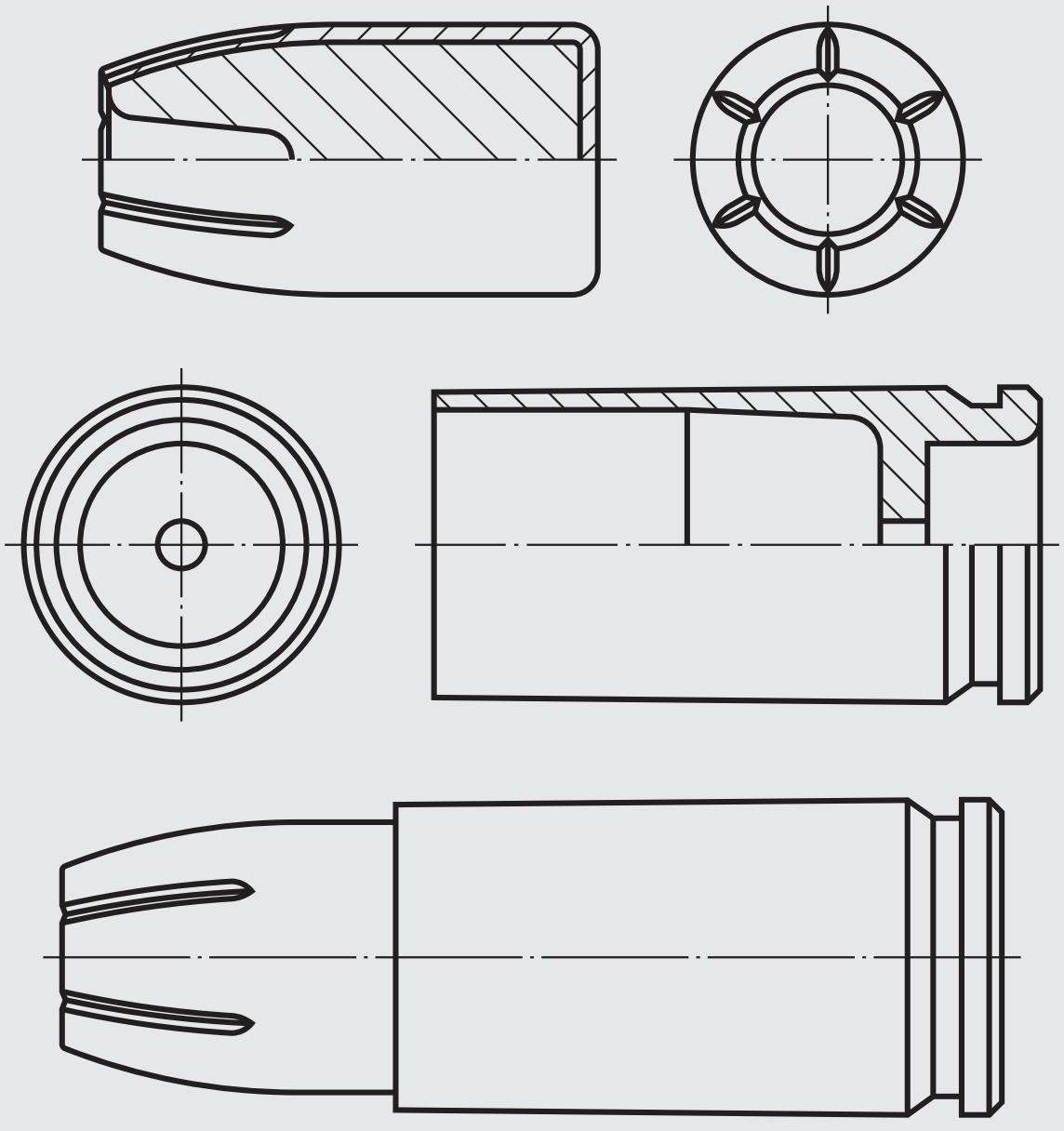
MIKHAIL GRINBERG

CONSTRUCTIONS OF CARTRIDGES



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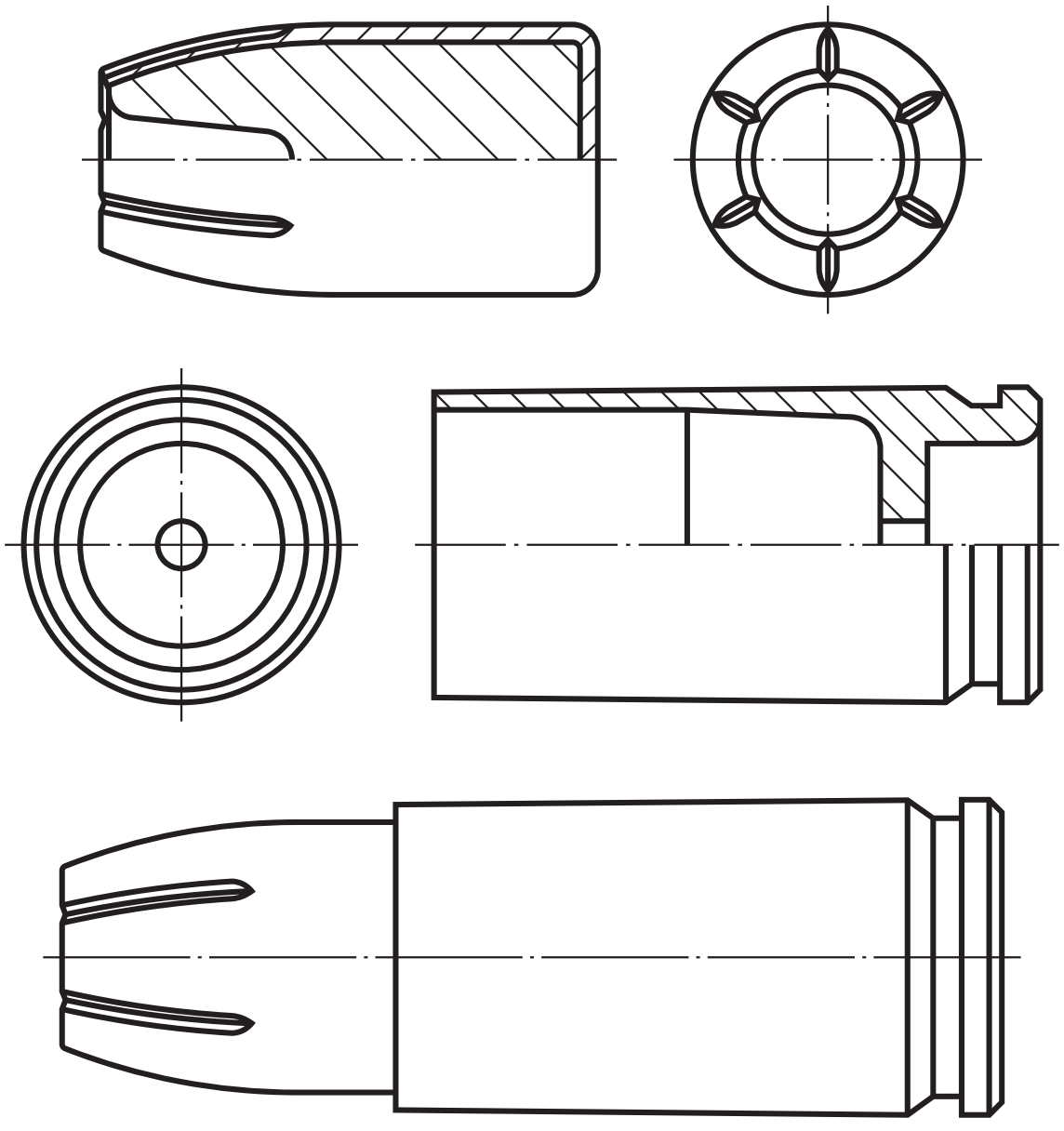

The book contains a detailed description of the constructions of the most widely used kinds of military cartridges, civilian cartridges, and cartridges for law enforcement based on the classification of cartridges established by basic international and national standards. The book covers a wide range of modern cartridges intended for firing the breech-loading weapons. The main focus of the book on special purpose cartridges and nontraditional types of cartridges that are of the greatest interest from the point of view of construction features and use of original technical solutions. The book is intended for engineering and managerial staff of manufacturers of cartridge and weapons, proof houses, shooting clubs; teachers, undergraduate and graduate students in higher education; hunters and shooters; owners and fans of weapons.

Visit the author's personal website: www.grinberg.su (www.greenberg.su)

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ABOUT THE AUTHOR

The author of this book Mikhail Grinberg was born in the former USSR in the city of Izhevsk in 1957 and is widely known as an expert in the areas of development, testing, certification, and organization of production of a wide range of cartridges for various purposes, as well as testing and certification of various kinds of weapons.

In the period from 1980 to 1993, the author conducted researches on the characteristics of special purpose munitions.

In 1988, he was awarded the degree of candidate of technical sciences on a specialty "Armament and military technology".

In the period from 1993 to 2011, the author held the position of chief designer of the company TECHCRIM, a well-known Russian developer and manufacturer of various kinds of weapons and cartridges.

Under the leadership of the author and with his direct participation, many dozens of models of different types of weapons and cartridges for civilian use and law enforcement were developed and prepared for production.

During the last decade of the last century, the author made a significant personal contribution to the development and wide dissemination in Russia of various types of tear gas weapons and cartridges, and since the middle of the 2000s - non-lethal traumatic weapons and cartridges.

The individual types of cartridges developed by the author had no analogs in Russian and international practice and were introduced as new calibers of cartridges in the C.I.P. Tables.

Mikhail Grinberg is the author of more than 70 scientific works, including 40 inventions and 4 national standards.

He began writing in 2011; in Russia, he published professional books "Development of cartridges for smoothbore weapons" (2013), "Development of tear gas weapons" (2014), "Calibres of cartridges and weapons in the C.I.P. Tables" (2015), "Constructions of cartridges" (2017).

Detailed information about the author and published books is available on the author's personal website www.grinberg.su (www.greenberg.su)

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INTRODUCTION

Modern cartridges are characterized by a constructive diversity and a wide range of functionality. The main purpose of cartridges is the mechanical defeat a target upon impact of the projectile that acquires directed movement at the expense of propellant energy.

Military cartridges are used to defeat unprotected or lightly protected enemy manpower and unarmored or lightly armored enemy targets. In addition, depending on the kind and presence of the projectile, military cartridges are used for training and sporting shooting, practice shooting, target designation, proof firing, attestation of ballistic equipment, verify the functioning of mechanisms of weapons, training in weapons handling skills, grenade launching, simulated firing and gun salutes.

Civilian cartridges are used for hunting, sporting, and practical shooting. In addition, depending on the kind and presence of the projectile, civilian cartridges are used for plinking, self-defense, proof firing, signaling, as well as for use with powder actuated tools and industrial firing devices.

Cartridges for law enforcement are used to riot control, deal with individual violators of public order, door breaching, and grenade launching.

The book considers the most widely used kinds of military cartridges, civilian cartridges, and cartridges for law enforcement based on the classification of cartridges established by basic international and national standards.

The most important international standard establishing the classification of cartridges is the rules and regulations of the Permanent International Commission for the Proof of Small Arms, created in compliance with the 1969 Convention.

The Permanent International Commission lays down common rules and regulations for the proof of small arms and cartridges in order to ensure the mutual recognition of Proof Marks by its member states. In international practice, the Permanent International Commission is abbreviated as C.I.P. (Commission Internationale Permanente).

The Permanent International Commission is developing the C.I.P. Documents and the C.I.P. Tables, the main part of which are Tables of dimensions of cartridges and chambers (TDCC). The official language of the Permanent International Commission is French. The C.I.P. Documents and Tables have been translated into English and German [1, 2].

In international practice, the C.I.P. rules and regulations are considered as the European C.I.P. standard.

In the Russian Federation, the C.I.P. rules and regulations are extremely important. The Russian Federation acceded to the 1969 Convention in accordance with the Resolution of the Government of the Russian Federation of 20 November 1992, No 891. The national standards of the Russian Federation, establishing mandatory requirements and methods for confirmation of conformity with mandatory requirements for cartridges and weapons falling under the C.I.P. responsibility, are harmonized with the C.I.P. rules and regulations and contain numerous references to the C.I.P. Tables.

In accordance with the classification of cartridges established in the C.I.P. Tables, cartridges are divided into the following kinds:

- Rimless cartridges for long rifled centerfire weapons;
- Rimmed cartridges for long rifled centerfire weapons;
- Magnum cartridges for long rifled centerfire weapons;
- Pistol and revolver cartridges for short rifled centerfire weapons;
- Rimfire cartridges for long and short rifled weapons;
- Cartridges for industrial use;
- Cartridges for smoothbore centerfire weapons;
- Cartridges for alarm weapons;
- Dust shot cartridges;
- Cartridges for other weapons;
- Caseless cartridges.

The most important national standard establishing the classification of cartridges is documents of the Sporting Arms and Ammunition Manufacturers' Institute (SAAMI). SAAMI is an association of the nation's leading manufacturers of firearms, ammunition, and components. In addition, SAAMI is an accredited standards developer of the American National Standards Institute (ANSI). The main part of the SAAMI documents is the ANSI/SAAMI Standards [3 – 6].

In international practice, the ANSI/SAAMI Standards are considered as the U.S. SAAMI Standard.

In accordance with the classification of cartridges established in the ANSI/SAAMI Standards, cartridges are divided into the following kinds:

- Centerfire rifle sporting ammunition;
- Centerfire pistol and revolver ammunition;
- Rimfire sporting ammunition;
- Shotshell ammunition.

Thus, the classification of cartridges established in the C.I.P. Tables covers a wider range of cartridges as compared with the classification established in the ANSI/SAAMI Standards. In this connection, the book is based on the classification of cartridges and terminology established in the C.I.P. Tables and Documents.

It should be borne in mind the existing differences in the spelling of certain terms related to the field of weapons and cartridges in British English and American English ("centre" vs. "center", "calibre" vs. "caliber", etc.). The English edition of the C.I.P. Documents uses terms in British English. In this connection, later this book uses terms in American English, except for direct quotations from the C.I.P. Documents.

Calibers of rimless cartridges, rimmed cartridges and magnum cartridges for long rifled centerfire weapons are specified in the separate C.I.P. Tables; however, the absence of significant differences between these kinds of cartridges determines the expediency of their joint consideration. In this connection, in this book the constructions of rimless cartridges, rimmed cartridges, and magnum cartridges are considered together in the chapter on civilian cartridges for long rifled centerfire weapons.

It should be borne in mind that the C.I.P. Documents do not apply to military cartridges and weapons, just like the ANSI/SAAMI Standards apply only to ammunition intended for commercial use. At the same time, a broad understanding of the construction features of cartridges is impossible without detailed consideration of military cartridges, which possess significant differences from civilian cartridges. In this connection, separate chapters of this book consider the constructions of military cartridges for long rifled centerfire weapons and military cartridges for short rifled centerfire weapons. The kinds of considered military cartridges largely correspond to the kinds of cartridges specified in the publicly available information and data sheets published by the U.S. Army.

The book covers a wide range of modern cartridges intended for firing the breech-loading weapons. The main focus of the book on special purpose cartridges and nontraditional types of cartridges that are of the greatest interest from the point of view of construction features and use of original technical solutions.

The sequence of consideration of different kinds of cartridges corresponds to their sequence in the C.I.P. Tables.

Chapter 1 considers cartridges for rifled weapons. This chapter contains a detailed description of the features of cartridges for rifled weapons, features and constructions of components of cartridges for rifled weapons (primers, cartridge cases, powders, bullets), as well as ballistic and aerodynamic characteristics of bullets, stabilization of bullets on the trajectory, firing accuracy and firing dispersion, stopping effect of bullets. Description of constructions of primers and features of powders for cartridges for rifled weapons contains formulations of primer compositions and chemical composition of powders used in the U.S. Army.

Chapter 2 considers military cartridges for long rifled centerfire weapons. This chapter contains a detailed description of the constructions of the main kinds of bullets, as well as a detailed description of the constructions of the main kinds of military cartridges, including ball cartridges, match cartridges, long range cartridges, incendiary cartridges, tracer cartridges, dim tracer cartridges, armor piercing cartridges, armor piercing incendiary cartridges, armor piercing tracer cartridges, armor piercing incendiary tracer cartridges, spotter and spotter tracer cartridges, practice cartridges, frangible and jacketed frangible cartridges, high pressure test cartridges,

reference cartridges, flash suppressed cartridges, saboted light armor penetrator and saboted light armor penetrator tracer cartridges, blank cartridges, grenade cartridges, blank plastic cartridges, plastic practice and tracer plastic practice cartridges, dummy cartridges, flechette cartridges, duplex cartridges, and multi-bullet cartridges. Description of the constructions of incendiary bullets, tracer bullets, dim tracer bullets and spotter bullets contains formulations of incendiary, tracer, dim tracer, igniter, and flash compositions used in the U.S. Army.

Chapter 3 considers civilian cartridges for long rifled centerfire weapons. This chapter contains a detailed description of the constructions of the main kinds of bullets, as well as a detailed description of the constructions of the main kinds of civilian cartridges, including hunting cartridges, sporting cartridges, and proof cartridges.

Chapter 4 considers military cartridges for short rifled centerfire weapons. This chapter contains a detailed description of the constructions of the main kinds of bullets, as well as a detailed description of the constructions of the main kinds of military cartridges, including ball cartridges, match cartridges, tracer cartridges, high pressure test cartridges, dummy cartridges, and marking cartridges.

Chapter 5 considers civilian cartridges for short rifled centerfire weapons. This chapter contains a detailed description of the constructions of the main kinds of bullets, as well as a detailed description of the constructions of the main kinds of civilian cartridges, including hunting cartridges, sporting cartridges, and proof cartridges.

Chapter 6 considers rimfire cartridges for long and short rifled weapons. This chapter contains a detailed description of the constructions of the main kinds of projectile for rimfire cartridges, as well as a detailed description of the constructions of the main kinds of rimfire cartridges, including the family of rimfire 22 caliber cartridge, lead bullet cartridges, bullet hunting cartridges, shot cartridges, bullet cartridges and shot cartridges, which do not contain propellant (Flobert cartridges), and proof cartridges.

Chapter 7 considers cartridges for industrial use. This chapter focuses on the most widely used cartridges for powder actuated tools for various purposes.

Chapter 8 considers cartridges for smoothbore centerfire weapons. This chapter contains a detailed description of the features of cartridges for smoothbore weapons, features and constructions of the primary components of cartridges for smoothbore weapons (primers, cartridge cases, powders), features and constructions of the secondary components of cartridges for smoothbore weapons (overpowder pads, overshot pads, wads, containers), features and constructions of the main kinds of projectile for cartridges for smoothbore weapons (lead shot, lead-free shot, lead buckshot, caliber bullets, subcaliber bullets, subcaliber fin-stabilized bullets, spherical bullets), as well as a detailed description of the constructions of the main kinds of cartridges for smoothbore weapons, including lead shot hunting cartridges, shot sporting cartridges, lead-free shot hunting cartridges, buckshot hunting cartridges, bullet hunting cartridges with different kinds of bullets (caliber, subcaliber, subcaliber fin-stabilized and spherical bullets), mini-hunting cartridges, signal cartridges, and proof cartridges. In addition, this chapter contains a detailed description of the constructions of the main kinds of cartridges for law enforcement, including non-lethal cartridges (rubber bullet cartridges, rubber buckshot cartridges, plastic shot cartridges, bean bag cartridges), door breaching cartridges, launching cartridges, and irritating cartridges.

Chapter 9 considers cartridges for alarm weapons. This chapter contains a detailed description of the constructions of the main kinds of cartridges for alarm weapons, including pistol and revolver blank cartridges, as well as pistol and revolver tear gas cartridges.

Chapter 10 considers dust shot cartridges.

Chapter 11 considers cartridges for other weapons. This chapter contains a detailed description of the constructions of the main kinds of cartridges for other weapons, including non-lethal pistol and revolver rubber bullet cartridges, short blank cartridges for various signal devices and separate loading weapons, as well as cartridges, construction, features or functional purpose of which are not applicable to any traditional kind of cartridges.

Chapter 12 considers caseless cartridges.

Sequential consideration of the constructions of cartridges for various functional purposes is a necessary condition for understanding both the specific features of individual kinds of cartridges and the general patterns, to varying degrees inherent in all kinds of cartridges.

The relevant chapters of the book consider:

- Features of various components for different kinds of cartridges;
- Features of the choice of components for different kinds of cartridges that provide the optimal configuration of the cartridge and the best ballistic characteristics of the shot;
- Technical solutions that provide the strength of cartridges, resistance to the effects of various kinds of mechanical loads, tightness, protection against exposure to environmental factors, the stability of the ballistic characteristics of the shot;
- Specific features of different kinds of cartridges;
- Features of the assembly of different kinds of cartridges;
- Features of the interaction of components of cartridges at the shot;
- Features of the functioning of cartridges at firing the different kinds of weapons.

Descriptions of the constructions of components of cartridges and the constructions of cartridges are accompanied by detailed technical drawings on an appropriate scale, executed in accordance with the rules of technical drawings, with the necessary views, sections, and cross-sections that provide a complete understanding of all technical details. If necessary, the drawings are accompanied by a detailed description of the components of the cartridge, as well as the features of their interaction and functioning at the shot. In accordance with Russian tradition, all bullets and cartridges are shown rotated to the left.

The designations of cartridges and components of cartridges in all chapters of the book are specified in accordance with their generally accepted international designations and corresponding abbreviations.

The book represents an English translation of the book of the same name published by the author in Russia in 2017 [7].

The book summarizes the experience accumulated by the author in the process of development, testing, and preparation of manufacture of a wide range of cartridges for various purposes, as well as in the process of inclusion of new calibers of cartridges into the C.I.P. Tables. The book contains materials from previously published books "Development of cartridges for smoothbore weapons" (2013) [8], "Development of tear gas weapons" (2014) [9], "Calibres of cartridges and weapons in the C.I.P. Tables" (2015) [10].