the front sight and the bottom edge of the target's "apple" and sees the bottom edge of the "apple" relatively clearly. Aiming closely, that is, without leaving a gap between them, is very difficult: no matter how sharp the shooter's vision is, there is always a risk of imperceptibly "crash" the top of the front sight into the "apple" and thereby disrupt the uniformity of aiming. This happens for the following reason

No matter how carefully the shooter smokes the front sight, its surface will still reflect a certain amount of light rays. And if you bring it under the "apple" without a gap, then due to the reflection of rays from the front sight, the lower edge of the "apple" will seem significantly lighter than its upper part (Fig. 203). It is quite clear that it is very difficult, and sometimes impossible, to aim uniformly without seeing the lower edge of the "apple". Over time, the shooter devel-

ops the ability to always take the same gap and uniformly place the front sight in a slit that is vaguely perceived by the eye.

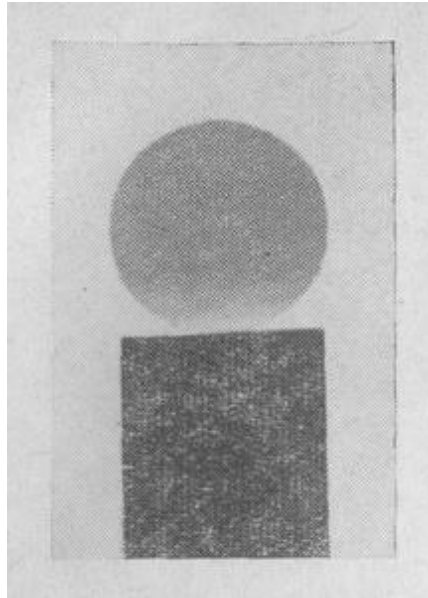


Fig. 203 - Aiming without clearance; the lower edge of the "apple" appears lighter due to the reflection of rays from the front sight

When shooting from a pistol (revolver), the distance between the sight notch and the front sight is relatively small. At the same time, the front sight and the notch are much further away from the eye, which makes it much easier to see both the front sight and the notch relatively sharply at the same time. Therefore, when aiming, the shooter should strive to see the front sight and the notch sharply, neglecting the sharpness of the eye's perception of the target's "apple" (Fig. 204).

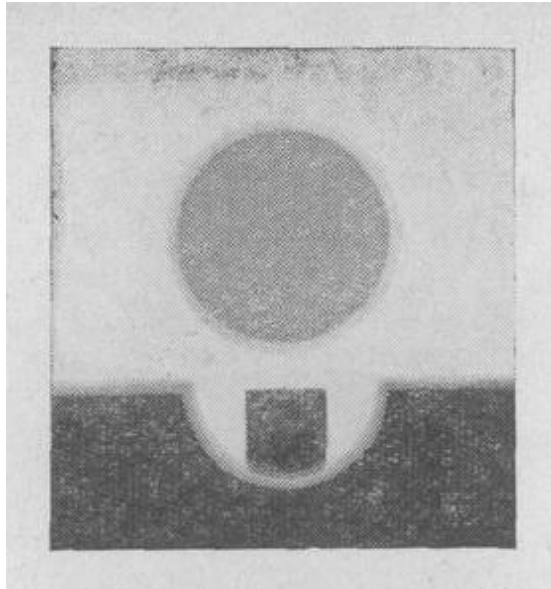


Fig. 204 - Schematic representation of the eye's perception of the notch, front sight and "apple" of the target when shooting from a revolver at 25 m, when the gaze is focused on the sighting devices

Aiming with a diopter sight

The diopter sight makes aiming much easier and simpler, since the shooter is relieved of the need to see one of the three objects (the sight slot), which is closest to the eye and therefore the most inconvenient for visual perception.

The role of the slot in the diopter sight is performed by a small round hole (diopter). When aiming, the shooter must look through it, paying attention mainly to only two objects - the front sight and the target

To aim with a diopter sight, you need to look through the diopter hole with your right eye and bring the top of the rectangular front sight under the lower edge of the target's "apple" or (with a ring front sight) place the target's "apple" in the center of the front sight ring (Fig. 205).

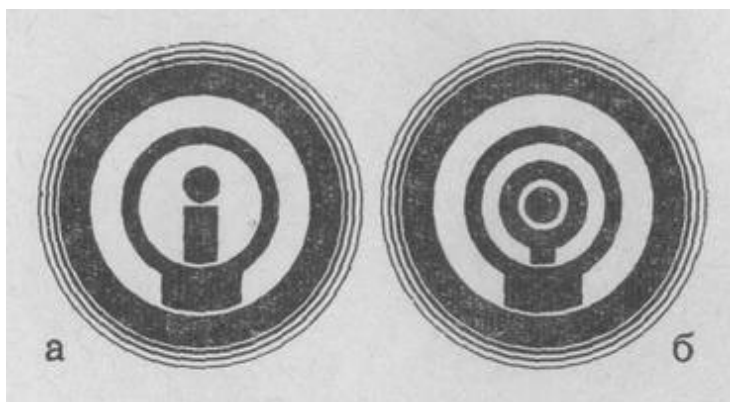


Fig. 205 - Sighting diagram with a diopter sight:

a - with a rectangular front sight; *b* - with a ring front sight.

When aiming, the shooter should not be particularly distracted by searching for the center of the diopter hole and aligning the top of the front sight with it: thanks to the sense of symmetry, the eye is able to do this work automatically and involuntarily. If the athlete makes an inaccuracy here and the line of sight turns out to be slightly shifted to the side, there will not be a big error in aiming, because the diopter hole itself is relatively small.

Thus, in order to ensure accurate and uniform aiming with a diopter sight, the shooter must mainly mobilize all his attention on correctly and uniformly positioning the top of the front sight relative to the aiming point, carefully maintaining the same clearance

There can be no two opinions about how far the plate should be from the eye when aiming: when shooting prone, the plate with the diopter hole should be placed closer to the eye (of course, taking into account the safety of the weapon's recoil). In this case, it does not distract the shooter's attention and does not interfere with aiming, since it is beyond the accommodative ability of the eye. Due to this, the eye directly perceives not the plate as an independent object, but the diopter hole itself, through which the line of sight passes to the front sight and the "apple" of the target. Moreover, the closer the plate is to the eye, the larger the diopter hole is perceived, which allows you to more accurately find its center and place the top of the front sight in it. The expediency of placing the diopter close to the eye is confirmed by the data obtained during the study of this issue: with an increase in the distance between the eye and the sight, visual acuity decreases; in this regard, the

most favorable distance for aiming should be considered to be 2-5 cm (Kalinichenko N.A., 1968)

Since one and the same rifle often has to be shot not only lying down, but also standing and kneeling, and the sight on the rifle can be moved within small limits, the shooter must, during training, establish for himself the distance between the eye and the diopter based on the fact that the position of the head during aiming ensures shooting safety (taking into account the recoil) and creates favorable conditions for the work of the eye.

Aiming with a telescopic sight

The design of the optical sight provides for aiming without using the front sight and the sight notch installed on the rifle barrel, since the aiming line in this case is the optical axis passing through the center of the lens and the tip of the aiming stump. Consequently, the role of the front sight in the optical sight is performed by the aiming threads, in particular the vertical thread (stump)

The aiming threads and the image of the observed object (target) are in the focal plane of the objective (the focal plane of the objective is the plane passing through the focus of the objective perpendicular to the main optical axis), therefore the shooter's eye perceives both the aiming threads and the image of the target with equal sharpness. The position of the head should be such that the line of sight passes along the main axis of the sight - in other words, you need to align the eye with the exit pupil of the eyepiece, and then bring the tip of the aiming stump under the edge of the "apple" of the target (align with the aiming point - Fig. 206).

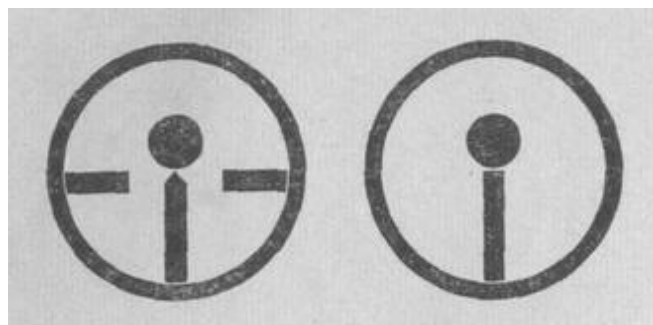


Fig. 206 - Aiming diagram with an optical sight

When aiming, the eye should be at the exit pupil distance (eye distance) from the outer lens of the eyepiece, which is 60-80 mm (Fig. 207). This ensures safety when the weapon is recoiling.

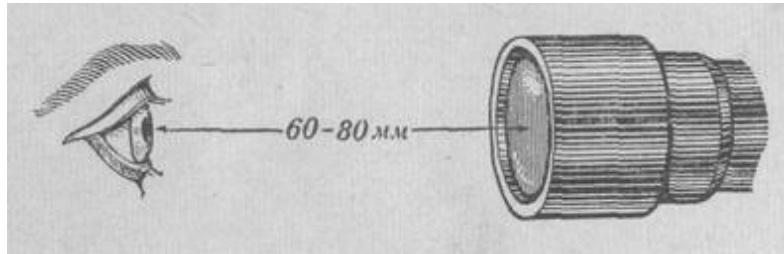


Fig. 207 - Distance of the exit pupil in an optical sight - eye distance

When aiming, you must carefully ensure that there are no dark spots in the sight's field of view; it must be completely clear.

If the eye is closer or further than the eye distance, then a circular darkening is obtained in the field of view, which reduces it and complicates aiming. If this darkening is the same on all sides, then there will be no deviation of the bullets

If the eye is positioned incorrectly relative to the main optical axis of the sight (shifted to the side), moon-shaped shadows are observed at the edges of the eyepiece during aiming. They can be on any side, depending on the position of the eye axis relative to the optical axis of the sight. Bullets will deviate to the side opposite to these shadows (Fig. 208). If, during aiming, the shooter notices shadows at the edges of the field of view, he needs to find a position for the head in which the eye clearly sees the entire field of view of the sight.

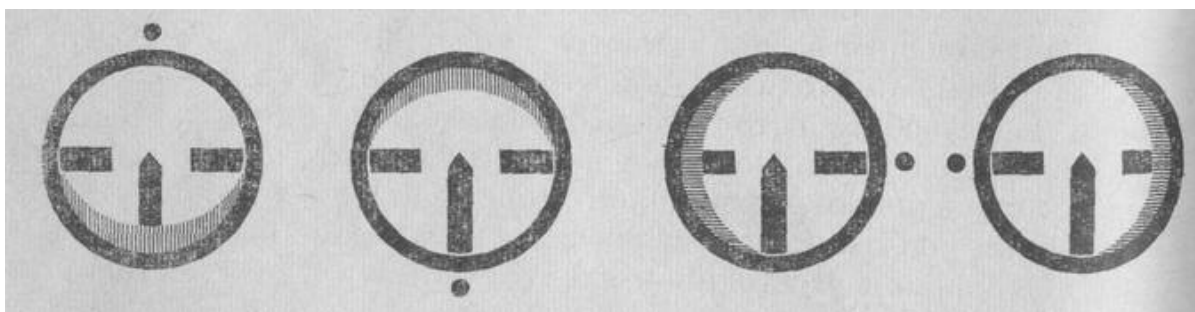


Fig. 208 - Bullet deviation to the side due to incorrect eye position relative to the main optical axis of the sight

Therefore, to ensure accurate aiming with an optical sight, the shooter must focus all his attention on keeping his eye on the optical axis of the sight and accurately aligning the tip of the stump with the aiming point.

3.2.4 Selection of sighting devices

Aiming accuracy largely depends on the shooter's ability to correctly select sighting devices for themselves based on their shape, size and relative dimensions, taking into account visual acuity, individual characteristics, and shooting conditions.

Open sight . The most convenient and common form of sighting devices is a rectangular front sight and a semicircular slot. This form, as practice has shown, allows you to aim with the greatest accuracy and the least fatigue of vision.

Of great importance for aiming accuracy are also the width of the front sight in relation to the visible dimensions of the target and the width of the notch, as well as the absolute size of the sighting devices.

When selecting a front sight, you need to make sure that it is wide enough. Then it allows you to aim more accurately, since it is easy to detect a violation of symmetry, as well as maintain a uniform, correct clearance without straining your eyes too much. The greatest aiming accuracy is achieved with a front sight, the width of which is perceived as equal to the visible diameter of the target's "apple" or slightly wider (Fig. 209). But since the eye perceives the contours of the target's "apple" and the front sight differently, located at different distances from it, the front sight should practically be slightly wider than the diameter of the "apple" (approximately 0.1-0.2 mm on each side). Therefore, when shooting at 300 m at target No. 3, it is best to use a front sight 2-2.2 mm wide.

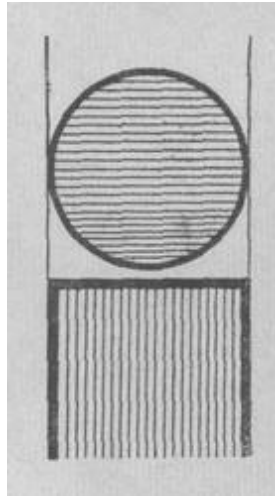


Fig. 209 - The width of the front sight on a rifle equal to the visible diameter of the target's "apple"

When selecting the width of the slit, you need to make sure that the front sight is clearly projected in the slit; in other words, the front sight should not be "cramped" in the slit. In no case should you fit the front sight tightly, leaving small gaps between it and the edges of the slit. The arguments of inexperienced shooters that such a ratio of sighting devices supposedly allows you to notice the slightest inaccuracies in aiming are not justified in practice, since such a ratio of the width of the front sight to the width of the slit only leads to rapid fatigue of the eyes and, as a result, to the admission of gross errors in aiming.

At the same time, large gaps between the front sight and the edges of the slot also worsen aiming: the shooter can unnoticeably hold the front sight to the right or to the left. The best ratios of the width of the front sight to the width of the slot, depending on visual acuity, lighting conditions and the nature of shooting, are from 1:2 to 1:3 (Fig. 210).

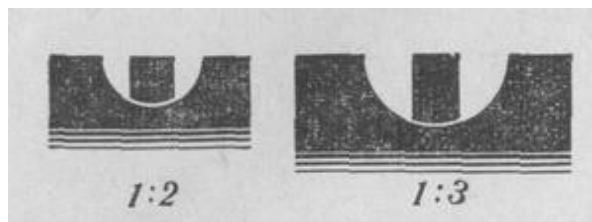


Fig. 210 - The most advantageous visible ratio of the front sight width and the notch width when shooting from a rifle (depending on lighting conditions, visual acuity and the nature of shooting)

With an open sight on a pistol (revolver), a rectangular front sight and a semicircular or rectangular slit are also most convenient. Since the dimensions of the "apple" of pistol targets are significantly larger than those of rifle targets, it is impractical to adjust the width of the front sight to the apparent diameter of the "apple". Therefore, the width of the front sight on pistols (revolvers) can be completely arbitrary. However, practice has shown that the greatest accuracy with less eye fatigue can be achieved by using a sufficiently wide front sight. Depending on the nature of the exercises and the type of weapon, it is best to use front sights of the following sizes:

match pistol	50 m	target #4	-3.2-3.6 mm
service revolver	25 m	target #4	-2.6-3.2 mm
service revolver	25 m	silhouette	-3.0-3.5 mm
self-loading pistol	25 m	silhouette	-3.0-3.5 mm

In the notch, the front sight must be designed absolutely clearly. Considering that the notch and the front sight are significantly further away from the eye than with a rifle open sight, and the distance between the front sight and the notch is relatively small, which is why the eye simultaneously perceives the outline of the front sight and the notch in a more contrasting manner, it is advisable to use a "tighter" notch than when shooting from a rifle. The best visible ratios of the front sight width to the notch width are within 1:1.5 and 1:2. For clarity, Fig. 211 shows data on the front sight width in mm and the visible ratios of the front sight width to the notch of the sight, which at one time allowed shooters to achieve outstanding results when shooting from various types of pistols (revolvers).

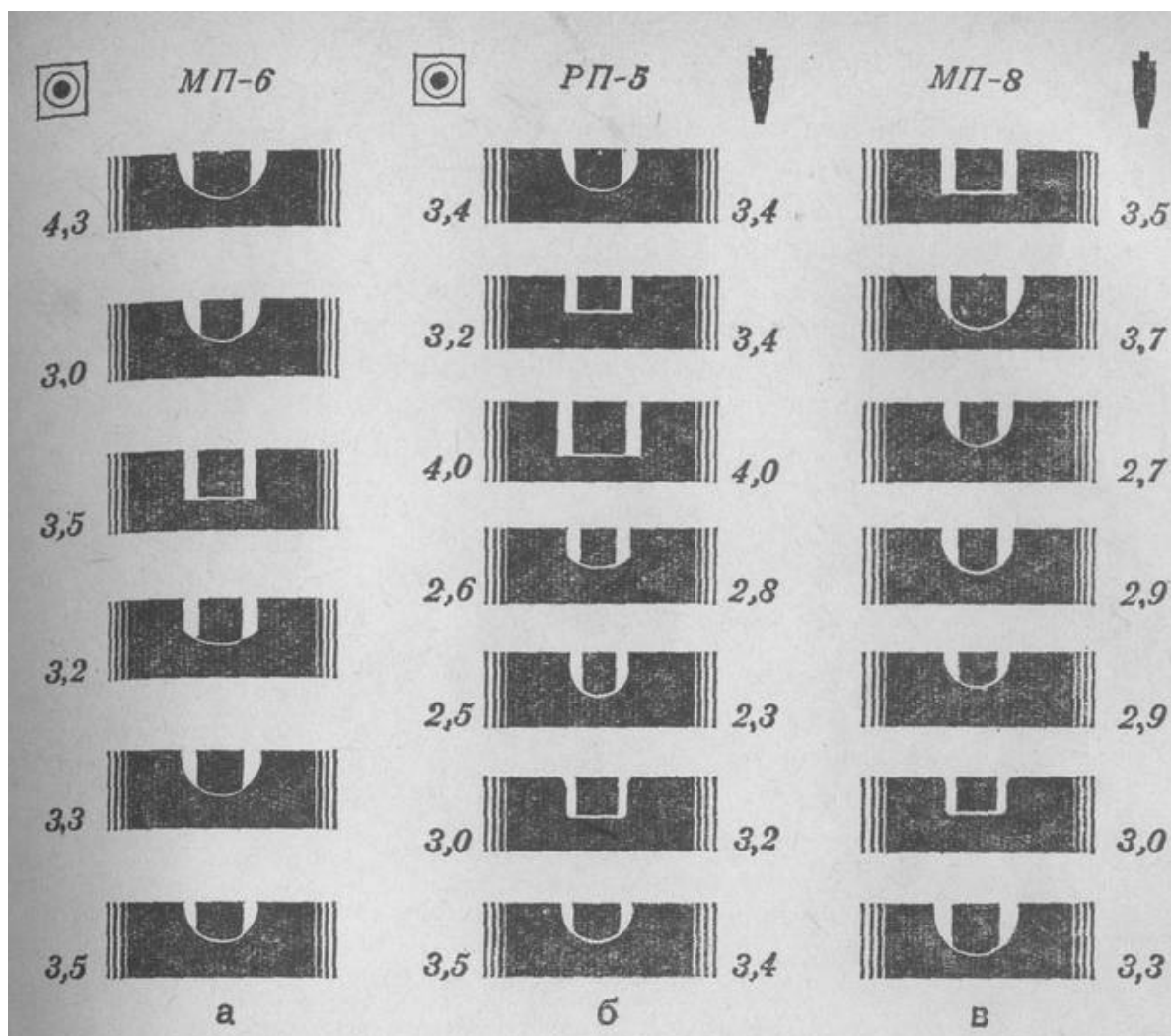


Fig. 211 - The shape and apparent ratio of the front sight width to the notch width, at which record results were achieved in pistol (revolver) shooting at one time: *a* - free (match) pistol; *b* - revolver (shooting at a target with a black circle and silhouette); *c* - free pistol (shooting at a silhouette).

Dioptric sight . The most convenient are rectangular and ring rifle front sights. The dimensions of the rectangular front sight are selected based on the fact that the greatest aiming accuracy can be achieved when its width during aiming is perceived to be slightly larger than the visible diameter of the target's "apple" (the diameter of the "apple" plus 0.2-0.25 mm on each side). Then it is easier to maintain a uniform gap between the top of the front sight and the lower edge of the target's "apple".

Width of rectangular front sights when shooting at different targets at different distances

Table 11

Target number and firing range, m	Target "apple" size, cm	Visible diameter of the target "ap- ple", mm	Front sight width, mm
№3 - 300	60	1.80	2.1-2.3
#4 - 100	21	1.89	2.3-2.4
#7 - 50	11 24	2.02	2.4-2.5

Note: The dimensions of the visible diameters of the target's "apple" were found based on the accepted distance between the front sight and the shooter's pupil - 900 mm.

You should not install a front sight that is too wide or too narrow, as it will be difficult to align its top relative to the middle of the lower edge of the "apple", which may lead to errors when aiming (horizontally)

When selecting the diameter of the front sight ring hole, the shooter must take into account the size of the target's "apple", visual acuity, shooting position and, most importantly, lighting conditions.

In principle, aiming with a ring front sight is more accurate the thinner the visible ring gap between the target "apple" and the front sight aperture (its ring), as they say - the "stricter" the ring front sight. However, in practice it is far from always possible to aim precisely with this "strict ring". It is desirable that the diameter of the opening of the "strict" ring front sight when shooting at 50 m at target No. 7 be no less than 3 mm, the diameter of the "free" ring front sight - no more than 4.2 mm (Fig. 212).



Fig. 212 - Visible ratio of the sizes of the target "apple" and the holes of the ring sights:

a - "strict" ring; *b* - "free".

"Strict" ring front sight is recommended first of all when shooting from the most stable position - lying down, less often from a kneeling position. "Free" ring front sight - when shooting from a standing position, the least stable, in which it is generally difficult to aim with a ring front sight without long training, which is very sensitive to the slightest vibrations of the weapon relative to the target.

It is especially important to select front sight rings for aiming in conditions of different visibility and target illumination. In cloudy weather, with even and soft lighting, the greatest efficiency can be achieved by using a "strict" front sight ring. With such lighting, the annular gap between the target "apple" and the front sight ring is very clearly visible and the shooter's eye records the slightest inaccuracies in aiming. In poor visibility conditions (early in the morning, at dusk, in fog), it is necessary to use a "free" front sight ring: the target is poorly illuminated, so the annular gap between the "apple" and the front sight ring is not very contrasting. On a sunny day, when the targets are brightly lit, the efficiency and expediency of using front sights is generally sharply reduced. In bright sunlight, aiming with a "strict" front sight is almost impossible, and often even a "free" front sight ring does not provide the necessary aiming accuracy. In such cases, you need to aim using light filters or smoked glass (see below)

Many foreign, and recently also our sportsmen successfully use ring front sights made of translucent plastic (thin organic glass or celluloid). There is a lot of common sense in using such front sights, despite the apparent uselessness of such an undertaking at

first glance due to the fact that the opening of the plastic ring front sight itself remains as unprotected from the blinding effect of the white background of the target as when aiming with a metal ring front sight. By darkening a significant part of the reflective white background of the target, located in the shooter's field of vision in close proximity to the "apple", the translucent plastic, covering the entire internal area in the front sight, protects the eye from the blinding effect of bright rays that fall into the area of the "yellow spot" and the posterior layers of the retina adjacent to it, the reflection from which enhances light scattering in the eye environments. In addition, by darkening part of the white background of the target, the light filter in the front sight contributes to a more contrasting perception by the eye of the annular gap between the "apple" and the boundaries of the opening of the ring front sight.

The design of plastic ring front sights is extremely simple. A hole is drilled in a round disk made of organic glass, inserted into the front sight, (Fig. 213), along the edge of which a circle is drawn with black oil or enamel paint. The thickness of such a black rim (which is the ring front sight) varies within the range of 0.5-2 mm. Recently, translucent plastic ring front sights without any painted rims-rings (Fig. 213, a) have been widely used. In them, the entire plate is slightly tinted, due to which the necessary contrast between the "apple" of the target and the ring edge of the front sight is achieved. According to research by N.A. Kalinichenko, translucent plastic front sights of moderate contrast increase aiming accuracy up to 24% compared to metal ring front sights of the same diameter. The best was a plastic front sight tinted light pink.

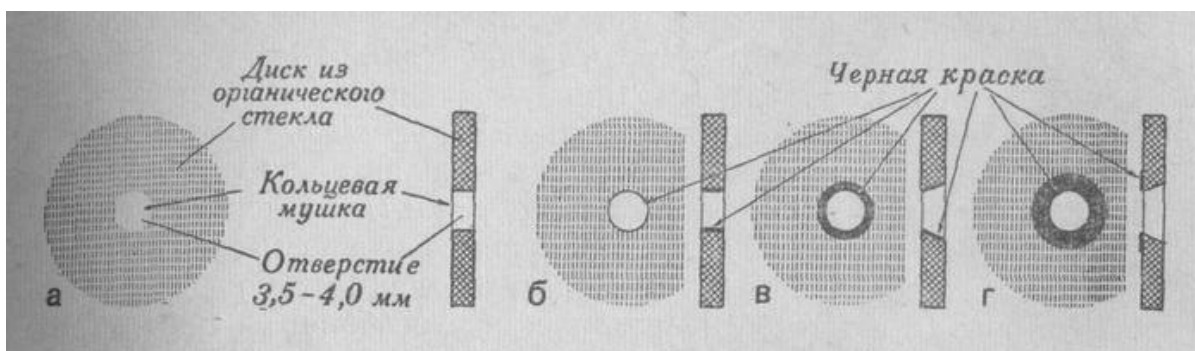


Fig. 213 - Plastic ring flies

When choosing the diameter of the diopter opening of the sight plate, it is necessary to take into account the lighting conditions, as

well as the shooter's positioning.

Diopter sights installed on arbitrary rifles have replaceable plates with diopter openings with a diameter of 0.75 to 1.75 mm. However, not all of them from this set are used in shooting practice. The experience of leading athletes, as well as the results of studies, indicate that the diameter of the diopter opening of 0.75 mm is unsuitable for shooting. The use of a 1 mm diopter is also very limited: with such small diopter openings, visual acuity and the speed of discrimination, especially important when shooting while standing, are significantly reduced. Therefore, the most effective should be considered a plate with a diopter opening of 1.5 mm in diameter. Depending on the degree of illumination of the targets, diopter openings within 1.25 - 1.8 mm are recommended (Fig. 214).

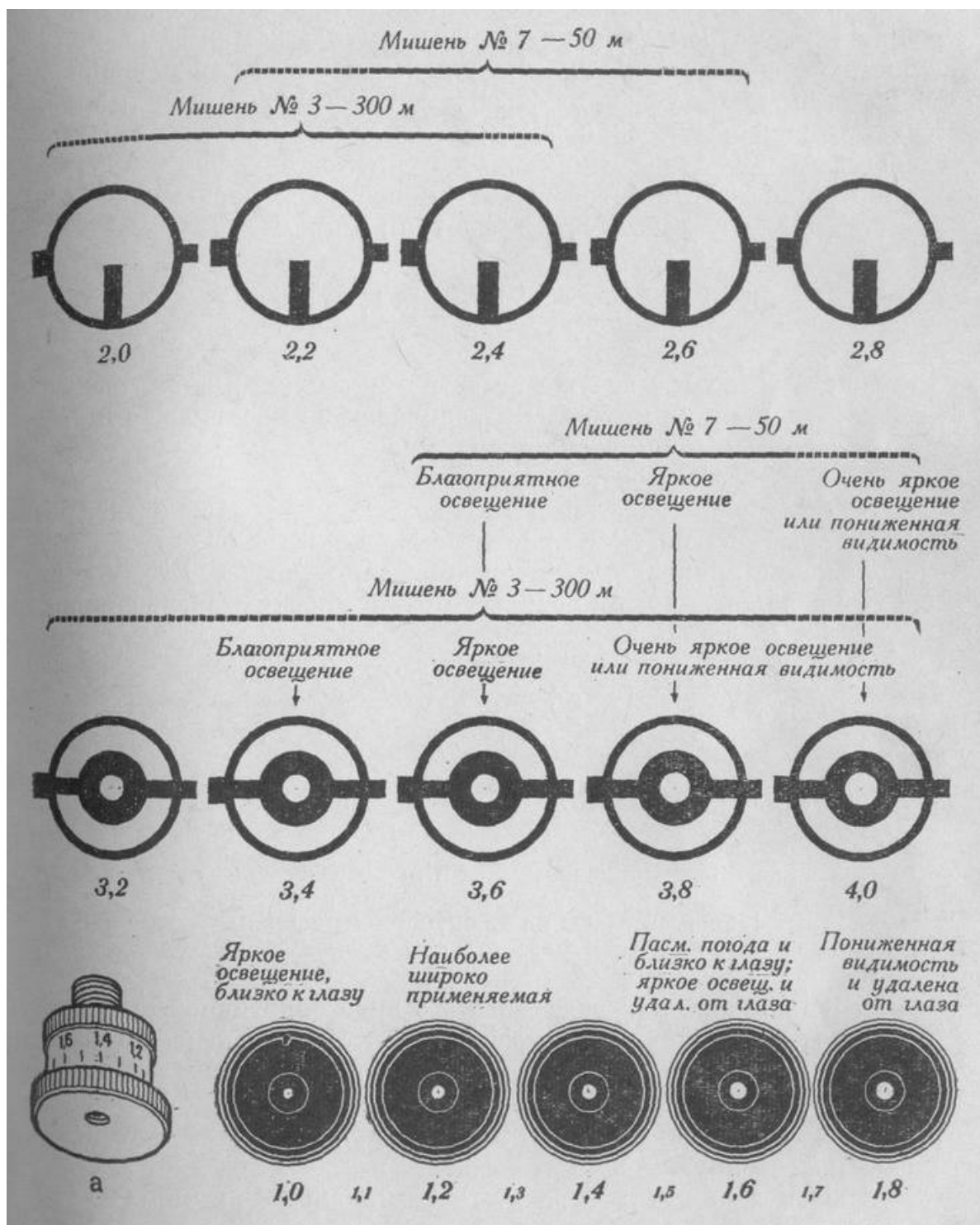


Fig. 214 - Use of various front sights and plates included in the kit of domestic free rifles, depending on the lighting: a - sight plate with iris diaphragm of the Typhoon rifle.

Most of our shooters still use rectangular front sights and only a few use ring front sights. However, this does not mean that rectangular front sights are more advantageous. On the contrary, if we take into account the optical imperfections of the human eye, the

phenomena of light irradiation inherent to it (in which the size of the white gap between the lower edge of the target's "apple" and the top of the front sight is perceived by the eye differently depending on the degree of illumination of the white background), as well as the presence of diffraction bands along the contour of the front sight and the "apple" of the target under bright illumination, we can say that, in principle, a ring front sight allows aiming with greater accuracy than a rectangular one. This is confirmed by the practice of the best foreign athletes, most of whom use ring front sights.

If we turn to the shooting practice of the comparatively recent past, it should be mentioned that in the period 1936-1939, when participating in correspondence international shooting competitions in prone shooting from a small-bore rifle, which invariably ended with a convincing victory for Soviet shooters, many of them shot with ring sights. The first absolute result - 400 points out of 400 possible - shown in 1936 by the Soviet shooter N. Alekseyev, was also achieved in shooting using a ring sight.

All of the above testifies to the great, still hidden possibilities inherent in the correct and competent use of ring sights, in improving the technical results of our shooters, especially in precision shooting. Our skeptical attitude towards ring sights, one must assume, is caused by the fact that athletes usually tried to shoot with very "strict", small-diameter front sights, not knowing how to operate light filters and smoked glass to extinguish the excess brightness of target illumination, in which it is really bad to shoot with a ring. Leading foreign shooters, who have accumulated much more experience in using ring sights, prefer front sights with a diameter of 3.5-4.3 mm, and in combination with light filters of varying density. Under such conditions, the high qualities of ring sights are manifested to the greatest extent.

It is obvious from the above that there cannot be a universal front sight of a certain shape and size and a sight with a certain diameter of the diopter opening that could fully suit every shooter and ensure accurate aiming under any shooting conditions. Therefore, modern free rifles are equipped with sighting devices supplied with sets of replaceable front sights and plates with different diopter openings (or iris diaphragm). The shooter only has to use them correctly and competently.

3.2.5 Aiming when shooting at the "Running Deer" and "Running Boar" targets

Nowadays, you will no longer meet an athlete at a shooting range who shoots at moving targets with a rifle with a diopter sight: split front sights, diopter sights with a flip-up have been completely replaced by optical sights.

When shooting at moving targets, we now use domestic optical sights TO-4, TO-6, TO-6P and TO-6s (the arrangement of the sighting threads is shown in Fig. 215, a). Since the arrangement of the sighting threads of many models of sights is not very convenient for this type of sport shooting, athletes themselves remake the sighting mechanism, removing the side alignment threads and filing down the conical tip of the sighting stump (Fig. 215, b). Such a single-stump optical sight is used when shooting at "deer", less often - at "wild boar".

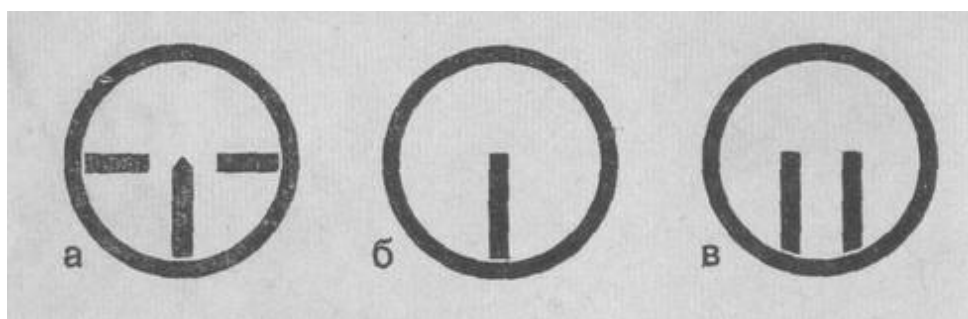


Fig. 215 - Sighting stumps of domestic optical sights used for sport shooting at moving targets

Considering the specifics of shooting at the "Running Boar" target, moving at different speeds - low and high, some athletes have redesigned the sights into two-stump optical sights (Fig. 215, c). Moreover, such sights have not two, but four drums (handwheels), allowing you to make horizontal and vertical adjustments for each stump separately. Due to this, they have a number of advantages. It should be borne in mind that reworking a regular sight into a two-stump one requires literally jewelry work, so it can only be entrusted to a highly qualified master.

The peculiarity of aiming at moving targets is that the athlete must aim not at the center of the target, but with a lead, due to the fact

that during the flight of the bullet the target will move. Therefore, with this type of shooting, before zeroing the weapon, it is necessary to be able to determine the amount of lead of the target, depending on the speed of the target and the flight time of the bullet

In general, the path traveled by the target during the bullet's flight (lead) is determined by the formula:

$$S = V_m * t_p$$

where S is the lead value, V_m is the target speed, t_p is the bullet flight time

The speed of movement of the target (V_m), in turn, is determined by the formula:

$$V_m = H / t_m$$

where H is the width of the target run window, t_m is the time of target movement in the run window

Let us now substitute the values of the quantities appearing in these formulas. When shooting at the "Running Deer" target, it is necessary to take into account in the calculations that the value of the run window (H) should be reduced by the length of the target itself. Therefore, $H = 23 \text{ m} - 1.65 \text{ m} = 21.35 \text{ m}$, the time of movement of the target in the run window (t_m) is 4 sec., the flight time of the bullet (t_p) when shooting at 100 m with an initial speed of 850-920 m/sec is approximately 0.1 sec.

When shooting at the "Running Boar" target, the lead (S) is determined taking into account the following values: the width of the target run window (H) - 10 m; the time of target movement in the run window (t_m) - 5 sec. (slow run) and 2.5 sec. (fast run); the bullet flight time (t_p) when shooting at 50 m with an initial speed of 320-340 m/sec is approximately 0.15 sec.

Then the lead value will be equal to: when shooting at a "deer" - 53.4 cm; at a "wild boar" at low speed - 30 cm, at high speed - 60 cm. However, the lead value determined by these formulas is only

the initial, basic data. In practice, an athlete has to shoot at different shooting ranges, using installations on which the target moves faster or slower by 0.2-0.4 sec. (within the limits allowed by the competition rules). In addition, the industry produces batches of cartridges that differ from each other in the initial speed of the bullet. Therefore, each time the lead value has to be slightly changed, setting it in accordance with the specific shooting conditions at a particular shooting range.

To determine the amount of lead, it is very convenient to use the calculation data of the Honored Master of Sports I. Nikitin, given in Tables 12 and 13 in abbreviated form. To do this, it is only necessary to establish the true speed of the target at a given shooting range, which is easy to determine with a stopwatch. Using this data, you can make the appropriate correction to the sight setting in advance, before sighting.

The magnitude of the lead when shooting at the target "Running deer" (according to I. Nikitin)

Table 12

Travel time, sec.	Initial bullet velocity, m/sec			
	850	920	1000	1050
	lead, cm	lead, cm	lead, cm	lead, cm
3.8	66.5	61.3	56.6	53.0
3.9	64.8	59.7	55.1	52.5
4.0	63.2	58.2	53.8	51.2
4.1	61.7	56.8	52.4	49.9
4.2	60.2	55.5	51.2	48.7

Lead times when shooting at the "Running Boar" target

Table 13

Travel time, sec.	Initial bullet velocity, m/sec		
	320	330	340
	lead, cm	lead, cm	lead, cm
2.5	62.5	60.6	58.8
2.6	60.1	58.3	56.5
2.7	57.9	56.1	54.4
5.0	31.2	30.3	29.4
5.1	30.6	29.7	28.6
5.2	30.0	29.1	28.2
5.3	29.4	28.6	27.7
5.4	28.9	28.1	27.2

The amount of lead can also be determined purely empirically. By gluing a clearly visible white paper circle to the center of the target and sighting the rifle in on it (with a stationary target), you then need to shoot a series at a moving target. In this case, naturally, the STP will be to the right or left of the aiming point, depending on the direction of the target's movement. The distance between the STP for a stationary target and the STP for a moving target will be equal to the amount of lead.

The choice of the most advantageous aiming area is also very important. To do this, let's consider what the relationship between the lead values and the target sizes looks like in graphic form, as well as the location of the lead points relative to the target contours (Fig. 216).

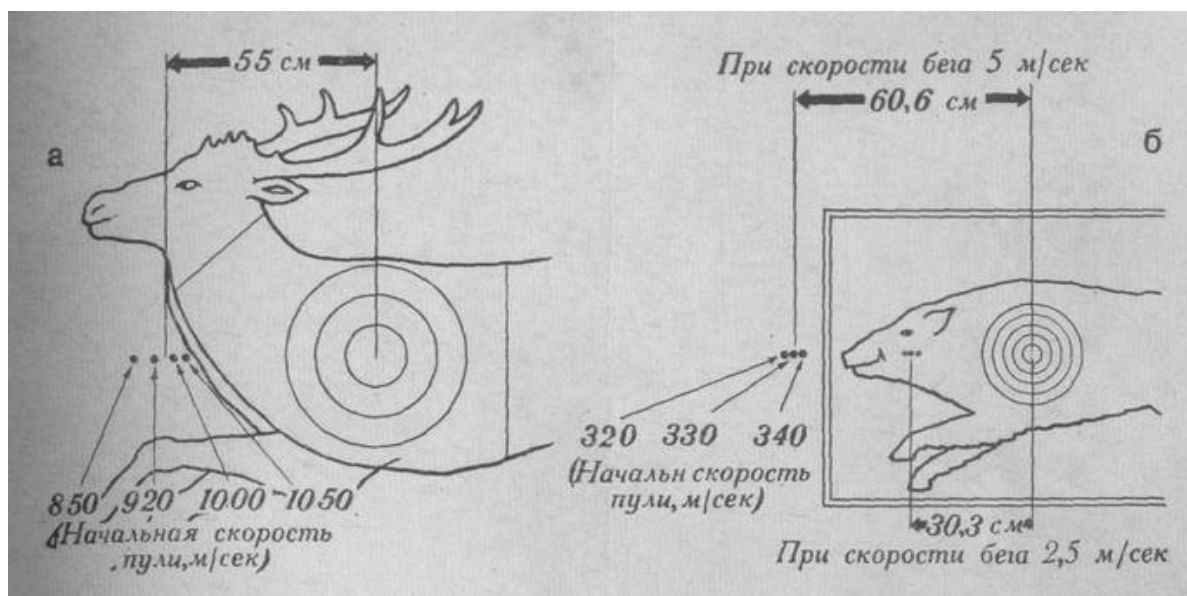


Fig. 216 - Target lead values when shooting at the "Running Deer" and "Running Boar" targets

When shooting at the "Running Deer" target with currently produced lots of cartridges (with an initial velocity of 1000-1050 m/sec), the lead value is approximately equal to the distance from the center of the target to the edge of the "deer's" chest (see Fig. 216, a), which is also clearly visible against the background of the run window and is a good reference point when aiming. Therefore, many athletes choose the "deer's" chest as the aiming area (Fig. 217, a). However, this method of aiming also has its drawbacks, the main one being the difficulty of maintaining uniformity in aiming vertically. It is much more advantageous to aim at the "deer's" head, which is relatively small. For example, Honored Master of Sports I. Nikitin chose a small but sufficiently visible reference point in the optical sight - the "deer's" eye - as the aiming area. During the movement of the "deer" in both directions, he aims, touching the left edge of the aiming stump to the "deer's" eye (Fig. 217, b). Many athletes very successfully use other areas of the "deer's" head as an aiming area (Fig. 217, c, d). In this case, the aiming stump is adjusted in width so that its projection on the target is equal to 8-10 cm.

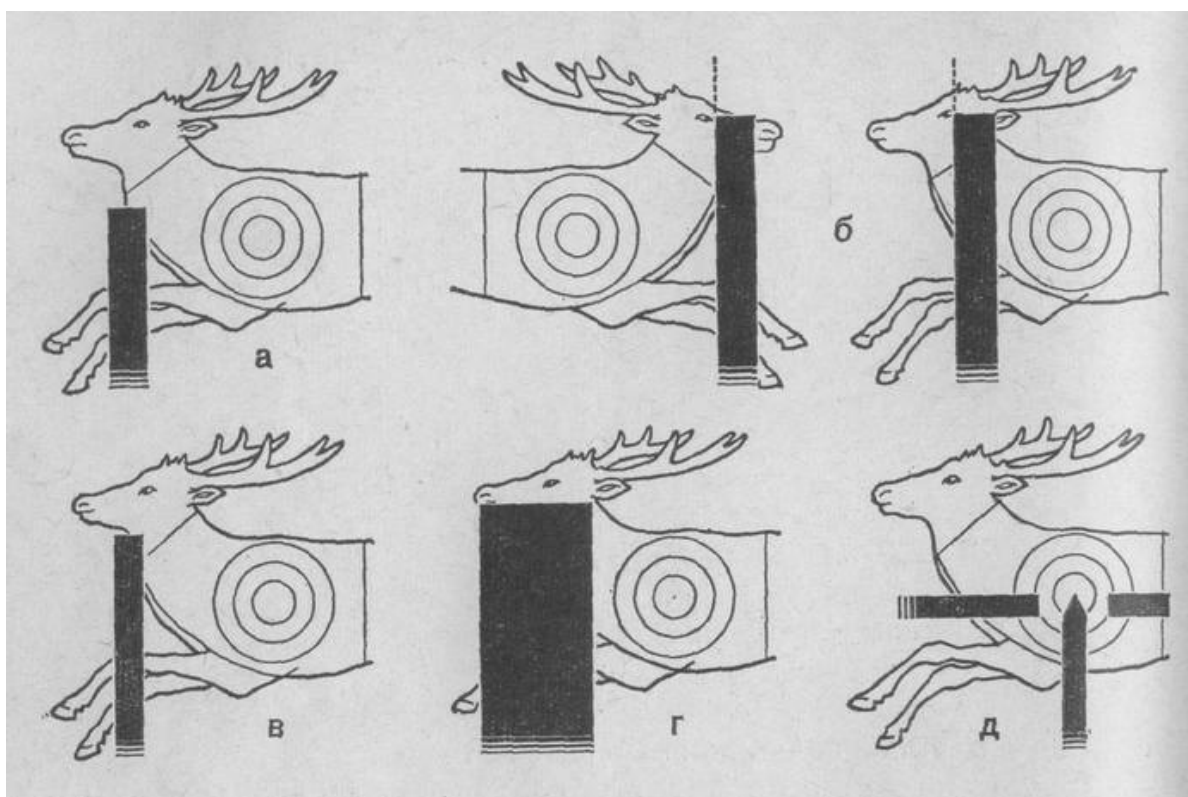


Fig. 217 - Aiming areas when shooting at the "Running Deer" target

Some shooters aim at the center of the target (Fig. 217, d). In this case, you can use a regular optical sight with a conical stump. The positive side of choosing the aiming area of the very center of the target is that the athlete is guaranteed against misalignment of the STP due to possible distortions of the shield or a target glued to the shield at an angle. However, this method of aiming is inconvenient, since it is necessary to make large lateral corrections ("flipping the sight" by the amount of lead) with each change in the direction of the target's movement.

When shooting at the "Running Boar" target, the lead values are such that the aiming point in one case (at high running speed of the "boar") is in front, outside the shield, and in the other (at low running speed) - approximately 30 cm from the center of the target, that is, in a completely inconspicuous place without a clear reference point (see Fig. 216, b). Naturally, it is inappropriate to use these areas as an aiming area.

The most advantageous (and therefore widespread) aiming area for this type of shooting is the target areas in front of or under the

nose of the "boar" (Fig. 218, a, b, c, d)

When using a single-stump optical sight, aiming at a target area in the area of the "wild boar's" nose, it is necessary to make a lateral correction from the zero mark before each shot by an amount equal to the distance from the target center to the aiming area (in one direction or another, depending on the direction of the target's movement). Such corrections during the exercise are associated with significant inconveniences, therefore single-stump optical sights, so popular when shooting at "deer", are used less and less when shooting at "wild boar"

Most leading sportsmen now use two-stump optical sights (Fig. 218, d). Their main advantage is that aiming with one of the stumps in turn, depending on the direction and speed of the target, does not require large lateral corrections before each shot (from the center of the target to the aiming area) - only small corrections are needed, and then only when they are needed during the exercise.

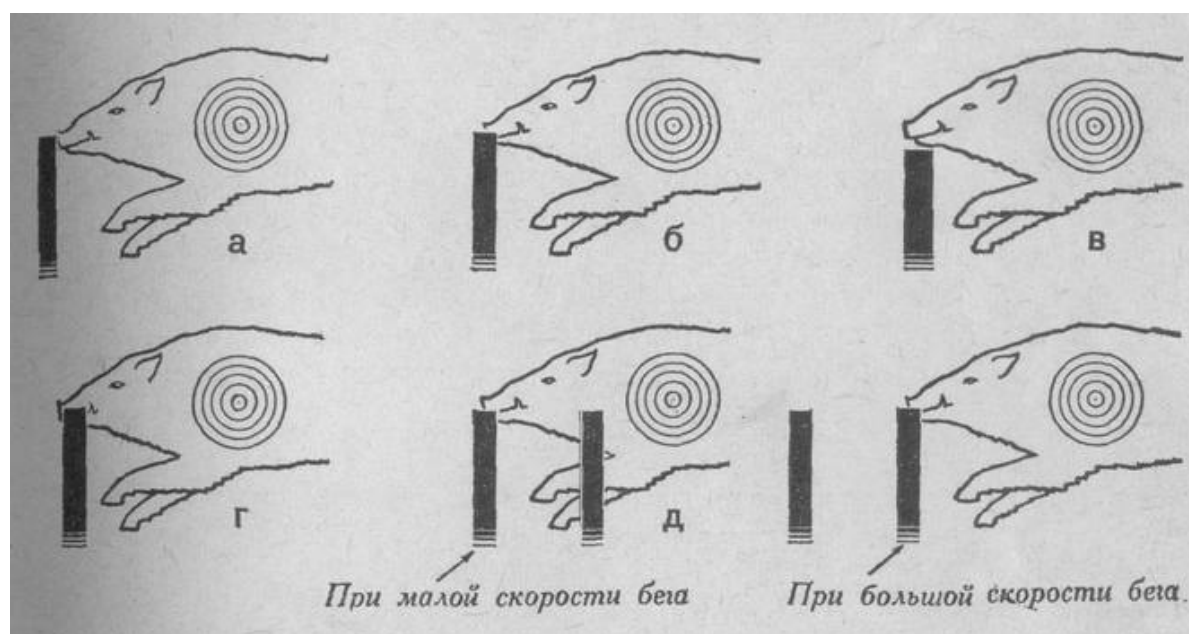


Fig. 218 - Aiming areas when shooting at the "Running Boar" target

This method of aiming became possible due to the fact that in the redesigned sights it is possible to make horizontal and vertical corrections separately for each stump: by spreading them, it is possible to set any distance between the stumps taking into account not only the speed of the "boar" (high and low), but also the change in

the speed of the target at a particular shooting range, when shooting with cartridges with a higher or lower initial velocity. In addition, it is possible to take into account the individual aiming characteristics of a particular athlete when shooting at targets moving in different directions.

The aiming area, as when shooting at a "deer", can also be the center of the target (Fig. 217, d). Then, as we have already said, a conventional optical sight with a conical tip of the aiming stump is used. Shooting is carried out "with a sight flip" before each shot, that is, making lateral corrections from the bullet mark to the amount of lead

When shooting at the "Running Boar" target, it is best to adjust the width of the aiming stumps so that their projection on the target is equal to 3.5-5 cm.

It should be recalled once again that when making lateral corrections, the value of one division on the drum (handwheel) of any domestic optical sight (except for the TO-6s) is equal to 1/1000 of the distance: when shooting at 100 m - 10 cm, when shooting at 50 m - 5 cm

Sighting in rifles for shooting at the "Running Deer" and "Running Boar" targets should be done from a standing position - first at a stationary target, and then at a moving one. In this case, shots should be fired at the same rate and mode at which scoring shooting is usually conducted, since due to the different nature of pressing the trigger, the STP for slow shooting may very often differ to a certain extent from the STP for accelerated shooting.

3.2.6 Protective means for aiming in adverse lighting conditions

Unfavorable lighting conditions for shooting are when the shooter's eyes are blinded by the sun, snow cover on a sunny day, excessively bright target lighting or sun glare on shiny surfaces of weapons and sights, etc. With an unprotected eye in such conditions, aiming is significantly complicated due to irritation accompanied by lacrimation, stinging, squinting and involuntary closing of the eyelids. In addition, irritation of the mucous membrane and eye

disease are possible. Therefore, the shooter must take care to create the most favorable conditions for the eye to work during aiming, as well as to preserve his vision.

First of all, you need to make sure that when aiming, there are no bright spots or sun glare on the surface of the weapon and sighting devices in the field of view. Despite the black paint, their smooth surface remains shiny, which is why in bright sunlight the outer edges of the front sight and sight, as well as the barrel, begin to shine. Light glare hides and distorts the contour of the sighting devices, produces a blinding effect, causing light scattering in the eye environment, which inevitably leads to gross errors in aiming and rapid fatigue of vision.

In order for the sights not to shine, to be correctly and contrastingly perceived by the eye, before shooting, as we said, it is necessary to smoke them. The best soot when burning is given by an oiled rag, birch bark, stearin candle, pieces of roofing felt

For the same purpose, it is recommended to use various darkening devices. Thus, when shooting with a diopter sight, to avoid the glare of the target plate, which occurs in bright sunlight from the side and from behind, a rubber cap should be put on it (Fig. 219, above).

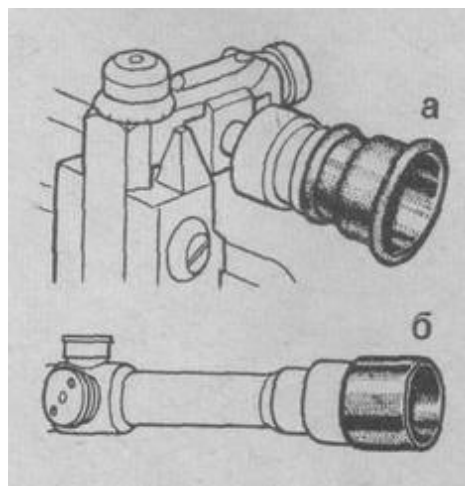


Fig. 219 - Darkeners - rubber caps installed on sights: *a* - dioptic; *b* - optical.

When shooting with an optical sight, it is necessary to protect the objective part of the sight from the sun with a metal tube, and the

ocular part with a rubber cap (for slow shooting, Fig. 219, below); the tube and cap act as a hood and protect against direct and lateral sunlight entering the objective or ocular, causing reflection and light scattering in the objective lenses, which also significantly complicates aiming.

To prevent the surface of the barrel from shining, it must be smoked or, better yet, a cloth tape must be put over it (Fig. 220).

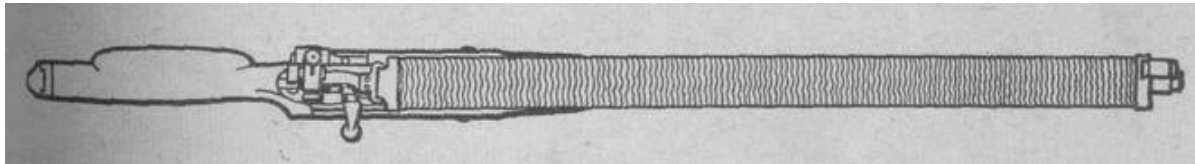


Fig. 220 - Fabric tape preventing barrel reflection

Visors are recommended to protect the eyes from bright sunlight (Fig. 221). The worst time to combat excessive illumination is on a sunny day. In the middle of the day, when the sun, located behind the shooter, illuminates the target with direct rays, its white field becomes a powerful source of light, having a blinding effect on the eyes. At the same time, as a result of light diffraction on the pupil and strong light scattering in the ocular environment, the shooter cannot see the outline of the sighting devices clearly enough. In such cases, not only the slit of the open sight, but also the front sight begin to double, and the eye perceives all three lenses - the slit, the front sight and the "apple" of the target as blurry (Fig. 222). The situation is no better in such conditions when aiming with a diopter sight. It is especially difficult to aim accurately with a ring front sight: the light halo that appears when the target is brightly illuminated prevents the shooter from correctly and clearly perceiving the outline of the "apple" and the front sight ring; the eye perceives the "apple" as a gray spot with an indistinct, as if blurred outline, and the front sight ring is of irregular shape (Fig. 223). It also happens that the shooter sees an "apple" of irregular shape with a whitish segment somewhere on the side.

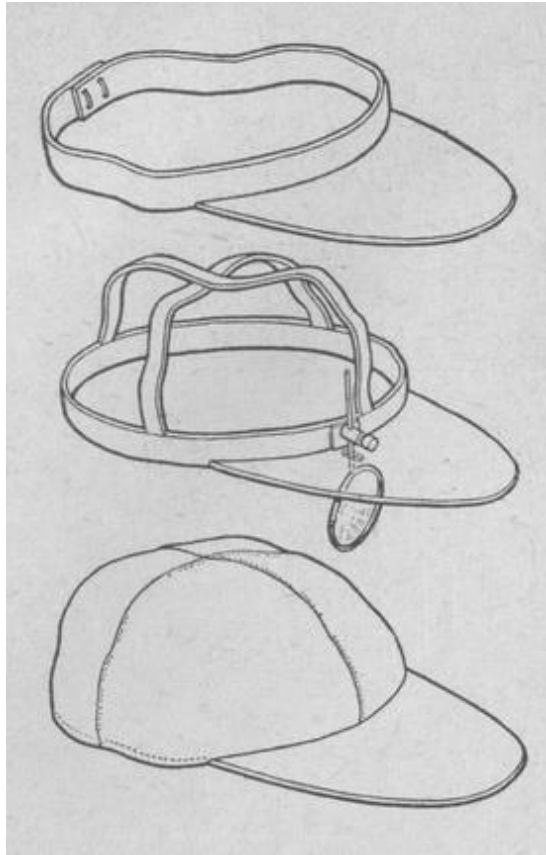


Fig. 221 - Visors used to protect the eyes from the bright sun

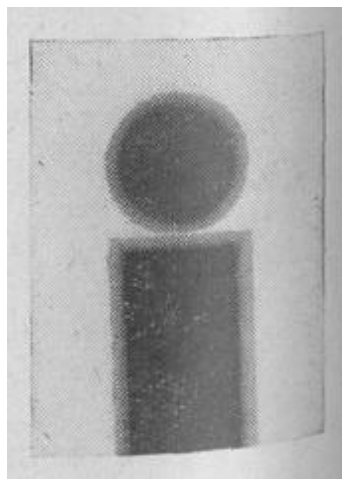


Fig. 222 - Schematic representation of the eye's perception of a rectangular front sight under conditions of bright target illumination

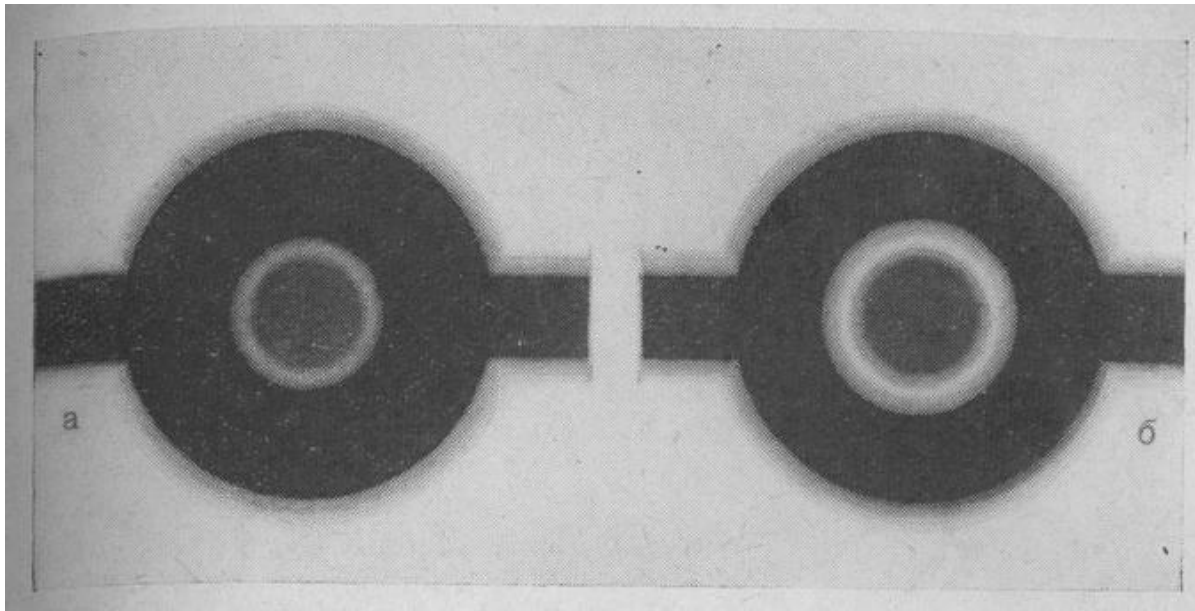


Fig. 223 - Schematic representation of the eye's perception of a ring front sight under conditions of bright target illumination:

a - "strict" ring; *b* - "free" ring.

Therefore, when targets are brightly lit, it is necessary to use light filters or smoked glasses. Having a set of glasses of different density and color, you can muffle the excess brightness of the lighting

In order to use light filters correctly, it is necessary to keep in mind the following. Experiments have shown that bright light sources are harmful to the eye mainly by the violet section of the visible and invisible parts of the spectrum. Violet rays, passing through the lens, are refracted more than rays of other parts of the spectrum, contributing to the formation of unclear images on the retina. It is best to eliminate violet sections of the spectrum with yellow, yellow-green and yellow-orange light filters. Moreover, not only do they not reduce visual acuity, but, on the contrary, significantly increase it. Light filters of a dark, neutral color, the so-called smoky glass, evenly absorbing, and therefore weakening light rays across the entire spectrum, protect the eyes from bright light sources, but at the same time somewhat reduce visual acuity. Despite this, dark glasses, reducing light scattering in the eye environment, make the work of the eye so much easier during aiming that they more than compensate for the minor losses in visual acuity when using them. Having a set of smoked glasses of different densities, you can select them so that even in the brightest lighting the shooter will see the target almost as well as in cloudy weather. At the same time,

he will be able to successfully shoot with rectangular and ring sights

Let us now consider some issues of practical application of light filters and smoked glass in sport shooting, using the practice of our and foreign athletes.

Despite the widespread use of filters abroad, there is probably no consensus among foreign shooters on the advantages of lenses of a particular color; this is the only way to explain the "group" commitment of athletes from a particular country to filters of a particular color or shade. Only well-designed experiments can answer the question of which filters are most suitable for shooting in different lighting conditions by color and density. As far as we know, the beginning of serious research in the field of using filters as applied to the needs of shooting sports was laid by Honored Master of Sports N.A. Kalinichenko, who used only the "ZhS-17", "OS-12", blue, green and red filters in his experiments. Unfortunately, the group of colored "TS" and "NS" (smoky) lenses has not been studied. However, based on the experience of the best Soviet and foreign shooters, experimental data, and also taking into account some optical characteristics of filters, the following recommendations can be adopted as initial ones.

The most suitable light filters for shooting are:

yellow "ЖС" and orange "ОС", light and medium density; absorbing the rays of the violet part of the spectrum well, they contribute to a clearer image on the retina of the contours of the target "apple" and sighting devices;

dark glasses "ТС" - gray filters with a brown tint, light and medium density; removing excess brightness of lighting across the entire spectrum due to some yellowness in the color, they retain the violet part of the spectrum somewhat more;

neutral glasses "НС" - gray with a greenish tint; protecting the eye from excessive brightness, they retain a little less of the violet part of the spectrum than "ТС", but have a greenish tint that is more pleasing to the eye

On a cloudy but bright day, light filters "ZhS-12" and "ZhS-16" are recommended.

When shooting on a sunny day, but in dim lighting when there is a "haze" - transparent cloudiness, as well as at the beginning or end of the day, when the sun's rays illuminate the targets from the side, it is better to use light filters of slightly higher density: yellow "ZhS-17", orange "OS-11" and yellow-green "ZhZS-6", which are slightly denser than the "ZhS-17" light filter. You can also successfully use neutral "NS-7" glasses and dark "TS-6" glasses - light filters of gray-greenish and gray-brown shades, approximately corresponding to the density of the glasses of light protective sunglasses

On a sunny day, when the sun is behind the shooter and the targets are especially brightly illuminated, filters of a significantly higher density are required. Yellow-green filters "ZhZS-4" are very good at reducing the excessive brightness of target illumination; at a relatively high density, they are distinguished by a color that is pleasant to the eye; orange "OS-16" (brown-orange color) and neutral glasses "NS-2" and "NS-8" (gray with a blue-greenish tint), as well as dark glasses "TS-6" and "TS-7" (gray with a brown tint). All these filters approximately correspond to the average density of glasses for protective sunglasses.

When shooting at brightly lit targets, you should not be afraid to use glasses of fairly high density. Often you have to observe how shooters in such cases use very light filters that have a barely noticeable color. These filters do not at all remove the excess brightness of the target illumination and therefore do not contribute to a clearer perception by the eye of the contours of the "apple" of the mouse and sighting devices.

Using light filters (as well as regular corrective lenses), you can achieve uniform aiming if:

the glass is located perpendicular to the aiming line;

the line of sight passes through the central part of the glass, since it is usually always better polished;

the distance between the glass and the eye is constant;

the glass is firmly fixed and does not shift from shot to shot

To meet all these requirements, you should use special spectacle frames, monacle glass holders, or, when shooting from rifles with a diopter sight, attach light filters to the rifle (in the sight).

The most widely used among foreign shooters is the monacle glass holder (Fig. 224). Its design allows both the glass to be moved and its angle to be changed in any plane; due to this, the monacle glass holder can be successfully used for both rifle and pistol shooting.

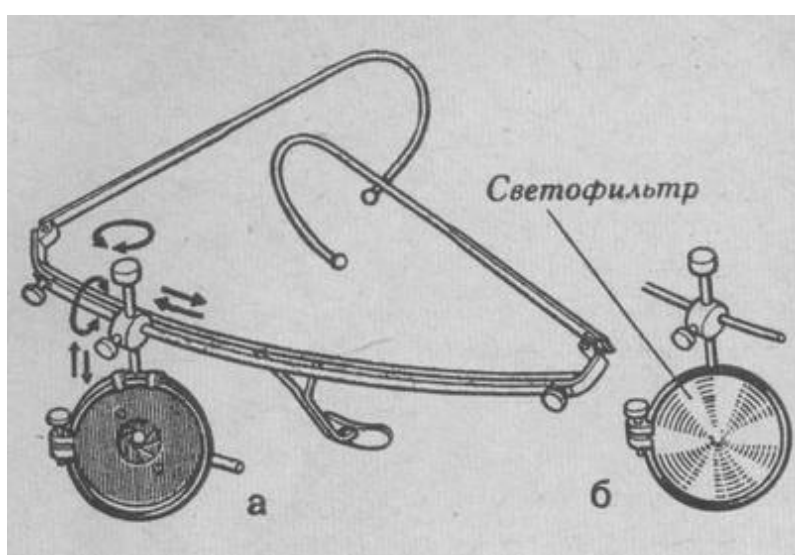


Fig. 224 - Glass holder-monocle:

a - with iris diaphragm; b - with light filter.

When shooting from a rifle with a diopter sight, it is advisable to attach the filters to the sight. If the weapon does not come with special brackets, the athlete can make them himself. They are very easy to make from a thin metal plate or even from tin. Homemade brackets-glass holders can be attached to the sight square, in front of the plate (Fig. 225). This method of placing the filters is good because it allows you to quickly and easily change the glass during shooting and the plate, if with changing lighting the shooter intends to operate not only glass of different densities, but also plates with different diopter holes. However, this arrangement of the filters also has a significant drawback: sun rays, hitting the glass from the front or side, cause light scattering in it, which can make aiming difficult.

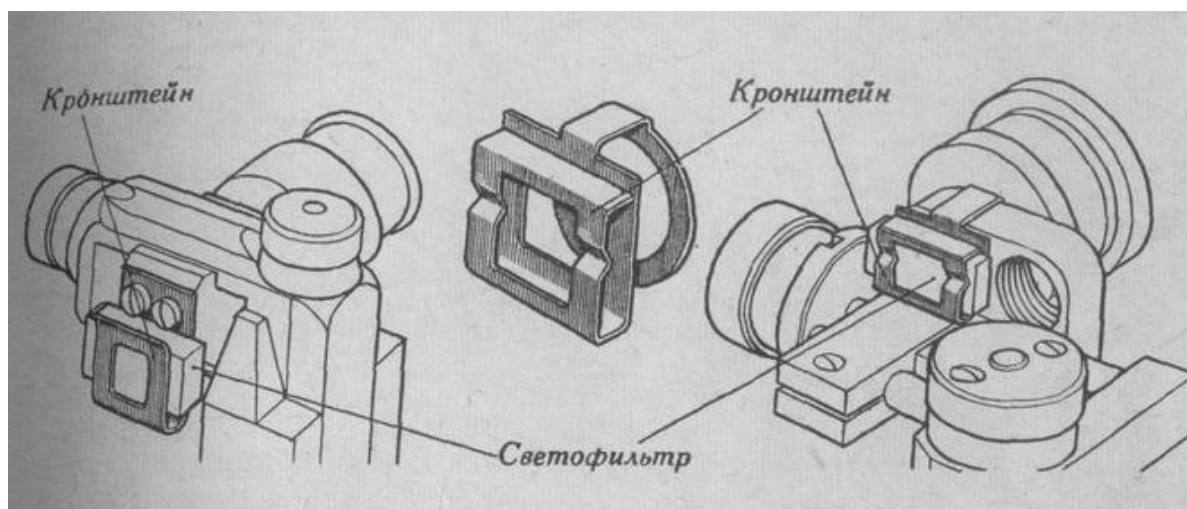


Fig. 225 - Fastening light filters and smoked glasses to the angle of dioptic sights

Many shooters, not without reason, prefer to place the light filter in the sight plate: then the sun's rays do not fall on it at all. In the sights of the MC-12 and MC-13 rifles, the easiest way to attach light filters is to place them between the base and the plate itself (Fig. 226, a). In the plates of other types of dioptic sights, the light filter can be attached by clamping it with a ring spring or a specially fitted coupling (Fig. 226, b). Finally, you can machine a new detachable plate, providing a small chamber in it to accommodate the light filter (Fig. 226, c).

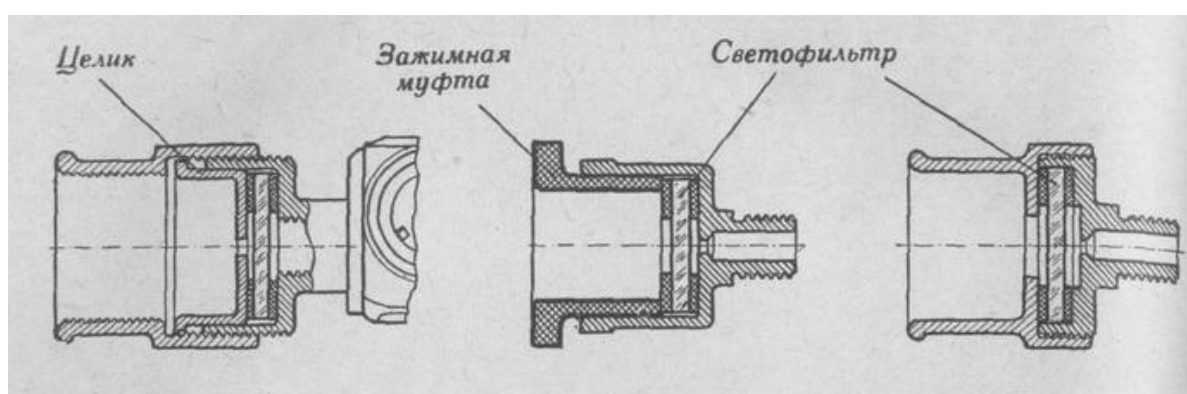


Fig. 226 - Methods of fixing light filters in the diopter sight plate:

a - in the MC-12 and MC-13 rifles; b - clamping sleeve; c - manufacturing a new plate with a chamber for the light filter.

There are many options for frames and devices for fixing light filters. One thing is certain - the wide and correct use of light filters and colored glasses greatly increases the accuracy of aiming in

excessively bright lighting and helps to maintain the "operability" of the eye throughout the shooting.

3.2.7 Dropping weapons

During aiming, some shooters tilt their weapons (Fig. 227, a). Uneven tilting affects both the accuracy of shooting and the deviation of the point of impact from the target center.

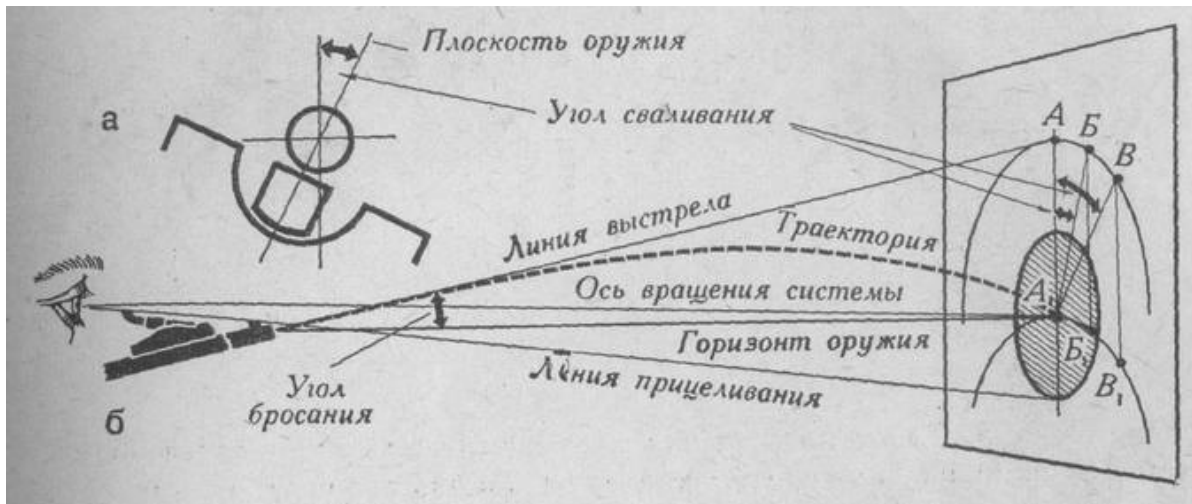


Fig. 227 - Rifle fall diagram

When the weapon is knocked down to the right or left, the plane of the weapon tilts to the side, rotating around an axis passing through the center of the target and the shooter's eye (Fig. 227, b). Moreover, the throwing line describes an arc AB on the plane. This arc has a radius AA_1 , which corresponds to the height of the bullet's fall under the action of gravity. Since this height is a constant value for a certain shooting range, then when the weapon is knocked down, each new point of intersection of the throwing line with the target plane corresponds to a new point of impact - lower vertically at a distance equal to the same segment AA_1 . Thus, the intersection of the throwing line with the target plane at point B corresponds to point of impact B_1 , point B - point of impact B_1 , etc.

Thus, when the weapon is knocked down, the throwing line and the point of impact describe two absolutely identical circles of the same radius on the plane of the target, the value of which directly depends on the throwing angle. Since the throwing angle must increase with increasing firing range, the radius of the circle also in-

creases, which is why the errors in knocking down are greater, the greater the firing range (see Tables 14 and 15).

Deviation of the point of impact of a light bullet when knocking down a service rifle (caliber 7.62 mm) by 5° (according to A. Gerbko)

Table 14

Distance, m	Stall circle radius, cm	Horizontal deviation, cm	Vertical deviation, cm
100	6	0.5	0.02
200	28	2.4	0.09
300	69	6.0	0.20
400	126	11.0	0.40
500	215	18.7	0.70
600	342	29.7	1.10

Deviation of the bullet impact point when a small-bore rifle is knocked down by 5 and 10°

Table 15

Distance, m	Stall circle radius, cm	Stall angle 5°		Stall angle 10°	
		horizontal deviation, cm	vertical deviation, cm	horizontal deviation, cm	vertical deviation, cm
25	3.0	0.2	0.01	0.5	0.04
50	12.6	1.0	0.04	2.1	0.18
75	28.9	2.5	0.09	5.0	0.40
100	52.0	4.5	0.17	9.0	0.70
150	122.0	10.6	0.40	21.0	1.80
200	231.0	20.1	0.70	40.2	3.40

As we can see, when the roll is within $5-10^\circ$, the vertical deviations of the point of impact are very small and practically have no significance. Of great importance when the roll is horizontal deviations of the point of impact, which quickly increase when shooting at long distances and negatively affect the accuracy of shooting.

Weapon swaying has a negative effect mostly on the shooting of beginner shooters; they sway the weapon unevenly and in different directions. In these cases, swaying leads to horizontal dispersion of shots

There are also experienced sportsmen who, due to habit, constantly tilt the weapon to the same side, and in a monotonous manner. Such constant tilting does not affect the accuracy of shooting, but requires lateral corrections when changing the shooting range.

Chapter 3. Breathing

The shooter's breathing technique determines not only the result of each shot, but also the successful completion of the entire exercise as a whole.

It is known that you cannot breathe while aiming: breathing is accompanied by rhythmic movement of the chest, abdomen, shoulder girdle, which causes the weapon to shift and oscillate, making it impossible to make an accurate shot. Therefore, you cannot breathe and make a shot at the same time; you must hold your breath for a while.

At the same time, we should not forget about the functional purpose of breathing, which is a physiological process associated with blood circulation and gas exchange, metabolism and complex phenomena occurring in the nervous system, on which the condition and vital functions of the entire organism depend. Therefore, breathing is of great importance, especially in such long exercises as "standard". Incorrect breathing has a negative effect on the general condition of the shooter's body, which, in turn, is reflected in the shooting results.

During breathing, there is an alternating increase and decrease in the volume of the chest, due to which inhalation and exhalation occur. Inhalation is accomplished by increasing the size of the chest due to the simultaneous contraction of several muscle groups, the diaphragm. When the chest expands, the lungs, which are elastic, straighten out and follow it - a rarefied space is formed in the chest cavity. Under the influence of atmospheric pressure, air enters the lungs through the respiratory tract. In the lungs, oxygen enters the blood from the air, and carbon dioxide and water vapor are removed from the blood. Then comes exhalation - all the muscles relax, the diaphragm is pushed upward, under the influence of the weight of the chest and the elasticity of the lungs, the size of the chest decreases. The lungs begin to collapse, thereby displacing air outward. In contrast to inhalation, exhalation does not require muscle tension, it occurs due to the elasticity of the ribs, muscle tissue and the elasticity of the lungs.

The breathing process is regulated reflexively by the respiratory center located in the brain. Carbon dioxide accumulating in the blood affects the respiratory center, nerve impulses are generated, directed to the respiratory muscles - they cause muscle contraction. The lungs are filled with air. Their expansion irritates the endings of the centripetal fibers of the vagus nerve, which leads to inhibition of the respiratory center - the respiratory muscles relax. After this, exhalation occurs again. With calm breathing, a person makes an average of 12-15 respiratory cycles per minute. If you carefully follow the respiratory cycle, it is easy to notice that the tense position of inhalation very quickly gives way to exhalation - inhalation and exhalation together take about 2 seconds. The next inhalation begins after a two-three-second respiratory pause (Fig. 228), during which carbon dioxide accumulates in the lungs. The breathing pause is caused by the fact that a certain amount of air remains in the lungs.



Fig. 228 - Schematic recording of breathing

With each inhalation, approximately 500 cm^3 of air, called respiratory air, enters the lungs. With a maximum inhalation, a person can inhale another 1500 cm^3 of so-called additional air. If, after a calm exhalation, an additional forced exhalation is made, then approximately 1500 cm^3 of air, called reserve air, is removed from the lungs. However, even after a forced exhalation, $1000\text{-}1500 \text{ cm}^3$ of residual air remains in the lungs.

A person can hold his breath for 12-15 seconds without any particular difficulty or discomfort. This is more than enough time to fire a shot. However, the following should be kept in mind. In general, the

longest breath holding can be done on the inhale rather than on the exhale (see Fig. 231, a). Consequently, the total breath holding on the inhales has a less negative effect on the general condition of the shooter's body, since he experiences less oxygen starvation. Observations show that holding your breath to fire a shot by extending the natural breathing pause (i.e. on the exhale) is not at all necessary. As the practice of leading shooters has shown, before firing you need to take two or three deep breaths in and out, and then, having taken almost half a breath, gradually hold your breath (Fig. 229). Many athletes adhere to a similar breath holding pattern, especially when shooting a pistol (revolver).



Fig. 229 - Diagram of holding the breath while firing a shot

Many experienced standard shooters hold their breath after several inhalations and exhalations, gradually decreasing in amplitude, with their frequency remaining constant (Fig. 230, P, P).

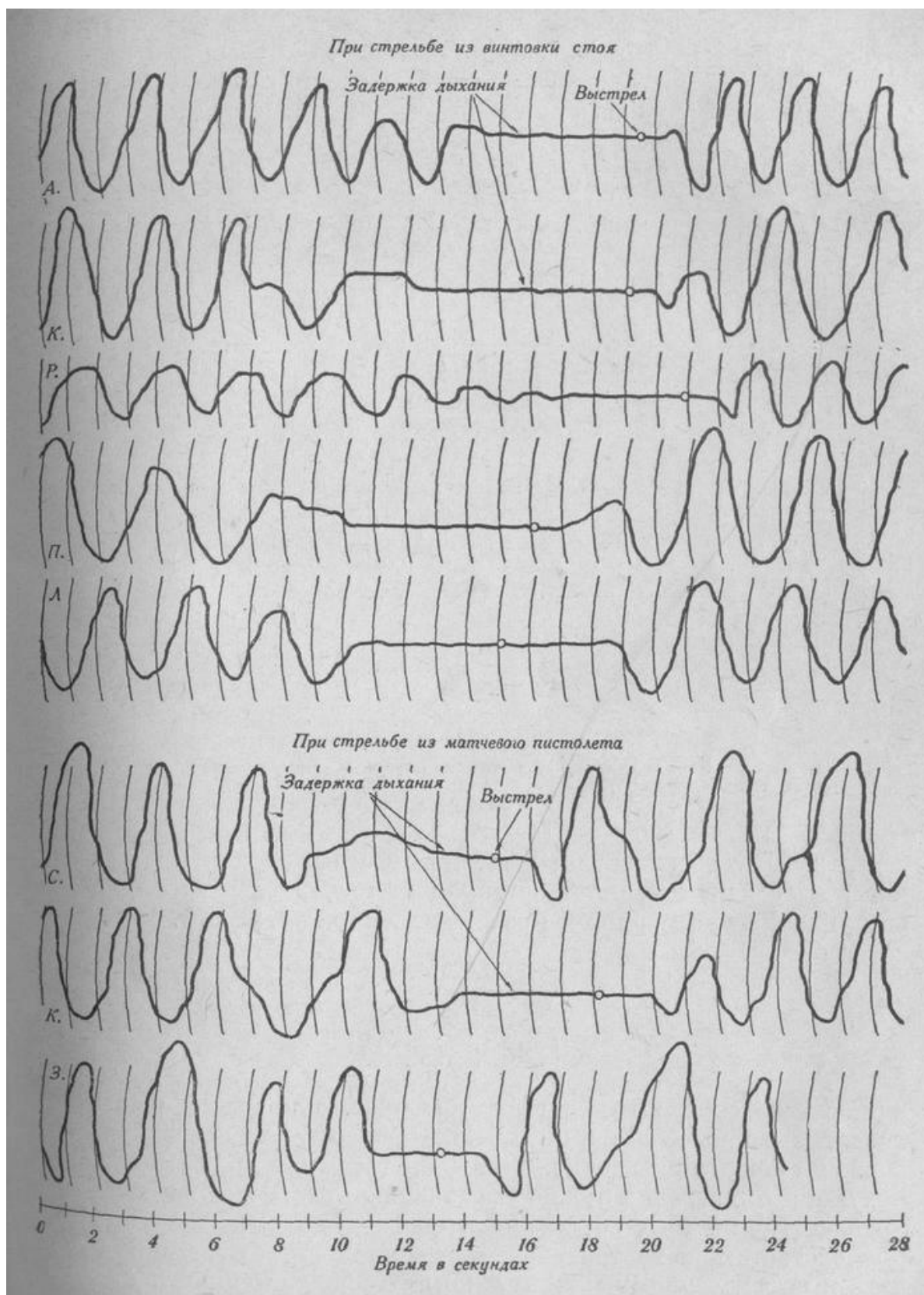


Fig. 230 - Schematic representation of the recording of the breath holding of leading shooters during the firing of a shot (the recording was made using the method of Ya.V. Gochicheladze)

Some leading athletes, when shooting standing and from a kneeling position, successfully use the method of holding their breath, doing it almost on inhalation.

If we examine the pneumogram of the shooter's breathing during the processing of a shot when shooting standing (Fig. 231, b), it is evident that the pulsation during breath holding on inhalation is significantly less noticeable than during breath holding on exhalation. Taking these circumstances into account, it can be assumed that a certain tension of the respiratory muscles during breath holding almost on inhalation to some extent contributes to the immobilization of the body when ready to shoot standing and from a kneeling position during the relatively short period of time necessary to fire a shot. Therefore, the decision on holding the breath when shooting from a rifle almost on inhalation or half-inhalation should be left to the shooter himself.

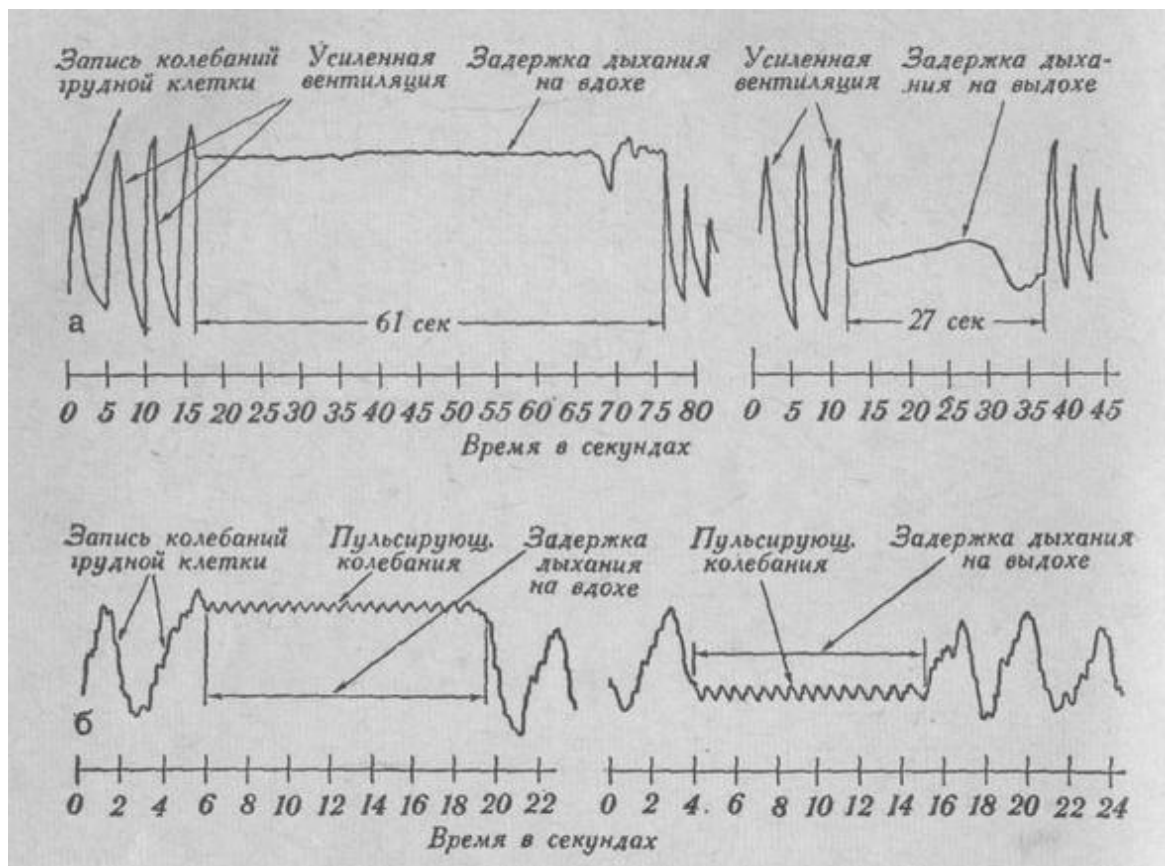


Fig. 231 - Pneumogram of breath holding: *a* - maximum breath holding by the same shooter on inhalation and exhalation;
b - breath holding during shot practice while shooting standing on inhalation and exhalation.

In order for the disturbance of the breathing rhythm not to have such a strong effect on the general condition of the body during prolonged shooting, one should not hold one's breath for a long time to make a shot: if the shooter does not manage to shoot within 10-12 seconds from the moment of holding one's breath, one should stop aiming and take a rest. Before the next attempt to make a shot, one should ventilate the lungs well, take several deep breaths with one's full chest; the same should be done between shots throughout the entire shooting. This ensures regular rest between shots, which generally protects the body from oxygen starvation and the onset of excessive and premature fatigue.

Chapter 4. Trigger release

The technique of pulling the trigger is of great, and sometimes decisive, importance in making a shot. First of all, pulling the trigger should not displace the weapon aimed at the target, i.e., disrupt the aim. To do this, the shooter must be able to smoothly pull the trigger. In addition, pulling the trigger must be done in full accordance with visual perception, i.e. timed to a certain moment when the "flat front sight" is under the lower edge of the target's "apple".

Therefore, in order to achieve an accurate shot, the shooter must perform the action - smoothly pressing the trigger and aiming - not separately, not in isolation from each other, but strictly in concert with each other.

The difficulty of performing such a coordinated action is that the weapon is never motionless when aiming, it oscillates continuously to a greater or lesser extent depending on the degree of stability of the shooter's stance. As a result, the "level front sight" deviates to a greater or lesser extent to the side from the point (area) of aiming, stopping under the lower edge of the target's "apple" only for a short time, during which the shooter must complete a smooth pull on the trigger and fire a shot. And since the oscillations of the weapon, for example when shooting standing from a rifle or a pistol (revolver), are involuntary and chaotic for many shooters, especially those who are not sufficiently trained, it is very difficult to predict the time and duration of such short stops of the "level front sight" under the lower edge of the "apple". These difficulties are further aggravated by the fact that the coordinated execution of actions in such conditions, on the one hand, is in conflict with the innate responses of the body and the skills acquired in the previous period of human life, and on the other hand, requires the formation of new skills aimed at improving the consistency (coordination) of movements with visual control over their execution.

3.4.1 Conditions that ensure correct trigger release

The desire to overcome the technical and psychological difficulties (which will be discussed below) that arise before the shooter in the

process of performing an interconnected action - aiming and pressing the trigger in concert with it - was expressed primarily in the abundance of trigger systems, types of triggers and various methods of controlling them.

In shooting practice, triggers of different tension and character are used. This is due to many reasons, and in particular, the rules of competitions regulating the trigger tension for each class of weapons; the appropriateness of their use depending on the nature of the exercises performed; the type of nervous system of the shooter, his mental characteristics, tastes, habits and, of course, volitional qualities.

Despite the different degrees of trigger tension in different classes of weapons, shooters use:

"dry trigger" - it is distinguished by the fact that the trigger does not move noticeably when pressed, but as soon as the applied force exceeds its tension, the hammer is released from the combat platoon and a shot is fired;

"soft trigger" or "trigger with a pull" - here, when you press your finger, the trigger is noticeably pushed, that is, it has a greater or lesser working stroke;

a trigger with a "warning", characterized by a preliminary, free movement of the trigger and a subsequent stop at the so-called "warning"; after additional effort, with further pressing of the index finger on the trigger to overcome the resistance of the "warning", a shot follows; the trigger after the warning, in turn, can be "dry" or with a slight "pull";

"trigger trigger" (trigger trigger) - as a rule, it has the character of a "dry" light trigger; its operation occurs when pressing even with a force of several tens of grams.

In practice, triggers with tension fluctuating within the range of approximately: on rifles - 30-1000 g and on pistols - 15-300 g.

However, regardless of what type of trigger the shooter uses, it is important that he observes the basic requirement: the release of

the trigger is the end of all actions when making a shot; therefore, pressing the trigger must be smooth so as not to disrupt the aim.

In order for the index finger to perform the work without disturbing the aim, first of all it is necessary to correctly grasp the neck of the rifle butt or the pistol (revolver) grip with the right hand and create the appropriate support that will allow the index finger to overcome the trigger tension. The neck of the butt and the pistol grip must be grasped tightly enough, but without excessive force, since muscle tension in the hand can lead to excessive vibrations of the weapon. In this case, it is necessary to find a position for the hand in which there is a gap between the index finger and the neck of the butt or the cheek of the pistol grip (Fig. 232). Then the movement of the index finger when pressing the trigger will not cause any lateral jolts that can displace the weapon, that is, disrupt the aim.

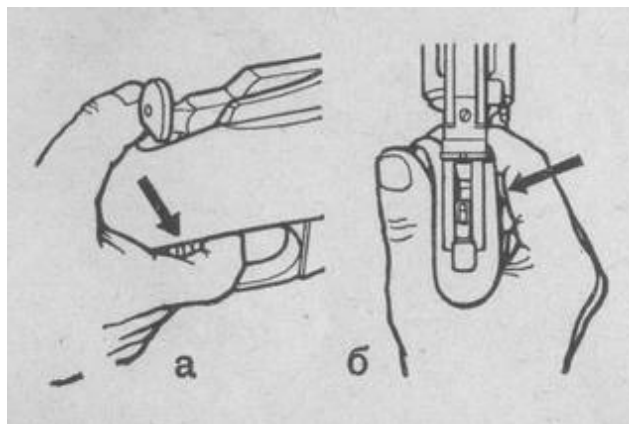


Fig. 232 - Correct position of the hand and index finger:
a - on the neck of the rifle butt; b - when grasping the handle of the revolver.

To fire a shot from a service and sporting rifle, as well as a service revolver, you must pull the trigger with either the first phalanx of the index finger or the first joint (Fig. 233, a). This type of pull requires the least movement of the finger. You must pull the trigger straight back so that the index finger moves along the axis of the barrel bore. If the finger pulls the trigger slightly to the side, at an angle to the axis of the barrel bore, this may lead to some increase in trigger tension and uneven, jerky movement of the trigger caused by skewing and additional friction of the trigger mechanism parts. This can also throw off aiming and cause a significant deviation of the bullet from the center of the target.

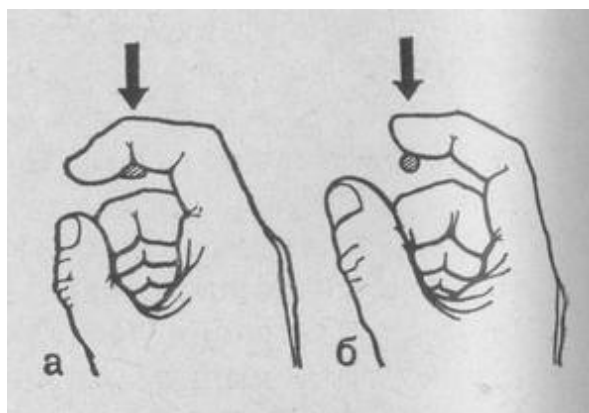


Fig. 233 - Correct placement of the index finger:

a - on the trigger; *b* - on the back of the accelerator.

When shooting from any rifles and pistols that have trigger mechanisms with an accelerator (setter), it is best to press on the accelerator spoke with the nail part of the first phalanx of the index finger (Fig. 233, b).

The shooter must learn to smoothly, gradually and evenly increase the pressure on the trigger, but this does not mean slowly, but smoothly, without jerking - the trigger pull should take no more than 1.5-2.5 seconds.

However, the ability to smoothly press the trigger is not enough to make an accurate shot. The second essential condition is that the work of the index finger when pressing the trigger must be coordinated with correct aiming.

Since during shooting it is necessary to pull the trigger with practically constant (more or less) weapon oscillations in order to simultaneously fulfill two conditions - to pull the trigger and to aim correctly - the shooter must choose certain, most favorable moments at which the weapon oscillations are the least. In short, he must master the art of smoothly and timely pressing the trigger. Therefore, it is necessary to understand well the very nature of weapon oscillations during aiming.

3.4.2 The nature and degree of weapon vibration when firing a shot

The system "shooter's body - weapon" always experiences complex oscillations during aiming and firing, regardless of the will of the athlete. As is known, the cause of this is the action and counteraction of muscles during the work they perform to hold the shooter's body in a certain position, as well as the pulsation of blood, causing rhythmic oscillations of individual parts of the shooter's body and weapon. In this case, the nature and degree of weapon oscillations change over different periods of time. Thus, at first, when the athlete makes a rough aim and has not yet had time to balance his body with the weapon to the greatest extent, the degree of oscillations is great. As the entire system is balanced and the aiming is refined, the oscillations of the weapon somewhat fade, and then after some time, when the muscles begin to tire and a long breath hold takes effect, the oscillations of the weapon begin to increase. A recording of the oscillations of the weapon on a moving paper tape gives a wave-like line in the form of an irregular sinusoid with different oscillation amplitudes (Fig. 234).

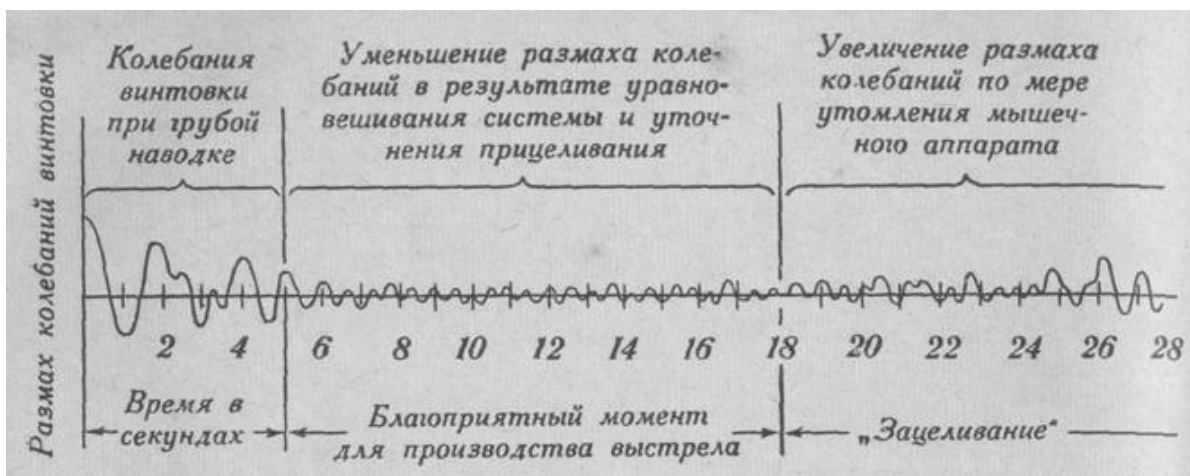


Fig. 234 - Schematic diagram of weapon oscillations during firing

Since different types of shooting positions have different degrees of stability, then, naturally, the vibrations of the rifle when shooting prone, kneeling and standing, as well as the vibrations of the hand with a pistol (revolver) differ both in magnitude and in character (Fig. 235). Thus, when shooting prone from a rifle, due to the great stability of the position, they are very insignificant and sometimes are not even visually recorded. When shooting from a kneeling position, the vibrations are also not great and are in the nature of frequent, vibrating movements, sometimes with a small rhythmic increase in their swing under the action of pulsation. When shooting

standing, when the position is least stable, the vibrations of the weapon are significantly greater and often have a chaotic character - they can increase unexpectedly and in any direction. Moreover, the time intervals advantageous for making a shot are mostly short.

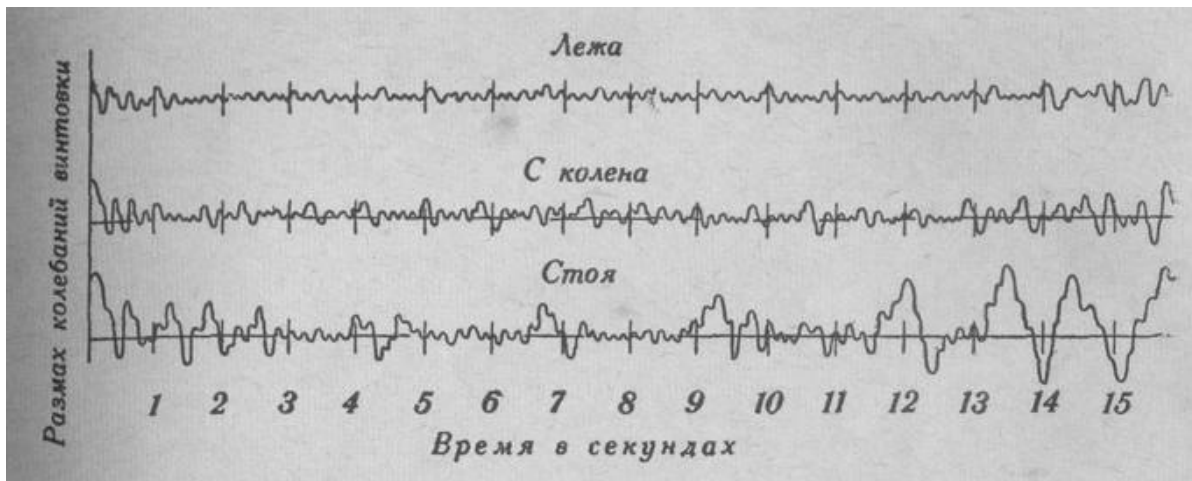


Fig. 235 - Schematic diagram of weapon oscillations in different types of positions

From the above it is clear that the periods of time, for example when shooting standing from a rifle or when shooting from a revolver, during which the weapon experiences small vibrating oscillations favorable for completing the trigger pull, are short. At the same time, the completion of the trigger pull must be smooth, without a jerk, for which the shooter needs to spend 1.5-2.5 seconds. That is why smooth pressing of the trigger should begin in advance, during rough aiming of the weapon. Then, as the aiming is refined and the weapon vibrations are regulated, it is necessary to smoothly increase the pressure, trying to complete the trigger pull when the weapon experiences small, vibrating oscillations or when they seem to have stopped. Based on these considerations, various methods of pressing the trigger and methods of controlling the trigger are used in shooting practice.

3.4.3 Methods of descent control

Depending on the type of trigger mechanism and type of manufacture, as well as the type of nervous system, shooters use different methods of trigger control.

Trigger without warning . When shooting from the prone position and partly from the kneeling position, that is, in those cases when the rifle is in a more or less stable position and the periods of the smallest vibrations are long, it makes no difference to the quality of the shot whether the trigger release is completed a second earlier or a second later. Therefore, after aiming, when stable vibrating vibrations of the weapon have been established, it is necessary to immediately begin to smoothly and continuously press the trigger until the shot occurs. This method of trigger control is called sequentially smooth (the terminology proposed by I. Blinkov in the book "Sport shooting from small-caliber weapons" is used. DOSAAF, 1955) (Fig. 236). It should be used both when shooting standing from a rifle and when shooting from a pistol (revolver), especially by young, poorly trained shooters who do not yet know how to balance themselves well with the weapon, which is why its vibrations are large, and the periods of vibrating vibrations are very short. In such cases, despite the vibrations of the weapon, the shooter must immediately after rough aiming begin to smoothly press the trigger, striving mainly to complete the press before the moment when the range of vibrations of the weapon begins to increase due to growing muscle fatigue.

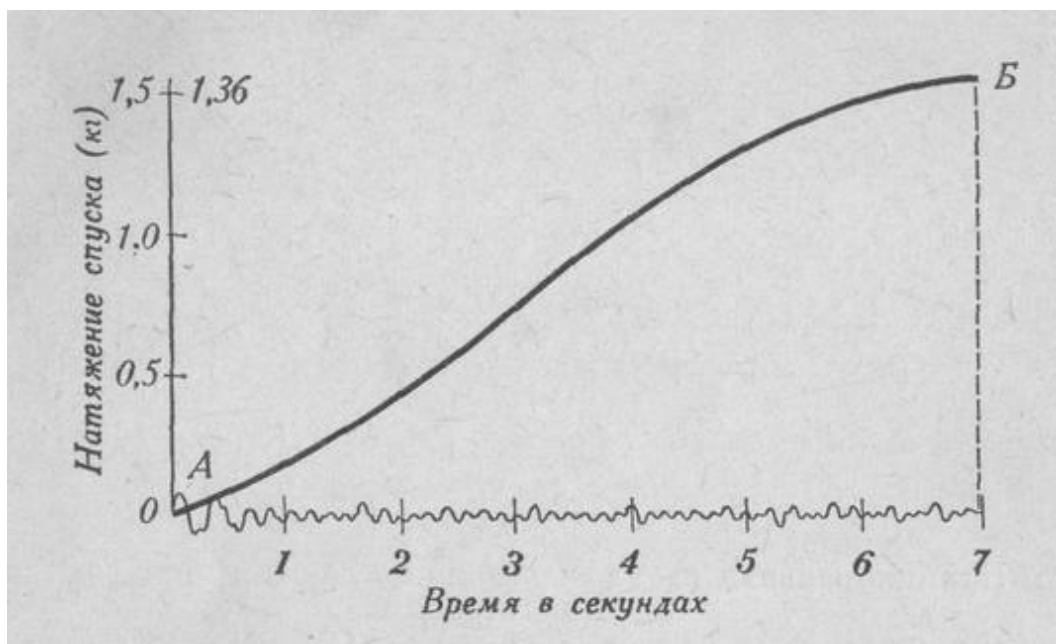


Fig. 236 - Basic diagram of trigger control without warning when shooting from a prone and kneeling position with a service rifle, as well as when shooting from a revolver. Sequentially smooth pressure on the trigger

However, experienced and sufficiently trained sportsmen, whose rifle or revolver vibrates considerably less when shooting standing up and the period of vibrating vibrations and fading of the weapon is much longer, use another method of trigger control. It consists of the shooter pressing the trigger when the weapon experiences vibrating vibrations, and stopping as soon as the vibrations increase. When the vibrations decrease, he continues pressing again, each time increasing the pressure in separate doses until a shot is fired. This method of trigger control is called step-sequential (Fig. 237).

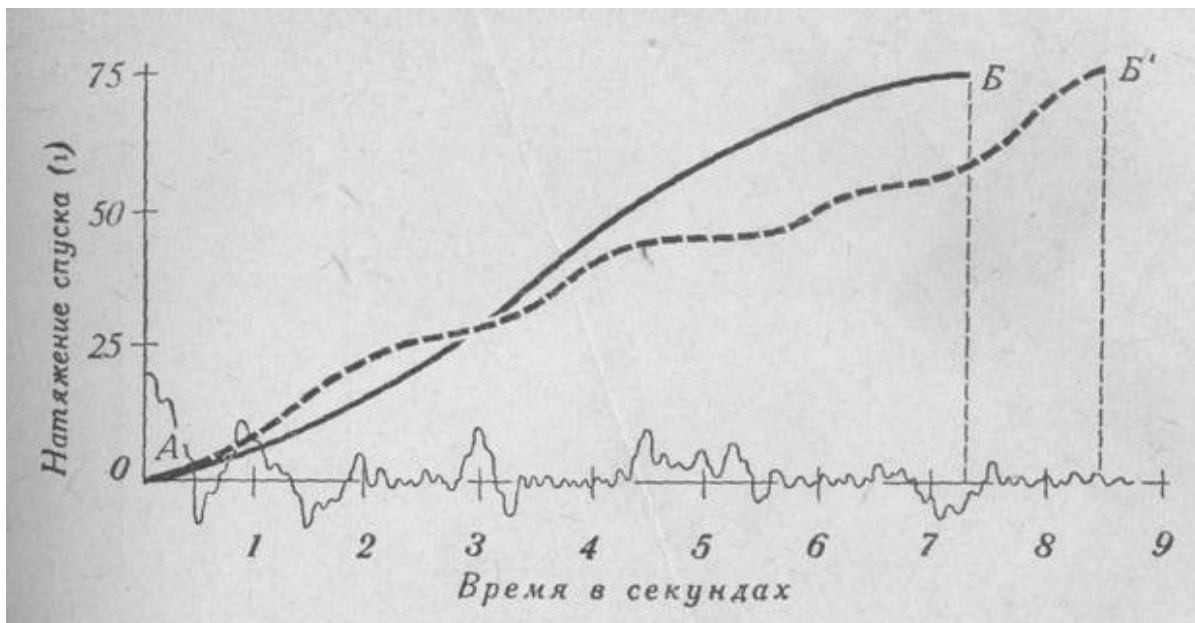


Fig. 237 - Basic diagram of trigger control without warning when shooting while standing from a service rifle and revolver

AB - sequentially smooth pressure on the trigger; *AB'* - step-by-step sequential pressure on the trigger.

Trigger with warning . In principle, the methods of trigger control with warning and without warning differ little from each other. When using a trigger with warning, it is necessary to boldly and decisively select the free play of the trigger until the warning during rough aiming, and then, with a smooth and continuous movement of the finger, increasing the pressure, fire the shot. Thus, after the warning, many shooters use the method of sequentially smooth trigger control (Fig. 238). When shooting standing from service and sport rifles and a sport pistol, under the condition of a relatively small swing of vibrations and relatively long periods of vibrating oscillations and fading of the weapon, the shooter should, having selected the free play of the trigger until the warning, press using the

method of step-sequential trigger control (Fig. 239). These two methods of trigger control are used when shooting from weapons that have conventional trigger mechanisms, that is, without an accelerator (trigger).

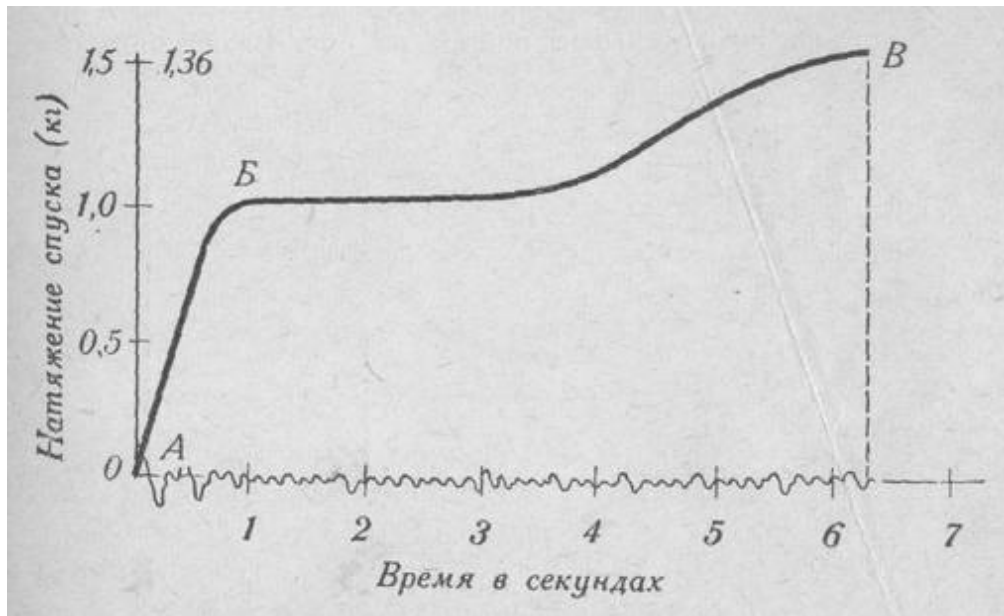


Fig. 238 - Basic diagram of trigger control with warning when shooting from a prone position and from a kneeling position from a service, small-caliber sport rifle and sport pistol: ABC - sequentially smooth pressure on the trigger;
B - warning.

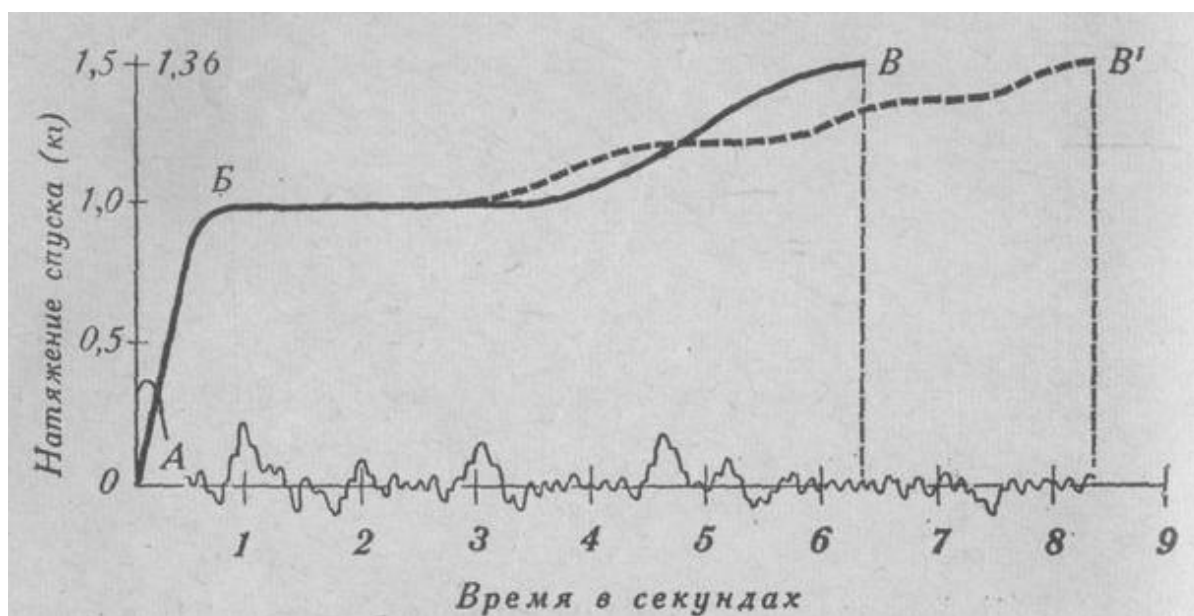


Fig. 239 - Basic diagram of trigger control with warning when shooting standing from service and sport rifles and a sport pistol:

АБВ - sequentially smooth pressing of the trigger;
АБВ' - step-by-step sequential pressing of the trigger.

In accordance with their tastes, condition and type of nervous system, shooters use triggers with accelerators, which differ from each other in tension, fluctuating within the range of approximately: on rifles - 30-700 g, on pistols - 15-100 g. Depending on the degree of tension, various methods of controlling the trigger with accelerator are used.

Trigger with accelerator (trigger) . In cases where the shooter uses a somewhat tight trigger (100-700 g), he can use it as a normal trigger without warning. Therefore, when shooting from a rifle lying down, kneeling and standing, as well as when shooting from an arbitrary pistol, the shooter must boldly place the index finger on the trigger spoke, and then after a rough aim, having specified the aim, begin pressing on the spoke. Consequently, with a somewhat tight trigger with an accelerator, shooters use sequential-smooth and step-sequential methods of trigger control (Fig. 240). Practice has shown that these methods are the most advantageous, since a somewhat tight trigger allows the shooter to place his finger on the spoke relatively safely when aiming.

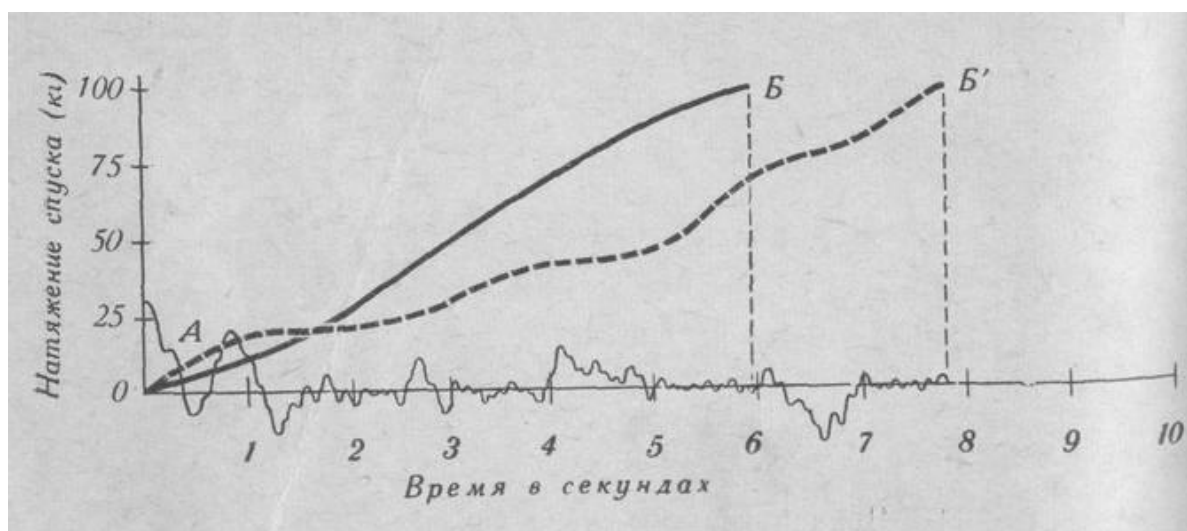


Fig. 240 - Basic diagram of trigger control with an accelerator when shooting from a rifle in a prone, kneeling and standing position and from an arbitrary pistol:

АВ - sequentially smooth pressure on the trigger; *АВ'* - step-by-step sequential pressure on the trigger.

Some shooters, when shooting standing from a rifle or from a free pistol, prefer a different method of trigger control. It consists of the fact that the index finger is in motion while aiming, as if pulsating, periodically touching the spoke of the trigger. Having chosen the most suitable moment for the shot, the athlete slightly increases the pressure and with such a final movement of the finger presses on the spoke, overcoming its tension. This method of trigger control is called pulsating (Fig. 241). Its advantage is that the shooter, continuously and rhythmically moving the index finger, achieves a certain balance between the processes of excitation and inhibition in the psychological and neuromuscular respect, which helps to increase the speed of reaction and coordination of movements (see below). This method of pressing the trigger, if used skillfully, allows achieving sufficient shooting accuracy. However, the use of the pulsating method is also associated with significant difficulties, overcoming which requires a lot of training.

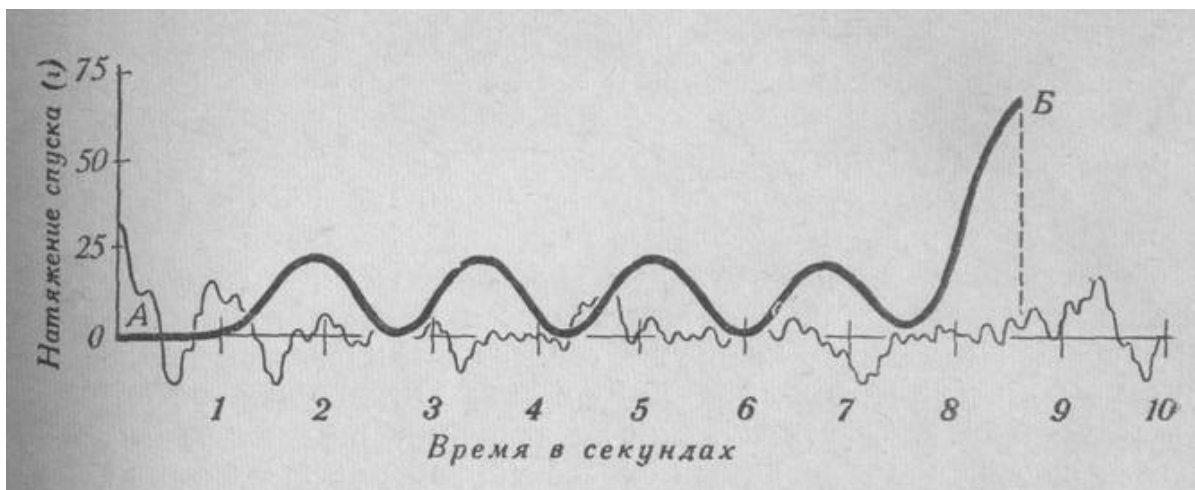


Fig. 241 - Schematic diagram of trigger control with accelerator when shooting standing.
Pulsating trigger pressure

Since the pulsating method has certain elements of "catching" the favorable moment for making a shot, which in itself already creates the prerequisites for a jerk of the finger, "pulling" the spoke at the most crucial moment preceding the shot, many leading shooters use a kind of combined method of trigger control - the pulsating movement of the index finger gradually fades, after which a smooth pressure on the trigger spoke begins. In fact, this is the same sequentially smooth method of trigger control (Fig. 242).



Fig. 242 - Schematic diagram of the most appropriate trigger control with an accelerator when shooting from a rifle while standing and kneeling and from a free pistol

So, we have analyzed various methods of trigger control, which are extremely important in the technique of accurate shooting. Everything seems clear and easy to implement. However, in practice it turns out that it is not so easy to coordinate correct aiming and timely pressing of the trigger. This is associated with difficulties caused by the course of nervous processes, as well as with difficulties, the overcoming of which is associated with the suppression of previous and the acquisition of new conditioned reflex connections in the central nervous system (which will be discussed below).

3.4.4 Some information about the physiological and psychological features of descent control

Making an aimed shot is a very complex process, requiring the shooter to have complex visual-motor coordination of actions. A large number of various stimuli, perceived primarily by the receptors of the eye, muscles and vestibular apparatus, are conducted along many centripetal pathways to the central nervous system, ultimately to its highest section - the cerebral cortex, from where the corresponding impulses - commands - then follow. Commands are sent to various muscles that perform one or another action, necessary, for example, to hold an outstretched hand with a pistol; the corresponding movement of the hand when there is a signal that

the aiming line is broken; holding the body in a standing position; holding the breath while processing the shot; moving the index finger at the most favorable moment for making a shot, etc. (Fig. 243). All these actions are manifested in various involuntary and voluntary movements. Voluntary movements also include the movements of the index finger when pressing the trigger. We will dwell on the specific features of the implementation of voluntary movements in more detail.

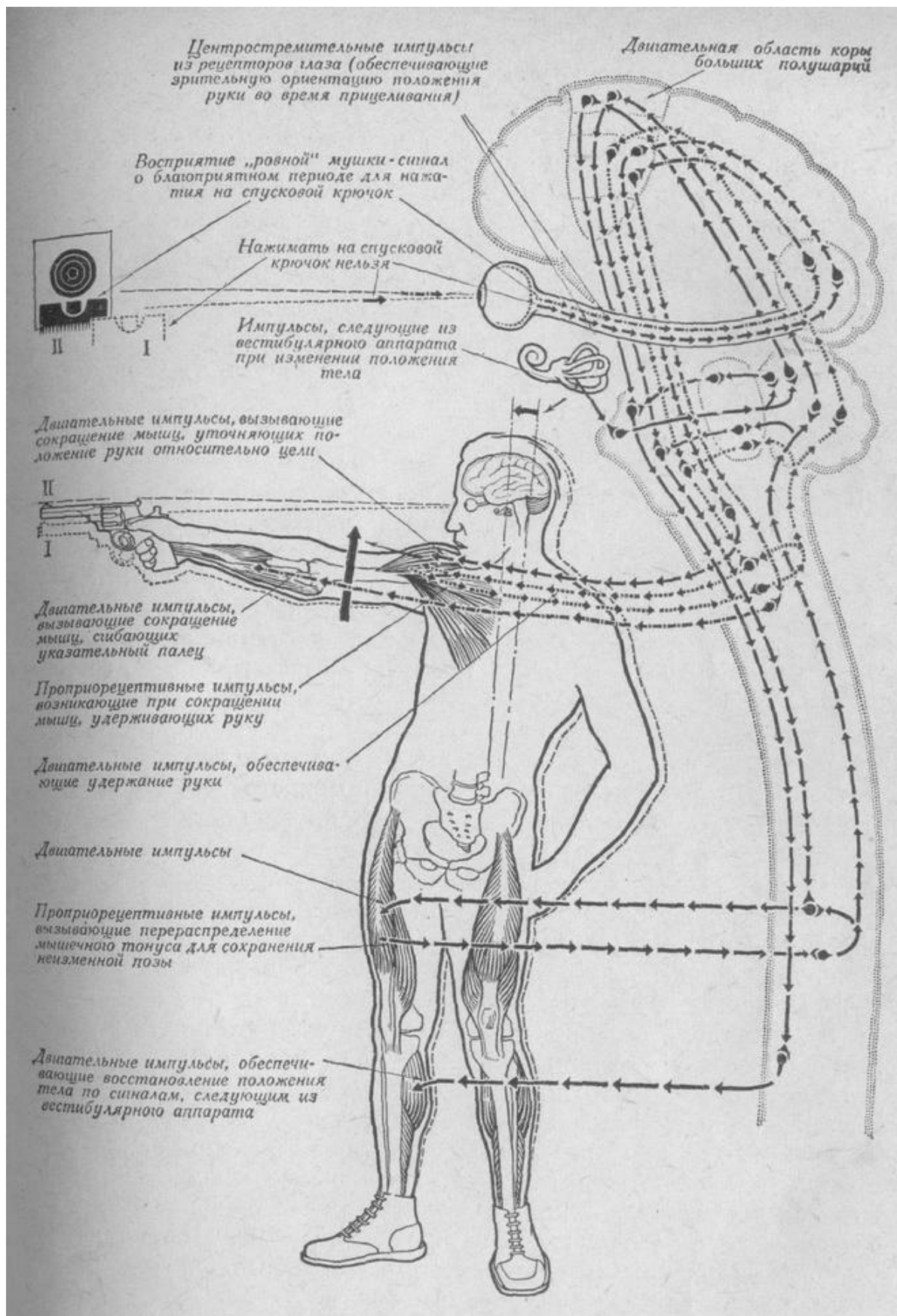


Fig. 243 - Schematic diagram of the flow of nervous processes during the firing of a shot

All kinds of actions, including movements, with which the organism responds to some stimulus are called reactions. We have already said that all actions performed by a person proceed according to the reflex type. The great Russian physiologist I.P. Pavlov divided all reflexes into unconditional and conditional.

Unconditioned reflexes are innate, inherited reactions of the organism to certain stimuli of the external or internal environment. Every living being has a certain fund of innate reactions, which immediately provide it with a certain relationship with the environment. Consequently, unconditioned reflexes do not require special development and always manifest themselves under certain conditions; they are distinguished by considerable constancy. Nevertheless, in some situations they can change under the influence of the cerebral cortex.

Unconditioned reflexes include, for example, defensive and orientation reflexes - motor reactions that underlie various involuntary movements. The neural pathways of unconditioned reflexes, including involuntary movements, pass through the subcortical parts of the central nervous system; at the same time, thanks to the system of intercalated neurons, they are also connected to the cerebral cortex.

Conditioned reflexes are temporary reactions developed in the process of accumulation of individual experience of a person throughout his life. From the first days of his life, a person encounters the surrounding world. In order to live, he must adapt to the continuously changing conditions of the environment. This connection of the organism with the environment is carried out partly with the help of simple, unconditional reflexes, and mainly by creating new, conditioned reflexes, and the possibility and diversity of their formation are infinitely great. Conditioned reflexes are carried out with the obligatory participation of the cerebral cortex.

The most diverse voluntary movements, that is, movements that obey our will, are, by their physiological nature, motor conditioned reflexes. The essence of mastering each new voluntary movement, as well as the execution of an already known one, lies in the formation of new and the use of previously created connections between the nerve centers in the cerebral cortex. Therefore, the ac-

curacy and timeliness of the implementation of voluntary movement largely depend on the speed of the nervous processes in the interacting nerve centers of the cerebral cortex.

Aiming and pressing the trigger require great mobility of the nervous processes, otherwise the shooter's response to visual perceptions - signals will be delayed and will lose their usefulness, since the shot will not be fired in time, and therefore, inaccurately. At the same time, pressing the trigger with the index finger should not only be done in time, but also be such an isolated and precise movement that the weapon will not shift, otherwise the shot will also be inaccurate. It is quite natural that the coordination of movements and the speed of the shooter's body's reaction to any stimulus-signal acquires primary importance.

Despite the fact that the body's response to irritation can be relatively fast, a certain amount of time still passes from the onset of the stimulus-signal to the onset of the response movement. Thus, when, during high-speed shooting from a pistol at silhouettes, the shooter begins to quickly raise his hand to make the first shot, in response to the signal - the visual perception of the targets (silhouettes) that have appeared passes approximately 0.18-0.25 seconds. This reaction time of the shooter is due to the fact that the image of the targets that have appeared, formed on the retina of the eye, is transmitted (in the form of nerve impulses) along the optic nerve to the corresponding center in the cortex and must be conscious. Some moment passes until the decision to raise the hand is formed. Then it takes time for the corresponding "order" from the brain to reach the arm muscles via the centrifugal nerves, which must do the work - raise the hand.

Does a shooter always react in the same way and with the same speed? No, and here's why. In addition to the excitation process, which is one aspect of complex nervous activity, in the central nervous system, as we have already said, there is also an inhibition process. Scientists have proven that inhibition occurs in the nerve centers as a process accompanying excitation. This is a special active state of the nerve centers, in which they do not send nerve impulses or do not pass them through themselves.

The processes of excitation and inhibition in the nerve centers have a certain mobility in replacing one another, since there can be no instant replacement of excitation by inhibition in nerve cells. One of the reasons for this is that, unlike a nerve fiber, in which excitation fades immediately, in the nerve centers excitation continues for some time after the cessation of the stimulus. As a result of this inertia and a number of other features of the conduction of excitation through the nerve centers, there is a latent period of reaction - the time required to replace the process of excitation by inhibition. At the same time, this latent period in the change of nerve processes is not at all a constant value, inherent once and for all to a given organism: the mobility of the processes of excitation and inhibition has great variability, obeying certain patterns.

To understand the complex phenomena that occur in the central nervous system when a shooter masters certain motor skills necessary to perform coordinated actions when firing a shot, let us turn to the teachings of I.P. Pavlov on higher nervous activity.

At the beginning of training and practice, when the shooter strives to achieve the greatest immobility of the weapon and to press the trigger correctly, numerous signals entering the cerebral cortex cause increased excitation of its motor centers. During this period of training, excitation processes prevail over inhibition processes and spread in the cerebral cortex, covering significant areas of it. The excitation process caused by irritants in one place of the motor area of the cerebral cortex spreads over a significant area. As a result, muscle groups that should not take direct part in the execution of a given movement are involved in the work. The phenomenon characterized by the presence of such widespread excitation in the cerebral cortex is called irradiation (Fig. 244, b). This, in fact, is the prerequisite for the fact that many athletes, especially beginners, when shooting a rifle standing or when shooting a pistol, instead of pressing the trigger only with the movement of the index finger, include many groups of skeletal muscles in the work, which disrupts the aiming of the weapon at the most crucial moment of the shot.

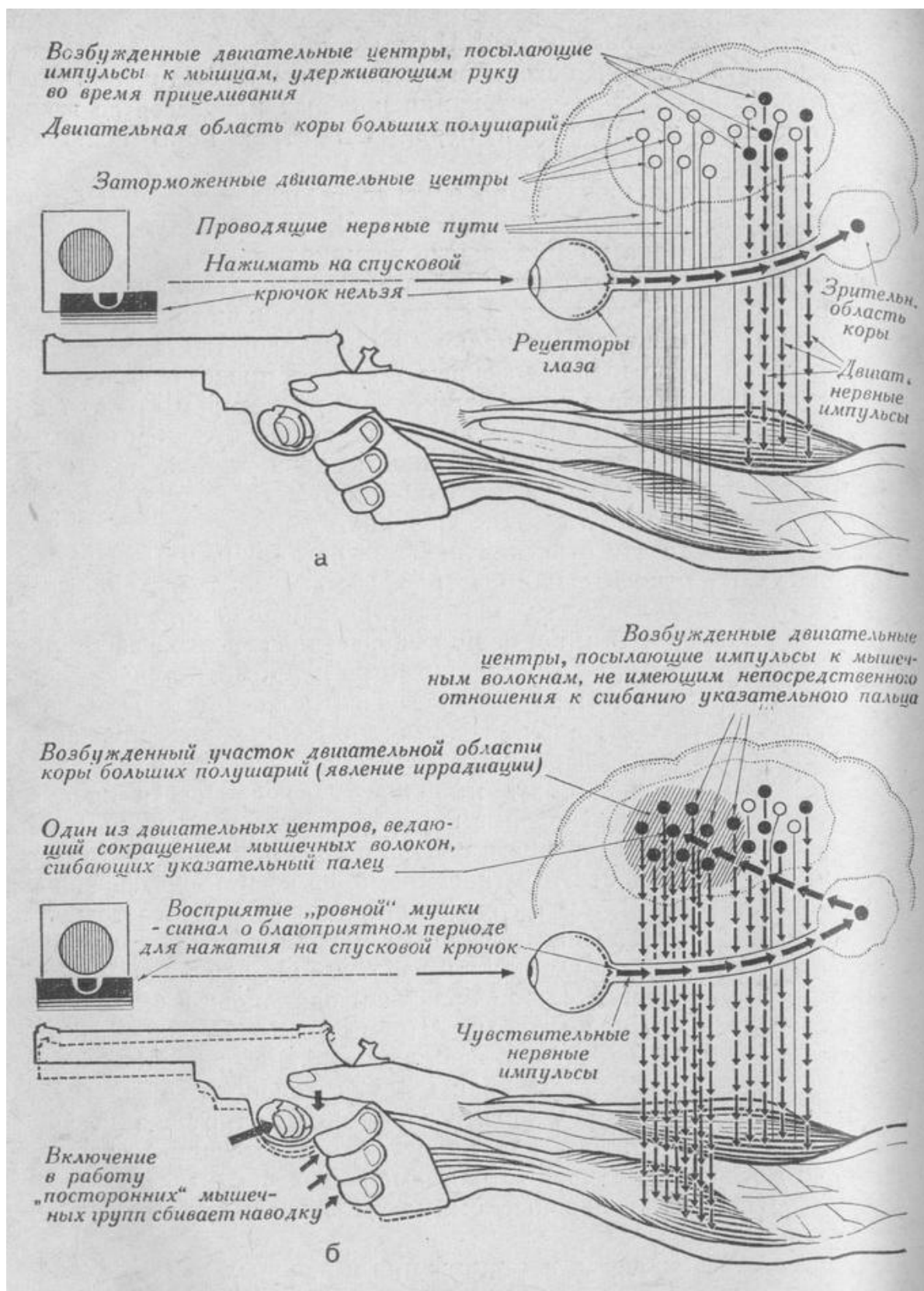


Fig. 244 - Basic diagram of the interaction of nervous processes in the central nervous system with different levels of training of the shooter: a - diagram of the spread of excitation and inhibition during aiming, when the "flat front sight" is not aligned with the "apple" of the target; b - diagram of irradiated

(spread) excitation of the motor area of the cerebral cortex, characteristic of an untrained shooter.

There is another peculiarity in the relationship between the processes of excitation and inhibition. The fact is that under certain conditions, strong, dominant centers of excitation arise in the central nervous system. They have the ability to increase their excitation due to impulses coming to other nerve centers, and at the same time inhibit the activity of those nerve centers to which these "intercepted" impulses were intended.

The temporarily dominant focus of excitation is called a dominant. Similar dominants naturally arise during the processing of a shot (temporarily dominant centers of excitation associated, for example, with the activity of the motor centers to ensure the most motionless holding of an outstretched hand with a pistol, with the movement of a finger when pressing the trigger, etc.). With insufficient training, the dominant motor nerve centers of the shooter cannot yet "command" the corresponding muscle groups in parallel with each other (or switching from one dominant to another cannot occur).

When the shooter concentrates all his attention, all his efforts on achieving maximum immobility of the position, the corresponding motor centers of the brain come into an excited state, as a result of which there follows a flow of motor impulses to the muscles that ensure the stability of the position. At the same time, other motor nerve centers, including those responsible for the movement of the index finger, find themselves in an excessively inhibited state; they cannot be brought out of it by those still weak volitional efforts that the shooter tries to apply, since his attention and will are still concentrated on performing the action - maintaining maximum immobility of the position (Fig. 245, a).

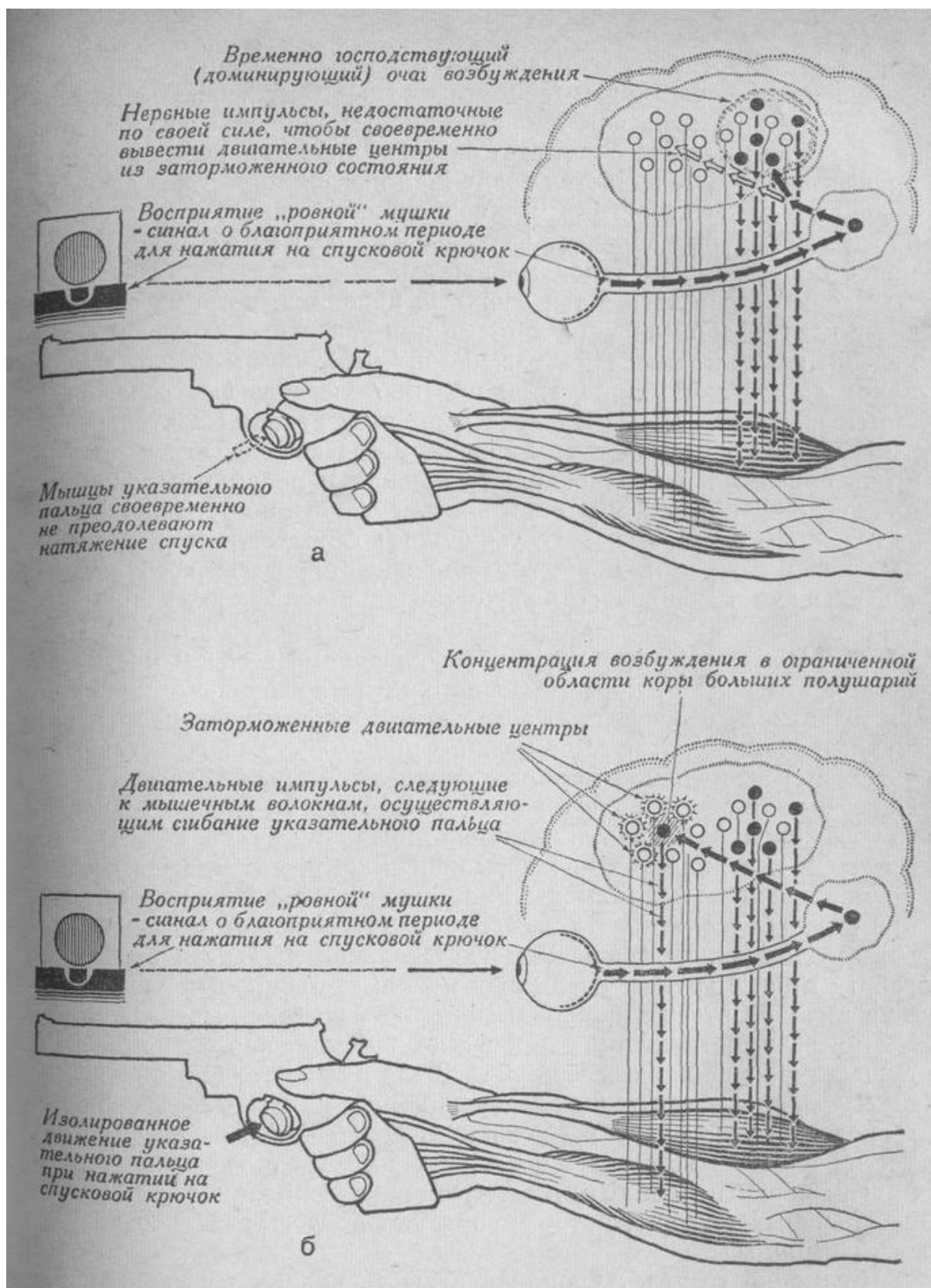


Fig. 245 - Basic diagram of the interaction of nervous processes in the central nervous system with different levels of training of the shooter: a - diagram of the interaction of excitation and inhibition processes, typical for an insufficiently trained shooter, when switching from one dominant to another does not

occur with sufficient speed; *b* - diagram of concentrated excitation of the motor area of the cerebral cortex, typical for a trained shooter.

This period is characterized by the shooter finishing pressing the trigger untimely, late and inappropriately. If an athlete with such a level of training of his central nervous system tries to overuse volitional efforts aimed at timely inclusion of the index finger into work, then this usually leads to a violation of the stability of the weapon, since bringing to an excited state of previously deeply inhibited nerve cells of the motor center, which controls the movement of the finger, is accompanied by inhibition of nerve cells of other motor centers of the brain, which control the work of the muscle group, ensuring the immobility of the position. And this entails a violation of the stability of the position at the moment of the finger work when pressing the trigger.

Subsequently, with systematic training, the shooter continues to improve the interaction between the processes of excitation and inhibition, and gradually develops the skills necessary for making a shot. As a particular movement is mastered, fewer and fewer muscles participate in its execution compared to those that were involved in the work at the beginning of learning it (Fig. 245, *b*). At the same time, the movements become automated.

Automation of movements consists in the fact that as a result of repeated stimuli entering the cerebral cortex in a certain order, a strong system of connections and a certain interaction between the processes of excitation and inhibition are formed between individual centers, which is called a dynamic stereotype (I.P. Pavlov). The expression of a dynamic stereotype is a coordinated, consistent, more or less uniform activity of the nerve centers of the cerebral cortex. Therefore, any movement that is well known to a person and learned is stereotyped. Strong and perfect conditioned reflex connections underlying a dynamic stereotype determine the coordinated and economical execution of learned movements, and at the same time, which is especially important, do not require increased control from the consciousness.

Thus, after appropriate training and acquisition of a perfect skill, that is, the formation of firmly fixed conditioned reflex connections in the cerebral cortex, the shooter, during rapid shooting from a ri-

fle, reloads without thinking at all about each individual movement, that is, performing a complex of these repetitive movements without focusing on them, automatically, in the established stereotypical order.

Thus, when performing the coordinated action of aiming and pressing the trigger in a timely manner, the shooter should strive to achieve, as a result of training, the formation of such strong conditioned reflex connections in the central nervous system, in which the movement of the index finger when pressing the trigger acquires the character of automated stereotypical movements and these actions do not require increased control from the consciousness, freeing it to exercise control over the execution of other actions during shooting (monitoring gusts of wind, the duration of processing the shot, etc.). And indeed, a shooter in good athletic shape, when he is shooting well, does not think about whether to press the trigger or not when processing the shot. As soon as the vibrations of the weapon decrease and the most favorable moment for firing a shot arrives, the finger itself presses the trigger, and, as a rule, does this work in a timely manner. This is the state of training of his nervous system that the shooter should strive for.

However, it should be borne in mind that any developed and established stereotype of conditioned reflex connections that ensures the execution of certain automated movements can, over time and under certain conditions, undergo significant changes, which will be discussed below.

Let us now return to the question concerning the speed of reaction to any stimulus. It must be said that even those trained shooters who, as a result of long training, have achieved the strengthening of the corresponding skills in trigger control, under certain circumstances the balance in the processes of excitation and inhibition is disturbed, which, naturally, affects the coordination of movements and the speed of reaction. When moving from a long rest, for example, to action, the body is not immediately drawn into work; if an athlete goes straight to shoot after sleep without warming up, his results will, as a rule, be underestimated, since in the interaction between the processes of excitation and inhibition the process of inhibition will prevail (as a consequence of sleep), which will make

the reaction slower, and the movements - insufficiently timely and accurate.

In addition, the shooter's reaction speed and coordination of movements are greatly influenced by: the length of the break between training sessions, the preliminary warm-up before each shooting session, the shooter's mood, his emotional state, especially in a competition environment, etc. Such changes in the interaction of excitation and inhibition processes are violations of the time order and are not particularly dangerous for the shooter; it is worth conducting appropriate training or a certain warm-up before shooting, calming down, as the balance in the course of nervous processes is restored and the previous coordination of movements appears.

However, even an experienced shooter often encounters more unpleasant cases of slow reactions, and this is sometimes observed over a fairly long period of time; the athlete is no longer able to perform the coordinated action - aiming and pressing the trigger in a timely manner - with the same ease and naturalness.

To clarify the reasons for such phenomena, let us look at the results of one experiment in which a group of Leningrad shooters took part. The experiment set the task of determining the speed of the shooter's reaction to a light stimulus - a signal.

Stage I. When the screen was suddenly illuminated, the shooter had to immediately press a button. The time interval between the flash of the light behind the screen and pressing the button expressed the speed of the shooter's reaction to this stimulus signal. It turned out that after three or four trial measurements, the shooter easily developed an automated finger movement in response to the signal - the illumination of the screen. This simple reaction took 0.16-0.17 sec.

Stage II . Lights of different colors - green and red - lit up behind the screen, and the shooter was warned that he should press the button only when a light of a certain color flashed. Since these lights flashed in different sequences, the shooter did not know when the light of the exact color he was supposed to react to would flash. This already complex reaction took 0.28-0.30 sec. The loss of time, as we see, occurred because the shooter had to real-

ize what color the light had lit up and decide whether to press the button or not.

Stage III . The shooter was warned that he must not make a mistake when pressing the button in response to the flash of the light of a given color. This required increased attention to his actions. It turned out that the time between the flash of the light and pressing the button began to be calculated as 0.35-0.40 sec.

These examples show that the loss of time, which affects the overall increase in the duration of the shooter's motor reaction, occurs due to the additional activation of some new nerve centers of the cerebral cortex that were not functioning before (see Fig. 246).

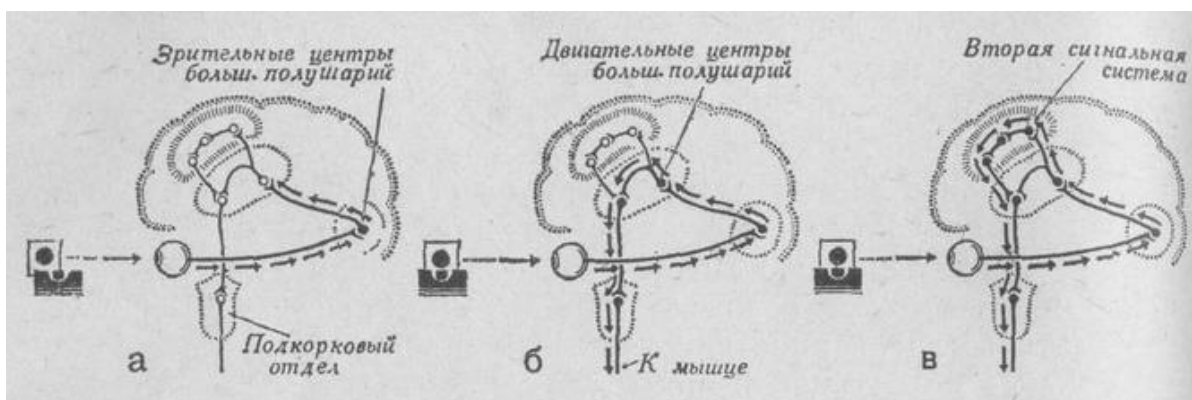


Fig. 246 - A purely conventional diagram of the course of motor reactions of varying complexity upon completion of pressing the trigger: *b* - reaction in conditions when the athlete is in good athletic shape and shoots confidently (distributed form of attention to the execution of actions); *c* - reaction in conditions of psychological difficulty, fear of making a bad shot (excessively increased attention and control over the execution of a given action).

Often an experienced shooter experiences a period in his sporting activity when shooting does not go well; with a good shooting position and improved weapon stability after training, by the end of the season, instead of an increase in results, a deterioration is found. This mainly occurs due to a violation of the coordination in the actions of aiming and pressing the trigger.

Many shooters, for example, are familiar with a very unpleasant condition observed during shooting, when, with a fairly stable position, the weapon stops for quite a long time (relatively, of course), and the index finger does not perform the work of pressing the trig-

ger. So it turns out that "the weapon stops, but the finger does not press", and then, when the weapon begins to deviate from the target again to the side, the shooter, even realizing in these tenths of a second that the favorable moment for making a shot has already been missed, still presses the trigger belatedly. This is where the shooting sayings come from: "shooter, pull in time" and "shooter, refrain from a bad shot".

In most cases, the onset of such a state is preceded by a great, but premature or accidental sporting success of a young shooter at a competition, when he begins to believe that the same high results are expected of him in the future. This may also be preceded, on the contrary, by a serious sporting failure, when the shooter is greatly demoralized by a major failure at important shooting. This may also happen to a shooter as a result of strong excitement, when, despite all his efforts, he could not pull himself together and felt his complete helplessness, which gave rise to a feeling of self-doubt. The same thing happens when the shooter is overly burdened with responsibility for the outcome of the fight, and when frequent scoring training has exhausted him, he cannot force himself to "pull" for the result, the consequence of which is extremely bad shooting, which has also received wide publicity and attracted the attention of a wide circle of people. After such failures, the shooter goes to the firing line with the thought that bad shooting can be repeated. Along with this, other thoughts come, for example, that "the target is small and the distance to it is large"; thoughts begin to arise about the fact that when shooting standing from a rifle and when shooting from a pistol, one has to deal with many uncertain things - the weapon oscillates, when aiming it can stop for several seconds or even fractions of a second, where, they say, can one guess when to choose the moment to finish pressing the trigger in order to make a good shot. As a result of such thoughts, which overcome the shooter before and during shooting, there is an excessive strengthening of control by consciousness over the actions when pressing the trigger. In this case, the previously developed automated nature of the execution of a coordinated movement is disrupted, since new, higher centers of consciousness are woven into the conditioned reflex connections previously formed between certain nerve centers (Fig. 246). All this complicates the reflex dynamics and lengthens the reaction time. And if a shooter with such a psychological attitude goes to the fir-

ing line not once, but several times, then the previous and newly connected nerve centers of the cortex, when interacting, form a new conditioned reflex connection, which is why the shooter is deprived of the opportunity to show previous sports results for a fairly long period of time. In such cases, with good stability of the weapon, the shooter will miss one favorable moment after another to make a shot, since the mental decision that "now you need to pull the trigger" will be carried out with a delay and the trigger will be pulled at the wrong time.

From all that has been said, it is clear that the difficulties that arise for the shooter in performing a coordinated action - aiming and pulling the trigger - are mainly due to the fact that the motor reaction under certain circumstances turns out to be "delayed" - either due to a violation of the optimal interaction of the processes of excitation and inhibition in the cerebral cortex, or as a result of excessive strengthening of control on its (the cortex's) part over movements, which as a result cease to be of a coordinated, automated nature.

However, there are other kinds of difficulties that the shooter encounters when pressing the trigger and firing a shot. They occur because the shot itself is accompanied by a strong sound effect and the recoil of the weapon. In addition, they are associated with changes in the course of reflex reactions in the athlete's body. Firstly, the shooter has to change the course of some unconditioned reflexes; secondly, in the process of mastering and learning new movements, the physiological basis of which is the formation of new conditioned reflex connections, the athlete must constantly control himself in order to prevent the formation and consolidation of new conditioned reflex connections, those undesirable skills that can subsequently have a detrimental effect on the quality of shooting.

Everyone knows that a person reacts to an unexpected sharp sound - a shot, a shout - with an involuntary sharp flinch, which is an unconditional orienting reflex to a sound stimulus. Naturally, if a shooter reacts this way to his own shot or to a shot from a neighbor on the firing line, then accurate shooting will not work. Therefore, a shooter must train himself to remain indifferent to such an

external stimulus as a shot, and thus suppress his innate unconditional reflex.

If you suddenly swing something at a person or, say, clap your hands right in front of his face, or shoot unexpectedly, the person will involuntarily and unconsciously close his eyes and blink. Such a reaction is a manifestation of an innate defensive unconditional reflex. However, despite this, shooting requires that during aiming and shooting (one's own or someone else's - in the neighborhood) a person leaves his eyes open, otherwise aiming will be inaccurate; in addition, he will not be able to mark the shot, that is, record the relative position of the "even front sight" and the lower edge of the "apple" of the target at the moment of the shot. Consequently, the shooter must learn to suppress this unconditional defensive reflex.

A person responds to any action that causes pain with an involuntary, sharp movement, accompanied by a contraction of muscle groups, which will also be a manifestation of an unconditional defensive reflex. Now let's imagine that a novice shooter who has never shot before has stepped onto the firing line. If he is given training cartridges, he will calmly load the rifle with them, aim and pull the trigger. But as soon as he fires one or two shots with a live cartridge and feels a blow to the shoulder from the recoil of the rifle, he will behave differently in the future; knowing that the shot is accompanied by a blow to the shoulder, the shooter, along with pulling the trigger, will involuntarily tense the muscles and move the shoulder forward to counteract the expected blow. Thus, this shooter has already developed a conditioned reflex to the expected blow on the basis of an unconditional reflex.

Achieving maximum immobility of the weapon when firing requires increased static work of the muscular system, and, consequently, increased functioning of the corresponding nerve centers. After the shot, naturally, the degree of muscle tension decreases, since both muscle tissue and nerve cells need rest. Gradually, the shooter's consciousness begins to identify the shot with rest, which is why a conditioned reflex to the shot as a signal for rest is developed. At the same time, it often happens that the signal for rest is not the shot itself, but the volitional effort that the athlete makes to move the index finger to press the trigger (Vanshtein, 1958). In this re-

gard, the relaxation of muscle groups, and therefore the loss of stability of the weapon, can occur a moment before the shot or at the moment of it. Consequently, under such circumstances, the shooter developed another undesirable conditioned reflex for shooting, in which the movement of the index finger when pressing the trigger serves as a signal for the relaxation of other muscles that ensure the immobility of the position. And if measures are not taken in time, such a conditioned reflex will become fixed, turning into a harmful habit. There are many similar examples.

As we see, the process of coordinated action - timely pressing of the trigger and correct aiming under firing conditions, - accompanied by the recoil of the weapon and the sound effect, places very high demands on the human nervous system. The need to achieve appropriate interaction in the course of excitation and inhibition processes in the central nervous system, to develop and maintain automation of movements, to suppress the manifestation of some innate, unconditioned reflexes, and finally, the need to prevent the development of new conditioned reflexes that are harmful to shooting creates very great difficulties that are not so easy for the shooter to overcome. These difficulties lead to the emergence of gross errors and the acquisition of harmful skills in controlling the trigger, which have an extremely negative effect on shooting accuracy.

3.4.5 Errors made when pulling the trigger and measures to combat them

One of the most serious mistakes a shooter makes when firing a shot is jerking, that is, pulling the trigger sharply. If jerking were limited to just pressing the trigger sharply with the index finger and quickly moving it along the axis of the barrel bore, it would be half the trouble. The worst thing is that jerking is accompanied by a sharp tension of many muscle groups, twitching of the shoulder to counteract the recoil of the weapon, sharp pressing of the entire right hand on the buttstock or pistol grip, pulling the trigger not straight back, but somewhere to the side. All this taken together leads to such a shift of the weapon to the side that an accurate shot is out of the question.

Most often, twitching is observed in young (in terms of experience), poorly trained shooters, who, due to insufficient stability of the weapon's position, experience large vibrations, during which favorable moments for firing a shot are very short-lived.

The reason that causes jerking of the trigger is, first of all, the so-called "catching the ten"; trying to hit the target as accurately as possible, the shooter inevitably begins to catch the moment when the "level front sight" in its oscillation passes under the lower edge of the "apple" of the target or stops for a short time, freezes. Since such favorable moments for making a shot are extremely short-lived for an untrained shooter, he tries to take advantage of them and quickly pull the trigger. This leads to increased excitation of some parts of the cerebral cortex, which negatively affects other motor centers that ensure the performance of the main task - achieving immobility of the preparedness and smooth movement of the index finger when pressing the trigger. As a result, a quick and sharp press-jerk is produced not only by the flexor muscles of the index finger; at the same time, regardless of the shooter's desire, a sharp jerk is accompanied by the involvement of a number of other muscle groups, which disrupts the aim.

The second reason for twitching is the shooter's body's reaction to the shot: a young shooter, expecting a blow to the shoulder from the recoil of the weapon and a loud sound, tenses his muscles to counteract the recoil and at the same time sharply presses the trigger, which disrupts the aim.

Practice has shown that if during the process of training and practice the shooter is not warned in time against the danger of twitching, and effective measures are not taken immediately to detect and eliminate this serious error, then subsequently he will have to spend a lot of work and time to get rid of the developed conditioned reflex connections that are harmful to shooting, which then turn into harmful skills.

The difficulty in detecting incorrect actions made by the shooter when pulling the trigger is that when firing and moving the weapon during recoil, many mistakes are "smeared". In this regard, the athlete's control over his actions becomes more difficult, and he does not notice how he pulls the trigger, blinks his eye, tenses his mus-

cles, moves his shoulder forward, which disrupts the aim at the most crucial moment in some fractions of a second preceding the shot.

The easiest way to detect twitching is if a young shooter gets into the hands of an experienced trainer who helps him to detect mistakes in a timely manner and acquire the correct skills in pulling the trigger. It is much worse if the shooter makes these mistakes in independent training because they were not paid attention to at the time, or because the skills in smoothly pulling the trigger were not developed firmly enough and the shooter imperceptibly gets used to twitching. Moreover, such shooters often do not realize, and sometimes do not consider it necessary to thoroughly check themselves whether they allow twitching. The latter is mostly found among shooters who have some sports experience and shoot with average, uneven results. It is necessary to remember well that without getting rid of the harmful skill of twitching, it is impossible to achieve high and stable results. That is why it is necessary, regardless of whether an athlete has recently joined the shooting sport or has many years of shooting experience, to systematically check himself and, if signs indicating twitching are detected, to get rid of the gross error in trigger control.

Signs of twitching are a deterioration in the accuracy of shooting, distant unfixed breaks (mostly to the right and down when shooting from a rifle and to the left and down when shooting from a pistol), and discrepancies in the shot marks. If this is detected, it is necessary to abruptly change the nature of training, but not to stop it, as some trainers advise. During training, the shooter should stop firing cartridges to give the nervous system a chance to rest a little from the shot (from blows to the shoulder and the sound of the shot). In this case, some acquired conditioned reflexes that are harmful to shooting (jerking the shoulder to counteract the recoil, excessive muscle tension in anticipation of the shot, blinking at the sound effect of the shot), not receiving reinforcement, will begin to fade and disappear altogether. The shooter should continue regular training, only without cartridges, "idle". Such training is necessary in order not to lose the stability of the position, as well as those useful conditioned reflex connections that were developed in the shooter during the previous shooting.

By carefully aiming and paying close attention to everything that happens to the weapon when the trigger is pulled, the shooter should detect his mistakes and correct them. Such "idle" training is very useful, as it helps to acquire motor skills in pulling the trigger, allows you to correctly and carefully practice the technique of pulling the trigger, in which the weapon will not move to the side, shake strongly when the trigger is pulled.

When starting training in dry-fire trigger control, it is first necessary to wage a decisive struggle against the desire to catch a favorable moment for a shot when the "flat front sight" is under the "apple" of the target. Despite the rifle's vibrations, which are not really that great, the shooter must accustom himself to only smoothly pressing the trigger, that is, to use the method of sequentially smooth trigger control. When the shooter again becomes accustomed to smoothly pulling the trigger and does not have to specially monitor it, you can switch to shooting cartridges again. It is even better if, at first, when switching to shooting cartridges, the first training sessions are conducted by shooting at a white sheet of paper, and not at a target with a black circle. In this case, less attention is concentrated on the vibrations of the weapon and switching from one dominant to another is facilitated, since the motor center of the cerebral cortex, associated with the work of the finger flexor muscles, becomes dominant. At the same time, when switching back to shooting with cartridges, the shooter must carefully monitor himself, his feelings, opposing the desire to pull the trigger with the will and awareness of the inadmissibility of reacting incorrectly to the shot.

Let's now consider another mistake made by the shooter when pulling the trigger - "delaying the shot", that is, excessively stretching the action of pressing the trigger. As a result of delaying the shot, the shooter does not have enough air when holding his breath, the eye gets tired and visual acuity decreases. In addition, due to muscle fatigue, the position loses stability. The athlete pulls the trigger in unfavorable conditions, when the vibrations of the weapon increase, and the eye does not notice errors in aiming well.

Delaying the shot is a consequence of excessively cautious, slow pressing of the trigger, caused mostly by the fear of making a bad

shot. In this case, the shooter's action is, as it were, the opposite of jerking. In addition, delaying the shot occurs when there is a violation of the coordination of movements, which manifests itself at certain stages of training and competitions due to a violation of the previously developed automation of movements as a result of increased control by the mind over the actions when pressing the trigger. In this case, the shooter simply cannot force himself to smoothly press the trigger in time, misses one moment after another that is favorable for making a shot, and thus generally delays the trigger pull. Very often this also happens because during such periods the shooter's correct idea of the trigger pull is disturbed. When testing it without a cartridge (when clicking "idle"), the trigger pull is perceived as normal, but when switching to shooting with cartridges, it suddenly seems large, requiring significant effort to overcome it. This phenomenon is also connected with the disruption of interaction of nervous processes in the motor centers, responsible for work of muscles - flexors and muscles - extensors of index finger. Usually in such periods the shooter attributes all his misadventures to the account of incorrect adjustment of the trigger mechanism, going to absurd things, trying to make the trigger so easy and adjust it almost so that, as shooters say, "it was enough to think - and there was a shot". Of course, under such circumstances from the whole idea with adjustment of the trigger usually nothing comes out; having spoiled several spare parts of the trigger mechanism, the shooter often returns to his previous version of the trigger, having not achieved significant improvement in shooting, since the root of the evil in this case is not in adjustment of the trigger, but in the disruption of coordination of the shooter's movements when controlling it.

Restoration of the coordination of movements, balance of the processes of excitation and inhibition when controlling the trigger is achieved mainly by systematic training without cartridges, by clicking "idle". With this method, the necessary coordination of actions is developed in the shooter, his movements acquire the necessary automation, due to which the index finger naturally and, most importantly, intensifies the pressure on the trigger in a timely manner. In particular, before each training session or test shooting, in order to restore the coordination of movements, the shooter should not limit himself to just test shooting; it is very useful both before and after test shots (if, of course, time allows) to click "idle" for several

minutes, thereby restoring the required balance in the course of nervous processes. To do this, during the shooting of the test series, when the shooter, after several attempts, cannot force himself to press the trigger and fire a shot, the weapon should be unloaded and "idle" clicked without a cartridge. Having overcome the feeling of indecision, you can continue shooting again without aiming, firing a shot in the first seconds (within 12-18 seconds from the moment the weapon is raised and the shot is processed, or 6-9 seconds from the beginning of refining the aim), when the position allows the weapon to be given the greatest stability and your vision is sufficiently sharp.

By the way, in order to avoid such a condition when, with a good, stable position and relatively small vibrations of the weapon, the shooter cannot press the trigger in time, it is advisable to switch to the method of pulsating pressing the trigger (when releasing with a set trigger). The pulsating movement is the action that helps restore temporarily lost coordination, parallel activity of the motor centers associated with work, and the group of muscles that ensure the immobility of the body when ready to shoot, and the muscles - flexors of the index finger.

It is very important to ensure that a conditioned reflex to a shot, as we have already said, which is harmful to shooting, does not form as a signal to rest. To combat this evil, you need to first of all force yourself to "hold" the weapon for a while, and not lower it immediately after the shot. Some experienced shooters in such cases mobilize their will and consciousness, convincing themselves that it takes more time than it actually does for the bullet to pass through the barrel after the trigger is pulled. Thanks to this psychological technique, the shooter is better able to maintain muscle tone unchanged during the shot. In this case, holding the weapon ceases to depend on the action - pulling the trigger.

Above we have considered the main, fundamental errors that are directly related to the physiological and psychological aspects of the shooter's activity when controlling the trigger. Now we will consider some technical issues that are directly related to controlling the trigger.

3.4.6 Dependence of correct trigger control on the adjustment of the trigger mechanism

Making an accurate shot depends to a large extent on the quality of the trigger adjustment. An incorrectly adjusted trigger aggravates the shooter's errors when pressing the trigger. Defects in the adjustment of the trigger include: excessive tension, i.e. an excessively tight trigger, an excessively long working stroke of the trigger, unclear warning, inconsistent trigger tension, its "failure", etc.

Usually, factories produce weapons with a trigger pull that significantly exceeds the limits set by competition rules. This is especially true, as has already been said, for military-grade weapons and, to some extent, for sport weapons. Naturally, it is completely inappropriate to use an excessively tight trigger during sport shooting: with a tight trigger, no matter how good the shooter's coordination, there will inevitably be a certain delay in the shots, and he will not have enough breath to smoothly press the trigger. Shooters usually adjust trigger mechanisms so that their pull has a small reserve; thus, the pull of a service rifle's trigger is made with a reserve of 100-120 g, a sport rifle - 50-100 g, a sport revolver - 100-150 g, and sport pistols - 50-100 g.

A vague trigger with a warning creates great inconvenience during shooting, since the shooter feels the warning differently, which causes him to feel insecure and afraid to make an unaimed shot. This forces the athlete to change the already developed style of handling the shot - after all, usually the shooter using a trigger with a warning, with a decisive movement chooses a free stroke during rough aiming. In such cases, a vague warning does not help the shooter in making a shot, but, on the contrary, disorients him and creates difficulties, being, in fact, an additional obstacle.

Significant difficulties in shooting also occur when the trigger mechanism has a tension that changes from shot to shot. The reason for this is a loose fit of the trigger pin (axis), which leads to its distortion and a change in the area of the rubbing surfaces of individual parts of the trigger mechanism. Inconstant tension of the trigger also creates a feeling of uncertainty in the shooter and negatively affects the quality of shooting. In this case, the shooter cannot de-

velop (or the already developed) specific muscle feeling is disrupted, which is so necessary for timely pressing the trigger, strictly coordinated with correct aiming. The fact is that the shooter needs to carefully study the characteristic features of the trigger of his weapon in order to accustom himself not only to smoothly squeeze the trigger in general, but to sense the approach of a shot by the applied finger force and the travel of the trigger. Such a feeling can only be developed with a stable trigger.

A major defect in the adjustment of the trigger mechanism, which has a very detrimental effect on shooting accuracy, is the so-called "failure" of the trigger, a sharp decrease in the resistance of the trigger to the force of the finger at the moment the hammer is pulled from the cocked position. In this case, the finger seems to fall, as a result of which the weapon abruptly shudders at the very last moment before the shot; it turns out to be approximately the same (of course, to a lesser extent) as when tugging the trigger. When the trigger "fails", the accuracy of fire usually worsens and there are breaks that the shooter does not notice and cannot explain, since the recoil of the weapon at the moment of the shot makes it difficult to observe and control his actions. When a "failure" of the trigger is detected, the shooter must adjust the trigger mechanism so that the resistance of the trigger to the force of the finger increases all the time both before and after the shot.

3.4.7 Some information about trigger release technique

In shooting practice, various types of triggers and methods of trigger control have become widespread; not all shooters use them equally. Let's consider some questions of trigger release technique when performing the most difficult exercises - shooting from a rifle while standing and from a pistol (revolver).

Triggers on rifles . When shooting from a service rifle, sports shooters use step-sequential and sequential-smooth methods of trigger control and two types of trigger - without warning and, less often, with warning. The trigger without warning is adjusted so that it is intermediate between "dry" and "soft", that is, a trigger with a slight pull.

Shooters using a trigger with a warning are advised to adjust it so that $\frac{2}{3}$ of the trigger tension falls on the free play before the warning, and $\frac{1}{3}$ - directly on the tension that must be overcome to fire a shot. In no case should the trigger be adjusted so that the free play before the warning falls on a smaller part of the tension. Otherwise, after two or three shots, the shooter, as a rule, develops a deceptive idea of its true tension: it seems that the trigger after the warning is extremely tight and overcoming its resistance requires a lot of effort.

Leading shooters, as a rule, attach great importance to a thorough study of the character and tension of the trigger of their rifle, accustoming themselves to sense the approach of the moment of the shot without error by the force of pressure of the index finger and the stroke of the trigger. This allows them to develop the ability to pre-press the trigger during rough aiming and thus select a part of the trigger tension in advance. Then, by the time of refining the aim, it takes significantly less time and effort to finally overcome the trigger tension and fire a shot (Fig. 247).

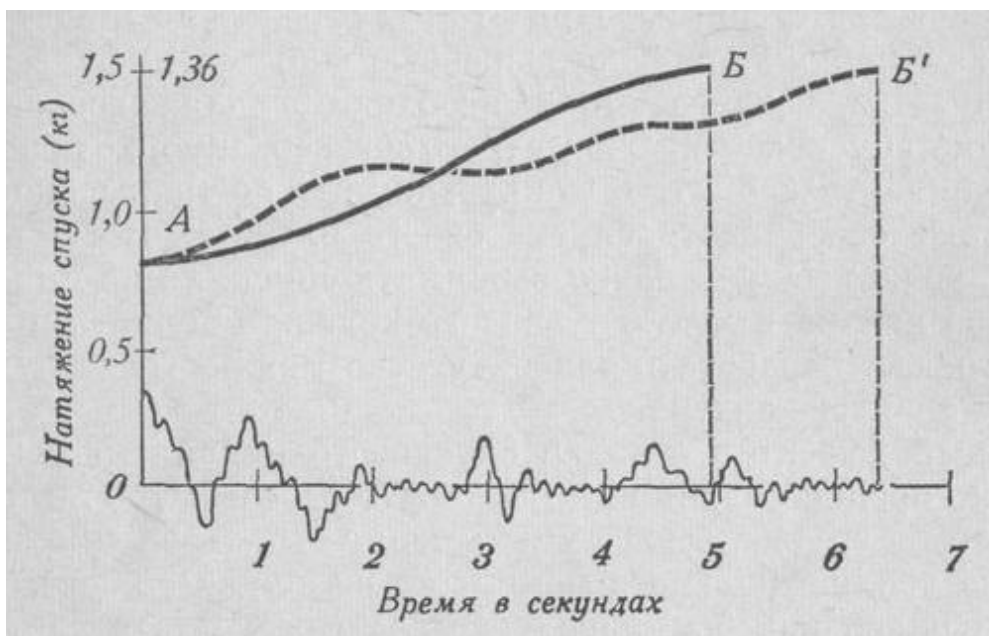


Fig. 247 - Schematic diagram of preliminary pressing of the trigger when shooting from a service rifle and from a sport revolver with a trigger without warning: *AB* - sequential-smooth pressing of the trigger; *AB'* - step-sequential.

When shooting at the Running Deer target, most leading shooters use a trigger without warning, short, dry, or with a slight pull, with a

tension of 900-1100 g.

When shooting at the "Running Boar" target, a trigger pull is usually used that is the same as when shooting at the "deer" - without warning, dry, or with a slight pull. The highest results in shooting at the "boar" are achieved with a trigger pull of 600-800 g.

When shooting from a rifle with a trigger mechanism with an accelerator (setter), shooters use triggers that differ significantly from each other in their tension. Practice has shown the inexpediency of using a trigger with a very low tension (10-20 g), since it can cause self-triggering and accidental, unaimed shots. In addition, bringing the trigger to extreme lightness forces the shooter to be on guard all the time and keep the index finger almost in the air; this is tiring, and the finger can accidentally press the trigger out of place with a careless movement (including during rough aiming). Therefore, the advantage of a trigger with an accelerator due to the presence of adjustment screws should be used mainly to create a simply light, dry trigger with a wide range of tension (50-800 g), which makes it possible to freely place the index finger on the trigger spoke without the risk of making an accidental shot and to vary the tension in different shooting conditions.

Some leading athletes use a pulsating trigger control method when shooting standing. Some move their index finger faster, others - slower, making one or two movements per second. Some shooters lift their finger from the trigger pin, others do not lift it and make barely noticeable movements with their finger.

The advantage of this method of trigger control is that the shooter, continuously and more or less rhythmically moving the index finger when processing the shot, prepares for work in advance and isolates that group of hand muscles that takes direct part in bending the finger and performing the pressing of the trigger. Pulsating movements, in fact, are that preliminary warm-up that promotes the "disinhibition" of the motor centers of the cerebral cortex associated with the work of the flexor muscles of the index finger, as well as the simultaneous activity of the motor centers associated with the work of the muscles that ensure the immobility of the preparedness.

Recently, some leading athletes have switched to shooting with a weighted trigger when shooting standing (when shooting prone and from a kneeling position, the trigger is 100-200 g, and when shooting standing - 800-1200 g). In this case, they are guided by the fact that a weighted trigger is more disciplined against the temptation to press the trigger too quickly, to jerk it. It should be noted that the use of a weighted trigger when shooting standing is also advisable because the shooter has to apply quite a significant muscular effort to overcome the trigger tension, and this, in turn, requires a sufficiently powerful excitation of the corresponding motor center of the cerebral cortex. As a result, it cannot remain in an excessively inhibited state and functions quite actively and in parallel with the nerve centers that are responsible for the work of the muscles that ensure the immobility of the ready position.

It should also be borne in mind that studies of the muscle-articular sensitivity of the shooter's index finger (Itkis M.A., 1970) with triggers of different weight characteristics showed that this important property manifests itself much more accurately with tensions of 200-800 g. Triggers less than 200 g are characterized by worse indicators of proprioceptive sensitivity.

Attaching great importance to the development of muscular sense, which allows one to determine the approach of the moment of the shot by the force applied to the trigger, leading shooters press the cocking lever, as a rule, not with the index finger, but with the middle finger, so as not to dull the sensitivity of the index finger when pressing the accelerator spoke.

Finally, it should be noted that some leading shooters sometimes slightly change their grip during shooting: they have noticed that when changing the grip (for example, changing the position of the thumb) during shooting, the sensitivity of the index finger is restored. The fact is that during prolonged shooting, the muscles of the right hand, and in particular the flexor muscles of the index finger, become tired, which is why its performance and sensitivity are somewhat reduced. Therefore, when the sensitivity of the finger decreases, which appears during a long exercise, in order to introduce, so to speak, some "novelty" into the shooter's sensation, they sometimes change the grip to create more support, allowing

the index finger to better overcome the resistance of the trigger and feel it better (Fig. 248).

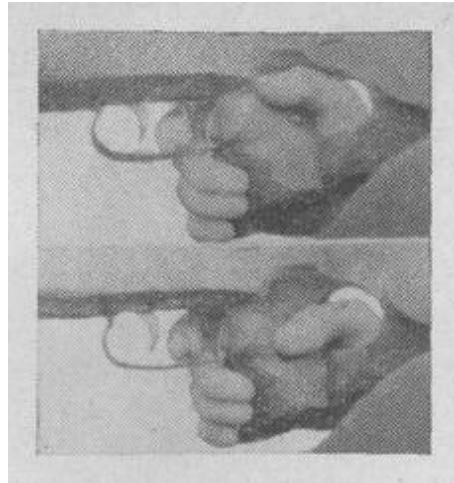


Fig. 248 - Changing the grip of the buttstock during shooting

Triggers on pistols (revolvers) . The design of the trigger mechanism of the TOZ-36 sports revolver allows the trigger to be used without warning and with warning.

When shooting slowly at a target with a black circle, it is best to use a trigger with a warning or a short trigger without warning, with a small pull (however, such that there is no "failure" of the trigger under any circumstances). For rapid shooting at a silhouette, a softer trigger without warning is desirable, with a larger pull, which allows you to pre-squeeze part of the trigger tension when raising your hand and better feel the approach of the moment of the shot by the movement of the trigger.

The position of the index finger on the trigger when shooting from a sport revolver is shown in Fig. 249.

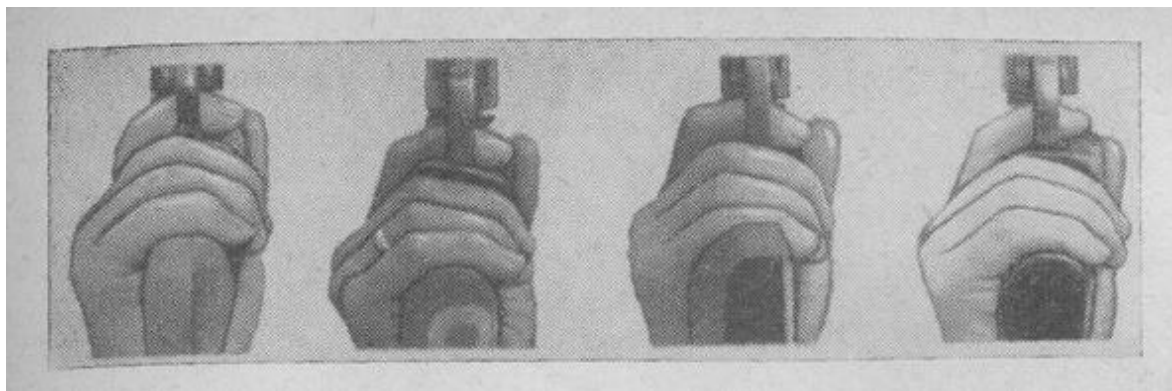


Fig. 249 - Position of the index finger when placing it on the trigger

during shooting from a sport revolver

When shooting slowly from sport pistols, triggers with a warning are most often used. They should be adjusted according to the same rule as when shooting from a service rifle: $\frac{2}{3}$ of the trigger tension should be for free play and $\frac{1}{3}$ directly for the tension that must be overcome after the warning to fire a shot.

When shooting at high speed from a self-loading pistol at silhouettes, it is best to use a soft trigger without warning, with a significant working stroke (3-5 mm). Such a long trigger creates the most favorable conditions for pre-squeezing the trigger tension during the hand lift when making the first shot, as well as during the transfer of the hand with the pistol when moving from one silhouette to the next.

In this type of shooting, most leading athletes currently use triggers with a tension of 100-200 g.

The limit of movement of the index finger when pressing the trigger by leading shooters in rapid shooting at silhouettes is shown in Fig. 250.

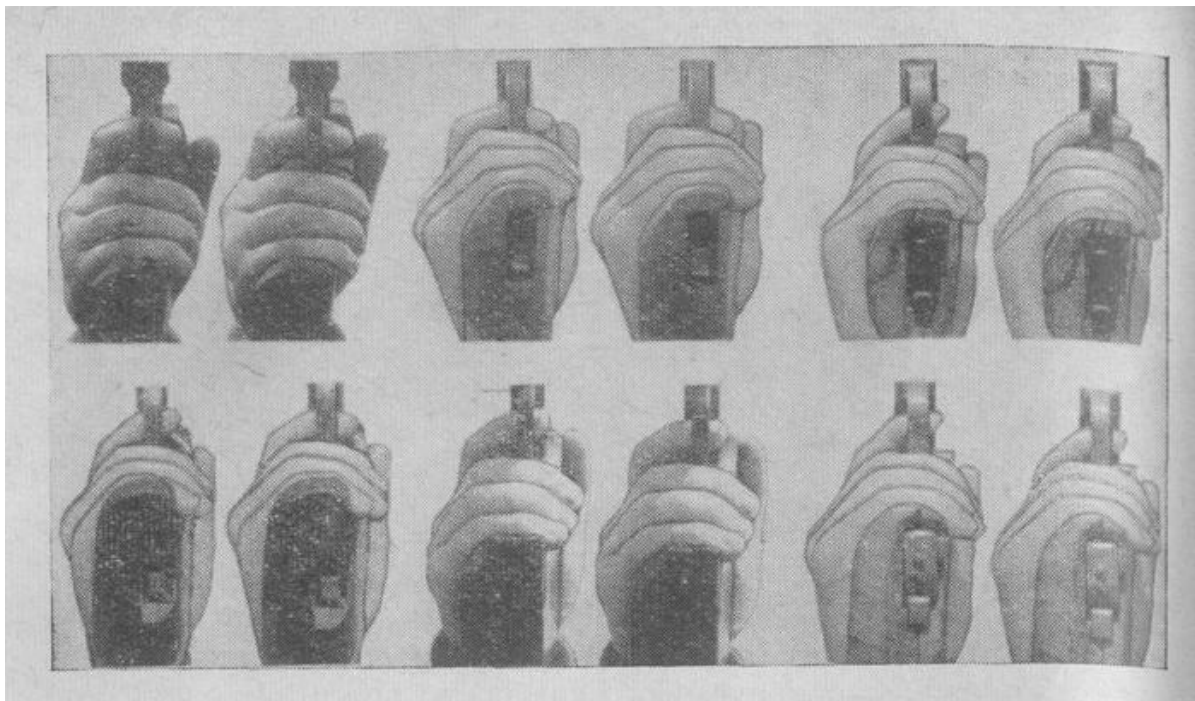


Fig. 250 - Degree of index finger movement when pressing the trig-

ger during rapid shooting at silhouettes

When shooting slowly from a pistol with a trigger mechanism that has an accelerator, the pulsating method of trigger control is preferable. At the same time, many leading shooters successfully use the sequentially smooth method. And since the pulsating method, in fact, ends with the same sequentially smooth pressing of the trigger spoke and does not contain anything fundamentally new, then the pulsating movement of the finger under all circumstances should be considered as a technique that helps to normalize the flow of nervous processes when aiming and pressing the trigger in a timely manner.

When shooting from arbitrary pistols, a dry, light trigger with a tension of 30-120 g is mostly used. It creates the most favorable conditions so that the movement of the index finger is not accompanied by the movement of the entire hand and thus does not disturb the stability of the weapon.

The position of the index finger when touching the trigger for leading shooters with a free pistol is shown in Fig. 251.

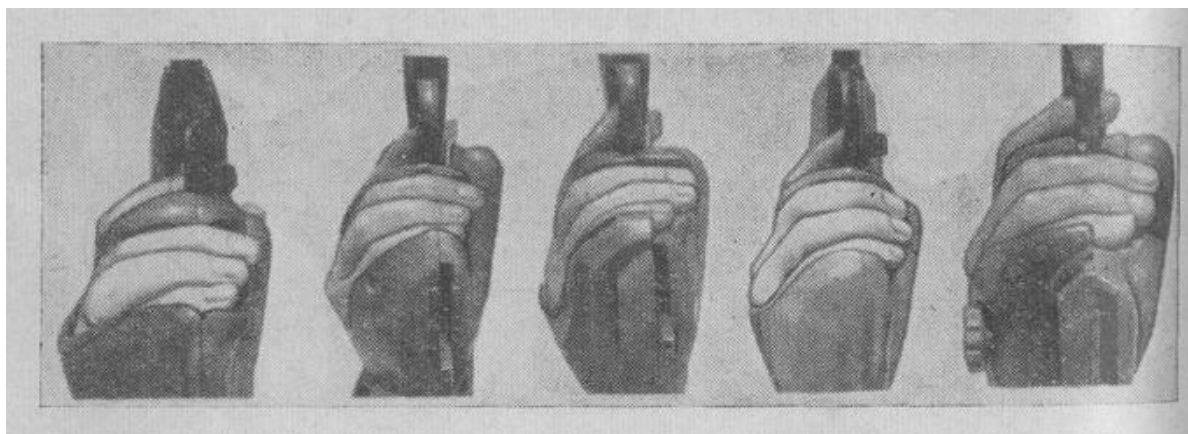


Fig. 251 - Position of the index finger when touching the trigger back when shooting from a free pistol

Some leading shooters press the trigger not by tensing the flexor muscles of the index finger, but, on the contrary, by relaxing these muscles, using the feature that the flexor muscles of the fingers are stronger than the extensor muscles. The contraction of the finger during muscle relaxation and the pressure exerted by it on the

trigger is quite sufficient to overcome the trigger tension of 15-20 g. Shooters who use this method of pressing the trigger consider it the most advantageous, ensuring the greatest immobility of the hand during the shot.

* * *

So, we have analyzed the technique of making an accurate shot.

However, in any exercise the shooter has to make not one shot, but several (in exercises such as the "standard", their number reaches 150). Here many new tasks and difficulties arise, mainly due to the great physical and nervous strain, which leads to significant fatigue of the shooter's muscular and visual apparatus, his nervous system, the duration of shooting, changes in external conditions, forcing him to make adjustments to the sight setting during shooting; contamination of the gun barrel, its heating, etc. All this taken together leads to the fact that the shooter must shoot at a certain pace and rhythm, advantageous under certain circumstances.

The need to overcome the difficulties that arise during long-term shooting in large series requires additional knowledge, the acquisition of experience, mastery of new elements of shooting technique, as well as the use of certain tactical techniques, which will be discussed in the next section.

Section IV.

SOME QUESTIONS OF SHOOTING TECHNIQUE AND TACTICS WHEN PERFORMING INDIVIDUAL EXERCISES

Shooting sports exercises are divided into different types:
rifle and pistol (revolver) exercises;
rifle shooting from different positions;
exercises that differ in the number of cartridges, etc.

In addition, all exercises, depending on the time given for their implementation, are divided into two more groups:

slow shooting, when at least a minute is given for each shot; it is usually carried out at targets with a black circle;

rapid shooting, when the time for each shot is measured in several seconds; usually conducted at shaped, silhouette targets.

Despite the significant differences, most exercises, especially those related to slow types of shooting, have much in common in principle. Therefore, to avoid repetition, we will first consider some general issues related to preparation for shooting, and then we will get acquainted in more detail with the technique and tactics of shooting when performing a particular shooting exercise.

Often, having gone out to the firing line, without taking into account the weather, without having previously thought through and outlined a plan for the upcoming shooting, an insufficiently experienced shooter is forced to begin it without being properly prepared. In this regard, he immediately puts himself in difficult shooting conditions.

Experienced masters behave completely differently. Having learned from their own experience, they firmly adhere to the rule that during shooting, as well as during the immediate preparation for it, there are no "little things", and therefore they think over the tactics of performing the exercise in advance long before the "fire" signal, from the very beginning of the day of the test shooting or even the day before.

Having familiarized himself with the weather and having thought in advance about possible options for lighting, direction, strength and nature of the wind during the competitive shooting, an experienced athlete, in accordance with his individual characteristics, outlines the appropriate technical and tactical methods for performing the exercise: the rate of fire, the duration of breaks between series of shots, the use of certain front sights depending on the expected illumination of targets, as well as protective devices from bright sunlight; he stops his choice on certain batches of cartridges, thinking about which cartridge is better to shoot in windy weather, and which in calm weather, etc. At the same time, the shooter equips his suitcase with tools and shooting accessories that he will need on the firing line.

Of course, such well-thought-out preparation largely eliminates many accidents and creates conditions for achieving high and stable results.

But a preliminary outline of shooting tactics is far from sufficient. For example, it is impossible to outline a tactical plan at the beginning of shooting and stick to it throughout its entire duration without changes: many shooting exercises last several hours, during which external conditions can change sharply, and more than once. In addition, at the beginning and at the end of the exercise, the shooter may feel differently, physically and mentally, and shooting may go easily for him or, on the contrary, each shot will be difficult, which will lead to varying degrees of fatigue after the first series of shots. Due to this, the athlete must necessarily learn to react correctly and promptly to the changes in the environment around him and, taking into account his strength and well-being, change the style and tactics of shooting.

First of all, the shooter must prepare himself for shooting in advance. It should be remembered that before long shooting, especially from a standing rifle and a free pistol, you cannot eat a lot; you need to eat a little, but nutritiously, so that before shooting there is neither a feeling of hunger nor a feeling of overload. You do not need to drink a lot either before or during shooting. Heavy food and excessive fluid intake increase the pulse and lead to excessive sweating, weakening the body during the exercise.

Before shooting, especially in the morning, on the first shift, the shooter must warm up, be it a certain set of physical exercises, fast walking, aiming and clicking "idle". If the athlete decides to go shooting without warming up, immediately after sleep, then his position will not have the necessary stability, and his movements will not be strictly coordinated.

Only after preliminary preparation can you go to the firing line and begin performing the exercise.

First of all, you should pay attention to the choice of location, that is, the site on which the athlete will prepare for shooting.

Although the cabin at the firing line is designed to protect the athlete from the sun and wind, he still does not always manage to completely hide from the oblique or headwind and from the sun's rays illuminating the end of the barrel, and what is even worse, from the oncoming light that hits his eyes. Therefore, depending on the time of day, when the sun's rays, penetrating the cabin, can create unfavorable conditions for aiming, the shooter must, foreseeing all this in advance, choose a place for himself closer to one or another side or back wall of the cabin, so that during the exercise he does not have to change his place and position.

Since when shooting from a rifle while standing (kneeling), as well as from a pistol (revolver), the wind not only blows the bullet to the side, but significantly increases the oscillation of the shooter's body with the weapon, swinging them and thereby reducing the accuracy of shooting, in a slanting wind you need to position yourself closer to the wall of the cabin, and in a headwind - make sure that the wind, reflecting off the walls, does not move the weapon.

According to the rules of the competition, the firing line area must be horizontal and smooth. In practice, this is not always the case: not all shooting ranges have a firing line paved or concreted, there are bumps and depressions, and sometimes even a slight slope. To prevent the unevenness of the area from interfering with the correct position, the shooter must level the area in advance by scraping off the bumps with a knife and screwdriver.

When the area allocated to the shooter on the firing line does not have a horizontal platform, the following should be followed:

for shooting from a prone position, choose a site with a slight backward slope and try to position yourself where the section of the firing line does not slope forward or to the right, so that the right elbow does not end up lower than the left and the body does not fall to the right;

for shooting from a kneeling position, select an area that does not have a slope to the right;

For shooting a rifle while standing, it is best to stand on a site that is inclined to the left, so that your heels are slightly lower than your toes.

Before shooting prone, having completed the preparation of the place on the firing line, the shooter must lie down and check whether grass bushes or individual stems interfere with aiming, in order to clear the aiming path in advance, before the start of shooting (at least in the immediate vicinity of the firing line).

Having finished with the preparation of the place, it is necessary to conduct a quick preventive inspection of the weapon. In general, it is necessary to make it your duty to check the sight before shooting: is the front sight firmly fixed, are the plate and square not wobbling. At the same time, depending on the lighting and the nature of the shooting, set the front sight of the appropriate size and shape (when shooting from any rifle), make a preliminary correction in the installation of the sight, and then smoke the sighting devices.

It would also be a good idea to check the tightening of the screws on the rifle and the trigger tension (service rifle and revolver). All checks should be done before test shots, otherwise test shooting will lose its meaning.

Before getting ready, you should carefully check and adjust your clothes and shoes for shooting from a particular position. Clothes should not create discomfort or tightness for the shooter, or interfere with blood circulation; before starting to shoot, you should unbutton your cuffs, collar, loosen your waist belt, etc. Now you can start performing a particular shooting exercise.

Chapter 1. Sports exercises performed when shooting from a rifle.

4.1.1 Standard exercises (shooting from prone, kneeling, standing)

"Standards" differ from each other in the class of rifles used and the number of cartridges. Shooting from 7.62 and 6.5 mm caliber rifles is carried out at a distance of 300 m at target No. 3, from small-caliber rifles - at 50 m at target No. 7.

The most difficult is the "standard" (3x40) of free rifles. The need to fire only 120 qualifying shots (not counting the trial ones) requires a great deal of physical effort, as well as great nervous tension. Therefore, the shooter must think through his actions especially carefully in order to use his strength rationally and maintain his working capacity throughout the entire duration of the exercise.

Before shooting, you should carefully check the fit of your sportswear. When shooting from a kneeling position, to prevent your right leg from going numb quickly, it is recommended to loosen the lacing of your right boot and carefully straighten the folds of your trousers under your knee. Before shooting while standing, you should tighten your boots to more firmly secure your feet at the ankle joints.

Experienced sportsmen, when preparing to shoot, move their legs and body several times, try them on until they find a comfortable position for themselves; they are in no hurry to start shooting until the entire system has acquired the necessary stability. However, for accurate shooting it is generally not enough to just take a comfortable and stable position; before starting to shoot, it is necessary to check the correctness of the position in relation to the target in order to avoid excessive muscle tension, which negatively affects the magnitude and nature of the weapon's oscillations. Finding the correct angle of rotation of the body in relation to the target completes the preparatory operations, after which the shooter can begin shooting.

Successful execution of the exercise as a whole can be achieved only if the shooter correctly and uniformly performs all shooting techniques during each individual shot. As has already been said, the accuracy of the shot is directly dependent on the stability of the stance. However, in order to successfully conduct long-term shooting with a large number of cartridges, it is necessary to be able to maintain not only a stable, but also a uniform stance from shot to shot. This means, first of all, that when starting to fire a series of shots, the athlete should not move from the spot, change the relative positions of the arms and legs, etc.

However, in practice this is not so easy to do, because after each shot (or unsuccessful attempt to make one) the shooter is forced to break the position in order to reload the weapon or give himself a rest. Therefore, in the process of shooting, the ability to accurately restore the position for making the next shot is of great importance. As practice has shown, in order to achieve the necessary composure and fixation of your position during the position, when processing each shot, you need to slowly point the rifle at the target from top to bottom or from bottom to top (depending on the type of position), bend your torso, redistribute the load, raise your shoulder girdle, right elbow - in general, make a number of successive movements, a kind of shaking down, in order to take the final position for shooting; and the whole complex of these movements should be brought to automatism and performed the same way each time.

As an example, in order to familiarize with the technique of processing a shot when performing the "standard" exercise, Fig. 252 shows filmograms that give an idea of the complex of movements performed by shooters to achieve composure and take the final position before each shot.

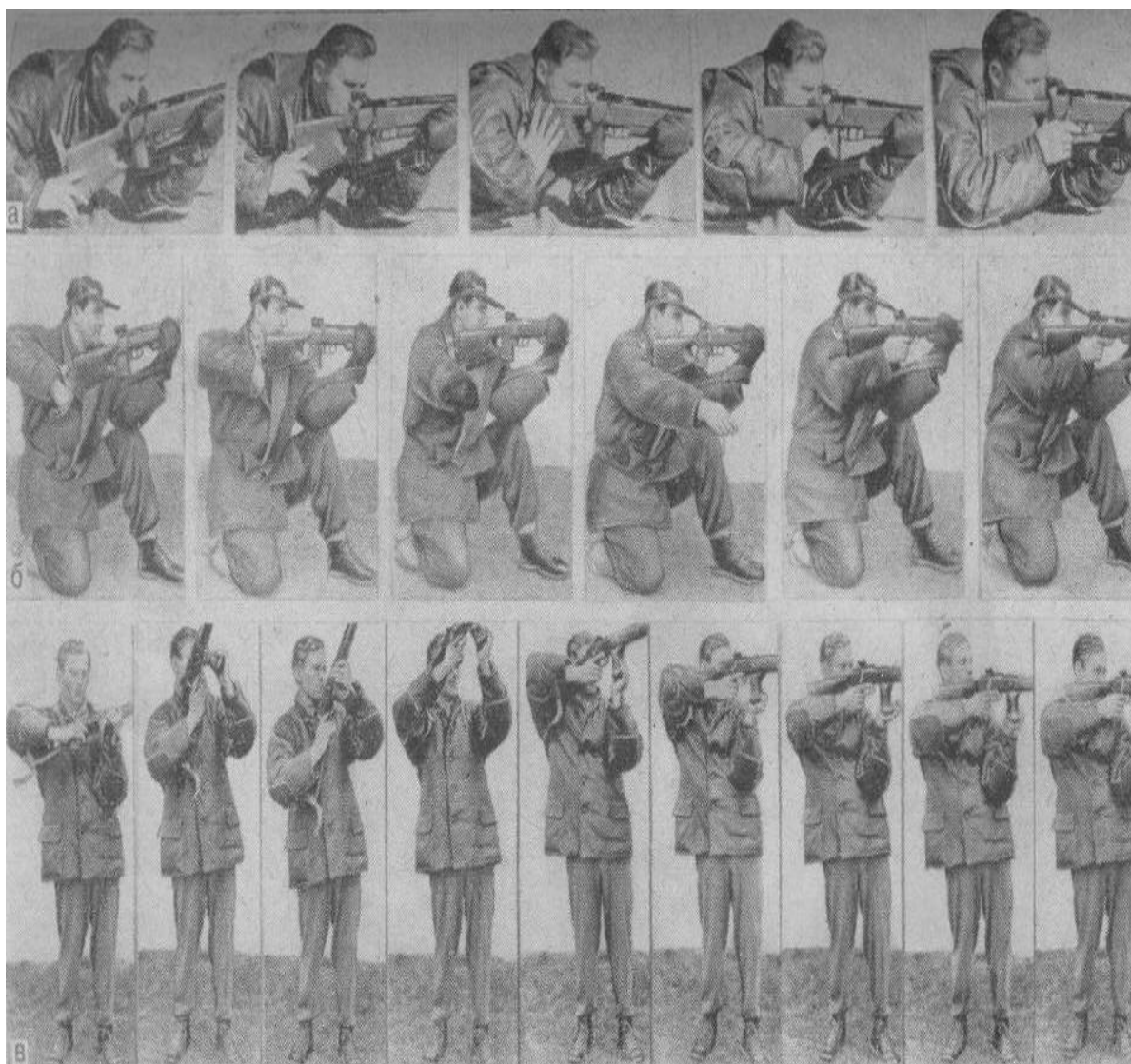


Fig. 252 - Shot processing elements when shooting from a prone position, kneeling, standing

The shooter must always remember that it is impossible to improve the result by aiming for a long time; when "aiming", the shooting accuracy is sharply reduced. To achieve the greatest accuracy, aiming must be completed, as already mentioned, within 6-9 seconds. After about 12-15 seconds of aiming, visual acuity begins to quickly dull and the eye stops noticing errors: the apparent well-being with aiming that occurs at this time ends with the shooter making an inaccurate shot. Therefore, it is better to aim for a short time, even if this requires an extra attempt to make a shot.

Significant difficulties in aiming, especially when shooting prone at long distances, are created by the so-called "mirage" - a wave-like movement of ascending currents of hot air. A mirage sometimes

occurs over the terrain in the morning or on a hot day after rain; all distant objects, including the "apple" of the target, are perceived by the eye as rhythmically trembling. Most often, a mirage occurs due to excessive heating of the barrel of a large-caliber rifle when shooting at an accelerated pace; in such cases, the shooter sees a floating target, and the "apple" not only oscillates, but also changes its shape, seeming to be flattened from above, then elongated, or even moving to the right and left. Naturally, in such conditions it is very difficult to aim accurately.

When a mirage appears over the terrain during evaporation and there is no time to wait for it to pass, you should aim quickly: when aiming, the shooter will see the "apple" very poorly and will make gross errors. If the mirage occurs due to overheating of the barrel and the sportsman does not have time to wait for it to cool down and the mirage to disappear, you need to blow out the barrel before each aiming to remove the hot air from it (Fig. 253). While the next portion of air heats up and begins to come out through the muzzle opening, you need to quickly aim and fire. Many experts shake the barrel before aiming to divert the hot air wave to the side, and then quickly aim and fire. When shooting from a random rifle, in order to combat the mirage, it is recommended to stretch a special fabric tape over the barrel (see Fig. 220).



Fig. 253 - Blowing out the barrel before the next aiming to reduce the "mirage"

In any shooting, but especially in the prone position, the alignment of the point of view with the center of the target is of great importance, which requires the ability to make timely adjustments to the sight setting during shooting. At the same time, if shooting is done at a long distance, especially from a standing shooting position, excessively frequent adjustments (after one or two shots) should be

avoided: making them without sufficient grounds often leads to the shooter, having lost points, being forced to return to the original position in the sight setting.

When shooting at long distances, when air masses move at a relatively uniform speed, it is necessary to make adjustments to the sight setting, taking into account the wind speed. However, one should not approach shooting formally and be satisfied with the fact that a certain adjustment has been made to the sight setting. During shooting, one must carefully monitor the behavior of the flags, determine the strength and direction of the wind, and shoot only under strictly defined conditions.

When shooting from a small-caliber rifle, that is, at a short shooting range, when the wind blows in gusts, experienced shooters usually time the shot to the period between bursts, in a lull.

A change in lighting also has a major impact on aiming accuracy; in such cases, the eye perceives the relative positions of the sighting devices and the target "apple" differently, which leads to a significant change in the POI. Usually, experienced shooters, in variable cloudiness, stop at one lighting mode, aiming either when the sun is shining brightly or when it goes into a cloud - depending on the duration of the periods of illumination and shadowing of the targets.

It has already been said above that holding your breath when shooting standing and from a kneeling position can be done both on an incomplete exhalation, prolonging the breathing pause, and on a half-inhalation. During the processing of the shot, when raising the rifle and performing the whole complex of movements performed to achieve composure and take the final pose when ready, you should breathe a little deeper than usual; then, just before aiming, take one or two deep breaths and hold your breath. Holding your breath for more than 12-15 seconds is not recommended. If you are unable to make a shot during this time, you need to stop aiming and take a rest. You should make it a rule to take two or three deep breaths in and out after a shot or an attempt to make one, in order to ventilate your lungs well.

When performing any exercise, including the "standard", no matter what method of trigger control the shooter uses, it is necessary to strictly adhere to the basic principle - the trigger pull must be smooth and strictly coordinated with the correct aiming. In order for the trigger pull to be smooth, without a jerk, the shooter must acquire the ability to complete it within approximately 1.5-2.5 seconds. Therefore, having chosen the most favorable moment, when the "flat front sight" under the lower edge of the target's "apple" experiences minor vibrations, you need to boldly and decisively (but always smoothly) pull the trigger. It is very important to train yourself to stop pulling the trigger. If the shot is not fired within 8-10 seconds from the time the aiming adjustments began, you need to stop further processing the shot and take a break.

To give an idea of the interconnected action performed by the shooter when making each shot, Fig. 254 shows a basic diagram of the processing of a shot when shooting standing from an arbitrary rifle.

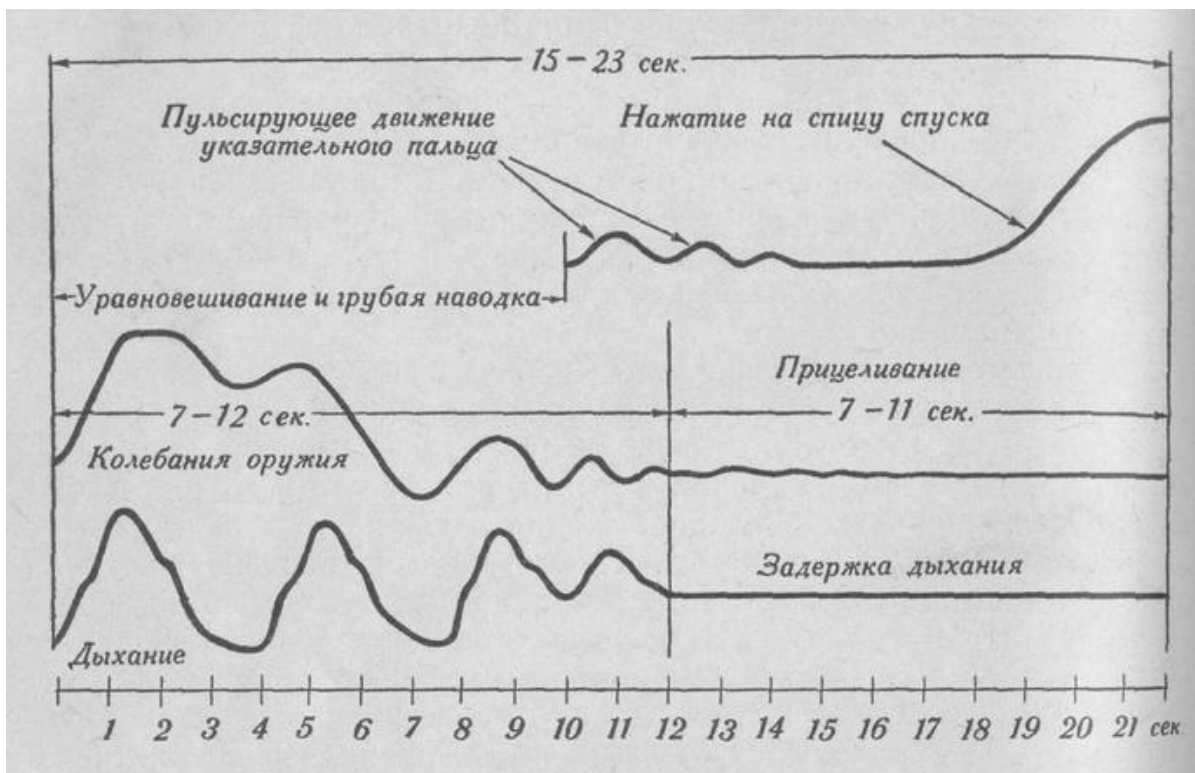


Fig. 254 - Schematic diagram of shot processing when shooting standing from a free rifle (trigger with accelerator)

Of course, the given numerical values vary to some extent from shot to shot, but the nature of the shot processing for each shooter

remains, as a rule, unchanged, since all the actions of an experienced shooter have long become habitual for him and have turned into automated movements.

As has already been said, successful shooting is possible if the athlete performs all shooting techniques uniformly during each shot. This, in turn, is possible if the shooter is able to sufficiently maintain physical strength, visual acuity, reaction speed, etc. during shooting. Therefore, achieving uniformity in the shooter's actions requires rational and economical expenditure of strength.

Practice has shown that the most rational shooting from this point of view is one in which the athlete fires a shot quickly, within 17-25 seconds from the moment the rifle is raised when processing the shot (when shooting slowly while standing).

However, the range of issues concerning the conservation of strength during shooting is not limited to the fact that the shooter should spend little time on the shot itself. In order not only to use strength economically, but also to restore it as fully as possible during the shooting process, it is necessary to take breaks of the appropriate duration between shots, as well as between series of shots, that is, to shoot at a certain pace, with a certain rhythm.

The shooter does not always manage to fire a shot on the first try. Usually, to avoid delaying the shot, accompanied by increased rifle oscillation and dulling of visual acuity, after 10-12 seconds of aiming, the shooter removes his finger from the trigger and rests, and then makes another attempt to fire.

Let us consider the issue of the shooter's rest between successive attempts to fire a shot. Currently, standard shooters use two completely different types of rest when shooting standing. The first of these is that after an unsuccessful attempt to fire a shot, the shooter lifts the butt from his shoulder and places the rifle butt on the floor or on a stool, resting in a free-standing pose. This type of rest is the most effective in terms of restoring the working capacity of the muscular system; however, after the rest, the shooter is forced to again perform the entire range of movements associated with taking the position. The other type of rest is that after an unsuccessful attempt, the athlete does not change his position, and

after several deep breaths in and out, giving his eyes the opportunity to rest during this time, he again attempts to fire a shot. In this case, while losing in the duration of holding the rifle in the air, the shooter wins in that he does not need to perform a number of movements to achieve composure and take the position. And only when, after two or three such attempts, the shooter still fails to fire a shot, he removes the butt from his shoulder, places the rifle on a stool and gives his muscles a chance to rest properly.

This method of handling a shot (Fig. 255) is used by many leading shooters. It is, naturally, good if the sportsman has sufficient physical strength, endurance, is in good athletic shape and, of course, does not abuse a large number of attempts to make a shot, that is, does not hold the weapon in the air for an excessively long time. In general, the shooter should not abuse the number of attempts to make a shot, regardless of the position in which he is resting; it should not be forgotten that such long shooting as "standard" requires intense work of the muscular and visual apparatus throughout the entire exercise.

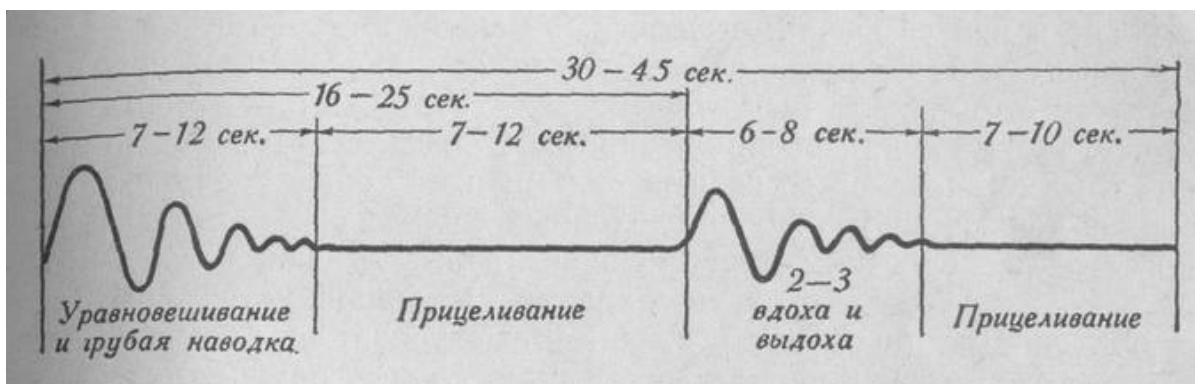


Fig. 255 - Basic diagram of the shot processing when shooting standing, when between successive attempts to fire the shot the shooter rests, holding the rifle in the air and not changing the shooting position

Therefore, at the beginning of long shooting, when the athlete starts it with fresh strength, one should not get too carried away with processing the shot mainly by multiple attempts to make it, otherwise he will not have enough strength to complete the entire exercise, especially at the end of shooting. Experienced athletes, usually taking into account their strength and level of training, outline for themselves a certain mode of processing shots, which al-

lows them to correctly distribute their strength in the process of performing the entire exercise. For most experienced standard shooters, when shooting standing (40 shots) from arbitrary rifles, the total time of holding the weapon in the air fluctuates within 20-30 minutes.

Based on the practice of a wide range of leading sports shooters, it can be said that shooting is most effective when the athlete, decreasing or increasing the number of attempts during the exercise, still shoots on average: lying down - on the first try, kneeling - on the first to second try, standing - on the first to third try, without changing the position of the ready position, i.e. without lowering the rifle until the shot is fired. Data on the duration of processing the shot, the total time spent on maintaining the weight of the weapon, etc. are given in Table 16.

**Data on shooting the exercise by some leading athletes
(shooting standing from free rifles)**

Table 16

Surname	Year	Rifle caliber, mm	Shot processing time, sec.		Total time spent (40 qualifying shots), min.		Total time to complete the exercise (with trial), min.
			on the first try	on average for processing a shot	to support the rifle in the air	for the production of 40 shots	
Bogdanov A.	1959 competition	5.6	30-34	73	54	81	102
	1959 competition	7.62	37-40	113.9	76	132	167

	1960 com- peti- tion	5.6	32- 36	92	72	124	144
Itkis M.	1959 com- peti- tion	5.6	22- 25	37	29.5	59	66
	1959 com- peti- tion	7.62	21- 23	37	29	72	86
	1960 com- peti- tion	5.6	29- 32	37.7	26.5	64	71
Borisov V.	1959 com- peti- tion	7.62	19- 21	25	20	85	96
	1960 com- peti- tion	7.62	18- 20	26	21	95	108
Shaburkin V.	1960 com- peti- tion	5.6	31- 34	46	30	60	67
Kveliashvili Sh.	1959 com- peti- tion	7.62	13- 15	29.5	22.5	80	94
	1968 com- peti- tion	5.6	18- 22	25.3	21.7	71	92
Gerasimenko A.	1968 com- peti- tion	5.6	25- 29	42	29.6	59	66

	1969 credit. tr.	5.6	29- 32	48.6	32.4	65	73
Kudryashov Yu.	1969 credit. tr.	5.6	28- 33	30.2	33.6	66	101
Parkhi- movich V.	1968 com- peti- tion	5.6	25- 30	50.9	39.6	74	94
	1971 credit. tr.	5.6	25- 31	41.2	27.6	63	78
	1972 credit tr	5.6	29- 33	41.9	27.9	61	76
Kornev V.	1972 com- peti- tion	7.62	25- 28	36.3	47.3	99	109
Melnik B.	1972 com- peti- tion	7.62	16- 21	22	17.9	64	74

The table shows that the majority of leading athletes process shots quickly and use their energy sparingly when performing the entire exercise. Of course, fast processing of a shot and economical shooting are not always good in themselves, since they directly depend on the athlete's level of preparedness and training. However, being in good athletic shape, a shooter should not be afraid of fast processing of a shot, but, on the contrary, strive for it in every possible way.

For a long time, there was a misconception among some shooters and trainers that when performing the "standard", mainly when shooting prone, reloading should be done without lifting the butt from the shoulder, since this supposedly maintains uniformity of the butt position. In reality, after each shot, the butt moves to some extent under the effect of recoil, and before the next butt position, it

still needs to be put back in its original place. Therefore, when reloading, the shooter can lift the butt from the shoulder. And in order not to disturb the uniformity of the position during reloading, it is necessary to carefully ensure that the left hand supporting the rifle does not move and the left elbow is always in the same place (prone and from the knee).

During the rest between shots, the shooter must ensure that the uniformity of the position is not disturbed - the left elbow does not move (when shooting prone and from the kneeling position), the sling does not slip off the hand, its tension does not change, the angle of the torso rotation and the relative position of the supporting surfaces of the body remain unchanged. Rest will be most effective if you adopt a position that allows the muscles to relax to the greatest extent and thereby give the opportunity to restore their performance. The most advantageous way to rest between shots is as shown in Fig. 256.

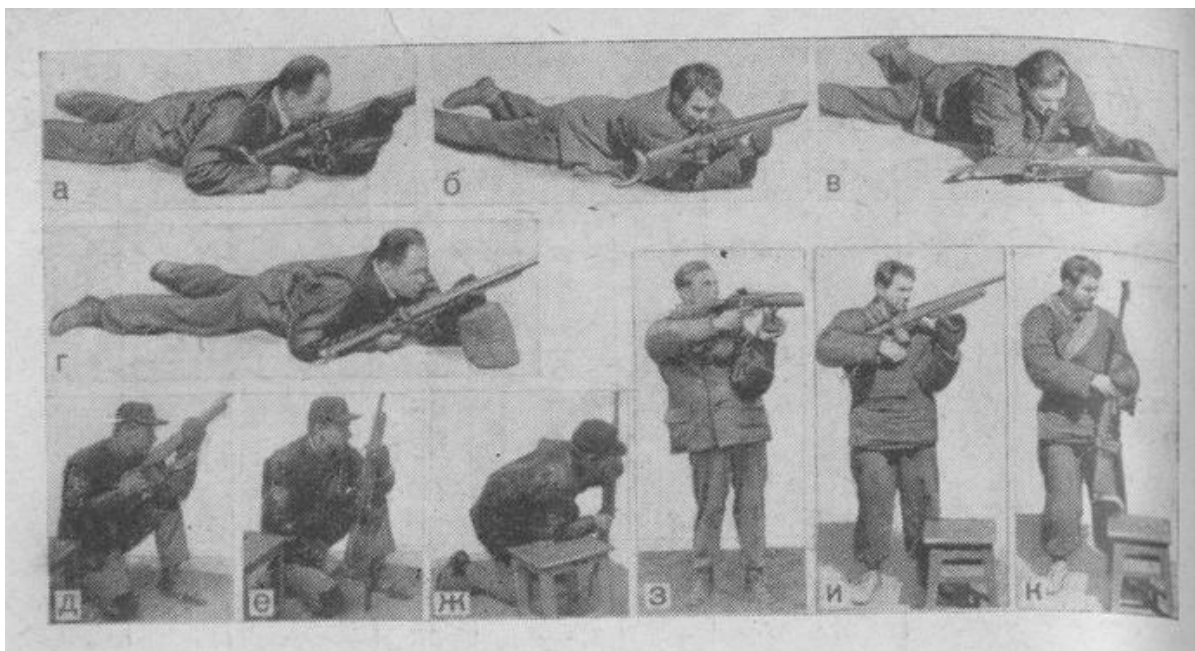


Fig. 256 - Rest between shots and during breaks between series of shots

When shooting in gusty wind conditions, when the shooter needs to be ready to quickly prepare and fire a shot between gusts, it is advisable to rest as shown in Fig. 256, а.

When setting a certain duration of rest between shots when shooting large-caliber cartridges, it should also be taken into account that the rifle barrel does not heat up too much from excessively rapid shooting and that a "mirage" does not occur, which makes aiming difficult. Considering also that when shooting large-caliber cartridges the rifle barrel still heats up, during the rest between butts it is necessary to open the bolt and extract the cartridge; a long stay of the cartridge in the hot chamber can cause the bullet to break upward.

So, above was outlined in general terms the technique of shooting when making several shots. Now let's consider, also in general terms, the technique of performing the "standard" exercise as a whole.

Some shooters, considering test shots as non-scoring, shoot carelessly, at a completely different pace, pressing the trigger differently. Having made an adjustment in the sight setting based on such test shots, when switching to scoring shooting they suddenly discover a sharp misalignment of the point of view and, having lost points on the very first shots, reduce the overall result.

Firing test shots is a crucial moment in any shooting exercise. Therefore, in order to properly sight in a weapon, test shots must be fired under exactly the same conditions and at the same firing mode as the qualifying shots.

In addition, test shots, especially when performing exercises involving long-range shooting, should not be considered only as sighting shots; they should be used as a means of drawing the shooter into the general process of performing exercises. For this purpose, experienced athletes always click "dry" before test shots, and then, when the position acquires the necessary stability and a feeling of confidence in the timely pressing of the trigger appears, they begin shooting.

During test shooting, you cannot make an adjustment for one shot; after making two or three shots and being firmly convinced that the rifle is not hitting the target, you can make an adjustment to the sight setting.

Sighting should not be taken as a formality, relying only on the actual location of the holes in the target; it is essential to match the shot mark with the hole. If the shot mark does not match the location of the hole, the rifle is not sighted in and an adjustment must be made to the sight setting.

During such a long shooting as "standard 3x40", the shooter should use the test rounds sparingly, not shoot them all at once. During the time allotted for shooting, as a rule, external conditions change significantly, which will require the shooter to check the rifle's performance after a break between series of shots. In addition, there is no need to overheat the rifle barrel with many test shots. Usually, when starting shooting from a particular position, masters use 5-7 test rounds, leaving 3-4 rounds in reserve in case of a sharp change in the weather and additional sighting in during the shooting.

Finally, the shooter must make it a rule not to take a long break after test shots, not to stand up, not to move from the spot, so as not to disrupt the uniformity of the shooting techniques between test and scoring shots.

From the point of view of preserving strength during the exercise and preventing the rifle from overheating (when shooting large-caliber cartridges), it is best to fire at equal intervals, using the entire time allotted for the exercise. However, circumstances rarely develop in such a way that it is possible to organize such rhythmic shooting. Therefore, the shooter must be able, taking into account the situation, his characteristics and well-being, to shoot at an accelerated or slow pace, sometimes completely disrupting the general rhythm of shooting.

Before starting the test shooting, it is recommended to click "idle" to get into the upcoming work. If at the first shots the shooter feels that shooting is going easily, it is necessary to continue shooting at a fast pace, without artificially slowing it down, so as not to disturb the established system in the activity of the nervous and muscular apparatus.

In cases where it is difficult for an athlete to make a shot and shooting is difficult, one should not rush; one should wait for some

time until the system "shooter's body - weapon" is well balanced: click "idle", patiently restore the coordination of movements when pulling the trigger, do the aiming several times before each shot, and then confidently begin shooting at a slightly accelerated pace to make up for lost time.

However, no matter how well the shooting goes, the shooter must always be attentive, not be careless when making shots, constantly control his actions in order to avoid failure due to his own negligence. Of course, with prolonged shooting, individual unsuccessful shots are possible, but at the same time one should not be nervous, wanting to compensate for a bad hole as soon as possible with further good shooting. Usually, excessive haste leads to a repetition of the same mistakes. Therefore, after a bad shot, you need to pull yourself together, not show haste, and more carefully process subsequent shots.

When shooting prone, when the rifle hardly oscillates, athletes try, especially if the rifle hits the target and the shooting is going well, to fire quickly, so as to, as they say, "having caught on to the ten, not to lose it." While rapid shooting from a small-caliber rifle is entirely appropriate and acceptable, one should not shoot excessively quickly from rifles chambered for live ammunition, so as not to overheat the barrel and prematurely cause a "mirage." Therefore, it is recommended to shoot prone in favorable weather from a small-caliber rifle at a fast pace, spending 10-12 minutes on a series of 10 shots. From a large-caliber free rifle, one should fire rhythmically at a slightly slower pace, spending 12-15 minutes on 10 shots.

When shooting from a kneeling position (when, on the one hand, one should not rush to open fire - one must sit down well before shooting, and on the other hand, it is difficult to sit on the right leg for a long time, since it goes numb and severe pain occurs) the question of the rate of shooting, which determines the time the athlete spends in an uncomfortable position, is of great importance. Before starting shooting, it is recommended to take a ready position and click "idle" (from an arbitrary rifle) for 3-5 minutes to sit down well. When making the first shots, one should not rush. The athlete should apply himself repeatedly when processing each shot, until he feels that a position has been found in which the rifle

experiences minor vibrations and stability "at ten" has appeared. After two or three carefully processed shots, one should continue shooting at an accelerated rate. It is most advisable to shoot from a kneeling position at such a pace that a series of 10 shots from a small-caliber free rifle takes 10-12 minutes, and from a large-caliber rifle - 12-17 minutes.

When shooting standing, the tempo is especially important: difficulties that arise when aiming and pulling the trigger in a coordinated manner often lead to the athlete not having enough time to complete the exercise. In cases where shooting is difficult and the athlete hesitantly pulls the trigger, often from the mere thought that there may not be enough time, a state arises in which the coordination of movements is even more disrupted: the shooter begins to get nervous and cannot fire a shot, ultimately getting into time trouble. Therefore, it is necessary to shoot standing at a slightly accelerated tempo so that there is always some time in reserve. In order not to get into time trouble, it is necessary to fight indecisiveness and excessive caution when pulling the trigger from the very beginning of shooting. For this purpose, it is recommended to sometimes force yourself decisively and, most importantly, from the first aiming, to fire the first shot without delaying it, even with some risk that it will not be entirely accurate. You need to force yourself to make subsequent shots at a slightly faster pace, and preferably also on the first or second try, spending 12-17 minutes on a series of 10 shots.

The questions regarding the rate of shooting mainly concern those cases when the athlete shoots under favorable conditions and weather. If the weather is not favorable for performing the exercise, it is necessary to choose a different rate and shooting tactics, depending on the current situation.

First of all, when the weather changes abruptly, you should not rush to shoot. You need to look closely at everything, analyze the meteorological situation that has arisen, and then, having made a decision and settled on one or another tactical option, confidently continue shooting in the new conditions.

The need to compete in gusty wind conditions requires the athlete to be able to shoot accurately in a limited time - 6-9 seconds. Suc-

cessful execution of the exercise in such conditions will be achieved if, during periods of short-term calm between gusts of wind, the shooter will have time to quickly prepare and fire an aimed shot. Therefore, when shooting in such conditions, it is necessary to think over and practice the most advantageous position for yourself, in which you need to rest and wait out the gusts of wind, so that when the calm sets in, you can quickly aim and fire (see Fig. 256, a). The athlete must be able to shoot at a fast pace. The need for this arises when you need to, for example, perform on a late shift in order to finish shooting before dusk. At certain times of the day on any shooting range, you either need to take a break (which is sometimes highly undesirable) or shoot at a faster pace - in cases where the target lighting changes - in order to finish shooting from a particular position before the target begins to be illuminated by the sliding rays of the sun and becomes mottled, making aiming difficult.

To ensure accurate shooting in gusty winds and variable lighting, the athlete must be able to shoot irregularly, either quickly firing one or two shots during a lull in favorable lighting, or taking fairly long breaks, waiting for unfavorable conditions to fire a shot.

And in order to successfully cope with the difficulties that arise during long-term shooting, the athlete must be prepared in advance to change the rate of shooting and even the elements of the technique of shooting each time depending on the developing situation.

Many leading sportsmen, when performing the "standard 3x40" exercise, try to shoot from one position or another without a break between series of shots. However, even very experienced, well-trained shooters do not always succeed in this without compromising the quality of shooting. A break is necessary to restore muscle performance, blood circulation, visual acuity, etc.

Young shooters are advised to take breaks of varying length between series of shots, guided by the following.

When shooting prone ("standard 3x40"), if it is going well, you should try to take a break no earlier than after 20 shots. A long break is desirable - 20-25 minutes. If the shooter decides for some reason to rest after 10 shots, the break should be short - no more

than 5 minutes, otherwise, before the scoring shooting, it will be necessary to make test shots again. If the shooter puts on smoked glasses during a long break, then before the start of shooting they should be removed in advance so that the eyes get used to the lighting in which it will be necessary to continue performing the exercise. After the break, having made two or three test shots, the athlete can again begin scoring shooting, conducting it at a slightly accelerated pace, without aiming and processing the shots on the first or second try.

When shooting from a kneeling position with a free rifle, if the athlete is immediately well seated and shooting is easy and fast, after the first series (10 shots) there should be no break at all and shooting should continue at the same fast pace. If shooting is difficult, then after the first series it is necessary to rest for 3-5 minutes without getting up. In order for such a rest to be effective, it is best, without changing the relative position of the body's support points and, if possible, without moving the left elbow, to take a pose in which the muscular system is most relaxed (see Fig. 256, e). In cases where the athlete feels severe pain in a numb right leg, he can rest by standing up a little, but at the same time maintaining the relative position of the legs unchanged (see Fig. 256, g).

After two series, i.e. after 20 shots, a break of 12-15 minutes is recommended. Before getting up, it is advisable to trace the contours of the supporting surfaces of the body on the ground - the foot of the left leg, the toe and knee of the right leg, so that after the break, using these "traces" as approximate reference points, you can settle down in the same place and take the same position with the same position of the legs and the angle of rotation of the body in relation to the target (the same should be done when shooting standing).

When shooting standing from a small-caliber rifle, if the exercise is easy, there is no need to take a break. However, in such cases, some shooters use a different tactic, taking a short break of 3-5 minutes after each series and resting without moving from their place. When shooting from a 7.62 mm free rifle, most experienced shooters take a break of 5-7 minutes after every 10 shots, resting without moving from their place, or leave the firing line. In the latter case, before the start of the scoring shooting, after the break, you

should click "idle" again, make two or three test shots, and then proceed to the scoring shooting.

In order to have an idea of the general layout of time when shooting standing, Fig. 257-261 shows the timing of the exercise performed by some leading shooters in a graphical record. Of course, each performance of these shooters will differ to some extent from day to day, depending on the athlete's well-being, the meteorological situation, etc. However, despite certain differences, the nature of shooting, the "handwriting" of an experienced athlete as a whole remains almost unchanged.

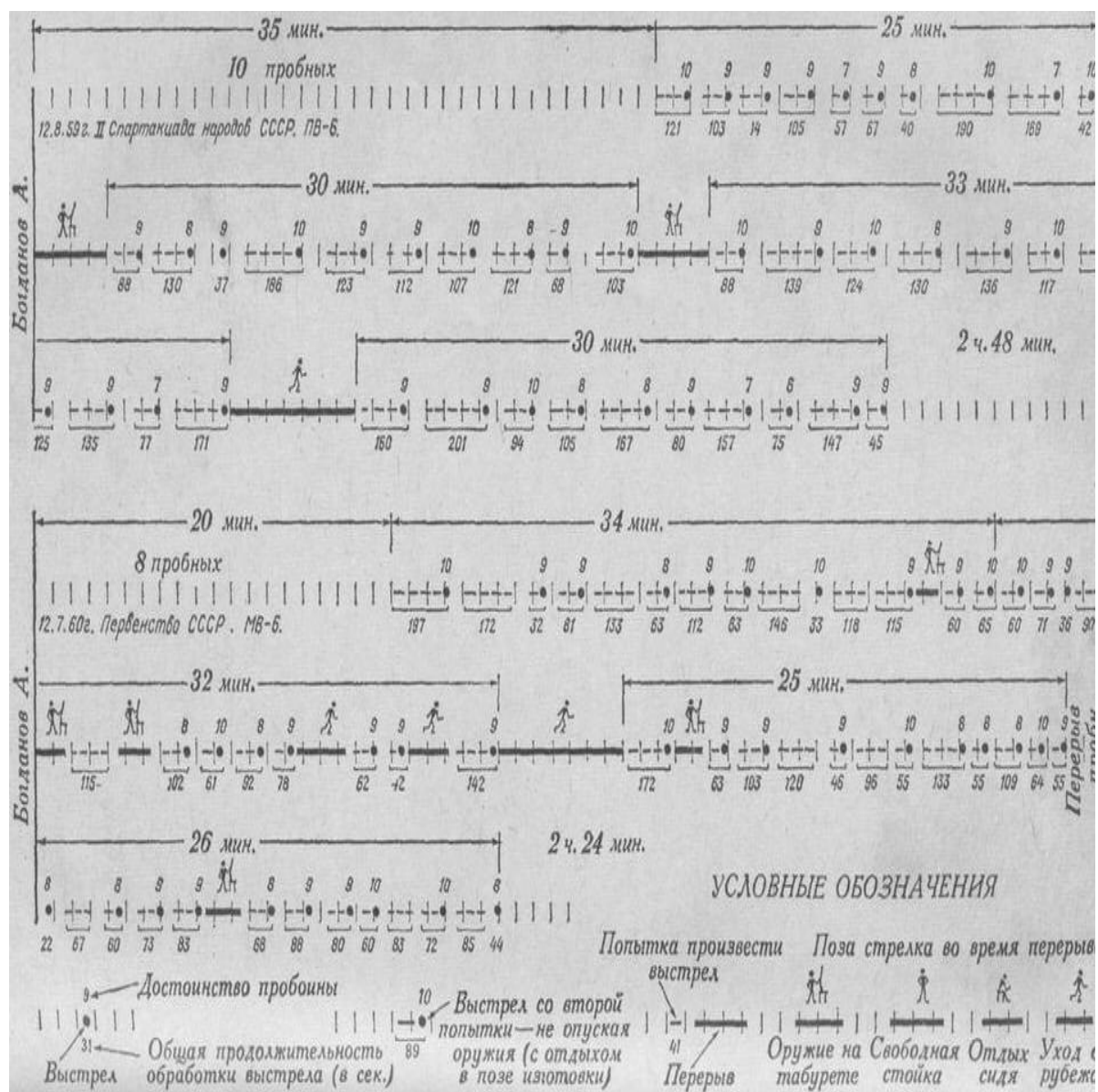


Fig. 257 - Graphic recording of the exercise. Standing shooting from a free rifle

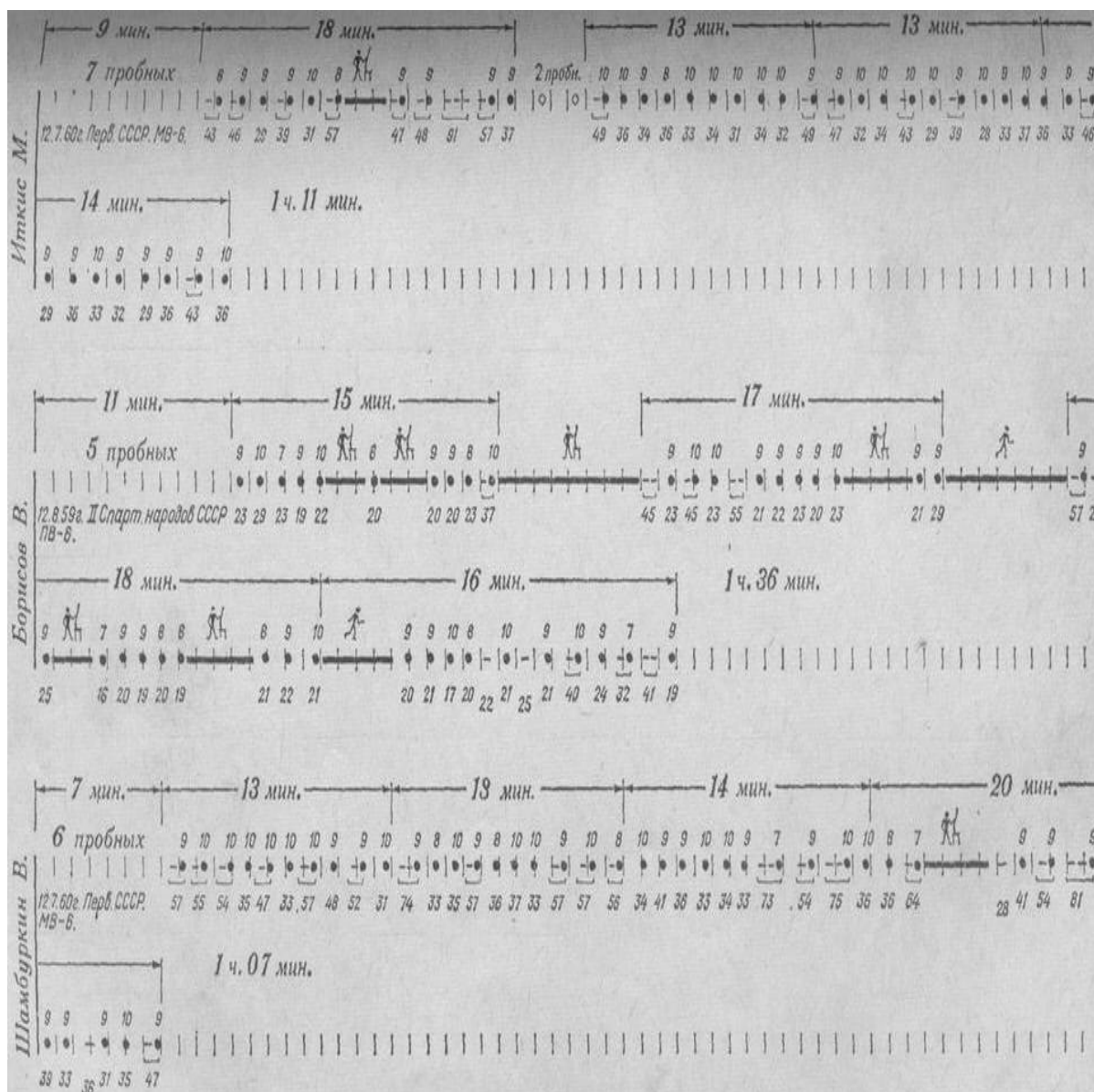


Fig. 258 - Graphic recording of the exercise. Standing shooting from a free rifle

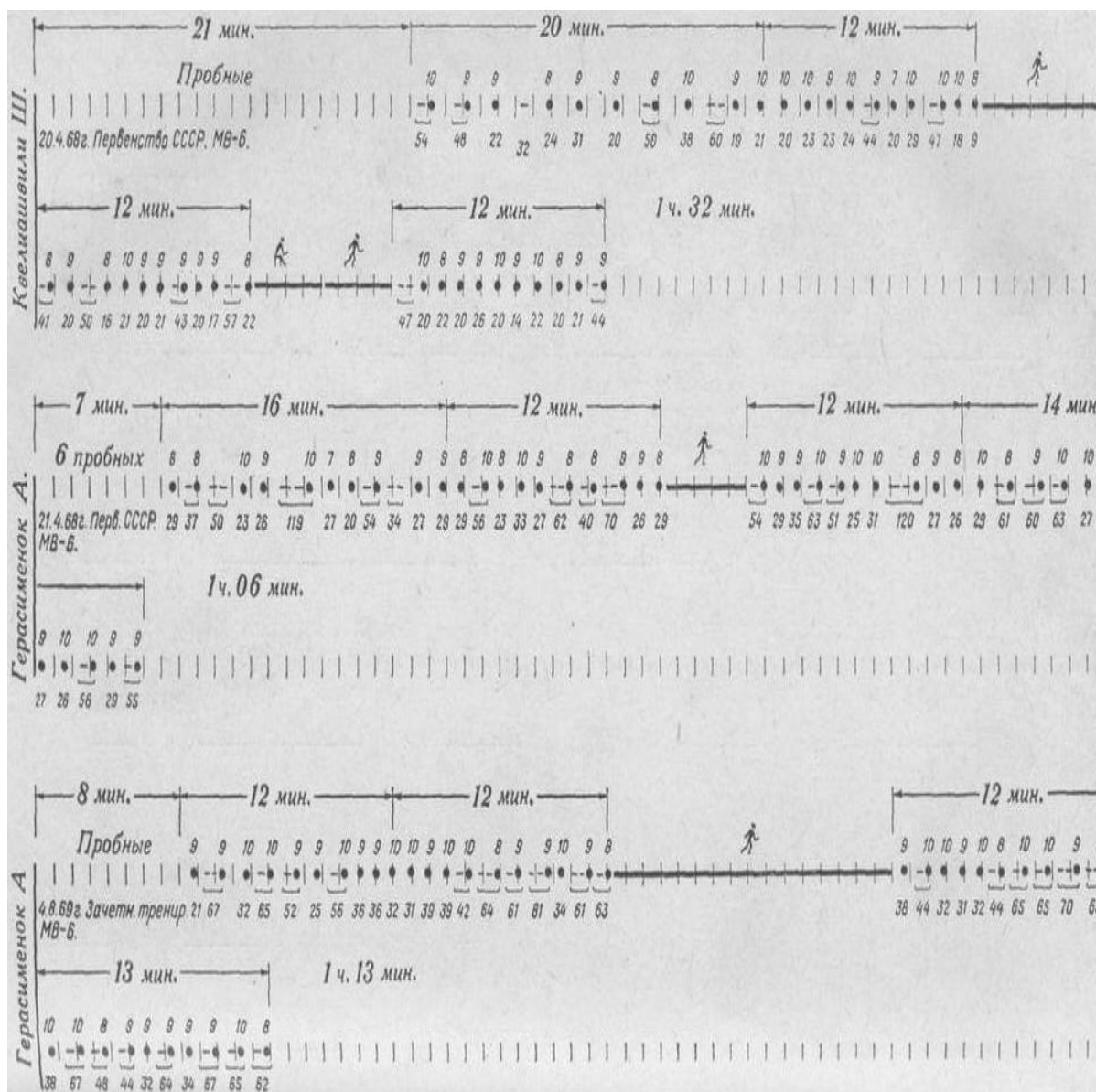


Fig. 259 - Graphic recording of the exercise. Shooting standing from a free rifle

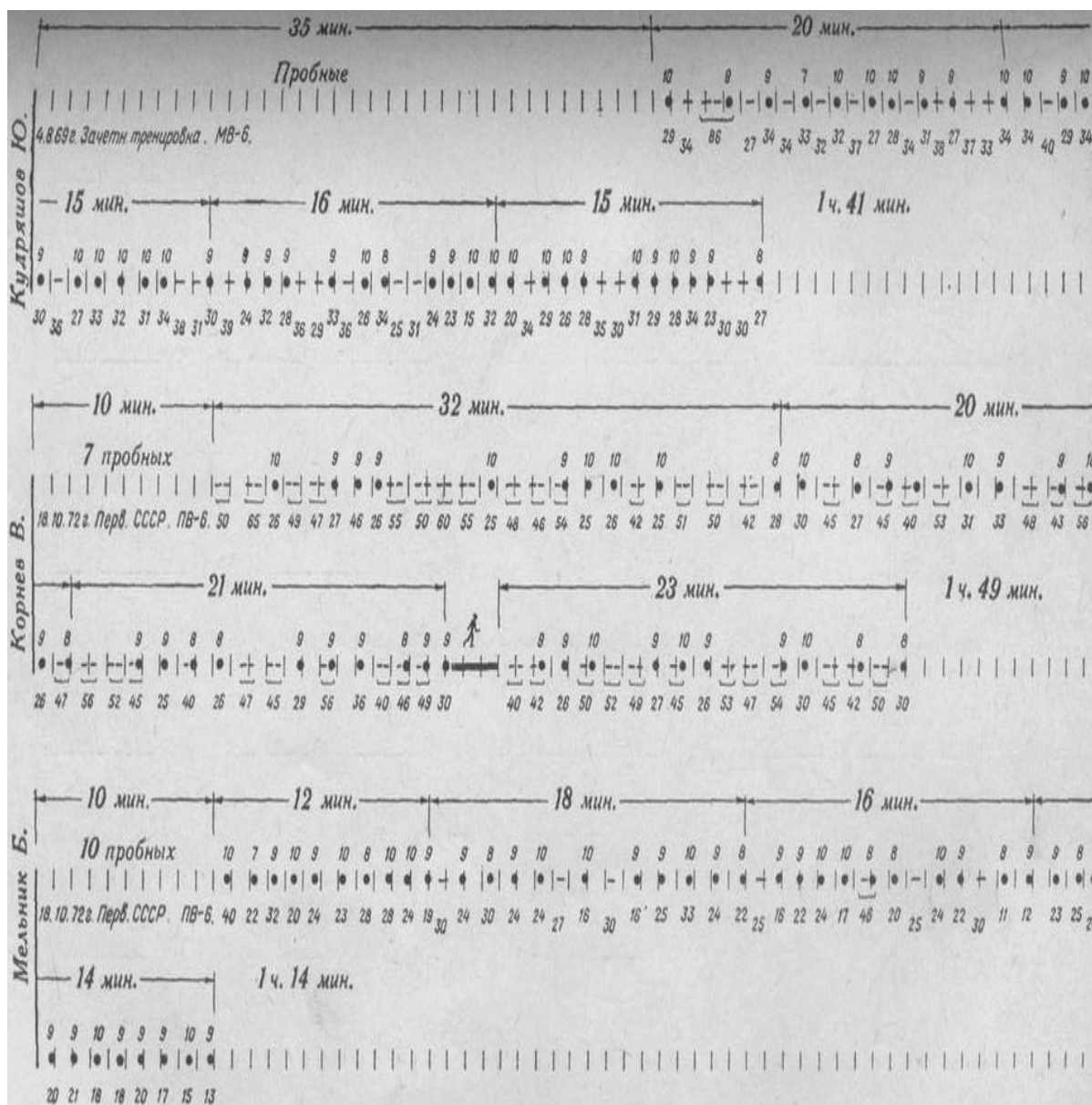


Fig. 260 - Graphic recording of the exercise. Shooting standing from a free rifle

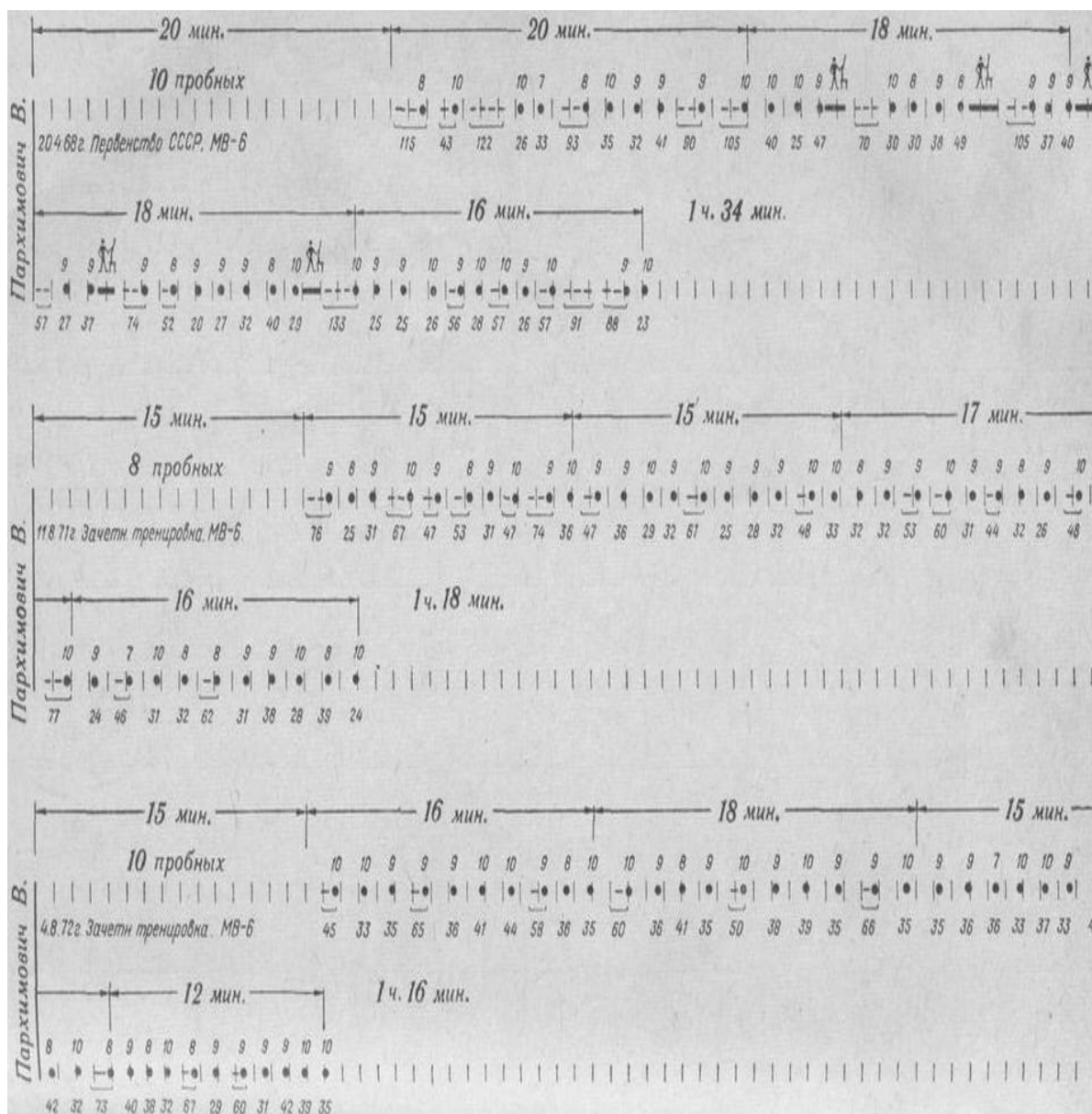


Fig. 261 - Graphic recording of the exercise. Shooting standing with a free rifle

At the same time, this graphic record clearly shows how different the shooting style of one athlete is from another, which is determined by the different physical development, type of nervous system, endurance, willpower and other qualities of each shooter. Therefore, the questions outlined above in general terms should not be considered as some kind of instruction requiring precise and strict execution of each point. Shooting sport, like any other sport, does not recognize templates. The shooter should approach the material we offer critically and use it as a certain canvas in the search for his own shooting style, corresponding to his character, temperament and individual characteristics.

4.1.2 Shooting at the "Running Deer" and "Running Boar" targets

Shooting at the "Running Deer" target is done from a multi-shot free rifle of 5.6-8 mm caliber at a distance of 100 m. The target, which is a life-size image of a deer, appears from behind cover and runs through an open section (run window) of the battle shaft with a length of 23 m for 4 seconds, and then hides behind cover again. The "deer" moves alternately in two directions - from right to left and from left to right. In this case, shooting is done with both single and double shots.

Shooting at the "Running Boar" target is carried out from a small-caliber (5.6 mm) arbitrary rifle with lateral fire cartridges at a distance of 50 m. The target, which is an image of a boar on a light background, appears from behind cover and runs through an open section (run window) of the battle shaft with a length of 10 m in 5 sec. - slow run and in 2.5 sec. - fast run, and then disappears behind cover. The "boar" also moves alternately in two directions. In this case, shooting is carried out with single shots separately - at a low speed of movement of the "boar", and then at a high speed.

It is quite obvious that the technique of performing exercises when shooting "Running Deer" and "Running Boar" has certain differences, due to the specifics of shooting, in the first case - double shots, in the second - shooting at a target moving at different speeds - 2 m / sec and 4 m / sec. At the same time, performing exercises when shooting at "deer" and "boar" has something in common, which we will dwell on.

The peculiarity of shooting at a moving target is that the athlete must briefly swing the rifle in both directions, maintain stable aiming and fire a shot (or two) in a very limited time.

Since the position must ensure a smooth movement of the rifle not in one but in both directions, the issue of the correct positioning of the shooter's body in relation to the target is of particular importance (see Fig. 150).

In order to maintain uniformity in the position, one should not move from the spot or change the accepted mutual arrangement of the

legs and the angle of rotation of the body during shooting. However, if the shooter finds that when shooting at targets moving in different directions, the average points of impact do not coincide (when moving in one direction, the bullets are located in front of the center of the target, and when moving in the other direction - behind it), then it is recommended to slightly change the angle of rotation and thereby slightly move the POI on both targets.

Since this type of shooting requires that shots be fired in a very limited time, the issue of quick and uniform aiming "off the cuff" is of great importance. It must be done quickly, but without fuss, gaining time mainly through precisely calculated and economical movements. The rifle must be raised quickly, but without jerking, with a gradual slowdown. Simultaneously with the raising, the rifle must be started to move.

Before starting the exercise, as a warm-up, it is necessary to perform several dozen "idle" throws, checking the uniformity and accuracy of the aim, as well as practicing the smoothness of the rifle's movement in both directions.

The trigger pull, despite the very limited time, should be accelerated, but necessarily smooth. In this case, you should especially control yourself in relation to the correct and uniform position of the index finger on the trigger. When shooting at moving targets, a short dry trigger is currently used for the most part, and much less often - with a slight pull. It is most advantageous to use triggers with a pull: for shooting at a "deer" - 1100-1200 g, when shooting at a "wild boar" - 600-900 g.

You need to start pressing the trigger simultaneously with the trigger pull, increasing and finishing the pressure at the moment the aiming stump aligns with the aiming area. Preliminary pressing the trigger allows for a smooth release and a shot in the first half of the target's run (except for shooting at a "wild boar" at high speed), which is very important for many reasons (see below).

Many young shooters have different POIs when swinging the rifle from right to left and vice versa, which is usually caused by excessively rapid trigger pull, bordering on a slight twitch. This forces the shooter to make some adjustments to the sight setting each time

he or she switches to swinging the rifle in the opposite direction. While this can be tolerated somewhat at the beginning of the sports season, the shooter must work hard to master the shooting technique in order to reduce such POI discrepancies to a minimum.

When shooting at the "Running Deer" target, the rifle should be raised immediately after the "deer's" antlers appear behind cover and should be completed before its chest appears on the open section of the rampart. The rifle butt should be pressed firmly against the shoulder: a tight butt is essential to ensure quick reloading. When raising the rifle, the right hand should be raised slightly higher than in the usual slow-shooting position: it is much more convenient to reload with the hand raised. The 1.8-2 sec. time interval, calculated from the moment the antlers appear behind cover until the moment the entire "deer" figure appears, should also be used to orientate oneself by the visible antlers and guess the aiming area, and begin to lead the "deer" at the speed of movement.

The shot should be made in the first half or middle of the "deer's" run, which is very important for several reasons. Firstly, if for some reason the shooter does not manage to immediately smoothly lead or aim correctly with the required lead, he has the opportunity to correct them and make an aimed shot. Secondly, from a psychological point of view, it is generally not very advantageous to let the "deer" run into the second half of the run, because as soon as the shooter delays the shot and feels that the "deer" is approaching the shelter and there is a possibility of not having time to hit it, he will involuntarily begin to hurry, afraid of missing the target. Thirdly, the shooter must get used to a certain rhythm and character of shooting, so that the process of making a single shot does not differ much from the process of making double shots. Therefore, an accelerated shot, that is, in the first half of the "deer's" run, will serve as a certain preparation for shooting double shots.

When shooting double shots at the Running Deer target, the question of reloading technique is of primary importance. Its complexity is determined primarily by the very limited time, and also by the fact that the reloading itself must be done without stopping the rifle. Therefore, the shooter must reload the weapon as quickly as pos-

sible and without lifting the butt from the shoulder (Fig. 262, 263). In order for the reloading to be fast and at the same time to maintain a uniform butt position (tight, with the right hand raised higher than usual), the butt must be inserted into the shoulder as close to the neck as possible; with such a butt position, the shooter has much more freedom to use his right hand. In the process of practicing the reloading technique, special attention should be paid to the position of the elbow of the right hand; many shooters make a gross mistake by leaving it lowered after reloading, forgetting to raise it to the original level. By disturbing the aim in this way, the shooter abruptly changes the direction of the rifle, which in turn disrupts the smooth nature of the lead and forces the shooter to either speed it up to catch up with the target, or slow it down until the target gets closer, and then start it again with the necessary speed and lead. Naturally, all this is accompanied by a loss of time and complicates the production of an aimed shot.

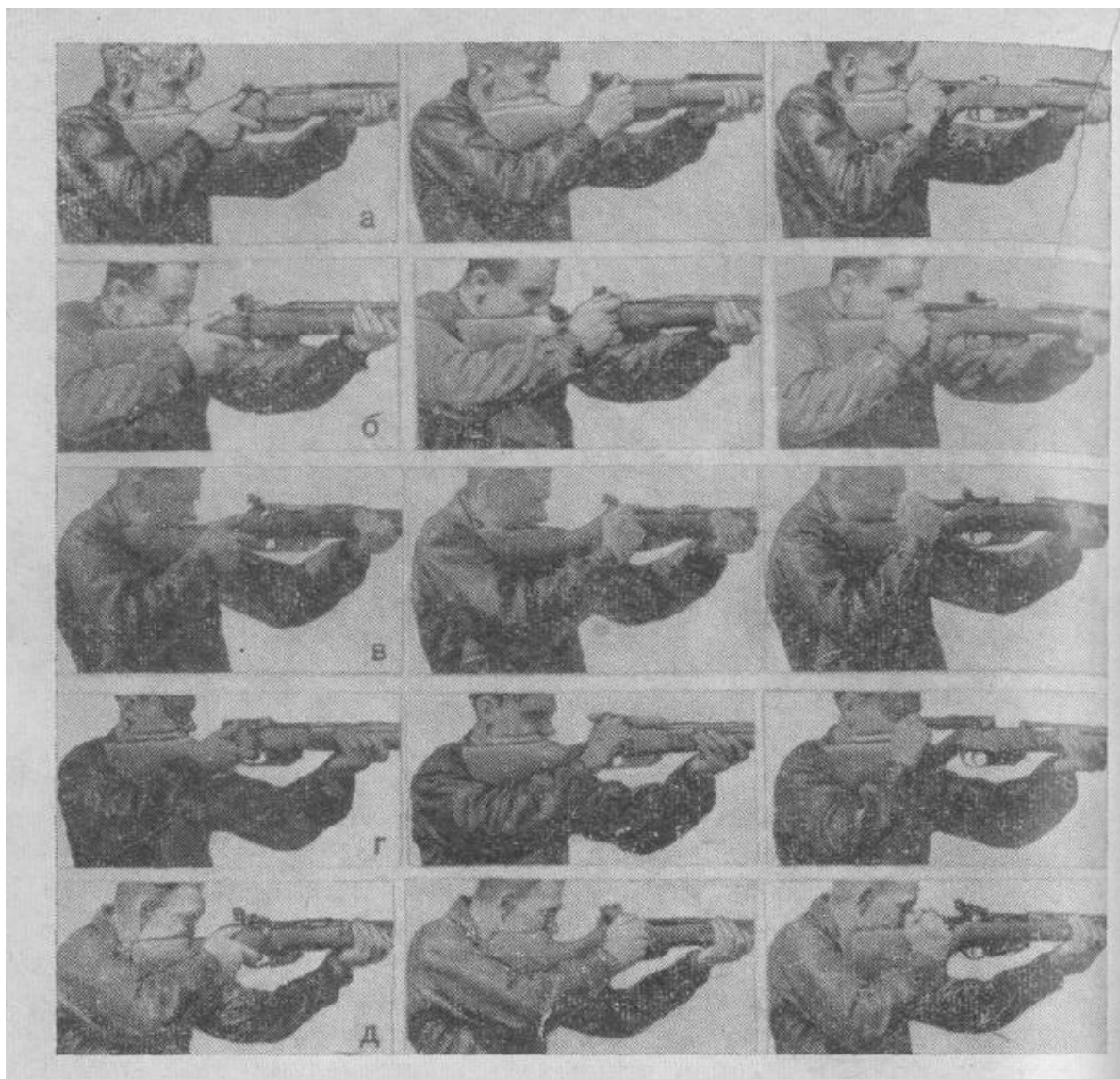


Fig. 262 - Technique of reloading a rifle when firing double shots at the "Running Deer" target, 1959-1961:

a - I. Nikitin; *b* - V. Romanenko; *c* - R. Lustberg; *d* - L. Gusevsky; *d* - V. Sokolov.

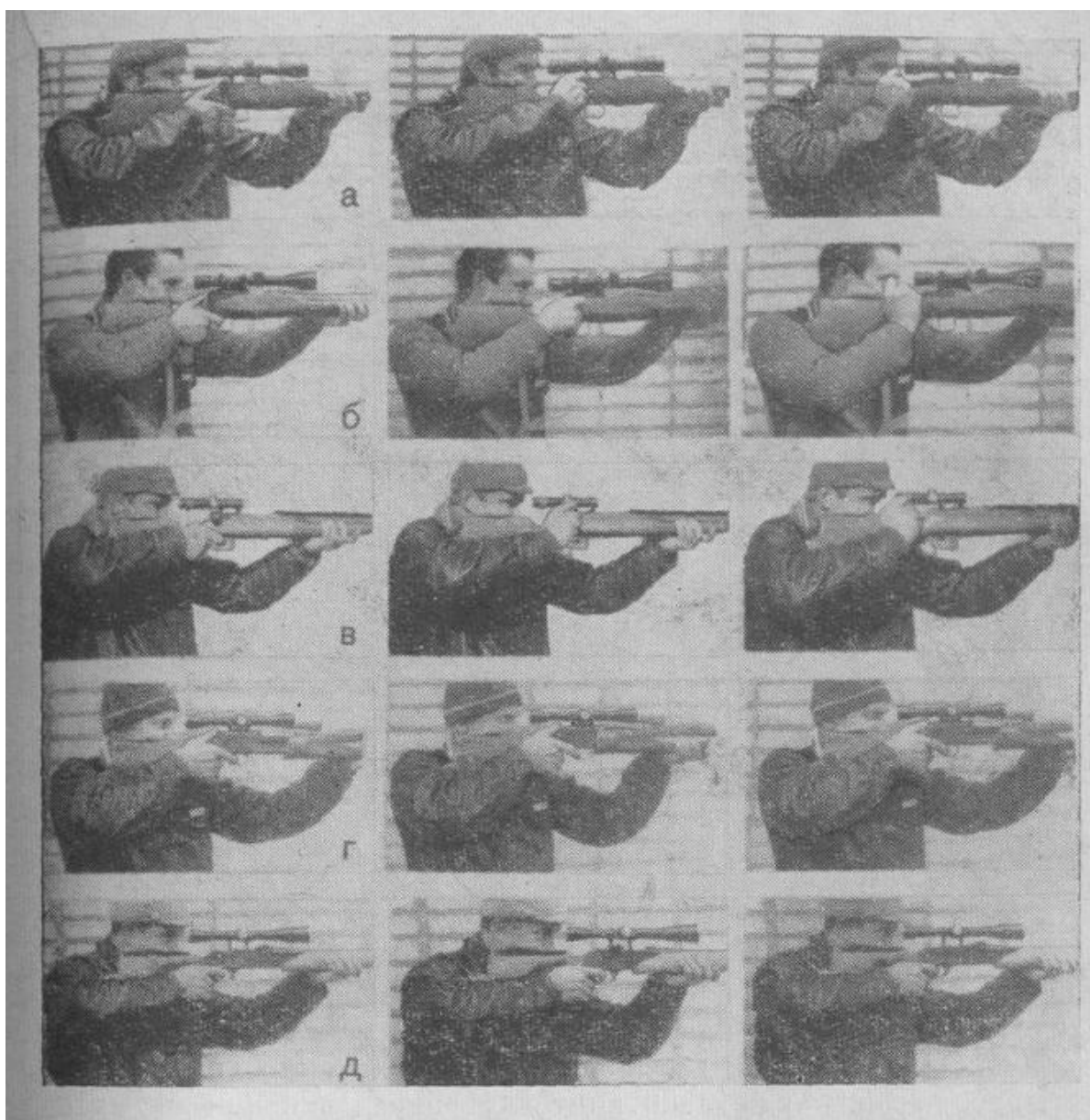


Fig. 263 - Technique of reloading a rifle when firing double shots at the "Running Deer" target, 1972:

a - V. Postoyanov; *б* - V. Polosin; *в* - A. Farafonov; *г* - I. Nikitin; *д* - A. Kedyarov.

When shooting double shots, the first shot should be taken at the end of the first half or in the middle of the "deer's" run window, the second - no further than 1.5-2 m from the target's cover.

When aiming with an optical sight, some sportsmen choose the chest of the "deer" as the aiming area (see Fig. 217, a, c). The positive side of such aiming is the clearly visible outline of the chest of the "deer" against the light background of the bullet receiving shaft, the negative side is the difficulty of uniform vertical aim-

ing. Therefore, it is best to use one or another area of the "deer's" head, or under its head, as the aiming area (see Fig. 217, b, d).

When shooting at the "Running Boar" target, due to the unexpected appearance of the target from behind cover compared to the "deer" and therefore the shorter leash of the rifle, the buttstock must be very rigid. The right hand must press the buttstock tightly to the shoulder, securing the buttstock also with the cheek.

Due to the short duration of the leash, especially when the "boar" is running at high speed, the speed and accuracy of raising the rifle acquires special significance. In the initial position (the butt at the hip), while waiting for the target, the muzzle of the rifle barrel should be oriented toward the area where the "boar" is expected to appear. When raising, slightly moving the rifle forward and raising the right hand with the butt, you need to hold your left hand (the end of the barrel) at approximately the same level (Fig. 264). Simultaneously with the raising, you need to begin raising the rifle with ever-increasing speed, bringing it to a speed proportionate to the movement of the target. Since it is difficult to immediately and equally align the aiming stump with the aiming area at the beginning of the swing with each shot, it is much better if the rifle barrel after being raised and at the beginning of the swing is located slightly behind the aiming area than in front: it is much easier to "catch up" with the target than to slow down the movement of the rifle in order to aim at the aiming area chosen for yourself.

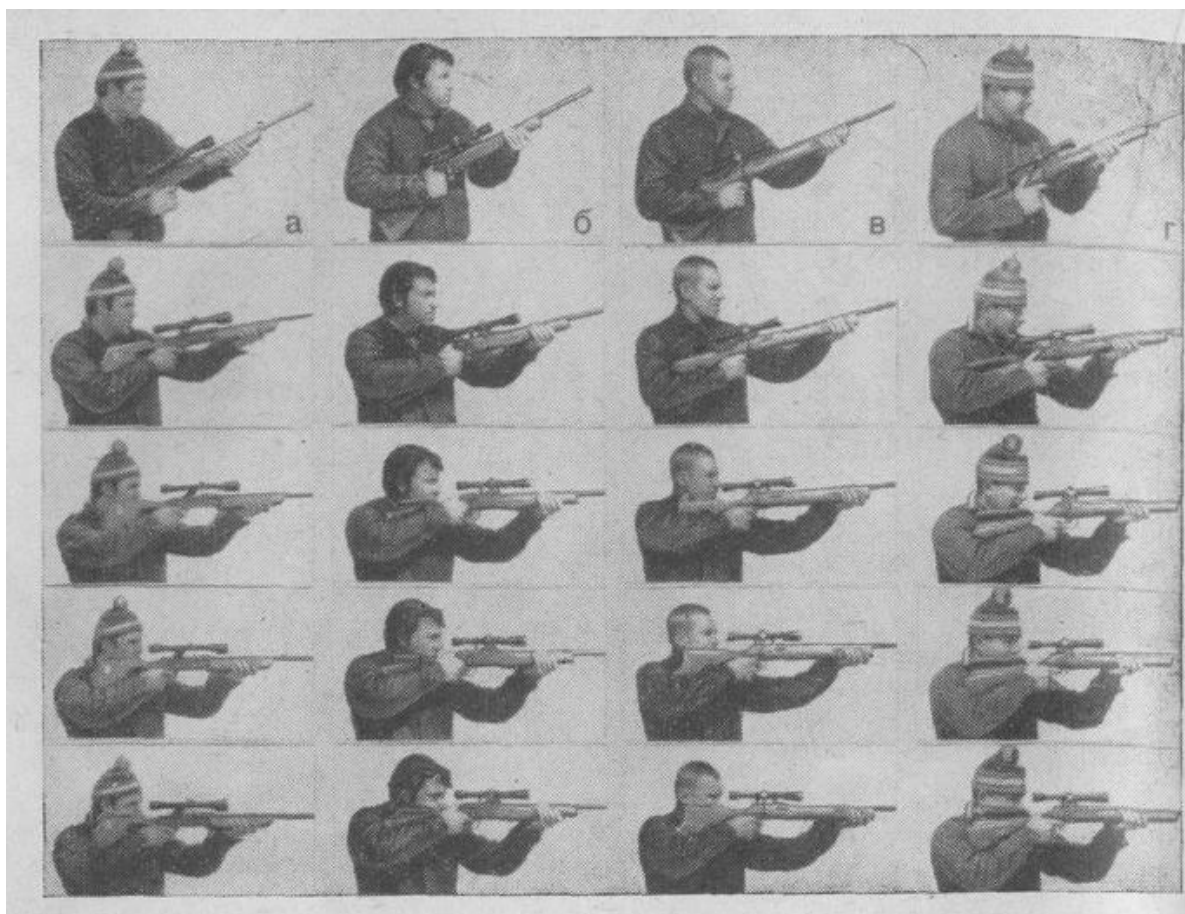


Fig. 264 - Film recording of the rifle being raised while shooting at the "Running Boar" target:

a - V. Postoyanov; *b* - Ya. Zheleznyak; *c* - I. Nikitin; *d* - V. Staratelov.

To successfully complete the exercise when shooting at a "wild boar", the rifle must be raised within 0.6-0.7 seconds. When the "wild boar" is running slowly, shots must be fired in an average of 3.5-4.3 seconds, and when running quickly - in 2.1-2.3 seconds (Fig. 265, 266).

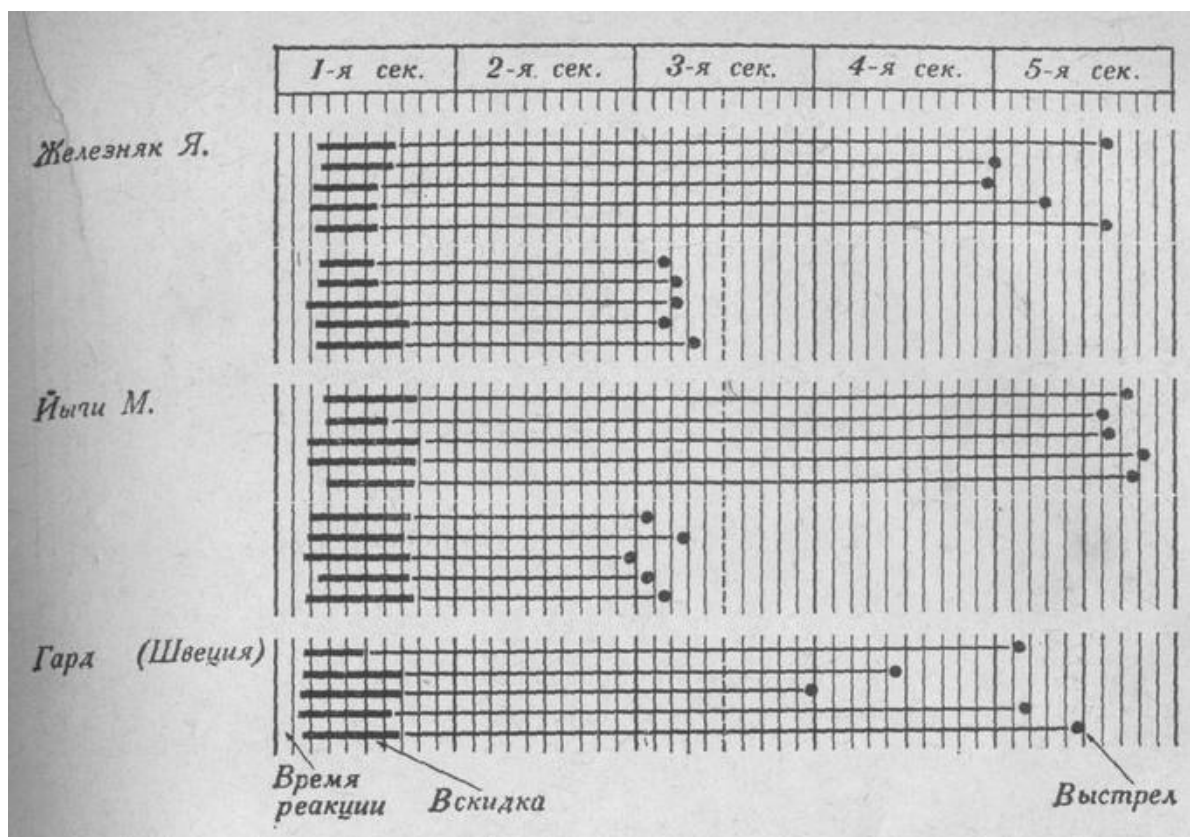


Fig. 265 - Graphic recording of the firing of individual series of shots when shooting at the "Running Boar" target, May 1972 (time counting was done using the method of G.V. Vasyukov and V.N. Sablin)

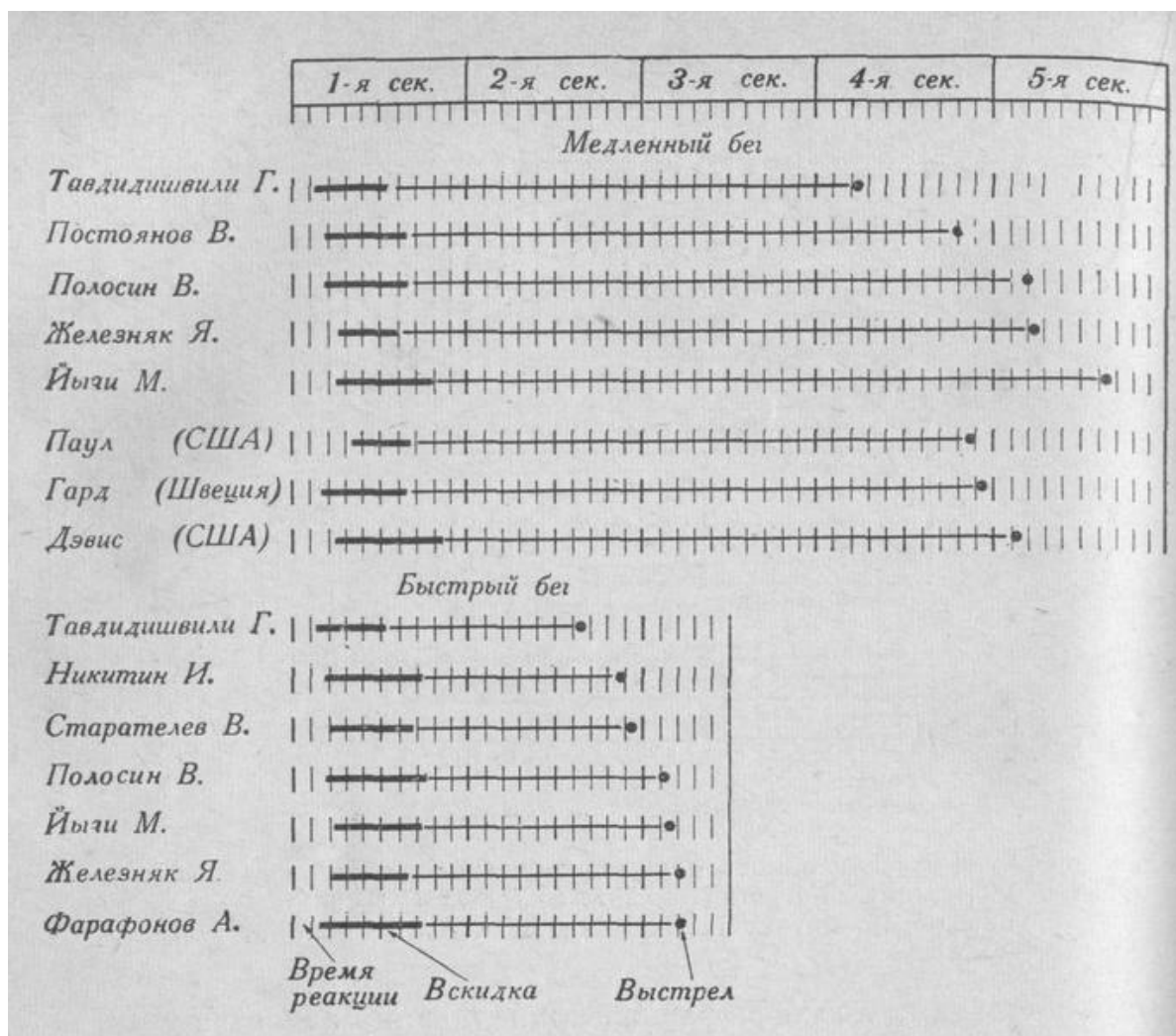


Fig. 266 - Average shot times for some leading athletes when shooting at the Running Boar target, May 1972.

When shooting with an optical sight, the most common options for choosing an aiming area are the area near the nose of the "boar" (see Fig. 218).

Finally, it should be said that the execution of exercises - shooting at moving targets in general and at the "Running Boar" target in particular - requires from the athlete a great deal of composure, maximum concentration and attentiveness to all actions at the firing line. The development and manifestation of these qualities throughout the shooting of the entire exercise is an integral part of the shooter's preparation for the execution of these fast-paced shooting exercises.

Chapter 2. Sports exercises performed when shooting from a pistol (revolver)

4.2.1 Shooting from a free (match) 5.6 mm pistol

The most difficult and challenging exercise to perform is MP-6 - shooting at a target with a black circle at 50 m - 75 rounds (15 test and 60 qualifying). It takes 2 hours 30 minutes to complete. Below we will look at the technique and tactics of performing this exercise.

The need to fire 60 qualifying shots, when the processing of each one individually requires at times repeated lifting and holding the pistol in an outstretched hand, forces the shooter to expend significant physical and volitional effort. In this regard, the athlete must carefully think everything through in advance, develop his own, quite specific shooting style taking into account individual characteristics, so that during the exercise he can rationally expend his strength and thus maintain shooting efficiency throughout the entire shooting.

Before shooting, especially in the morning, on the first shift, it is necessary to do a warm-up to restore blood circulation and the necessary reaction speed after sleep. The warm-up should be both general (a set of exercises included in the usual morning exercises) and special (a certain dose of static load for the muscles of the right part of the shoulder girdle and the muscles of the right hand). For this purpose, experienced shooters in the morning, after exercise, stand with a pistol for several minutes and aim, clicking "idle".

In addition, it is advisable to give additional load to the flexor muscles of the index finger: bending and unbending the index finger at a fast pace several dozen times with breaks between series of such movements, imitate pressing the trigger. It is useful and at the same time convenient to warm up the flexor muscles of the index finger before shooting from a sports revolver, quickly pressing the trigger with your finger several dozen times in a row. If you shoot immediately after sleep without warming up, then the position as a

whole does not have sufficient immobility, the right hand, especially the wrist, sways much more than usual.

Let us now consider in general terms some issues of technique and tactics of slow shooting from a pistol from the moment the shooter reaches the firing line.

Each time before starting to shoot from a pistol, it is necessary to check the correctness of the adopted position in relation to the target in order to avoid excessive muscle tension, in which the hand with the pistol will be constantly pulled to one side from the center of the target, which will have a negative effect on the nature and magnitude of the weapon's oscillations. It is also necessary to check the grip in relation to the position and work of the index finger: does the pistol shift from the movement of the finger when pressing the trigger. After the specified check, the athlete can directly begin shooting.

The key to successfully completing an exercise in shooting from any type of sporting weapon is, as already mentioned, the observance of one indispensable condition: when making each individual shot, the shooter must correctly and as uniformly as possible perform all shooting techniques (readiness, aiming, holding the breath and pressing the trigger). All actions on the firing line when performing a particular sporting exercise must be subordinated to the observance of this fundamentally important condition.

It is quite obvious that the production of an accurate shot is directly dependent on the degree of immobility of the athlete's body with a weapon when ready to shoot. However, in order to shoot the entire exercise well, to conduct prolonged shooting from a pistol or revolver with a large number of cartridges, it is necessary to be able to maintain not only a stable, but also a uniform position from shot to shot. Therefore, the shooter, having started to shoot a series of shots, should try to keep everything unchanged in the position as much as possible: not to move from the place (or to precisely restore the previously adopted position of the feet before each shot), to lean the body to the left uniformly, to maintain an unchanged grip, to try to load the muscular system uniformly, first of all, the right part of the shoulder girdle and the right hand, that is, to create the same conditions for the production of each individual shot.

However, it is impossible to maintain the same position during shooting, since after each shot or the next raising of the hand when trying to fire a shot, the shooter breaks the position due to the need to rest and reload the pistol. Therefore, during shooting, the ability to restore the position for the next shot is of great importance. To do this, before each shot, you need to perform a series of successive movements: throw your body to the left, bending at the waist, raise your right hand with the pistol slightly upward, and then, aiming the "level front sight" at the aiming area (lowering or raising your hand), achieve composure and final fixation of the moving parts of your body in the position of the position; moreover, the entire complex of these movements should be practiced to the point of automatism, so that they are all performed each time in exactly the same way, monotonously. As the practice of the best shooters has shown, it is most advisable to complete the entire complex of movements when processing a shot in 4-6 seconds.

If you follow the complex of movements performed by experienced shooters when processing a shot, it is easy to notice that all of them, before making the outstretched arm with the pistol as still as possible, make several oscillating movements with it; these movements vary in magnitude and frequency among different shooters, but they are always made, and their character is the same when processing each shot (see Fig. 267). The fact is that such deliberate oscillating movements of the hand require alternating work of the flexor and extensor muscles and contribute to better interaction between the motor centers of the cerebral cortex and, as a consequence, more coordinated work of the muscle groups to ensure the greatest degree of immobility of the hand for the time necessary to produce an accurate shot.

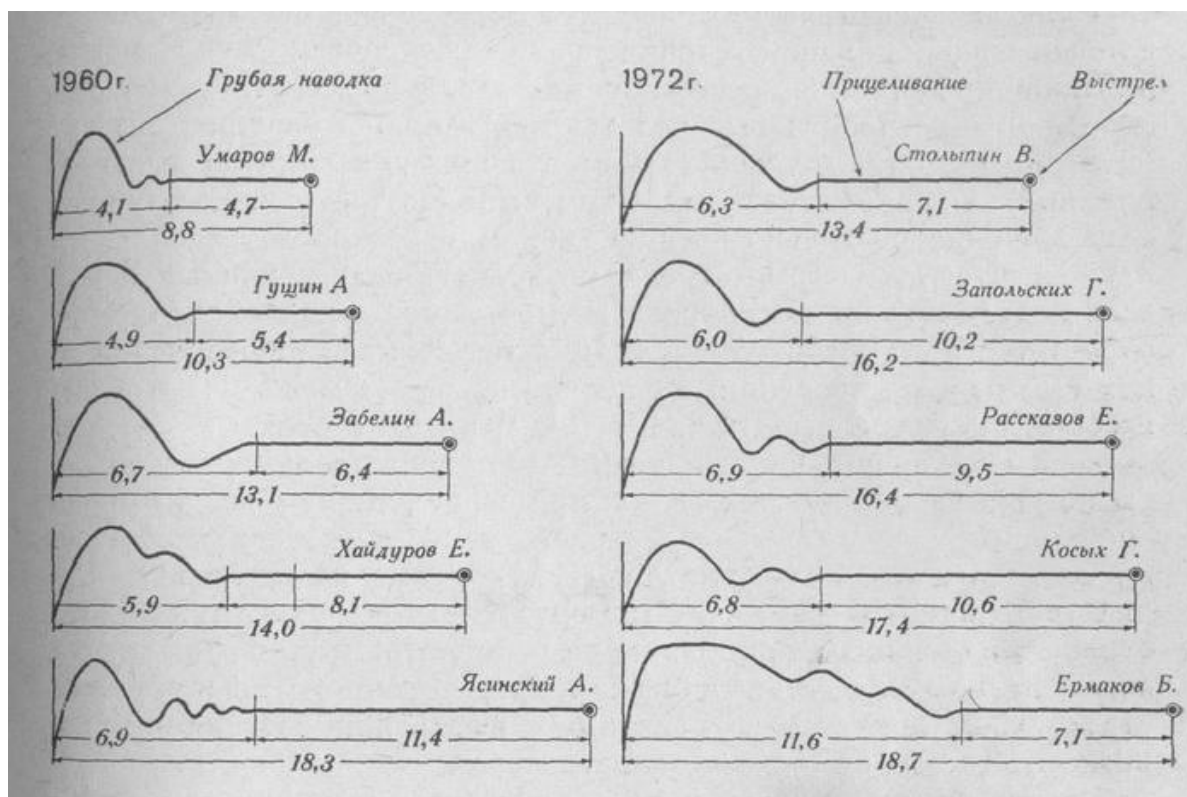


Fig. 267 - Approximate data on the average duration of shot processing during slow shooting from a pistol and revolver. Time (sec.) from the beginning of raising the hand to the shot

Aiming, especially when shooting from a pistol or revolver, is known to be to a large extent an act of motor order, consisting in the fact that the shooter clearly perceives with his eye the disturbance in the mutual arrangement of the sighting devices and the target and restores the aiming line with the corresponding movement of the hand. During aiming, your attention should be focused not only on reducing the oscillations of the hand with the pistol, but also on constantly maintaining a "level front sight". In order to better fulfill this essential requirement when shooting, it is necessary to focus your gaze on the sighting devices, clearly see the front sight in the slit of the sight, somewhat neglecting the clear visibility of the "apple" of the target. The greatest accuracy in shooting can be achieved by completing aiming within 7-9 seconds; after 12-15 seconds the aiming accuracy decreases, not only because the shooter's visual acuity is dulled, but also because the muscles of the right hand become fatigued, which increases the overall range of its oscillations. Therefore, especially when shooting slowly, accuracy should be achieved not by aiming for a long time, but by

confidently handling the shot in the first seconds (4-6 sec.) of aiming, since the range of oscillations of the hand with the weapon at this time is, as a rule, the smallest.

When shooting, you should generally hold your breath on an incomplete inhalation; take a few deep breaths and then inhale more slowly than usual, and then hold your breath. To prevent your body from feeling oxygen starvation during prolonged shooting, you should hold your breath for no more than 12-15 seconds. If you are unable to shoot during this time, you should stop aiming, ventilate your lungs well with several deep breaths and exhalations, and give yourself a rest before attempting to shoot again.

The trigger pull, as in rifle shooting, must be smooth and strictly coordinated with correct aiming. No matter what trigger control method the shooter uses, in order to ensure a smooth pull on the trigger, he should learn to complete it within 1.5-2.5 seconds. Having chosen the most favorable moment, when the weapon experiences the least vibrations and the "flat front sight" is in the aiming area, you need to boldly and confidently, but necessarily smoothly, without jerking, pull the trigger. It is very important for the successful execution of the shooting exercise to acquire the ability to stop pulling the trigger in time, as soon as the athlete feels that the time favorable for firing a shot has expired. If within 10-12 seconds from the beginning of the aiming refinement it was not possible to shoot, you need to force yourself to stop further processing the shot, take your finger off the trigger, lower your hand with the pistol and rest.

Based on the practice of leading shooters, the most rational shooting from the point of view of energy expenditure throughout the entire exercise is the shooting in which the athlete makes a shot quickly, spending a total of 12-18 seconds on it (from the moment the hand is raised to the shot, Fig. 267). However, in order to successfully perform shooting exercises, it is important not only to generally economically expend energy when making each shot, but also to be able to restore it to the greatest extent during the shooting. Therefore, the question of the number of arm raises when trying to shoot, the duration of breaks between shots and series of shots, as well as the tempo and rhythm of shooting are of great importance.

No matter how well the shooter is technically prepared, no matter how confident he is in his abilities, with the modern high level of sports results he does not always risk shooting from the first time he raises his hand with the pistol. Usually, if he fails to shoot within 15-17 seconds from the moment he raises his hand with the pistol, the shooter stops aiming and, lowering his hand, rests, and then makes another attempt. Of course, this is how shooting should be conducted, without delaying the shot. However, it should be remembered that multiple attempts to shoot are a rather dangerous path that can lead to excessive fatigue of the visual apparatus and muscles of the right hand long before the end of the exercise. It is precisely such fruitless multiple attempts that exhaust an athlete most during prolonged shooting. Therefore, one should strive in every way to quickly get involved in the process of performing the exercise in such a shooting mode and in such a working state, in which a feeling of confidence will appear that in the nearest period of time necessary to complete a smooth press on the trigger, "the hand will not fail", no sudden unexpected movement will occur. Internal confidence that the hand with the weapon can remain relatively motionless for a slightly longer time than is necessary to produce an accurate shot, allows you to shoot calmly, as a rule, on the first or, less often, on the second attempt. As the practice of leading shooters' performances has shown, it is precisely in this shooting mode that the most outstanding sports results were shown.

Since it is not always possible to get into such shooting, each shooter should, in the process of training, taking into account individual characteristics, develop a very specific shooting style, in particular with regard to the number of arm raises in attempts to make a shot. For this purpose, you should establish for yourself a certain, acceptable layout of arm raises when shooting certain series of shots, forcing yourself by willpower not to abuse the number of attempts so that there is enough strength and time to complete the entire exercise, and the quality of shooting does not decrease. Of course, it is generally impossible to maintain exactly the same layout of arm raises for each shooting due to the different state of the shooter and the developing situation. However, in principle, the shooting style of a particular athlete should remain the same, characteristic of him, which is confirmed by observations of experienced athletes. If a shooter has developed a style of rapid shooting with a certain number of arm raises when processing each shot,

then he will complete the entire exercise, say, in 1.5 hours, plus or minus 10-15 minutes. on the established shooting characteristics of that day. He simply will not be able to abruptly change his usual shooting mode - with such an increase in the number of raises before each shot, in order to fully use the allotted time for the exercise - 2.5 hours. An attempt to greatly change the established skills and increase the physical load will only lead to a sharp decrease in the quality of shooting.

Below, in Table 17, are data on the number of hand raises with a pistol during the exercise performed by some leading shooters on a given shooting day. These data largely characterize the style of a particular athlete, since they adhere to it with relatively small deviations in each performance.

**The number of hand raises with a pistol during the execution
of the MP-6 exercise by some leading athletes
(match pistol 15+60)**

Table 17

Surname	Month, year	Number of throws in a se- ries						Total number of throws for 60 shots	Total time to com- plete the ex- ercise (with tri- als)
		I	II	III	IV	V	VI		
Umarov M.	VII.59 credit. tr.	11	11	11	11	14	10	68	2:00
	VIII.59 competi- tion.	10	13	14	12	12	14	75	2:15
Yasinsky A.	VII.60 g. competi- tion.	12	11	10	14	11	12	70	2:40
Gushchin A.	VII.60 g. competi- tion.	19	15	11	12	12	19	88	2:25

Stolypin V.	IV.68 g. competi- tion.	12	14	13	13	11	12	75	1:38
Egrishin A.	IV.68 g. competi- tion.	31	16	22	12	16	18	115	1:52
Udachin A.	IV.68 g. competi- tion.	12	13	12	13	11	12	73	1:39
Rasska- zov E.	VIII.69 credit. tr.	16	21	14	18	12	13	94	1:47
Kosykh G.	IV.68 g. competi- tion.	12	12	17	16	10	14	81	1:45
	VIII.69 credit. tr.	10	10	10	10	10	10	60	1:33
	VIII.71 credit. tr.	10	12	11	10	10	11	64	1:21
	VIII.72 credit. tr.	10	10	10	10	11	11	62	1:20

As can be seen from the table, the leading shooters in the overwhelming majority make a shot on the first attempt, much less often on the second and very rarely on the third or fourth, which allows them to conserve energy throughout the entire exercise. Based on the experience of a wider range of leading shooters, it can be said that the most effective shooting is when an athlete makes approximately 50% of shots on the first attempt, 30-40% on the second and 10-20% on the third. It should be firmly remembered that success can be achieved not by multiple attempts to make a shot, but by economically using energy, spending a minimum of energy on each shot and thereby conserving energy throughout the entire shooting.

If the design of a pistol does not allow it to be reloaded without changing the grip, then after each reloading, you need to be especially careful to maintain its uniformity from shot to shot.

When shooting from a revolver or a sport pistol, all operations related to loading and cocking the hammer should preferably be

done with the left hand in order to maintain the same grip of the pistol with the right hand.

During the rest between shots or subsequent arm raises when attempting to fire a shot, it is necessary to ensure that the uniformity of the position is not disturbed: the angle of the body's rotation relative to the target, as well as the mutual arrangement of the feet, should remain unchanged if possible. In order for the rest to be as complete as possible, it is necessary to adopt a position that allows, without moving from the place, without changing the mutual arrangement of the legs, to sufficiently relax the muscles of the legs, shoulder girdle and, especially, the muscles of the right arm, to give them the opportunity to restore their working capacity. In cases where the shooter takes a short break between subsequent arm raises, as well as when shooting in gusty wind conditions, when it is necessary to be on the alert all the time in order to fire a shot during the lull between gusts of wind, it is most advisable to lower the right hand with the pistol, resting it on the shelf.

During the break between shots, you need to give rest not only to the muscles that hold your arm in a horizontal position, but also to the muscles of your hand. After a few shots, you should release your hand and put the gun on the shelf.

In order for the rest between shots or successive arm raises to be effective, the breaks between them must be long enough and, if possible, at equal intervals. Otherwise, the muscles of the right arm and shoulder girdle will not have time to restore their performance, which will lead to premature fatigue of the muscular system. Often, not very experienced athletes, having delayed the execution of the exercise in the first series and having got into time trouble, try to make up for lost time in the last series by reducing the breaks between arm raises. Such haste gives completely opposite results: from the thought that there is little time left, and the hand with the pistol "walks" and it is impossible to shoot without having properly rested during the excessively short break between raises, the shooter hurries to raise his hand with the pistol again and immediately lowers it, since the hand does not provide the necessary stability of the pistol for an accurate shot. Frequent attempts to shoot under such circumstances only lead to an even greater aimless loss of time. In such cases, despite the fact that

the shooter is in time trouble, he must force himself to shoot only after a long break between shots, and with the first or second raise of the hand.

Above, some issues of shooting technique when making several shots were outlined in general terms. Let us now consider - also in general terms - the technique and tactics of shooting from a free pistol when performing the MP-6 exercise.

Firing test shots, as has already been said, is always one of the most important moments in any shooting exercise. Therefore, in order to properly sight in a pistol, test shots should always be processed in exactly the same way and in the same shooting mode as the qualifying shots. At the same time, test shots should not be considered only as sighting shots. They serve as a means of drawing the shooter into a general, habitual and previously developed shooting style. That is why experienced athletes mostly click "idle" before test shots, and only then, when the position acquires the necessary stability and the correct visual-motor coordination is restored, they proceed directly to shooting.

When firing test shots, do not rush to make adjustments to the sight setting after 1-2 shots; if the STP diverges sharply compared to the previous shooting, you should check your position, and first of all your grip, and then after another 2-3 shots, firmly convinced that the pistol is not hitting the right spot, make adjustments to the sight setting.

When shooting test shots (and then test shots), it is necessary to match the shot mark with the location of the hole; if the mark does not coincide with the actual location of the hole, it means that the pistol is not hitting the right spot and it is necessary to make an adjustment to the sight setting.

When shooting, especially for such a long time as the MP-6 exercise, it is necessary to use trial shots sparingly. During the two and a half hours allotted for the exercise, the meteorological conditions or the shooter's condition may change significantly, which will lead to a change in the usual shooting style. The consequence of this is the appearance of premature fatigue, the need for a long break, after which it is necessary to shoot trial shots again. Therefore, most

leading athletes fire 7-10 trial shots before the start of the scoring shooting, leaving the remaining cartridges in reserve for unforeseen cases.

After the test shots, there is no need to take a break before the scoring shots, so that this transition is as least noticeable as possible.

If we are guided only by considerations of preserving strength during shooting, then it is obviously best to shoot at a strictly measured pace, firing shots at equal intervals and fully using the time allotted for the exercise. However, on any given shooting day, circumstances can rarely develop in such a way that rhythmic shooting can be carried out. Therefore, the athlete must acquire the ability, taking into account the situation, his well-being and individual characteristics, to vary the general pace and rhythm of shooting to some extent.

If the athlete feels that shooting has become easy for him during the first shots, he should continue processing the shots at the same pace, from the first or second hand raise, trying in every way to maintain the established visual-motor coordination of his actions for as long as possible. At the same time, no matter how well the shooting goes, the athlete should always be careful, not be careless when processing the shots, so as not to allow a breakdown.

Of course, during prolonged shooting, as has already been said, it is impossible to do without individual unsuccessful shots, but with each failure you need to be aware of why it happened. If an athlete, shooting at a strictly measured pace and not feeling tired, made a bad shot, which is accidental with well-established shooting, then you must, without paying special attention to it, continue shooting at the same pace. If an athlete, carried away by his good shooting, shooting at an accelerated pace and not attaching due importance to the onset of fatigue, strives to continue shooting, guided by considerations of maintaining the previous pace, "while the shooting is going well", then a bad shot will inevitably occur. It should no longer be considered accidental, but as a completely natural phenomenon, to which you should react in a completely different way. First of all, you need to force yourself not to rush after an unsuccessful shot, suppress the desire to shoot as quickly as

possible in order to compensate for the bad hole with further good shooting; haste when fatigue has set in only leads to a repeat of the breakdown. In such cases, after a bad shot, you need to rest and then start shooting at a slower pace, taking into account that the breaks between shots are sufficient in duration to restore the necessary performance of the arm muscles.

If at the beginning of the exercise the athlete feels that it is difficult for him to make shots, the hand with the pistol has not yet become stable and shooting is difficult, he should not rush too much; he needs to wait for some time, click "idle" until he feels confident that all actions during the processing of the shot have become sufficiently coordinated, and then confidently begin to shoot at a slightly accelerated pace from the first or second raise of the hand in order to make up for lost time.

Despite the fact that an exercise like MP-6 is given 2.5 hours to complete, some shooters, under certain conditions, especially during competitions, still do not have enough time. The most common reason for this is the difficulties that the athlete has in the coordinated action of aiming and pulling the trigger, when, with good stability of the hand with the pistol, he misses one favorable moment after another for a shot, overloading the hand with excessively frequent unsuccessful attempts to make it. In order not to get into time trouble under such circumstances, at the very beginning of shooting it is necessary to fight indecision and excessive caution when pulling the trigger. As with shooting from a rifle while standing, sometimes as a last resort it is recommended to force yourself to decisively make the first shot from the very first raising of the hand, even with a certain risk that it will not be accurate enough. Usually, in such a case, it is worth overcoming yourself at the beginning of shooting, as the coordination of action when pulling the trigger improves and the shooter begins to shoot calmly and confidently. In general, in principle, one should shoot at a measured, but somewhat accelerated pace, so that the shooter always has a certain amount of time - this makes shooting much calmer.

The most favorable rate of shooting from a free pistol is one in which it takes an average of 12-18 minutes to shoot a series of 10 shots. As an example, Table 18 shows the rate of shooting of some

leading shooters, which they generally adhere to when performing the MP-6 exercise.

**Rate of fire of some leading athletes during the MP-6 exercise
under favorable
weather conditions (match pistol 15+60)**

Table 18

Surname	Month, year	Time spent on shooting a se- ries, min.						Aver- age time for 10 shots, min.	Time to fire 60 rounds	Total time to com- plete the exer- cise (with trials)
		I	II	III	IV	V	VI			
Umarov M.	VII.59 tr.	11	14	11	11	12	10	11.5	1:09	2:00
	VIII.59 competi- tion.	12	15	19	16	14	17	14	1:24	2:15
Yasinsky A.	VII.59 tr.	19	16	15	17	16	17	16.6	1:40	2:40
Gushchin A.	VII.60 g. competi- tion.	34	19	10	13	14	24	19	1:54	2:25
Stolypin V.	IV.68 g. competi- tion.	12	11	9	14	12	10	13	1:18	1:38
Egrishin A.	IV.68 g. competi- tion.	25	12	17	10	12	15	15	1:31	1:52
Udachin A.	IV.68 g. competi- tion.	11	14	14	12	13	10	12.1	1:13	1:39
Rasska- zov E.	VIII.69 tr.	13	18	15	15	10	10	13.5	1:21	1:47

Kosykh G.	IV.68 g. competi- tion.	10	15	21	14	13	13	14.3	1:26	1:45
	VIII.69 tr.	12	11	11	10	10	10	10.8	1:04	1:33
	VIII.71 tr.	10	10	9	9	11	10	9.8	0:59	1:21
	VIII.72 tr.	10	10	9	12	11	11	10.5	1:03	1:20

Everything stated about the rate of fire applies to those cases when shooting is carried out under favorable meteorological conditions.

In order for any shooting exercise to be successful, the athlete must follow the rule: never rush when the weather changes abruptly; carefully assess the current situation, and only then, having chosen one or another tactical technique, confidently continue shooting in the new conditions.

The need to shoot in gusty winds requires the shooter to be able to make an accurate shot in a more limited time, 5-7 seconds. Successful shooting in such conditions is only possible if the shooter quickly prepares and makes an aimed shot during the lulls between gusts. To shoot in such a difficult situation, you should first find a position in which it is best to rest and wait out the gust of wind, so that when the lull comes, you can quickly prepare and shoot. The shooter must also be able to shoot at a fast pace, with a minimum number of arm raises; this is necessary, for example, to finish the exercise before dark if for some reason the last shift began shooting late or dense clouds approaching towards the end of the day threaten to hasten the onset of darkness.

You should also learn to shoot irregularly (this is especially important when shooting in gusty wind conditions, when you need to make the most of the time during a lull), sometimes firing one or two shots at a fast pace, sometimes taking long breaks to wait out the time that is unfavorable for shooting.

Successful execution of the exercise with such long shooting as MP-6 requires breaks of varying duration during the shooting

process. They are extremely necessary for restoring the working capacity of muscles, primarily the right arm and shoulder girdle, restoring visual acuity, etc.

Taking into account the practice of experienced pistol shooters, young shooters can be recommended to take breaks from shooting (under favorable conditions) based on the following.

If the shooting is going well at the very beginning of the exercise, you should try to take short breaks between series (no more than 5 minutes), otherwise, before the next scoring series, you will need to make test shots again. It is best to rest during such short breaks while sitting on a stool, placing the pistol on the shelf to give the muscles of the right hand a rest. After the first three series, a longer break is recommended (10-15 minutes), during which it is best not to sit still, but to walk around, massage the right hand, do a little warm-up, performing several free movements. Before the start of the scoring series after the break, you need to click "idle", make 2-3 test shots, and then start scoring shooting again, but with longer intervals between shots to give the muscular system an opportunity to better restore its performance.

If shooting is difficult from the very beginning, then the entire exercise should be divided into three parts, taking long breaks after every 20 shots.

Some leading shooters generally take breaks of 5-7 minutes after every 10 shots, without any long breaks during the shooting process.

Each shooter must decide for himself what tactics to use regarding the number and duration of breaks, taking into account his own data, level of training and external shooting conditions.

Above we have considered in general and in detail some elements of technique and tactics of performing one of the most difficult exercises in shooting from a free pistol. However, it is impossible to limit ourselves to only considering individual elements, since each of them is in a certain relationship with the others: thus, shooting at a fast pace requires long breaks between series of shots; rhythmic shooting with significant intervals between shots predetermines

shorter breaks between series of shots; processing of shots, accompanied by multiple arm raises, requires an extension of the total time for performing the exercise, etc.

In order to have an idea of the shooting style used by individual athletes, Fig. 268-270 provides a graphical record of the timing of the MP-6 exercise performed by leading shooters. The graphs show that the shooting style of each athlete, despite the different circumstances that develop during the exercise, remains, in principle, almost the same. At the same time, the execution of exercises by different shooters differs significantly in nature, which is determined by the individual characteristics of the shooter in terms of physical development, volitional qualities, state of the nervous system, endurance, etc. Therefore, each shooter must develop his own shooting style and adhere to it.

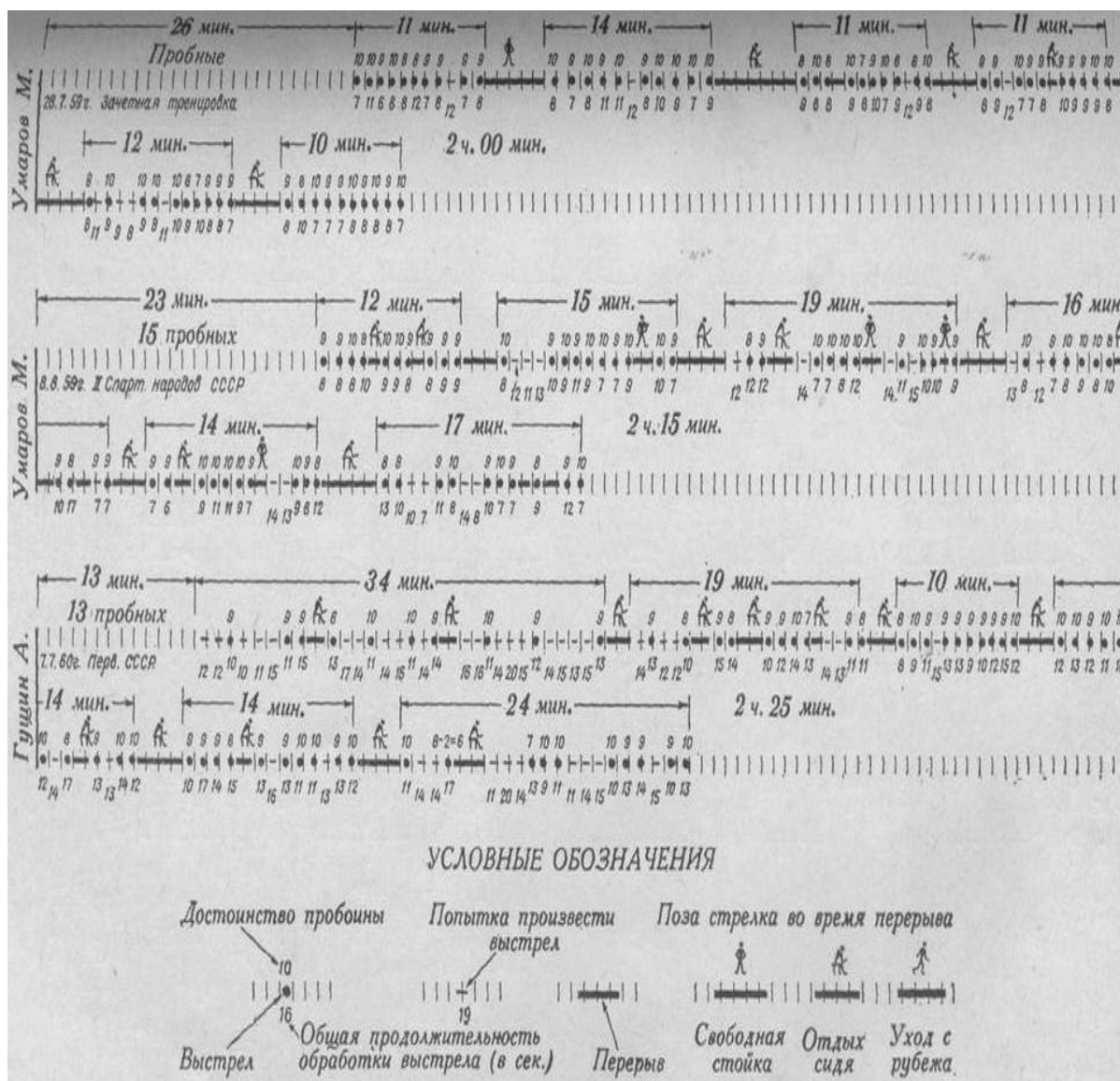


Fig. 268 - Graphic recording of the exercise. Shooting from a match pistol (MP-6)

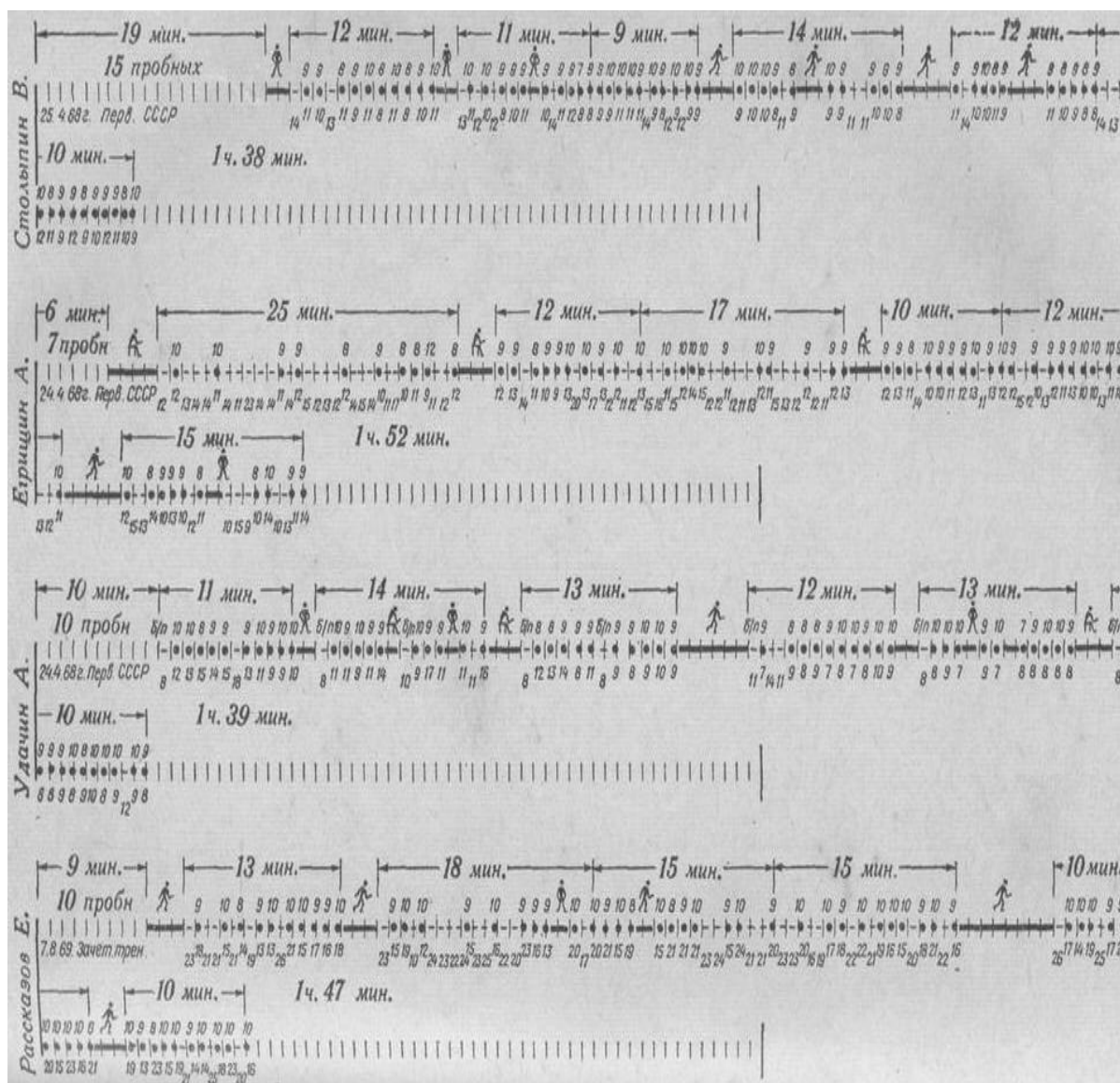


Fig. 269 - Graphic recording of the exercise. Shooting from a match pistol (MP-6)

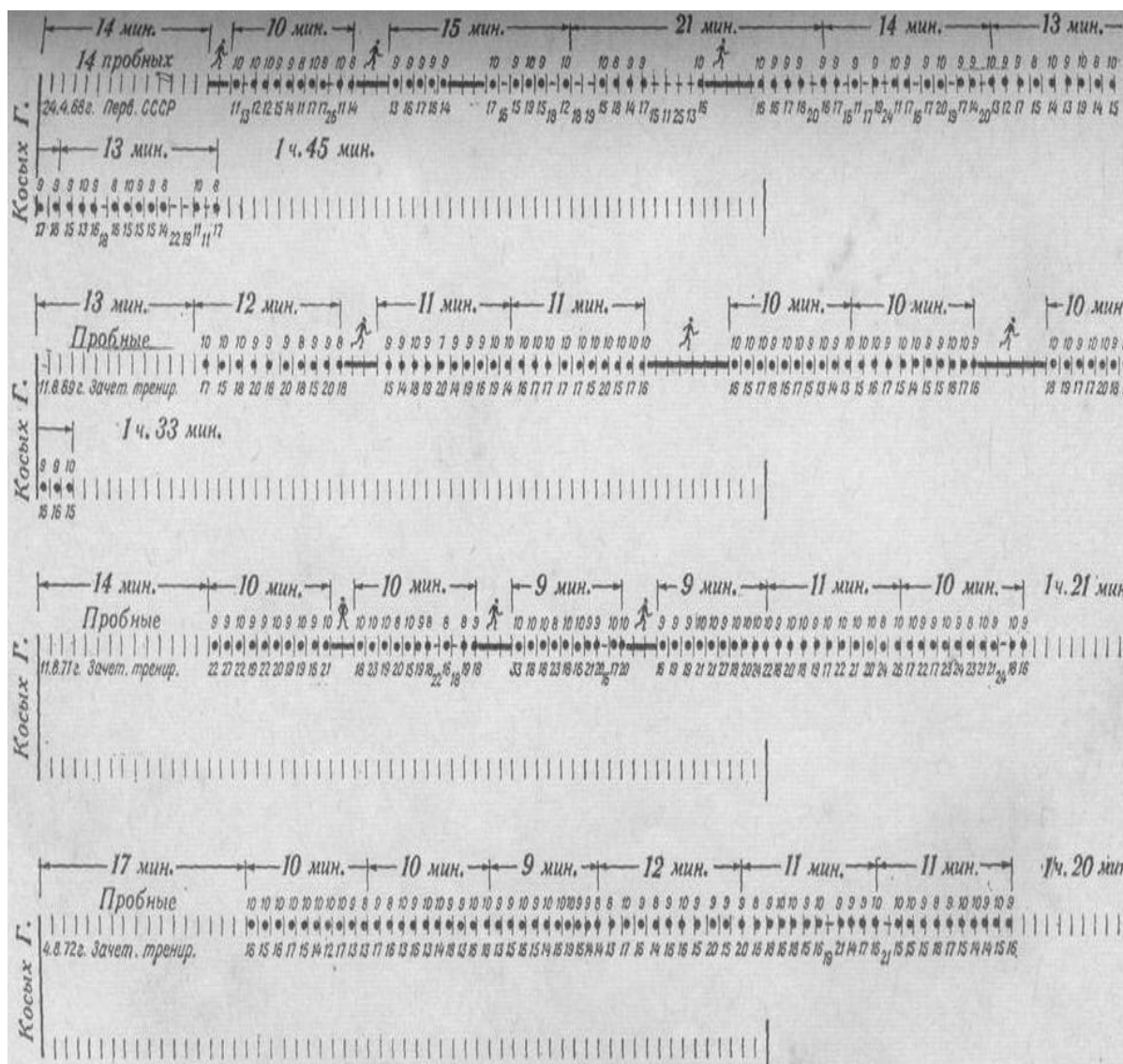


Fig. 270 - Graphic recording of the exercise. Shooting from a match pistol (MP-6)

4.2.2 Rapid fire from a self-loading pistol at silhouettes

Rapid pistol shooting at silhouette targets is conducted at a distance of 25 m. Holding his straight right arm with a loaded pistol lowered at an angle of 45° , the shooter reports: "Ready!" After this, in 2-3 seconds, the silhouette targets appear (unfold) and the shooter opens fire independently, firing 5 shots - one at each target. Shooting is conducted in a very limited time: the athlete must fire 2 series of 5 shots in 8 seconds each, 2 series - in 6 seconds and 2 series - in 4 seconds. Exercise MP-8 provides for such shooting to be performed twice.

The peculiarity of shooting exercises of this type is a very fast rate of shooting combined with the transfer of fire to each of the 5 silhouettes, which requires the shooter to have a well-developed sense of timing and impeccable shooting technique, brought to automatism in each of its elements.

Let's look at the technique and tactics of performing this fast-paced and dynamic shooting exercise from the moment the athlete steps onto the firing line.

First of all, when going to the firing line and preparing for shooting, the athlete should not forget for a minute that there will be high-speed shooting, in a very limited time, during which it is impossible to correct any mistake made in preparing the weapon and cartridges. Therefore, first of all, you should start with preparing your "workplace" - a table on the firing line, where the pistol, cartridges, a rag for wiping hands, an oiler, a screwdriver and other accessories should be. Immediately before shooting, you need to check the weapon again, paying special attention to its condition, lubrication, cleanliness of moving parts, so that the pistol does not fail at the most crucial moment - when firing a series of shots.

Further actions related to loading the pistol and checking its readiness must always be performed in strict sequence, concentrating on each operation separately, carefully monitoring yourself and not relying on previously developed automatism of actions; shooting practice knows many cases when athletes absent-mindedly forget to load a cartridge into the chamber and raise the safety catch, etc., which hopelessly spoils their result. Therefore, before each series, you must carefully and consistently do the following: load the magazine and check that it contains all five (or six - with the referee's permission) cartridges; insert the magazine into the pistol grip, sending it under the latch; wipe your right palm dry with a rag or rag; pull back the bolt and load a cartridge into the chamber; check the tightness of the bolt locking the chamber, check whether the safety catch is released. Attaching great importance to such a consistent check of their actions, some, even experienced, shooters stick a poster listing all these points on the inside of the lid of their shooting case.

Since the position for rapid shooting at silhouettes must have, together with increased rigidity, sufficient elasticity necessary for smooth rotational movement of the body with the arm when moving to the next silhouette, the correct orientation of the shooter's body in relation to the silhouette is of great importance. In shooting practice in recent years, as has already been said, two methods of position orientation have become widespread - by the first silhouette and by the middle one.

The position with orientation on the first silhouette is expedient in that the athlete creates the most favorable conditions for the first shot, the most difficult in technique (see below) and decisive for the quality of the execution of the entire series. The position on the middle silhouette is advantageous in that it does not require excessive "twisting" of the body at the waist by the end of the shooting of the series - when transferring fire to the last silhouettes.

Although the first silhouette stance is more common, the practice of leading shooters shows that outstanding results can be achieved with the middle silhouette stance. Therefore, each shooter should test both stances, choose the one that suits him best, and stick to it.

The preliminary position in the "ready" pose should be (with the exception of the position of the right hand) as close as possible to the shooting position, so that raising the hand and moving to the final position is not accompanied by a sharp shift in the overall center of gravity of the shooter's body (see Fig. 169).

The correctness of the position relative to the first (or third) silhouette is verified in the usual way: if, when raising the hand in the "ready" pose, the shooter finds that the barrel of the pistol is directed somewhere away from the silhouette, the direction of the barrel should be changed not by moving the hand, but by changing the angle of rotation of the entire body relative to the silhouette by rearranging the feet. Then, having checked the position again by a natural, most free two-three-fold raising of the hand with the pistol and having made sure that this movement of the hand during the rise is sufficiently smooth, it can be considered that the shooter is completely ready to shoot.

However, before giving the signal: "Ready!" - you need to look around carefully, so as not to have to shoot a series in unfavorable conditions - in a gust of wind, which can sharply reduce the accuracy of shooting. It should always be remembered that with the appearance of silhouettes, the athlete has to shoot regardless of the current situation. Therefore, giving the signal: "Ready!" - should be timed, as a rule, to a period of calm.

Let's look at the shooting technique when making the first shot.

Correct handling of the first shot is one of the main elements when shooting the entire series. The difficulty in making the first shot is due, firstly, to the fact that the path traveled by the right hand with the pistol when raising it is much longer than the path traveled by the hand when transferring fire to the next silhouette. Secondly, making the first shot should take a certain amount of time so as not to disrupt the required rate of fire when shooting the entire series. Thirdly, the quality of shooting the entire series depends on the quality of handling the first shot. Indeed, as soon as the athlete delays the first shot, the usual rate of shooting will be disrupted, since, fearing that there will not be enough time to shoot the series, the shooter inevitably begins to hurry too much. At the same time, if the sportsman in a hurry makes a mistake in handling the first shot, then, as a rule, the whole series will be spoiled, because in the remaining time, simultaneously with the transfer of the hand to the next silhouette, the shooter will not be able to correct the previously made inaccuracy in his actions, and the shooting will go "awry". Therefore, the first shot should always be given the most serious attention.

The arm lift during the eight- and six-second series should be in the nature of a quick but soft jerk with a gradual, smooth slowdown of the movement as the "level front sight" approaches the "ten", and then a short stop of the arm to make an aimed shot. The beginning of the arm lift, reminiscent of a "toss" in its nature, should not be very abrupt, so that the arm does not have lateral deviations from the vertical plane when lifted, and so that noticeable vibrations of the shooter's body are not caused by the abrupt shift of his overall center of gravity.

However, the complexity of the technique of making the first shot is associated not only with raising the hand, but also with the fact that this same time must be used to perform two actions: moving the index finger to press the trigger and aligning the front sight in the notch of the sight.

It is obvious that an accurate shot, even in high-speed shooting, is only possible if the trigger pull is fast enough and necessarily smooth. If the shooter starts pulling the trigger only when the arm lift is complete and the "level front sight" is brought to "ten", then the process of smoothly pulling the trigger will take too long. The desire to gain time by reducing the trigger pull time will only lead to a jerk, twitching and a sharp shift of the pistol at the most crucial moment of the shot. Therefore, in order to gain the time necessary for a smooth trigger pull, you should start pulling the trigger together with the arm lift. The movement of the index finger when pulling the trigger should be similar in nature to the movement of the arm when lifting (first fast and energetic, followed by a slow-down in pressing by the time the arm lift is completed), so that when the hand stops, a slight additional effort is required for a soft, smooth squeeze of the trigger. The art of firing the first shot in rapid fire is essentially the coordinated action of raising the hand and simultaneously moving the index finger when pressing the trigger.

The method of handling a shot, based on the coordinated action of raising the hand and moving the index finger when pressing the trigger, requires special adjustment of the trigger mechanism. Based on the experience of leading shooters, the following recommendations can be adopted. By its nature, the trigger should be soft, with a tension of 100-200 g, without warning and long, with a working stroke of the trigger of 3-5 mm. A sufficiently long trigger is necessary so that the shooter, relying on the developed muscle memory, could accurately determine the approach of the moment of the end of the trigger release and the shot by the movement of the finger.

The time spent raising the hand should also be used to facilitate further aiming at the silhouette. Having assumed the "ready" position, the shooter should direct his gaze to the lower part of the silhouette at which the first shot will be fired. As soon as the silhouettes appear and the right hand begins to rise, the gaze should be

immediately transferred to the sights, using the time spent raising the hand to align the front sight in the notch so that by the time the lift is complete there will already be a "level front sight". If this time is not used to find and align the front sight in the notch, the shooter risks being faced with the fact that with the hand fully raised the front sight will not be in the notch at all and will have to waste time searching for the front sight and aligning it in the notch. To ensure that the front sight is in the slot, as well as the necessary aiming accuracy for shooting at silhouettes, it is necessary to use a sufficiently wide front sight - 2.75-3.5 mm and a slot in a ratio of approximately 1:2 to the visible width of the front sight (see Fig. 211).

So, above we have considered the shooter's set of actions when firing the first shot in an eight- and six-second series.

Now let's look at the technique of processing the first shot in a four-second series. The difficulty of firing a shot in this case is due to the very limited time allotted for firing the entire series, and, consequently, to the small period of time that can be allocated for the first shot without obvious damage to the quality of firing the entire series of shots. The fact is that with a four-second series, the shooter actually has less than 4 seconds: the period between the beginning of the visual perception of the appearance of silhouettes and the response - the beginning of raising the hand - takes at least 0.14-0.20 seconds with a very good reaction of the shooter; for the bullet to fly to the silhouette, 0.1-0.12 seconds are required. Consequently, to fire a four-second series, the shooter has approximately 3.7 seconds. From this it becomes obvious what difficulties the shooter faces when firing the first shot in this small period of time, which can be carved out of the meager overall time budget allotted for firing the entire series.

The processing of the first shot in a four-second series is in principle close to the eight- and six-second series, only it is performed in an even shorter time. The raising of the hand during a four-second series is the same in nature, with a short stop of the "level front sight" in the "ten"; the movement of the index finger is more energetic, but with a limited time, the completion of the trigger release should also be without a jerk. It is necessary to intercept the pistol with a glance already with a more flat position of the hand, which somewhat reduces the possibility of timely alignment of the front

sight in the slot due to lack of time; thus, with a delay in the production of the first shot, the shooter risks the quality of shooting the entire series. At the same time, an excessively fast raising of the hand is not at all a reliable means of reducing the time of the first shot, since in this case the hand with the gun often "slips" the center of the target, and it is necessary to spend time on lowering it, and this leads to exactly the opposite results - a loss of time and a violation of the rhythm of shooting the series. If, however, when quickly raising the arm in order to prevent it from "slipping through", its movement is sharply slowed down, then this requires significant muscular effort, which makes it difficult to refine the aim and maintain a "straight front sight".

The basic diagram of the coordinated action of raising the hand, pressing the trigger with the index finger and aligning the front sight in the notch when firing the first shot in a four-second series is shown in Fig. 271.

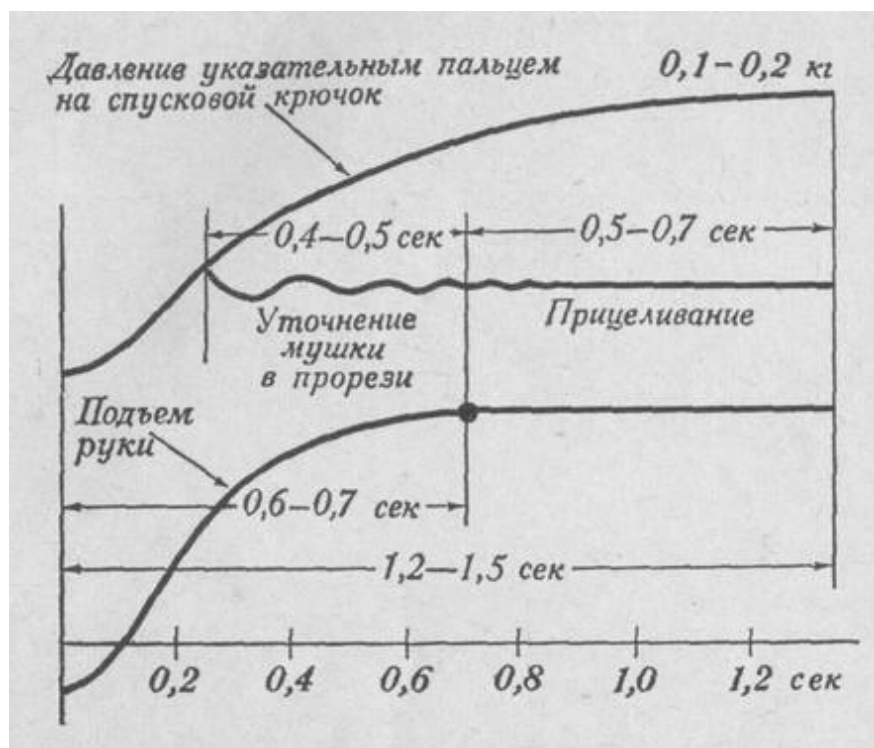


Fig. 271 - Schematic diagram of the hand movement when raising the trigger while simultaneously pressing the trigger and aligning the front sight in the notch when firing the first shot of a four-second series

Fig. 272 shows various basic schemes for practicing the first shot in a four-second series: each of the schemes given has its positive aspects. Thus, variant I is good in that the shooter has a relatively large time to align the front sight in the notch. However, a quick and significant shift of the gaze downwards can lead to the fact that when subsequently raising the hand and following the sights with the gaze, the general orientation relative to the center of the target will be lost, as a result of which the hand with the weapon will be moved somewhere to the side of the "ten". With variant II, when the gaze is directed not at the center, but at the lower part of the target, it is necessary to shift it less to intercept the sights. Variant III is characterized by the fact that the shooter looks with a distracted (unfocused) gaze at the lower part of the target; then, when the sights meet the gaze, as the hand is raised, the gaze begins to focus on the sights; In this case, the relative position of the front sight in the slot is specified. In option V, the shooter does not move his gaze downwards at all, but meets the sighting devices at the level of the "ten". In this case, when observing the athlete during shooting, it seems that he slowly raises his hand and the shot will be fired with a delay. In fact, the shot is fired quickly, as if on the move. It must be said that with this method, the hand with the gun is very accurately brought to the "ten", which requires minimal time to clarify the aim. As can be seen, with this option, the property of the visual analyzer in relation to correction and control of the movement performed has a positive effect. Here, the same thing takes place as when riding a bicycle, when in one case the cyclist looks at the front wheel and barely maintains balance, and in the other - looks forward and confidently rides almost in a straight line.

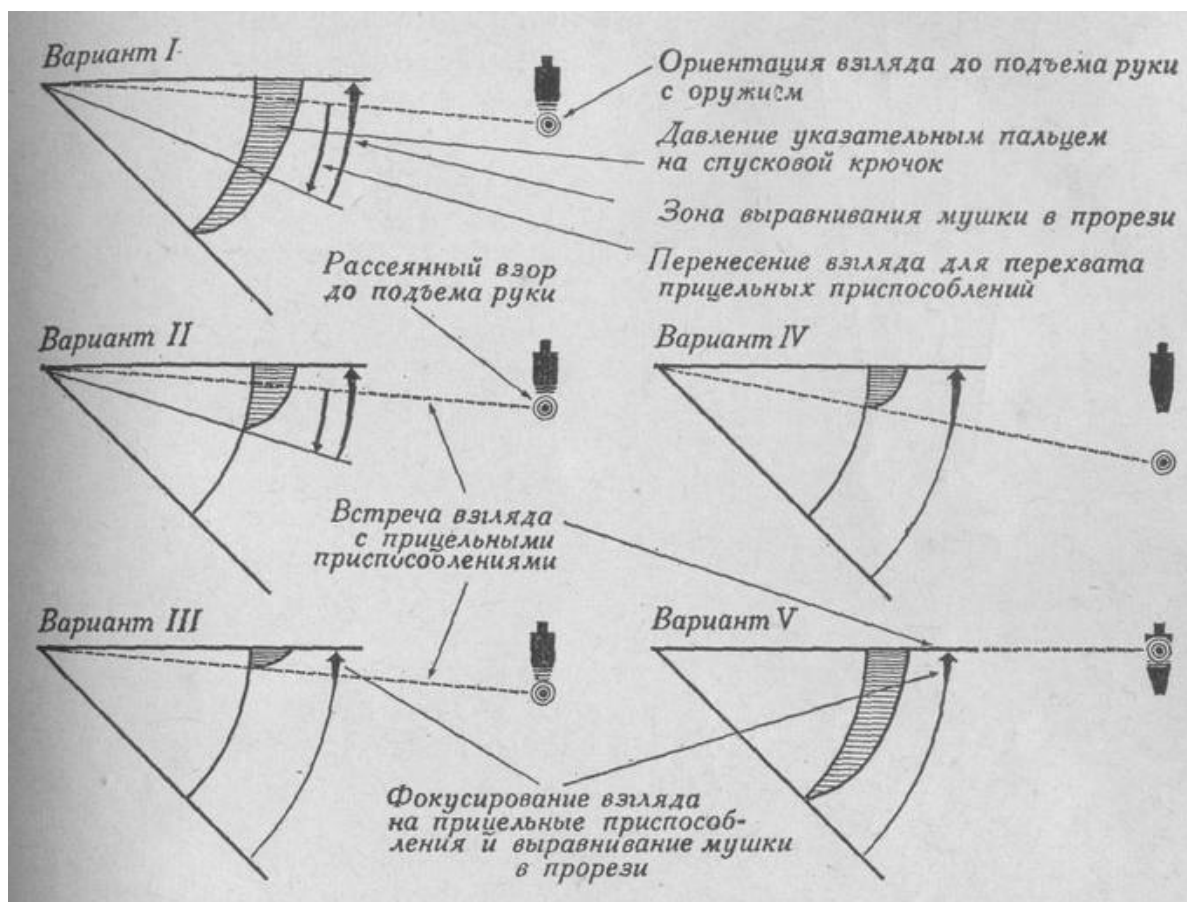


Fig. 272 - Basic diagrams of processing the first shot in a four-second series

Considering the great importance of the first shot for the shooting of the entire series, it is necessary to try several methods of processing it in order to choose the most acceptable one for yourself.

The series of shots should be started from the first silhouette on the right, moving the fire from right to left. This sequence of shooting has undoubted advantages, which are determined by the direction of the pistol's displacement during recoil, as well as the fact that the view of the silhouettes located to the left of the pistol is much better than to the right.

The transfer of fire from one silhouette to another should not be done by an isolated movement of the arm, but by turning the entire body with the right arm firmly attached to it (see Fig. 168). After the shot, the athlete should quickly but elastically rotate the body with the arm towards the next silhouette, followed by a short stop of the "level front sight" on it, while fixing each time on each silhouette the next shooting position. This is where the difficulty of transferring

fire from silhouette to silhouette lies to a certain extent: it should not be done by a continuous rotational movement of the body, but by alternating a smooth movement with fading, with clear, "dotted" stops of the body with the arm on each silhouette, which requires strictly coordinated and clear actions based on firmly developed visual-motor skills.

In order to ensure more strict control over the accuracy of the rotation of the body with the arm and its subsequent stop, many leading shooters immediately after the shot transfer their gaze to the center of the next silhouette, meeting a "flat front sight" near the "ten" and at the same time slowing down the movement of the body with the arm (Fig. 273).

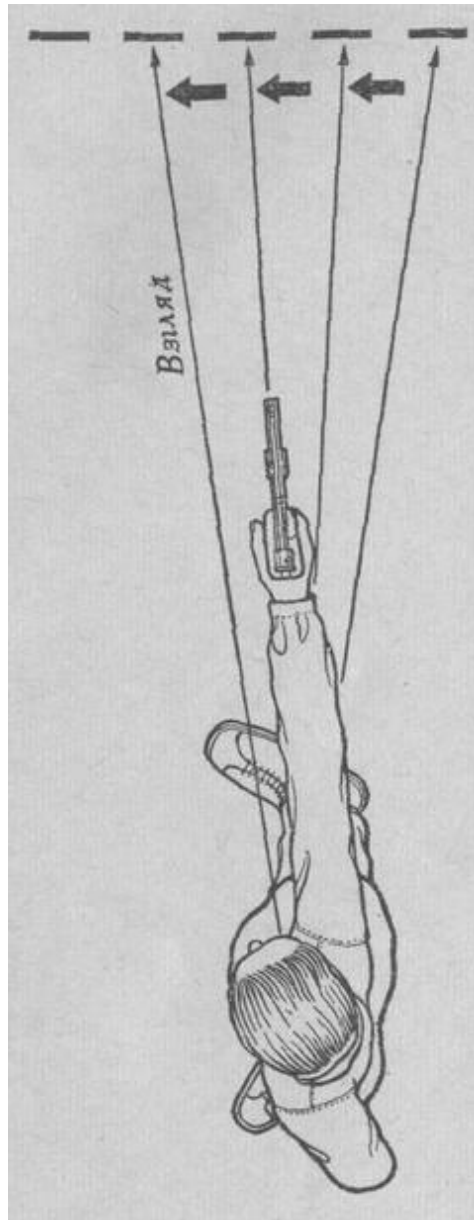


Fig. 273 - Preliminary shift of the gaze to the center of the next silhouette and subsequent meeting of the "flat fly" with the gaze

The trigger release technique when transferring fire from one silhouette to another should be such that the time spent on the movement of the body with the arm can be used rationally. Therefore, the trigger pull should basically be the same as when processing the first shot. First of all, it is necessary to develop the habit of immediately moving the finger away from the trigger by 2-3 mm after the shot to prevent a delay in shooting due to the fact that the trigger was not loosened. After such a throwing back, the finger must be immediately placed on the trigger. A quick movement of the index finger ("throw" from the trigger and placing it on it) should

be done during the movement of the hand on the way between the silhouettes. Following this, it is necessary to immediately begin an energetic but smooth pull on the trigger to ensure an accurate shot. The basic diagram of the shot processing when transferring fire from one silhouette to another is shown in Fig. 274. It shows how advantageous this method of shooting is from the point of view of rational use of time for aiming and pulling the trigger: in general, it reduces the time required to make an aimed shot.

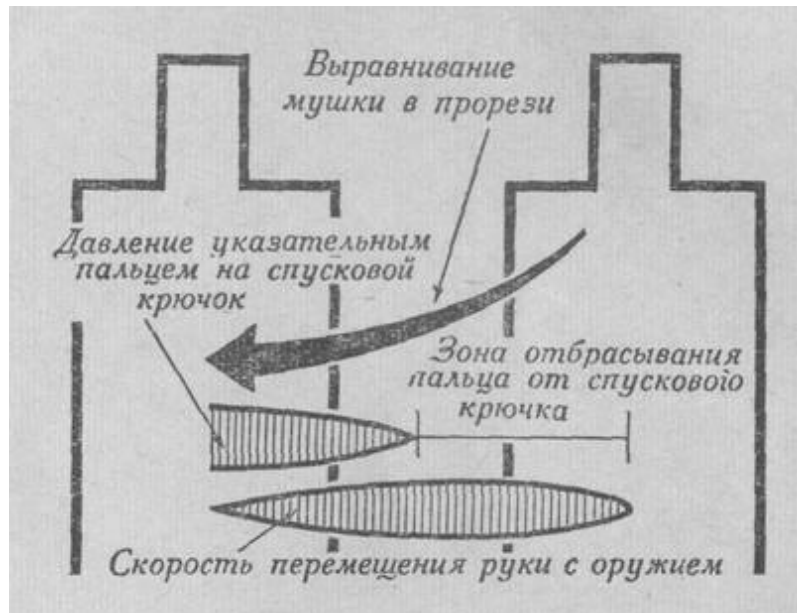


Fig. 274 - Schematic diagram of shot processing when transferring fire from one silhouette to another during a four-second series

Let us now consider issues related to the rhythm and rate of fire when firing eight-, six- and four-second series.

Success in any high-speed shooting exercise is directly dependent on how developed the shooter's sense of time and rhythm is, which allows him to make the most of the limited time he has available during high-speed shooting. The sense of time and rhythm is developed during training and subsequently reinforced. Sports practice shows that an experienced high-speed shooter can maintain the time when shooting 4-second series with an accuracy of 0.1-0.2 sec.; such accuracy in determining the time, combined with high shooting technique, allows the shooter to correctly and rationally distribute the time for each of the 5 shots when shooting a series. However, given that the shooter still allows for some inaccuracy in estimating time, especially in competition conditions, it is

advisable to deliberately reduce the time for shooting a series, accustoming yourself to shooting at a faster pace in order to always have a small reserve of time. With such a reserve, the athlete shoots more confidently and calmly, without fear that the last target will remain unhit.

Taking into account the positive and negative aspects of accelerated and slow rates of fire, the most advantageous rate should be considered to be the one at which, on average, the shooter spends:

in an eight-second series: for the first shot - 2.3 sec, for the entire series - 7.6 sec;

in a six-second series: for the first shot - 2.0 sec, for the entire series - 5.7 sec;

in a four-second series: for the first shot - 1.5 sec, for the entire series - 3.8 sec.

Of course, it is practically impossible to maintain exactly the same rate of fire every time during the same series. In accordance with how much time was spent on the first shot, the shooter must, relying on the developed sense of time, slightly change the rate of fire in order, on the one hand, to rationally use the time for shooting the entire series, and on the other hand, to fit into the time allotted for shooting. However, these fluctuations in the rate of fire must be insignificant so that the athlete can accustom himself to a very specific, his own rate of fire when shooting a particular series, which will allow him to bring to automatism his actions associated with the movement of the hand, aiming and the coordinated movement of the index finger when pressing the trigger.

It should be borne in mind that the time spent on firing a series can be adjusted, as a rule, only by changing the rate of fire, but not by changing the rhythm of the shots - the time intervals between shots should be the same; this contributes to good shooting - without the hand with the pistol "slipping" or "not bringing it up" to the aiming area when moving to the next silhouette.

To familiarize you with the elements of the technique for performing the MP-8 exercise, Fig. 275 shows the time characteristics of the shots fired by some leading athletes.

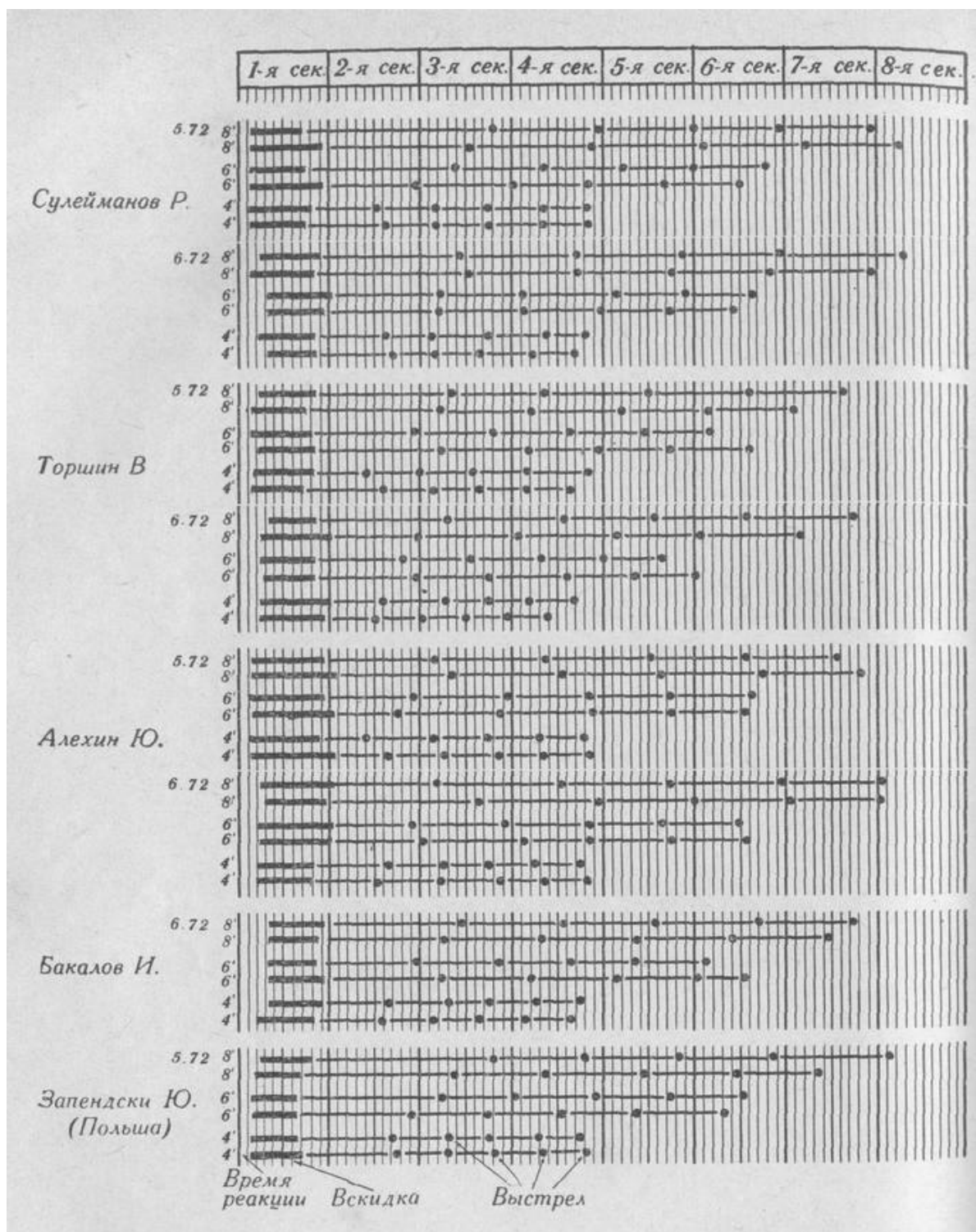


Fig. 275 - Graphic recording of the firing of a series of shots by some leading athletes when shooting at silhouettes (time counting was done according to the method of G.V. Vasyukov and V.N. Sablin)

The pistol sighting in, as well as test shooting, must be conducted at the rate of rapid fire under the same general conditions as the

qualifying shots, since the STP during slow shooting may differ significantly from the STP during accelerated shooting. This is mainly due to the different nature of the trigger pull. In addition, during training, you should carefully study yourself and try to ensure that the STP in eight-, six- and four-second series do not differ from each other. Often, even very experienced shooters have a certain discrepancy in the STP. For example, with some shooters, with a normally sighted pistol, sometimes the first shot goes to the left, the hole is on the dimension of the "ten"; when delaying the shot, the bullet hits the "nine at 7 o'clock", etc.

As practice shows, it is best to sight in a pistol so that the aiming point coincides with the point of impact. This is how most leading shooters sight in pistols.

When shooting test shots, it is best to order the silhouettes to be shown for 8 seconds or even 1 minute. Then, having carefully checked the correctness of the position in relation to the silhouettes by several arm raises with the pistol and having positioned yourself in the "ready" pose, you should shoot the test shots at the rate of eight- or six-second series, carefully comparing your estimate of the time with the stopwatch. Having thus adjusted your shooting rate, the athlete can begin shooting the qualifying series.

When shooting a series, it is advisable to fire a conditional sixth "shot" blankly at the same rate of fire (with the targets already hidden). The meaning of this is that, psychologically, the fifth shot no longer becomes the last one, completing the series, but rather the penultimate one, which allows it to be fired under conditions identical to the previous one.

4.2.3 Shooting from a large-caliber revolver and a sport (standard) small-caliber pistol at a target with a black circle and at a silhouette

The most popular exercises in shooting from a sport revolver and a small-caliber pistol are the RP-5 and MP-5 exercises - shooting at a target with a black circle and a silhouette, 60 shots (30 + 30). They consist of two parts: shooting at 25 m at target No. 4 (6 series of 5 shots), 6 minutes for each series; shooting at 25 m at the

silhouette - target No. 1 (6 series of 5 shots), with 3 seconds given for each shot, after which the target disappears for 7 seconds. Consequently, the RP-5 and MP-5 exercises contain elements of both slow shooting (at a target with a black circle) and high-speed shooting (shots at the silhouette), which have already been mentioned above. Therefore, here we will focus only on the specific features inherent in these exercises.

Shooting at a target with a black circle . Despite the fact that when performing exercises RP-5 and MP-5 shooting at a target with a black circle is classified as slow, it must be done at a significantly faster pace than in other slow shooting. This is due not only to the rather limited time allotted for a series of shots according to the conditions of the exercise, but also to the fact that the second part of the exercise - shooting at the silhouette requires the shooter to be drawn into the process of accelerated shot production.

When performing this exercise, the shooter should more than ever strive to maintain the same foot placement and body orientation relative to the target.

Considering that the recoil of the weapon when shooting from a revolver can significantly affect accuracy, special attention should be paid to maintaining the same grip. The fingers should grip the handle not only uniformly and with constant force, but also tightly enough.

While the entire set of actions and movements for making a shot remains essentially unchanged compared to slower types of shooting, when performing this exercise the athlete must devote significantly less time to processing each shot. This is dictated by the following considerations. The stability of the hand with the weapon in the first seconds of aiming is, as a rule, quite reliable and can guarantee a good shot with a timely, accelerated (but necessarily smooth) pull on the trigger. The desire to improve the quality of the shot by extending the aiming time does not always lead to the desired results: with prolonged aiming, the likelihood of the onset of that critical moment increases, after which it is necessary to stop processing the shot and rest. Moreover, the longer the shooter processes the shot, the longer the rest must be before the next attempt to make it. Considering the limited time for shooting a series

(6 minutes for 5 shots), athletes do not have the opportunity to make multiple attempts to make a shot. Therefore, it is necessary to accustom oneself to such an accelerated mode of shot production, which can ensure an accurate shot with a minimum number of attempts to raise the hand. In addition, shooting in an accelerated mode of processing each shot and, as a rule, from the first attempt accustoms the shooter to decisive actions, which is a good preparation for the subsequent execution of the second part of the exercise - shooting in a very limited time at the silhouette.

Based on the practice of a wide range of leading shooters, it is possible to recommend that young athletes develop a shooting technique in which a shot (counting from the moment the hand is raised to the shot) will take 9-13 seconds, including 5-8 seconds for aiming.

The rate of fire when shooting a series should be somewhat accelerated: the shooter should always have some time to spare for any unforeseen circumstances (increased gusts of wind, etc.). In addition, there should be some time to spare so that if an attempt to shoot is unsuccessful, especially the last one, there is still some time to rest the arm muscles and, thanks to this, to make a full shot without rushing. And in general, with a limited time for shooting a series, the athlete will always feel much calmer and shoot more confidently if he knows that he has some time to spare. Therefore, it is best to adhere to such a rate of fire that the entire series of 5 shots is shot in 4-4.5 minutes.

Considering the specifics of the exercise, which consist of an accelerated mode of shooting and, as a rule, from the first throw, it is advisable to shoot rhythmically, with equal intervals of time between shots.

Most leading sportsmen shoot a series at an accelerated pace, leaving a reserve of time of 1-1.5 minutes. Even when for some reason shooting is difficult, they still have some reserve time.

Shooting at a silhouette . Making a shot at a silhouette contains the same specific features as the previously described making of the first shot in high-speed shooting from a free pistol at silhou-

ettes. However, all elements are performed at a slightly slower pace, but so as to fit into the allotted time - 3 seconds.

The raising of the arm from the "ready" position to the shooting position should be in the nature of a "throw" followed by a slowing of the movement.

In order to make an accurate shot in such a limited time, you need to start pressing the trigger while raising your hand and, catching the sights with your gaze, align the front sight in the slot by the end of the lift.

Despite the limited time (3 sec.), the shot should be fired in a shorter time to shoot without fear that the target will disappear before the shot. Therefore, as practice has shown, the shot processing should take 2.4 sec. plus or minus 0.2 sec. To fit into such a time, it is best to practice the shot with the timing shown in Fig. 276.

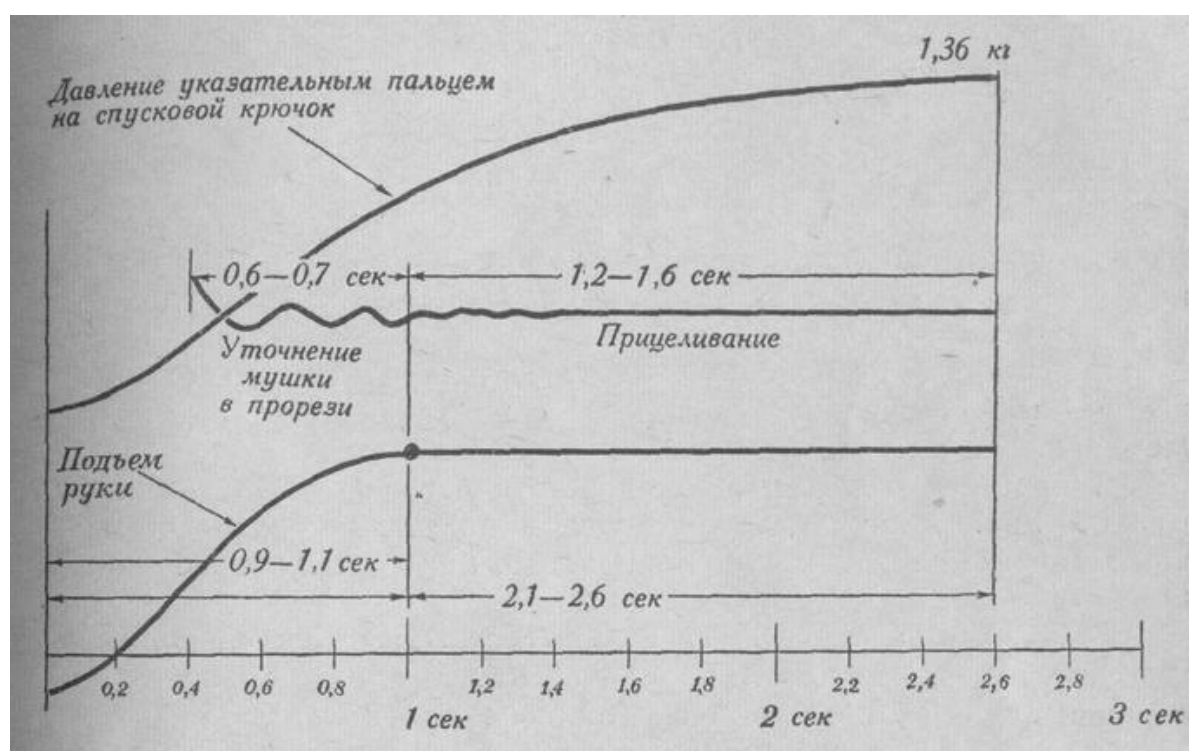


Fig. 276 - Schematic diagram of shot processing during accelerated shooting from a revolver (pistol) at a silhouette

The sportsman will successfully perform this exercise if he learns to make each shot in the same mode of its processing, identically

performing each action and keeping within the same time with insignificant fluctuations in it. Of course, in the course of the exercise it may be necessary to change the rate of shooting - to process the shot in a more compressed time or vice versa, but changing the time for making a shot should be a controlled process, and not at all such that the shot occurs "as it happens" - sometimes faster, sometimes slower; with such shooting it is difficult to achieve accuracy and stability of the battle.

Section V.
TRAINING AND PERFOR-
MANCE OF THE SHOOTER IN
COMPETITIONS

Chapter 1. Training

To become a really good shooter, capable of consistently showing high and stable results, you need to learn how to practically correctly perform all shooting techniques and consolidate certain skills. And for this, you need to train.

At the same time, the training process should not be limited to the technical growth of the young shooter. The organization of training must necessarily provide for the physical, technical, moral-volitional and psychological, tactical and theoretical preparation of the shooter.

It is very difficult - if not impossible - to give such a universal recipe that would suit every shooter and would apply to all shooting exercises; the organization of training requires a strictly individual approach to the person.

However, despite the differences in details and methods, there is much in common at the core of sports training that applies to all athletes without exception, which will be discussed below.

5.1.1 On some physiological bases of formation of motor skills in the process of sports training

Sports training is a multiple, specially organized repetition of a series of actions aimed at mastering certain movements, as well as developing, consolidating and maintaining certain motor skills and abilities at the proper level.

A motor skill is one of the forms of human motor actions. It is a well-coordinated, established system of conditioned reflex connections between the sense organs, the central nervous system, the muscular system and the internal organs. These connections are not formed immediately: three phases of the formation of a motor skill are distinguished (according to A.N. Krestovnikov).

The first phase is characterized by the formation of conditioned reflex connections with a wide distribution (irradiation) of excitatory

processes in the cerebral cortex. The excitation of a significant number of elements in the cortex entails excessive tension and contraction of a large number of muscles, due to which the performance of actions is accompanied by inaccurate and unnecessary movements. This first phase of the generalized reaction is called the generalization stage.

In the second phase, as the exercises are repeated many times, excessive irradiation is limited by the development of inhibitory processes in the cerebral cortex (there is a concentration of excitation). This corresponds to a more correct execution of motor actions. At the same time, due to the still insufficient perfection in the interactions of the excitation and inhibition processes, excessive stiffness and stiffness of movements are still externally observed. Mistakes are still possible in this phase, and the process of performing an action, movement itself requires continuous careful control (motor skill appears - the ability to correctly control an action while concentrating attention on the method of its execution).

In the third phase of skill formation, the automation of movements occurs, the formation of a motor dynamic stereotype, which determines the correct and more perfect execution of actions, and does not require special attention directed at them.

The importance of motor skills in human life and sports activities is very great, as they enable a person to solve complex problems simultaneously, concentrating on the main thing; as skills develop, the role of consciousness in motor actions changes. If at the first stages of mastering any actions a person must constantly consciously direct and control all elements of movement, then as they become automated, consciousness is freed from such hard and tiring work, it participates mainly not in the process of performing the movement, but in taking into account changes in the surrounding environment, in solving the main task, the most important at the moment, etc.

At the same time, with the presence of motor skills, it becomes possible to take conscious control of the smallest details of these automated movements and actions, if the slightest need arises.

A necessary condition for developing a strong skill is its conscious acquisition; the more consciously a skill is formed, the more firmly it is fixed. In order for a skill to be formed faster and better, it is necessary to understand the movement or action being learned well, and to create a mental image of its execution. Relying on the previously created image of the action, the athlete tries to consciously reproduce it in movement. Therefore, knowledge of the movement being learned and a clear idea of it are an absolutely necessary condition for its acquisition.

It should also be borne in mind that for the fastest and most correct formation of motor skills, all repeatedly repeated actions must be performed extremely correctly. And this, in turn, requires the shooter to show a very high degree of attention to the action being learned.

Improvement of muscular activity, improvement of coordination in movements, increase of efficiency and endurance of a person, occurring during mastering of motor skills, are the consequence of various changes in the organism, caused, first of all, by formation of new conditioned reflex, temporary connections in the central nervous system. In the process of their formation interaction is improved, mobility and balance of the main nervous processes in the cerebral cortex are improved. Therefore, the leading role in restructuring of the organism under the influence of training - specially organized repetition of a number of actions, movements - belongs to the nervous system, and first of all to the activity of its higher section - the cerebral cortex. At the same time, training causes restructuring of all physiological manifestations of the organism's activity. This restructuring is the consequence of the organism's adaptation to the work being performed.

It should be borne in mind that the functional restructuring of the central nervous system, aimed at improving muscle activity, is possible only under the indispensable condition that training is regular and sufficiently intense in terms of load.

The shooter should know that a comprehensive training, performing sports exercises containing individual elements of the movements that he performs in his main type of shooting, contributes to

strengthening the previously formed dynamic stereotype as a whole, while one-sided training can lead to the fact that the already developed dynamic stereotype will be impoverished and even gradually destroyed.

During training, the distinguishing activity of analyzers improves, and the sensitivity of organs increases. The sensitivity of the motor analyzer increases especially noticeably during training, which is very important for an athlete. At the same time, as special observations have shown, the acuity of muscle-joint sensation formed for a given exercise is significantly dulled if the athlete uses exercises with excessively large physical loads with weights as auxiliary exercises. This means that a shooter who has been developing the fine distinguishing ability of the motor analyzer for many years can significantly reduce it if he uses as auxiliary those sports that are associated with large physical overloads (gymnastics, weightlifting, etc.).

During the training process, the plasticity of the cerebral cortex increases, in other words, its ability to more quickly form new temporary connections and rebuild old ones increases; along with this, the ability to more finely and appropriately react to irritation associated with muscle work develops. At the same time, training associated with the predominant activity of one sense organ can have a progressive effect on the activity of other sense organs associated with it. Therefore, during the training process, the shooter must strive to diversify individual shooting techniques in every possible way, since this increases his ability to subsequently more quickly assimilate new movements and improve the execution of previously known ones. This will ultimately ensure the growth of sports results and their stability under various shooting conditions.

During the training process, stable conditioned reflex connections are formed, which over time, as has already been said, develop into a dynamic stereotype. It should be borne in mind that in the initial period of training, when temporary connections in the cortex have not yet become stronger, secondary external stimuli, also causing secondary centers of excitation, can destroy these still weak connections. However, in the further course of training, conditioned reflexes are firmly fixed, the exercise is automated and

external stimuli no longer have a harmful effect. Consequently, in the initial period of training, the shooter needs to create the most favorable conditions for improving shooting technique, and practice individual elements of the shot so that they are firmly fixed and automated, and only then, after mastering all the actions in a complex with the processing of the shot, begin to train in increasingly complex conditions (in unfavorable meteorological conditions, in a competitive environment, in a deliberately complicated one, etc.). In this way, stable conditioned reflex connections and strong motor skills with flexible adaptability to changing shooting conditions will be developed.

The basis for the formation of a motor skill, as has already been said, is the formation of new conditioned reflex connections in the central nervous system. When learning the technique of performing any exercise, a person consistently makes a series of movements, which make up the entire exercise. When, with constant repetition of movements, the connection between them is strengthened, it becomes possible to perform the entire sports exercise as a whole, since all parts of the exercise are interconnected due to the formation of a dynamic stereotype - a complex balanced system of cortical processes. The dynamic stereotype, having a certain inertia, determines a constant technique for performing an exercise, which is why a firmly established motor skill is difficult to change. However, due to the plasticity of higher nervous activity, reworking the skill is still possible, the dynamic stereotype can change under certain circumstances. This is the basis for restructuring skills, correcting errors.

Various motor skills develop in close interaction with each other. The formation of new human movements is possible only on the basis of existing conditioned reflex connections. Therefore, new motor skills are formed depending on previously acquired ones, including their individual elements. In turn, newly formed skills have an impact on the existing ones. Therefore, the shooter must be careful when selecting auxiliary sports and shooting exercises. If, for example, the shooter's main activity is high-speed shooting from a pistol at silhouettes, then such an auxiliary exercise for him as slow shooting from a match pistol will only be beneficial, since

it will help to strengthen and enrich the fund of skills necessary to ensure the stability of an outstretched arm with a weapon.

The basis for the stability of a motor skill is the automation of movements. As has already been said, the execution of an automated movement is almost not consciously realized. At the same time, a person can at any time become aware of both individual parts of an exercise and the execution of the entire exercise as a whole, if he or she specifically concentrates on this. The fixed automated conditioned reflex connections are surrounded in the cerebral cortex by a kind of brake shaft (Kvasov D.G., 1952), isolating these connections from the action of other stimuli not associated with the execution of a given movement. The automation of certain movements creates a psychophysiological basis for expanding control by consciousness over the execution of the exercise as a whole, the surrounding environment, etc. However, a motor skill developed in extremely monotonous conditions can easily become deautomatized if these conditions are suddenly changed. To prevent this from happening, it is necessary to deliberately diversify the shooting style during training. Thus, it is very important for a shooter to practice, for example, the "standard" exercise from both free and sport and service rifles, which have different weights, trigger tensions; to use different shooting tempos and rhythms in different meteorological conditions, etc., which in general contributes to the development of a fairly wide range and stability of motor skills.

It should be noted that the study of physiological foundations of movement automation by specialists has led to the conclusion that increased automation leads to increased functional isolation of conditioned reflex connections underlying a given skill (due to the development of a braking shaft around them), and as a result to the cessation of further improvement of the motor skill. Sports practice in various sports shows that with the use of a limited range of exercises, a rapid, but relatively short-term increase in sports results is possible, since it occurs due to the improvement of conditioned reflex connections that ensure the performance of only a given movement, without the wide use of the functional capabilities of the body as a whole. Therefore, the training of an athlete-shooter will be many times more effective if during it constant

work on the automation of movements associated with improving shooting technique is combined with versatile physical training: classes in auxiliary sports and the performance of auxiliary shooting exercises (provided, of course, that they are chosen correctly).

It should be borne in mind that during training, the phenomenon of skill transfer takes place. It is expressed in the fact that when two or more motor skills are simultaneously formed, they can influence each other. In addition, a previously formed skill can affect the formation of subsequent ones or vice versa. A distinction is made between positive and negative skill transfer, depending on whether the previously acquired skill facilitates the acquisition of a new one or, on the contrary, hinders its formation. The phenomenon of positive and negative transfer of motor skills is based on the similarity or difference in the structure of dynamic stereotypes.

Motor skills gradually deteriorate in the absence of exercise; in the absence of reinforcement, conditioned reflex connections fade away. After long breaks in physical exercise, an athlete loses the ability to perform many complex motor skills that previously characterized the level of his athletic training. Moreover, the most finely differentiated elements of motor skills fade away first of all - in fact, what characterizes high mastery in motor actions. With this in mind, a sportsman-shooter should not allow long breaks in performing shooting exercises and maintain previously developed motor skills at the appropriate level.

Changing already established motor reactions, as has already been said, is very difficult. Therefore, both the athlete and the coach have to face great difficulties when retraining any exercise. There are often cases when, after retraining and mastering a more perfect technique of execution, when the new technique has seemingly been well mastered, the athlete at the most crucial moments (at competitions, during a threatening danger, etc.) returns to the old habitual actions (Yakovlev N.N. et al., 1957).

It is well known that it is always more difficult to retrain than to teach. Therefore, during training work, it is necessary to carefully monitor that the practice of shooting exercises and classes in auxiliary sports are carried out taking into account the specific fea-

tures inherent in the main shooting exercises in which the shooter is improving, and thus, as far as possible, prevent the formation of motor skills harmful to this exercise.

5.1.2 Physical training of a sportsman-shooter

Shooting sports are very poor in terms of movement diversity. In addition, some coaches to this day neglect general physical training and other sports, directing the shooter's activity during his training work only to practicing one shooting exercise. Shooting exercises, generally characterized by monotonous repetition of the same actions, turn into a tedious, tiresome activity that bores shooters. At the same time, automated processes and motor skills are not enriched, on the contrary, the possibilities for their further improvement are narrowed. This is sometimes the main reason for the cessation of growth in sports skills with ongoing training, and overfatigue and loss of interest in training, occurring due to monotonous work, lead to a decrease in sports results.

Therefore, the educational and training work of a sportsman-shooter in general and of one specializing in one type of shooting in particular should include general and special physical training and classes in auxiliary sports. Moreover, these classes should be planned as a mandatory part of the educational and training lesson, and not turn into an amateur activity of one or another sportsman.

The basis for developing motor skills is one of the remarkable features of the human body - to respond to repeated and ever-increasing loads with a certain excess of the initial level of performance. To implement this property, an athlete must, along with the formation of motor skills and abilities, develop physical qualities in himself, and first of all strength, endurance, agility and speed. These qualities do not exist separately from each other. However, their interrelation does not mean at all that when selecting and using appropriate exercises, it is impossible to achieve the preferential development of any of these qualities, for example, endurance. This is precisely the task that is solved by general physical and special physical training in any sport, including shooting.

At the present stage of its development, target shooting is usually associated with significant static efforts. The need to repeatedly lift a rifle weighing 7-8 kg for 5 hours during an exercise such as the "standard 3x40" requires the shooter to expend significant energy, since during this time he lifts a load in total exceeding 3 tons. At the same time, significant static work of the shooter's muscular system occurs, caused by the total prolonged holding of the rifle in the air; thus, according to observations made by the author of shooting standing from a free rifle by standard shooters, holding the rifle in the air during the exercise sometimes continues for a total of up to 75 minutes.

In addition, shooting is associated with holding the breath; thus, when performing the "standard 3x40" exercise, in which the athlete makes a shot on average on the 1st-3rd attempt, the total breath holding during 5-hour shooting reaches 40-50 minutes, which inevitably causes a certain oxygen starvation of the body, leading to premature fatigue.

From all this it becomes obvious what a huge importance physical training has for a shooter as a means of developing strength and endurance. It acquires no less important importance in relation to the restructuring of the shooter's central nervous system - increasing the mobility of the nervous processes in the cerebral cortex, forming new conditioned reflex connections, forming a dynamic stereotype, developing and consolidating positive motor skills. Therefore, physical education and sports, in addition to maintaining and strengthening health, are the main means for establishing correct breathing and increasing the vital capacity of the lungs, strengthening the muscular system, developing strength and static endurance, dexterity, agility, resourcefulness, self-control, etc. It is thanks to good physical fitness and practicing other sports that many athletes managed to achieve high results in a short time and join the ranks of the country's leading shooters.

Summarizing the material accumulated at present, based on the experience of leading shooters and coaches, we can draw certain conclusions about the nature of the physical training of a sports shooter.

The shooter must have the following general physical characteristics:

- a sufficiently developed muscular system (especially the abdominal muscles, shoulder girdle, arms and legs) and endurance to produce a large number of shots without noticeably reducing their quality;

- the ability to maximally relax and, to the greatest extent, turn off from work those muscle groups that do not directly participate in holding the body when ready, as well as when pressing the trigger;

- strong muscles involved in the breathing process, so that when shooting from a prone position and from a kneeling position, when the chest is somewhat compressed, you do not feel difficulty in breathing;

- precision and coordination of movements, quick reaction, well-developed sense of balance, etc.

The general and special physical training of the shooter should be aimed at developing these qualities. Considering that successful execution of shooting exercises requires comprehensive physical development and a high level of training of the nervous system from the athlete, his physical training should be predominantly comprehensive and ensure the harmonious development of the main physical and special qualities.

First of all, the physical training of a sportsman-shooter should not be episodic and should not be confined to a certain period of his training and preparation for competitions; it should be carried out regularly (but with varying intensity) throughout the training year. In this regard, the introduction of morning exercises and water procedures (rubbing with cold water or shower) into the shooter's life and everyday life is of particular importance; they should be a mandatory part of his regime.

The shooter's morning exercises should contain a sufficient number of general exercises aimed at strengthening the muscular system as a whole, setting up breathing, developing body flexibility

and precision of movements. Taking into account the specific requirements that shooting sports impose on an athlete, the exercises should include exercises designed to develop the muscles - flexors of the arms and fingers, muscles of the shoulder girdle, lumbar part of the back. It is necessary to point out the value of introducing static tensions in small doses into the exercises (for example, not very long holding of a load on the weight), which contributes to better development of the muscles and accustoms the muscular system to the work that it performs when ready to shoot. It is also necessary to include exercises for developing balance (for example, balancing on a rail or the edge of a board, etc.). Taking all this into account, when exercising it is desirable to use a set of exercises shown in Fig. 277. For periodic changes to the complex, here are given in individual cases the same type of exercises, which are recommended to be used in various combinations - with an increasing number of repetitions and the addition of more complex exercises - depending on the age and level of training of the athlete. The load during exercise should be such that after it you feel vigor, and not fatigue.

 Exercises for the shooter's morning physical exercise complex

Fig. 277 - Exercises for the shooter's morning physical exercises: /
- preparatory exercises; // - general developmental

exercises for specific muscle groups; /// - special exercises; IV - final exercises.

The general physical training of a shooter, regardless of the specifics of shooting sports, should be aimed at developing physical qualities: strength, power and general endurance, speed, agility and flexibility.

Strength. Strength training means are exercises: with weights (dumbbells, medicine balls, weights on blocks, etc.); with the resistance of elastic objects (rubber bands, expander); with overcoming one's own weight (pull-ups, squats, bending and unbending arms in a prone position, etc.); static (muscle tension developed without movement, where muscle effort is directed at a stationary object - pressing on a wall, pole, etc.).

There are several methods of developing strength using physical weights, but they all represent different variations in the ratio of the amount of weight, the number of repetitions of movements, the tempo of the exercise, and the duration of rest.

Considering that when shooting, the need to lift and hold a weapon in the air requires the shooter to demonstrate not excessively great muscular strength, but mainly strength and static endurance (associated with a relatively long and repeated stay in the ready position), when training to develop strength, it is advisable to use light weights with a large number of repetitions - until some fatigue occurs; then, after a short rest, you need to move on to performing another exercise (there should be 6-8 of them) to develop strength, strength and static endurance of another muscle group.

Exercises involving overcoming one's own weight can be used with great success to develop strength: squats, extension and bending of the arms in a prone position, in a position against a chair, stool, wall, etc.; such training does not require any equipment, a gym or a sports ground. Such a set of exercises can be performed anywhere during the day. Exercises with a stuffed ball are very useful for developing strength and strength endurance. S.M. Vaitsekhovsky (Collection "Bullet Shooting". Physical Culture and Sport, 1964) recommends exercises with stuffed balls as one of the main means of physical training for a shooter. Paired and group exercises in throwing balls (weight 4-6 kg) from various positions and poses, performed with maximum effort, develop not only strength, but also the speed of contraction of the most important muscle groups. In addition, performing exercises with a large number of repetitions (25-75) very well develops strength endurance. The exercises should be performed at different tempos: to develop strength, the tempo should be no less than 8-15 throws per minute, to develop strength endurance - no less than 23-35. Perhaps, S.M. Vaitsekhovsky's recommendations regarding the tempo and number of repetitions are somewhat overstated here, but this does not in any way diminish the importance of exercises with stuffed balls as an effective means of developing valuable physical qualities for a shooter, and first of all strength endurance.

Endurance - the body's ability to resist fatigue - is determined by the high level of physical and technical preparedness of the athlete, the ability of nerve cells to maintain a certain degree of excitation for a long time, high coherence in the functioning of the central nervous system, the economy of metabolic processes, the ability to resist the sensations of approaching fatigue with the help of volitional efforts. In sports practice, it is customary to distinguish between general and special endurance.

The method of developing general endurance is long-term performance of physical exercises of moderate intensity with the involvement of as much muscle mass as possible. General endurance is developed mainly by exercises with long-term repetition of cyclic movements. Therefore, the main means of developing general endurance in a sportsman-shooter should be: skiing, swimming, long-distance running, long-distance walking at a fast pace, various sports games.

Special endurance - the ability to maintain effective performance for a long time in a certain type of physical exercise in which the athlete specializes - is developed mainly during the execution of the shooting exercises themselves. In this case, two circumstances must be taken into account. Firstly, a high degree of static endurance must be developed to ensure the greatest stability of the "shooter's body - weapon" system during the production of each individual shot and, secondly, to ensure the withstanding of a long static load during the shooting of the entire exercise. Therefore, the main method of developing special endurance is special training with a weapon, its model or some object held in a ready position (see below).

Agility and speed are physical qualities that are also extremely necessary for a sportsman-shooter. With their development, the ability to quickly master new movements increases, to successfully act in changing shooting conditions, the ability to distribute and concentrate attention is improved, the stock of conditioned reflex connections is enriched, reactions are accelerated, and a number of other qualities important for a shooter are acquired. A valuable means of developing agility and speed, as well as reac-

tion accuracy, for example, sports and active games with a ball, gymnastic exercises.

Volleyball and basketball deserve special attention in this regard. The movements in these games are quite varied and include such useful elements as short runs, jumps, bends, turns of the body, hand movements; the games require mobility, develop precision of movements, which generally contributes to the comprehensive development of the shooter's physical qualities.

The general physical training of a sportsman-shooter, in addition to developing basic physical qualities - strength, endurance, agility and speed - is designed to solve specific, narrower special tasks - developing breathing and a sense of balance.

It is quite obvious that shooting sports make increased demands on the development of the athlete's respiratory system (tightness of the chest in the prepared position, multiple breath holdings when making shots can lead to a certain oxygen starvation of the body). Therefore, the correct breathing should be given the most serious attention when planning the general physical training of the shooter.

For the development of breathing, as proven by research and sports practice, it is best to use exercises not at rest, but with a steady physical load. A good and also accessible at any time of the year means for this is fast walking with rhythmic breathing. In winter, the shooter needs to go skiing; in summer, do track and field, especially running with rhythmic breathing, as well as swimming and rowing. These types of sports contribute to the correct setting of breathing, increasing the strength of the respiratory muscles, increasing the vital capacity of the lungs.

Developing a sense of balance is also necessary for a shooter, as it is of direct importance for imparting the greatest degree of stability to the "shooter's body - weapon" system during the shot. A proven means of increasing the discriminative sensitivity of the vestibular apparatus is figure skating and skating. Many shooters (and not without reason) note the positive role of cycling, which in addition to general physical development helps train the vestibular apparatus. According to the observations of some shooters, after

cycling and a short break (1-2 hours), it is good to shoot standing up. As you can see, cycling also serves as a good warm-up, helping to create a favorable general condition for the muscles of the legs, abdominal press and arms, which ensures the greatest degree of immobility of the position.

When selecting the means of general physical training for a sportsman-shooter, it is necessary to avoid, especially during the competitive period, certain sports that are to some extent antagonists of target shooting (weightlifting, partly projectile gymnastics, clay pigeon shooting). According to the observations of some coaches and instructors, almost all skiers, skaters, track and field athletes, swimmers and rowers quickly achieve good results when shooting, weightlifters, as a rule, shoot poorly and achieve more or less satisfactory results with difficulty. In any case, it should be borne in mind that a shooter should not perform a great deal of physical exertion shortly before shooting: hand trembling after heavy physical work can make itself felt for many hours.

Before competitions, you should be very careful when engaging in other sports. It is advisable to include rhythmic running and fast walking with deep inhalations and exhalations in small doses in the shooter's training daily routine. During competitions, the daily routine should only include morning exercises, and walking and skiing as active recreation. During competitions, it is also not recommended to take part in sports games, as injuries and muscle pain are possible, which are often the cause of a sharp decline in the results of the shooter.

Special physical training is a continuation of the general physical training of a sportsman-shooter. It is aimed at the specialized development of physical qualities applicable to the specifics of sport shooting and is designed to solve the following tasks: preferential development of muscle groups that perform static work on holding the body with a weapon in a ready position; development of special static endurance associated with the need to hold a weapon in the air for a long time both for the production of an individual shot and for shooting the entire exercise; development of special qualities - a sense of balance, "muscle sense", finely differentiated coordination of movements, etc.

The main means of special physical training are, first of all, the shooting exercises themselves or elements of shooting technique, as well as special preparatory exercises. Therefore, it should be based on training with a weapon or a model in a shooting position. Moreover, many of the physical exercises associated with special physical training can be performed during the working day or at home.

First of all, a universal means of developing special physical qualities of a shooter is training with a weapon in a ready position, with imitation of shooting "dry". This type of exercise with different dosages of static loads allows for the targeted development of various special qualities of a sportsman-shooter.

There are many methods and techniques for developing special static endurance, developed during training. These include, for example, the following:

- extending the time of a single holding of the weapon in the ready position; after the shot, without lowering the weapon, again process the "shot" with aiming and pressing the trigger. When training "idle", maintain a "level front sight" and repeatedly press the trigger at favorable moments, thus gradually increasing the aiming time;

- increasing the intensity of the training load, the total increase in the time spent holding the weapon in the air by alternating actual shots and handling "dry" shots;

- development of strength endurance of the muscles of the right (left) arm and shoulder girdle in pistol shooters in the ready position by holding a mock-up of a weapon or some object weighing approximately equal to the weight of the weapon for a long time. This method is convenient because it can be used very effectively at any time of the day, at home.

To develop a sense of balance, the following special preparatory exercises should be used: standing on one or two legs along and across a wooden slat or block placed on the floor; balancing on a board placed on a support - a small diameter roller (it would be a good idea to have such simple sports "equipment" at home); bal-

ancing on a bicycle standing still; walking on a rail, the edge of a board; exercise on a log, etc.

In order to develop muscular sense and some ability to dampen involuntary body vibrations when standing in the ready position by means of voluntary, conscious counteraction to these vibrations, as well as to develop the ability to finely control your muscles, it is necessary to create complicated conditions during training (for example, by conducting some rifle shooting while standing without a sports jacket). Shooting or training "dry" with an artificial reduction of the body support area can be of great benefit for developing these qualities. To do this, in the ready position, you need to stand not on the floor, but on low wooden washers of a relatively small diameter, concentrating attention mainly on controlling the work of the muscles that hold the body in this position, as well as on reducing body vibrations, giving the "shooter's body - weapon" system the greatest degree of immobility. Such exercises are also good for developing a sense of balance. During training, it is also advisable to use special linear targets (Itkis M., 1970) - in the form of cross-shaped or circular (spiral, etc.) strips of white paper of varying width on a dark background, placed on the target line (Fig. 278). By aiming, slowly and smoothly moving the "flat front sight" along the perimeter of these targets, the athlete develops the ability to better control his muscular system, which ultimately contributes to the development and acquisition of special stability when ready to shoot.



Linear targets for developing special stability when ready for shooting

Fig. 278 - Linear targets for developing special stability when ready to fire

(using the method of Master of Sports M. Itkis). Dimensions in cm.

5.1.3 Technical and tactical training of a sports shooter

Despite the diversity of existing training methods in various sports, due to the specifics of shooting sports (low mobility, predominantly static muscle work), two methods have been established in recent years that are closely related to each other. These are the methods of repeated and competitive training.

The first method consists of systematic repetition of exercises. Due to the repetition of the same movements, new conditioned reflex connections arise and are consolidated, motor skills are formed and movements become automated. This method allows for practicing individual key parts of a motor skill and thus creating the most favorable conditions for learning parts and the entire exercise as a whole. Consequently, this method involves learning and practicing individual elements of shooting technique, searching for new and most advantageous technical and tactical methods for performing the exercise.

The second method is that the shooter, in competition with other team members (while observing all the rules of the competition), performs a shooting exercise with maximum mobilization of his strength and capabilities. This method involves strengthening the moral and volitional qualities of the athlete, as well as preparing the body to endure strong and varied irritants, which, as a rule, have a negative effect on the course of motor reactions, disrupting the coordination of the shooter's movements when making a shot.

It is quite obvious that the first method - regular training of the shooter at the firing line - ensures further technical growth of his skill, and the second method is aimed mainly at the shooter being able to show results at the level of his technical training in competition conditions. Therefore, when organizing training, it is necessary to provide for a reasonable combination of these two methods, without abusing either one or the other.

As practice in recent years has shown, sports training at the current level of technical results is effective if it is sufficiently intense, providing for significant physical and psychological stress. At the same time, achieving intensity in training should be gradual, consistent and regular.

The requirement for gradual increase of load during training follows from the fact that as training increases, the body's reaction to a given load will decrease due to its adaptation to the work being performed. Therefore, increasing shooting performance requires a continuous increase in load.

However, training based on the principle of a large and ever-increasing load must be used with sufficient caution, otherwise, instead of increasing athletic performance, it may lead to a decrease in it.

Sport shooting, where precise execution of each shot is necessary, especially in such long exercises as "standard" and shooting from a match pistol, is a very tiring occupation; prolonged concentration, enormous strain of will, nervous system, vision, frequent holding of breath and multiple attempts to make a shot require a great expenditure of physical and spiritual strength from the shooter.

With properly structured training, after performing a long shooting exercise, a certain physiological fatigue usually occurs. It temporarily reduces performance, which is fully restored after rest; such fatigue does not cause any painful changes in the body. Gradually, with the onset of a trained state, the moment of fatigue is postponed, and the athlete can work longer and more intensely during the shooting exercise, and get tired less.

If the training is structured incorrectly (when the load exceeds the physical and psychophysical capabilities of the shooter's body), the principle of gradualness and consistency is not observed, then after it the shooter experiences severe fatigue. Research into the dynamics of recovery processes (Medvedeva N.G., 1959-1960) shows that the restoration of the functional

state of the visual analyzer, as well as static endurance in shooters occurs 20-40 hours after performing the "standard" exercises from arbitrary rifles and shooting from a match pistol. It is quite natural that with daily performance of these exercises, rest between training sessions does not allow the shooter to restore his performance. If the training continues with such intensity, the athlete will become overtired. Overtiredness is accompanied by the appearance of a feeling of fatigue, a desire to stop training, drowsiness. Constant stress on the nervous system caused by excessively intense training leads to imbalance between the excitatory and inhibitory processes in the central nervous system, sometimes to the predominance of the excitatory process, as a result of which the athlete begins to suffer from insomnia. And if the load during training is not reduced in time, then systematic overfatigue will lead to a very unpleasant phenomenon - overtraining.

Prof. A. N. Krestovnikov pointed out that one of the signs of overtraining is a disorder of movement coordination. In such cases, they say that the shooter's shooting has "gone wrong": he presses the trigger at the wrong time, he becomes indecisive and afraid to fire a shot. In such cases, along with the disruption of motor skills, coordination of movements during training, negative phenomena from the psyche are also observed: a bad mood, depression, lethargy, indifference. Some athletes, on the contrary, experience increased irritability, irascibility. All this is accompanied by an aversion to training, a lack of desire to process shots, the shooter cannot force himself to "pull" a high result. Naturally, such a state is primarily reflected in sports performance, which, instead of growing, begin to steadily decline.

Therefore, during training, the athlete must carefully observe himself, and the coach must take into account the individual characteristics of the shooter, give him a feasible load during training and listen to his statements and statements, monitor the growth of results in order to detect and prevent overfatigue and its consequences - overtraining - in time. At the same time, it is necessary to keep in mind that there is a certain limit for a regular, intensive, but feasible for the shooter training. If sports results are steadily declining, if the athlete is tired, has lost the desire to train, if shooting becomes a burden for him, it is necessary to stop training. In such cases, you need to take a short break in training, have a good rest from the shot, and then with renewed strength proceed to further training.

Shooting practice, especially in recent years, has shown that the most effective training system is one in which the shooter combines actual shooting with cartridges with dry-fire training - without shooting - which complement each other and are very necessary for the further athletic growth of the athlete.

Dry-fire training has its positive aspects and cannot be replaced by shooting with cartridges. Only when training without cartridges - "dry-fire" - can you detect a number of errors in the technique of shooting, trigger defects, and facilitate and speed up the consolidation of many skills that are essential for shooting. And, despite the fact that such training is not a very exciting activity, the vast majority of leading shooters do not do without it, systematically and carefully practicing all the elements of the technique of shooting "dry-fire".

Training without shots is especially necessary to improve the position and smooth trigger pull, coordinated with correct aiming, as well as to search for more advantageous positioning options. Since the daily load on the firing line during training remains almost unchanged (execution of the exercise or part of it), the increase in intensity is usually achieved by different dosing of the "idle" training.

However, one should not overestimate this special type of physical and technical training and conclude that it can replace real shooting, because nothing can replace the psychophysiological processes that occur in the athlete's body during the actual shot. During "dry" training, when the simulated shot is not accompanied by a loud sound and a blow to the shoulder from the recoil of the weapon, the shooter's nervous processes proceed completely differently, and therefore the muscle tone does not change as much as during real shooting at the moment preceding the shot. In addition, during "dry" training, the athlete does not feel due responsibility for the quality of the shot and does not process it as carefully. Therefore, the shooter and the coach

need to find the right ratio of these types of technical training in the educational and training process, without overestimating either one or the other and without neglecting them. During the transitional and preparatory periods of home training in "dry" shooting, one should find an opportunity to shoot cartridges at least once a week.

First of all, when starting training, one should not think that athletic growth is achieved by firing a large number of shots; such "training" at the expense of shooting "in general" is the least effective and only leads to a senseless waste of cartridges. You can shoot from morning to night and not advance at all if shooting is done thoughtlessly, formally, without the shooter concentrating on polishing certain elements of firing a shot.

Therefore, success in training is achieved not by the quantity, but by the quality of shots; it is very important to immediately accustom yourself to careful processing of the shot, without which the shooter cannot develop and consolidate the necessary skills. In this case, you need to keep in mind the following.

Many athletes shoot somewhat irresponsibly, casually and at a fast pace during training, knowing that their shots are not recorded and do not count. When switching to shooting during qualifying training or competitions, there is no trace of such casualness left, the athlete begins to carefully process the shots, thereby abruptly changing the nature of their processing. This knocks him out of the previously acquired working rhythm and causes excessive nervousness. Therefore, during training, it is necessary to carefully process the shots, develop and consolidate your shooting style, which in general and adhere to in training and qualifying shooting.

Experienced shooters, as a rule, strictly plan their training day, setting themselves very specific tasks for practicing shooting techniques at each training session.

It is this training system, according to a strictly thought-out plan, which provides for the shooter to solve very specific tasks at each training session, a critical analysis of each shot fired, and contributes to rapid athletic growth or rapid restoration of the shooter's athletic form after a break in training.

It is extremely important for a shooter to develop the ability to approach each shot thoughtfully and critically, to find the reasons that affect shooting accuracy. Without carefully studying your actions, without analyzing your shooting, especially bad shooting, you cannot become a good athlete; you need to be clearly aware of what you see, what you feel, and get to the bottom of the reasons for unsuccessful shooting. Some shooters remember their good training targets well, fuss over them, and disdainfully throw bad targets, of which such shooters usually have more, into the trash bin, without bothering to think carefully about why the shooting was unsuccessful. It is safe to say that such a shooter will be of no use, since he cannot extract the necessary benefit from training and, without finding the reasons for his mistakes, will not grow in sports. Creative persistent work on oneself during training greatly contributes to the shooter's athletic growth.

Only when training is not just a drill, but a conscious, purposeful work on oneself, will the athlete steadily improve his results and achieve their stability.

Since the shooter's athletic growth largely depends on the ability to correctly analyze his shooting, understand his feelings during the shot, observe himself, it is extremely important to keep records of the results, periodically review them and copies of targets, summarize the material and draw appropriate conclusions for himself. Most leading shooters keep such shooting diaries, carefully recording their observations during shooting, the training system, experiments carried out to adjust the weapon and sighting devices, as well as their search for more advantageous shooting techniques.

Keeping shooting diaries has another positive side: the athlete, making notes, involuntarily begins to think more deeply about everything that he encounters during shooting, develops observation skills, acquires the ability to analyze, generalize and draw correct conclusions and thus

quickly reveal and eliminate his mistakes. And in shooting sports, when the result depends not only on the shooter himself, but also on the weapon, cartridges and weather, the main and decisive role is played by establishing a "diagnosis" of one's failures, since in such cases getting rid of certain shooting "ailments" is no longer particularly difficult.

An essential condition for successful training is adherence to a certain regime. The regime concerns both the training process itself (the athlete's fulfillment of certain requirements, the appropriateness of which is proven by theory and practice) and the athlete's entire daily life.

Some shooters and coaches still believe for some reason that during training, especially before important competitions, it is necessary to create special conditions: go to bed early, stick to a certain menu, etc. This is incorrect. An athlete's regimen does not consist of creating special conditions, but of observing certain terms and times for sleep, training, rest, nutrition, etc.

The main principle of the regime during training and competitions is to create healthy and familiar conditions for the athlete and to observe a certain periodicity in his daily routine. If the shooter is healthy, in good spirits, does not overwork, his diet is high in calories, he does not allow himself any excesses, and the surrounding environment does not upset him or throw him off balance, then this is quite enough to successfully conduct training and prepare well for the upcoming competition. The only thing that the shooter should pay attention to, especially during training, is not to overload the eyes with additional work, take care of vision: do not read a lot in unfavorable lighting conditions and while lying in bed.

You should also not change your regime abruptly when switching from training to competition performance: the shooter should not feel such a transition either physiologically or psychologically, since the established skills and habits, the conditioned reflex connections developed during training can be disrupted, and he will only lose from this.

It is necessary to dwell on one more means of technical and special training of the shooter, which has been ignored to some extent up to now - on various shooting exercises, which are a supplement to the main exercise in which the shooter specializes. The urgent need for this is dictated by the following.

All shooting exercises, despite their diversity, have one important thing in common - the established systemic nature of the nervous processes in the central nervous system (dynamic stereotype), which allows the shooter to give the greatest degree of immobility to his body with the weapon, as well as to perform a strictly coordinated action of aiming and timely smooth pressing of the trigger. Therefore, the shooter's training, consisting of various shooting exercises, enriches the central nervous system with a large stock of new temporary connections, diversifies, strengthens and increases the stability of basic motor skills. Therefore, when planning the training of an athlete-shooter, it is necessary to provide for his performance of other shooting exercises, similar in nature to the main one, in which the shooter is improving.

Finally, it should be said that research in other sports and the practice of leading sports shooters have proven that performing exercises with loads exceeding those required to perform exercises in competitions gives particularly effective results. Therefore, in the process of general, special physical and technical training, a sports shooter must develop the ability to withstand double and even triple loads of exercises in his profile (except, of course, PV-6 and MV-6).

Some features of technical, tactical and special training of a sportsman-shooter when practicing various shooting exercises

In presenting the material concerning the technique and tactics of shooting and the performance of individual shooting exercises, the training issues have already been reflected to a certain extent; in addition, the analysis of the technique and tactics of shooting, as well as special physical training in itself, to a large extent, allows the shooter to draw conclusions about the direction in which he needs to work on himself during training. Therefore, below, only some fun-

damental issues concerning the training (technical preparation) of an athlete-shooter when practicing certain shooting exercises will be outlined in general terms.

The "standard" exercise requires a great deal of effort from the shooter; therefore, in order not to cause him to become overtired, it is not always necessary to perform the "standards" completely; it is best to plan shooting the "large standards" less often, and to limit yourself more often to shooting 20-40 rounds standing or kneeling, combining them with other special exercises. Despite the fact that shooting standing is the most difficult, this does not mean that it is the one that should be practiced primarily, since the position for shooting from the kneeling and prone positions, although more stable, allows you to score more points; but such exercises are correspondingly more demanding in terms of shooting efficiency. Therefore, during training, due attention should be paid to shooting from all three positions, still giving some preference to shooting standing.

Training in shooting while standing should be conducted mainly to acquire a stable stance, develop strength and special static endurance, develop appropriate coordination of actions - aiming and pressing the trigger, as well as to develop the ability to shoot in different modes of firing - at different speeds and rhythms.

To develop strength and special endurance, it is recommended to use training methods and tools based on alternating actual shooting under the conditions of performing exercises with training in firing a blank shot.

To develop the skill of holding the rifle in a ready position for a long time, the following techniques can be used when processing each shot:

- after the shot, without lowering the weapon, completely repeat the dry firing procedure;
- holding the weapon in a ready position, fire only on the 3rd or 4th attempt;
 - when training "idle", holding the rifle in the ready position and maintaining a "level front sight", repeatedly press the trigger (spoke), choosing favorable moments in the weapon's oscillation, thus extending the aiming time to 35-40 seconds;
- gradually achieve the ability to continuously hold the rifle in a ready and aiming position - for up to 20 minutes, giving rest only to the vision every 12-15 seconds (periodically looking away, blinking and closing the eyes).

In addition to the listed training techniques for developing static endurance, which is necessary for successfully shooting the entire exercise, the following techniques can be used:

- extension of training time at the firing line by alternating an actual shot and subsequent complete processing of 1-3 "blank" shots;
- conducting systematic "dry" training at home - with a weapon or its model.

To improve the stability of the position and develop "muscle feeling" it is necessary to periodically conduct training in difficult conditions:

- conduct dry-fire and actual shooting training with a limited support area - standing on wooden blocks and washers with a gradual decrease in their area. At the same time, focus on developing the ability to consciously counteract the vibrations of the "shooter's body - weapon" system by engaging certain muscle groups. Then, you need to conduct training in the same conditions, but with focused attention on developing a strictly coordinated action - timely pressing of the trigger, coordinated with aiming.

Training in shooting from a kneeling position should be devoted not only to finding the most stable position, but also to developing the special endurance necessary for staying in the position

for a long time, so that it would be relatively painless to fire 20, and then 40 or more shots without getting up from the spot.

Increasing the stability of the position, acquiring special endurance is achieved mainly by "idle" training, holding the rifle in the position for a long time, while giving rest only to the vision every 8-12 seconds (periodically closing the eyes). Thus, it is necessary to develop endurance that allows you to bear the loads associated with continuous holding of the weapon and aiming for one hour.

During training, one should also improve the skills of quickly making a shot during the period of clear vision, without allowing aiming, which occurs especially quickly when shooting from the kneeling position due to particularly unfavorable conditions for the eye.

When training in shooting from a prone position, it is necessary to work on not only stability, but also to acquire special endurance to ensure a long stay in the ready position. Special endurance is developed by the same special techniques as when shooting standing and from a kneeling position - dry-fire training, as well as long-term holding of the rifle in the ready position with continuous aiming (periodically closing the eyes to rest the aiming eye). During such training, it is necessary to develop endurance that allows you to maintain an unchanged position for 30-40 minutes.

During training in prone shooting, it is necessary to gain experience in accurately aligning the STP with the center of the target when the lighting and wind changes during the exercises. Training to develop these qualities of the shooter must be planned and specially developed, using for this purpose days with unfavorable meteorological conditions for shooting.

During training shooting in the prone position, it is necessary to systematically conduct experiments on the selection of cartridges for the barrel of your rifle, study the behavior of the barrel under various shooting and cleaning modes, and also look for the most favorable combinations of sighting device sizes, light filters for one or another degree of target illumination for your vision.

When training in shooting while standing, kneeling and lying down, as the stability of the position and special static endurance are developed, it is necessary to periodically conduct special training sessions aimed at mastering the technical and tactical skills and techniques necessary for the ability to perform shooting exercises in various and unexpected shooting conditions. To do this, during special training sessions it is necessary to:

- fire a series of shots only from the first attempt;
- to fire a shot in a time significantly reduced compared to the usual shot processing time;
- shoot individual series at a very fast pace, spending 8, 6, 4 minutes on 10 shots;
- shoot an exercise with an unexpected reduction in the shooting completion time for the shooter, etc.

Shooting while standing at the "Running Deer" and "Running Boar" targets requires mainly training in acquiring a quick and accurate rifle raise, smooth right and left swing, quick reloading ("Running Deer"), and a quick but smooth trigger pull. During training, you need to practice individual elements of the shot technique, and then move on to training the complex execution of all actions - firing a shot while swinging the rifle to the right and left.

Fast and precise rifle raising is developed by repeated repetition of all movements, brought to automatism. This is achieved during each training as a warm-up before shooting.

The stability of the "shooter's body - weapon" system is developed by developing the strength and static endurance of the shooter's body - by long-term aiming in a ready position, first at a stationary target. The duration of holding the weapon with each aiming gradually increases from

15-20 sec. to 1 min. The most productive training lasting 30-40 min. with the following intensity of load: 10-minute work on the firing line with 5-minute rest intervals.

Then you need to develop the accuracy of shooting at a stationary target (No. 7). At first, shots are fired in an unlimited time, and then, as you get more trained, this exercise needs to be made more difficult - firing a shot in a limited time - in 4-6 seconds, bringing it to 2-3 seconds. In this case, you need to move on to shooting at a figured target, using the front part of the right and left target of the "deer" or "wild boar", aiming the aiming stump at the targeting area chosen for yourself, say under the "patch" of the "wild boar" head or at the head of the "deer".

Training in the shouldering and in the smoothness of the leash and the stability of aiming when the target moves to the right and to the left is carried out by firing "dry" on the firing line, when the next shooter is conducting real shooting. In addition, training in the shouldering and leash should be carried out in a classroom or at home on a reduced target setup. In the absence of moving targets, training in the leash can be carried out along a horizontal line (twine, wire, tape), stretched at the level of the rifle, held in the shooting position. The length of such a horizontal line should be such that it is possible to leash to the right and to the left within an angle of 15-25° (i.e. with a slightly greater angular movement of the weapon than on the real target setup). The issues of training in shooting at moving targets are described in detail in the book by I.M. Eselson, which we recommend to readers.

Slow shooting from a pistol (revolver) . Training should be mainly conducted in the following directions: development of stability of the hand with the weapon when aiming; development of strength endurance of the muscles of the shoulder girdle and the hand holding the weapon, necessary for successful execution of the entire exercise and acquisition of motor skills necessary for performing a strictly coordinated action of aiming and pressing the trigger (trigger needle). To acquire these qualities, it is necessary to use training tools and methods based on alternating actual shooting under the conditions of performing shooting exercises with "dry" training - in various combinations with actual shooting.

To develop the stability of the hand with the weapon when aiming and to develop the ability to hold the pistol in the air for a long time in the ready position, you can use the following techniques:

- periodically use pistols (revolvers) of increased weight (due to the attached special weights weighing 80-100 g) during actual shooting and dry-fire training;
- after the shot, without lowering the weapon, repeat the dry firing procedure;
- hold the pistol in the ready position for 15-30 seconds and only then begin processing the shot;
- when training "idle", without lowering your hand with the weapon and maintaining a "level front sight", repeatedly press the trigger (trigger needle) at favorable moments in the weapon's oscillation, thus extending the aiming time to 30-40 seconds, etc.

To develop the strength and static endurance necessary for successfully completing the entire exercise, you can use the following techniques:

- alternate between firing an actual shot and then raising your hand to process the shot "blank";
- fire shots only after the 2nd or 3rd raise of the hand (attempt);
- conduct systematic, dosed, "idle" training at home, using a model pistol or some objects to weigh down the hand held in the ready and aiming position, etc.

As the stability of the hand with the pistol (revolver) is developed during aiming and the strength endurance necessary for successful shooting of the entire exercise, it is necessary, as for slow shooting from a rifle, to periodically conduct special training aimed at mastering technical and

tactical techniques that allow successful execution of exercises under various shooting conditions. To do this, during such training it is necessary:

- fire individual series of shots only from the first raising of the hand with the pistol (attempt);
- make a shot in a sharply reduced time compared to the usual manner of processing a shot, bringing the time to 7-9 seconds per shot (from the moment the hand is raised to the shot);
- carry out shooting of individual series at a fast pace, sometimes bringing it up to 10 shots in 4-5 minutes;
- perform exercises with an unexpected reduction in the shooting completion time for the shooter, etc.

High-speed pistol shooting at silhouettes, being one of the fastest shooting exercises, requires the development of precise automated movements and a highly developed sense of time. First of all, during training, special attention should be paid to practicing the first shot. To do this, it is necessary to learn and practice individual elements of it in stages, focusing attention in each case on precise practice:

- a quick, jerky start to raise the hand with the pistol;
- raising the arm strictly in a vertical plane with a smooth slowdown as the lift is completed; at the same time, you should control yourself so that the weapon does not "slip" through the center of the target, otherwise time will inevitably be lost in lowering the arm;
- raising the arm while simultaneously aligning the "flat front sight";
- the beginning of the inclusion of the index finger in the work to press the trigger and the completion of pressing the trigger; in this case, it is necessary to pay attention to the fact that there is no delay in the inclusion of the index finger in the work;
- raising the hand while simultaneously performing a complex of actions: maintaining a level front sight and moving the index finger when pressing the trigger.

All these actions must acquire an automated character, form a strong motor skill and represent a holistic motor act. And even if all the actions associated with raising the hand and making the first shot have already acquired an automated character, each training day must begin with multiple repetitions of the complex training "idle", carefully monitoring the accuracy of each of the elements.

Then it is necessary to start training in making the first shot by actual shooting. It should be carried out on a stationary silhouette target - with different time modes, in accordance with the layout of the time allocated for making the first shot when shooting eight-six-four-second series. Usually it is necessary to make 15-20 shots. The time spent on each of them is measured by a stopwatch and immediately communicated to the shooter so that he develops a sense of time: shooting the entire series largely depends on the accuracy of the shooter's determination of the time spent on making the first shot.

After this, you need to move on to training in making the first two shots - with the arm raised and transferred (rotational movement of the body) to the next silhouette. After several minutes of training "idle", you should make 10-15 such paired shots and only then proceed to shooting full series according to the conditions of the exercise, and it is necessary to use a stopwatch, so that the shooter, as with the first shot, develops a sense of rhythm, necessary for rational use of the time allotted for shooting a series, without fear that he will not be able to fit it.

Automation of movements associated with raising the arm, making the first and subsequent shots is developed mainly by "idle" training at the firing line, as well as in free time from shooting, at home on reduced targets using a pistol, its model, or some object that weighs down the

arm. Moreover, the specific weight of "idle" training should be large and amount to 60-70% of the total time allocated for training the silhouette shooter.

To develop special stability and endurance, practice the technique of shooting (expanding the range of special motor skills), and also to improve the accuracy of shooting, the following should be used:

- slow shooting from a silhouette pistol at a target with a black circle and silhouette;
- slow shooting from a match pistol and a sport revolver;
- slow and accelerated shooting from a sport (standard) pistol and a sport revolver at a target with a black circle and silhouette.

5.1.4 Development of moral and volitional qualities of a sports shooter

The peculiarity of sports exercises, including shooting, is that their performance is associated with overcoming difficulties that require great effort of all the athlete's strength. In order to force himself to overcome these difficulties, the shooter must make significant efforts of will and have sufficiently developed volitional qualities: persistence, determination, endurance, discipline. The shooter must be able to overcome fatigue, a painful state, endure pain during prolonged shooting, forcing himself to shoot to the end, without reducing the indicators. By an effort of will, he must restrain himself and after unsuccessful shots not give in to a feeling of annoyance and irritation, pull himself together and correct a bad result with subsequent good shooting.

The ability to control oneself, to force oneself to overcome difficulties and to maintain one's presence of mind under any circumstances are important character traits. Without this, one cannot achieve good athletic form or show high results when required, i.e. in competitions.

Along with strong-willed qualities, an athlete must also possess high moral qualities: a sense of duty and responsibility to the team, a sense of camaraderie, friendship, honor and justice. These character traits help the shooter to mobilize his strength to achieve victory in difficult moments of intense sports competition. That is why experienced coaches attach such great importance to the issues of developing high moral and strong-willed qualities in athletes. That is why training must be structured in such a way that not only the technical growth of the athlete is envisaged, but also his strong-willed qualities are necessarily strengthened, so that thanks to the developed willpower he can persistently and persistently train and be able to control himself during competitions.

When competing, an athlete gets nervous. Strong nervousness in shooting sports is especially harmful (see below about the pre-start state), since it reduces control over one's actions, disrupts the shooter's coordination of movements, and ultimately often sharply reduces his athletic performance. Only a strong-willed shooter, endowed with sufficient self-control and endurance, who is able to overcome nervousness, can achieve good results. These qualities not only manifest themselves, but are also developed in competition conditions. A shooter with experience in competitions copes with nervousness much better and, having overcome it, shoots well. To acquire such experience, it is important to create an environment close to a competitive one during training.

Therefore, along with regular training with and without shooting (dry shooting), it is essential to use various competitive shooting training, competitions and shooting tournaments as a preparation method, during which, on the one hand, the shooter's volitional qualities are revealed, and on the other hand, he develops self-control and the ability, despite excitement, to shoot evenly and show results at the level of his technical training.

Domestic shooting sports know many varieties of competitive training shooting, designed to develop and strengthen various aspects of the volitional qualities of the sportsman-shooter. However, their choice in many cases to this day is random: there is no consideration of the influence

that various types of competitive training shooting have on the volitional preparation of the shooter in general and on sportsmen of a certain level of training in particular. The first, and quite successful, attempt to systematize and determine the influence of various variants of competitive shooting on the formation and development of certain aspects of the volitional preparation of the sportsman-shooter was made by L.M. Weinstein. Among his numerous recommendations are the following:

"A competition is a long-term form of collective training. It is practiced in groups of shooters who cannot attend training sessions at the same time. The conditions of competitions can be very diverse, as well as the influence they exert.

Here are some options for competitions:

1. The term is one month. The number of shootings is not limited. The 6 best results are counted.

If the athlete starts this shooting well, he tries to finish it just as well. If he starts badly, the shooter switches to correcting the shortcomings in the shooting technique. Such conditions of the competition are appropriate in section work: holding a competition activates the work of the section, increases attendance and the performance of athletes. This option is especially recommended for shooters of average training level.

2. Number of shootings - 12. The 10 best results count. These tough conditions are designed for a more prepared team. The athlete has only two preferential attempts, and the value of each shooting increases.

3. Number of shootings - 12. The score is based on the sum of the 4 worst results. These conditions are appropriate for shooters who show high but unstable results. Each unsuccessful shooting will stimulate the athlete's efforts to correct it.

4. Number of shootings - 12, the results of a series of not less than 90 points are counted. This will force the athlete to work on each series with concentration.

The sum of the series that we have named - 90 points - is conditional. The established criterion depends on the level of training of the group shooters. The standard must be realistic, evoke a feeling of confidence in its implementation, but at the same time be difficult enough, demanding the full mobilization of the athlete's spiritual and physical strength" (L.M. Weinstein. Shooter and Trainer. FiS, 1969).

It is quite obvious that there can be a great many variants of the competition; it is important that each of them pursues a specific goal, contributes to the successful resolution of current issues of the volitional and technical training of a given group of shooters at a given level of their training.

For example, shoot at a fast pace; do not allow individual breakaways - fire a series of shots without releasing bullets from certain dimensions; shoot for accuracy - determine the winner by the number of "tens" shot; fire shots during competitive shooting only with the first application (raising) of the hand, etc.

Shooting tournaments are a time-tested good means of developing athletes' willpower. They are held like chess tournaments: each participant meets in turn at the shooting range in pairs with their sports "opponent" (Fig. 279). In the tournament table, the winner of a given pair is given 1 for a victory, the loser - 0; in case of equal points - a draw - the participants in the paired meeting are given 1/2. Usually, the conditions of a shooting tournament are shooting one series of 5 or 10 shots.

ХОД СТРЕЛКОВОГО ТУРНИРА МЕЖДУ СОТРУДНИКАМИ ТИПОГРАФИИ													
	Гурский	Федоров	Захаров	Ушицин	Симаков	Матвеев	Томилов	Сумкин	Табачков	Медведев	Ч-во побед	Очки	Занятое место
Гурский		1 49	1 50	0 47	1 49	0 47	1 50	1/2 48	1 49	1 48	6 1/2	437	II
Федоров	0 48		1 50	1 49	1 50	1 50	0 49	1 49	1 50	1 48	7	443	I
Захаров	0 47	0 49		1 48	1 49	1 47	0 46	0 48	1 47	1 49	5	430	IV
Ушицин	1 48	0 48	0 47		1/2 48	1 50	1 49	0 48	1/2 49	0 48	4	435	VI
Симаков	0 47	0 45	0 47	1/2 48		0 46	1 47	1 49	0 48	1/2 47	8	424	VIII
Матвеев	1 48	0 48	0 46	0 49	1 47		0 46	0 47	1 49	1 50	4	430	VII
Томилов	0 49	1 50	1 48	0 46	0 46	1 48		0 48	1 47	1 49	5	429	V
Сумкин	1/2 48	0 47	1 49	1 50	0 48	1 49	1 50		1 49	0 48	5 1/2	438	III
Табачков	0 48	0 47	0 45	1/2 49	1 49	0 48	0 46	0 48		1 49	2 1/2	429	IX
Медведев	0 47	0 45	0 47	1 49	1/2 47	0 44	0 48	1 49	0 48		2 1/2	424	X

Fig. 279 - Tournament table for 10 participants

The advantages of shooting tournaments are the significant and repeated emotional tension that arises when each pair shoots simultaneously, requiring a great mobilization of willpower from the shooter.

In addition to the round robin tournament system, when all participants meet each other in turn, it is also possible to use a system of meetings like the Olympic one - with quarterfinals, semifinals and a final meeting. It is only desirable that the groups be staffed with participants who are equal in their level of technical preparation.

Control shooting, which is usually conducted according to the conditions of competitions, will have a more acute, emotional character if the shooting results are published not in the form of lists with dry, bare figures, but in the form of various graphs. Keeping a graph with the cumulative shooting results (Fig. 280) significantly enlivens the control training and increases interest in it. It is also useful to show the results of control shooting in the form of graphs - curves (Fig. 281), from which the degree of growth and stability of the results of each athlete are clearly visible.



Fig. 280 - Graph of the progress of control shooting with a cumulative total



Fig. 281 - Graph of control training shooting in the form of curves

Reflecting the shooting results in the form of various graphs, as a rule, increases the athlete's responsibility for his control shooting and mobilizes his will.

When planning and conducting such control and qualifying shooting, measures should be taken to create equal conditions for all athletes; distribute shields only by lot, issue everyone with cartridges of equal quality, and even better - give shooters the right to choose the cartridges that they consider most suitable for the barrel of their weapon. Organizing the scoring shooting, calculating the results should be done in conditions as close as possible to competition. The situation should not be simplified. Sometimes, on the contrary, it is necessary to complicate the requirements in order to cultivate firm discipline, which is especially necessary for successful performance in competitions. This will help to avoid many troubles in the future for both the team and the shooter (for example, making unaimed and accidental shots, incorrectly making adjustments, shooting at someone else's target, unnecessary holes in your target, etc.). Naturally, during scoring shooting, it is necessary to show an impartial attitude towards all shooters without exception. Only by setting up training and competitive shooting in this way can the shooter realize and feel that he needs to earn the right to be included in the team.

The effectiveness of competitive shooting will be greatest if during it the sporting competition will not only take place among the shooters of one's own team; it is necessary to use the slightest opportunity to measure strength with other athletes training in the same shooting range or on the same shooting range.

However, one should not abuse a large number of scoring shootings to accustom the shooter to an environment close to competition: they can exhaust the shooter so much, overload his nervous system, that he will develop an aversion to shooting and the results will decrease. In addition, "working only for points", the shooter will not have time for individual work, to eliminate the weak points in his technique.

When preparing for a competition, the following should be kept in mind. Achieving high sports results in training should not be a reason to even temporarily stop them. On the contrary, no matter how high the training result is, it should be consolidated so that it becomes stable and habitual for the shooter.

An athlete should not hide his high results by artificially reducing them by deliberately firing a few carelessly bullets, citing the fact that he needs to have more opportunities in reserve in order to demonstrate them to the full extent at the competition. Such views must be resolutely combated and shooters must be explained that at a certain stage of training they must psychologically get used to their high results. There are many known cases when a technically well-prepared athlete was frightened by his high results at competitions, began to worry even more and hopelessly spoiled the shooting, which could have been a record. The developed habit of his high result, on the contrary, instills self-confidence, and this result becomes a common occurrence for this shooter. In this regard, many experienced shooters say that "it is not enough to be technically well-prepared, a good shooter - you also need to be able to set records."

5.1.5 Periodization and planning of sports training

Sports practice of recent years convincingly testifies that further improvement of an athlete specializing in any kind of sport requires continuous year-round training. This year-round sports training is divided into separate periods during which the intensity of the training load, the ratio of general physical and special training, as well as the methods and means of preparation and training of the athlete differ significantly from each other.

Such periodization also exists in the year-round training of a sportsman-shooter. And it is not that the shooter, due to his busy work and studies, cannot train year-round with the same intensity; periodization is introduced not for the convenience of planning training work - it is dictated by objective laws, mainly the phased development of sports form.

Phases of development of sports form and periods of sports training

Sports form - the state of an athlete at that stage of training development when he is prepared to demonstrate the highest sports results in his sport - cannot be considered as an unchanging, frozen state. Sports form is a changeable process of sports improvement, which is an alternation of three phases: 1) acquisition, 2) maintenance (relative stabilization) and 3) temporary loss of sports form (L.P. Matveyev. The Problem of Periodization of Sports Training, Physical Culture and Sport, 1964).

The first phase (acquisition of sports form) includes two stages. At the first stage - the formation and development of prerequisites for sports form - there is an increase in the general level of functional capabilities of the body due to the comprehensive development of the physical and moral-volitional qualities of the athlete; on this basis, various motor skills and abilities are formed. At the second stage - the direct formation of sports form - the process of changes acquires a more specialized nature, special training increases, and qualities inherent in a given sport are developed.

The second phase - (maintenance, relative stabilization of sports form) and is the state of training when the athlete is prepared to show the highest sports results. This period is characterized by the stabilization of sports results at a high level.

The third phase (temporary loss of athletic form) is characterized by a decline in fitness, the fading of connections that make up certain elements of athletic form. First of all, specialized, finely differentiated conditioned reflex connections fade away. In general, the body switches to a different level of functioning. It is noteworthy that when athletic form is lost, active rest allows maintaining fitness at a level higher than that from which the formation of the first phase of athletic form development began, since passive rest and long breaks in training lead to significant losses, the compensation of which subsequently entails an unjustified expenditure of time. Loss of athletic form, notes L.P. Matveyev, is not a decline in the vital functions of the body; during this period, positive changes caused by past loads also continue.

Temporary loss of athletic form is a condition for its further development, and here is why. Athletic form acquired at a certain stage of improving athletic skills is an optimal state only for this stage; in order to move forward, it is necessary to ensure a higher all-round development of physical and volitional qualities, enrich oneself with more advanced motor skills and abilities, and improve many aspects of athletic preparedness. Consequently, a new athletic form, arising on the basis of the previous one, must include new acquisitions, relying on a new, higher level of all-round development of the athlete. Therefore, temporary loss of athletic form is a natural phase in the process of athletic improvement.

That is why the laws of periodization of sports training are first of all the laws of management of development of sports form. This is the reason why the training cycle consists of three periods:

a) preparatory (ensuring the development of athletic fitness);

b) competitive (creating conditions for maintaining athletic fitness and realizing acquired optimal capabilities in athletic achievements);

c) transitional (maintaining fitness at a certain level through active rest), which is the connecting link between two training cycles.

The duration of the cycles of development of sports form in one or another sport is different and fluctuates from one year to three months. The accumulated experience, as well as the dynamics of sports results of the strongest shooters, allow us to state that the development of sports form in sports shooters has an annual cycle.

It should be taken into account that the new, next cycle should not be a simple repetition of the previous one. It should be built on a new basis, to some extent updating the methods and means of training, with a large volume of training load (Matveev L.P., 1964).

Planning sports training . Training plans for sports shooters are:

prospective - multi-year, usually for 4 years, designed to prepare for participation in the Olympic Games, the World Shooting Championship, the Spartakiad of the Peoples of the USSR. These plans define the main direction in improving the athlete - a list of the means used, aimed at developing the basic physical and special qualities of the shooter; the number of planned major competitions; determination of control standards, etc. These plans are usually not detailed;

annual, which define in more detail specific tasks for the general and special training of the shooter. Annual plans, as a rule, are based on the periodization of sports training;

operational, compiled on the basis of annual plans. These plans determine training work for the near future - a month, a week, a separate microcycle, the time of a training camp, etc. Such plans, as a rule, are distinguished by significantly greater detail, precise dosing of training loads.

The annual training plan consists of three periods: preparatory, main (competitive) and transitional.

The preparatory period (January, February, March, April), in turn, is divided into two stages - general preparatory and special preparatory.

At the first (January, February), general preparatory stage, the main task is to increase the level of development of the basic physical qualities and the development of general and special endurance of the shooter. At this time, general physical training should occupy a significant place in the preparation of the shooter; its means are practicing other sports that have a complex effect aimed at developing the basic physical qualities, as well as sports that contribute to the development of special qualities in the shooter (skiing, skating). To develop general and special endurance, it is necessary to widely use special training means (dry training, prolonged holding of the weapon in the air, etc.). Technical training with actual shooting at this time should be aimed mainly at the restoration and further development of skills and abilities related to the technique of firing a shot. At this time, it is advisable to focus on careful development of individual elements that make up the shooting technique in one or another shooting exercise. At this stage, you need to complete experiments in search of the most advantageous shooting techniques, advantageous shooting positions, etc.

At the second (March, April), special preparatory stage, the main task is to create direct prerequisites for the development of sports form. Therefore, the ratio of loads that determine various aspects of the shooter's training also changes. The volume of general physical training is somewhat reduced, it is assigned only the role of maintaining the achieved level of development of basic physical qualities. The specific weight of special physical training increases; along with the use of special means aimed at further development of general and special endurance, various types of "idle" training are widely used, designed to develop special stability and practice the coordinated action of aiming and pressing the trigger. At the same time, the transition from

practicing individual elements of shooting technique to the holistic performance of actions related to the technique of making a shot and shooting the exercise is completed. The volume of training with actual shooting increases significantly, and according to the conditions of performing shooting exercises.

The main (competition) period (May, June, July, August, September) has as its goal the regulation and maintenance of sports form and on this basis - the achievement of the highest sports results. The volume of general physical training is reduced here, it serves mainly to ensure active rest. The best means for this are: brisk walks, slow jogging over rough terrain, cycling, swimming. The volume of special training at the beginning of this period continues to increase partly due to the use of various methods of "idle" training at home using mock weapons or hand weights; the main special training means of this period is the shooting itself under the conditions of the exercises. During this period, the shooter's moral and volitional qualities should be improved especially intensively and his psychological readiness for the upcoming responsible sports performances should increase. Therefore, about a third of all training should be close to competition conditions.

Since the main (competition) period in shooting sports is relatively long, it is recommended for shooters of senior sports categories, especially those who are part of national teams, to introduce a so-called intermediate stage in the training process somewhere in the middle of the main period, a kind of "unloading microcycle", which is especially necessary either after important and difficult competitions or after intensive, intense training. The introduction of an intermediate stage will help to avoid overtraining and create the necessary conditions for maintaining athletic form for a longer period. At this short stage (7-14 days), it is necessary to provide the shooter with active rest by means of general physical training (but not in large doses); these include: outdoor games, fast walking, swimming, cycling, etc. As means of special training, various methods of "idle" training and a small amount of training with actual shooting under competition conditions should be used.

During the rest of the main period (after the intermediate stage), the main task is: firstly, to create conditions for stabilizing the sports form and, on its basis, successful performance in competitions; secondly, to consolidate the experience of performing shooting exercises in the conditions of important competitions. During this period of time (approximately August - September), the volume of general physical training remains at the same level as before the intermediate stage. Its means remain the same auxiliary sports, but with a predominance of fast walking, swimming and cycling; participation in sports and active games should be avoided due to the risk of injury, which is absolutely unacceptable at this stage of the training process. Special and technical training is carried out mainly by performing shooting exercises under competition conditions and dry-fire training in a small volume, aimed at reinforcing skills in special stability, practicing the trigger pull, strictly coordinated with aiming, as well as reinforcing other highly specific actions associated with the individual technique of firing a shot and one's style of performing a shooting exercise.

The transition period (October, November, December) sets the task of ensuring good, full-fledged active rest and at the same time creating conditions for maintaining a certain level of sports training necessary for a successful start of the next annual training cycle. During this period, the content of all means of sports training should be subordinated to the main thing - the elimination of nervous and physical fatigue that developed during the previous intensive training and performances at competitions. Active rest will be most complete when changing activities and when the environment changes. The means of active rest should be tourism, hunting trips, fishing, sports and outdoor games, walking, swimming, slow running, fast walking; towards the end of the period - skating, skiing. These means of general physical training, promoting active rest, generally occupy a leading place in the training of an athlete-shooter during this period, since the specific weight of special training is reduced to a minimum. It should be narrowly focused: to maintain specific skills related to the technique of shooting, to the extent possible to maintain the previously achieved level of special stability of the body in the ready position, etc. The means of special training include: periodic actual shooting and various options for "dry"

training. One of the most important tasks of the transition period is also a thorough analysis of various aspects of the shooter's sports activity in past training periods.

Below is an approximate schedule of the annual training load for shooters of senior sports categories, combining work or study with regular sports (Fig. 282). This schedule of loads is made for the specialization of the athlete in exercises characterized by slow shooting, on the basis of three training days a week and one training camp. At the same time, almost daily short training "idle" with a model of a weapon at home is assumed. The calculation of general physical training includes a daily 30-minute exercise.

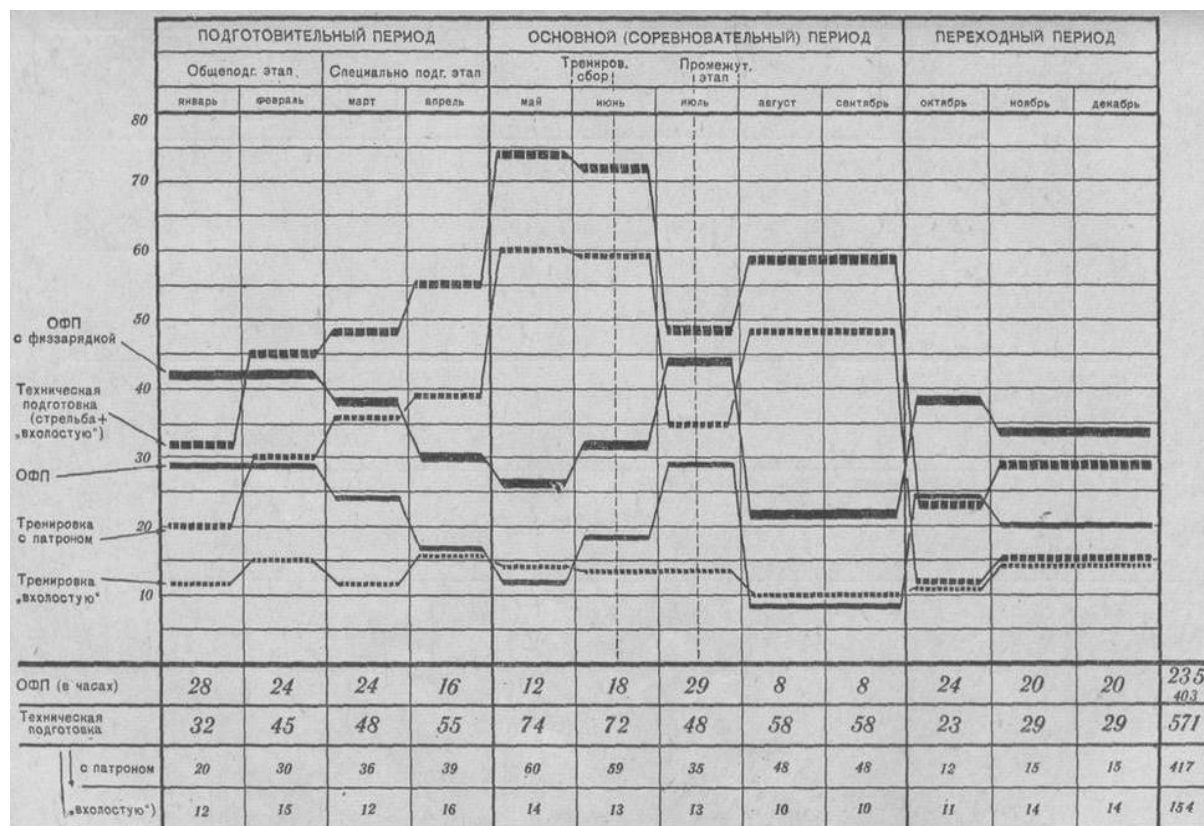


Fig. 282 - One of the possible options for the annual training load schedule for shooters of senior sports categories specializing in slow shooting exercises

The graph shown in Fig. 282 should be considered only as one of many possible options, since when drawing up such graphs in each individual case it is necessary to take into account:

— the athlete's specialization; the schedule of the annual training load for shooters improving in high-speed shooting, as well as in shooting at moving targets, should be drawn up with a completely different ratio of time allocated to actual shooting and "dry" training, etc.;

— the shooter's qualifications, sports experience and level of sportsmanship; specific features of his production activities;

— the duration of individual periods of sports training (and hence the inclusion of "intermediate" stages and "unloading" microcycles of varying duration, determined by the calendar dates of the most important competitions), etc.;

— local climatic conditions, possibilities in choosing means of general physical training, availability and occupancy of shooting galleries and ranges, etc.

Tables 19-23 provide, as one of the possible options, the content of weekly plans (microcycles) for training shooters of senior sports categories in the preparatory, main (competitive) and transitional periods, compiled in development of the annual training load schedule shown in Fig. 282.

Contents of weekly plans (microcycles) for training shooters of senior sports categories in the preparatory period (general preparatory stage), specializing in slow shooting exercises

Table 19

Content		January. Weekly cycles							February. Weekly cycles						
		Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	IN.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	IN.
Physical exercise - 30 min.		Daily							Daily						
General physical fitness															
Skiing								4 hours.							4 hours.
Sports games, skating, swimming					3 hours.							3 hours.			
For riflemen															
Shooting practice															
standing	qty of cartridges			20			20				40			40	
	time			1 hour.			1 hour.				2 hours.			2 hours.	
from the knee	qty of cartridges			20			20				20			20	
	time			1 hour.			1 hour.				1 hour.			1 hour.	
lying down	qty of cartridges						20				20			20	
	time						45 min.				45 min.			45 min.	
Idle training															
standing	time	30 min.	30 min.		30 min.	30 min.			40 min.	40 min.		30 min.	40 min.		
from the knee	time	30 min.				30 min.			40 min.				30 min.		
lying down	time														
For pistol shooters															
Shooting practice															
	qty of car-			30			60				30			60	

	tridges														
	time			1 hour.			2 hours 30 min-utes.				1 hour 30 min.		2 hours 30 min-utes.		
Idle training															
	time	30 min.	30 min.	30 min.	30 min.	30 min.	30 min.		1 hour.	30 min.	30 min.	30 min.	1 hour.		

Note: In January: Wednesday - practicing individual elements of shot production technique. In February: Wednesday - developing special endurance.

Contents of weekly plans (microcycles) for training shooters of senior sports categories in the preparatory period (special preparatory stage), specializing in slow shooting exercises

Table 20

Content		March. Weekly cycles							April. Weekly cycles						
		Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	IN.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	IN.
Physical exercise - 30 min.		Daily							Daily						
General physical fitness															
Sports games, fast walking, swimming, slow running, cycling				2 hours.				3 hours.							3 hours.
Ex. for balance				1 hour.						1 hour.					
For riflemen															
Shooting practice															
standing	qty of cartridges		20				40			20		40		40	
	time		1 hour 30 min.				2 hours.			1 hour.		2 hours.		2 hours.	
from the knee	qty of cartridges		20		20		20			20		20		40	
	time		1 hour 30 min.		1 hour 30 min.		1 hour.			1 hour.		1 hour.		2 hours.	
lying down	qty of cartridges				20		20							20	
	time				45 min.		45 min.							45 min.	

Idle training															
stand- ing	time	30 min.		30 min.		30 min.		30 min.	1 hour.	30 min.	40 min.		40 min.		
from the knee	time	30 min.				30 min.					30 min.		30 min.		
lying down	time														
For pistol shooters															
Shooting practice															
	qty of car- tridges		30		30		60			30		60		60	
	time		1 hour 30 min.		1 hour 30 min.		2 hours 30 min- utes.			1 hour 30 min.		2 hours 30 min- utes.		2 hours 30 min- utes.	
Idle training															
	time	1 hour.		30 min.		1 hour.			1 hour.		1 hour.		1 hour.		

Note. In March. Tuesday - development of special endurance. Saturday - first and third, control shooting. In April. Thursday - development of special stability. Saturday - first and third control shooting.

Contents of weekly plans (microcycles) for training shooters of senior sports categories in the main (competitive) period, specializing in slow shooting exercises

Table 21

Content	May - July. Weekly cycles							August - September. Weekly cycles						
	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	IN.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	IN.
Physical exercise - 30 min.	Daily							Daily						
General physical fitness														
Fast walking, slow running, cycling, swimming				2 hours.							2 hours.			
Ex. for balance		30 min.												
For riflemen														
Shooting practice														
standing	qty of car-tridges	40		40			40	20		40			40	
	time	2 hours.		2 hours.			2 hours.	1 hour.		2 hours.			2 hours.	

from the knee	qty of cartridges	20		20			40	20		40			40	
	time	1 hour.		1 hour.			2 hours.	1 hour.		2 hours.			2 hours.	
lying down	qty of cartridges	20		20		60	40	20					40	
	time	45 min.		45 min.		2 hours.	1 hour 30 min.	45 min.					1 hour 30 min.	
Idle training														
standing	time		1 hour.		30 min.	1 hour.		30 min.		30 min.	1 hour.			
from the knee	time		30 min.		30 min.						30 min.			
lying down	time													
For pistol shooters														
Shooting practice														
	qty of cartridges	60		60	30		60	30		60	30		60	
	time	2 hours 30 min-utes.		2 hours 30 min-utes.	1 hour 30 min.		2 hours 30 min-utes.	1 hour 30 min.		2 hours 30 min-utes.	1 hour 30 min.		2 hours 30 min-utes.	
Idle training														
	time	30 min.	1 hour.	30 min.	30 min.	1 hour.		1 hour.		30 min.	1 hour.			

Note. Monday - free training. Wednesday - shooting according to the conditions of the exercise. Friday, Saturday - control shooting, "dry" training - developing special stability. Sunday - day off.

Contents of weekly plans (microcycles) for training shooters of senior sports categories at training camps and during the intermediate stage of the main period, specializing in slow shooting exercises

Table 22

Content	Training camp							Intermediate stage						
	May (June) 10-20 days							July (August) 7-14 days						
	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	IN.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	IN.
Physical exercise - 30 min.	Daily							Daily						
General physical fitness														
Light jogging, walking, cycling				2 hours.			2 hours.	2 hours.	2 hours.	2 hours.	2 hours.		2 hours.	

cling, sports games															
Ex. for balance		1 hour.			1 hour.				30 min.		30 min.		30 min.		
For riflemen															
Shooting practice															
standing	qty of cartridges	20		40			40								
	time	1 hour.		2 hours.			2 hours.								
from the knee	qty of cartridges	20		20			40								
	time	1 hour.		1 hour.			2 hours.								
lying down	qty of cartridges	20		20		60	40								
	time	40 min.		40 min.		2 hours.	1 hour 30 min.								
Idle training															
standing	time		1 hour.			30 min.			30 min.		30 min.		30 min.		
from the knee	time	30 min.		30 min.		30 min.			30 min.		30 min.		30 min.		
lying down	time														
For pistol shooters															
Shooting practice															
	qty of cartridges	30		60			60								
	time	2 hours.		2 hours 30 minutes.			2 hours 30 minutes.								
Idle training															
	time	30 min.	1 hour.			1 hour.									

Note. In May (June). Monday - free training. Wednesday - shooting according to the conditions of the exercise. Friday, Saturday - control shooting. Thursday, Sunday - active rest. In July (August). Friday - shooting at will (selection of cartridges, checking of weapons, etc.). Sunday - day off.

Contents of weekly plans (microcycles) for training senior sports category shooters in the transition period, specializing in slow shooting exercises

Table 23

Content		October. Weekly cycles							November - December. Weekly cycles						
		Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	IN.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	IN.
Physical exercise - 30 min.		Daily							Daily						
General physical fitness															
Active games, slow running, fast walking, cycling, skating and skiing					2 hours.							2 hours.			3 hours.
Additional means of active recreation															
Hunting, fishing, tourism							4 hours.								
For riflemen															
Shooting practice															
standing	qty of car-tridges					20							40		
	time					1 hour.							2 hours.		
from the knee	qty of car-tridges					20							20		
	time					1 hour.							1 hour.		
lying down	qty of car-tridges					20							20		
	time					40 min.							40 min.		
Idle training															
standing	time	20 min.	20 min.	40 min.	20 min.	20 min.			30 min.	30 min.	30 min.	30 min.	30 min.		
from the knee	time		20 min.			20 min.				30 min.			30 min.		
lying down	time														
For pistol shooters															
Shooting practice															
	qty of car-tridges					30							60		

	time						1 hour 30 min.							2 hours 30 min- utes.	
Idle training															
	time	30 min.	30 min.	30 min.	30 min.	30 min.			30 min.	30 min.	1 hour.	30 min.	30 min.		

Note. Training with cartridges - according to the conditions of the shooting exercise. Dry-fire training is aimed at maintaining the level of special stability and skills in the technique of firing a shot.

In conclusion, it should be said that any system, any method will be powerless to help a shooter who will treat training formally and turn it into memorization and mechanical repetition of shooting techniques.

Training is one of the most responsible aspects of the sports activity of a sportsman-shooter, it requires not only systematic, painstaking, but also thoughtful, creative work on oneself, continuous strengthening of volitional qualities. Only with such work on oneself will training turn into a reliable means of further sports growth of the shooter and allow him to win in sports competition.

Chapter 2. Shooter's performance at competitions

It is well known that competitions serve as a good school for a sportsman. They enrich him with valuable practical knowledge and skills. During them, communicating with other masters of accurate fire, a shooter can learn many "little things" that will significantly enrich his sports experience.

At the same time, competitions are also a serious test for the athlete, in which he must demonstrate his athletic skills and show results at the level of the technical capabilities that he has achieved in the process of training and education.

However, the peculiarity of performing at competitions is that it is not so easy for an athlete to demonstrate his true technical preparedness. Due to the specific competitive environment, which primarily affects his psyche, an athlete sometimes finds himself in an unusual state that does not contribute to the growth of results, but on the contrary, sharply reduces them. Athletes involved in any kind of sport are well aware of this "pre-start state" before the start of a competition. Simply put, an athlete experiences anxiety, which to one degree or another affects his athletic performance. A shooter experiences the same anxiety at competitions, with the only difference being that a sharp pre-start state, strong anxiety, has a significantly greater negative effect on results in shooting than in other sports. Athletes of different specialties, performing an exercise, put their anxiety, their emotional excitement into movements and thus provide some relief to their feelings. The shooter must remain completely still while processing the shot and fight the excitement, so to speak, one on one, suppressing it only by will. It is quite natural that the value of the shooter for the team is determined not only by his technical training, but equally by the ability to show results at the level of his training in a competitive environment, i.e. the ability to control himself and force himself, despite the excitement, to shoot well and evenly.

What is the pre-start state and how best to overcome the anxiety caused by it? If the first part of the question is relatively easy to answer, then the second is more difficult to answer, mainly because serious work, put on a solid scientific basis, with sports shooters in this direction, unfortunately, has not yet been carried out enough. The only thing that can help a shooter is to familiarize him with the accumulated experience and practice of performing in competitions of leading shooters who, despite the excitement, not only do not reduce their results, but, on the contrary, mobilizing all their strength, even increase them.

5.2.1 Pre-start condition when performing at competitions

Any emotions, various feelings and experiences that a person experiences have their physiological basis in the nervous processes occurring in the cerebral cortex, as well as in its subcortical regions. The emergence and development of the pre-start state, as a rule, occurs through conditioned reflex mechanisms. The situation at the competition - verbal commands, going out to the firing line, emphasized formality, the presence of judges and spectators - is a strong irritant that causes corresponding ideas and thoughts in the mind of the athlete, and a complex of physiological shifts in the body. When the pre-start state is characterized by the predominance of the excitatory process over the inhibitory one, motor excitement is observed, the shooter cannot find a place for himself before the start of shooting of his shift: excessive excitement, "starting fever", clearly hinders him. There are also opposite phenomena, when the process of inhibition prevails: low mood; sometimes complete indifference, lethargy in movements, drowsiness; psychologists call this condition "starting apathy".

The most favorable pre-start condition is the "state of combat readiness", caused by optimal excitation of the central nervous system and characterized by moderate physiological changes, good coordination and a feeling of pleasant uplift and inspiration.

Strong excitement during the pre-start state can be accompanied by a sharp increase in pulse rate, sometimes reaching 120 or more beats per minute. Due to the increase in blood pressure and

increased pulse rate, the shooter feels a strong pulsation, which significantly increases the rhythmic pulsating oscillation of the weapon; breathing becomes frequent and shallow, the athlete becomes hot, he sweats; excitement affects the muscle tone and the work of the shooter's motor apparatus so much that the weapon begins to oscillate strongly; the awareness of the loss of stability of the position further increases the excitement. Due to the disruption of the relationship between the excitatory and inhibitory processes in the central nervous system, coordination, consistency of movements is also disrupted, which has a psychological effect on the shooter, causing him a feeling of indecision, fear, anxiety for his result. The sportsman pulls the trigger extremely hesitantly, usually at the wrong time, when the favorable moment for firing has already been missed and the "straight front sight" is somewhere away from the aiming area. Indecisiveness and stiffness in movements lead to the shooter losing the ability to smoothly pull the trigger; the movement of the index finger when pulling becomes jerky, convulsive. It also happens that during shooting, a deceptive feeling appears, as if the trigger tension has increased incredibly, the index finger stops obeying. Excitement leads to a loss of the sense of time, a fear of not having enough time to shoot a series, etc.

Due to psychological and physiological characteristics inherent in each person, the pre-start state of shooters manifests itself differently in the signs themselves, and in strength, and in intensity. However, all athletes, regardless of their sports experience and willpower, are nervous in one way or another at competitions. Of course, the more a shooter is trained, the more self-confident he is, the less he is nervous. Less nervous are also athletes who have trained in an environment close to a competitive one, who have experience of frequent performances at competitions. At the beginning of the sports season, leading, experienced shooters are also much more nervous at competitions, but they, in comparison with inexperienced shooters, do not remain passive in the face of their experiences, do not give in to them entirely, but stubbornly fight the nervousness, forcing themselves to shoot well. And if any athlete declares that he is completely unfamiliar with nervousness at competitions, then either he is not telling the truth, or he is completely indifferent to the interests of the team, whose sporting

honor he is defending; he lacks basic concepts of sporting pride, which allows him to show indifference to such a strong natural stimulant as competition and sports competition.

How, in fact, can we combat the negative manifestations of the pre-start state, the anxiety that sharply reduces the results of young shooters during competitions and is a serious obstacle for experienced masters?

The history of shooting sports in the past knows many shooters who, performing at competitions and knowing in advance that they would be very nervous, placed their main hope in the fight against nervousness on alcoholic drinks, which they resorted to "for courage" just before the qualifying shooting. Of course, with the strong nervousness that they experienced during the competition and with which they actually did not fight, these shooters chose, in their opinion, the lesser of two evils, trying to somehow artificially "normalize" their mental state with alcohol. However, with the further development of shooting sports, with the steady growth of sports results, requiring the shooter to mobilize all his strength, significant volitional effort and, as they say, sober and serious work at the firing line, such unfortunate athletes found themselves overboard.

Shooting sports of the period 1936-1938 also know such leading shooters who, during preparation for major competitions, knowing in advance that they would be nervous during them, tried to accustom themselves to shooting while nervous by jumping on the spot, catching up the pulse to 110-120 beats per minute, and then in this state began to practice shooting. However, such a method of combating nervousness also turned out to be ineffective, since nervousness affects the quality of shooting mainly not because of the increased pulse, but because the overall coordination of the shooter's movements is disrupted due to the imbalance in the course of nervous processes, and the shooter experiences a state that cannot be imitated in a normal situation by any jumping.

The history of shooting sports also knows of cases when some rather famous shooters, having noticed that one cannot get too excited twice in a row, tried to deliberately get themselves worked

up before the scoring shooting, starting an unfounded quarrel with one of the participants of the competition or the judge. At the same time, having become very excited, such a shooter could conduct the scoring shooting relatively calmly, because due to the excitement to the limit during the quarrel, his nervous system was simply incapable of being fully excited again, a second time, during the scoring. However, this "method" of fighting excitement did not lead to anything good, since the shooting community gave a proper assessment of the behavior of such athletes, who ended up being disqualified for violating sports ethics and rules of conduct at competitions.

Shooters are also known to try to neutralize excessive excitement by deliberately not getting enough sleep before the test in order to strengthen the inhibition process and thus balance the flow of nervous processes.

However, in modern conditions, with a very high technical level of sports results, requiring the shooter to mobilize all his forces when shooting, this method is also unacceptable.

Naturally, the question arises: is there any way to combat anxiety? Maybe only people who are naturally endowed with extraordinary composure and an iron character shoot well in competition conditions?

Not at all, and this is evident from the following fact. As is known, starting from 1949-1950, the general level of sports results of Soviet shooters has sharply increased and continues to increase, despite the fact that each time it seems that shooting records have already reached the limit of human capabilities. And all this began to happen precisely from the time when it was forbidden to hide the athlete's true result from the competition during shooting.

Before this, a system was used where both the indicator and the corrector strenuously hid the result from the shooter during the shooting and considered this the height of the art of assisting the shooter in setting a record.

When a shooter was going for a record and heard about his good shooting, the result was immediately "diluted" by several bad

shots. It seemed as if the shooter had some mechanism inside that immediately triggered as soon as he learned that he was about to exceed the record, and the result dropped. At the same time, each new record set contributed to the general, mass rise of results to the next level, since such a "mechanism" in the shooter's mind began to work when he tried to exceed a new barrier - the newly set record. That is why the showmen and correctors tried very hard to hide the athlete's high result from him and present him with a pleasant surprise after the shooting with a message about setting a new record. And suddenly - "blind" correction was categorically prohibited; the judges demanded that the shooter be accurately informed of each shot and that each series of his shots be immediately made public. It was then that instead of a decrease in results, their growth and stabilization at a high sports level began.

The growth of results did not stop even after the joint work of the shooter and the spotter was completely prohibited in 1960. If earlier the shooter could still ignore the spotter's message about the merit of the hole (which is what the spotter was actually striving for), concentrating on that part of the spotter's message that concerned the technical side of the exercise (aligning the STP with the center of the target, favorable conditions for making the next shot, etc.), now he was forced to look at his target through a telescope or at the demonstration from a dugout, that is, to directly face the assessment of the qualitative side of his shooting.

Why did the results increase? Because these events with demonstration and correction "openly" forced the shooters to re-educate themselves, develop high volitional qualities, acquire the ability to suppress anxiety and, knowing in advance about their high result in this performance, force themselves, despite everything, to shoot well.

Speaking from a purely psychological perspective, we can say that the peculiarity of the pre-start state, excitement at competitions, is that it is caused by ideas about the competition, the situation at the competition (officialdom, judges, controllers), thoughts about performing poorly and letting the team down, etc. Consequently, the root cause of excitement are psychological factors

that cause physiological changes in the body: increased heart rate, impaired coordination of movements, etc. Therefore, in the fight against excitement, the shooter needs to force himself to change the flow of his thoughts, divert his thoughts from the situation at the competition, by an effort of will concentrate all his attention on the main thing - making a shot and not be distracted by anything that is not related to the shooting exercise.

Well, what should those athletes do or in those cases when, with all the desire and effort, no matter how you distract your thoughts, no matter how you switch them, you cannot cope with the excitement and the emotional state at the competition still remains a poorly controlled process? Here, the knowledge and mastery of autogenic training techniques can be of great benefit to the athlete-shooter.

Concepts of autogenic training . Autogenic training, as indicated by O.A. Chernikova and O.V. Dashkevich (O.A. Chernikova, O.V. Dashkevich. Active self-regulation of emotional states of an athlete. Physical Culture and Sport, 1971), is a system of psychological techniques consciously applied by a person that help change the tone of the muscular system and the course of psychological processes; in this case, it becomes possible to exert a deliberate influence on certain functions of one's body and mental state (emotional state, activity of some internal organs, etc.).

The original method of autogenic training, developed by the German psychiatrist I. Schulz (1920s), has undergone a number of changes, has gone far beyond the scope of medical practice and currently represents various variants of well-organized methods aimed at developing the athlete's ability to self-hypnosis and thus self-regulation of his mental state. What is the basis of the very principle of autogenic training?

We already know about the two main sections of our nervous system. One of them is the central nervous system, which includes the brain and spinal cord. The second section is the peripheral section, which consists of numerous nerves, a kind of conducting nerve pathways along which centripetal and centrifugal motor nerve impulses follow. The third main section is the autonomic

nervous system, which controls all internal organs, endocrine glands, etc. It performs its functions to a certain extent independently: a direct volitional command directed to any internal organ in the normal state of the organism will have no effect, since the autonomic nervous system is not subject to our conscious control, like some processes directly regulated by the brain.

If, as a result of appropriate training, an athlete develops the ability to more or less consciously, of his own free will, to control the activity of the autonomic nervous system, then he will be able to purposefully change his well-being, emotional state, which depends to a greater extent on the functioning of the internal organs and endocrine system at the moment.

This is the task that autogenic training is designed to solve, the psychophysiological mechanism of which is based on the use of not direct, but indirect, roundabout paths that influence the involuntary functions of the body.

O.A. Chernikova and O.V. Dashkevich indicate the existence of the following four paths (the text is given in abbreviated form).

"The first way: ... in addition to direct nerve connections going from the brain to the muscle and carrying the impulse of a reflex response, there are feedback connections with the cerebral cortex and subcortical nerve centers that are responsible for the activity of not only the skeletal muscles, but also the internal organs - the heart, endocrine glands, external secretion, etc. ... The state of the skeletal muscles, as well as the nature of breathing, due to feedback nerve connections, affects the activity of the nerve centers, and this, in turn, affects the activity of the internal organs themselves. ... By arbitrarily changing the degree of tension of the skeletal muscles (for example, relaxing the muscles of the legs and arms), changing the frequency and depth of breathing, it is possible to influence the activity of the central nervous system and those of its functions that are associated with the work of the internal organs, and, consequently, the mechanism of emotions.

By performing specially selected relaxation and tension exercises, as well as breathing exercises, it is possible to influence all other

components of emotional reactions, as well as the nature of emotional experiences.

The second way is in the deliberate, purposeful use of words - second-signal stimuli that activate or suppress certain functions of the organism and mental (subjective) states. ... In order for the verbal signal "self-order" to have an effective impact, it is necessary that the word be clothed in a special form that is capable of evoking a certain idea, and that it be of a figurative, concrete nature. ... Words denoting specific phenomena evoke ... the most distinct changes in the functions of the organism when these ideas have an emotional coloring (pleasant or unpleasant), evoke pleasure or displeasure and other emotions ... By deliberately evoking certain ideas in your imagination, you can arbitrarily evoke (and in some cases - change or suppress) a certain emotional state ...

The third way is ... the use of attention abilities. ... When a person concentrates on one object, tries to evoke the necessary idea, he is distracted from other thoughts and images. The ability to distract oneself from extraneous ideas or thoughts and concentrate on the object needed at the moment contributes to the purposeful change of emotional states.

The fourth way: ... the degree of effectiveness of the word and its influence on involuntary processes increases when the cerebral cortex is somewhat inhibited and the person is in a semi-drowsy state. ... In a state of inhibition, nerve cells react "paradoxically": a weak stimulus causes a strong reaction, while a strong stimulus causes a minimal or no reaction at all. Thus, in a state of inhibition of the brain's nerve cells, many interferences are eliminated that, under waking conditions, hinder the ability to voluntarily, by means of words, evoke certain vivid ideas. In a drowsy state, i.e., when the brain's nerve cells are inhibited, the excitation caused by a verbal stimulus easily makes its way from the cerebral cortex to its subcortical parts associated with the activity of the internal organs.

The inhibitory state of the cerebral cortex can be induced intentionally, by relaxing the muscles of the body, concentrating on this relaxation, on the regulation of breathing, ... on a state of rest and relaxation."

This is the mechanism of action - the use of ways to influence the involuntary functions of the body, on which various methods of autogenic training used in sports practice are based, with certain differences between them.

The methods of self-regulation of the athlete's mental states are based on the use of pre-developed and purposefully programmed verbal formulations, the meaning and content of which are associated with the tasks set before the athlete.

As an example, below is a set of verbal formulas for relieving unfavorable emotional states before the start and calming down in case of excessive nervous excitement.

A set of formulas for the calming part of psychoregulatory training (PRT) with various options for its completion (according to A.V. Alekseev).

1. I calm down.
2. And I concentrate on my face.
3. My face is calm.
4. My whole body is calm.
5. My whole body is calm.
6. My (passive) attention is (completely) focused on my (calm) face.
7. It is calm and motionless.
8. My attention moves to my hands.
9. My hands begin to relax and warm up.
10. My fingers and hands relax and become warm.
11. My forearms and elbows relax and become warm.

12. My shoulders and shoulder blades relax and become warm.
13. Both my hands are completely relaxed and warm.
14. My (passive) attention is (completely) focused on my (warm) fingers.
15. My attention moves to my face.
16. It is calm and motionless.
17. My whole body is calm and motionless.
18. My attention moves to my legs.
19. My legs begin to relax and warm up.
20. My soles and ankles feel relaxed and warm.
21. My shins and knees feel relaxed and warm.
22. My hips and pelvis will relax and become warm.
23. All my legs are completely relaxed and warm.
24. My (passive) attention is (completely) focused on my (warm) ankles.
25. My attention moves to my face.
26. It is calm and motionless.
27. My whole body is calm and motionless.
28. My attention moves to my torso.
29. It is completely relaxed and warm.
30. My attention stops on my chest.
31. My breathing is calm and easy.
32. My passive attention is focused on my heart.

33. My heart beats calmly, evenly, slowly.

34. It is resting.

35. My attention moves to my face.

36. It is calm and motionless.

37. My whole body is absolutely calm and motionless.

38. My whole body is resting.

After this formula, the following final options can be used:

Option I (normal completion)

39. I'm resting.

40. I rested and calmed down or - I rested, calmed down and gained strength.

Option II (sleepy ending)

39. Drowsiness appears.

40. It is getting stronger.

41. It gets deeper and deeper...

42. The eyelids become heavy.

43. Sleep comes.

Option III (activating completion)

39. ... and gains strength.

40. The feeling of heaviness and relaxation leaves my hands, my legs, my whole body.

41. All my muscles become light and elastic.

42. My attention is on my face.

43. The muscles of my face are flexible and light....
44. The drowsiness has dissipated...
45. I am becoming more and more cheerful...
46. I breathe deeply.
47. My head is rested and clear.
48. I feel good and energetic.
49. I am full of energy.
50. I'm ready to act!
51. Stand up!!

Autogenic training is usually conducted in a lying or sitting position (the latter, presumably, is more acceptable for the shooter). You need to sit in a comfortable, calm pose, the so-called "coachman's pose on a drozhky". It is worth noting that the duration of self-regulation of mental states, used shortly before the start of the competition, is reduced to 5-10 minutes; this is easily accomplished in shooting sports - such sessions can be conducted even on the firing line before the start of shooting - sit, relax your muscles and focus on the content and mentally pronounced verbal formulas.

The material presented here on autogenic training is presented very briefly, only for the purpose of familiarizing with the essence of this training method, as well as its popularization among sports shooters - as a very effective means in the fight against an unfavorable emotional state when performing at competitions.

Mastering these techniques is not as easy as it may seem at first glance. In addition, incorrect mastering of autogenic training, this "powerful remedy", can lead to undesirable results instead of benefit.

Therefore, to successfully master the techniques of autogenic training, it is necessary to familiarize yourself with special works

devoted to this issue, and begin classes only under the guidance of a doctor, psychologist or experienced trainer.

5.2.2 Performing shooting exercises during competitions

As already mentioned, the main task facing a shooter at a competition is to show a sports result at the level of his technical training. Consequently, the technique and tactics of shooting when performing an exercise at a competition should be the same as when shooting in everyday conditions. The only difference between regular and competitive shooting is the difficult competitive environment, which, as already mentioned, causes anxiety in the shooter, which sometimes has a negative effect on his technical results. Below we will focus on some techniques and measures that should be used to combat anxiety so that it has the least effect on the shooting results.

The day of shooting competitions should not be marked for the shooter by any changes in either the regime or the general daily routine - everything should be normal and, if possible, mundane. Remembering that one should not shoot immediately after sleep (since the process of inhibition will prevail in the course of nervous processes and the reaction will be slow), the athlete needs, if he shoots in the early shift, to get up in advance and, as usual, do exercises, or even better - a short warm-up in the form of a fast walk or even a short run at a slow pace. It is also good to include "idle" training in the warm-up.

It is necessary to appear at the firing line in advance, 20-30 minutes before the start of the shift; if any misunderstandings arise during the check of the trigger tension, shooting jacket, etc., the shooter will have the opportunity to eliminate them without haste. In the time remaining before the start of shooting, the athlete must not forget to smoke the sights and, in accordance with the weather conditions, once again review the previously planned shooting tactics, taking into account the wind and lighting.

If a shooter is very nervous while waiting to go to the firing line, he should not sit still and worry, but should move; some athletes do

the right thing when, just before shooting, 20-30 minutes before going to the firing line, they walk, accompanying the walk with light free exercises. Such a warm-up, albeit insignificant, removes excessive inhibition.

Having reached the firing line and prepared for shooting, do not rush to load the weapon, so as not to fire prematurely before the command "Fire!" The time remaining before the start of shooting should be filled with some insignificant activities, such as preparing your place, cartridges, adjusting the belt, and by this try to distract your thoughts from the competition.

It would be a good idea for the shooter to use his free time for dry-fire training.

When firing test shots, special attention should be paid to the careful processing of each shot - there should be no noticeable difference in the technique of firing test shots from the scoring shots.

At the beginning of shooting, if you notice a discrepancy between the shot mark and the actual location of the hole, you should not rush to conclude that you need to make adjustments (judging by one or two holes). Inexperienced shooters, especially when nervous in competition conditions, can sometimes mark the shot insufficiently accurately. In such cases, haste in making adjustments will only lead to the shooter continuously and uselessly turning the sight in pursuit of aligning the STP with the center of the target.

The transition from test shooting to scoring shots should not be emphasized; one should try to make this transition the least noticeable for oneself, convincing oneself that scoring shooting is a continuation of test shooting. In order for this transition to be the least noticeable, one should continue shooting after test shooting without a break at the already accepted pace, adhering to the same shot processing regime.

To suppress anxiety and distract your thoughts from the competition, it is useful to conduct rhythmic shooting. Many shooters do this by placing a stopwatch in front of them while shooting and concentrating on firing shots at equal intervals.

During long shooting sessions, it is good to use the psychological method of setting intermediate goals for yourself to combat anxiety. Thus, the shooter can mentally set himself the task of making every effort to shoot well only this series, and then, after shooting it, shoot well the next one, etc.; make a series of shots while standing, without letting a single bullet go beyond the dimensions of, say, an "eight"; shoot a series, keeping equal breaks between shots; shoot (say, 20 shots) without a break, etc. Having set himself one or another intermediate task, the athlete concentrates his attention on its implementation and thus distracts his thoughts from the competition, from all those irritants that generate anxiety.

It should be taken into account that when nervous, focusing on some decisive actions is usually accompanied by a weakening of attention to other actions; many shooters are excessively absent-minded during competitions. It is during competitions that cases most often occur when athletes confuse targets and shoot at others. Very often, due to absent-mindedness, they make an incorrect correction - in the opposite direction. Unwittingly weakening attention and control over other actions, an athlete often shoots without taking into account the meteorological conditions that have developed at one time or another. Therefore, it is no coincidence that you can see shooting cases on the firing line, on the lids of which posters are pasted with laconic phrases in large print: "Be attentive", "Enhanced control", etc. Such constant reminders of the need to be attentive and consistently control your actions in themselves turn into a good means of distracting the shooter's thoughts from the competition, switching them to the main thing - accurate shooting.

A good way to combat anxiety is time. Since most shooting exercises are performed over a long period of time, you should not rush shooting when you feel that the anxiety has not subsided and the weapon is shaking a lot. You should also force yourself to delay making a shot when you are not sure of its quality and to rest. It is especially important to stop yourself in time during long shooting sessions, when anxiety and fatigue greatly exhaust the shooter's nervous system and his will begins to weaken.

However, using time as a means of combating anxiety, one should not go to extremes when there is not enough time for shooting and the athlete finds himself in time trouble. By the way, there is often not enough time for shooting when the shooter wants to use it to suppress anxiety: often he is simply unable to make a shot due to a disruption in the normal course of nervous processes, a disorder of movement coordination, or indecision when making a shot.

When indecision appears, which is primarily expressed in the fear of pulling the trigger, it is necessary to unload the weapon and work "idle". This kind of warm-up balances the flow of nervous processes, restores to a certain extent the coordination of movements, and the shooter can confidently continue shooting without any particular hindrance. When indecision appears, it is imperative to force yourself by an effort of will to work more boldly. Many shooters, as already indicated, use the method of quickly making the first shot in the fight against indecision - from the first aiming, even at the risk of making it with some damage to the quality. Having thus overcome himself at the first shot, the athlete continues to shoot much more confidently.

During competitions, one should not mentally calculate one's results while shooting - the refereeing apparatus will do this successfully. One should also not mentally add or subtract points from some average or, in the shooter's opinion, "decent" result, since by doing so the shooter condemns himself to a mediocre result. By calculating points in this way and discovering that some reserve of them is accumulating, exceeding this average result, the athlete often unconsciously allows some carelessness and inattention, counting on the fact that there are points in reserve; on the other hand, having convinced himself that the result is high, he begins to experience excessive tension, which ultimately leads to a decrease in the result. Therefore, the shooter should not count points, but concentrate only on how to make the next shot more accurately. For the same reason, one should not be interested in the sports results of neighbors on the firing line, look through the telescope at someone else's targets or follow someone else's pointer; Comparing your results with those of your sports opponents will inevitably lead to the idea of counting points, of possible

chances of winning, which does not at all contribute to maintaining a good, even working condition when performing an exercise.

As is known, the presence of spectators at competitions, their remarks and conversations can significantly affect the psyche of an athlete, preventing him from concentrating on the exercise. A crowd of spectators, which is a sure sign that he is going for a high result, causes a particularly tense state of the shooter and increases his anxiety. Therefore, it is very important to train yourself not to pay attention to everything that happens on the firing line behind the shooter.

When competing, you should not think about personal success, all thoughts should be switched to helping your team win with your points, and in this you should draw strength for the sporting struggle, despite the excitement. If, due to excitement, shooting is difficult, the shooter has failed and he feels that hope for personal success has been lost, you need to pull yourself together and shoot attentively until the end of the shooting with tension, fight for every point, on which the success of the team sometimes depends.

Chapter 3. Some information about the work of trainers

Of course, it is impossible to speak in a few words about the work of trainers due to its multifaceted and extensive nature. However, some of the main issues that are only within the competence of the trainer, which the shooter cannot and has no right to resolve without him, should at least be outlined schematically in the same way as all the material concerning the training of a sportsman-shooter.

Successful training, fast and continuous sports growth of the shooter largely depend on the coach. And it is no coincidence that many leading shooters, looking back on their sports path, say that they owe their achievements to the fact that they were lucky enough to train under the guidance of a good coach from the very beginning. But this should not be a happy exception. From the very first days of training, it is necessary to correctly organize the work of the coach with the shooter, so that the latter does not acquire incorrect and harmful skills for sports shooting.

The moral character and personal merits of the coach should always serve as a model for his students. Integrity and deep knowledge of the theory and practice of sport shooting, a serious attitude to one's duties and love for one's work, sincere goodwill, constant exactingness towards students and towards oneself are the only things that can create the necessary authority of a coach among shooters.

The coach must be consistent in his demands. Constant control over the athlete's discipline and compliance with the daily routine, the shooter's knowledge that his misconduct will not go unnoticed by the coach, are an incentive for the athlete to conscientiously work on himself.

When training with a team, the coach should not forget that real coaching involves an individual approach to each athlete. Therefore, it is necessary to be especially careful to ensure that each

shooter solves a feasible task that corresponds to his technical training and characteristics. The coach should plan special hours in training for the athlete to work independently on weak points in his shooting technique.

If the coach detects signs of fatigue and the beginning of over-training in an athlete, he must take immediate action: either reduce the excessively high load for the shooter, or give him a break from shooting for a while, switching to adjusting the weapon or selecting cartridges. However, it should be remembered that signs of fatigue in some shooters cannot serve as a reason to reduce the load for the rest of the team.

Training should include the use of forms and methods that will often give the shooter the opportunity to independently solve technical and tactical problems and look for methods that are advantageous to him. The trainer should not impose anything on the shooter; he should teach athletes to think, experiment, and then imperceptibly lead them to the correct conclusions that the shooter must draw from independent work. Excessive care during training interferes with the development of initiative, independence, and, along with this, other important volitional qualities in the shooter.

In order to be able to study the individual characteristics of the athlete's technique and his behavior when shooting, the coach must, using a telescope, periodically view (during the shooting) all the targets and make comments and instructions. From time to time, it is necessary to sit down next to the shooter to give him advice, pay attention to the features of his position, the technique of making a shot, the rate of shooting, the correct and rational rest between shots, etc. By monitoring how the shooter reacts to good and bad shots, the coach has the opportunity to study the volitional qualities and character traits of the athlete.

The coach's assessment of the shooter's work is of great importance for his further growth. The shooter's successes should not go unnoticed; the coach should note and encourage them to some extent. At the same time, it is necessary to show a certain restraint, not to praise young shooters too much, so that they do not

overestimate their abilities and stop working on themselves. Such complacency usually leads to the athlete's skill growth ceasing.

During training, it is necessary to systematically conduct scoring shooting, competitions and tournaments that help shooters acquire the necessary volitional qualities. At the same time, the coach must necessarily publish the results of these shootings, posting tables, graphs, diagrams, which will further increase the responsibility of the shooter. Requiring an impartial scoring of points during scoring shooting in accordance with the rules of the competition, without counting any average results or results by shooting accuracy, without re-shooting, the coach must keep his record of the results not formally, but strictly objectively, noting the reasons and random interference that reduced the shooting result: an unaimed shot, a weapon malfunction, the shooter's illness, a sharp misalignment of the STP, etc. Only taking into account these records and observations can conclusions be drawn about the degree of technical training of the shooter.

The coach should not abuse the holding of competitive shooting. Any overt or covert reinsurance on his part, the desire to have as many official results of competitive shooting as possible, so that they could be used as a cover when motivating his actions in recruiting a team, is absolutely unacceptable. It should not be forgotten that excessively frequent competitive shooting is very exhausting for shooters and can lead to them coming to the competition unable to force themselves to show a result due to the previous great nervous and physical strain.

In addition to caring about the technical growth and strengthening of the shooters' volitional qualities, the coach must pay the most serious attention to their morale and mood, maintain their spirits, and immediately eliminate the causes of anxiety and despondency. While cultivating high moral qualities in an athlete: a sense of duty and responsibility to the team, a sense of friendship and camaraderie, it is necessary to carefully study his character, psychology, waging a merciless fight against manifestations of careerism. If a shooter thinks only about the laurels of a champion and performs at competitions with these thoughts, it can be said in advance that he will become a burden for the team. Shooters who

think not about the team, but about themselves, as a rule, worry a lot at competitions, which reduces their results. And then, having failed in their ambitious plans and having lost interest in further struggle, they begin to shoot somehow, not caring about the results, and thus finally "fail" the team.

However, when demanding responsibility from the shooter to the team, it is necessary to act within reasonable limits: do not suppress his will excessively, do not burden him with responsibility excessively and, of course, do not use threats. It should be remembered that often the reason for the athlete's reduced results in competitions is uncertainty, stiffness of movements caused precisely by the fear of letting the team down, the fear of shooting poorly.

Finally, when finishing the work on preparing the team for the competition, the coach should keep the following in mind. A few days before the competition, the condition and serviceability of the weapon should be checked first, and individual defects in it should be detected and eliminated in a timely manner. It is necessary to give the shooters the opportunity to get used to the changes made to the weapon during the last 3-4 training sessions: a different tension and trigger character, a new installation of sighting devices, etc.

In general, 2-3 days before the competition, it is better for the coach to stop shooting training sessions and give the shooters a chance to have a good rest from shooting. In such cases, after a break, the athlete shoots with greater desire, attention, and therefore can process each shot more carefully. However, it will not be superfluous if during such a break the coach instructs the shooters to regularly pick up their weapons and, at least for a short period, work "idle", thus maintaining the state of training.

When drawing up an application for a team to participate in a particular exercise, the coach should take the issue of the order of shooters' performance in shifts especially seriously. As a rule, shooters with some experience of participating in competitions and sufficiently strong-willed should be put in the first shift. Strong-willed shooters should also be in the last shift, when the sports ex-

citement reaches its highest level and the result of this shift decides the outcome of the team's sports struggle as a whole. In intermediate shifts, less experienced shooters can be put, as well as those whose sports results the coach for some reason doubts.

It should also be taken into account that some shooters, by nature, like to shoot in the first shift, when the results of others are not yet known; others, on the contrary, strive to perform in later shifts, when the results of the previous shifts are already known. The coach must accommodate the wishes of the athletes. If the interests of the shooters coincide, the coach accommodates the shooter who can contribute to the most successful performance of the entire team.

As already mentioned, the joint work of the shooter and the spotter has long been prohibited; the only person who is allowed to communicate with the shooter at competitions is the coach. Therefore, some of the previous functions of the spotter are now to some extent performed by the coach; we are talking about the influence of the spotter on the will of the athlete in order to suppress anxiety or, in any case, to weaken the effect of anxiety on the quality of shooting. Therefore, at present, more than ever before, the coach must be in close proximity to the shooter during the scoring shooting, observe him during the exercise and, during the breaks between series or exercises, help him cope with the technical and psychological difficulties that the athlete faces during shooting with a well-timed remark.

First of all, the coach should take into account that the shooter's anxiety at competitions manifests itself not only in, say, an increased heart rate and impaired coordination of movements, but also in a change in the shooter's behavior, in the manifestation of character traits that are not noticeable under normal conditions. Sometimes a shooter, completely calm and docile in a normal environment, suddenly becomes capricious at competitions, everything bothers him; the day is very hot, his jacket is tight in some places, someone is laughing too loudly, someone is looking at him too closely, point-blank, the coach and team members seem to be indifferent to him. This is followed by discontent and resentment. Another shooter becomes very absent-minded; you talk to him -

he nods his head as a sign that he understands everything, but he does the opposite, etc. The coach must be prepared for all this in advance in order to show due restraint, make the shooter work correctly at the firing line and improve the sports result.

Such changes in the athlete's behavior when nervous should always alert the coach; especially close attention and increased control over the actions of such shooters are needed at the beginning of shooting, when the nervousness has not yet subsided. During this period, all sorts of omissions are most likely, since with maximum concentration on processing the shot and on fighting nervousness, some other actions of the shooter go beyond the control of consciousness.

If you look closely at how athletes process a shot at the beginning of an exercise during competitions, you can see how not only young but also some mature masters have certain unconscious secondary movements that negatively affect the stability of the weapon and actually deprive them of the ability to take an accurate aim. In everyday life, each of us has to observe how a person, for example, when working with scissors, moves his jaw in time with the movement of his fingers; or, say, when concentrating on drawing or sketching, sticks out the tip of his tongue; fans at a football match "help" score a goal by moving their legs, etc. A person performs all these actions unconsciously, without noticing them.

Something similar can be observed in shooting, when the shooter intensely concentrates his attention on some of his actions. For example, some standard shooters who use the pulsating trigger control method, when shooting standing, the movement of the index finger is sometimes accompanied by the movement of the fingers of the left hand, squeezing or unclenching the "champignon"; the sportsman makes these movements unconsciously. Making one attempt after another to shoot, they have no idea that such a movement of the fingers, sorting through the "champignon" and disturbing the stability of the rifle during the refinement of the aim, may be the reason that did not allow the successful completion of the shot. Subsequently, as the excitement passed, these side movements of the fingers of the left hand ceased.

One also has to observe such things when an experienced revolver shooter, having already raised his hand with the weapon and completed aiming, continues to move the fingers of his right hand, improving and refining his grip; losing the most favorable time on this, he lowers his hand without making a shot. One attempt to shoot follows another, accompanied by such finger-picking; the shooter takes aim and makes an unsuccessful shot. Very often one can see how revolver shooters move their thumbs when aiming, without suspecting it, prolonging the time of processing the shot and worsening the quality of shooting. At the 1972 national shooting championship one could observe how one sportsman, when shooting at a "wild boar", at the beginning of each lead moved his fingers along the fore-end of the rifle (missing the target because of this almost to the very shelter), completely unaware of these movements. Another famous standard shooter, while shooting standing, in the ready position before processing the first 3-4 shots of each series, adjusted the earpiece with his right hand so that it did not touch the butt; he learned this to his surprise only after leaving the firing line, when he was advised to adjust the earpiece more carefully, etc.

That is why the coach should carefully observe the shooter during competitions and, if possible, intervene in such cases, and later, after the competition, take measures to eliminate the ingrained harmful skills.

While observing the shooter and influencing with his comments the weakening of the influence of the pre-start state at the beginning of the exercise, the coach should not lose sight of the shooter's main work, concerning the technique and tactics of shooting in conditions complicated by the competitive environment.

If shooting is difficult and there is a danger of time pressure, the shooter should be prompted to fire shots at equal intervals according to the clock, and this will make him work more boldly and decisively.

It is especially important to keep track of time when shooting in gusty wind conditions. In such conditions, the coach should re-

mind the shooter of the need to shoot at a slightly faster pace so that the shooter has a certain amount of time in case the gusts of wind become prolonged: the shooter will not be able to shoot in them and will inevitably find himself in time trouble by the end of the shooting.

The coach should closely monitor that the athlete adheres to his usual shooting style as much as possible during the exercise, in particular, that he takes sufficiently long breaks between shots. This often happens at competitions, especially with pistol shooters who are in time trouble, when after a long period of aiming they lower their hand to rest for literally 2-3 seconds, and then start aiming again. It seems to them that they have given their hand a sufficiently long rest, but in fact such a rest is more of a formal nature, since the arm muscles are in no way able to restore their working capacity in such a short period of time. After such a rest that gives nothing, there follows another (and, as a rule, unsuccessful) attempt to shoot, and the shooter again lowers his hand for a short time. In such cases, the coach should advise the athlete to lengthen the rest, working according to the stopwatch. Usually, the use of such a technique allows the shooter to quickly enter his normal shooting tempo.

The coach must understand that the shooter's anxiety, his condition during the exercise cannot be considered as a constant value: athletes can be nervous at the beginning of shooting, and then calm down, and, conversely, start shooting relatively calmly, and then get nervous. Due to the changing conditions of sports competition, some feelings can quickly be replaced by others, often opposite. All this requires that the coach understands the shooter, knows his character, and also constantly monitors his condition and mood. So, if the athlete, after a difficult start to shooting, overcomes himself, begins to shoot boldly and confidently, the coach should not interfere at first. However, if the coach feels that the shooter's confidence is going beyond the limits and he, despite obvious fatigue, is eager to continue shooting, which usually ends, as a rule, with bad, "sobering" shots, the coach should, if possible, intervene and thus prevent the inevitable loss of points in the future, recommending the shooter to take breaks for rest when shooting the next series.

The mood of sportsmen changes very abruptly after unsuccessful shots; after them, there is often no trace of a good, cheerful mood. The trainer should also foresee such a sharp change in the shooter's mood and act depending on the character traits of his pupil. Shooters react differently to bad holes. For one, they have a strong "sobering" effect, and he only mobilizes himself more when processing subsequent shots, while showing greater caution. For another shooter, a bad hole causes a desire to make the next shot as soon as possible in order to compensate for the failure to some extent, which usually leads to a repeat of the failure. In these cases, the trainer should recommend the sportsman to take a short break from shooting, and also check his position. For some shooters, bad holes have a disorganizing effect, causing self-doubt. Under such circumstances, if the coach feels that the bad hole is accidental, he should insist on continuing the next series at the same pace or, if the shooter still cannot bring himself to shoot further due to uncertainty, suggest unloading the gun and practicing "dry".

Moreover, such guidance of the shooter during breaks should be carried out skillfully and wisely: do not talk too much, and especially do not lecture excessively, do not give boring instructions, since such "guidance" can only cause the shooter to feel irritation and hostility towards the trainer.

While actively assisting the shooter in achieving a sports result, the coach should not impose his will on him, which may lead to the shooter losing self-confidence and faith in his own strength. In no case should the coach show irritation during unsuccessful shooting, and especially raise his voice, since this nervousness is transmitted to the shooter. If the athlete's shooting is going poorly, the coach needs to show special tact towards him and remember that failure is not the shooter's malicious intent or a manifestation of negligence towards the team. In such difficult moments for the athlete, you need to act on the shooter not by shouting or smiling ironically, but by saying a word of sympathy and providing moral support; only such help can restore the shooter's self-confidence and restore the necessary psychological balance, which will help to correct the result with subsequent good shooting. At the same time, the coach should not indulge the capricious shooter, but take

the most decisive measures to force him to work properly and not make the team's results dependent on his whims.

It should be remembered that it is possible to create a good working condition in the shooter, a cheerful mood in which he can confidently and boldly shoot, only if the coach strives in every way to create a relaxed atmosphere before and during shooting, and the shooter feels in every word, in every gesture his benevolent attitude towards himself, the active participation of his comrades in his results, as well as their understanding of the excitement that he experiences when performing in competitions.

In conclusion, the following should be said. Sometimes a coach, having studied a shooter sufficiently based on the results of test shooting and personal observations, decides to put him among the reserves. When competing in an individual championship, such a shooter sometimes shows a result higher than those athletes who were included in the main team. In such cases, the coach should not blame himself for not knowing people; it should be taken into account that a shooter, competing in an individual championship and not bearing the burden of responsibility to the team, feels much freer during shooting. If he had been included in the team, it is still unknown whether he would have shown the same high result with the tension and excitement that accompany an athlete's performance in competitions as part of a qualifying team. In such cases, the coach should not show confusion. He must be firm in his decisions, principled, and self-possessed. It must always be remembered that the coach is the soul of the team; the shooters' calmness, self-possession, and confidence in a sporting victory in competitions depend on his behavior.

Like all Soviet teachers, the coach is an active member of our socialist society. His duty is not only to care for the athletic growth of students, but also to educate people who harmoniously combine spiritual wealth, moral purity and physical perfection.

THE END OF THE BOOK

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