HEADQUARTERS
UNITED STATES ARMY, EUROPE
AND SEVENTH ARMY
APO New York 09403

USAREUR PAM
No. 30-60-1

30 July 1975

IDENTIFICATION GUIDE

PART THREE

WEAPONS AND EQUIPMENT
EAST EUROPEAN COMMUNIST ARMIES

VOLUME II

MINE WARFARE AND DEMOLITION EQUIPMENT

This document is NATO-releasable.

HEADQUARTERS
UNITED STATES ARMY, EUROPE and SEVENTH ARMY
APO New York 09403

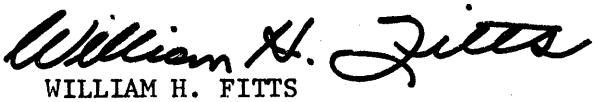
P A M P H L E T) 30 July 1975
No. 30-60-1)

USAREUR Pamphlet 30-60-1, Volume II, Part Three, is published for information.
(AEAGB-PDN, HBG Mil (2121-)8376)

FOR THE COMMANDER IN CHIEF:

OFFICIAL:

WILLIAM R. KRAFT, JR.
Major General, GS
Chief of Staff



WILLIAM H. FITTS
Brigadier General, USA
Adjutant General

DISTRIBUTION: Special

*For supersession see Foreword (page 2).

FOREWORD

The purpose of this guide is to present the essential tactical, technical and recognition data on weapons and equipment presently employed in the armies and security forces of the Communist countries of Eastern Europe.

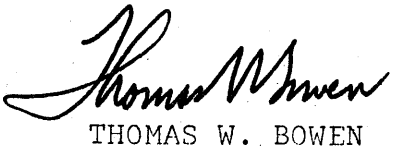
Every effort has been made to make this guide comprehensive, within the limits of an unclassified publication. Any discrepancies noted or any information on new or modified weapons or equipment should be forwarded to this headquarters for inclusion in future change sheets.

Part One of this guide supersedes the weapons and armored vehicles sections of the Identification Guide (Ordnance Equipment) Warsaw Pact Countries, USAREUR Pam 30-60-1, Seventh Revised Edition, 31 July 1968; and it also replaces the same section that appeared in the rescinded (6 Oct 69) Identification Handbook, Yugoslav Army Weapons and Equipment, USAREUR Pam 30-60-5, 31 March 1965.

Part Two of this guide replaces the truck and tractor sections of the above-mentioned publications and of the Identification Guide (Engineer Equipment) Warsaw Pact Countries, USAREUR Pam 30-60-8, Fifth Edition, 27 February 1970.

Part Three of this guide covers engineer equipment, thus completing the replacement of the older guides mentioned.

The date of information for Part Three, Volume II of the new guide is February 1975.



THOMAS W. BOWEN
Brigadier General, GS
Deputy Chief of Staff,
Intelligence

INTRODUCTION

This guide is neither the final nor complete word on the armament and equipment of the ground forces of the East European Communist countries. The fact that this book represents the eighth edition of the weapons and vehicles guide in 18 years, the sixth edition of the engineer equipment guide over the same period and the second edition of a special guide on Yugoslav Army weapons and equipment in 7 years, is testimony to this fact. The picture of any nation's armament and equipment is one of constant obsolescence, change and development. Any nation or military alliance, regardless of political orientation, cannot be understood properly without reference to other nations or alliances. Military developments are among the most international of activities. For this reason the information set forth in this guide should be studied and compared with comparable information about other countries. Pertinent field and technical manuals are good sources of information, as are many unofficial books and periodicals available in many languages.

The old grouping of weapons and equipment by countries has been replaced by a strict grouping by types of weapons and equipment, regardless of country of origin or use. In order to standardize measurements, data have been given in the metric system--the international system. Extensive conversion tables both to and from the metric system have been provided as well as an explanation of the abbreviations used.

Tables in this guide showing characteristics and specifications will occasionally be incomplete. Data not applicable are indicated by a series of dashes, whereas data either not available or not releaseable in this publication are indicated by a blank space.

TABLE OF CONTENTS

FOREWORD 2
INTRODUCTION 3
TABLE OF CONTENTS 4
ABBREVIATIONS 6
CONVERSION TABLES 7

NOTE ON MINE WARFARE EQUIPMENT 9

ANTITANK MINES
Metallic Antitank Mines 14
Plastic Antitank Mines 23
Cardboard Antitank Mines 35
Wooden Antitank Mines 36
Shaped and Plate-Charge Antitank Mines 46
Off-Route Antitank Mines 50

ANTIPERSONNEL MINES
Plastic Antipersonnel Mines 56
Wooden Antipersonnel Mines 63
Antipersonnel Stake Mines 68
Bounding Antipersonnel Mines 74
Directional Fragmentation Antipersonnel Mines 82
Chemical Antipersonnel Mines 84

MISCELLANEOUS MINES
General Purpose Mines 88
River Mines 90
Limpet Mines 94
Explosive Barbed Wire Obstacle 98
Training Mines 102

FUZES
Pressure Fuzes 112
Pull Fuzes 126
Tilt-Rod Fuzes 138
Pressure/Pull Fuzes 142
Miscellaneous Fuzes 144

MINELAYING EQUIPMENT
Towed Mechanical Minelayers 152
Armored Tracked Mechanical Minelayer GMZ 166
Minelaying Helicopters 171

MINE DETECTION EQUIPMENT
Mine Probes 174
Mine Detector VIM-203M. 176
Mine Detectors VIM-625 Model 1942 and VIM-695 Model 1942. 178
Mine Detector UMIV-1. 181
Mine Detector IMP 185
Mine Detectors VISF Models 1943 and 1944. 188
Mine Detector VISF Model 1946 190
Mine Detector M62 192
Mine Detectors M-10 and M-11. 194
Mine Detector MSG 64. 196
Vehicle-Mounted Mine Detector DIM 198
Mine Detecting Helicopters. 202

MINEFIELD BREACHING EQUIPMENT
Soviet Minefield Reconnaissance and Clearing Kit. 206
Explosive Mine-Clearing Devices 208
Tank-Mounted Mine-Clearing Rollers and Plows. 216

DEMOLITION EQUIPMENT
Individual and Prepared Bulk Explosive Charges. 230
Bangalore Torpedos. 236
Shaped Charges. 242
Detonating Cord 248
Detonators. 250
Blasting Caps and Associated Devices. 254
Time Blasting Fuse. 262
Electric Firing Wire. 264
Blasting Machines and Associated Equipment. 266
Demolition Accessories Sets 276
Explosive-Initiation Demolition Set 278

ABBREVIATIONS

cm	=centimeter
g	=gram
h	=hour
kg	=kilogram
kg/cm^2	=kilograms per square centimeter
km	=kilometer
km/h	=kilometers per hour
l	=liter
l/100 km	=liters per 100 kilometers
l/h	=liters per hour
m	=meter
min	=minute
mm	=millimeter
m/s	=meters per second
s	=second
t	=ton

CONVERSION TABLES

Metric to U.S. units	U.S. to metric units
WEIGHT	
Milligrams x 0.015 = grains	Grains x 64.80 = milligrams
Grams x 15.43 = grains Grams x 0.035 = ounces Grams x 0.0022 = pounds	Grains x 0.065 = grams Ounces x 28.35 = grams Pounds x 453.59 = grams
Kilograms x 2.205 = pounds Kilograms x 0.0011 = short tons	Pounds x 0.454 = kilograms Short tons x 907.18 = kilograms
Metric tons x 2204.62 = pounds Metric tons x 1.102 = short tons	Pounds x 0.00045 = metric tons Short tons x 0.907 = metric tons
VELOCITY	
Centimeters/second x 0.033 = feet/second Meters/second x 3.281 = feet/second Meters/second x 196.85 = feet/minute Kilometers/hour x 0.621 = miles/hour	Feet/second x 30.48 = centimeters/second Feet/second x 0.305 = meters/second Feet/minute x 0.0051 = meters/second Miles/hour x 1.609 = kilometers/hour
PRESSURE	
Atmospheres x 14.70 = pounds/square inch Kilograms per square centimeter x 14.223 = pounds per square inch	Pounds/square inch x 0.068 = atmospheres Pounds per square inch x 0.0703 = kilograms per square centimeter
POWER	
Metric horsepower x 0.9863 = U.S. horsepower Kilogram-meters x 7.233 = foot-pounds	U.S. horsepower x 1.014 = metric horsepower Foot-pounds x 0.138 = kilogram-meters
FUEL CONSUMPTION	
$\frac{235}{\text{Liters/100 kilometers}}$ = miles per gallon	$\frac{235}{\text{Miles per gallon}}$ = liters/100 kilometers
TEMPERATURE	
$\frac{9}{5}$ centigrade + 32 = degrees Fahrenheit	$\frac{5}{9}$ (Fahrenheit - 32) = degrees centigrade

Metric to U.S. units	U.S. to metric units
LENGTH	
Millimeters x 0.03937 = inches	Inches x 25.40 = millimeters
Millimeters x 0.00328 = feet	Feet x 304.80 = millimeters
Millimeters x 0.00109 = yards	Yards x 914.40 = millimeters
Centimeters x 0.3937 = inches	Inches x 2.54 = centimeters
Centimeters x 0.0328 = feet	Feet x 30.48 = centimeters
Centimeters x 0.0109 = yards	Yards x 91.44 = centimeters
Meters x 39.37 = inches	Inches x 0.025 = meters
Meters x 3.281 = feet	Feet x 0.305 = meters
Meters x 1.094 = yards	Yards x 0.914 = meters
Meters x 0.00062 = miles	Miles x 1609.34 = meters
Kilometers x 3280.84 = feet	Feet x 0.00030 = kilometers
Kilometers x 1093.61 = yards	Yards x 0.00091 = kilometers
Kilometers x 0.621 = miles	Miles x 1.609 = kilometers
AREA	
Square millimeters x 0.00155 = square inches	Square inches x 645.16 = square millimeters
Square centimeters x 0.155 = square inches	Square inches x 6.452 = square centimeters
Square meters x 1550.000 = square inches	Square inches x 0.00065 = square meters
Square meters x 10.764 = square feet	Square feet x 0.093 = square meters
Square meters x 1.196 = square yards	Square yards x 0.836 = square meters
Square kilometers x 0.386 = square miles	Square miles x 2.59 = square kilometers
VOLUME	
Cubic centimeters x 0.061 = cubic inches	Cubic inches x 16.39 = cubic centimeters
Cubic meters x 35.31 = cubic feet	Cubic feet x 0.028 = cubic meters
Cubic meters x 1.308 = cubic yards	Cubic yards x 0.765 = cubic meters
Liters x 61.02 = cubic inches	Cubic inches x 0.016 = liters
Liters x 0.035 = cubic feet	Cubic feet x 28.32 = liters
CAPACITY	
Milliliters x 0.271 = fluid drams	Fluid drams x 3.697 = milliliters
Milliliters x 0.034 = fluid ounces	Fluid ounces x 29.57 = milliliters
Liters x 33.81 = fluid ounces	Fluid ounces x 0.030 = liters
Liters x 2.113 = pints	Pints x 0.473 = liters
Liters x 1.057 = quarts	Quarts x 0.946 = liters
Liters x 0.264 = gallons	Gallons x 3.785 = liters

NOTE ON MINE WARFARE EQUIPMENT

The Soviets and their allies use a vast variety of mine warfare equipment. A large number of items which could be encountered in a prolonged conflict, especially in static and guerrilla situations, are not discussed in this guide. For some of the possibilities one should consult DA Training Circular, TC 5-31, Viet Cong Boobytraps, Mines and Mine Warfare Techniques, December 1969, and Army Technical Manual, TM 5-280, Foreign Mine Warfare Equipment, July 1971. If available, TM 5-223A, Soviet Mine Warfare Equipment, August 1951, should be consulted as the fullest coverage of the subject as of the date of publication. It has many details not found in later publications.

This guide concentrates on newer East European Communist mines, mine warfare equipment, and demolition equipment. Currently the Warsaw Pact (which does not include Yugoslavia), under Soviet tutelage, emphasizes the use of rapidly laid mine fields to protect the flanks of advancing troops. For this reason the employment of mechanically laid antitank mines is paramount, although the use of antipersonnel mines and of hand-laid mine fields on a large scale is provided for in static situations.

Because of the Soviet interest in maintaining a high rate of advance, the emphasis in mine clearing is on mechanical and explosive (preferably rocket delivered) devices. Other methods, however, are provided for and used when necessary. Much progress has been made in recent years in both mechanical and explosive clearing on the part of the Soviets and their allies.

East European Communist armies have a wide range of mines and fuzes. Their developments in this field are fully equal to those of other advanced countries. Those mines and fuzes discussed here represent only part of the complete arsenal. Other mines and fuzes exist, but are subject to security restrictions. IT MUST BE EMPHASIZED THAT THIS GUIDE IS NOT A TECHNICAL MANUAL ON NEUTRALIZING OR DISARMING OF ANY MINE OR FUZE, NOR ON THE EMPLOYMENT OF THE SAME!

Soviet mine and mine warfare equipment nomenclature is often confusing, but a basic system is employed, although with many exceptions.

Antitank mines are generally denoted by the letters TM, plus the possible addition of one or more letters giving a clue as to the nature of the mine. This group of letters is then followed by a dash and one or two numbers. Some mines may have the modifying letters after the numbers. The letters include D for wooden mine, B for paper mine, SB for tar-paper mine, K for shaped-charge mine, and N for mines with an anti-lifting fuze well. Some of the exceptions to these basic rules are the TMD-B wooden mine which uses the letter B (for large) in place of a number, and the wooden mines of the YaM series which use the Russian letter Ya to replace both the T and D. The Ya simply stands for "box."

Antipersonnel mines are generally denoted by the letters PM, although there are numerous exceptions. Additional letters are usually added, and sometimes a dash and a number. The modifying letters include D for wooden mine, N for tread mine, O for fragmentation mine, and Z for "obstacle" mine. The latter two letters are normally used together and form part of two exceptions to the general rule for nomenclature. These are the POMZ stake mine, which is known as the "antipersonnel fragmentation mine, obstacle," and the OZM bounding mine, which is known as the "fragmentation obstacle mine" without any reference to the antipersonnel role. The letter O also appears in the MON "mine fragmentation, directional." Note here the letter N being used for "directional" rather than "tread." Chemical antipersonnel mines have a completely different nomenclature with the letters KhF standing for "chemical fougasse."

General-purpose mines have a wide variety of nomenclatures, with the widely used MZD standing for "mine, delayed action." Two common nomenclatures for river mines are PDM for "anti-landing mine" and YaRM for "anchored river mine." Training mines have the letter U in front of the nomenclature.

Mechanical and chemical fuzes have the letter V, meaning "exploder," while electrical fuzes use Z meaning "circuit closer." EKh is used for electro-chemical combinations, while Ch denotes a clockwork element. Other letters and many combinations can be used.

Towed mechanical minelayers have been designated PMR, and more recently PMZ. Both stand for "trailed minelayer." The new armored tracked mechanical minelayer is known as the GMZ, denoting "tracked minelayer." Mine-clearing rollers and plows are called "mine trawls," actually a naval term. The roller

systems have the nomenclature PT, meaning "antimine trawl," while the plow and plow/roller systems are designated KMT, meaning "lane (clearing) mine trawl."

Prepared explosive charges use a two-letter combination, such as UZ for bangalore torpedos, KZ for shaped charges, and SZ for concentrated charges.

Bulgaria, which uses both Soviet and Czechoslovak mine-warfare equipment, also produces its own mine detectors. Imported equipment bears the original nomenclature.

Czechoslovakia has designed and produced an extensive line of mines and mine-warfare equipment. The mines are designated by three sets of letters, separated by dashes, sometimes followed by Roman numerals. The first set of letters denotes the kind of mine, TP for antitank and PP for antipersonnel. The second set of letters is always Mi for mine, while the third set denotes the type of mine case and/or the nature of the mine. Ba is used for plastic mines, K for metallic blast mines, D for wooden mines, Sb for antipersonnel stake mines with concrete fragmentation bodies, Sk for antipersonnel stake mines with metallic fragmentation bodies, and Sr for bounding antipersonnel mines with metallic fragmentation bodies. Training mines have the abbreviation Cv in front of the nomenclature. Czechoslovak mechanical mine fuzes are denoted by the letters Ro followed by a number. Prepared explosive charges use two-letter combinations such as TN for bangalore torpedos, UTN for linear shaped charges, and PN for shaped charges.

East Germany produces a limited amount of mine-warfare equipment such as the PM-60 plastic antitank mine, the MSG-64 mine detector, and the MLG-60 mechanical minelayer. PM denotes antitank mine, MSG mine search equipment, and MLG minelaying equipment. Other mine-warfare equipment is largely Soviet in origin. Demolition equipment is normally either East German or Czechoslovak.

Hungary uses mines and mine-warfare equipment of both Soviet and national origin. Poland produces a wide variety of mines and mine-warfare equipment and uses these along with items of Soviet origin. Romania also uses a mix of Soviet and national items.

Yugoslavia produces and employs an extensive line of mines and fuzes, some of national design, others copied from German or Soviet World War II models. Minelaying and mechanical

clearing equipment has been imported from the U.S.S.R. Yugoslav mine nomenclature is very similar to the Soviet, but it is more regular in nature. Antitank mines are marked TM, while antipersonnel mines show PM. These basic letters are followed by a third letter denoting the case material and/or the nature of the mine. The letter M stands for a metallic case, A ("antimagnetic") for a plastic case, D for a wooden case, and R for antipersonnel stake mine. For bounding mines the letters RO are used and inserted between the letters P and M, resulting in PROM. Arabic numerals follow the letters to mark the specific mine model. Training mines have the letter S in front of the nomenclature.

Yugoslav fuze nomenclature starts with the letter U followed by the mine type, e.g. UTMA for a fuze for a plastic antitank mine. The letter H is added if the fuze is chemical rather than mechanical, such as UTMAH, a chemical fuze for a plastic antitank mine. Training fuzes also add the letter S in front of the nomenclature.

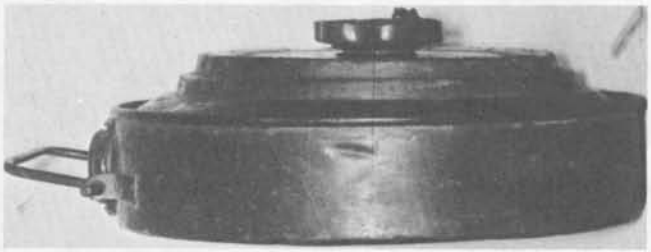
ANTITANK MINES



Top View: Soviet Antitank Mine TMN-46



Bottom View: Soviet Anti-tank Mine TMN-46



Side View: Soviet Anti-tank Mine TMN-46

METALLIC ANTITANK MINES

Soviet Antitank Mine TM-46
Soviet Antitank Mine TMN-46
Soviet Antitank Mine TM-57
Czechoslovak Antitank Mine PT-Mi-K
Yugoslav Antitank Mine TMM-1

The World War II metallic antitank mines of the Soviet Army have all been replaced by improved models which can be laid mechanically. The earliest of these, the TM-46 and TMN-46, both have the same basic characteristics, differing only in that the TMN-46 has a fuze well located on the bottom of the mine for booby-trapping purposes. Both mines use the MVM pressure fuze for mechanical laying, or the MV-5 for hand laying. In both cases the MD-2 detonator, which is used in many mines, is replaced by the smaller MD-6. The most recent development is the MVSh-46 angled tilt-rod fuze. With this fuze the mine must be laid by hand.

The TM-57 is almost identical to the older TM-46, but has a larger charge and improved fuzing. No booby-trap well is present since the mine is designed for mechanical laying. The standard fuze is the delay-armed MVZ-57, but the MVSh-57 tilt-rod fuze can be used when the mine is laid by hand.

The Czechoslovak PT-Mi-K is very similar to late-model German World War II metallic mines, and like the current Soviet metallic mines is suitable for mechanical laying. In contrast to the Soviet mines it uses an open-type pressure plate which is covered during transport. The standard Ro-5 pressure fuze is used and an extra antilifting fuze well is found in the bottom of the mine case.

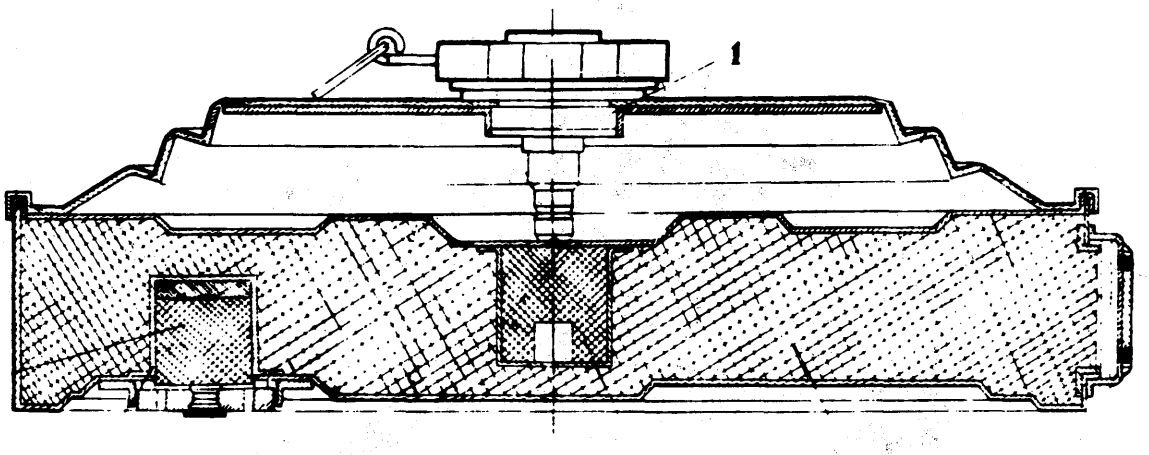
The Yugoslav TMM-1 is a direct copy of the German World War II Tellermine 43. It has a solid mushroom-shaped pressure plate and two antilifting fuze wells, one in the bottom and one in the side of the mine case. The UTMM pressure fuze is used.

CHARACTERISTICS

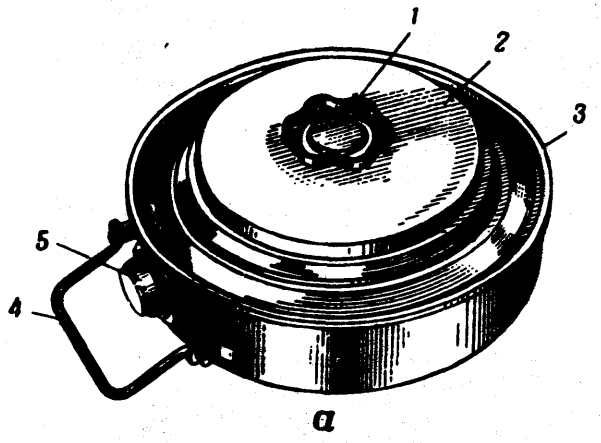
		TM-46	TM-57
weight	kg	9	9.5
diameter	mm	310	300
height	mm	75	100
main charge		TNT	TNT
weight	kg	5.3	7
operating force	kg	180	200-700
booby trapping		improvised*	improvised

		PT-Mi-K	TMM-1
weight	kg	7.8	8.6
diameter	mm	300	310
height	mm	97	100
main charge		TNT	TNT
weight	kg	4.9	5.6
operating force	kg	200-450	
booby trapping		bottom well	bottom & side wells

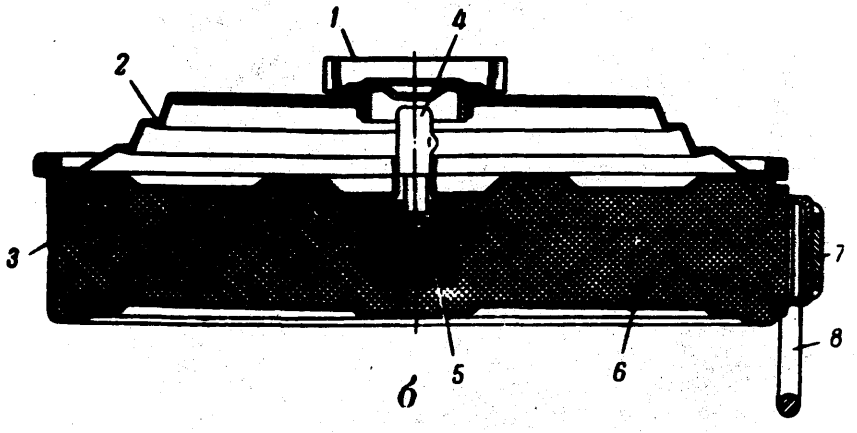
*TMN-46 has bottom fuze well



TMN-46 with MVM Fuze



а



б

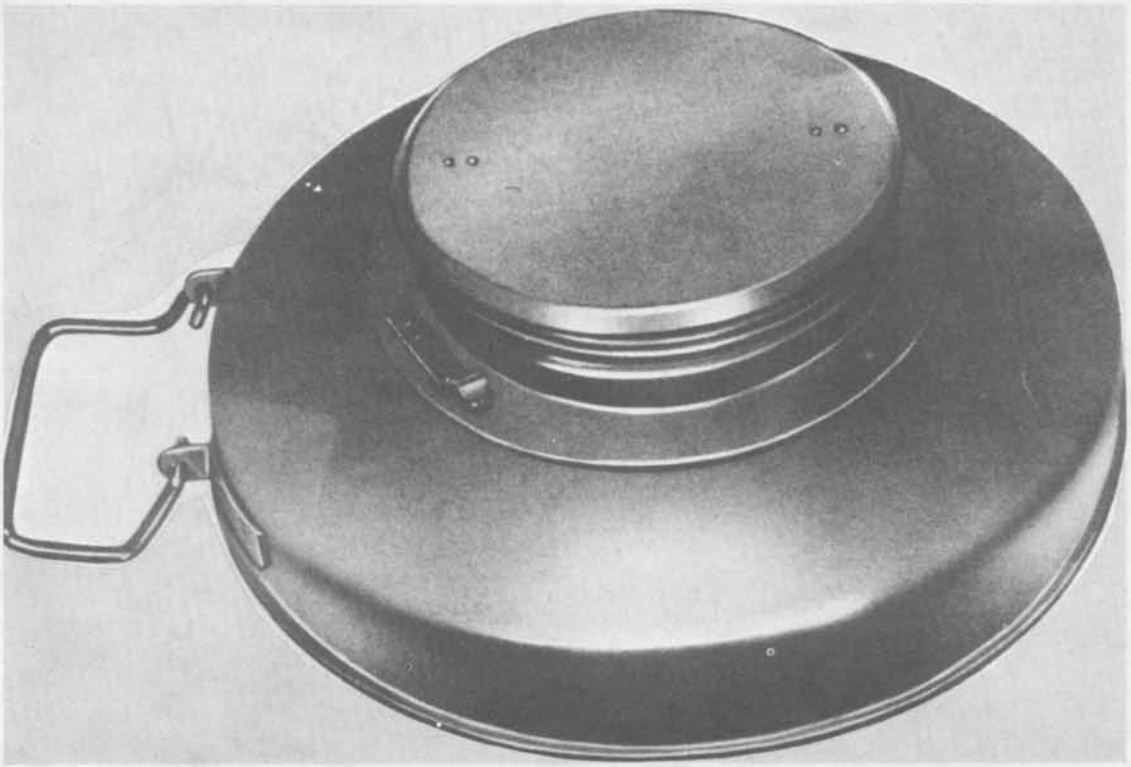
TM-46 with MV-5 Fuze



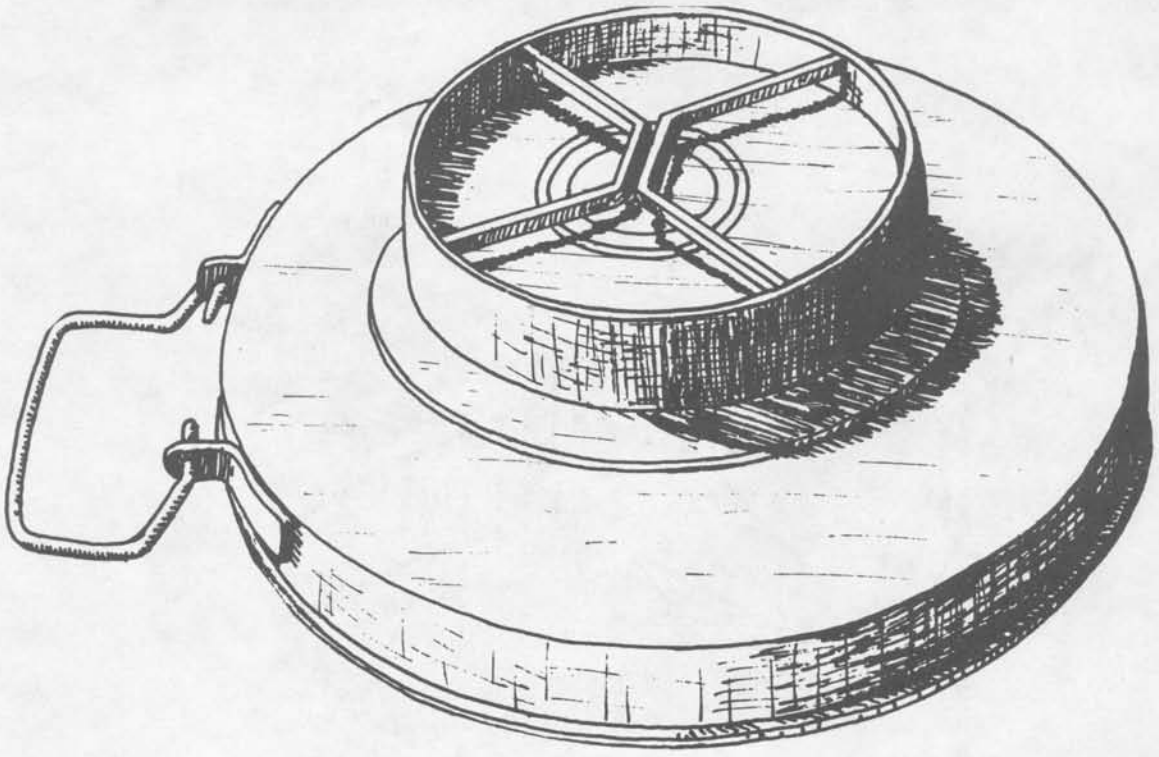
Bottom View: Soviet Antitank Mine TM-57



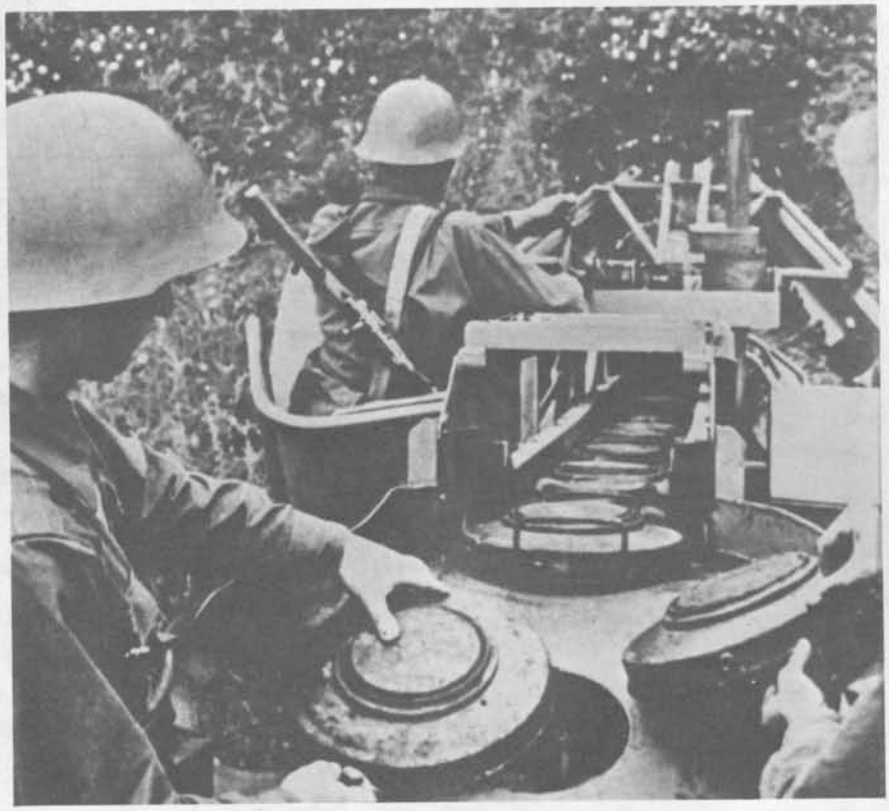
Top View: Soviet Antitank Mine
TM-57 without Fuze



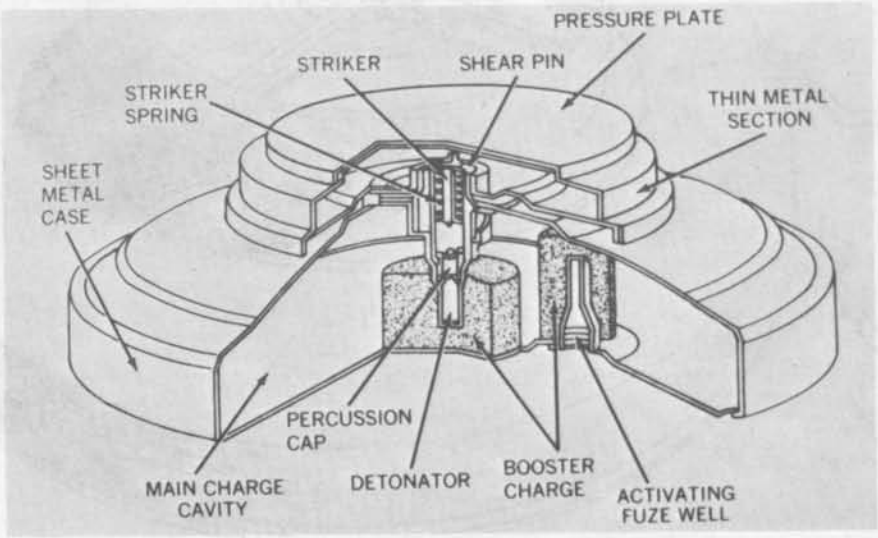
Czechoslovak Antitank Mine PT-Mi-K with Pressure Plate Cover



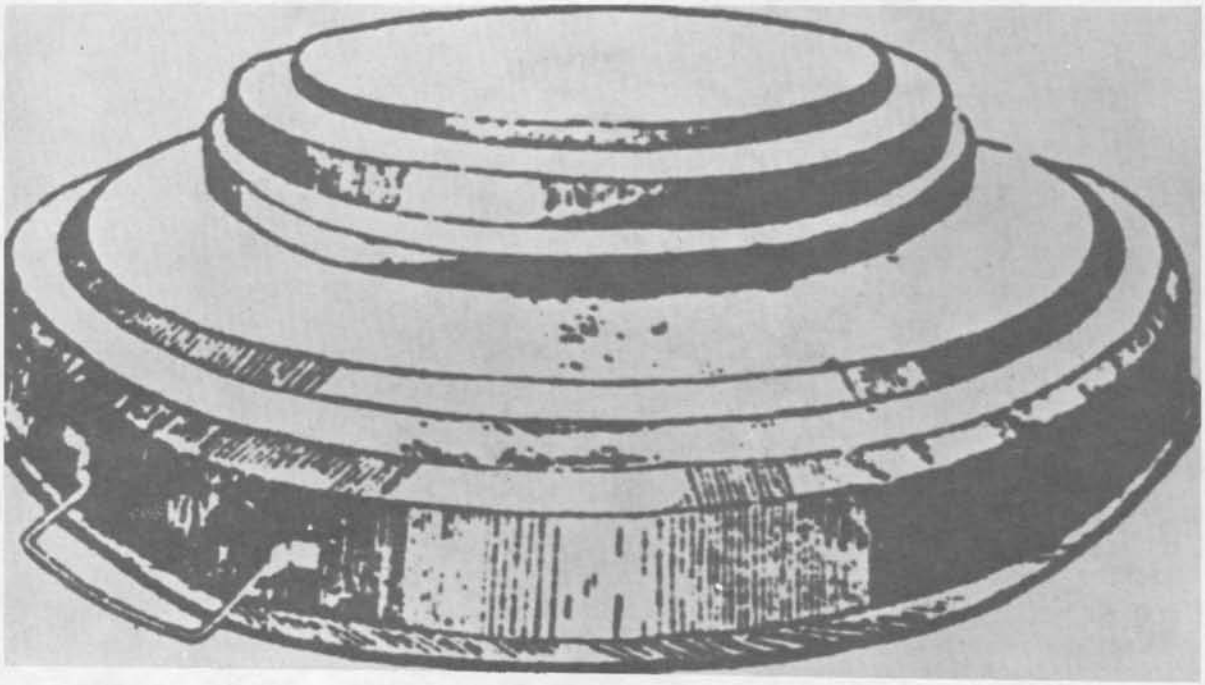
Czechoslovak Antitank Mine PT-Mi-K

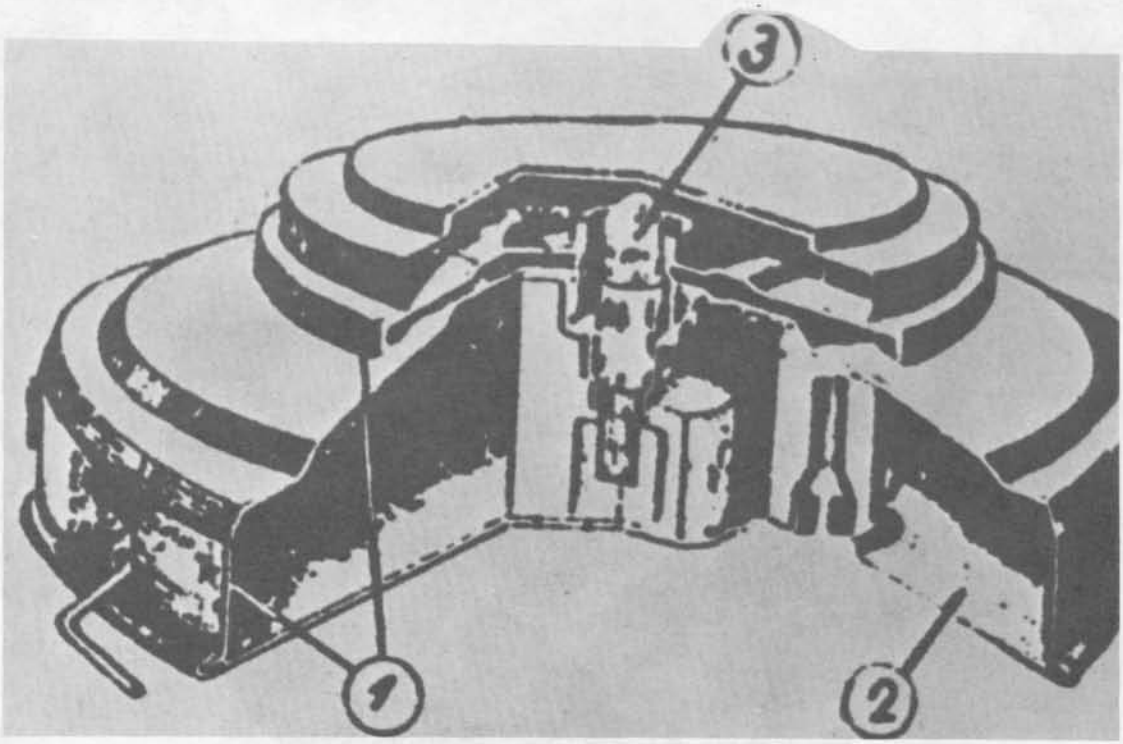


TMM-1 Being Laid by PMR-3



Yugoslav Antitank Mine TMM-1





Yugoslav Antitank Mine TMM-1



Bottom View: Czechoslovak Antitank Mine PT-Mi-Ba



Top View: Czechoslovak Antitank Mine PT-Mi-Ba

PLASTIC ANTITANK MINES

Czechoslovak Antitank Mine PT-Mi-Ba
Czechoslovak Antitank Mine PT-Mi-Ba-II
Czechoslovak Antitank Mine PT-Mi-Ba-III
East German Antitank Mine PM-60
Yugoslav Antitank Mine TMA-1
Yugoslav Antitank Mine TMA-2
Yugoslav Antitank Mine TMA-3
Yugoslav Antitank Mine TMA-5

The Czechoslovak Army introduced its own plastic antitank mine in the early 1950s after using up existing stocks of German mines. The original PT-Mi-Ba (sometimes known as the PT-Mi-Ba-53) somewhat resembles the German Topfmine, and is circular, as is the more recently introduced PT-Mi-Ba-III. The latter mine differs in that it has a heavier main charge, a different type pressure plate, and a modified carrying handle. The plastic PT-Mi-Ba-II is different in design, being oblong in shape with a weight between that of the two circular mines. It is not suitable for mechanical laying. In contrast to the circular mines it uses two fuzes instead of one. All of these Czechoslovak plastic mines use the Ro-7-II pressure fuze which contains the only metallic part in the mines. No provision is made for booby trapping.

The East German PM-60 is a plastic mine equipped with a pressure fuze. Very distinctive in design, the PM-60 was designed for mechanical laying. Two fuze models exist, a mechanical model with minimal metallic components, and a non-metallic chemical model. The PM-60 also has a bottom fuze well for booby trapping.

The Yugoslav "antimagnetic" plastic mines include the TMA-1, TMA-3, and TMA-5 circular models, and the TMA-2 oblong model. The TMA-1 has a large distinctive corrugated pressure plate. The TMA-3, which has a larger explosive charge, has no pressure plate, but employs three pressure fuzes which are screwed into the fuze wells on the top of the mine and remain exposed. Both mines also have bottom fuze wells for antilifting devices. The TMA-5 is a rather large mine, also with multiple fuze wells. The TMA-2, like the Czechoslovak PT-Mi-Ba-II, is an oblong-shaped mine. All of these models use the Yugoslav UTMAH-1 chemical pressure fuze.

CHARACTERISTICS

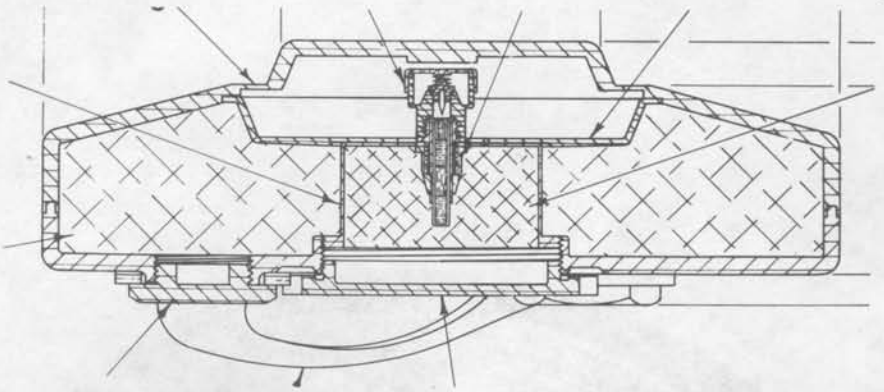
		PT-Mi-Ba	PT-Mi-Ba-II	PT-Mi-Ba-III
weight	kg	7.6	9.6	9.9***
diameter	mm	322	*	330
height	mm	102	135	108
main charge		TNT	TNT	TNT
weight	kg	5.6	6.0	7.2
operating force	kg	200-400	200-450	
booby trapping		improvised	improvised	improvised

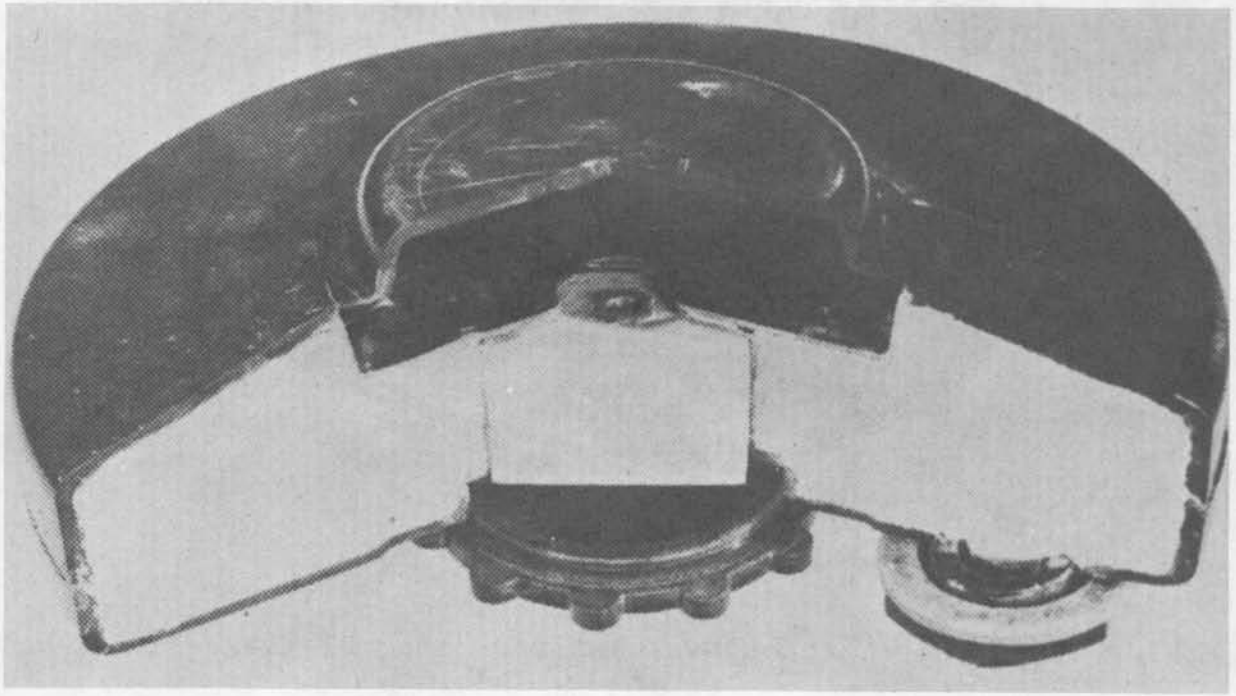
		PM-60	TMA-1	TMA-2	TMA-3
weight	kg	11.35	5.5	7.5	7.0
diameter	mm	320	300	**	260
height	mm	117	105	140	82
main charge		TNT	TNT	TNT	TNT
weight	kg	7.5	5.0	6.5	6.5
operating force	kg	200-500	200-600	200	180-320
booby trapping		bottom fuze well	bottom fuze well		bottom fuze well

*oblong shape 395 x 230 mm

**oblong shape 260 x 200 mm

***without fuze

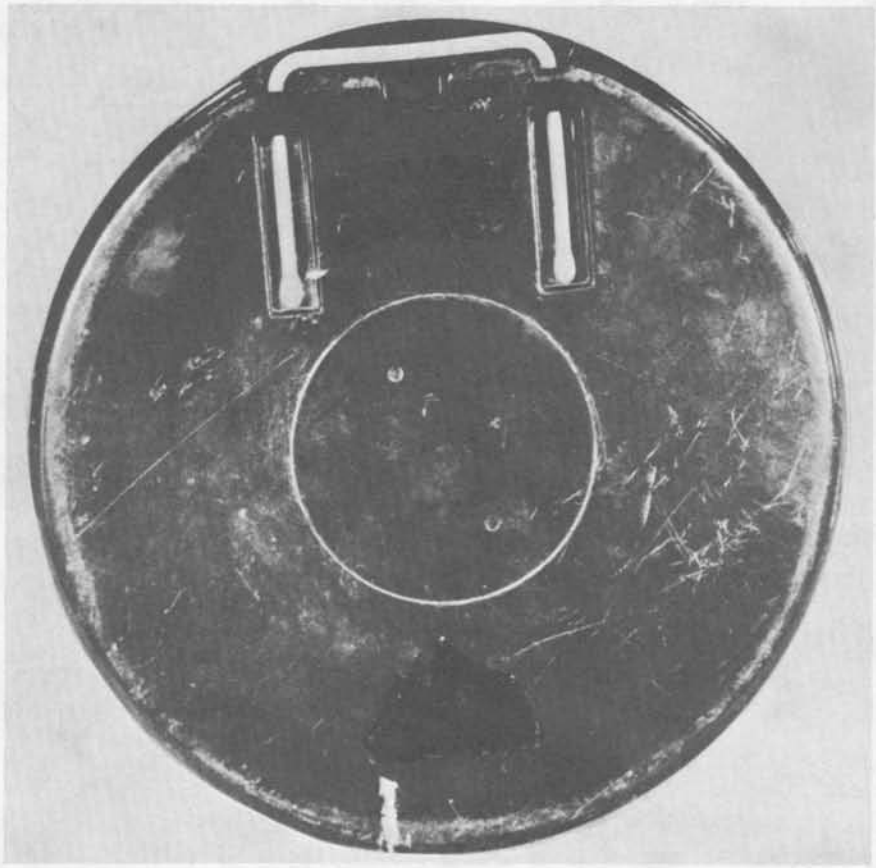




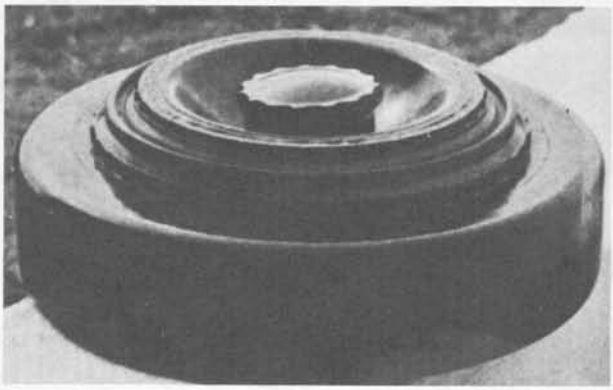
Czechoslovak Antitank Mine PT-Mi-Ba



Top View: Czechoslovak Antitank Mine PT-Mi-Ba-III



Bottom View: Czechoslovak Antitank Mine PT-Mi-Ba-III



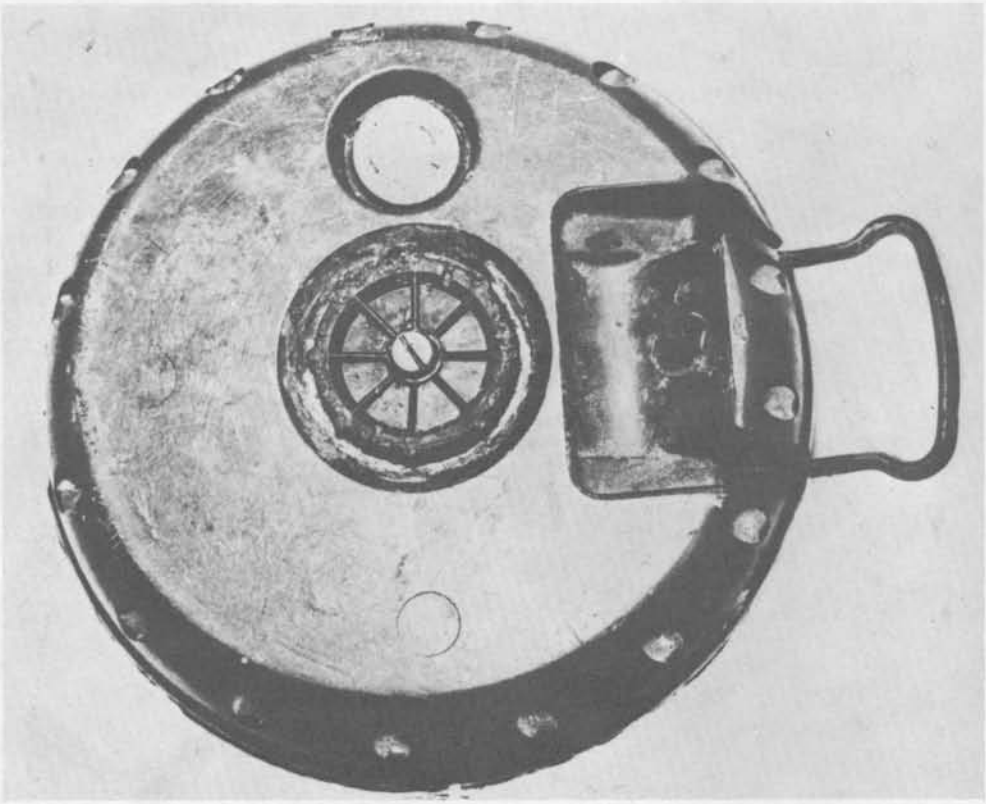
Czechoslovak Antitank Mine PT-Mi-Ba-III



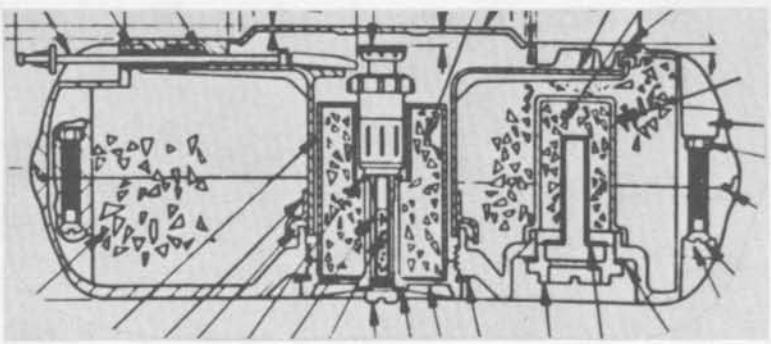
East German Troops Feeding PM-60
Antitank Mines into Mechanical Minelayer



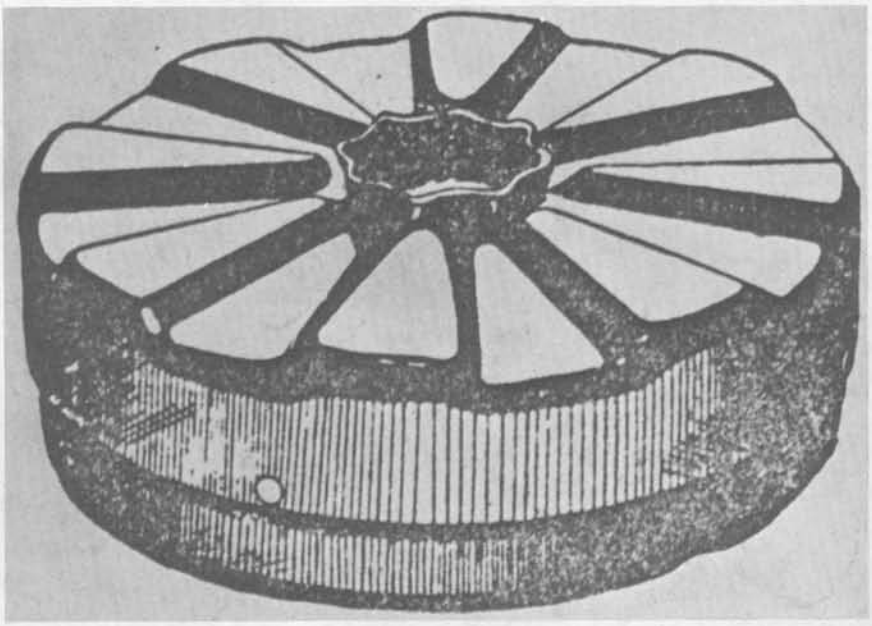
Top View of East German Antitank Mine PM-60



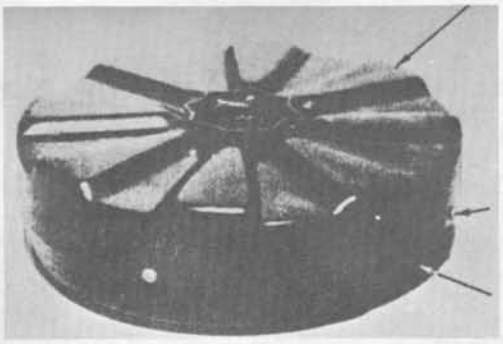
Bottom View: East German Antitank Mine PM-60



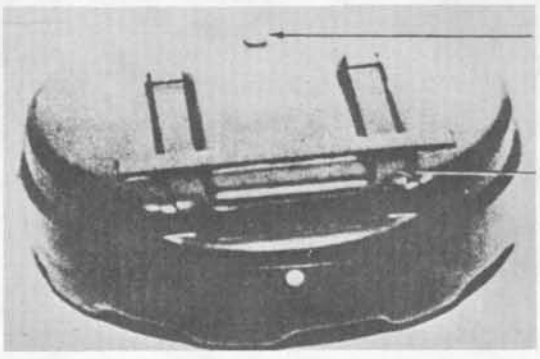
East German Antitank Mine PM-60



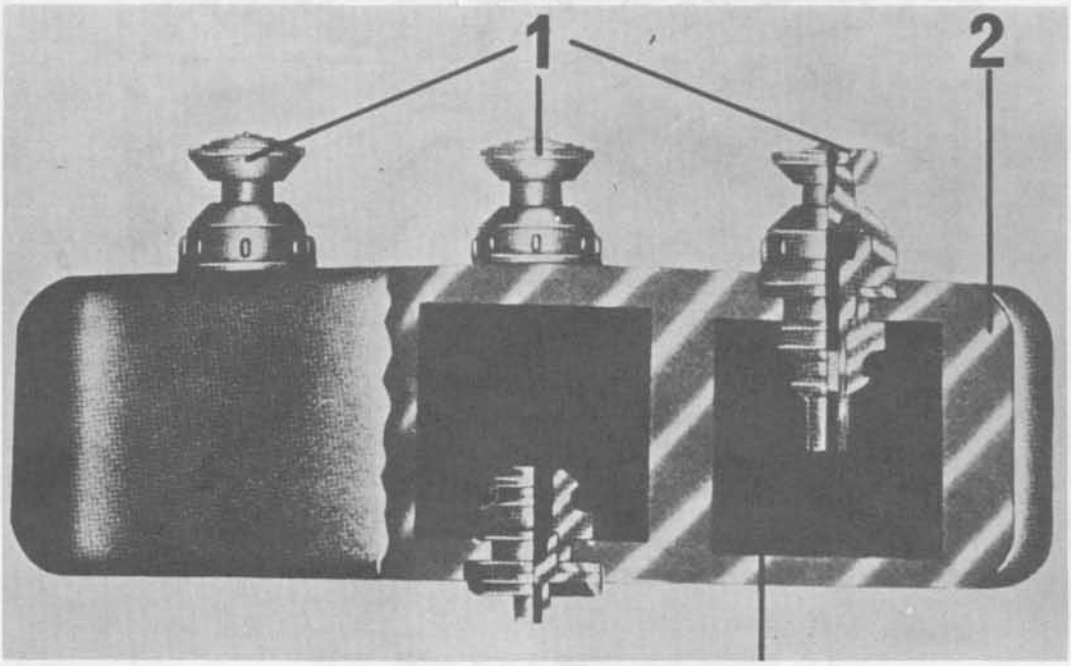
Top View: Yugoslav Antitank Mine TMA-1



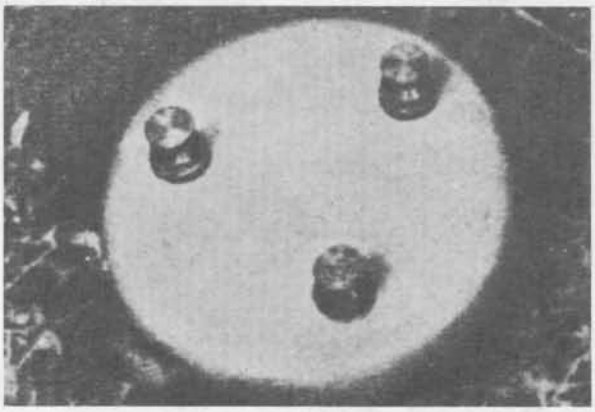
Top View: Yugoslav Antitank Mine TMA-1



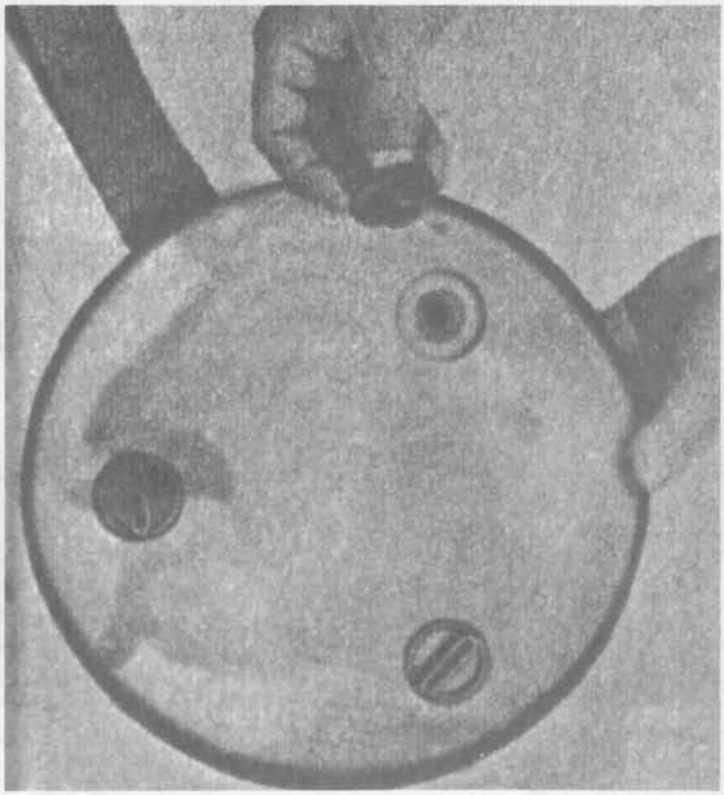
Bottom View: Yugoslav Antitank Mine TMA-1



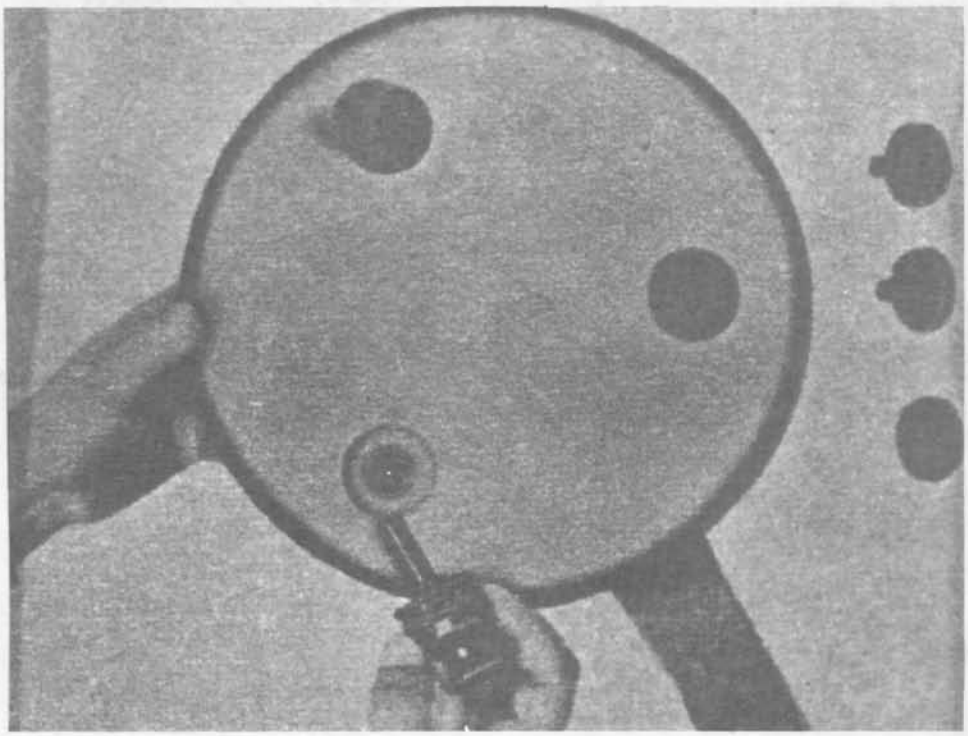
Cross Section: Yugoslav Antitank Mine TMA-3



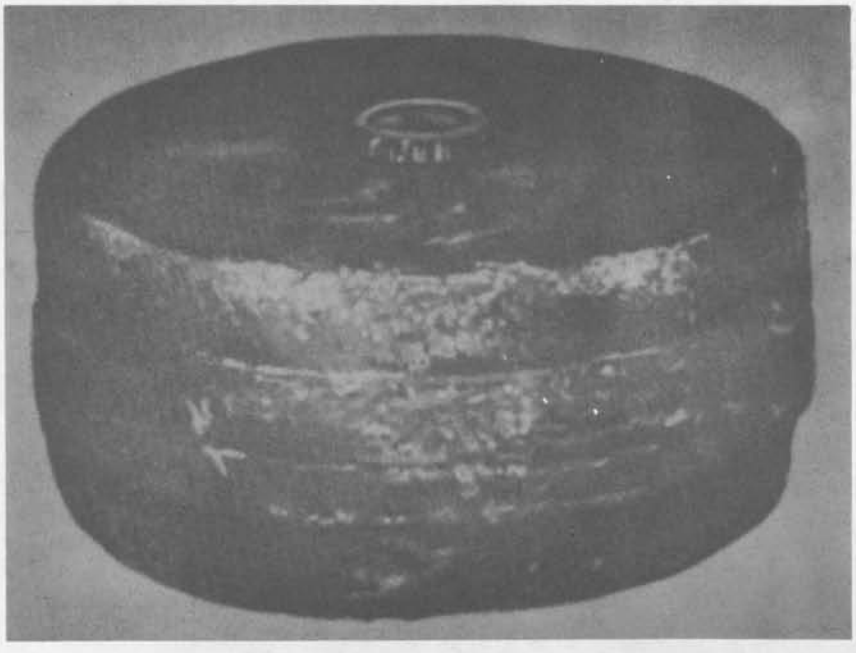
Yugoslav Antitank Mine TMA-3



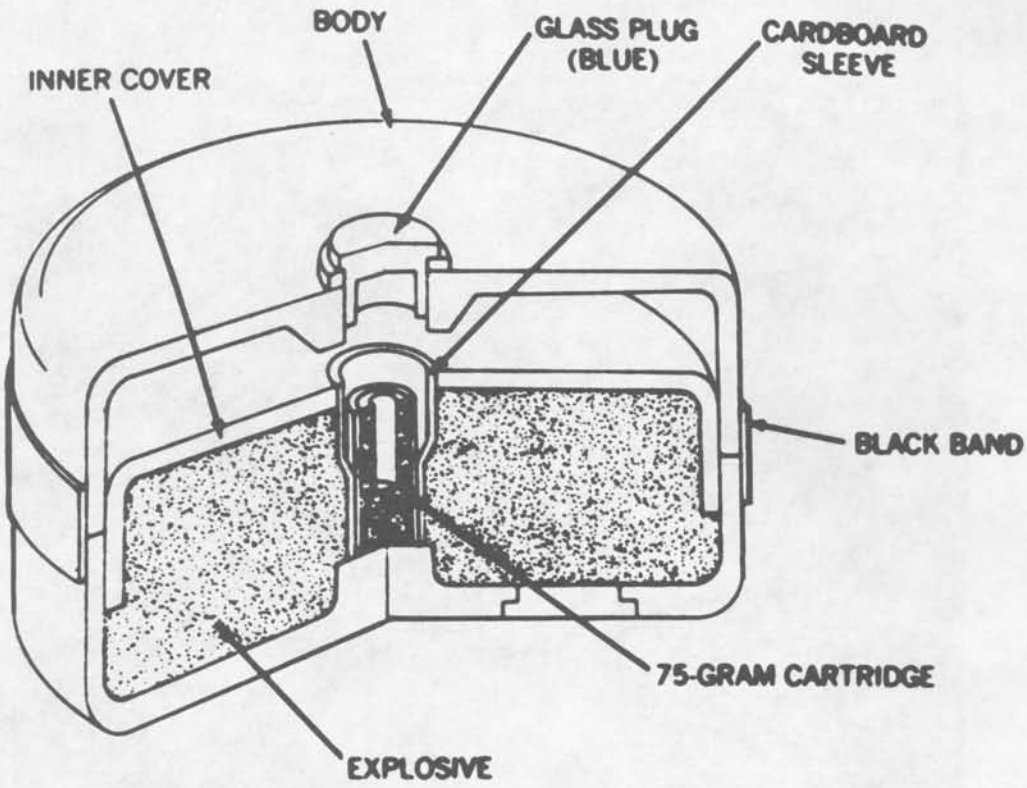
Removing Fuze Well Cover
from Yugoslav Antitank Mine TMA-3



Inserting UTMAH-1 Fuzes
Into Yugoslav Antitank Mine TMA-3



Soviet Antitank Mine TMSB



Soviet Antitank Mine TMSB

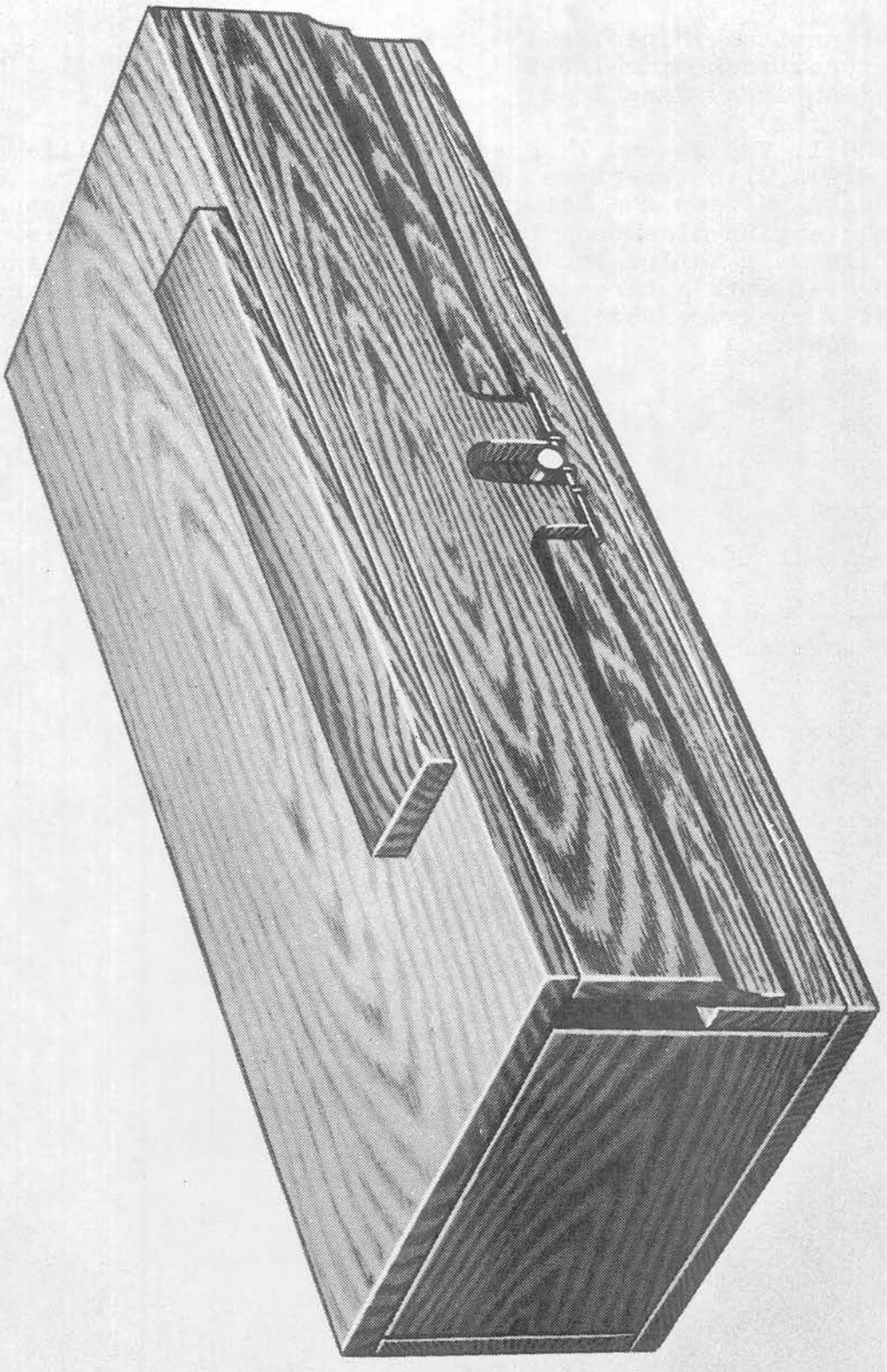
Soviet Antitank Mine TMB-1
Soviet Antitank Mine TMB-2
Soviet Antitank Mine TMSB

The TMB-1, TMB-2, and TMSB are World War II non-metallic antitank mines with two-piece, tar-impregnated cardboard bodies. The joint between the halves is sealed with tape and asphalt, and the entire mine body is coated with a waterproof tar. The fuze well is located in the top center of the mine and is covered with a threaded glass plug and a rubber washer. The MV-5 pressure fuze and the MD-2 detonator are used with these mines.

		TMB-2	TMSB
weight	kg	7	8
diameter*	mm	274	287
height*	mm	155	168
main charge		TNT**	amatol
weight	kg	5	6
operating force	kg	11.8	11.8
booby trapping		improvised	improvised

*mine body only

**or amatol



Soviet Antitank Mine YaM Series

WOODEN ANTITANK MINES

Soviet Antitank Mine YaM-5
Soviet Antitank Mine YaM-5K
Soviet Antitank Mine YaM-5M
Soviet Antitank Mine YaM-5U
Soviet Antitank Mine YaM-10
Soviet Antitank Mine TMD-B
Soviet Antitank Mine TMD-44
Czechoslovak Antitank Mine PT-Mi-D
Czechoslovak Antitank Mine PT-Mi-D-II
Czechoslovak Antitank Mine PT-Mi-D-III
Yugoslav Antitank Mine TMD-1

Since and during World War II, wooden antitank mines have played an important role in Soviet mine warfare. The mines are easy to manufacture, even under field conditions. When built without nails, as they sometimes were, they were difficult to detect. On the other hand, they are not waterproof and are, therefore, not suitable for permanent-type mine fields. However, wooden mines of various types still continue to be considered as standard in the Soviet Army.

One of the earliest wooden antitank mines to appear was the YaM-5, which was widely used during World War II. The four models of this mine all closely resembled one another, differing only slightly in overall dimensions, weight and size of the pressure board on the mine lid. In general, all models consisted of an oblong wooden box with a hinged lid. The front of the lid overlapped the box and was recessed in the center of the overlap to fit over the protruding end of the striker of the MUV pull fuze. The YaM-10, a post-World War II mine, was similarly constructed, but of larger size and contained more explosive.

The TMD-B was first employed in 1943, later used in Korea, and still is held in the Soviet inventory. It is of simple wooden construction with the boards either nailed together or fastened by tongue-and-groove joints. There are three pressure boards on the cover, with the center board hinged to permit insertion of the fuze. When the mine is armed, the hinged pressure board is held shut by a wooden locking bar. The main charge normally consists of two waterproof, paper-wrapped blocks of pressed amatol, dynammon, or ammonite. The TMD-B, which may either be factory or field manufactured, employs the MV-5 pressure fuze and the MD-2 detonator.

The TMD-44 is a field-fabricated mine very similar to the TMD-B. It has a centrally located plastic fuze well cover and only two pressure boards. Although not in the current inventory, it may reappear in a future conflict.

The Czechoslovak PT-Mi-D is similar to the Soviet TMD-B, but is more complicated in design, having wooden shear dowels at each end for adjustment to increase or decrease activation pressure. Instead of pressure fuzes, two Ro-1 pull fuzes are used with this mine, which also may be booby trapped with the assistance of the holes found in the bottom of the mine. The PT-Mi-D-II and III are variants of this mine with different dimensions and weights.

The Yugoslav TMD-1 is a close copy of the Soviet TMD-B.

It must be remembered that weights and dimensions of given models of wooden antitank mines will vary considerably.

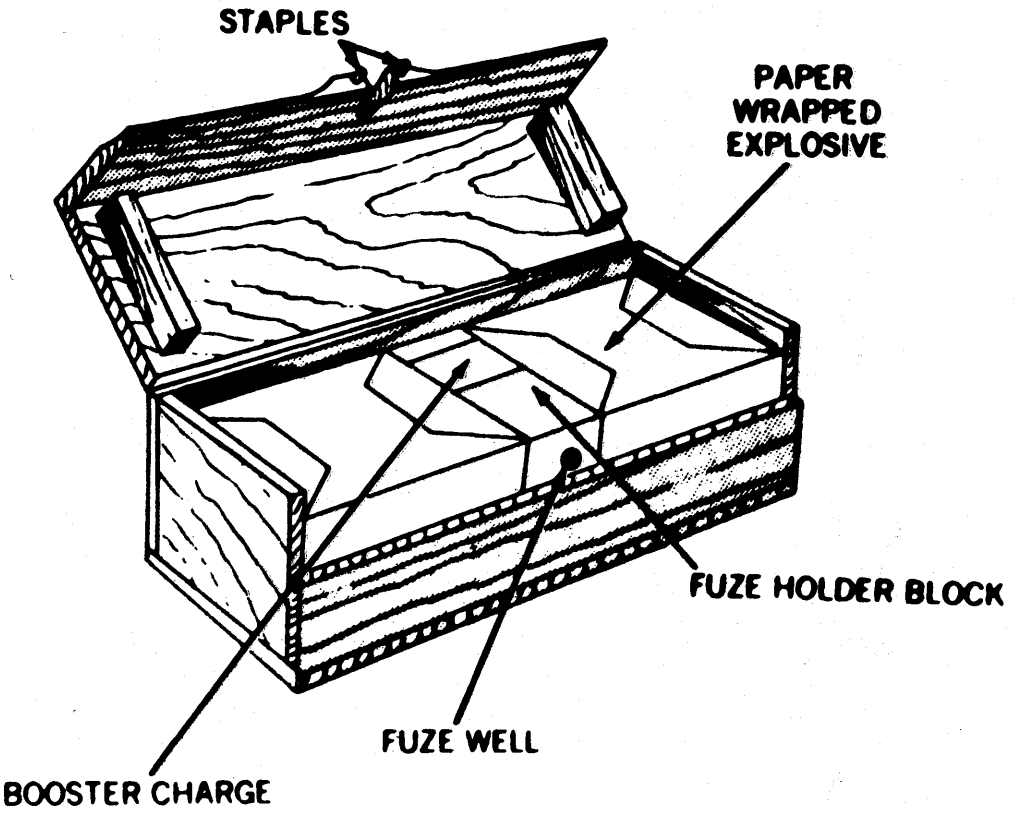
		YaM-5	YaM-10'	TMD-B
weight	kg	6.8-7.7	11.8	7.7
length	mm	475	620	320
width	mm	195	216	280
height	mm	95	196	140
main charge		TNT*	TNT*	varies
weight	kg	3.6-5	10	5-6.7
operating force	kg	136	136	200
booby trapping		improvised	improvised	improvised

		TMD-44	PT-Mi-D	TMD-1
weight	kg	10	9.0	7.5
length	mm	315	320	320
width	mm	280	230	280
height	mm	158	175**	140
main charge		varies	TNT	TNT
weight	kg	6	6.2	5.5
operating force	kg	200	200-450	200
booby trapping		improvised	***	improvised

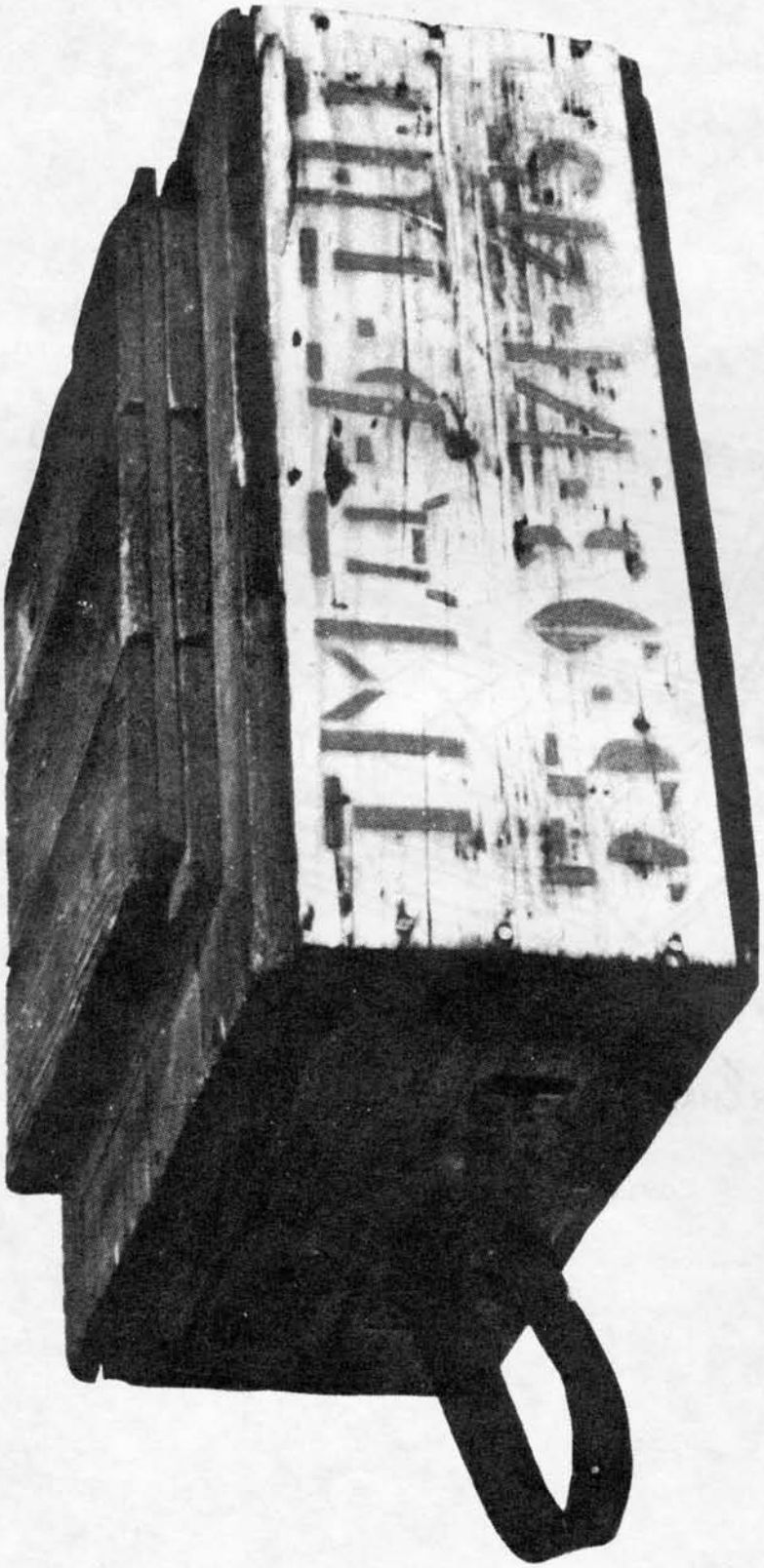
*or amatol

**135 mm without pressure block

***improvised or use of anchor wire tied to striker retaining pin

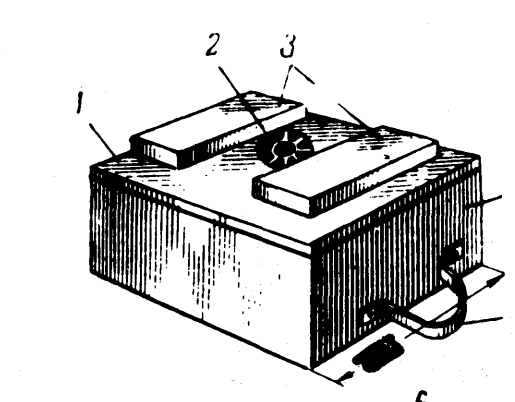


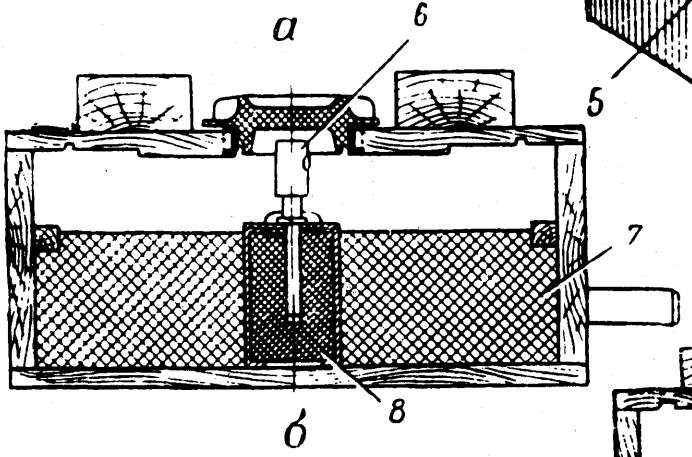
Soviet Antitank Mine YaM Series



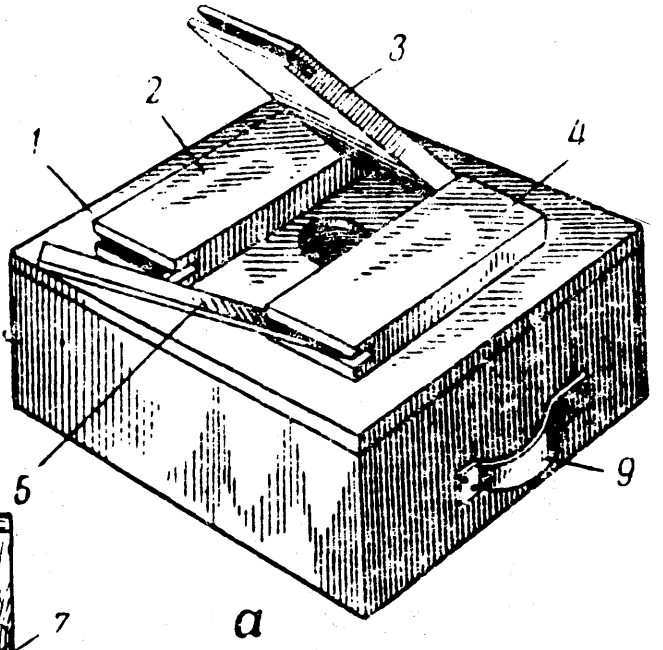
Soviet Antitank Mine TMD-B

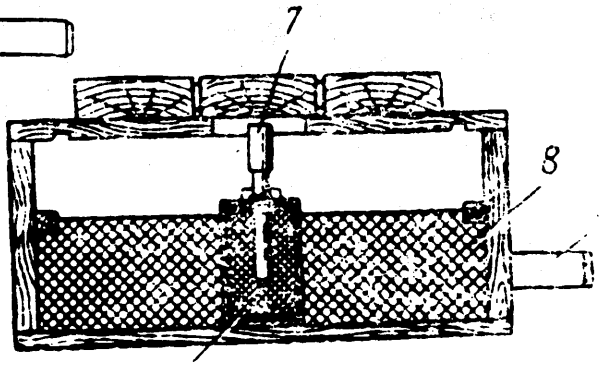
Soviet Wooden Antitank Mines



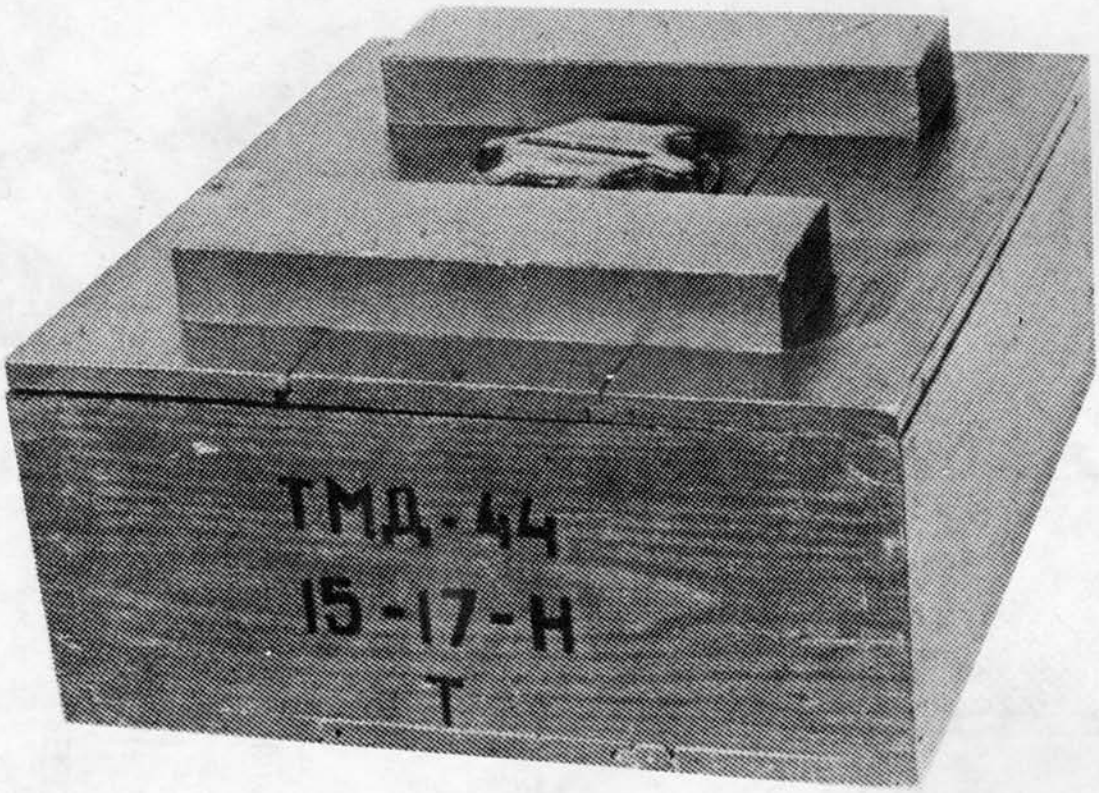


TMD-44

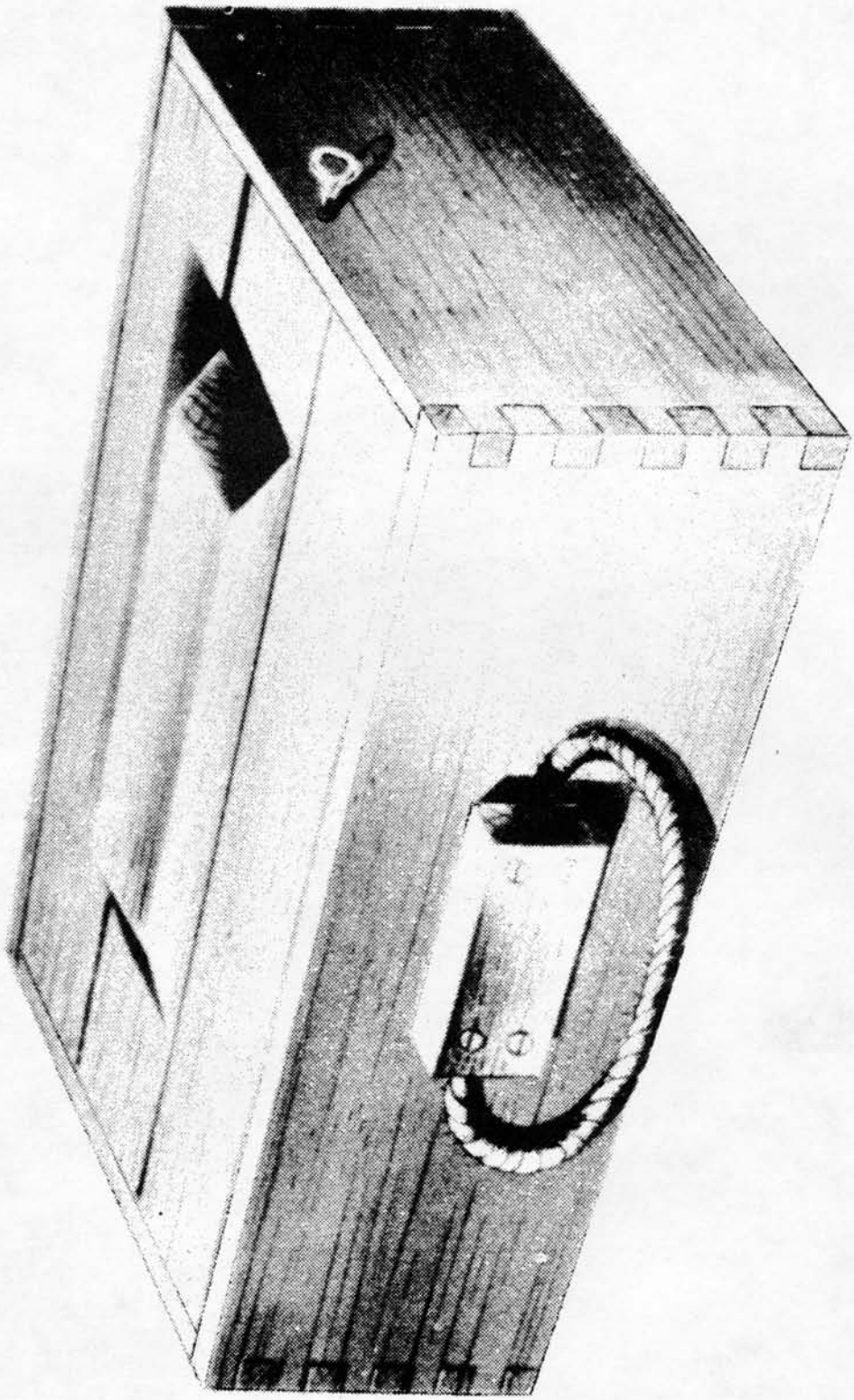




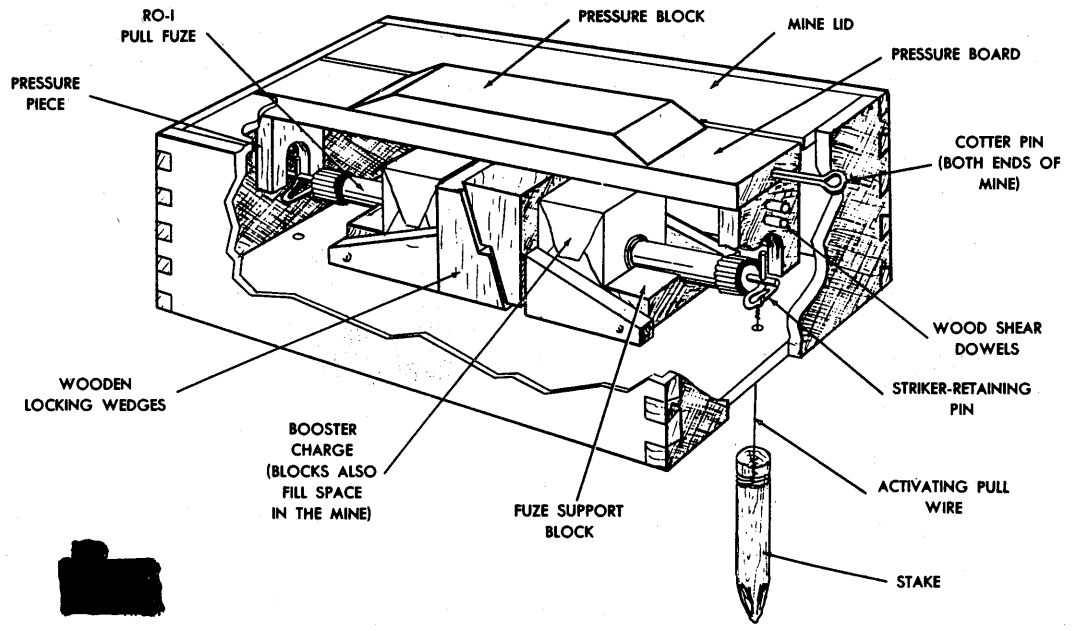
TMD-B



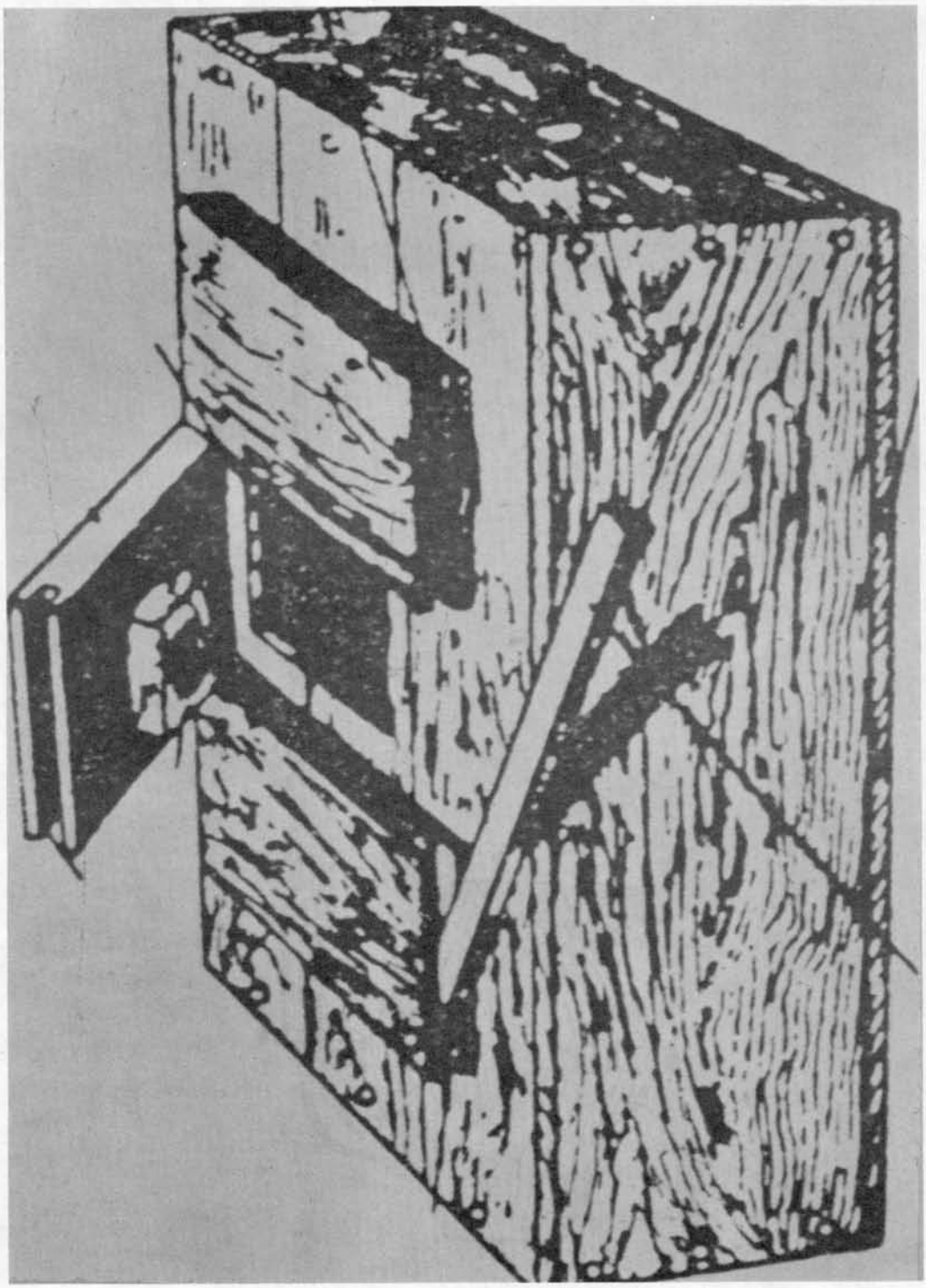
TMD-44



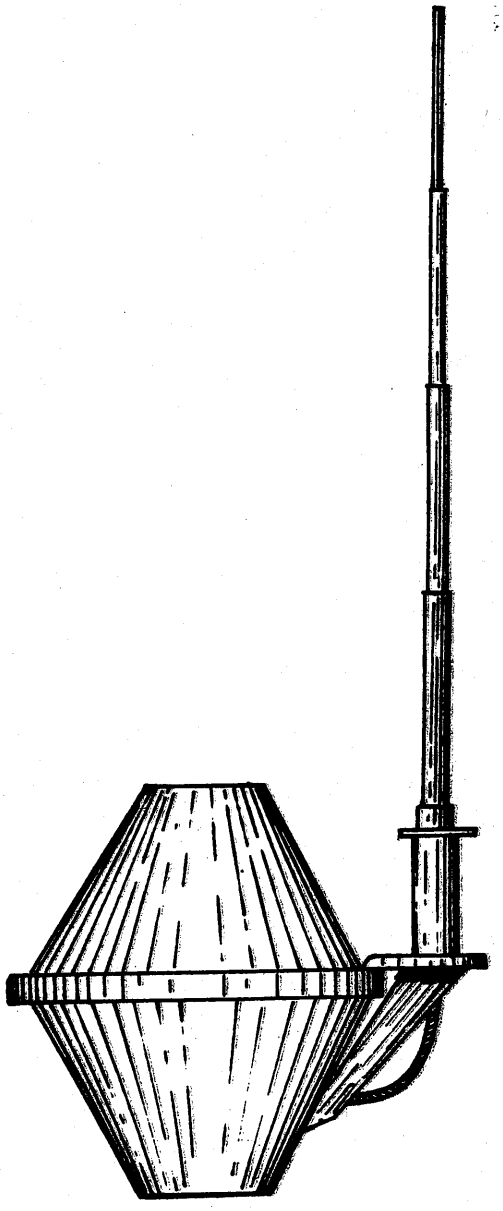
Czechoslovak Antitank Mine PT-Mi-D



Czechoslovak Antitank Mine PT-Mi-D



Yugoslav Antitank Mine TMD-1



Soviet Antitank Mine TMK-2

Soviet Antitank Mine TMK-2
Czechoslovak Plate-Charge Antitank Mine
Hungarian Plate-Charge Antitank Mine

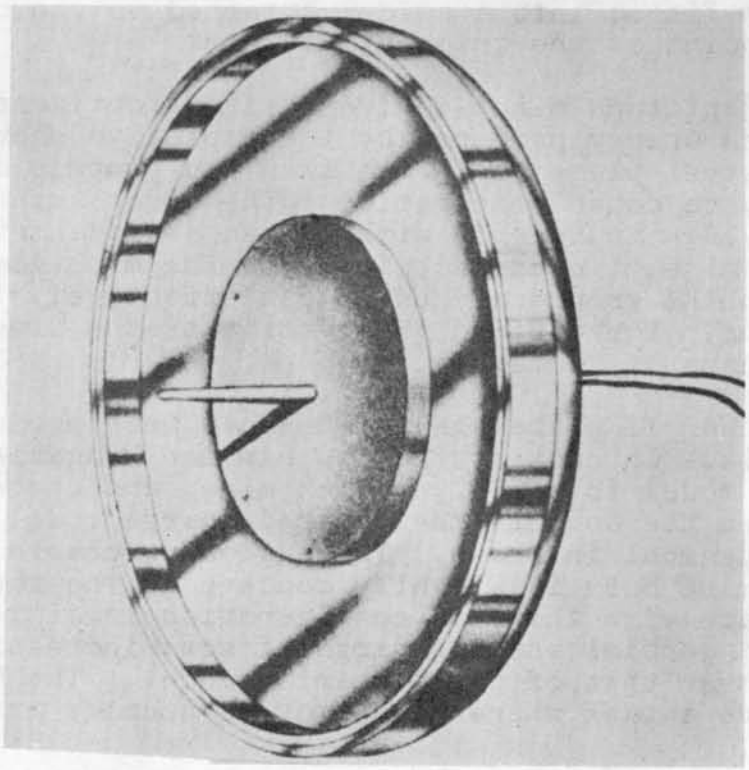
Shaped-charge antitank mines are designed to attack the bellies of tanks and other armored vehicles. Normally they are buried in the ground and fitted with a tilt-rod fuze, although other types of fuzes could be used. The effectiveness of the mine results from the shaped charge (HEAT) which produces a penetrating jet in the same manner as shaped demolition charges and HEAT projectiles fired from artillery cannon. The Soviet TMK-2 is such a mine. It consists of a double-truncated, conical-shaped mine body with the shaped charge placed in the lower half. The mine is fitted with an adjustable-length, tilt-rod fuze which is fitted into a holder attached to the side of the mine at the point of the greatest diameter.

Plate-charge antitank mines derive their effectiveness against armor from the energy produced by the explosive charge, which collapses a steel plate to form a slug and propels it at a high velocity to cause penetration. The first such mine was developed in 1944 in Hungary with German assistance. It is a controlled mine, fired electrically. The mine is mounted vertically on the ground and used most effectively in ambush configurations. The maximum penetration of the steel slug is 100mm at a range of 20 meters.

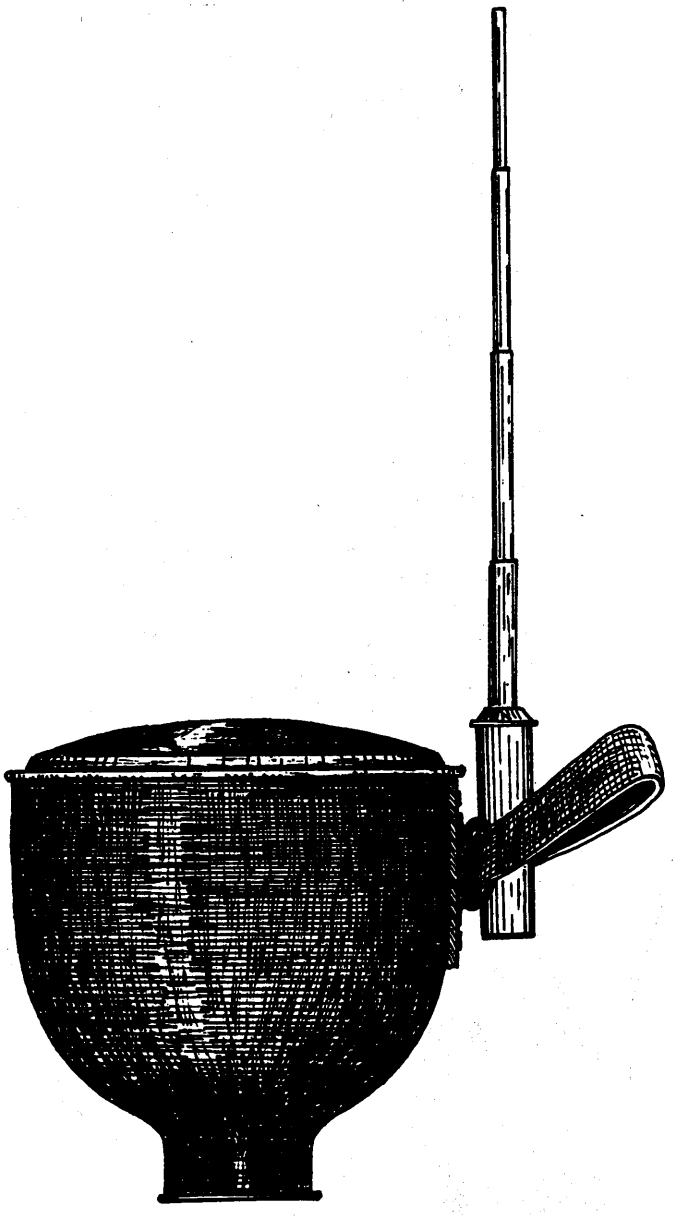
A post-World War II plate-charge mine has been produced in Czechoslovakia. In contrast to the earlier Hungarian mine, the Czechoslovak model is a belly-attack mine, and therefore somewhat resembles the Soviet TMK-2 shaped-charge model, although it is hemispherical in shape. The explosive charge, which fills most of the mine body is slightly concave on the top, and a 5mm steel plate with the same configuration is fitted on top. Thus it has a partial shaped-charge effect, increasing the penetration over that of the Hungarian model. The belly-attack mode endangers a tank where the armor is usually at its thinnest.

		Czech Plate Charge
weight	kg	9.5*
diameter	mm	240
height	mm	230
main charge weight	kg	RDX/TNT
operating force	kg	5.7

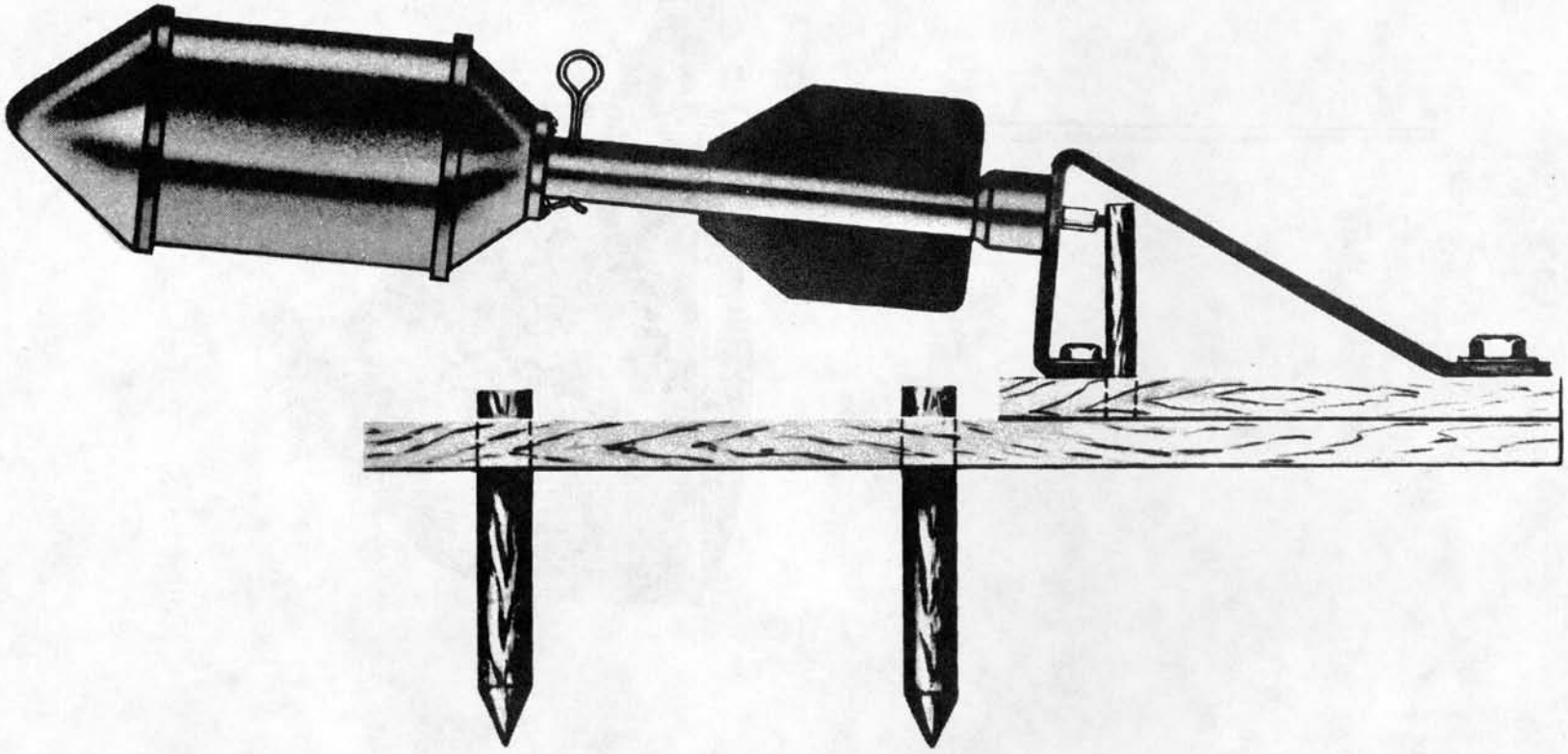
*without fuze



Hungarian Plate-Charge Antitank Mine



Czechoslovak Plate-Charge Antitank Mine

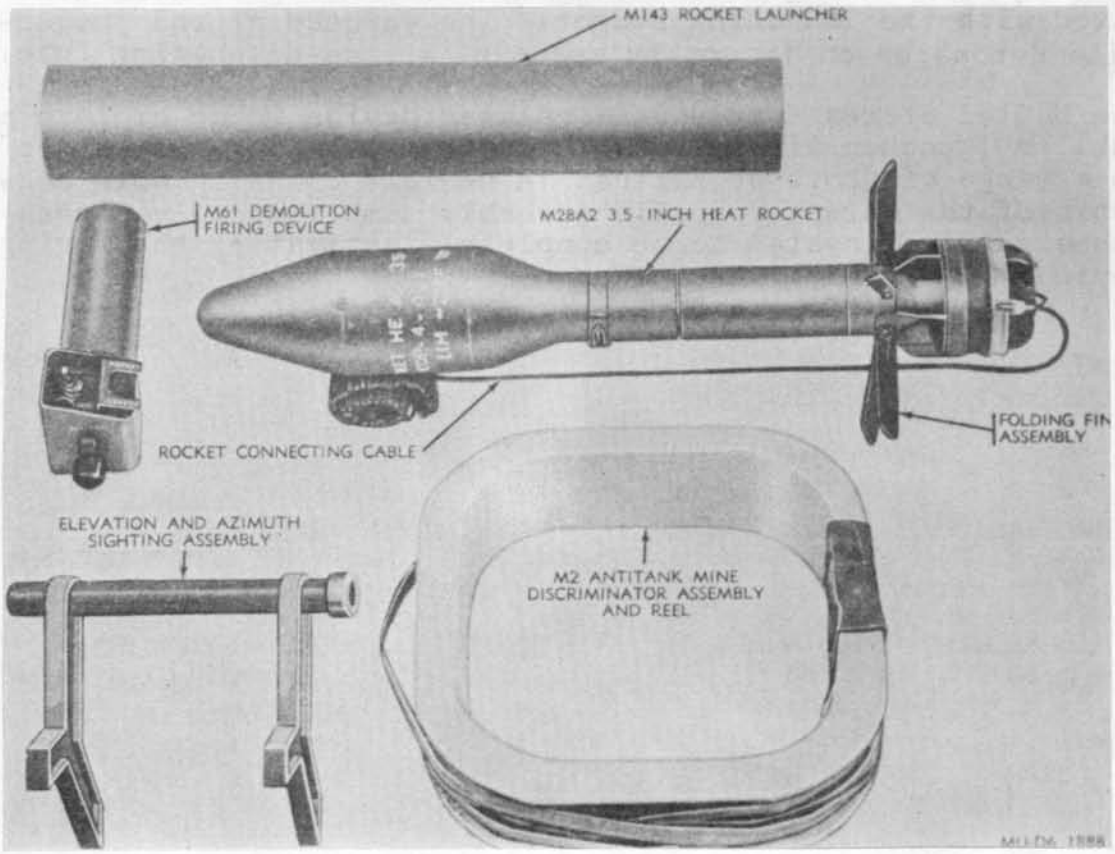


Soviet Off-Route Antitank Mine LMG

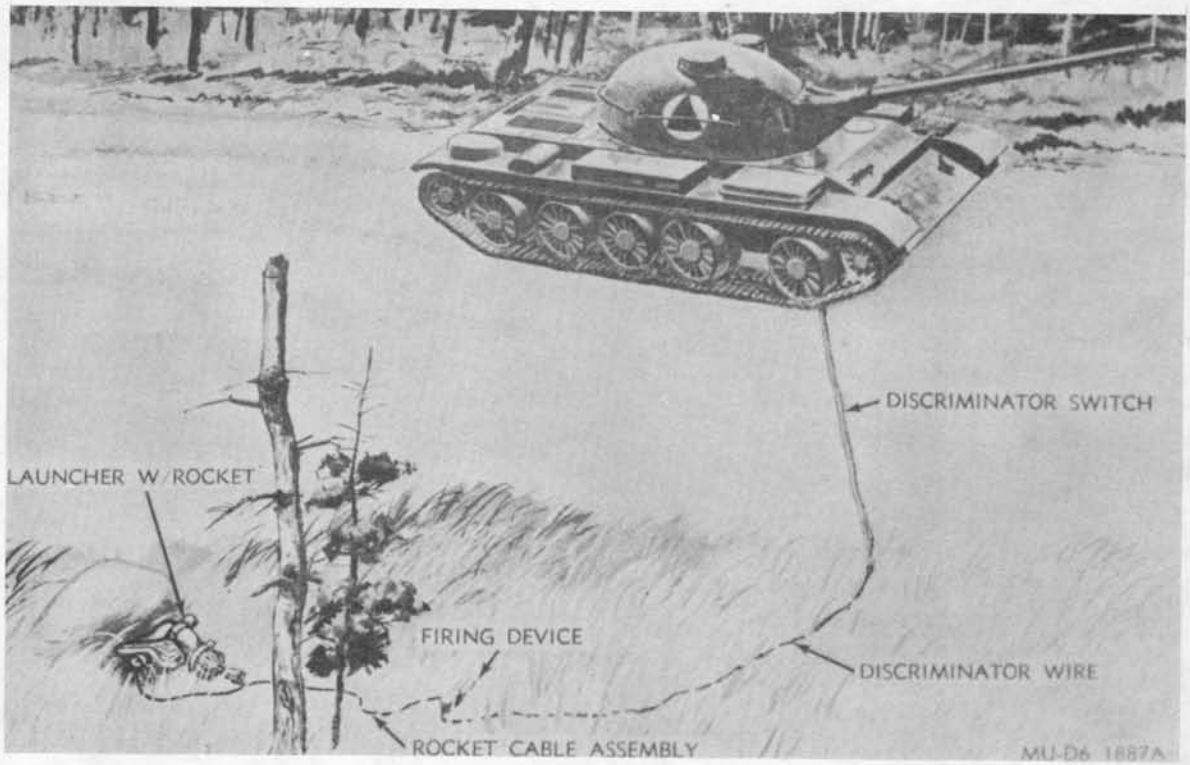
Soviet Antitank Grenade Mine LMG

Off-route mines are horizontal-action antitank mines. They are usually placed beside roads, trails, or defiles. They can be remotely controlled by the use of an observer or through an unattended remote fuze. During World War II the Soviets employed the LMG "flying mine Galitsky." The mine was a spigot-launched projectile with a shaped-charge warhead. The projectile and spigot launcher were placed on a wooden platform which was positioned in a shallow trench and aimed at a probable tank approach. The device was fired by a force pulling or breaking a wire attached to a MUV pull fuze located with the launching spigot. The warhead of the projectile detonates on impact by means of a base-detonating fuze.

The United States Army uses a related device which employs a tubular launcher firing a 3.5 inch (89mm) bazooka rocket up to a range of about 30 meters. A vehicle crossing both segments of the detector cable assembly simultaneously causes the electrical system to be completed, activating the firing devices, and firing the rocket.



United States Off-Route Antitank Mine M24

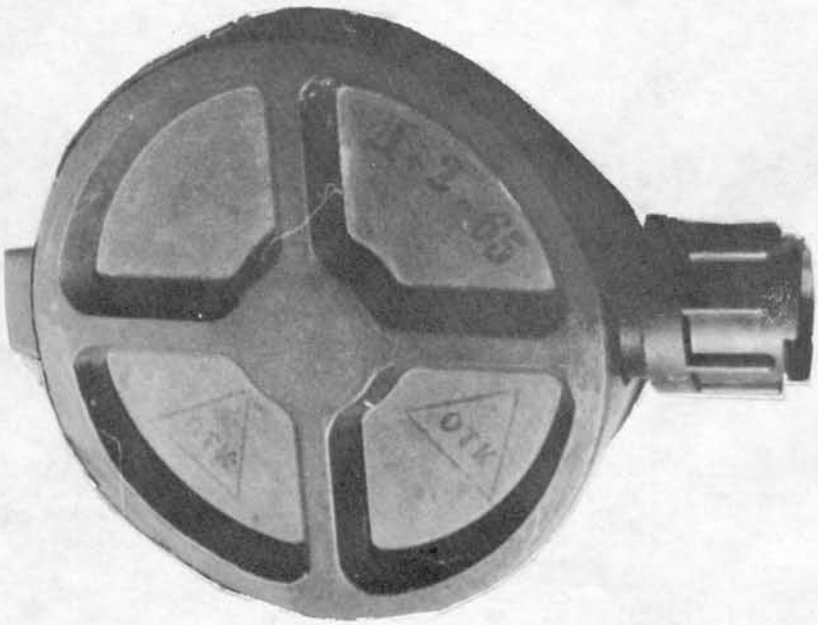


Employment of the United States Off-Route Antitank Mine M24

ANTIPERSONNEL MINES



Top and Side View of Soviet Antipersonnel Mine PMN



Bottom View of Soviet Antipersonnel Mine PMN

PLASTIC ANTIPERSONNEL MINES

Soviet Antipersonnel Mine PMN
Czechoslovak Antipersonnel Mine PP-Mi-Ba
Hungarian Antipersonnel Mine M62
Yugoslav Antipersonnel Mine PMA-1
Yugoslav Antipersonnel Mine PMA-2

The Soviet PMN plastic mine is a post-World War II development which has been employed on the East German border as well as in Vietnam. The casing of the PMN is made of duroplastic and has a side hole for the firing mechanism and primer charge. The top half of the mine case has a rubber mantle which is secured by a metal clasp. The mine is activated by pressure on the top of the case. This pressure releases a spring-loaded striker, in turn hitting the percussion cap capsule, thus setting off the main charge. On laying the mine, after removing the safety pin there is a 15 to 20 minute delay in arming. The mine cannot be disarmed.

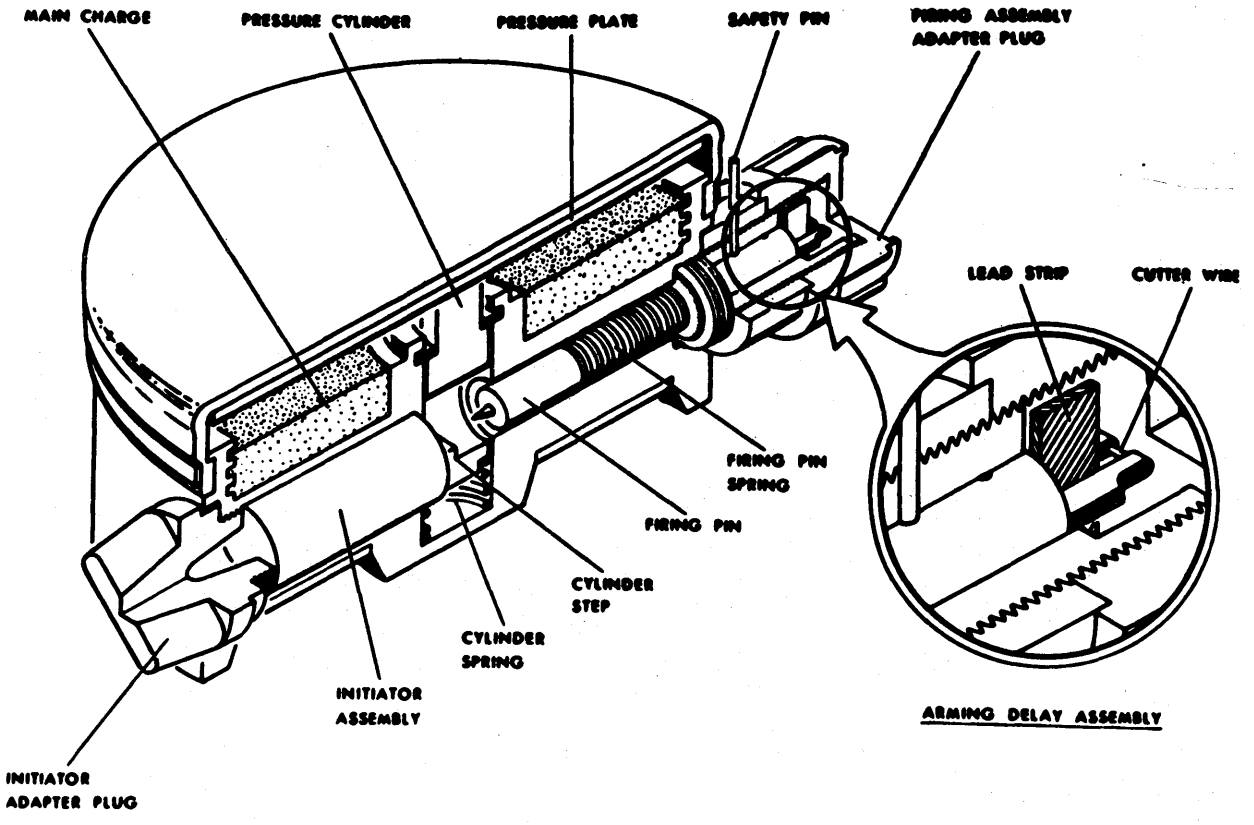
The Czechoslovak PP-Mi-Ba is a circular-shaped mine, lighter in weight than the Soviet PMN, but it contains over 80 percent more explosive in the main charge. The Hungarian M62 has the same approximate dimensions and explosive charge as the wooden M49, but is made of plastic. The Yugoslav PMA-1 also resembles the typical wooden antipersonnel mine. However, the PMA-1 uses a UPMAH-1 chemical pressure fuze in place of the MUV-type pull fuzes normally used in mines of this design. The PMA-2 is quite different in design, with a cylindrical plastic case with a fuze well in the top, into which a special plastic mechanical pressure fuze is inserted.

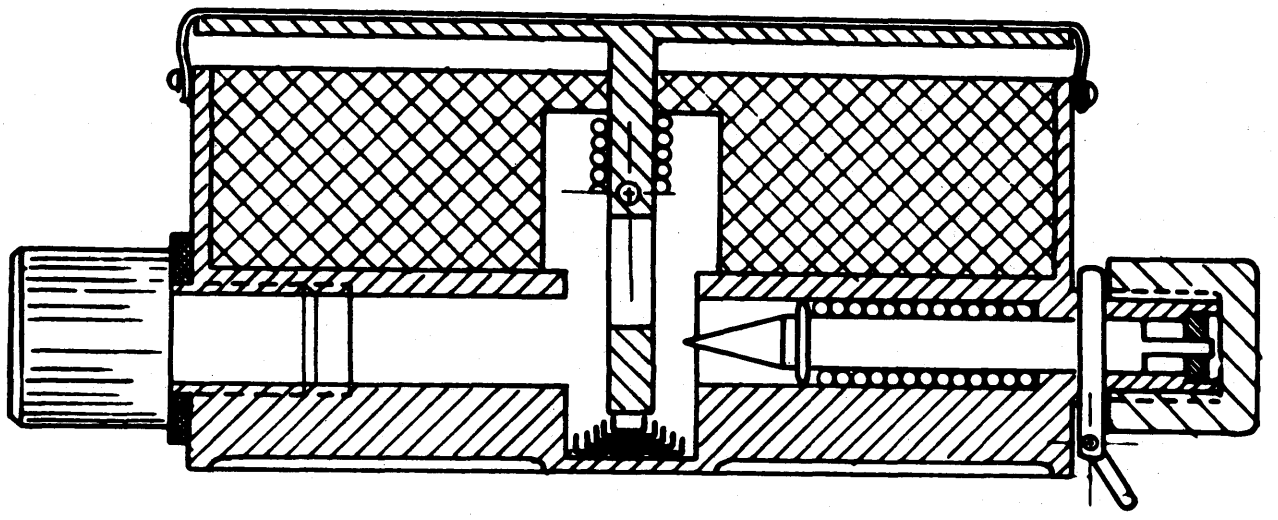
		PMN	PP-Mi-Ba	M62
weight	g	600	340	
diameter	mm	112	150	*
height	mm	56	60	65
main charge		TNT	TNT	TNT
weight	g	240	200	75
operating force	kg		0.5 to 1.0	1.5 to 4.5
booby trapping		improvised	improvised	improvised

		PMA-1	PMA-2
weight	g	280	140
diameter	mm	**	65
height	mm	40	62
main charge		TNT	TNT
weight	g	200	100
booby trapping		improvised	improvised

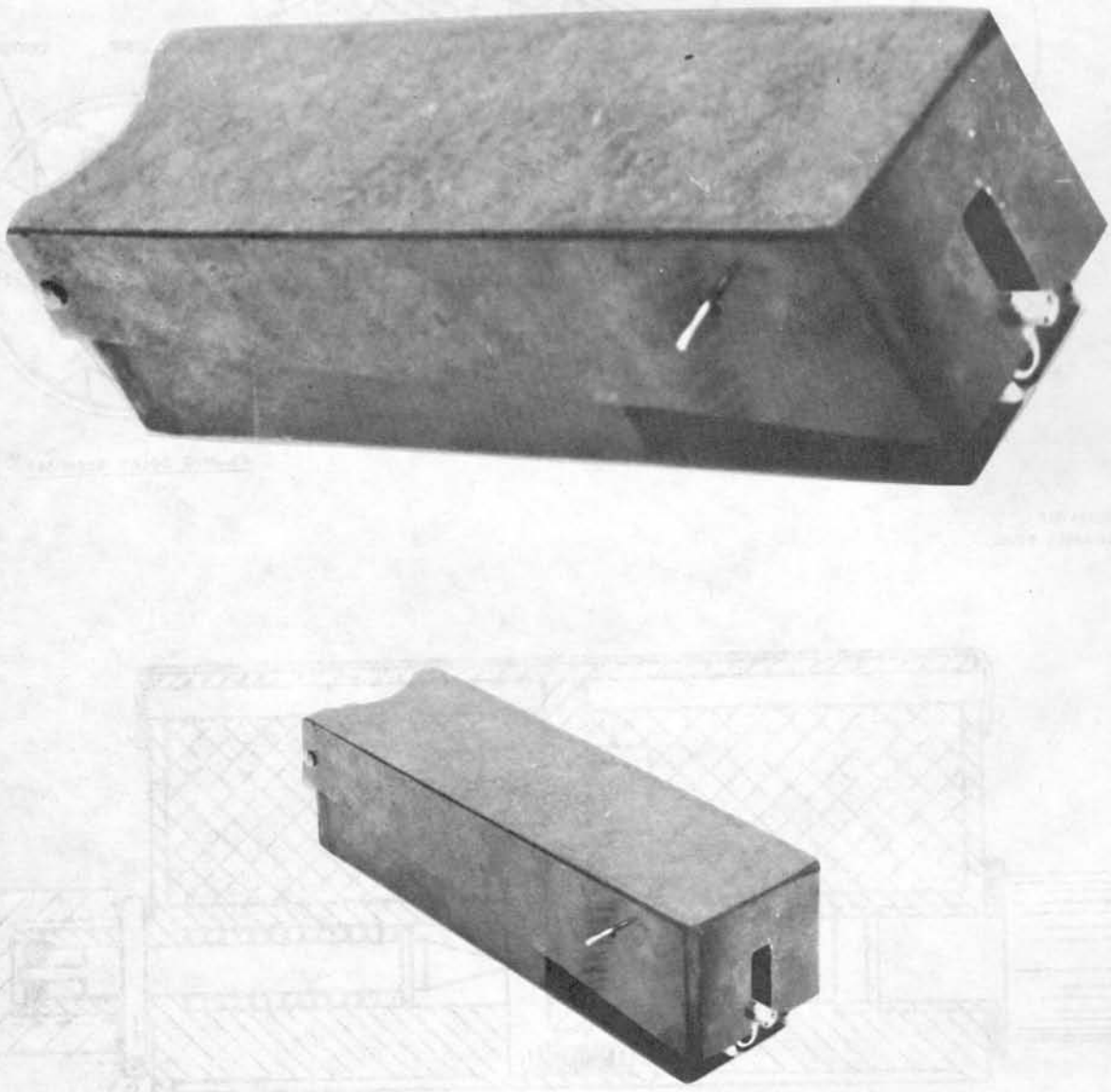
*oblong 187 x 50 mm

**oblong 140 x 65 mm (152 x 67 mm)

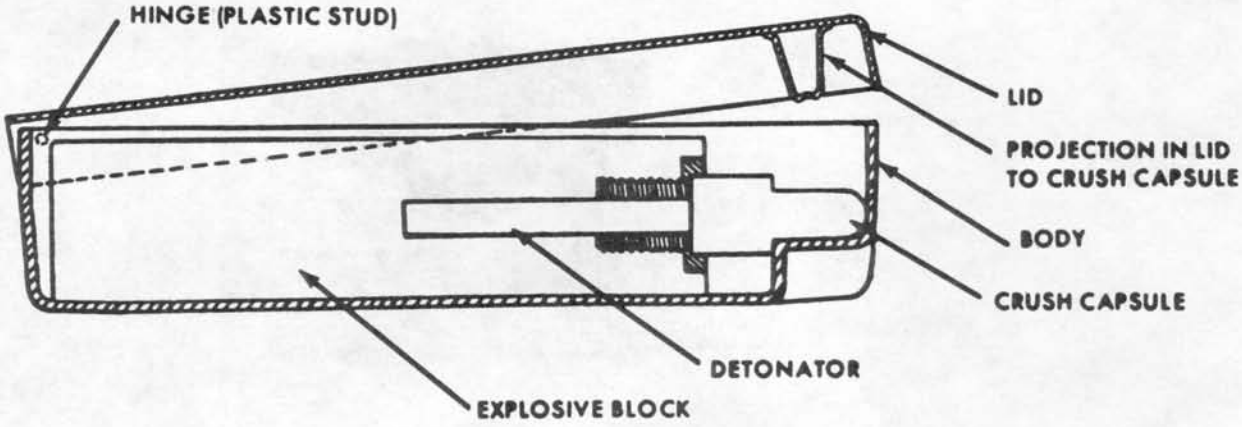




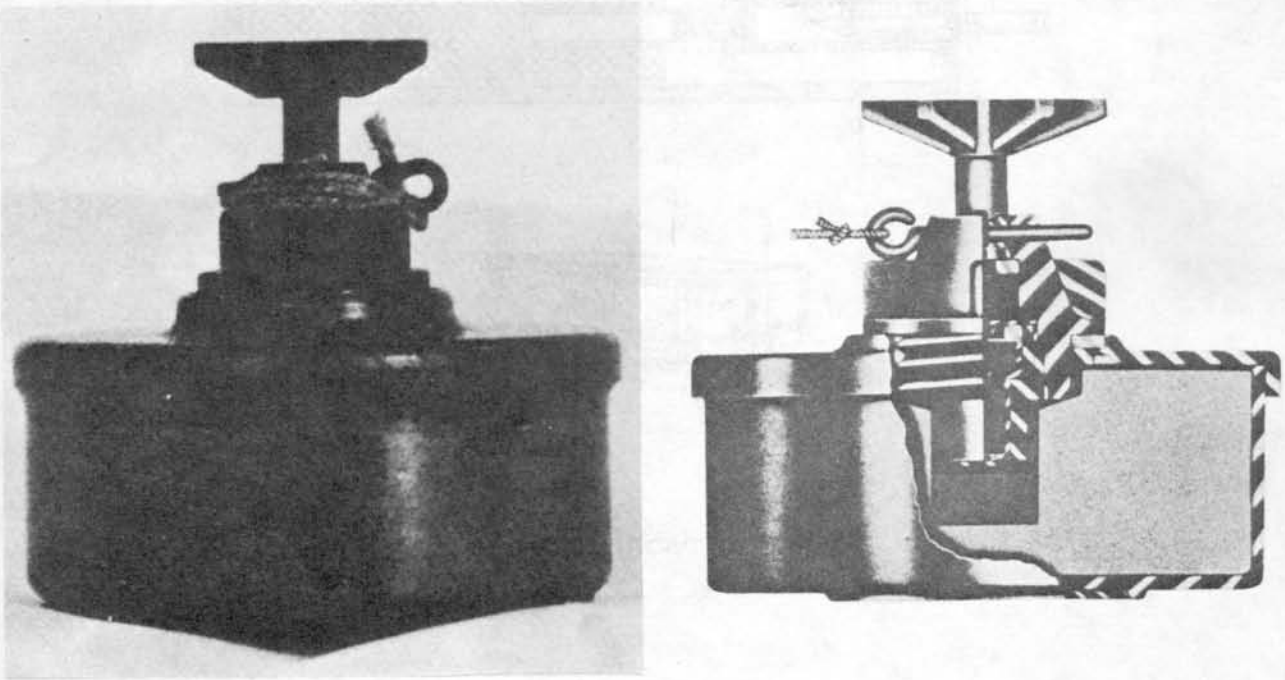
Soviet Antipersonnel Mine PMN



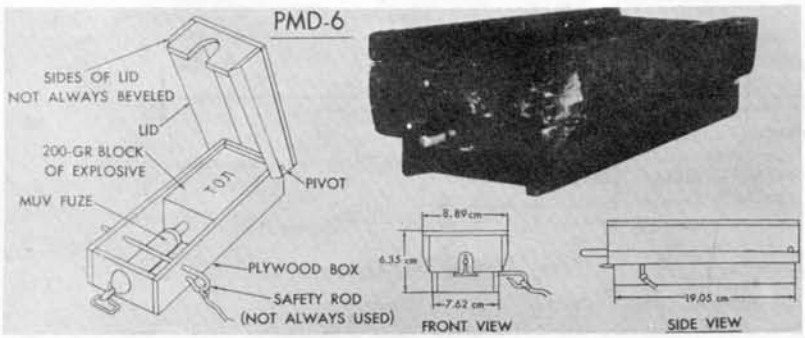
Hungarian Antipersonnel Mine M62

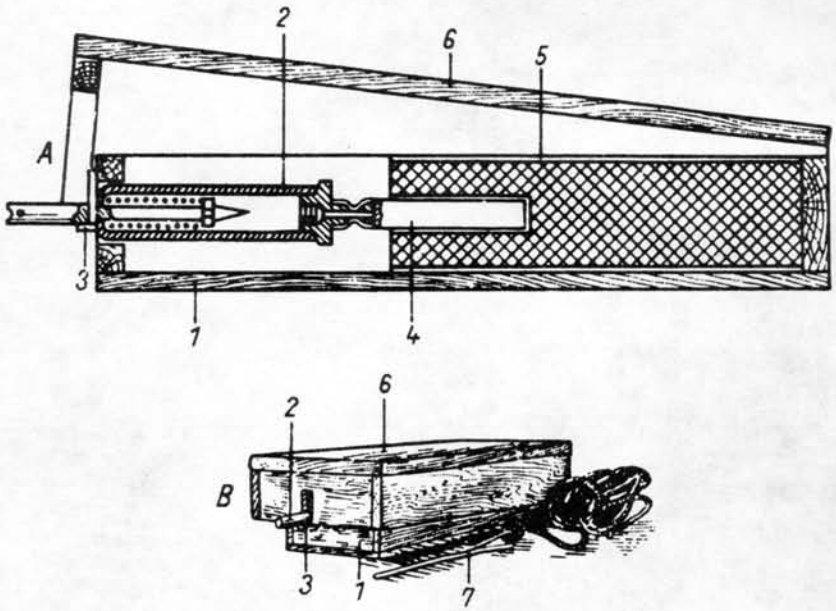


Yugoslav Antipersonnel Mine PMA-1



Yugoslav Antipersonnel Mine PMA-2





Soviet Antipersonnel Mine PMD-6

WOODEN ANTIPERSONNEL MINES

Soviet Antipersonnel Mine PMD-6
Soviet Antipersonnel Mine PMD-6M
Soviet Antipersonnel Mine PMD-7
Soviet Antipersonnel Mine PMD-7ts
Soviet Antipersonnel Mine PMD-57
Czechoslovak Antipersonnel Mine PP-Mi-D
Hungarian Antipersonnel Mine M49
Yugoslav Antipersonnel Mine PMD-1

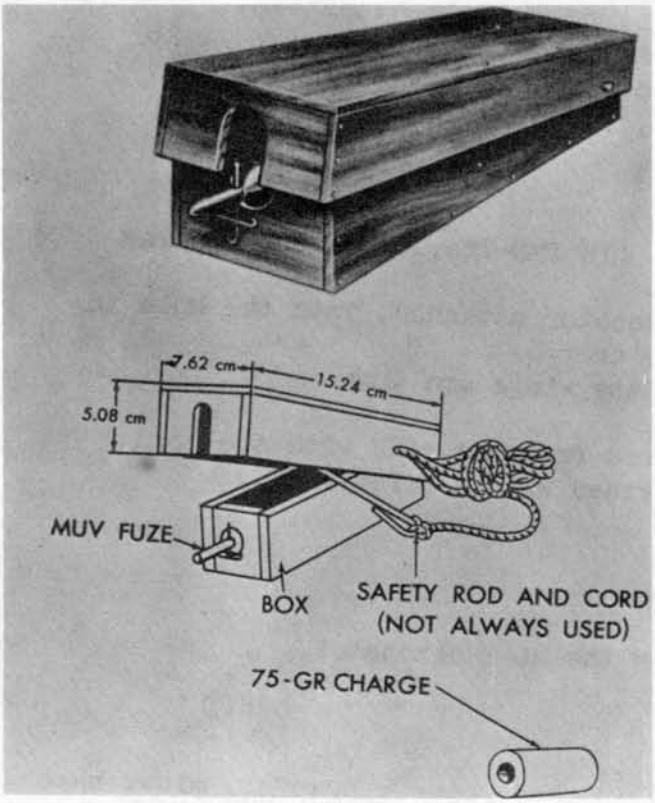
Wooden antipersonnel tread mines were used widely during World War II beginning with the Soviet-Finnish Winter War of 1939/40. Since these mines are so easy and cheap to make, so easy to lay, and so difficult to detect, and were so effective against foot troops, they were adopted during the war by both the Germans and Italians. After the war wooden antipersonnel mines remained in the Soviet inventory, and are still used today.

The first mine, already used in Finland in 1939/40, was the PMD-6. Later came the PMD-7, which was similar in design, but smaller in size with less explosive. The modified PMD-7ts differed from the PMD-7 in that the mine body was made of a single block of wood hollowed out for the charge. All of these mines used standard demolition charges (200-gram block for the PMD-6 and 75-gram borehole charge for the PMD-7 models), and employed the MUV pull fuze. After the war the PMD-6 was improved by the use of the MUV-2 pull fuze, resulting in the model change to PMD-6M. A further postwar variant is the PMD-57.

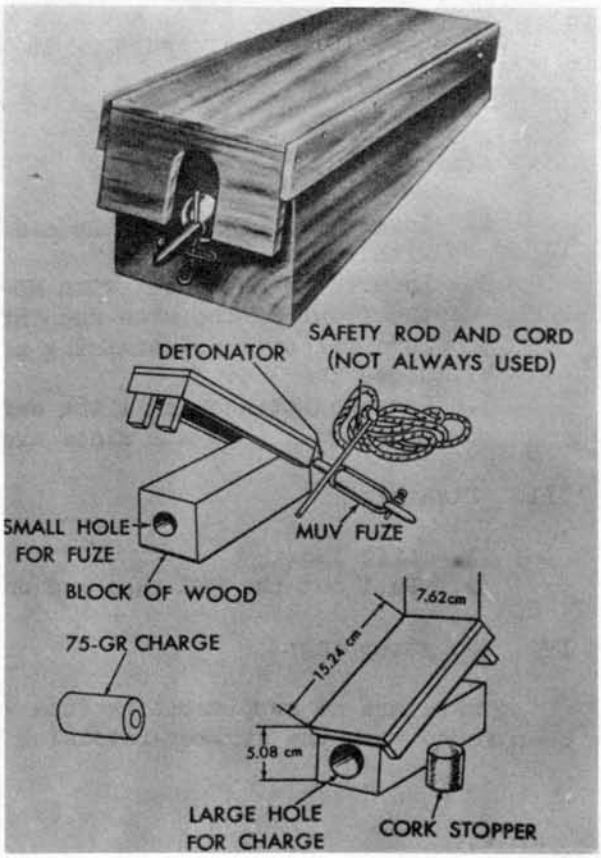
Other East European Communist countries also manufacture wooden antipersonnel mines which follow the same basic pattern as the Soviet models. The Czechoslovak PP-Mi-D and the Yugoslav PMD-1 are in the same weight class as the PMD-6, while the Hungarian M49 is smaller and lighter, being modeled on the PMD-7ts. The fuze for the Czechoslovak PP-Mi-D is the Ro-1; that of the Yugoslav PMD-1 is the UPMD-1. The fuzes are all based on the Soviet MUV with varying modifications.

		PMD-6	PMD-7	PMD-7ts
weight	kg	0.4	0.3	0.3
length	mm	200	150	150
width	mm	90	75	75
height	mm	65	50	50
main charge		TNT	TNT	TNT
weight	g	200	75	75
operating force	kg	1	1	1
booby trapping		improvised	improvised	improvised

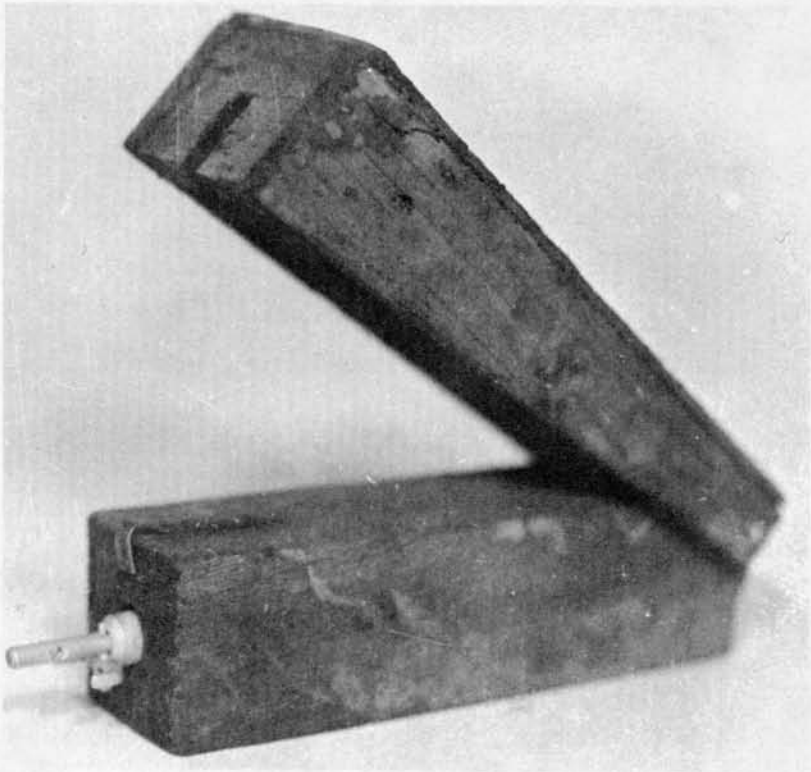
		PP-Mi-D	M49	PMD-1
weight	kg	0.5	0.33	0.5
length	mm	135	185	120
width	mm	105	50	100
height	mm	55	58	40
main charge		TNT	TNT	TNT
weight	g	200	75	200
operating force	kg	4	1	5
booby trapping		improvised	improvised	improvised



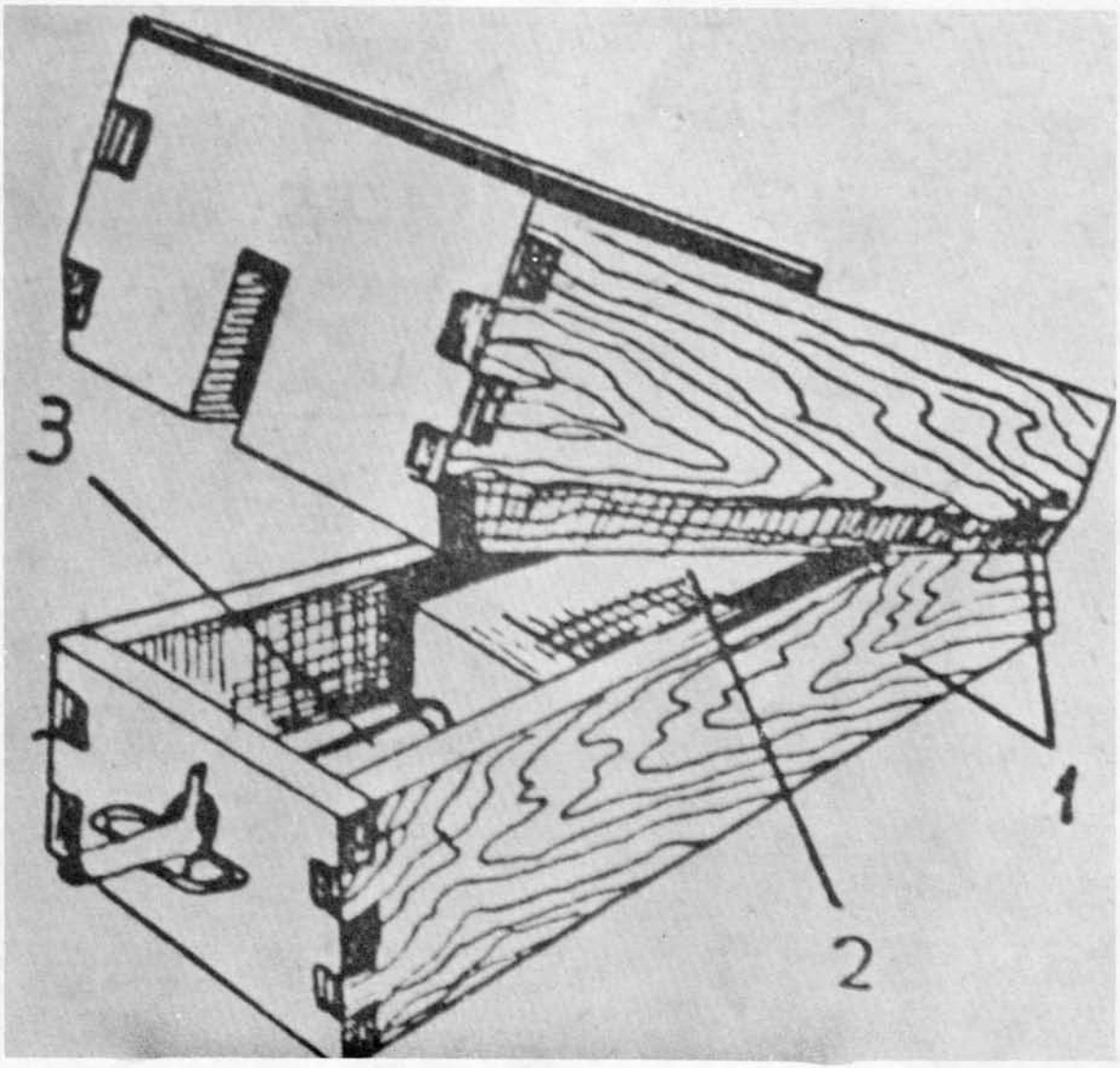
Soviet Antipersonnel Mines PMD-7



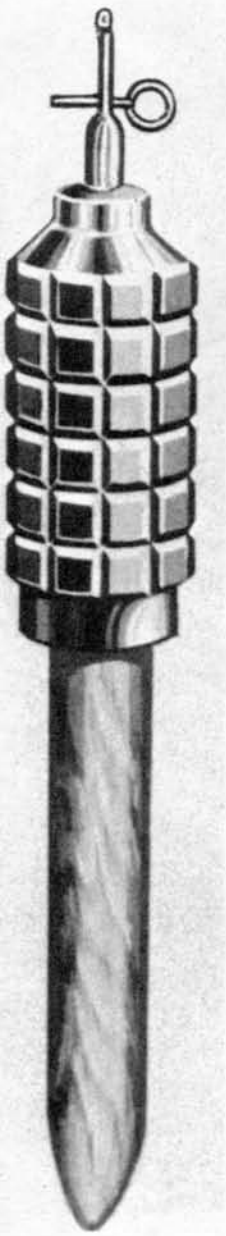
Soviet Antipersonnel Mines PMD-7ts



Hungarian Antipersonnel Mine M49



Yugoslav Antipersonnel PMD-1



POMZ-2



POMZ-2M

Soviet Antipersonnel Stake Mines

Soviet Antipersonnel Stake Mine POMZ-2
Soviet Antipersonnel Stake Mine POMZ-2M
Czechoslovak Antipersonnel Stake Mine PP-Mi-Sb
Czechoslovak Antipersonnel Stake Mine PP-Mi-Sk
Yugoslav Antipersonnel Stake Mine PMR-1
Yugoslav Antipersonnel Stake Mine PMR-2

Stake mines for antipersonnel missions were developed during World War II by the Soviets and copied from them by the Germans. The Soviet POMZ-2 of that period used an iron fragmentation body (like that of a hand grenade) with six rows of fragments, but when the Germans copied the mine they substituted concrete with metal fragments imbedded in it. The Soviet mine used standard components such as the 75-gram borehole charge and either the MUV or VPF pull fuze. The mines were normally laid in clusters of at least four mines and were fitted with trip wires. After the war the mine was modified by threading the fuze hole, using the MUV-2 pull fuze, and reducing the rows of fragments from six to five. The modifications resulted in a change in nomenclature to POMZ-2M. The mine is still in the active inventory.

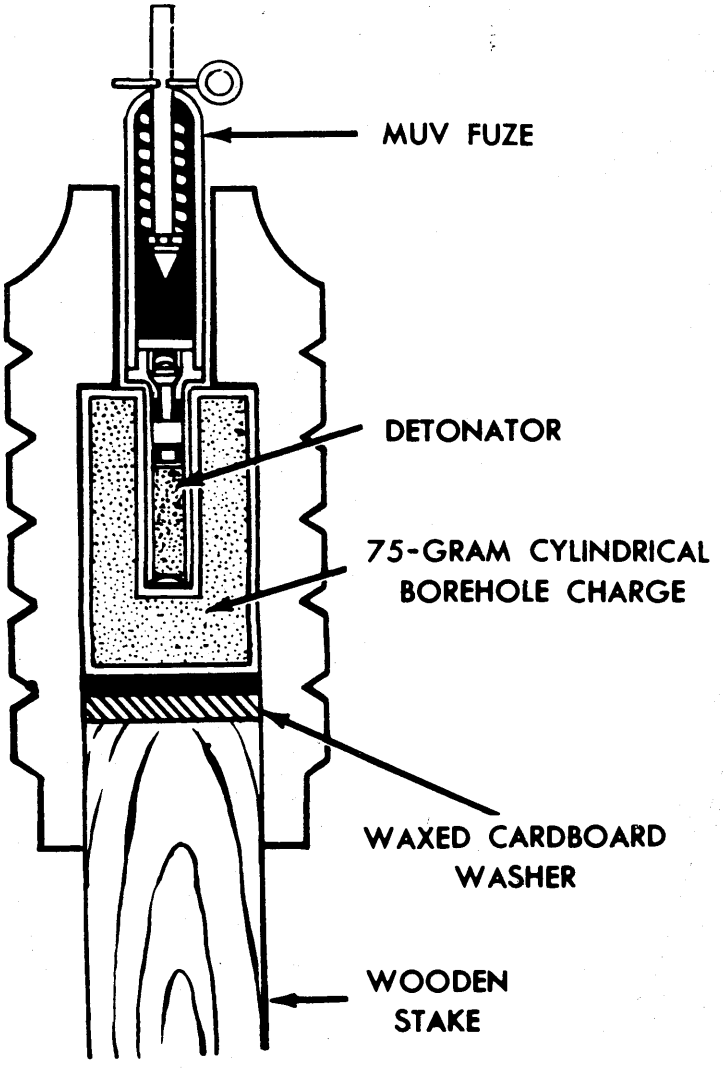
The Czechoslovak PP-Mi-Sk is a very close copy of the Soviet POMZ-2M, using the Ro-1 pull fuze. The mine body, however, has six rows of fragments as in the older POMZ-2. The PP-Mi-Sb resembles the German World War II stake mine and has a concrete body with steel scrap fragments. It too uses the Ro-1 fuze.

The Yugoslav PMR-1 stake mine is similar to the Soviet POMZ-2M, but has nine rows of fragments. The PMR-2 resembles the German stake mine and the Czechoslovak PP-Mi-Sb with its concrete and scrap metal fragmentation body. The UPM-1 pull fuze, a copy of the German Z.Z.42 is used.

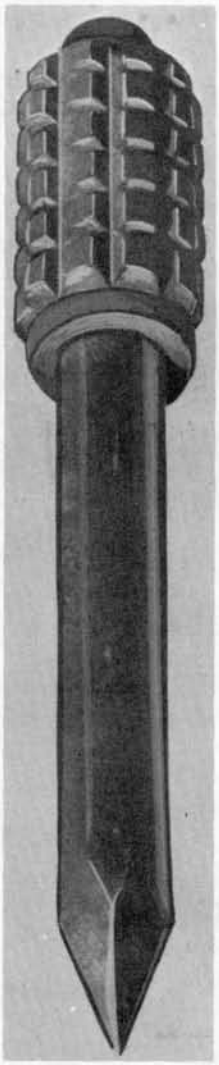
It should be noted that both the Soviet MUV and Yugoslav UPM-1 pull fuzes can be used as tension-release fuzes with taut trip wires.

		POMZ-2	POMZ-2M	PP-Mi-Sk
weight	kg	2.0	1.7	1.6
diameter	mm	60	60	60
height w/fuze	mm	135	111	137
main charge		TNT	TNT	TNT
weight	g	75	75	75
operating force	kg	1.0	1.0	
booby trapping		improvised	improvised	improvised

		PP-Mi-Sb	PMR-1	PMR-2
weight	kg	2.1	2.0	2.2
diameter	mm	75	80	80
height w/fuze	mm	140	120	120
main charge		TNT	TNT	TNT
weight	g	75	75	100
operating force	kg	1.0		
booby trapping		improvised	improvised	improvised



Soviet Antipersonnel Stake Mine POMZ-2

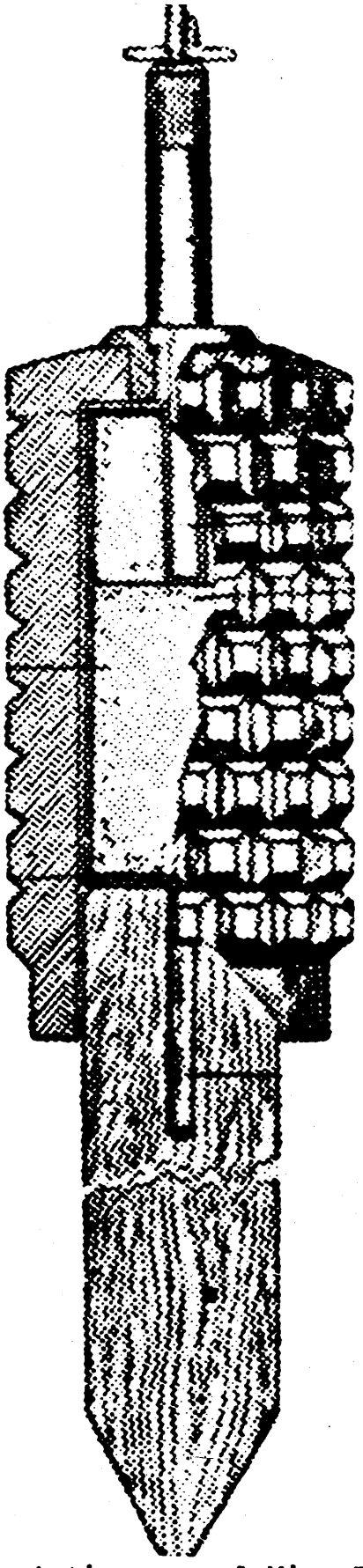


PP-Mi-Sk

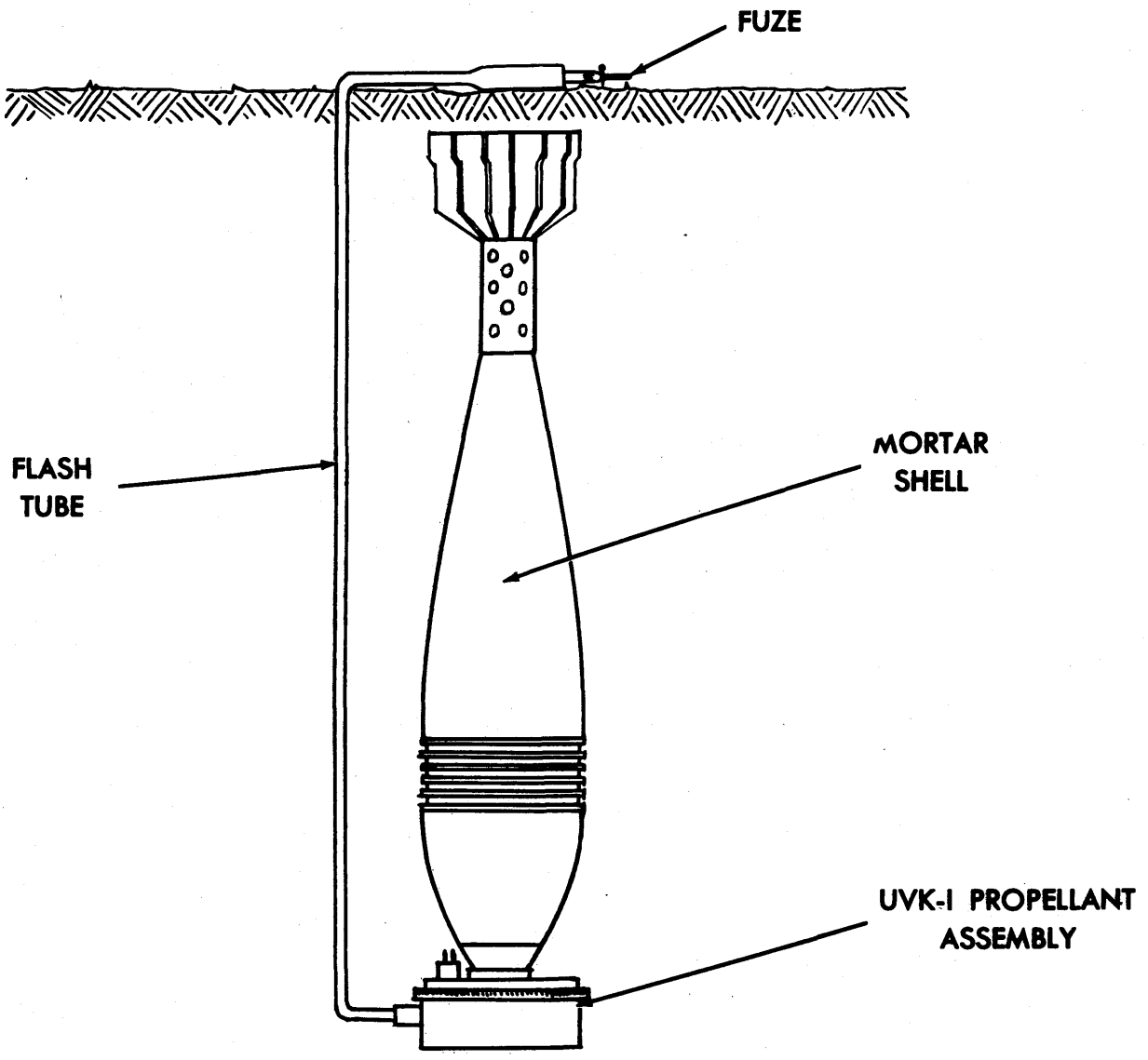


PP-Mi-Sb

Czechoslovak Antipersonnel Mines



Yugoslav Antipersonnel Mine PMR-1



Soviet Improvised Bounding Antipersonnel Mine OZM

BOUNDING ANTIPERSONNEL MINES

Soviet Antipersonnel Mine OZM
Soviet Antipersonnel Mine OZM-3
Soviet Antipersonnel Mine OZM-4
Czechoslovak Antipersonnel Mine PP-Mi-Sr
Yugoslav Antipersonnel Mine PROM-1

Bounding antipersonnel mines were introduced by the Germans prior to World War II with the production of the S.Mi.35. Although this mine and its successor, the S.Mi.44, were used with devastating effectiveness during the war, the Soviets only employed improvised OZM "fragmentation obstacle mines" during that conflict. They did not introduce factory-made bounding antipersonnel mines patterned after the German models until after the war.

The wartime improvised mines used a standard propellant assembly UVK-1 along with modified mortar or artillery shells. The Soviets preferred to use these mines in controlled fields to allow friendly troops to pass without danger. Commonly used shells were those of the 120 mm mortar (illustrated), the 122 mm howitzer, the 152 mm howitzer, and the 152 mm gun howitzer. If shells of these sizes exploded under tanks they would be quite capable of disabling them, thus making OZM mines of this type effective antitank as well as antipersonnel weapons. Similar mines may appear in any future conflict.

Although superficially resembling the German wartime S.Mi.44, the Soviet postwar OZM-3 has incorporated a number of changes, among them the addition of electronic fuzing to permit use in controlled minefields. Mechanical fuzing is done through the use of pull fuzes, although other types such as pressure, and pull-tension release models can be used. Of further note is the fact that the OZM-3 does not have inner and outer mine cases as in the case of the S.Mi.44 and the Czechoslovak PP-Mi-Sr. On firing, the base of the mine case blows through while the rest of it bounds. The height of the explosion is determined by a tethering wire like in the S.Mi.44 and PP-Mi-Sr. The OXM-4 is a more recent mine about which little is known.

The Czechoslovak PP-Mi-Sr resembles the S.Mi.35 in that it has a central fuze well, and like both German mines, has both inner and outer mine cases. Like the S.Mi.44 and the Soviet OZM-3, the height of the mine explosion is controlled by a tethering wire which remains attached to the base of the outer case. The PP-Mi-Sr can be fuzed in a great variety of ways. Normally, it is used with a Y-shaped connector and two Ro-1 pull fuzes with trip wires, or with a single Ro-8 pronged pressure fuze.

A third method is to eliminate the bounding feature by inserting a pull fuze Ro-1 into the detonator well with the detonator upside down. This converts the mine into a simple, non-bounding, fragmentation mine. A fourth possibility is to use the single Ro-1 pull fuze in the normal fuze well, thus retaining the bounding feature. A fifth method is to use either P-1 or P-2 electric squibs for remote control.

The Yugoslav PROM-1 bounding mine is considerably different in appearance from any of the above-mentioned mines, being considerably taller. Unlike the German and Czechoslovak mines, it has only a single, thick-walled mine case, which separates from the base on firing. Height of burst is determined by a length of tethering wire attached to this base. The mine comes equipped with the UPROM-1 pressure/pull fuze.

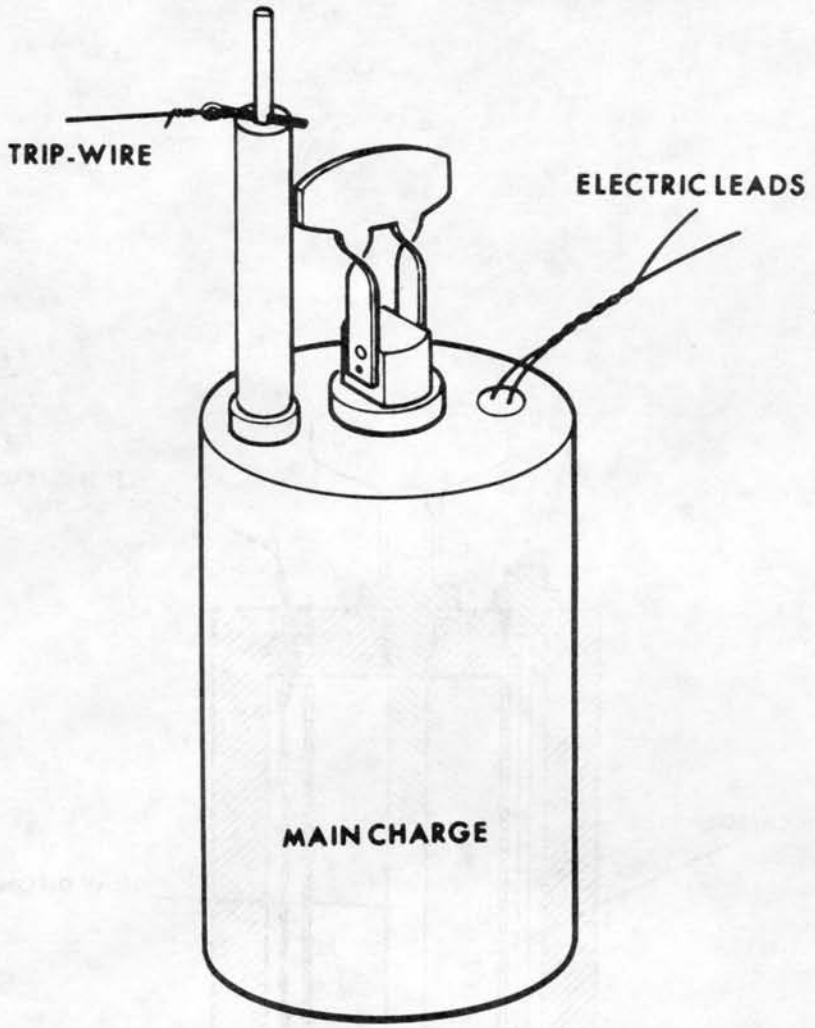
		OZM-3	PP-Mi-Sr	PROM-1
weight	kg	3.0	3.25*	3.0
diameter	mm	75	101	75
height	mm	120	152	470***
main charge		TNT	TNT	TNT
weight	g	75	325	
operating forces			**	9 to 16****
booby trapping		improvised	improvised	improvised

*without fuze

**3 to 6 kg with Ro-8 pressure fuze
4 to 8 kg with Ro-1 pull fuze

***with fuze

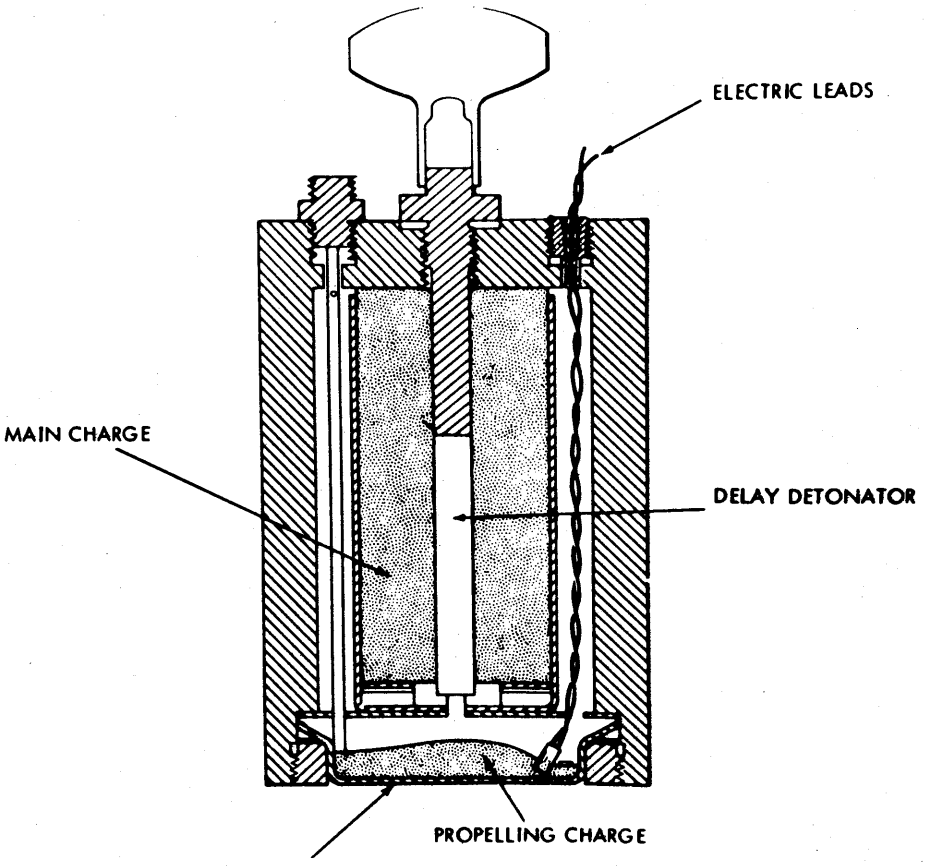
****pressure, for pull 3 to 5.5 kg



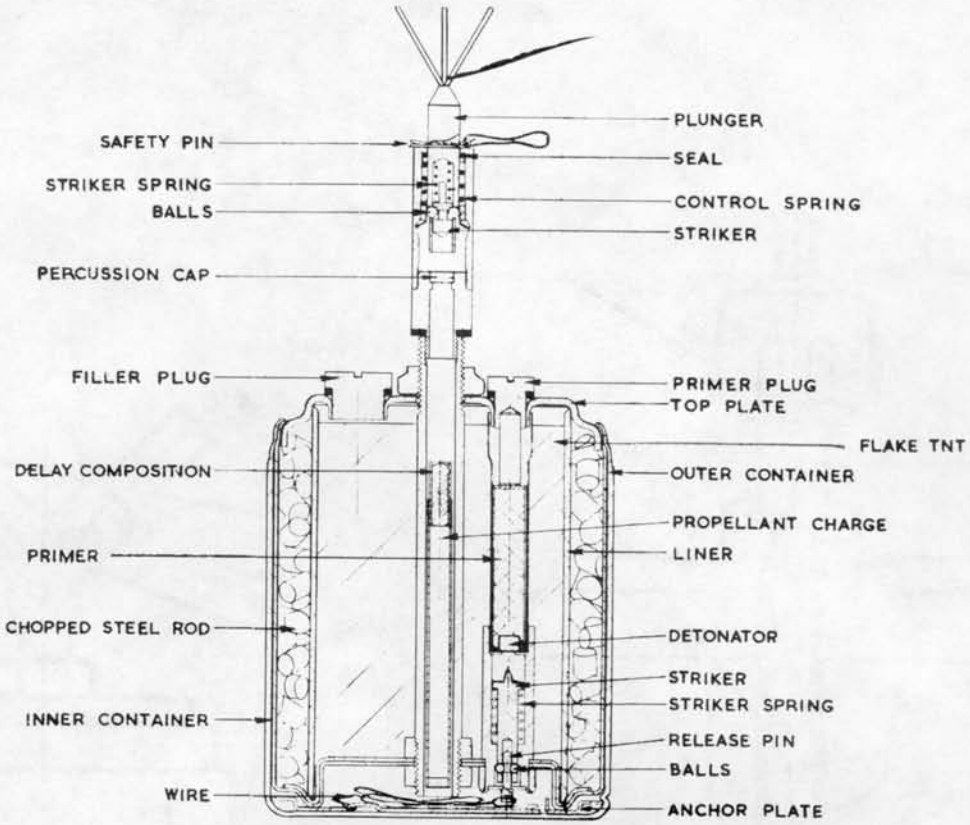
Soviet Antipersonnel Mine OZM-3 with Pull Fuze



Soviet Antipersonnel Mine OZM-3 without Pull Fuze



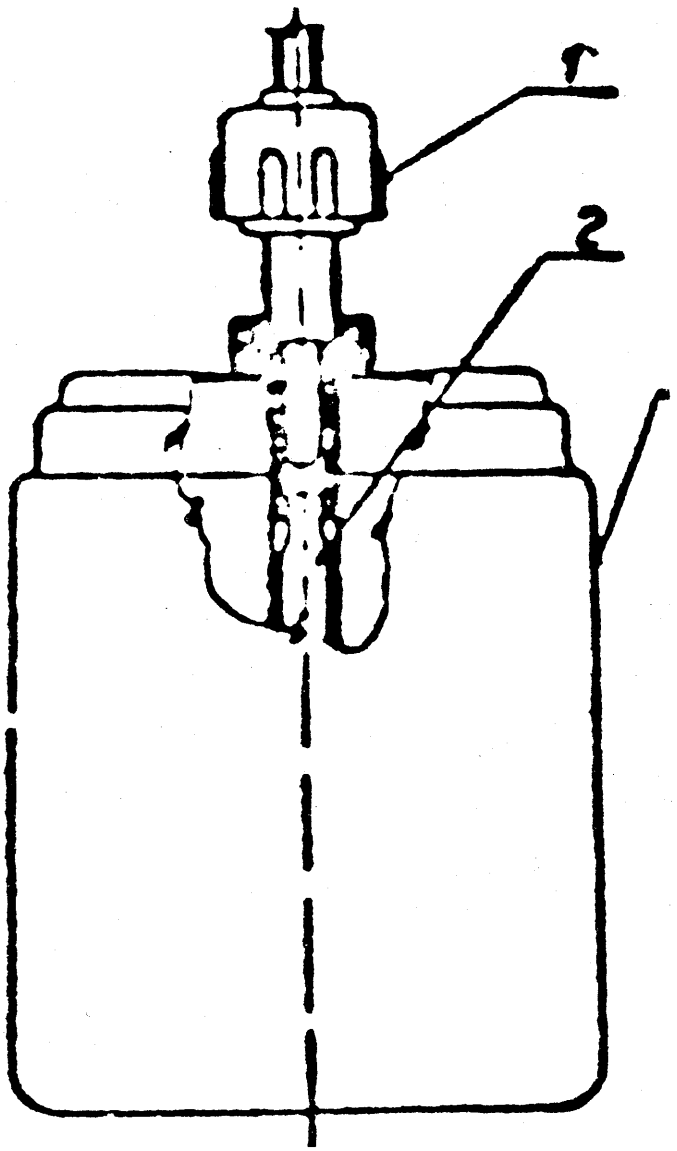
Soviet Antipersonnel Mine OZM-3



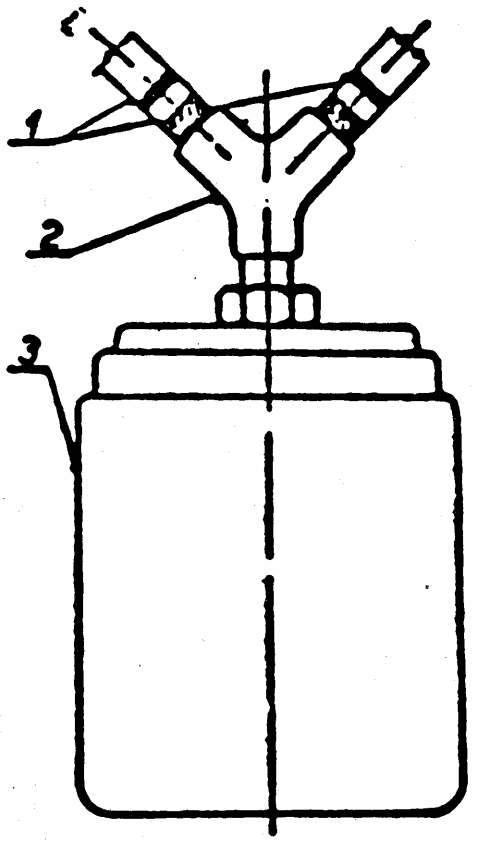
Czechoslovak Antipersonnel Mine PP-Mi-Sr with Ro-8 Pressure Fuze



Czechoslovak Antipersonnel Mine PP-Mi-Sr without Fuze

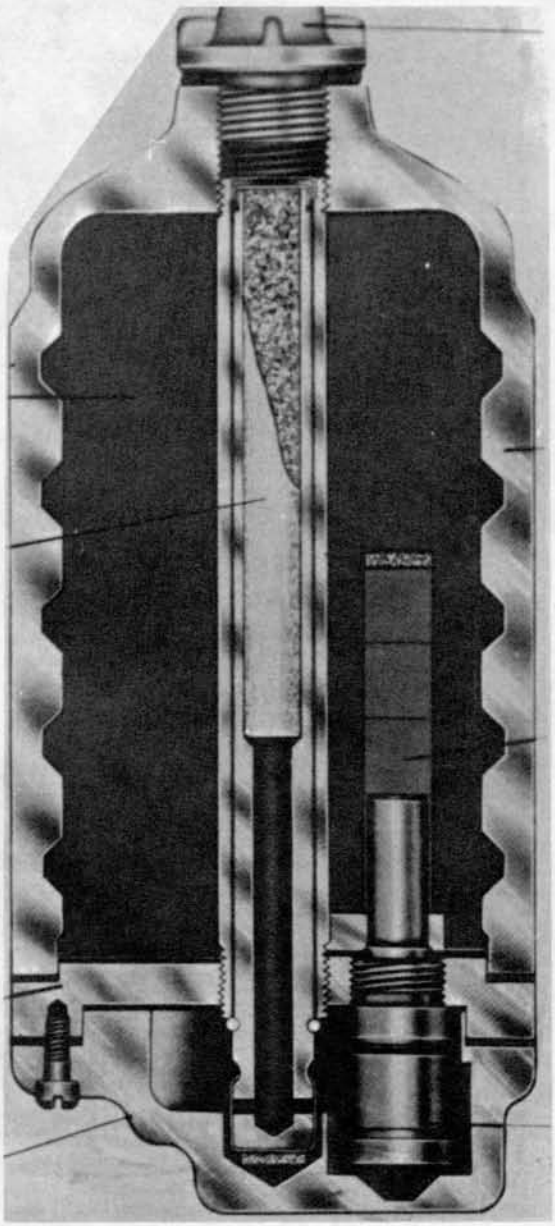


Czechoslovak Antipersonnel Mine PP-Mi-Sr adjusted for Command Detonation with Electric Squib P-2



Czechoslovak Antipersonnel Mine PP-Mi-Sr with Y Connector and Two Ro-1 Pull Fuzes

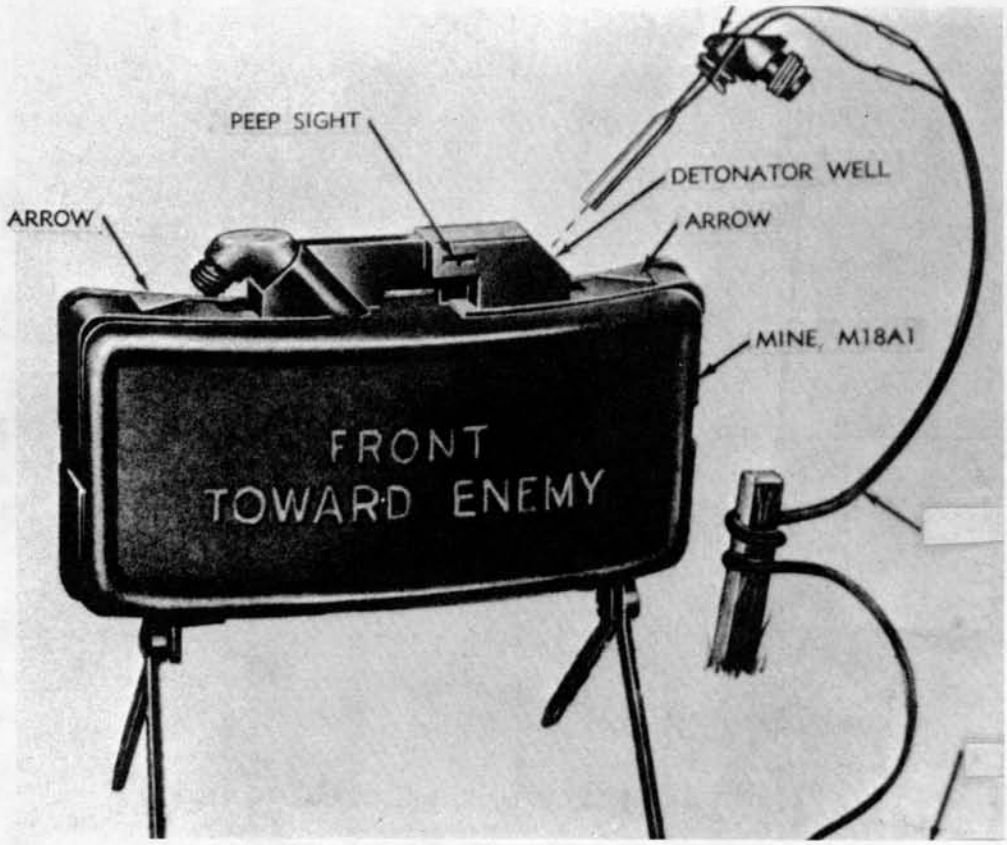




Yugoslav Antipersonnel Mine PROM-1



North Vietnamese MDH-7 Circular Directional Fragmentation Mine



United States M18 Claymore Mine

DIRECTIONAL FRAGMENTATION ANTIPERSONNEL MINES

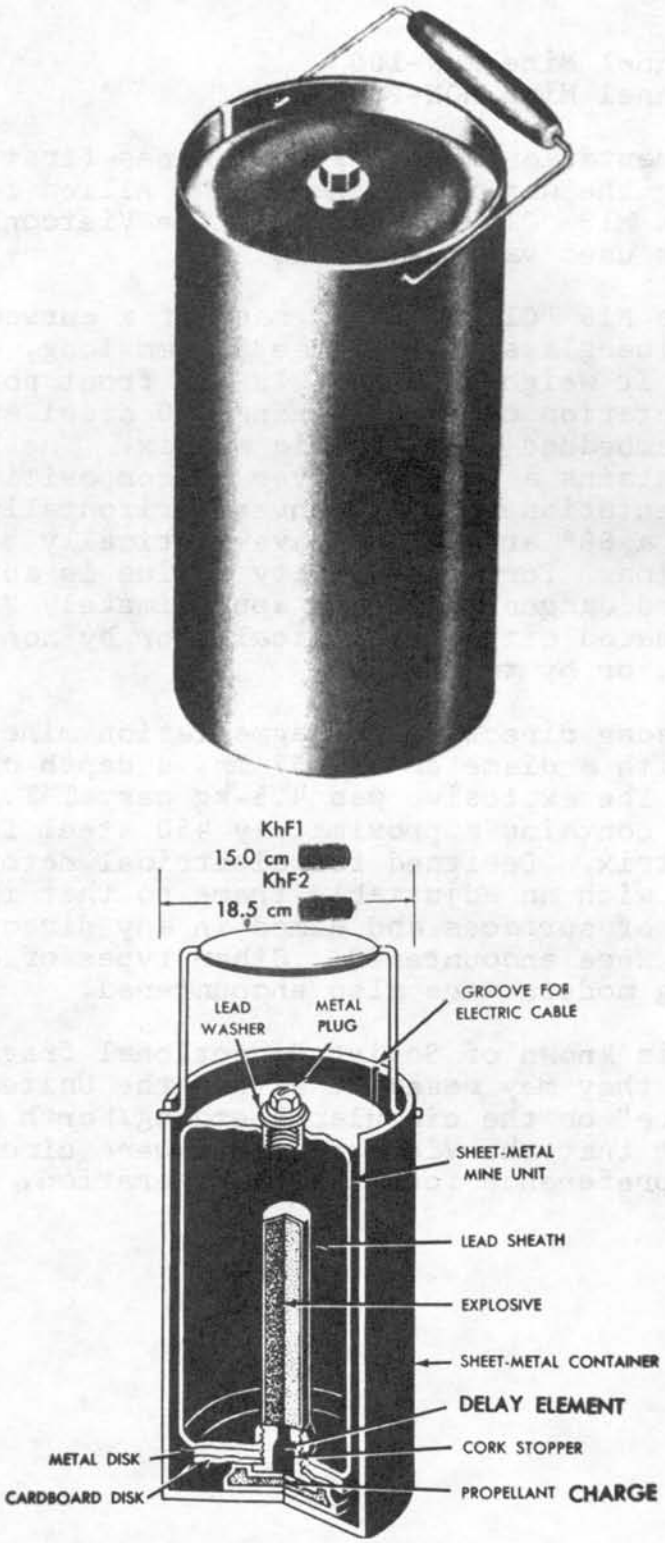
Soviet Antipersonnel Mine MON-100
Soviet Antipersonnel Mine MON-200

Directional fragmentation antipersonnel mines first came into common use during the war in Vietnam. The Allied forces employed the United States M18 "Claymore," while the Vietcong and North Vietnamese troops used various models.

The United States M18 "Claymore" is made of a curved, rectangular, molded plastic fiberglass-filled case 216 mm long, 35 mm in depth, and 83 mm high. It weighs 1.6 kg. In the front portion of the mine is a fragmentation case containing 700 steel spheres (each weighing 6.8 g) embedded in a plastic matrix. The back portion of the matrix contains a 0.68-kg layer of composition C-4 explosive. The fragmentation face is convex horizontally to direct the fragments in a 60° arc and concave vertically to control the vertical dispersion. Forward casualty radius is approximately 100 m; the forward danger radius is approximately 250 m. The mine can be detonated either electrically or by non-electrical means on command, or by trip wire.

The initial Vietcong directional fragmentation mine was the DH-10 circular model with a diameter of 457 mm, a depth of 100 mm and a weight of 9 kg. The explosive was 4.5-kg cast TNT. The concave face of the mine contains approximately 450 steel fragments (13 mm) embedded in a matrix. Designed for electrical detonation, the mine is provided with an adjustable frame so that it can be placed on various types of surfaces and aimed in any direction. Three variants in size were encountered. Other types of circular mines as well as oblong models were also encountered.

Although little is known of Soviet directional fragmentation antipersonnel mines, they may resemble either the United States rectangular "Claymore" or the circular Vietcong/North Vietnamese models. The fact that the Vietcong mines were circular may indicate a Soviet preference for this configuration.



Soviet Chemical Antipersonnel Mines KhF-1&2

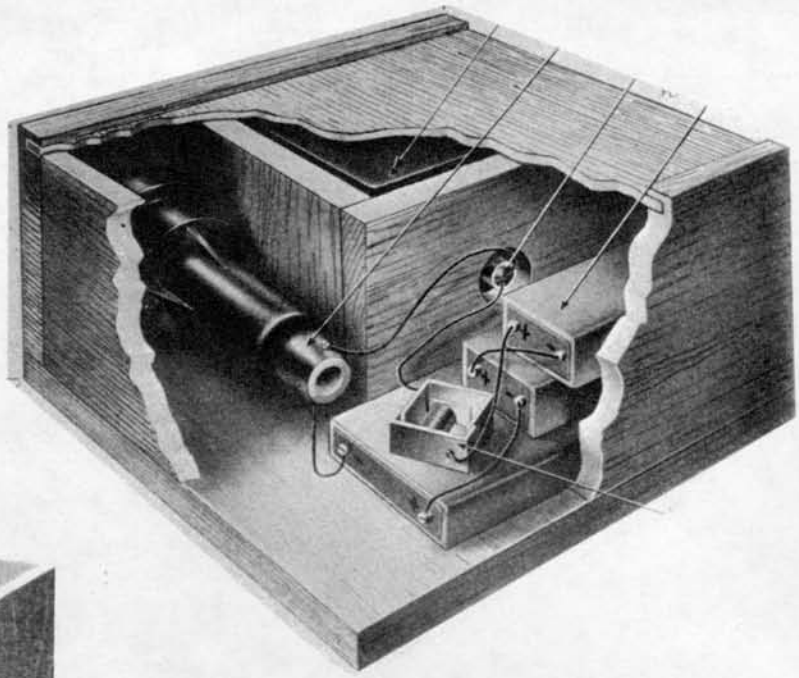
Soviet Antipersonnel Mine KhF-1
Soviet Antipersonnel Mine KhF-2

During World War II the Soviet Union produced, but did not employ, two chemical antipersonnel mines of the bounding type. These mines are both cylindrical in shape, resembling the German World War II bounding shrapnel antipersonnel mines.

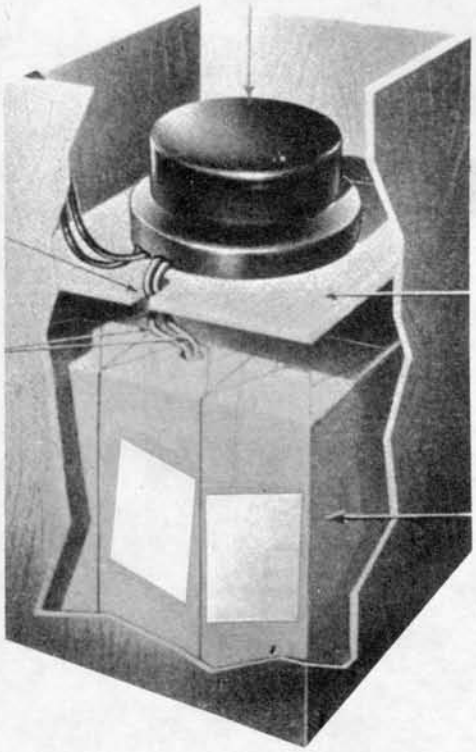
The two mines, which differed only in dimensions, had steel cases filled with liquid contaminant. They were fired electrically by an observer stationed up to 300 meters distant. The firing of the electric detonator ignites the propellant, which hurls the mine upward out of the container, simultaneously igniting the delay fuze. After a delay of 1 to 1.5 seconds, the delay fuze sets off the explosive charge, shattering the mine and spreading the liquid contaminant over an area of 250 to 300 m^2 with an average concentration of 20 to 25 g/m^2

		KhF-1	KhF-2
weight	kg	15	15
diameter	mm	150	185
height	mm	345	280
main charge		toluol or melinite	toluol or melinite
weight	g	10	10
propellant charge		black powder	black powder
quantity of agent	l	4.5	4.5

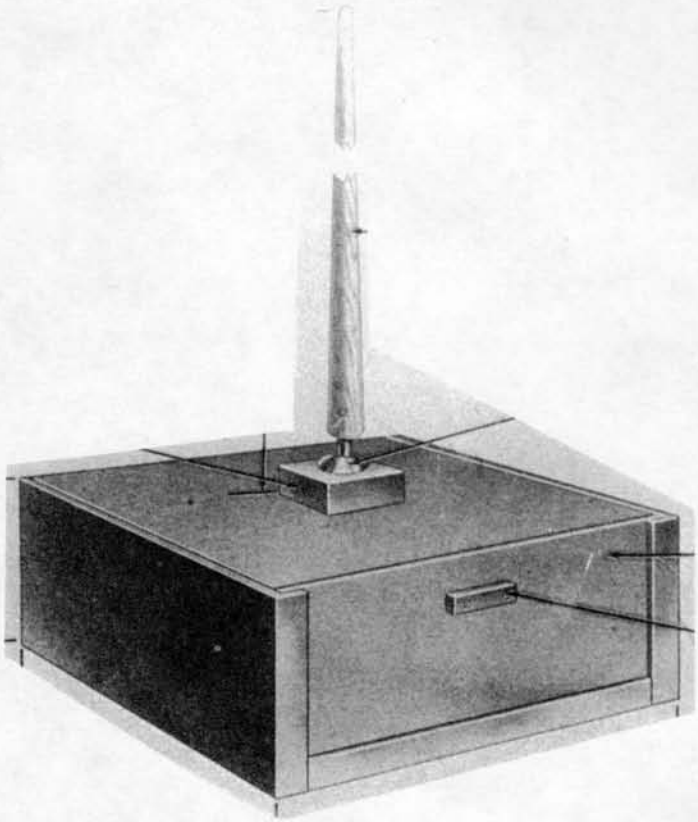
MISCELLANEOUS MINES



Soviet Delayed-Action
Mine MZD-2



Soviet Road Mine DM



Soviet Dual-Purpose Mine AKS

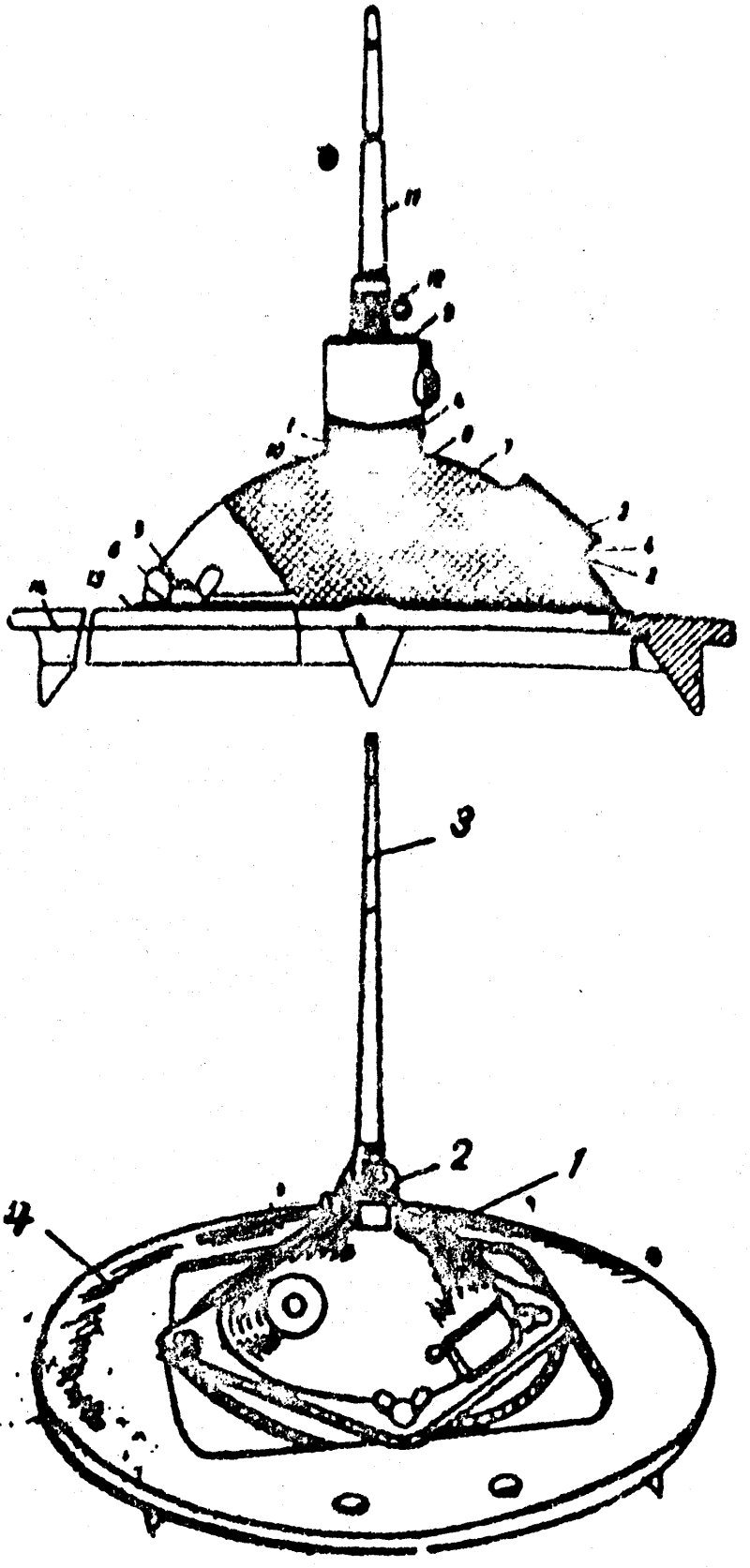
GENERAL-PURPOSE MINES

During World War II the Soviet Army employed a variety of mines with relatively small explosive charges for the mission of destroying sections of roadway, bridges, and railways while these were being traversed by vehicles or trains. Many of these mines were improvised, and many were used by partisans rather than regular troops. Because of their mission they were called "antitransport" mines. Most of the mines functioned with pressure fuzes, but some used trip wires with pull fuzes. Others had delayed-action electric fuzes, or even a combination of several types.

Typical were the MZD "delayed-action mines" which ranged in explosive content from 400 g to 10 kg. These mines had electric, electro-chemical, vibration, or electric-delay fuzes, or combinations thereof. Among the currently used models are the MZD-5m and the MZD-60. Another mine was the DM "road mine" which used a vibration fuze with an electric detonator. This mine, with 1.2 kg of TNT, was designed to attack soft-skinned wheeled vehicles. Another mine currently used is the APM "under ice" mine.

There were also the so-called dual-purpose mines, which had an antipersonnel role as well as an antivehicular/antitank role. These mines generally had charges too large for a pure antipersonnel role, and too small for effective antitank work. In the antipersonnel role they were used for their increased psychological effect, and in the antitank role they were often coupled with additional charges. The larger models were effective against light tracked and wheeled vehicles. Typical was the AKS "anticlearance mine" which had a metallic case and used a tilt-rod fuze. It had 6.8 kg of explosive. This mine, which was first used against the Finns in 1939/40, was especially effective against personnel and vehicles even in deep snow when other mines often failed.

Although it is doubted if all of the above-mentioned specific models are still held in the Soviet Army mine inventory, similar mines with improved characteristics will be encountered in any possible future conflict. The various general-purpose mines, both factory made and improvised, encountered in Vietnam are but a small indication of the possibilities in this field.



Soviet River-Bottom Mine PDM-1M

Soviet River-Bottom Mine PDM-1
Soviet River-Bottom Mine PDM-1M
Soviet River-Bottom Mine PDM-2
Soviet River-Bottom Mine PDM-6
Soviet Anchored River Mine YaRM

In addition to the river mines of the floating, unanchored type, which are frequently designed to attack bridges as well as river craft, the Soviets use specially-designed river mines to attack landing craft and amphibious vehicles. These mines, which are emplaced, rather than free floating, are divided into two types. These are the bottom mines, called PDM "antilanding mines," and the YaRM "anchored river mines." Both classes are intended to be placed in lakes, or in streams with a maximum velocity of 1.5 m/s. They also can be used on seashores with water depths ranging from 1 to 5 meters.

The PDM-1M has a hemispherical case resting on a concrete base. It uses a VPDM-1M tilt-rod fuze which requires a pressure of from 18 to 26 kg. Normally it is placed in water which is from 1 to 2 meters in depth with a minimum distance of 6 meters between mines. Two soldiers can lay and arm the mine in from 10 to 20 minutes. The earlier PDM-1 is very similar, but lacks the booster in the firing chain.

The PDM-2 is spherical in shape. It too rests on a concrete base and its VPDM-2 tilt-rod fuze functions very similarly to the VPDM-1M, but requires 40 to 50 kg pressure. It is placed in water ranging from 2.4 to 3.8 meters in depth.

The PDM-6 is a newer mine which resembles the PDM-1M in configuration, but has three fuze wells as well as an additional fuze well on the bottom of the mine for an antidisturbance device. The tilt-rod fuzes installed in the three fuze wells can be adjusted so that the mine will fire immediately on contact, or can be adjusted to three other settings - from 20 mm to 500 mm - where a rod deflection will trigger the explosion.

The YaRM anchored mine is spherical in shape and also uses a single tilt-rod fuze. It must be placed in water with a depth of from 0.1 to 0.7 meters measured from the surface to the anchoring grid. Maximum permissable stream velocity is 1 m/s. Minimum distance between the mines is 12 meters.

		PDM-1M	PDM-2	PDM-6	YaRM
weight	kg	21*	100***	47.5*****	15
height	mm	1000	1400****	250******	900
diameter	mm		270	500	300
base diameter	mm		---	1000	
main charge		TNT	TNT**	TNT+PETN	
weight	kg	10	15	28	3
operating force	kg	18 to 26	40 to 50		

*without concrete base weighing between 24 and 29 kg

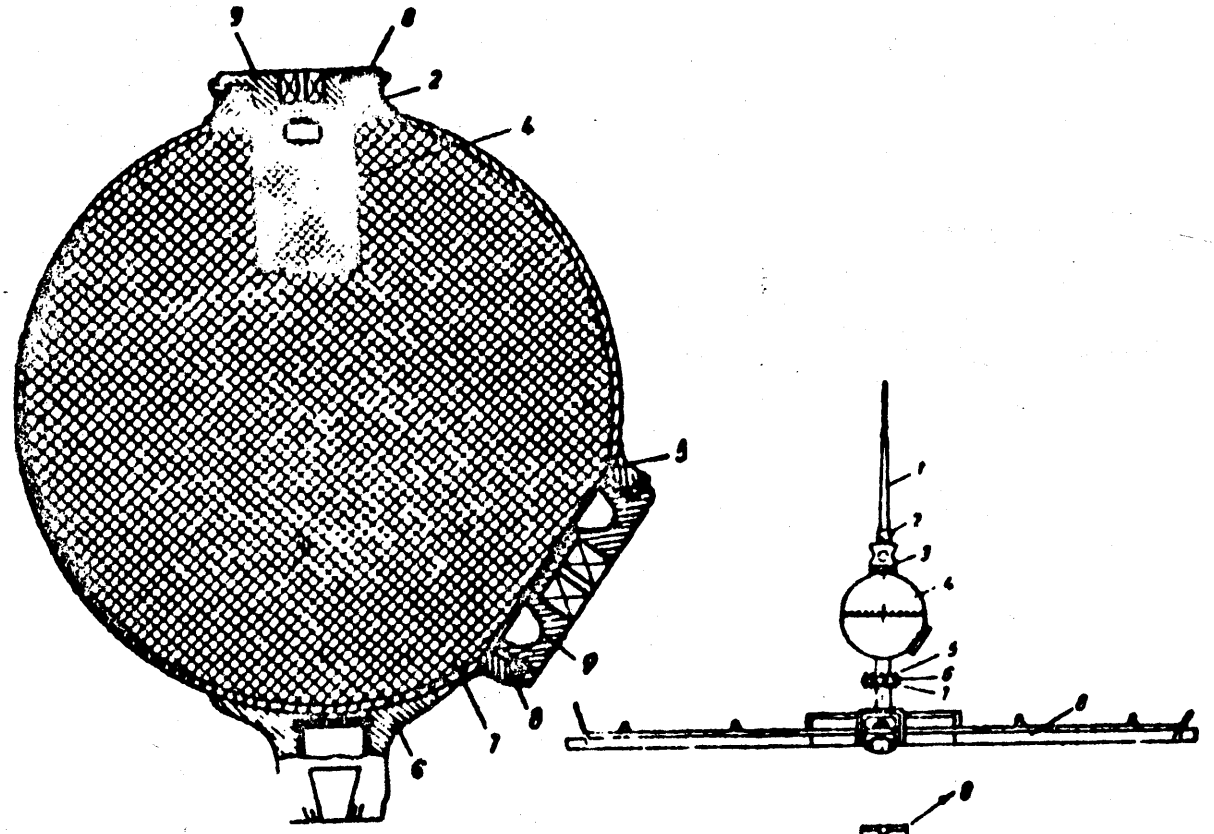
**or ammonite

***on low stand, 135 kg on high stand

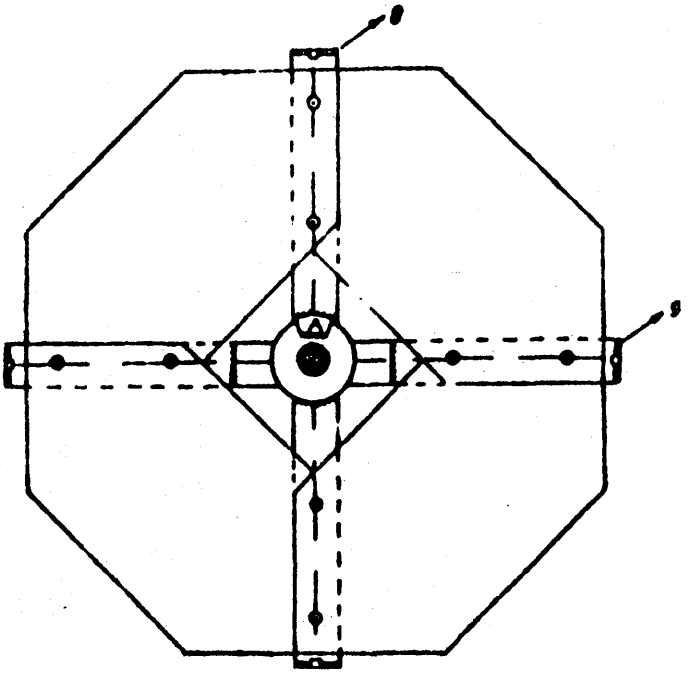
****ranging from 1100 to 2700 mm depending on type of stand

*****with base plate

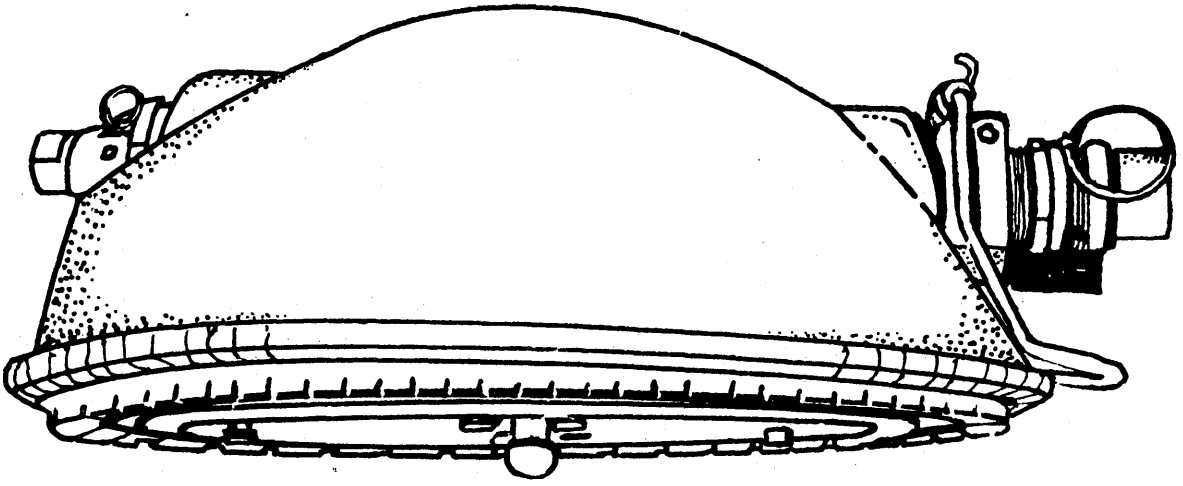
******mine proper, can be from 550 to 1050 mm overall with fuze



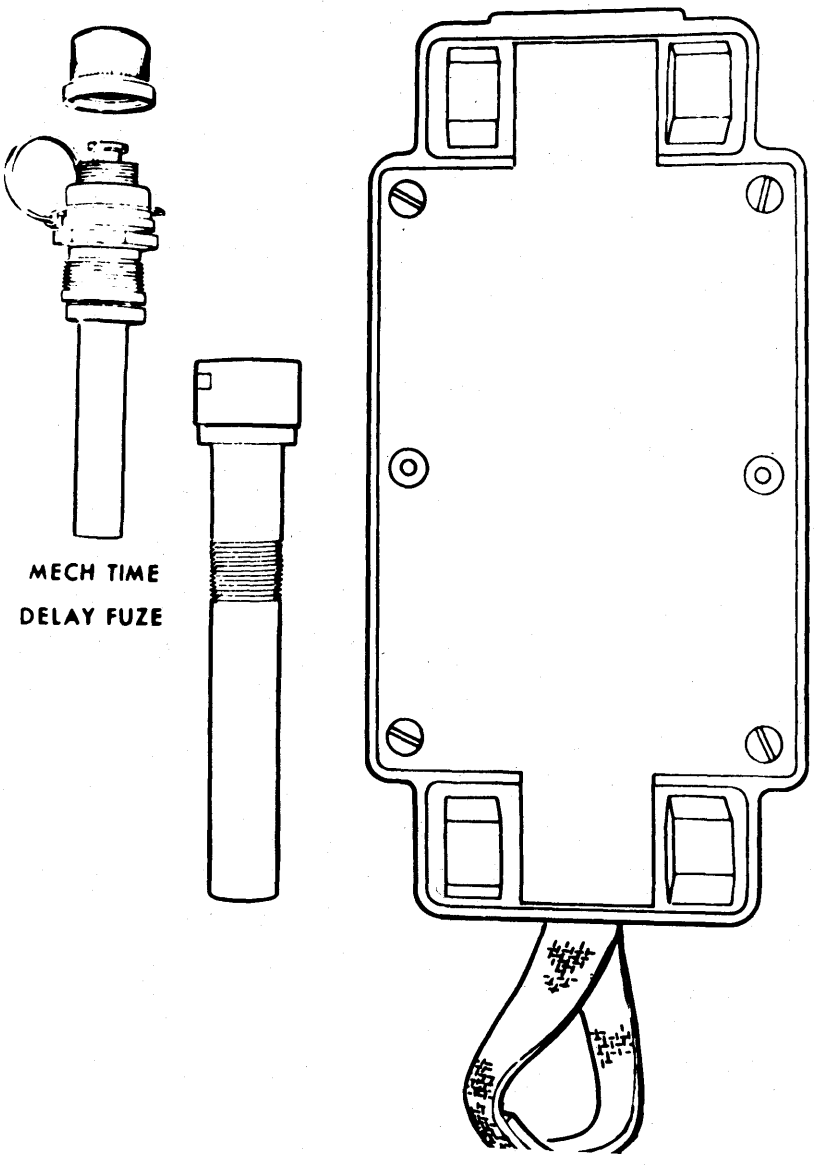
Soviet River-
Bottom Mine PDM-2



Soviet Anchored
River Mine YaRM



Soviet Limpet Mine BPM-2



Soviet Limpet Mine Plastic Model

LIMPET MINES

Soviet Plastic Limpet Mine
Soviet Metallic Limpet Mine "Turtle"
Soviet Limpet Mine BPM-2
Czechoslovak Limpet Mine M1
Czechoslovak Limpet Mine M2

Limpet mines are designed to sink or disable ships. They are attached magnetically to the hull of the target below the water line. The Soviet models listed above have mechanical time-delay fuzes. The Czechoslovak models, which have armor-penetrating characteristics as well, use electrically operated fuzes with 9-volt batteries. They are primarily sabotage mines which are designed for use on land as well as under water.

The small plastic limpet mine uses a mechanical-delay fuze utilizing metal fatigue as the operating principle. Delay can be set from 5 minutes to 832 hours by the use of six delay tabs. The mine has two horseshoe magnets on both ends. There are two fuze wells and an arming device 180 degrees from the fuze wells. The cylindrical cavity charge is mounted on a bridge supported by the two horseshoe magnets. The magnets provide a standoff of 16mm.

The "Turtle" metallic limpet mine is hemispherical in shape. Its flat-surfaced bottom is magnetized with two rows of circular magnets mounted nearly flush with the bottom surface of the mine. The mine has three separate fuzes -- two main detonator fuzes and one antidisturbance fuze. Two identical mechanical time-delay fuzes are used. They can be set at five different time delays ranging from 15 minutes to 12 hours. They work on the metal-fatigue principle.

The BPM-2 is also hemispherical in shape. Attached to the metal surface of a ship's hull by 4 arcs of 11 small horseshoe magnets on its flat side, the mine is activated by 2 metal-fatigue time-delay fuzes like those of the plastic limpet mine. In addition, an antidisturbance fuze is located in the center of the flat side of the mine. The case material of the BPM-2 is aluminum.

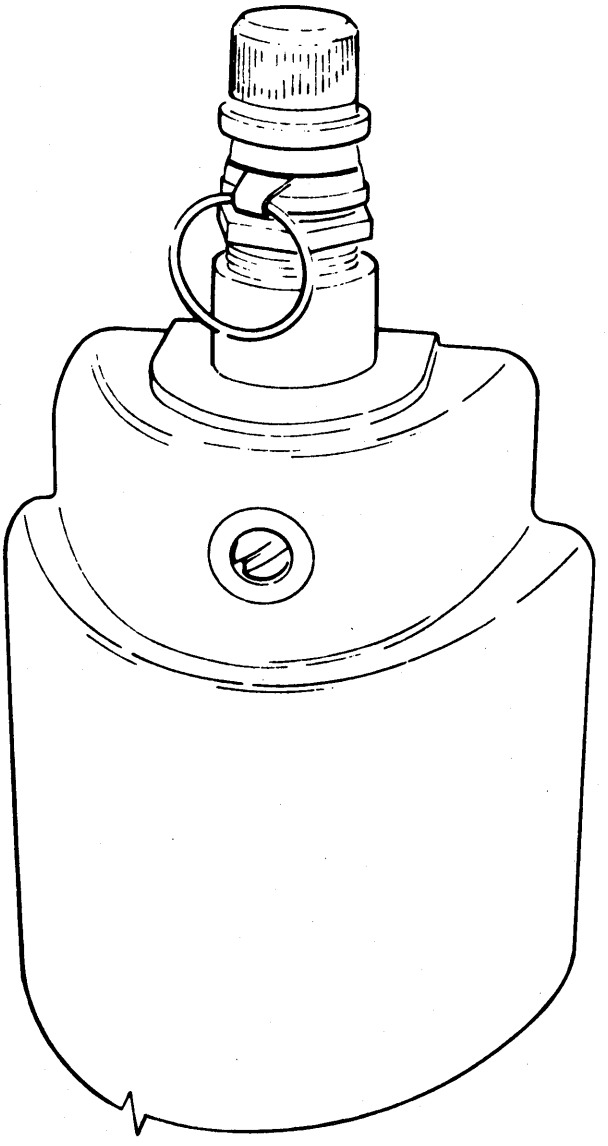
The Czechoslovak M1 and M2 magnetic shaped-charge limpet mines can be used underwater against ships or on land against armored targets. They are electrically fuzed with a delay element adjustable from 1 to 11 hours.

		Plastic	"Turtle"	BPM-2
weight	kg	2.7*	6.8	6.6
length/diameter	mm	270	300	255**
width/height	mm	115	180	115
main charge weight	kg	0.95 tritanol	3.0 TNT	3.0 tritanol

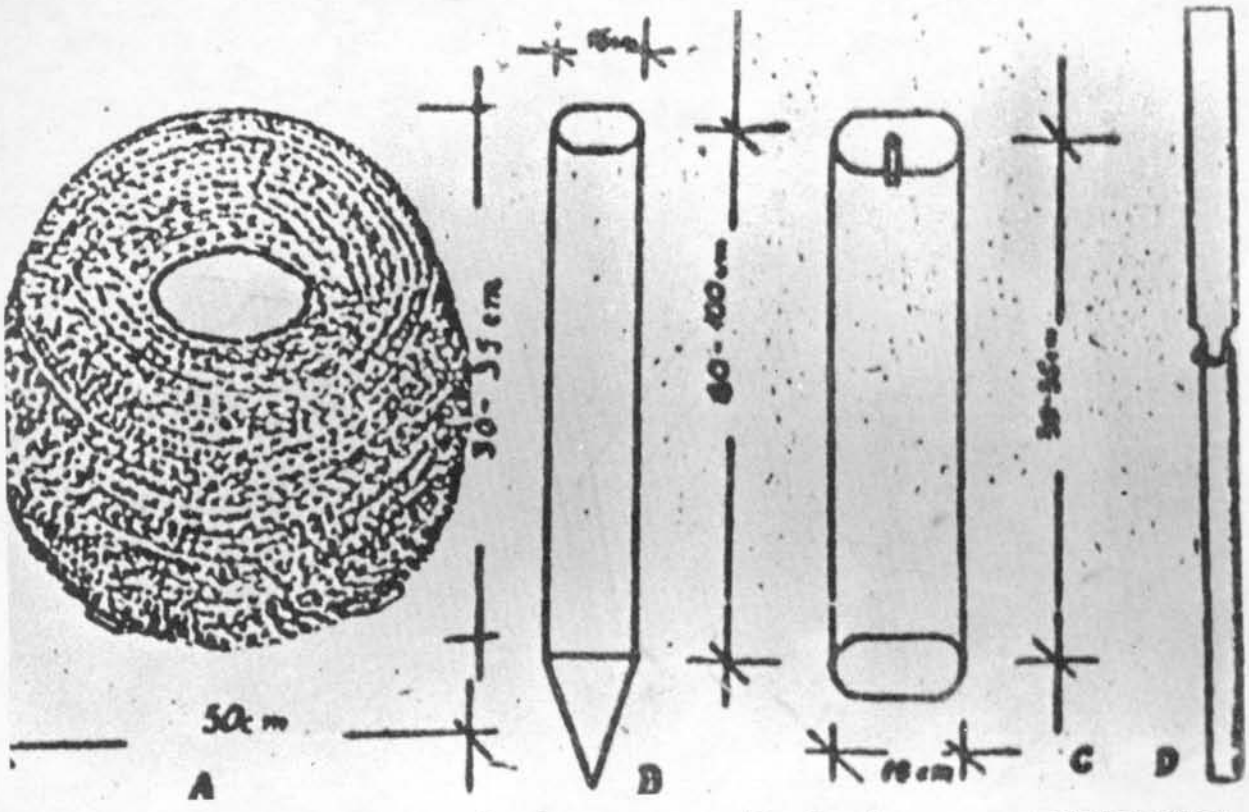
*without fuzes

**305 mm overall

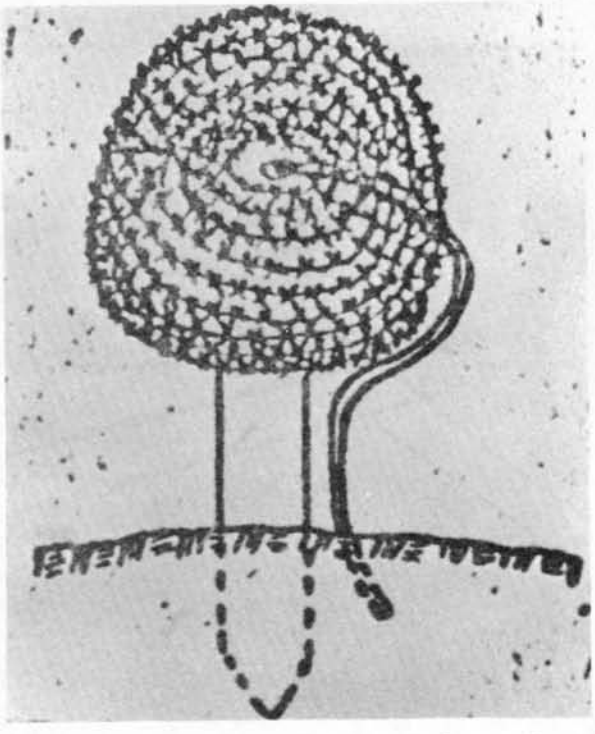
		M1	M2
weight	kg	6.3	14.3
diameter	mm	90	187
height	mm	258	483
main charge weight	kg	0.55?	3.5
armor penetration	mm	70	150



Soviet Plastic Limpet Mine



Barbed Wire | Stake Components | Explosive | Detonator



Yugoslav Explosive Barbed Wire Obstacle

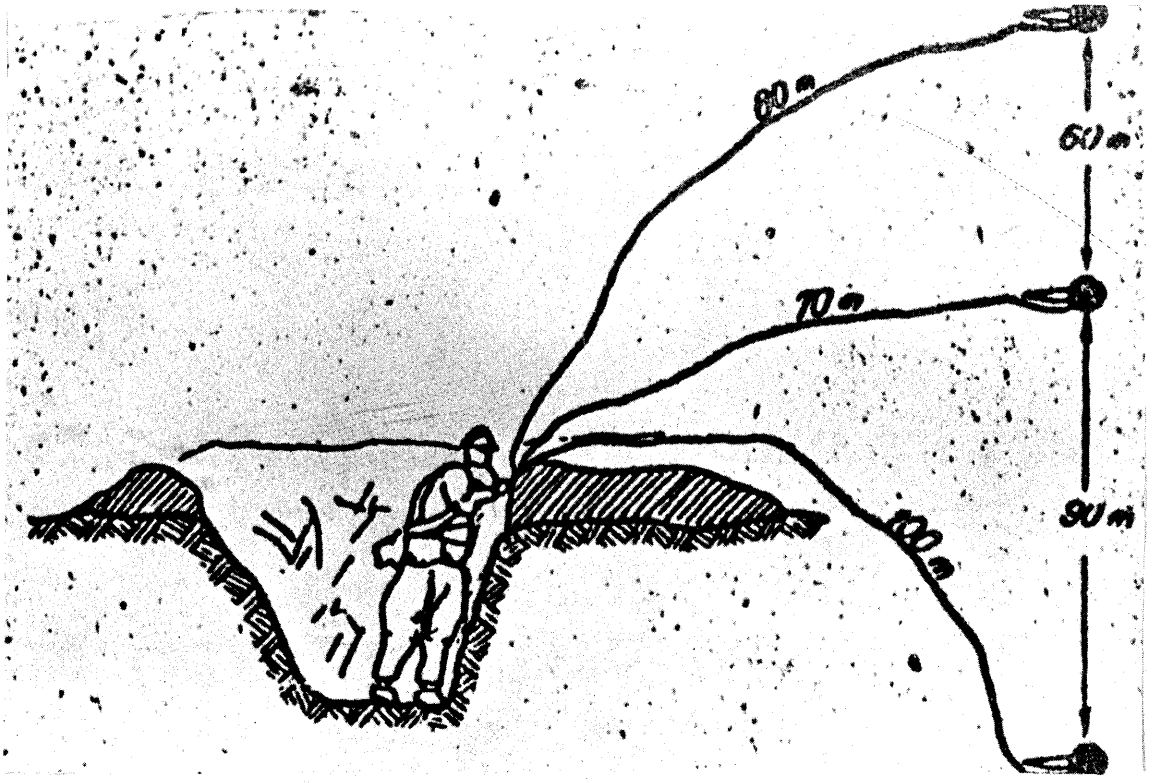
EXPLOSIVE BARBED WIRE OBSTACLE

The Yugoslav Army has developed a new "explosive barbed wire obstacle" of great effectiveness. Compared to normal barbed wire obstacles, the explosive type uses less barbed wire, can be erected with greater ease by fewer men in a shorter time, and has greater lethality. It can also be camouflaged.

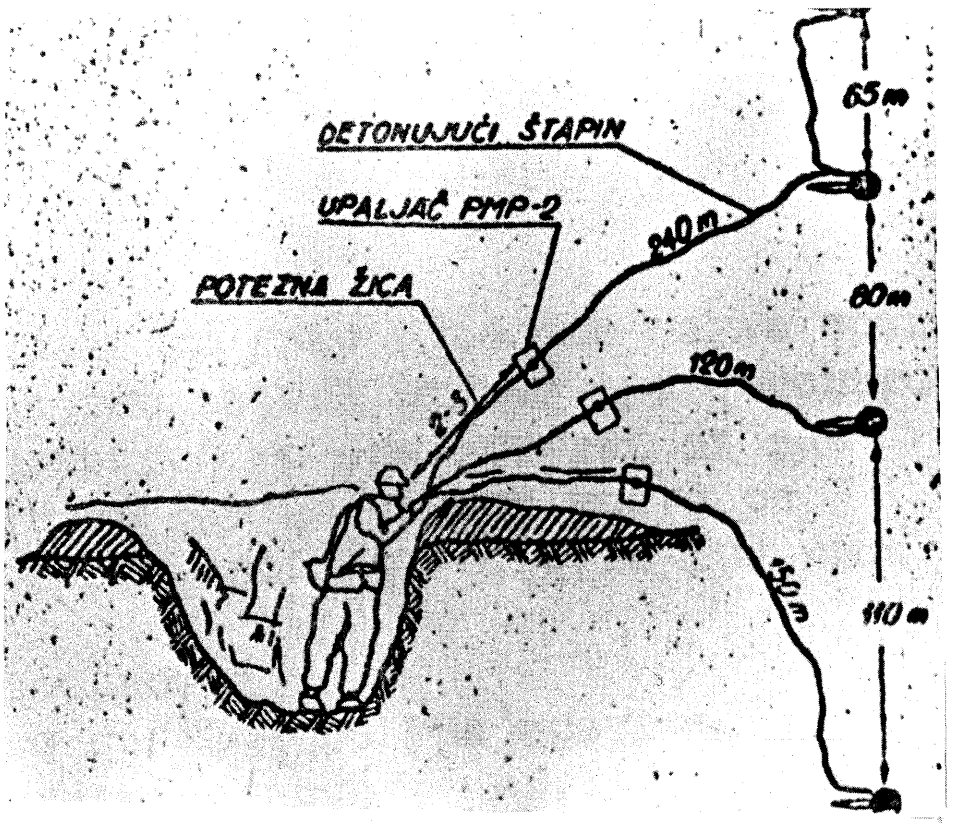
The obstacle is constructed of barbed wire which is wound into tight rolls about 0.5 m in diameter and about 0.3 to 0.35 m thick. A 2-kg explosive charge is then inserted into the hole of the roll and tamped. These charges are preferably cylindrical in shape and as long as the hole is deep. The rolls of wire, with inserted explosive, are then placed on wooden stakes. These stakes, about 1 meter long and 15 cm in diameter, are driven into the ground to a depth of about 30 cm before the wire rolls are placed on them.

The whole obstacle is made up of one or more rows of prepared stakes, each row placed about 100 meters apart. Normally, these rows are placed from 50 to 200 meters in front of the forward edge of the defensive position. The individual stakes in each row are placed at intervals which give mutual coverage within the average lethal radius (around 80 m). Antipersonnel mines can also be placed in the intervals between the stakes.

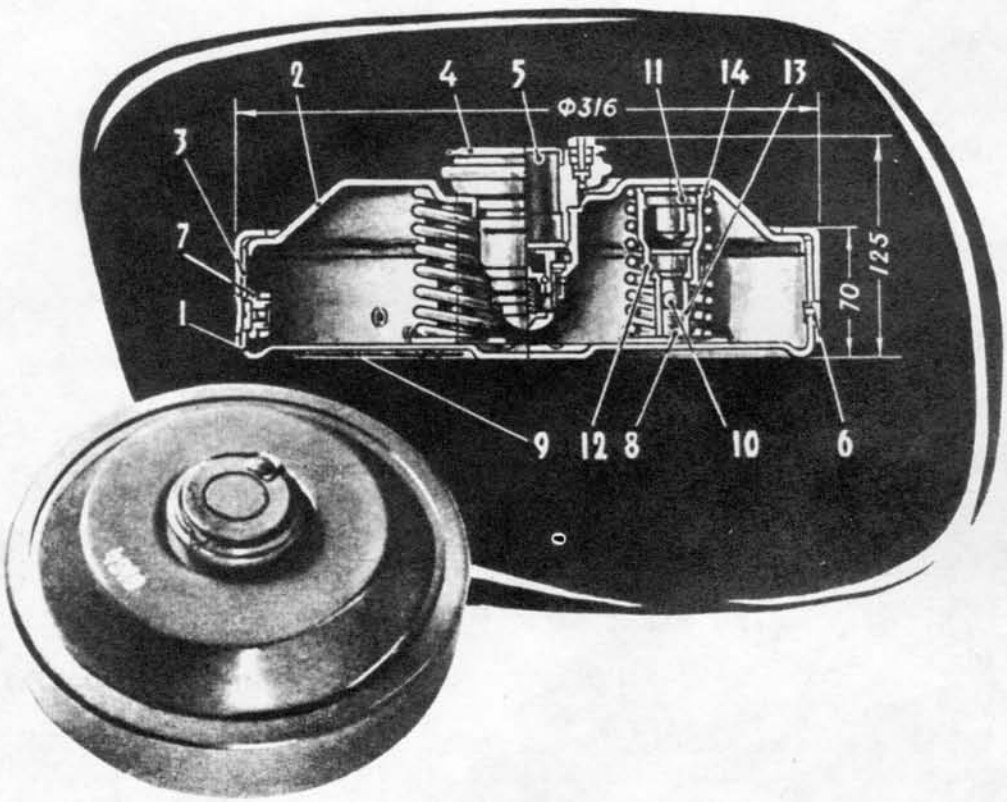
The obstacle can be fired by various means. One is to use trip wires with pull fuzes, similar to the procedure employed with stake fragmentation mines. A second way is through command detonation where a soldier stationed at least 100 meters from the obstacle uses individual wires to pull the pins from two to four separate obstacles. The third way, used for more distant obstacles, is to connect the explosives (fitted with No. 8 blasting caps) with pull fuzes by means of detonating cord. The pull fuzes are placed near the observer (2 to 3 m) who can initiate the detonating cord by pulling the pins from the fuzes by individual wires leading to his position.



Schematic of Explosive Barbed Wire Emplacement



Another Possible Layout for an
Explosive Barbed Wire Obstacle



Soviet Training Antitank Mine UITM-60

TRAINING MINES

Soviet Training Antitank Mine UTMD-B
Soviet Training Antitank Mine UITM-60
Soviet Training Antipersonnel Mine UPMD-6
Soviet Training Antipersonnel Mine UPOMZ-2
Czechoslovak Training Antitank Mine Cv. PT-Mi-Ba III
Yugoslav Training Antitank Mine STMM-1
Yugoslav Training Antitank Mine STDM-2
Yugoslav Training Antitank Mine STAM-3
Yugoslav Training Antitank Mine STAM-4
Yugoslav Training Antipersonnel Mine SPAM-2

A wide variety of Soviet training antitank and antipersonnel mines exist. Many of them are simple inert models of standard mines with inert fuzes. These are useful for instructional purposes, especially for minefield laying practice. On the other hand, there is a need for training mines which can simulate the explosion of the live models, such as the UTMD-B antitank, the UPMD-6 and UPOMZ-2 antipersonnel mines. Although these have no high explosive charges, they are fitted with a fuze and a smoke charge. Because of the lack of realism and the delay in giving off smoke, these mines are regarded as less than satisfactory. In their place many Soviet units use improvised simulated mines with MV-5 pressure fuzes and SM signal mines with VPF fuzes. Although these are more realistic in action, they give no practice in minelaying and can be used for the antitank role only.

A much more realistic and useful mine is the UITM-60 "training imitation antitank mine." This mine, which resembles the conventional metallic antitank mines such as the TM-46, and TM-57, can be mechanically laid, and used again repeatedly. When a tank track hits the lid of the mine, the springs are compressed, allowing the lid to descend until the stopper of the UIMV-60 fuze contacts the bottom of the mine case. At this point, the copper safety pins break, the retaining balls roll out, and the firing pin is freed to hit the percussion cap thus starting the firing chain. The firing chain has a 3- to 4-second delay, which normally allows it to function after the mine has been rolled over by the tank. After the delay, a signal cartridge is expelled, tossing two green and two red flares 10 to 40 meters into the air. The mine can also be operated electrically with an electric blasting cap.

Yugoslavia also produces a great variety of training mines which simulate explosion by the use of a smoke charge. They can be distinguished by the broad yellow band painted across the mine.

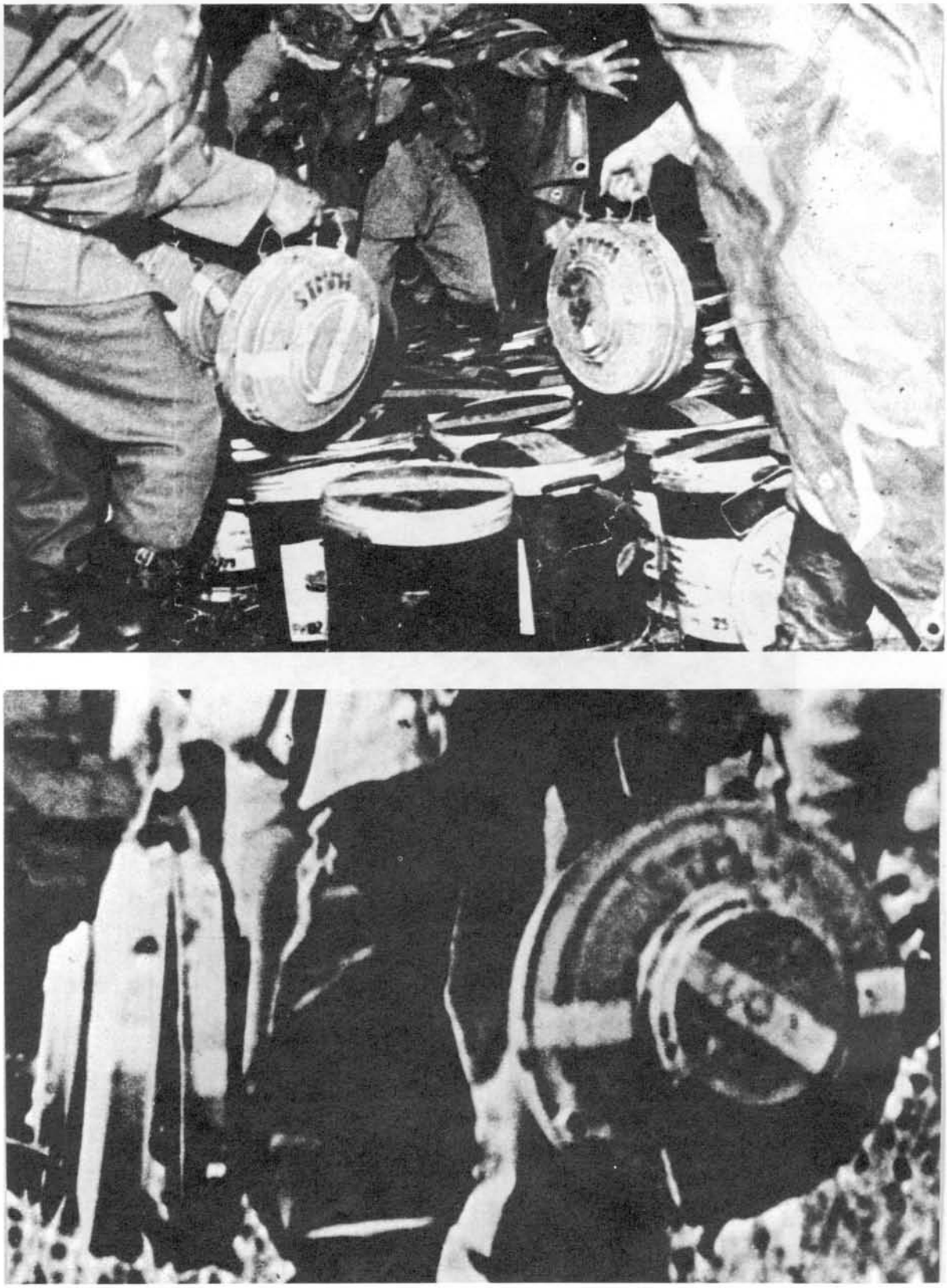
Yugoslav training mines have the letter S at the beginning of their nomenclature, and with the exception of the STMM-1, have their last two letters reversed. This is to preclude a mix-up with the normal models.

Soviet training mine nomenclatures start with the letter U, which stands for training in Russian. This should not be confused with the same letter which is used with live Yugoslav fuzes. In Serbo-Croatian, the letter U stands for fuze, S is used for training.

Czechoslovak training mines have the abbreviation Cv (training) before the model designation, such as Cv. PT-Mi-Ba III.

UITM-60

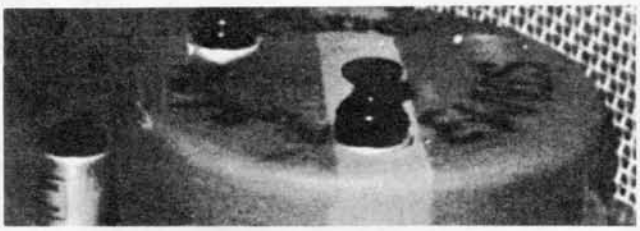
weight	kg	8.7
diameter	mm	316
height	mm	125
operating force	kg	200 to 600



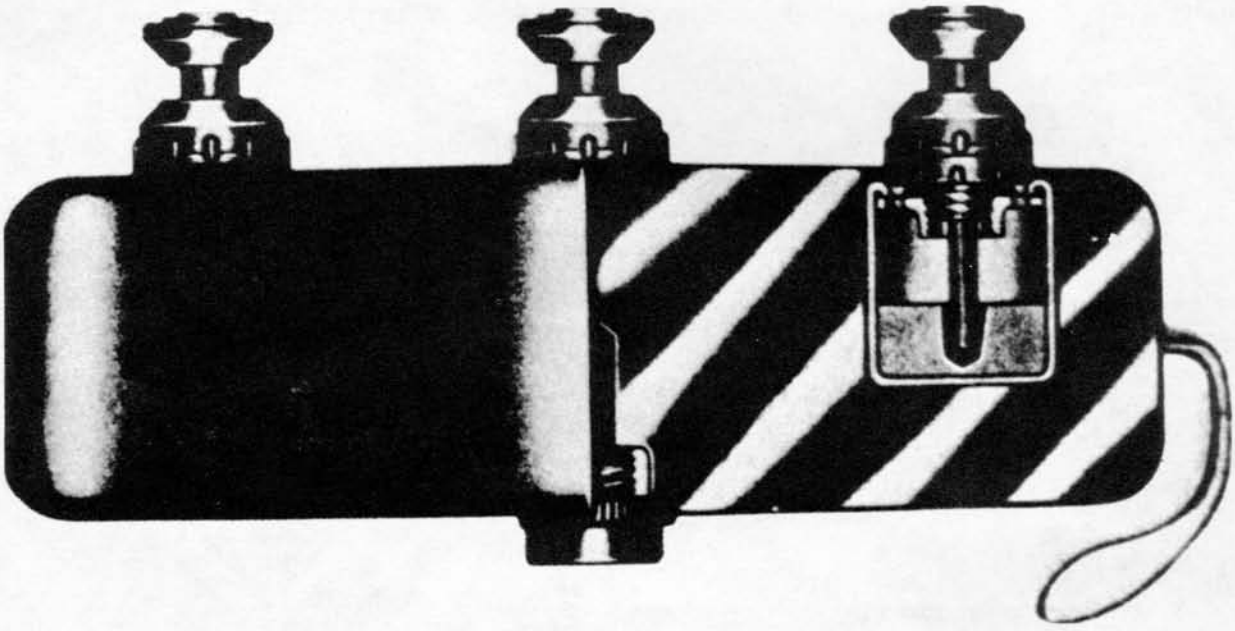
Yugoslav Training Antitank Mine STMM-1



Yugoslav Training Antitank Mine STDM-2



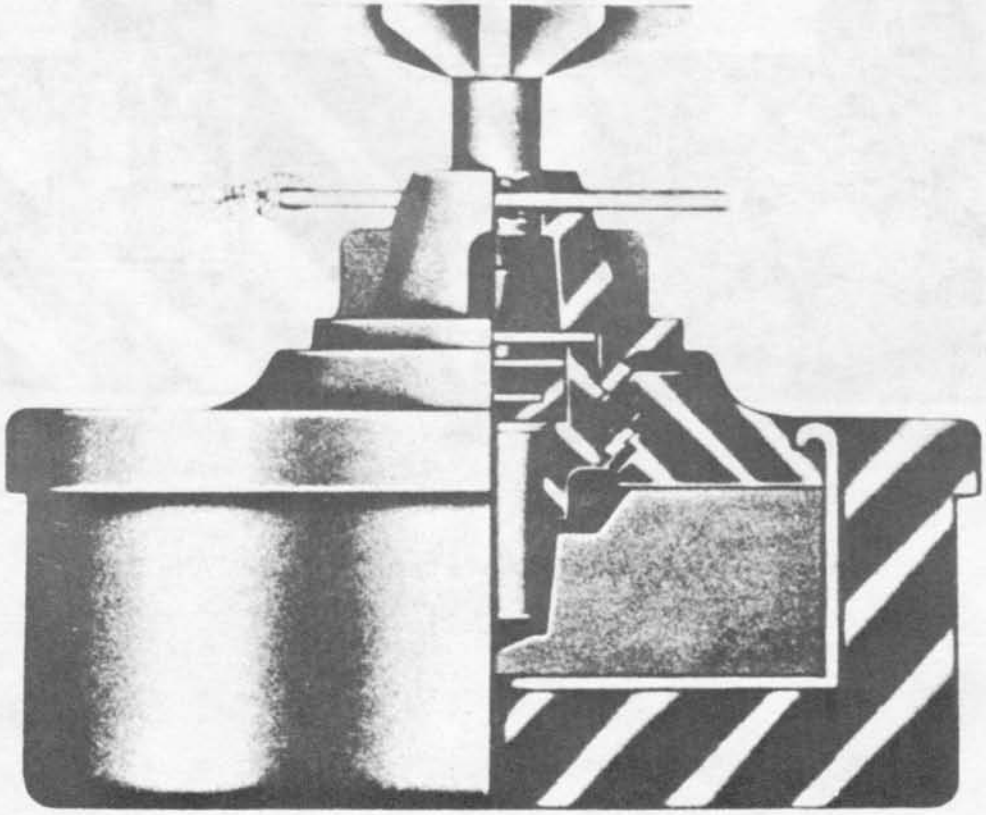
Yugoslav Training
Antitank Mine STAM-3



Yugoslav Training Antitank Mine STAM-3



Yugoslav Training STAM-4 Antitank Mine



Yugoslav Training Antipersonnel Mine SPAM-2



Czechoslovak Training Antitank Mine
Cv. PT-Mi-Ba III

FUZES

PRESSURE FUZES

Soviet Pressure Fuze MV-5
Soviet Pressure Fuze MV-5K
Soviet Pressure Fuze MVM
Soviet Pressure Fuze MVZ-57
Czechoslovak Pressure Fuze Ro-5
Czechoslovak Pressure Fuze Ro-7-II
Czechoslovak Pressure Fuze Ro-8
Czechoslovak Pressure Fuze Ro-9
East German Mechanical Pressure Fuze
East German Chemical Pressure Fuze
Yugoslav Pressure Fuze UPMAH-1
Yugoslav Pressure Fuze UTMAH-1
Yugoslav Pressure Fuze UTMM
Yugoslav Pressure Fuze for PMA-2 Mine

The MV-5 has been one of the most widely employed Soviet antitank mine fuzes, and has often been encountered in improvised mines of all types. The original MV-5 had a metal case; the newer models, designated MV-5K, have a plastic one. The MV-5 fuze has a spring-loaded, ball-release striker with a recess in the pressure cap to free the striker retaining ball. Pressure depresses the cap and compresses the striker spring. As the pressure cap moves down, the striker retaining ball escapes into the recess, releasing the striker and starting the firing chain. Originally, the MV-5 fuze was used in connection with the MD-2 detonator. However, with the introduction of flatter mines, such as the TM-46, the MD-2 detonator proved to be too long, and therefore was replaced with the much smaller MD-6 detonator.

The MVM is a post-World War II fuze designed primarily to be used in antitank mines to be laid by mechanical means and for mines which are transported in armed condition. Basically, this fuze consists of a metal case, a diaphragm, a spring-loaded ball-retaining striker, and a safety pin. The safety pin is inserted through the top of the case and the striker shaft. Pressure on the cover breaks the diaphragm, forcing the cap down. The cap moves down until it reaches a recess in the side opposite the striker retaining ball. The ball then escapes into the recess and releases the spring-loaded striker against the percussion cap, starting the firing chain. The MVM fuze is used in conjunction with the MD-6 detonator.

The Czechoslovak Ro-5 and Ro-9 pressure fuzes were specially designed to be used in the PT-Mi-K metallic antitank mine. They are similar in operation and design features except the Ro-5 requires a separate booster charge, while the Ro-9 does not.

Both fuzes are equipped with shear-pin retained strikers. Pressure on the head of the striker releases the shear pin and frees the striker to actuate the detonator.

The Ro-7-II plastic case fuze was designed especially for use with the Czechoslovak PP-Mi-Ba series of plastic antitank mines. It has only two metal parts; the striker point and the striker spring. Both rest between the cap and the striker shear ring. Pressure on the cap compresses the striker spring and breaks off the striker shear ring, freeing the striker and firing the detonator.

The Ro-8 fuze is used primarily in the PP-Mi-Sr bounding antipersonnel mine. It has a three-prong plunger and a ball-retained striker. A safety pin may be inserted through the plunger at the top of the case. A pressure of 4 kg or more on the prong depresses the plunger and compresses the creep spring, which in turn compresses the striker spring. When the striker is depressed the retaining balls fall into the recesses in the side of the case, releasing the striker to fire the detonator.

Two different pressure fuzes are used for the East German PM-60 plastic antitank mine. One is a mechanical model with minimal metal parts, while the other is a chemical model without any metal parts. They can be distinguished by a colored band on the upper housing collar. For the mechanical fuze the color is red, for the chemical fuze the color is yellow. Otherwise, the fuze is OD in color.

The mechanical fuze, which is used when the PM-60 is laid mechanically, consists of three parts: the upper housing, the center housing, and the lower housing. The upper housing contains the steel pressure retaining spring and an aluminum tubular plunger which has a bakelite pressure cap attached to the upper end. Contained inside the plunger is a striker spring and two steel balls. The center housing serves as a guide for the plunger and has an aluminum ball-retaining collar. The lower housing contains the percussion cap and is threaded for attachment to the main booster . All other portions of the fuze are made of plastic. Pressure on the pressure cap overcomes the resistance of the pressure plunger retaining spring and depresses the plunger. This frees the retaining balls and releases the striker, which is then driven into the percussion cap, initiating the firing chain.

The chemical fuze, which is used when the mine is laid by hand, also consists of three parts: the upper, center, and lower housings. The upper housing contains a plastic tubular plunger which has a bakelite pressure cap attached to its upper end. The center housing serves as a guide for the plunger. The lower housing contains a chemical pad, flash compound, and a plastic disk. The lower housing is threaded for attachment to the main booster. There are no metal parts in this fuze. When adequate pressure is exerted on the pressure cap of the plunger, the plunger is forced downward, crushing the ampoule of acid. The acid is then absorbed by the cotton pad, mixes with the flash compound, and causes a flash that sets off the detonator, initiating the firing chain.

The Yugoslav UPMAH-1 is a chemical fuze used with the PMA-1 antipersonnel mine. It is used in connection with a No. 8 non-electric blasting cap. Pressure on the crush capsule (which contains a friction compound) produces an explosion which fires the No. 8 cap. The UTMAH-1 is also a chemical fuze, but of a different design. The top of the fuze, which is also constructed of bakelite like the UPMAH-1, has a knob, which when crushed, ignites the friction compound, setting off the No. 8 non-electric blasting cap. The UTMAH-1 is used in the TMA-1, TMA-2, and TMA-3 plastic antitank mines. The UTMM is a mechanical pressure fuze used with the TMM-1 metallic antitank mine TMM-1. The fuze is a copy of the German World War II T.Mi.Z.42.

The fuze for the PMA-2 plastic antipersonnel mine functions similarly.

		MV-5	MVM
length	mm	43	48
diameter	mm	13	87
operating force	kg	6-8	

		Ro-5/9	Ro-7-II	Ro-8
length	mm	70	41	107
diameter	mm	50	28	17
operating force	kg		136-227	3.65

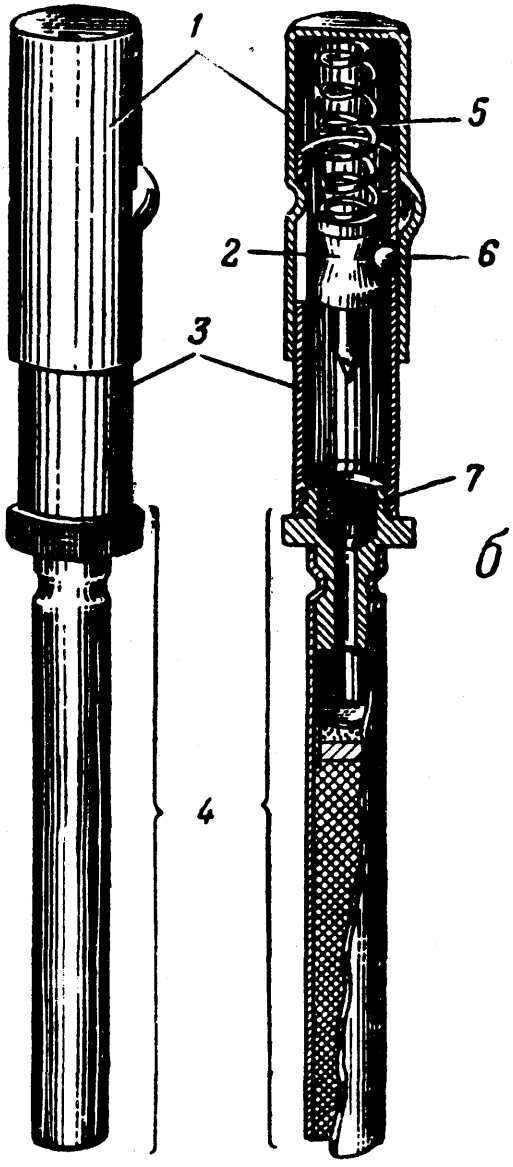
		UPMA-2
length	mm	43
diameter	mm	26
operating force	kg	5-7

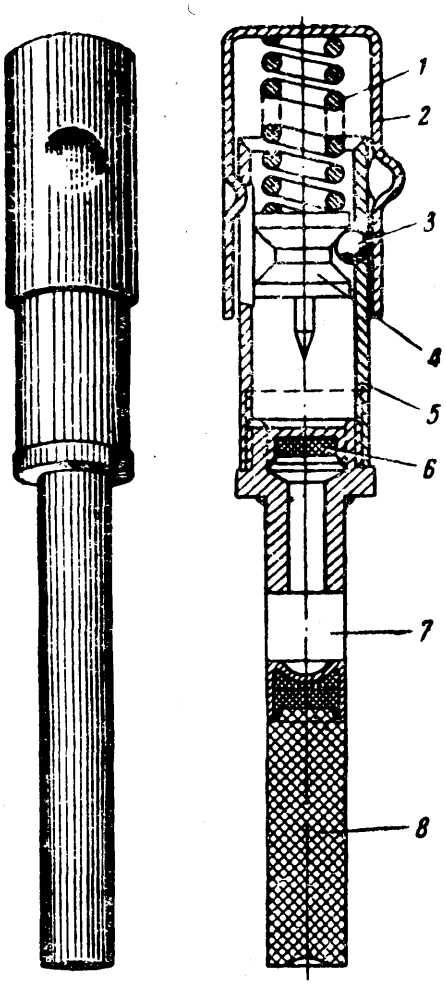
		UTMM
length	mm	50
diameter	mm	20
operating force	kg	100-180

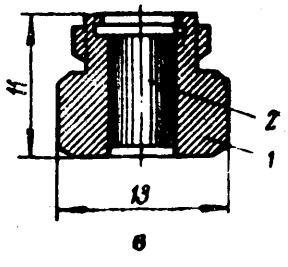
		EG mech	EG chem
length	mm	69	69
diameter	mm	27	25
operating force	kg	*	

*varies

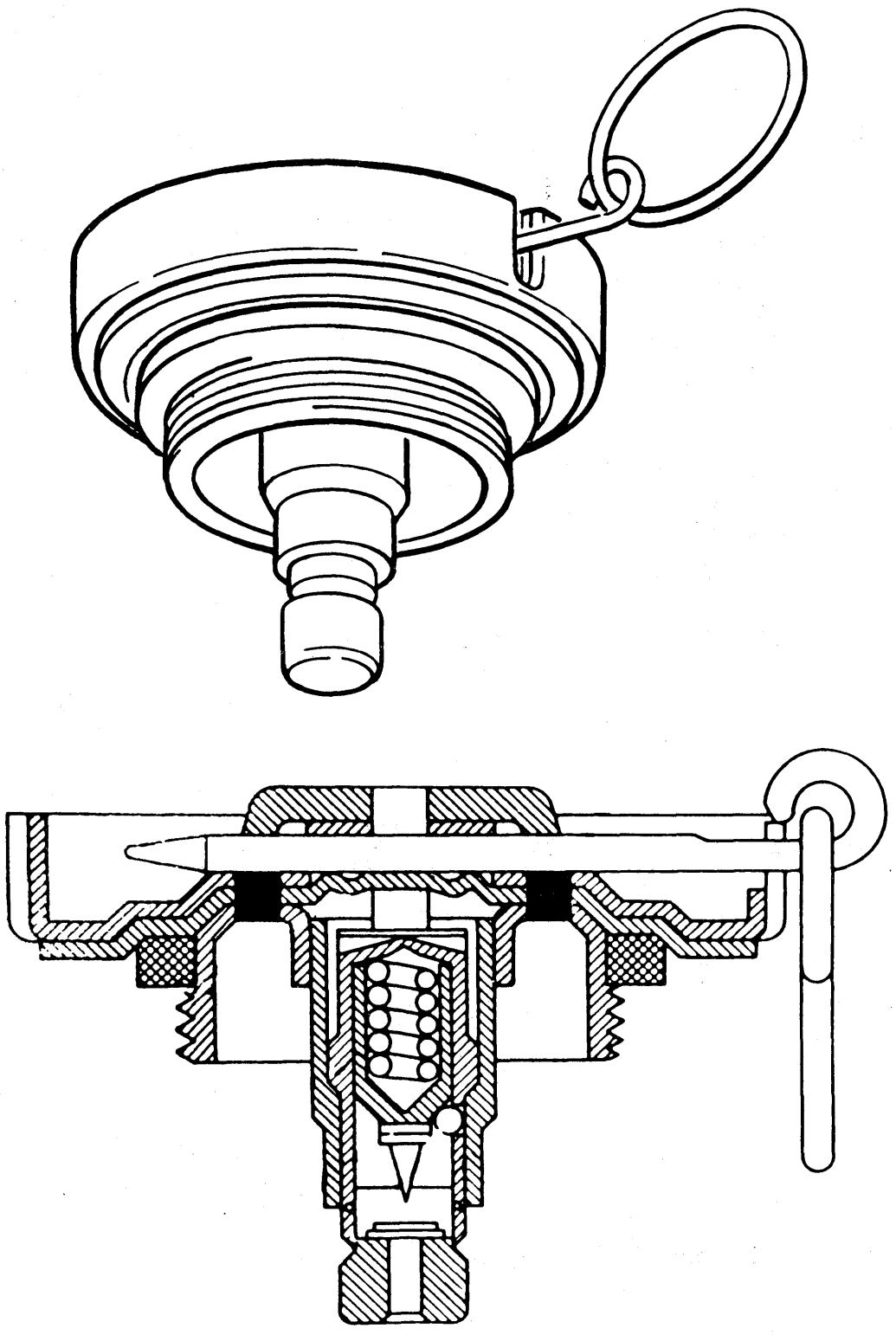
Soviet Pressure Fuze
MV-5 with
MD-2 Detonator



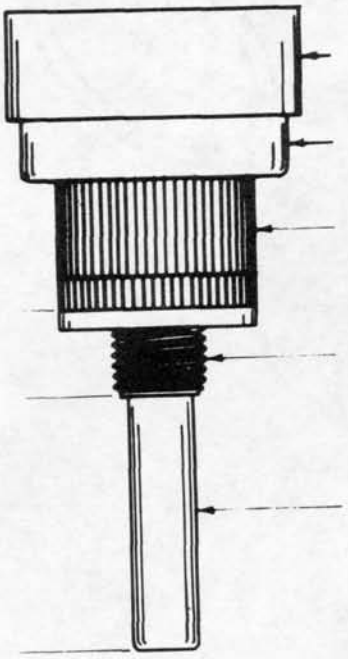


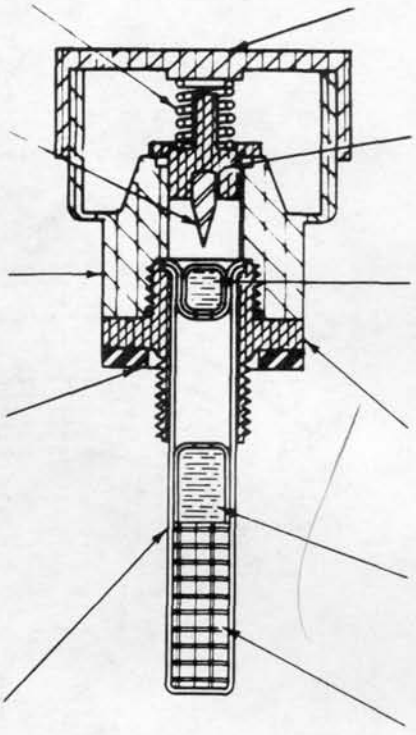


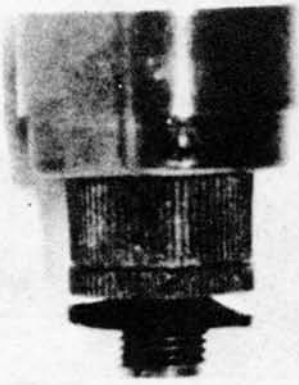
MD-6
Detonator



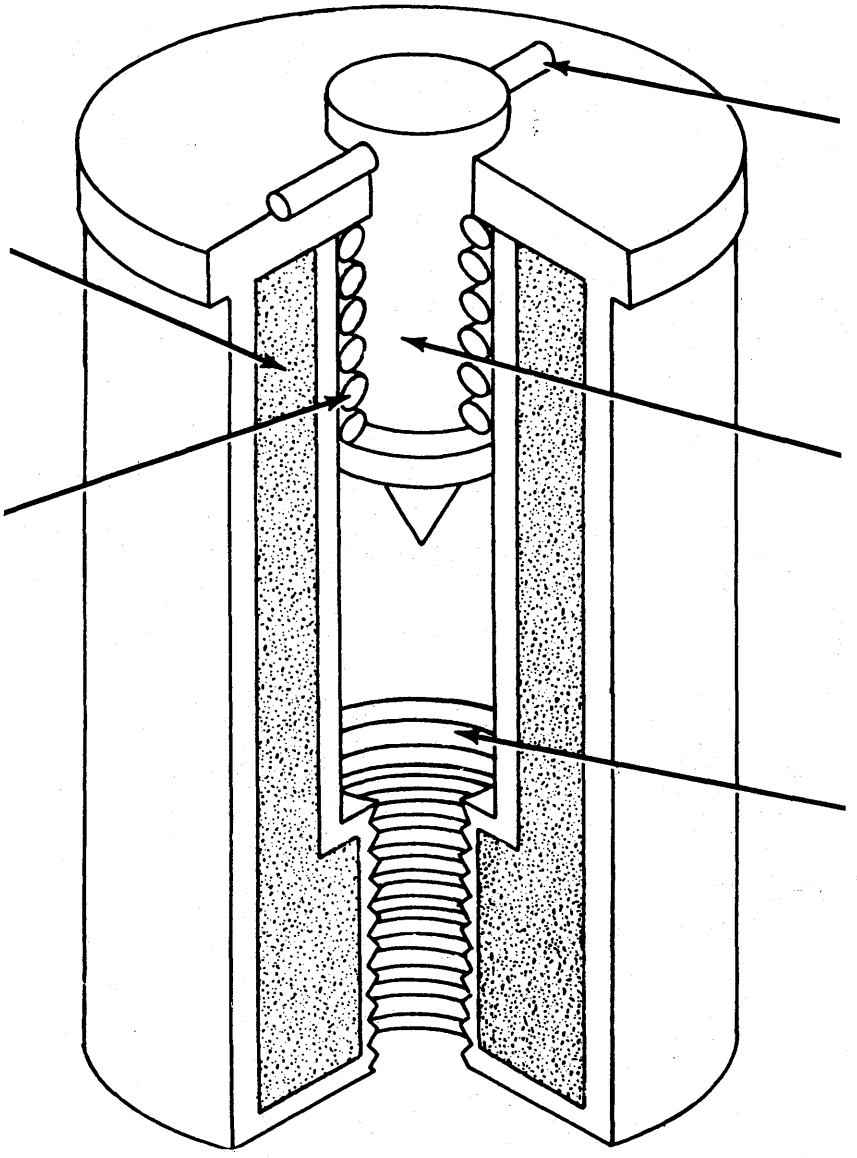
Soviet Pressure Fuze MVM



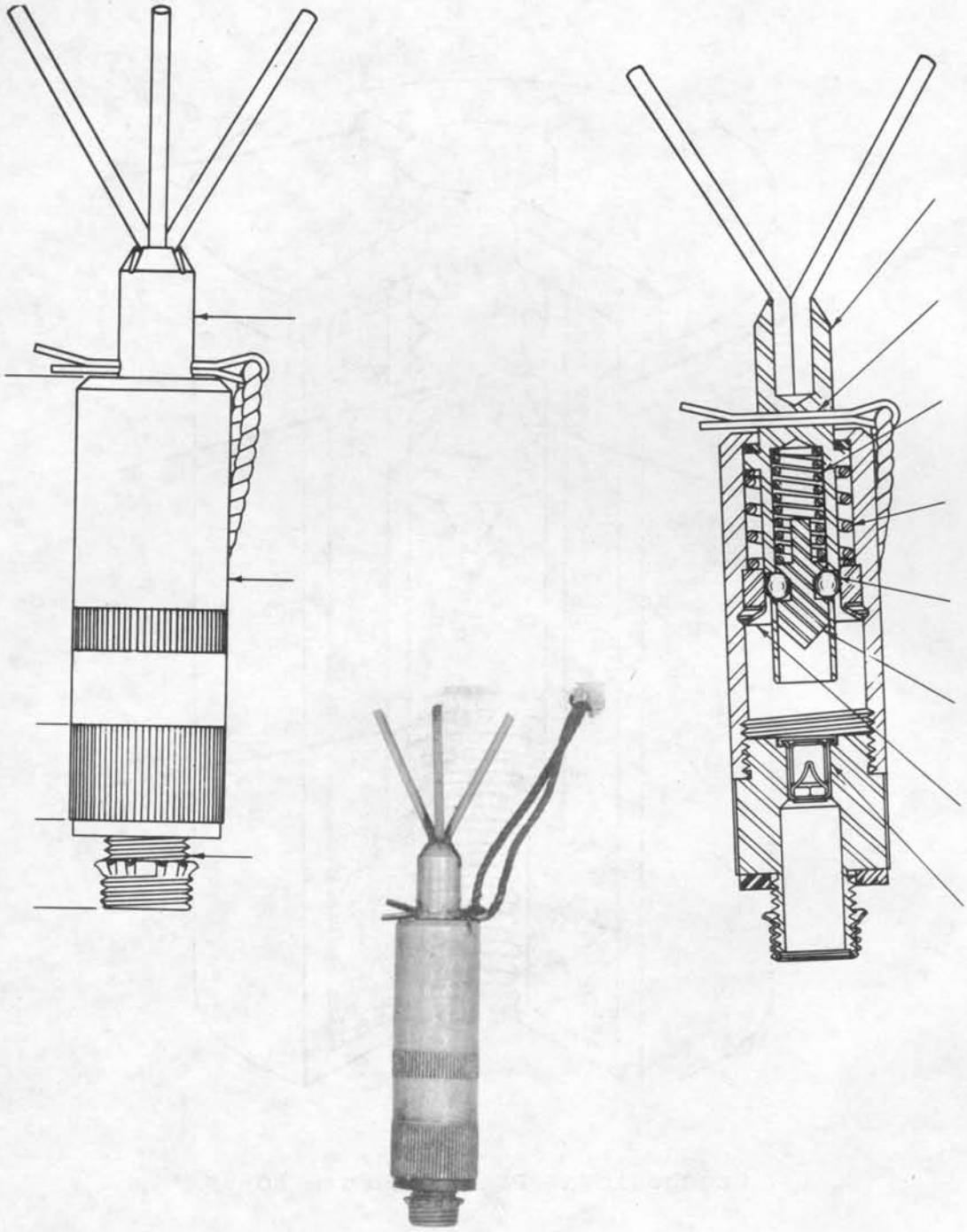




Czechoslovak Pressure Fuze Ro-7-II



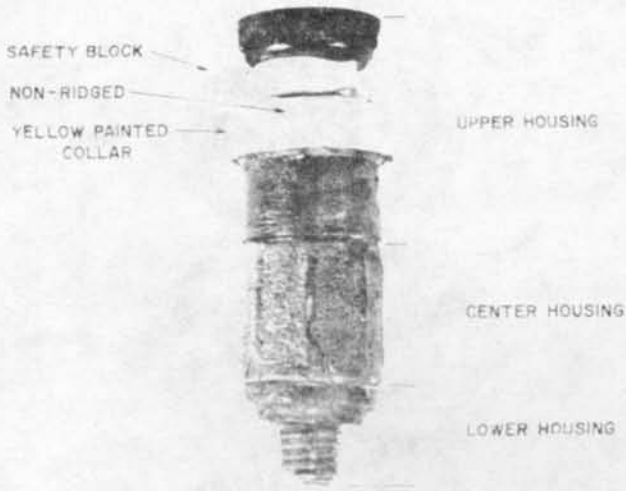
Czechoslovak Pressure Fuze Ro-9

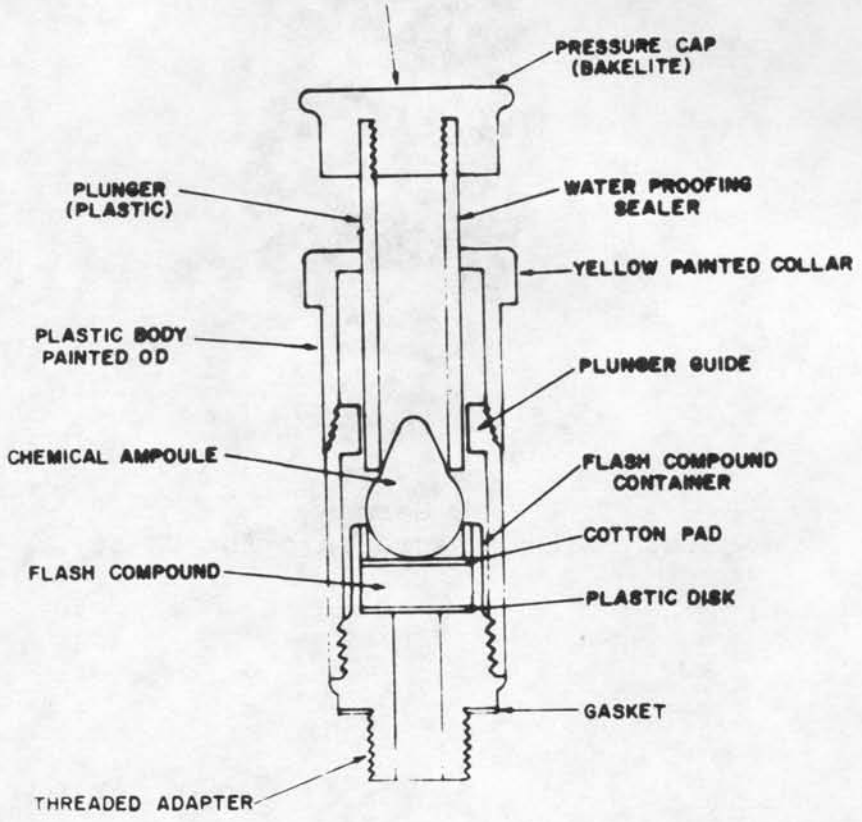


Czechoslovak Pressure Fuze Ro-8

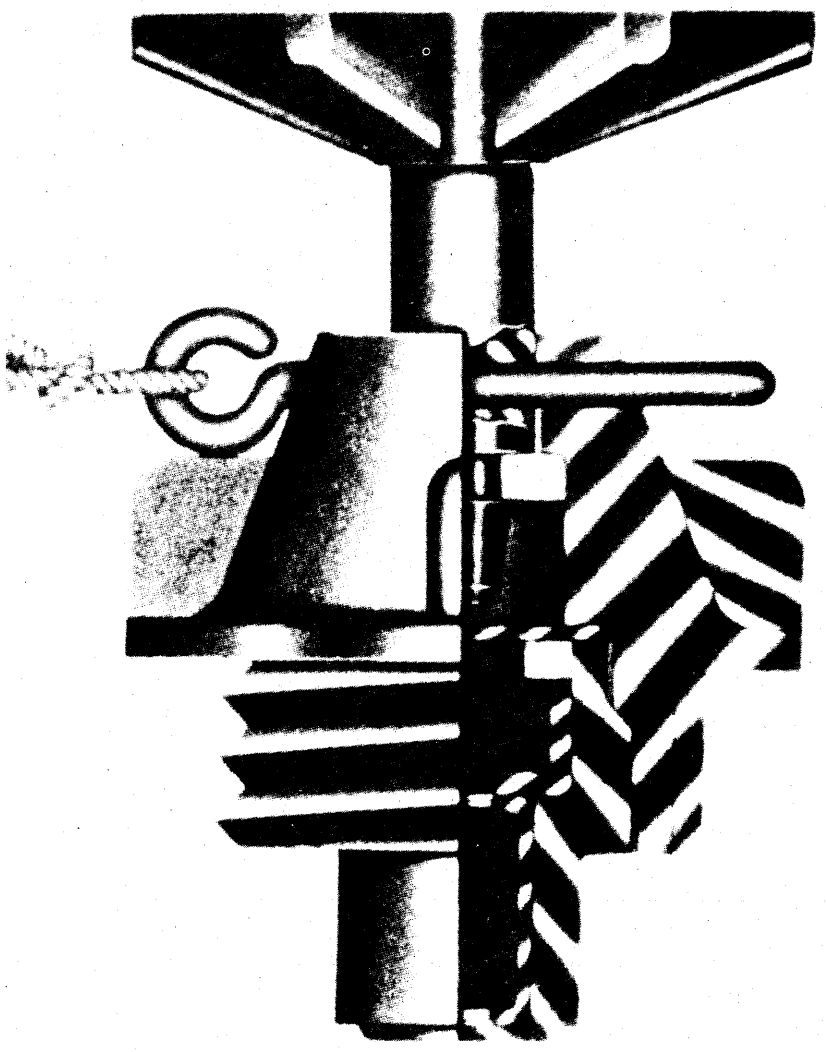


East German
Mechanical Pressure Fuze for PM-60

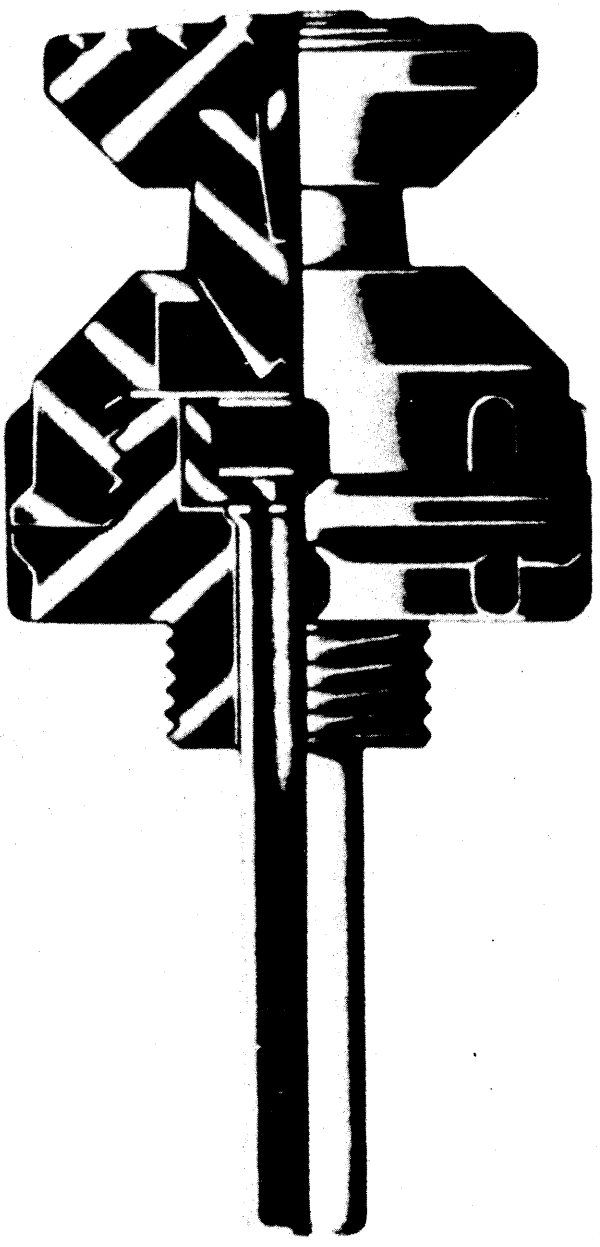




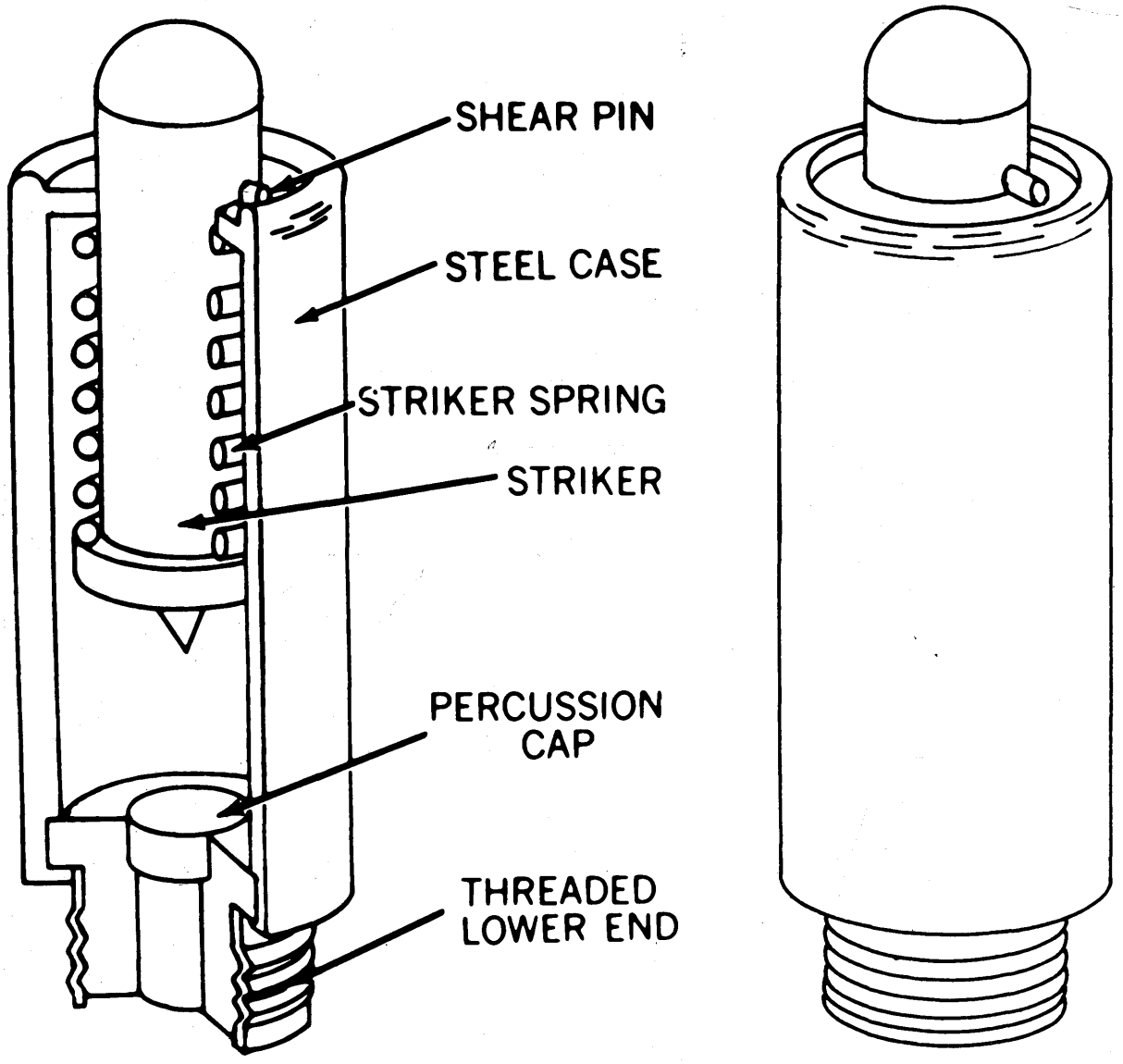
East German Chemical
Pressure Fuze for PM-60 Antitank Mine



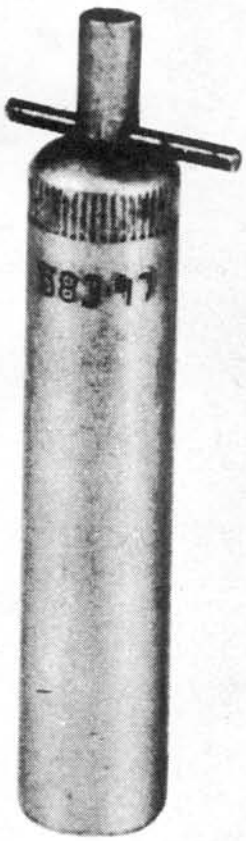
Pressure Fuze for PMA-2
Antipersonnel Mine (Training Version)



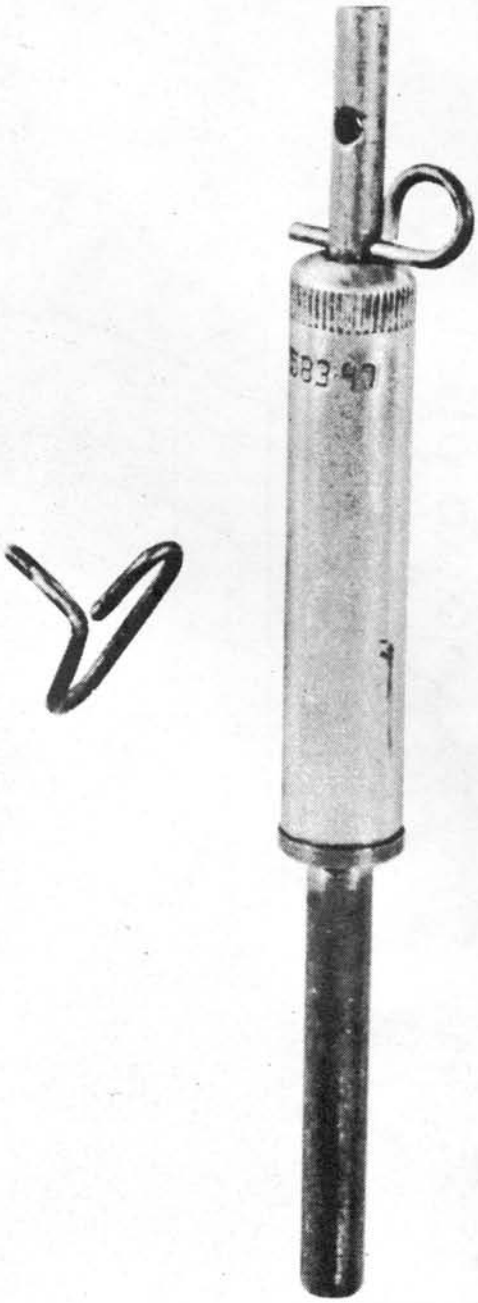
Yugoslav Pressure Fuze
UTMAH-1 (Training Version)



Yugoslav Pressure Fuze UTMM



Transport Mode



Operational Mode with
MD-2 Detonator

Soviet Pull Fuze MUV

Soviet Pull Fuze MUV
Soviet Pull Fuze MUV-2
Soviet Pull Fuze VPF
Czechoslovak Pull Fuze Ro-1
Hungarian Pull Fuze M49
Yugoslav Pull Fuze UPM-1

The MUV pull fuze, an improved version of the now obsolete UV, is widely used in Soviet antipersonnel mines, although for many purposes it has been replaced by the newer MUV-2. The MUV consists of a tubular case which houses a spring-loaded striker. Cases vary in design details and in material. Four types have been identified to date. They are Type I made of tin-plated steel, Type II of plastic, Type III of ebonite, and Type IV of sheet steel. All types are threaded internally to take a detonator, but not externally. Because of this the MUV is merely placed rather than screwed into the explosive charge of a mine. As a result it can be used with the POMZ-2. Today the MUV is largely used with the PMD-6 and PMD-7 wooden antipersonnel mines. In the stake mines the MUV is connected with a trip wire so that it is activated by a pull on the loop-end striker-retaining pin. It can also be used as a tension-release device by using a taut wire and no retaining pin. With wooden antipersonnel mines, a winged pin is used. A force of 1 kg or more either removes the winged pin, or pulls the loop-end pin from the striker. The spring then drives the striker against the percussion cap, starting the firing chain. Although the MD-2 detonator is normally used with the MUV, other detonators such as the MD-6 could also be employed.

The MUV-2 is a modification of the MUV incorporating an arming-delay device. This device gives troops ample time to lay and camouflage a mine and to reach a safe distance before the fuze becomes fully armed. A thin cutting wire is attached to a groove across the protruding end of the striker. Beneath the wire is a soft metal plate held in place by a sleeve fitted over the end of the striker. When the safety pin is removed the wire cuts through the soft metal plate. The striker is then held only by the retaining pin. The MUV-2 otherwise functions in the same fashion as the MUV, except it cannot be used as a tension-release device because of the absence of the safety pin hole for fastening the taut trip wire. The MUV-2 is standard with the POMZ-2M antipersonnel mine because it is externally threaded. The fuze is also used in the PMD-6M wooden antipersonnel mine. The MD-2 detonator is standard, but could be replaced by other models.

The VPF fuze, which is frequently employed in improvised mines and charges, consists of three parts: the clamp top, the body and the detonator assembly. The fuze is normally assembled at the point of use. Although the usual method used to arm it is to pull on the pull ring, it may be equipped with a rod projecting from the clamp top so that it will function by lateral pressure on the rod. After the safety pin is removed, the clamp top holds the spring-driver striker under tension. Lateral pressure or axial pull on the clamp pulls the clawlike base from under the ball-shaped end of the striker, releasing it and firing the detonator. A "C" ring clamp is provided to facilitate fastening the fuze to a wall, stake, or a tree. The MD-2 detonator is standard.

The Czechoslovak Ro-1 fuze is used primarily with the PP-Mi-Sb and PP-Mi-Sk antipersonnel stake mines, as well as with the PP-Mi-D wooden antipersonnel mine. It consists of a spring-loaded striker enclosed in a threaded-base plastic case. A pull on the loop or pressure on the wings of the striker retaining pin releases the striker spring. The spring drives the striker against the percussion cap, starting the firing chain. The Ro-1 has no delay-arming feature, nor can it be set for tension release.

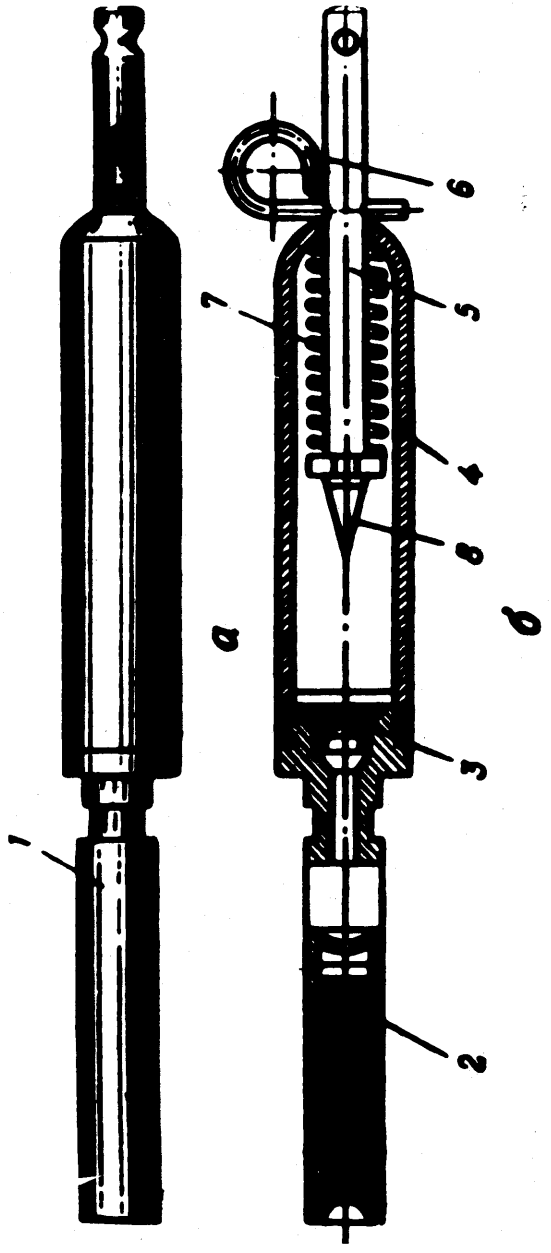
The Hungarian M49 fuze is used with the M49 wooden antipersonnel mine and can be adapted to improvised mines. It is very similar to the Soviet MUV. A plastic body version of the same fuze is used with the M62 plastic antipersonnel mine.

The Yugoslav UPM-1, which is employed with the PMR-1 and PMR-2 antipersonnel stake mines, is a copy of the German World War II Z.Z.42 fuze, which in turn was based on the Soviet MUV. A major change over the MUV is that the base is threaded externally. Normally the UPM-1 is used as a pull fuze, but it can also be employed as a tension-release device with a taut trip wire. When employed with the PMD-1 wooden antipersonnel mines the adjustment is similar to that of the Soviet PMD-6 with the MUV fuze.

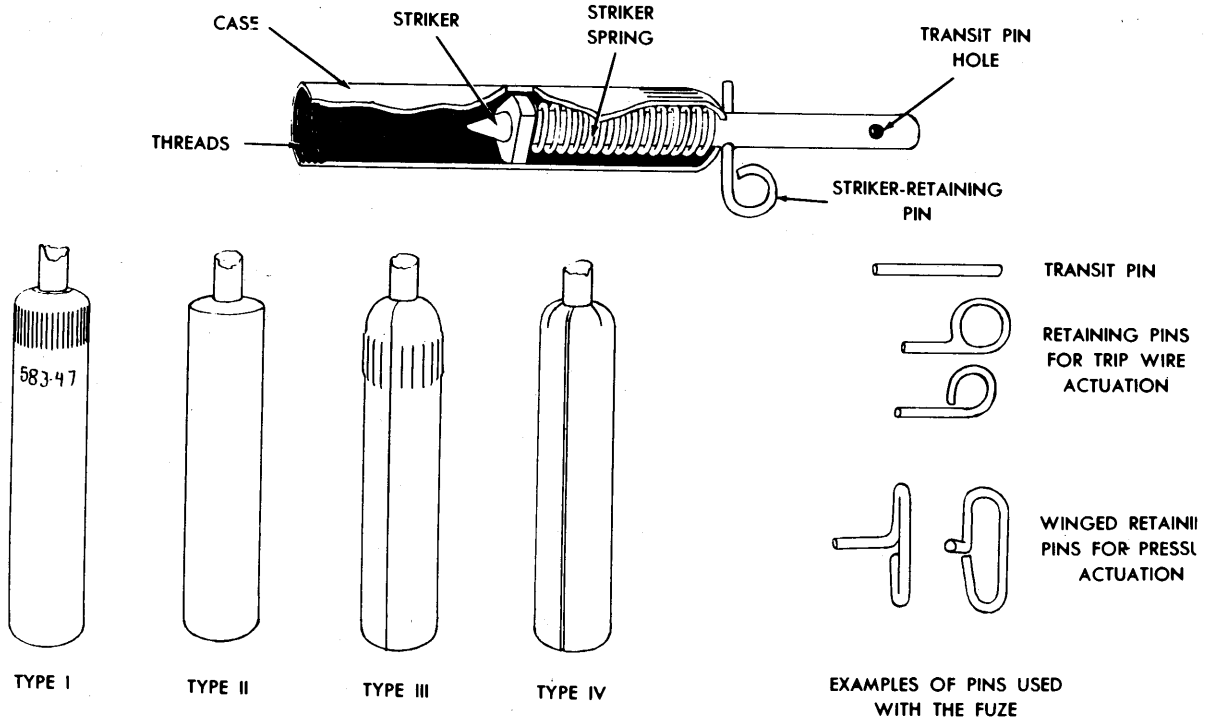
		MUV	MUV-2	VPF
length	mm	56	125	75
diameter	mm	13	12.2	15
operating force	kg	1	1	3.6 to 6.4*

		Ro-1	M49	UPM-1
length	mm	88	62	87
diameter	mm	12	15	12.7
operating force	kg	1	5	2.5 to 5

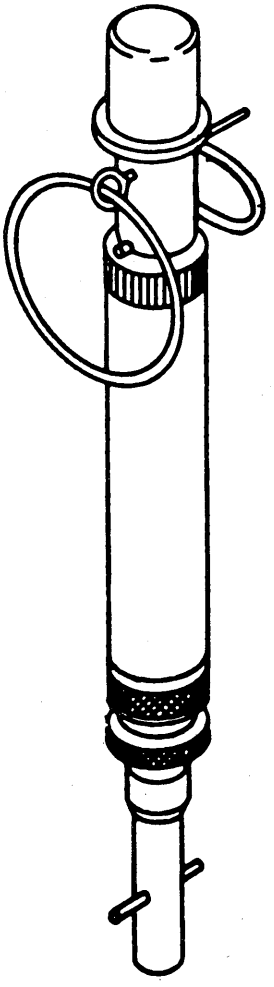
*by axial pull, 1.25 to 1.6 kg with lateral force



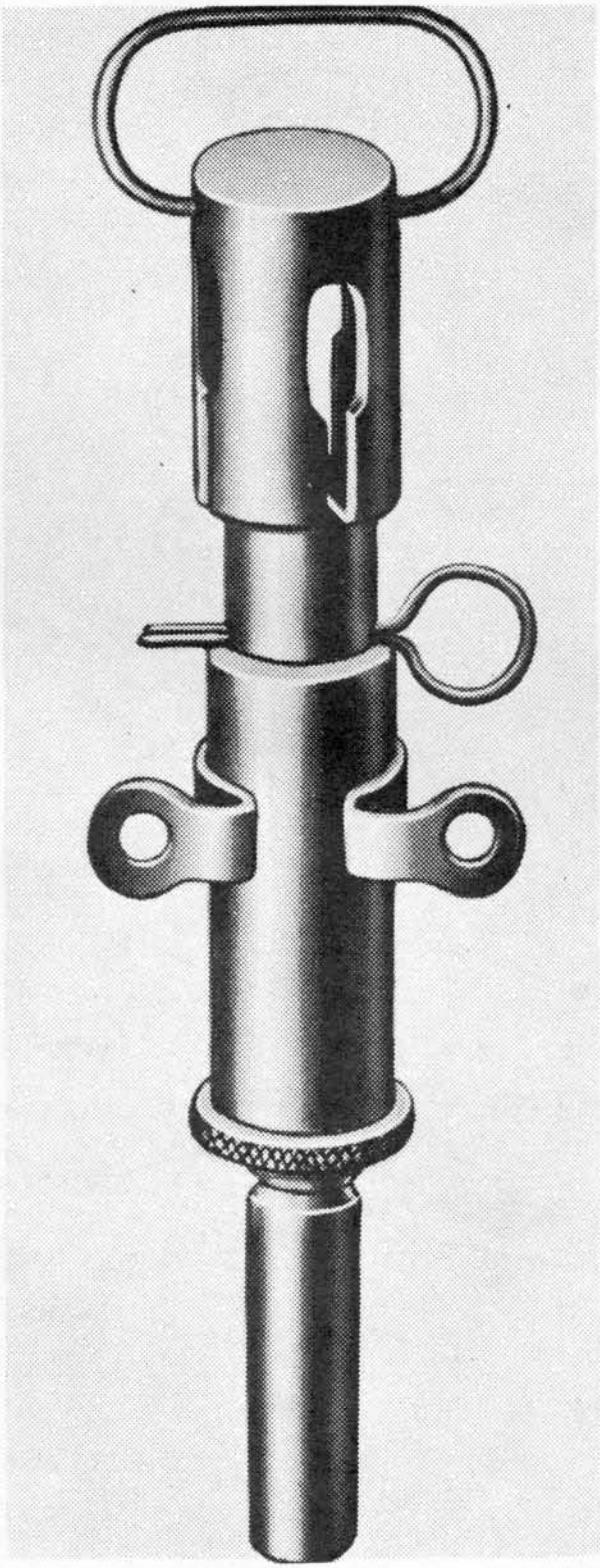
Soviet Pull Fuze
MUV with MD-2 Detonator



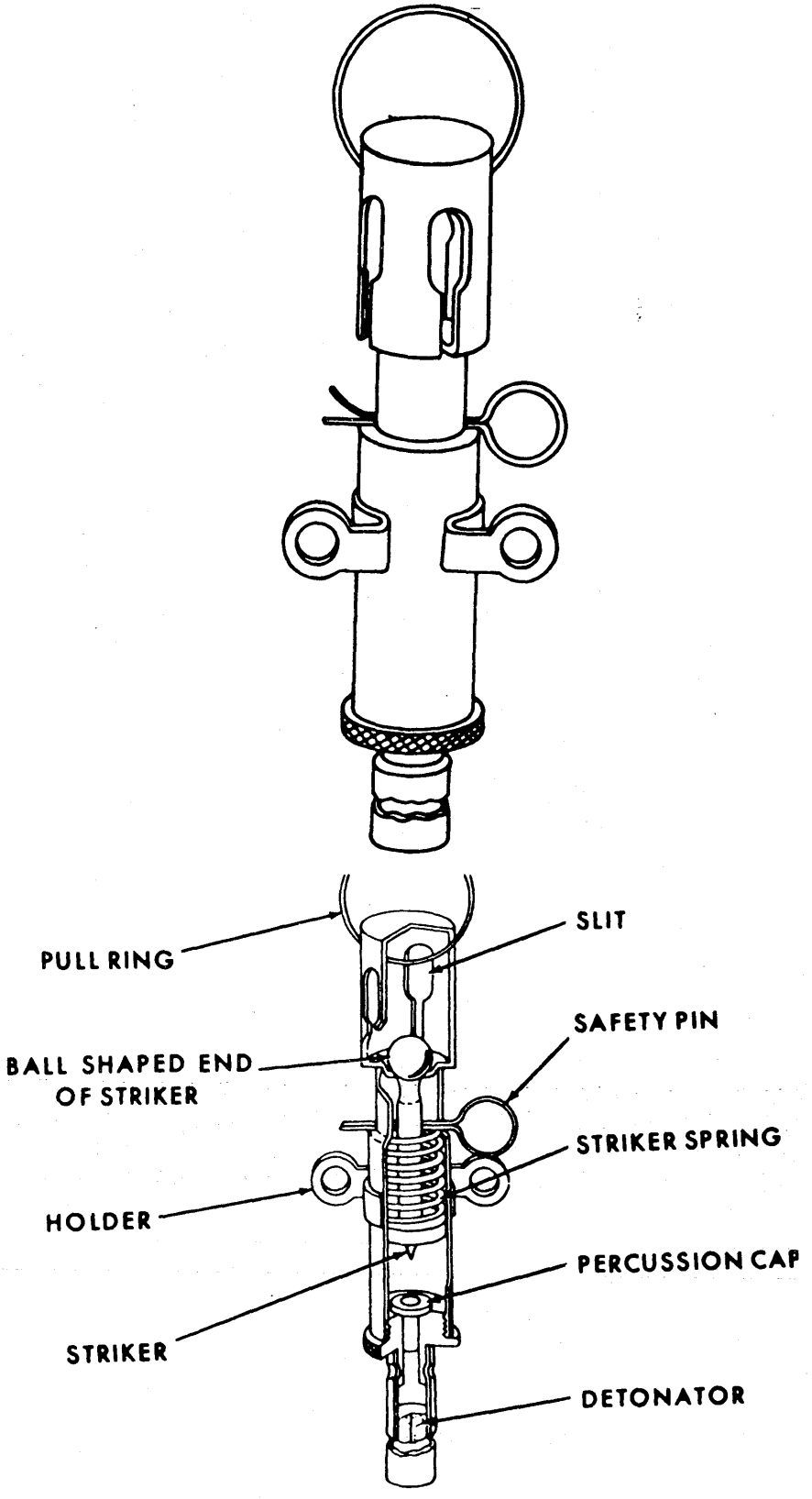
Variants of Soviet MUV Pull Fuze



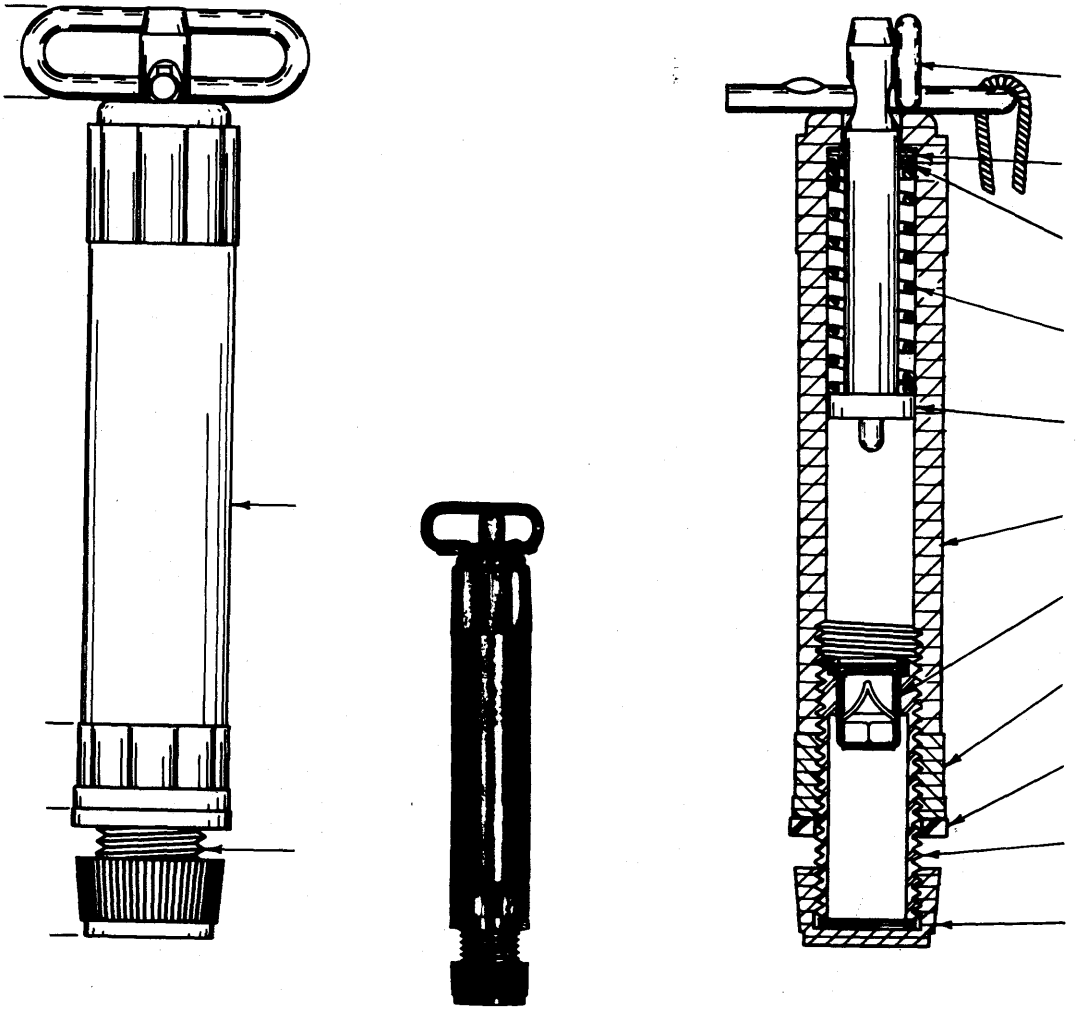
MUV-2
Soviet Pull Fuze



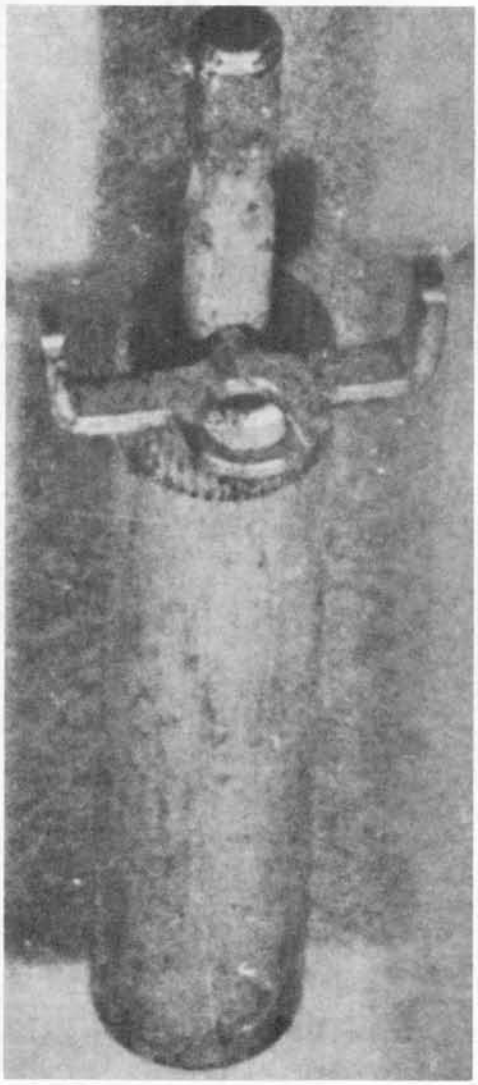
Soviet Pull Fuze VPF

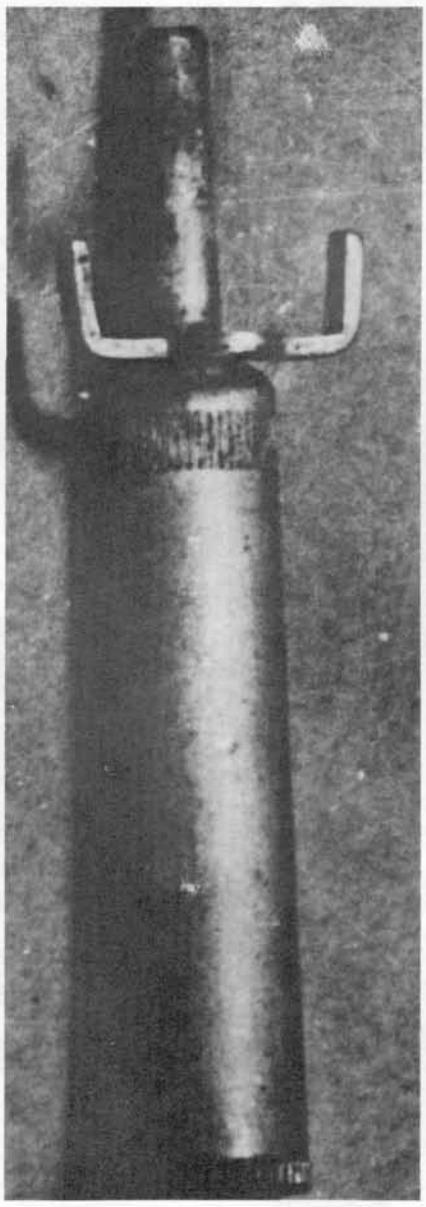


Soviet Pull Fuze VPF

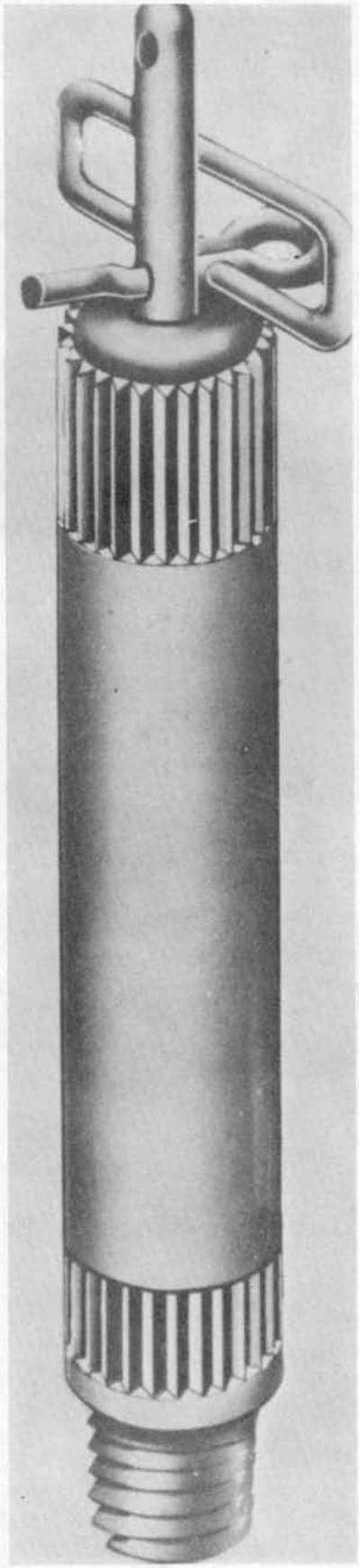


Czechoslovak Pull Fuze Ro-1





Hungarian Pull Fuze M49



Yugoslav Pull Fuze
UPM-1



Soviet Tilt-Rod Fuze MVSh-46

TILT-ROD FUZES

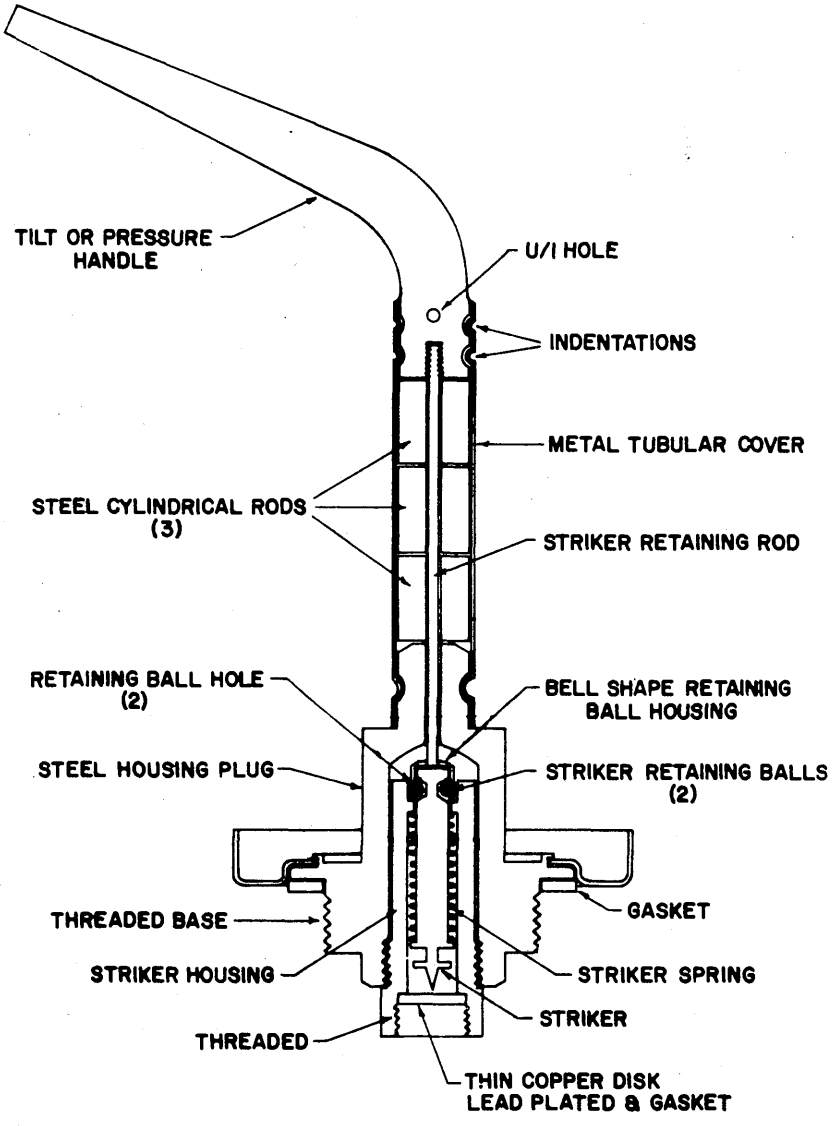
Soviet Tilt-Rod Fuze MVSh-46
Soviet Tilt-Rod Fuze MVSh-57
Soviet Tilt-Rod Fuze for TMK-2
Czechoslovak Tilt-Rod Fuze for Plate-Charge Antitank Mine

The MVSh-46 tilt-rod fuze is used in the Soviet TM-46 and TMN-46 metallic antitank mines. The three main components of the fuze are the steel body, a metal tube, and a metal tilt/pressure handle. The body, threaded to fit the TM-46/TMN-46 antitank mine fuze well, houses the striker assembly. The metal tube houses three steel rods through which the striker retaining rod passes. The tilt/pressure handle is angled at about 20 degrees, and its base is threaded to accept the striker retaining rod. Pressure in any direction on the handle lifts the striker retaining rod about 3 mm. This releases the striker-retaining balls, allowing the striker spring to drive the striker into the percussion cap, firing the mine. The MVSh-57 tilt-rod fuze is similar, and is designed for use with the TM-57 metallic antitank mine.

Similar tilt-rod fuzes with longer, telescoping rods, are used with the Soviet TMK-2 shaped-charge antitank mine, and the Czechoslovak plate-charge, belly-attack antitank mine. Tilt-rod fuzes are also used with the AKS "anticlearance" mine and with various river mines. The VPF pull fuze can also be used with a tilt rod in improvised mines, or for training devices.

MVSh-46

weight	g	526
height	mm	202
diameter	mm	77



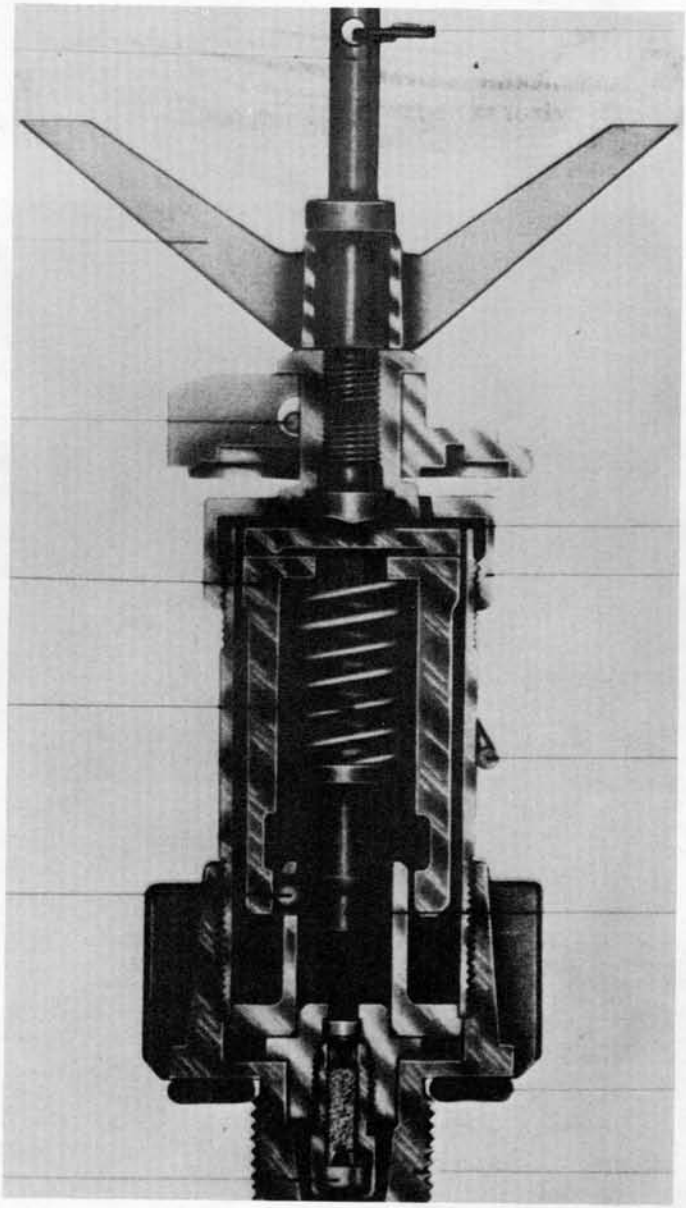
Soviet Tilt-Rod Fuze MVSh-46



Side View of Tilt-Rod
MVSh-46



Soviet Tilt-Rod
Fuze MVSh-46



Yugoslav Pressure/Pull Fuze UPROM-1

Yugoslav Pressure/Pull Fuze UPROM-1

The Yugoslav antipersonnel bounding mine PROM-1 uses the UPROM-1 fuze which incorporates both pressure and pull features. The pressure piece has four blades.



Soviet Clockwork
Mechanical-Delay Fuze ChMV-16

MISCELLANEOUS FUZES

In addition to the more common standard fuzes described under separate headings in this guide, the East European Communist forces use a variety of more specialized fuzes. Many of these are used chiefly for special or improvised charges for the destruction of railways, bridges, and other structures. Some may be encountered in river mines, road mines, and even in more conventional antitank and antipersonnel mines. Fuzes include pressure and tilt-rod types for special employment, and delay types using chemical, chemical-electrical, and mechanical actions. Further types include vibration fuzes, audio frequency fuzes, radio frequency fuzes, pneumatic hose pressure fuzes, tension-release fuzes, and pressure-release fuzes. There may also be various combinations of some of the above, plus the more normal types.

River-mine fuzes are normally tilt-rod models, such as the VPDM-1, VPDM-1M, and VPDM-2 used in the PDM-1 and PDM-1M, and PDM-2 river-bottom mines, respectively. Soviet limpet mines normally use mechanical-delay fuzes employing metal fatigue as the operating principle. The Czech shaped-charge limpet mines have electrical-delay fuzes.

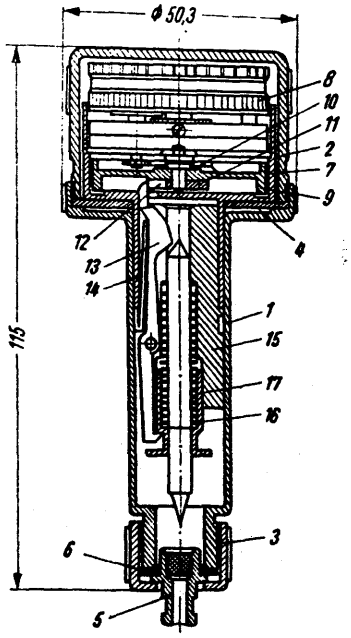
Other types of delay fuzes are illustrated by the ChMV-16 and ChMV-60 clockwork mechanical fuzes. The ChMV-16, which is used with either the MD-2 or MD-5M detonators, can also be adjusted for electrical firing. It can be set for delays ranging from 6 hours to 16 days. The ChMV-60, which uses the same detonators, cannot be adjusted for electrical firing. It can be set for delays ranging from 2 to 60 days.

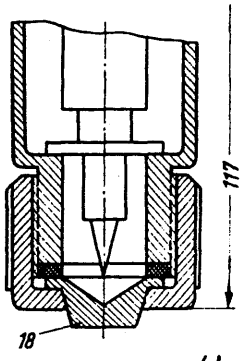
A further type of delay fuze is the EKhP which works on the chemical-electrical principle. It is produced in two models. The smaller one, 50 mm long and 15 mm in diameter, can be set for delays ranging from 10 minutes to 4 hours. The larger model, 127 mm long and 34 mm in diameter, can be set for delays ranging up to 4 months.

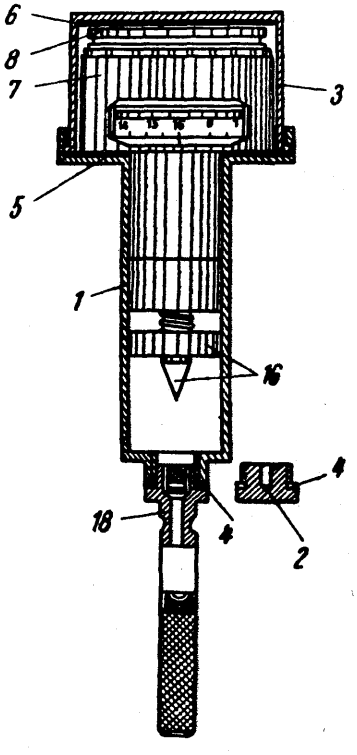
Vibration fuzes, such as the ChVZ, which was used in the MZD delayed-action mines, is an electrical fuze with clockwork-delay arming mechanism.

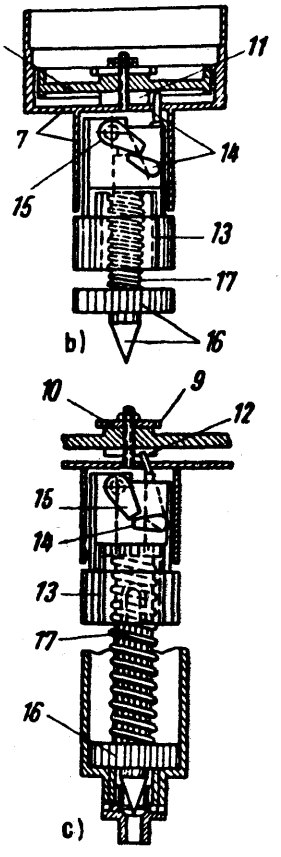
For special charges designed to derail or destroy moving railway trains, the PV-42 rod-pressure fuze is employed. It uses the standard MD-2 or MD-5M detonators. Pressure required is only 12 kg.

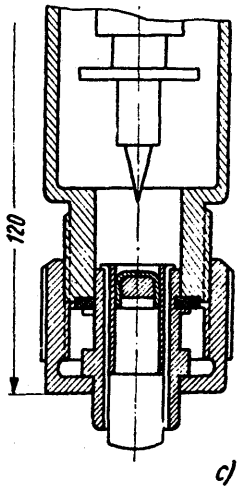
The Soviet forces made extensive use of delay fuzes of the radio-frequency type during the great retreats of 1941 and 1942. Buildings which were expected to be occupied by the enemy were mined with very large charges (several hundred kg) and fitted with the F-10 radio frequency fuze which could be activated at distances up to 480 km.



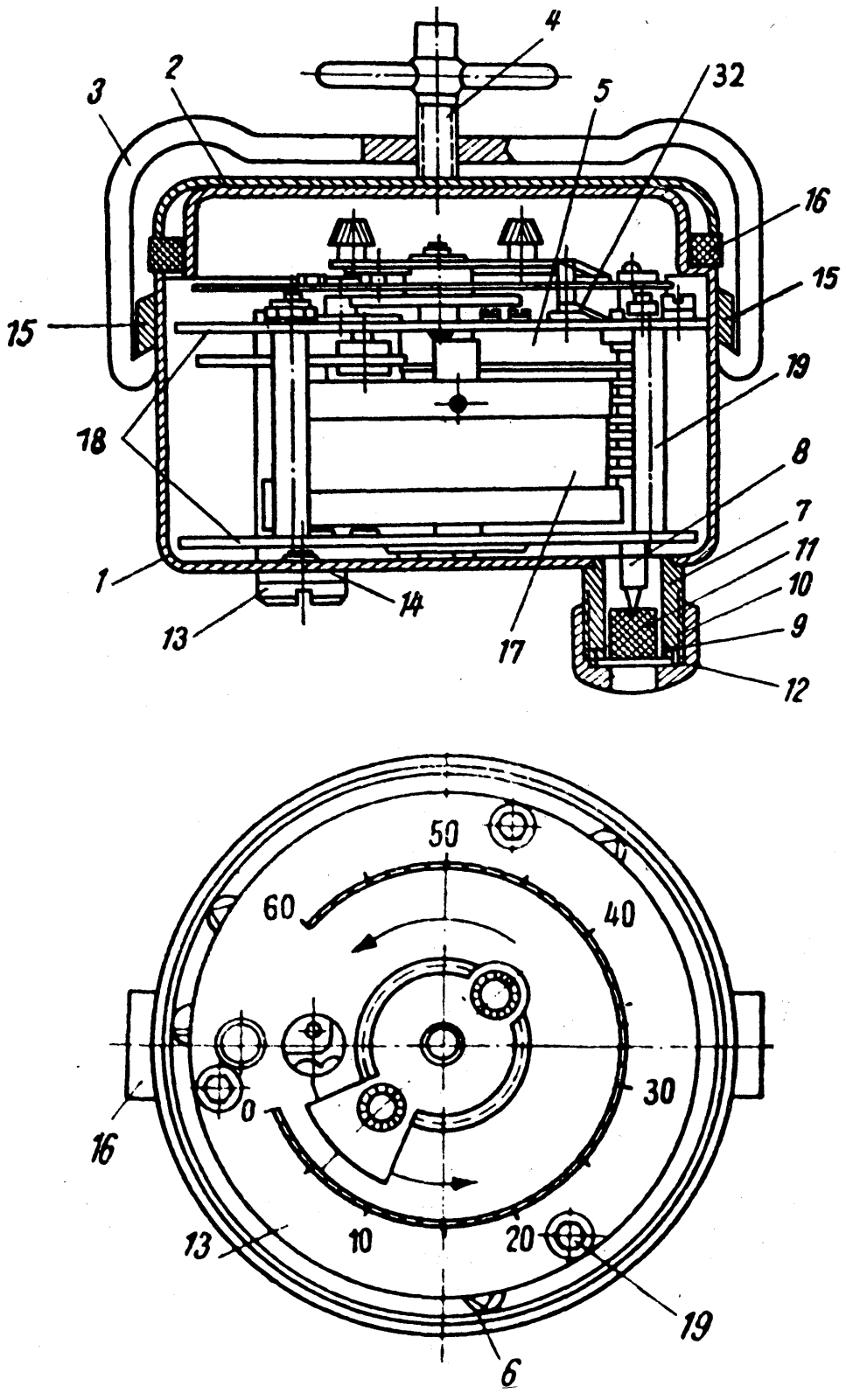




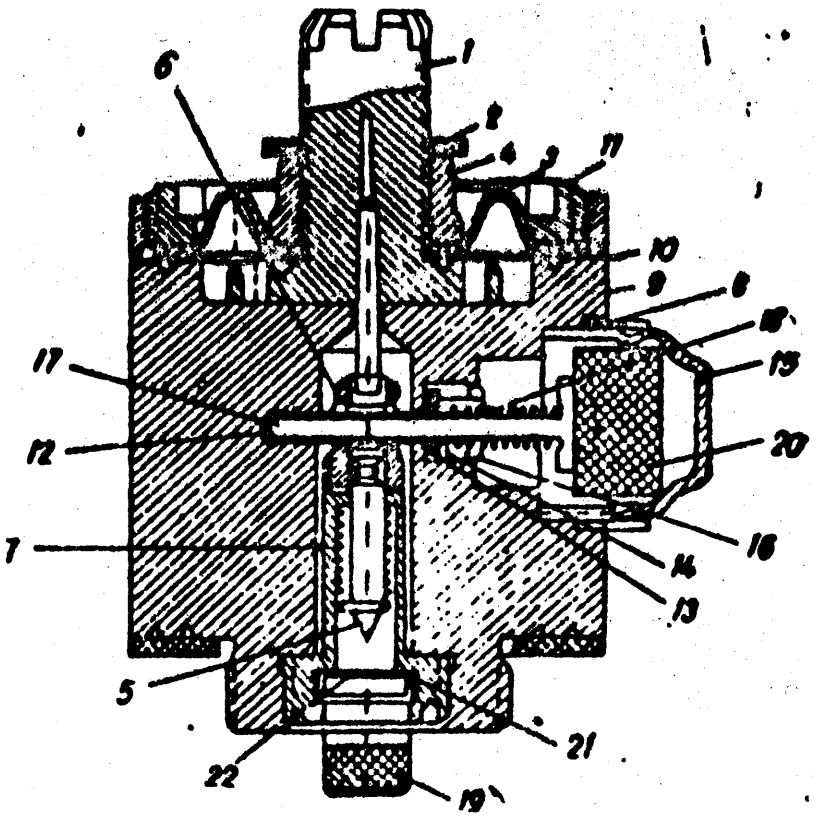




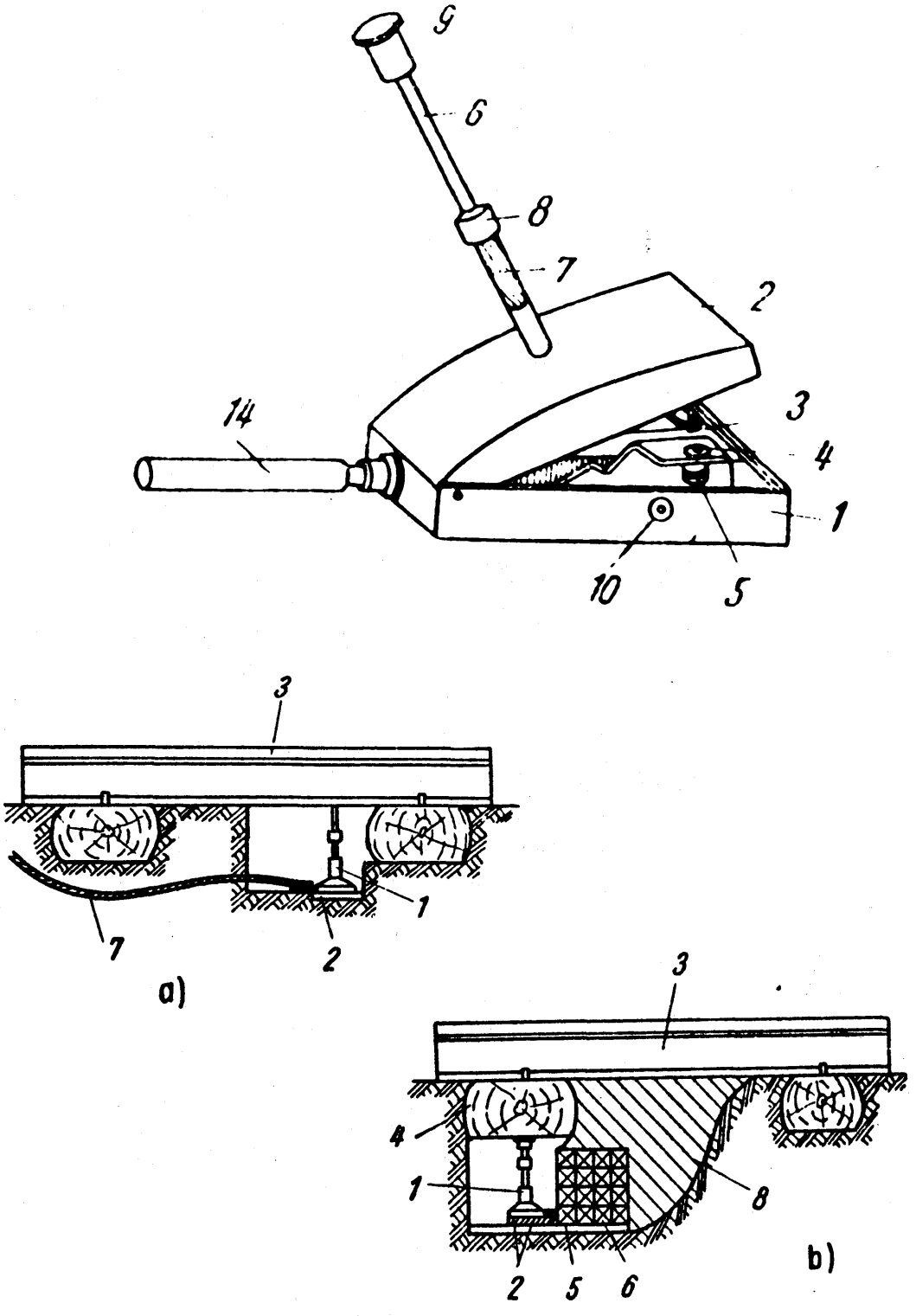
Soviet Clockwork Mechanical-Delay Fuze ChMV-16



Soviet Clockwork Mechanical-Delay Fuze ChMV-60



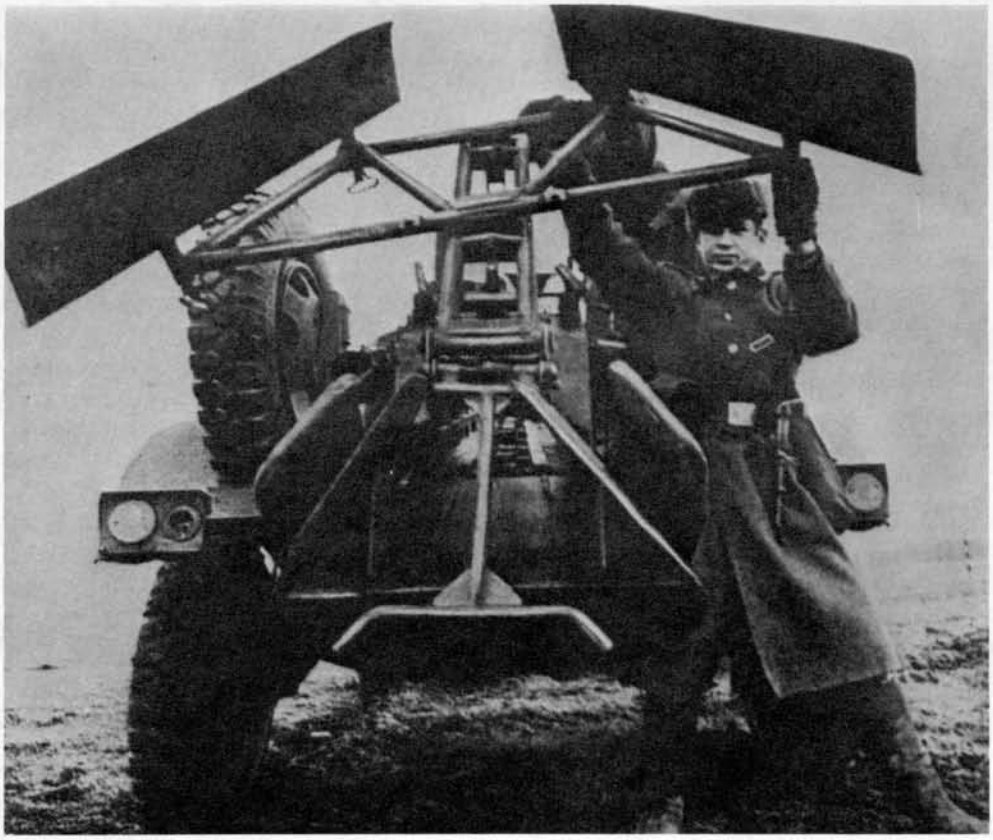
Soviet River-Mine Tilt-Rod
Fuze UPDM-1M



Soviet Rod-Pressure Fuze PV-42

MINELAYING EQUIPMENT





Modified Soviet Mechanical Minelayer PRM-3

TOWED MECHANICAL MINELAYERS

Minelaying Chutes
Soviet Mechanical Minelayer PMR-2
Soviet Mechanical Minelayer PMR-3
Soviet Mechanical Minelayer PMZ-4
East German Mechanical Minelayer MLG-60

Before the advent of the more sophisticated mechanical minelayers, the Warsaw Pact armies used mine-dispensing chutes which were hung over the sides of vehicles such as the BTR-152 armored personnel carrier. With this system the spacing between the mines is regulated by the speed of the vehicle and how rapidly the crew can place the mines in the chutes. This type of minelaying is intended to be used for hastily placing mine barriers on the surface of the ground, relying on the undergrowth for concealment. Similar chutes are used from helicopters.

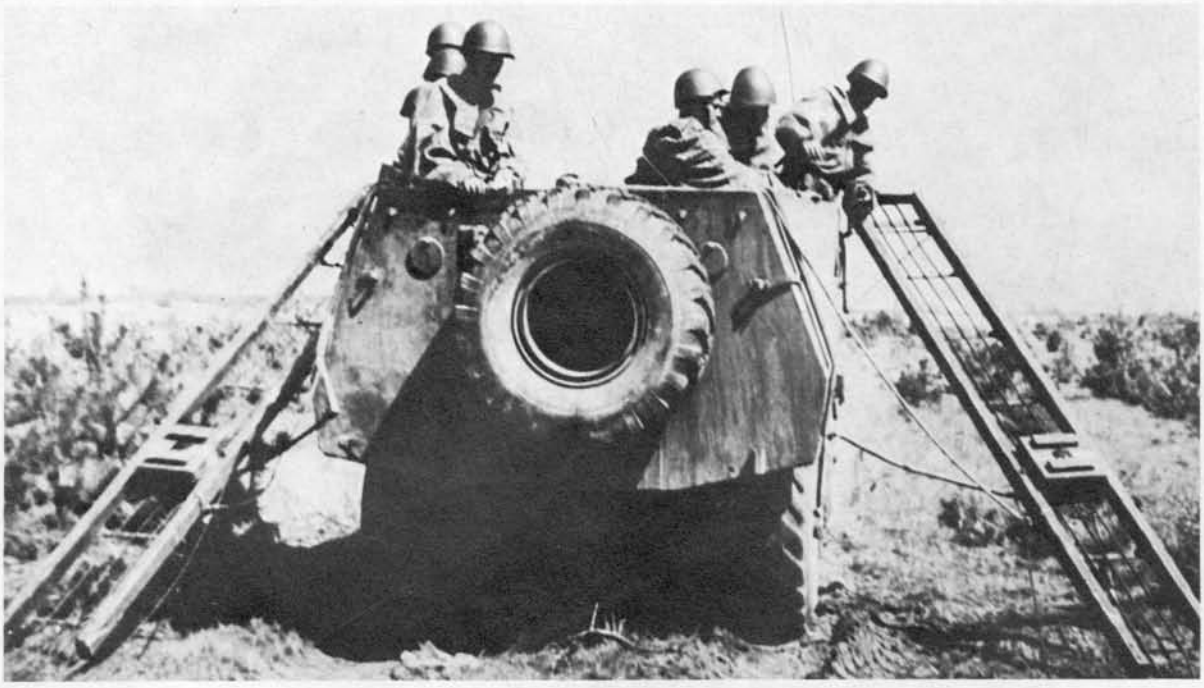
The PMR-2 mechanical minelaying trailer was used by a number of Warsaw Pact armies before the improved PMR-3 appeared. The PMR-2, which is towed either by a truck or a BTR-152, consists of two chutes. The upper part of the chutes have a wide mouth through which the mines are loaded. Double roller conveyors extend along the entire length of the chutes allowing the mines to slide down to the distributing mechanism. This distributing mechanism spaces the mines at 2- or 4-meter intervals. It is chain driven and controlled by a three-position lever mounted on the control box. Unlike later models, the PMR-2 can only lay the mines on the surface of the ground.

The PMR-3 mechanical-minelaying trailer is still used by a number of Warsaw Pact armies and has been exported to the Middle East. It is the first Soviet model which can bury mines as well as lay them on top of the ground. Normally the PMR-3 is towed by a modified BTR-152, which has storage racks for 120 antitank mines of the TM-46 or similar types. In addition to the driver of the armored personnel carrier, the PMR-3 has a crew of three men, the two mine feeders riding the armored personnel carriers and the equipment operator who rides the PMR-3. The operator selects the minelaying interval by a selector lever and also controls the choice of open or buried laying.

The East German MLG-60 is similar in outward appearance to the older Soviet PMR-3 and has similar operational characteristics. It can be identified, however, by the large twin follow-up scraper mounted high on the rear of the trailer.

The great advantage of the MLG-60 is that no one is required to ride the trailer as in the case of the PMR-3, thus allowing the use of the equipment when under fire.

		PMR-2	PMR-3	MLG-60
weight	kg			
length	mm		3000	
width	mm		2000	
height	mm		2500	
track	mm			
tire size			7.50 x 20	
mine spacing	m	2 or 4	4 or 5.5	4 to 6
burial depth (soft soil)	cm		30 to 40	

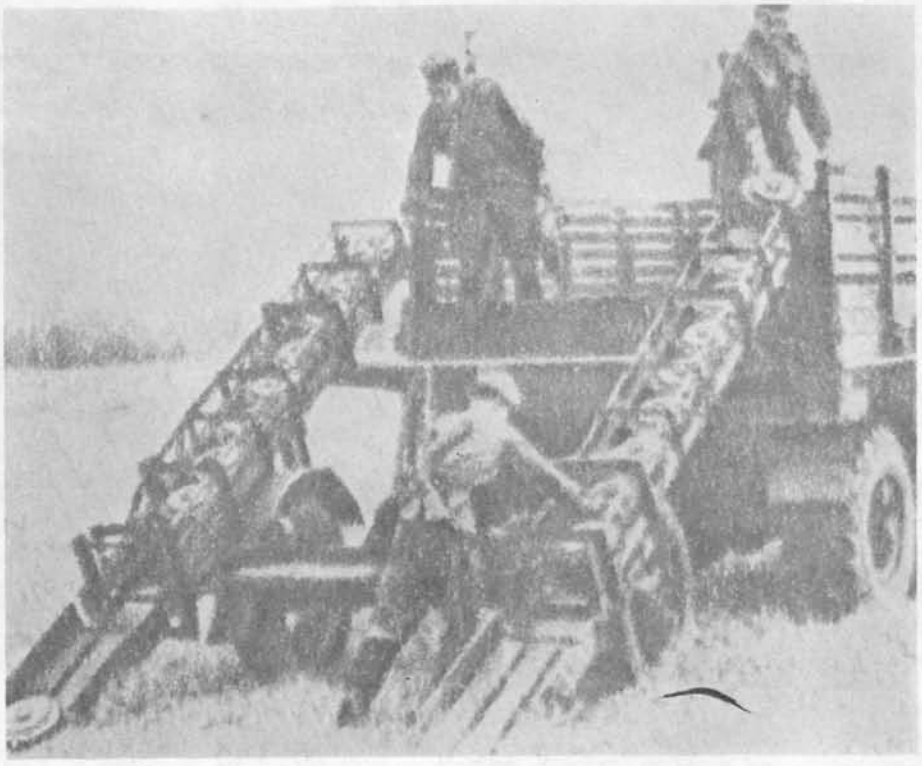




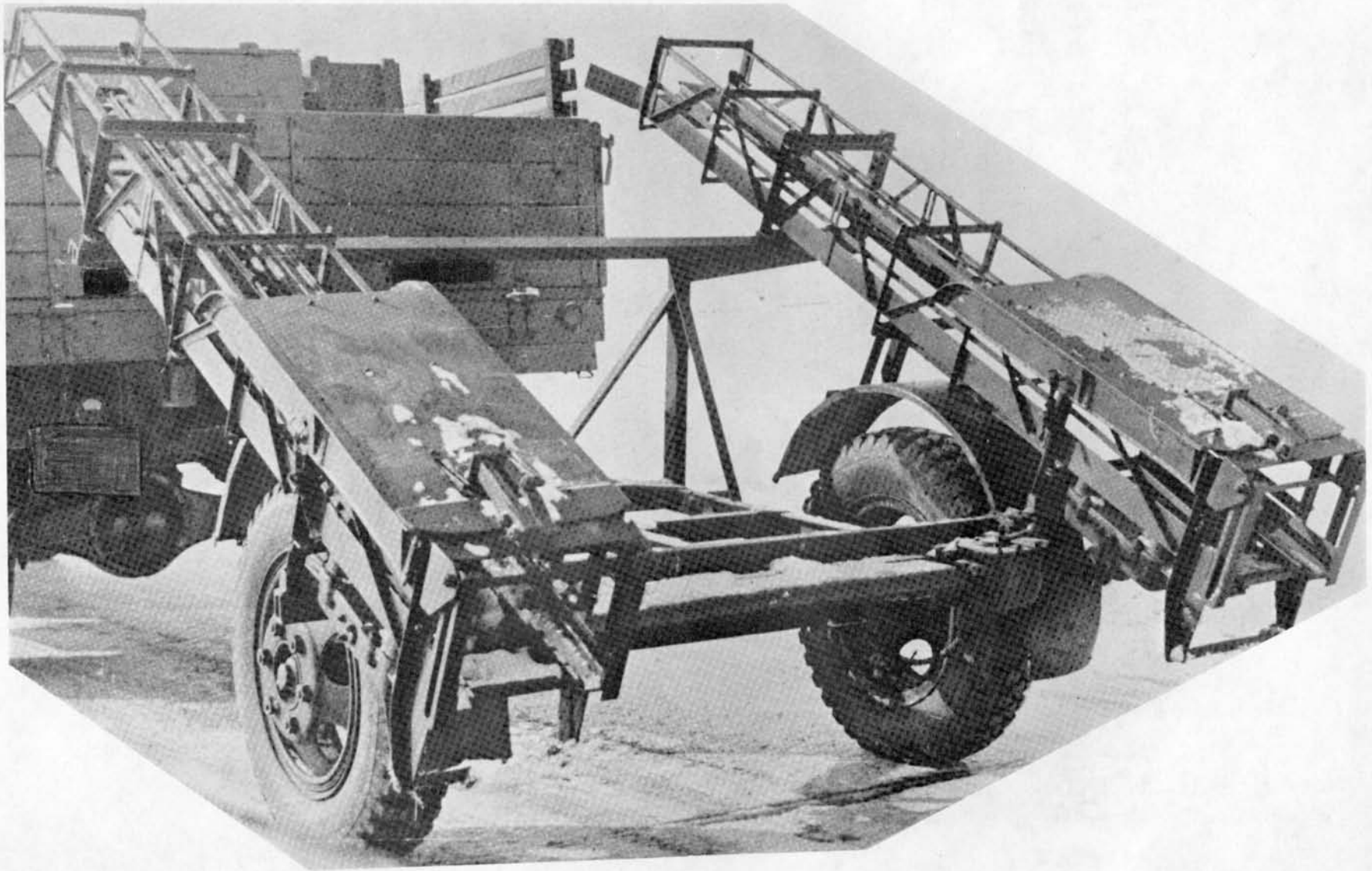
Polish Troops Employing
Minelaying Chutes with BTR-152



Soviet Mechanical Minelayer PMR-2
In Travel--Towed by GAZ-63 Truck



Soviet Mechanical Minelayer PMR-2 in Action



Soviet Mechanical Minelayer PMR-2



Towed by Truck with Romanian Troops

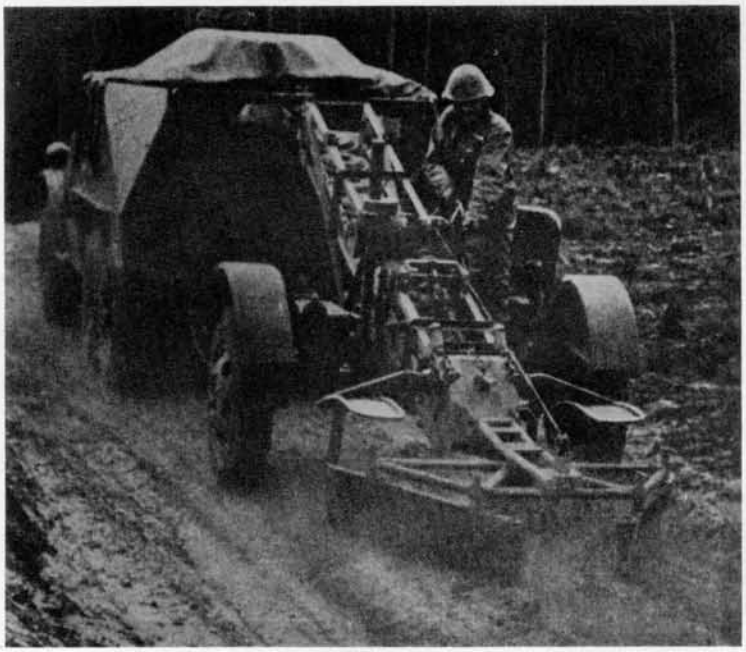


Towed by BTR-152V Armored Personnel Carrier with East German Troops

Soviet Mechanical Minelayer PMR-3



In Travel



In Action

East German Troops with PMR-3 Mechanical Minelayer
Towed by BTR-152V Armored Personnel Carrier





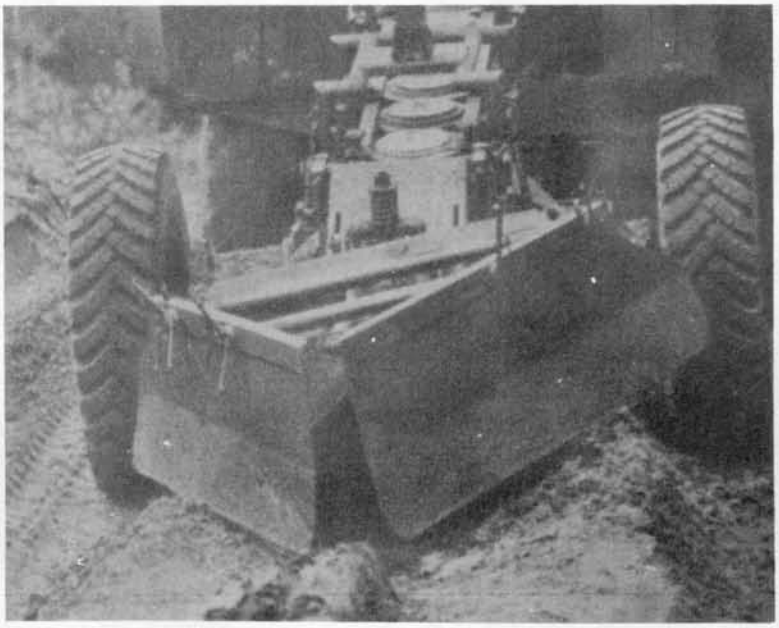
Yugoslav Troops

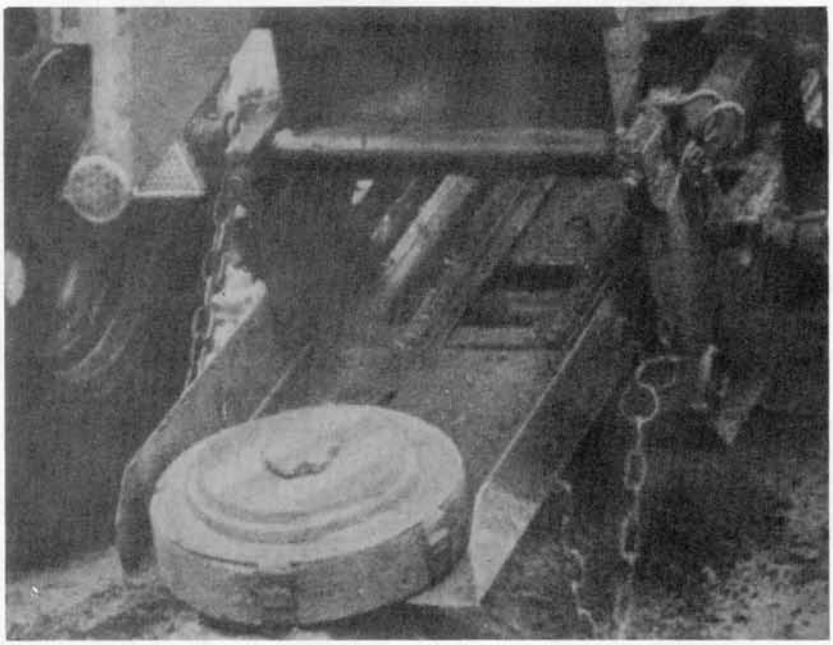
Soviet Mechanical Minelayer PMR-3



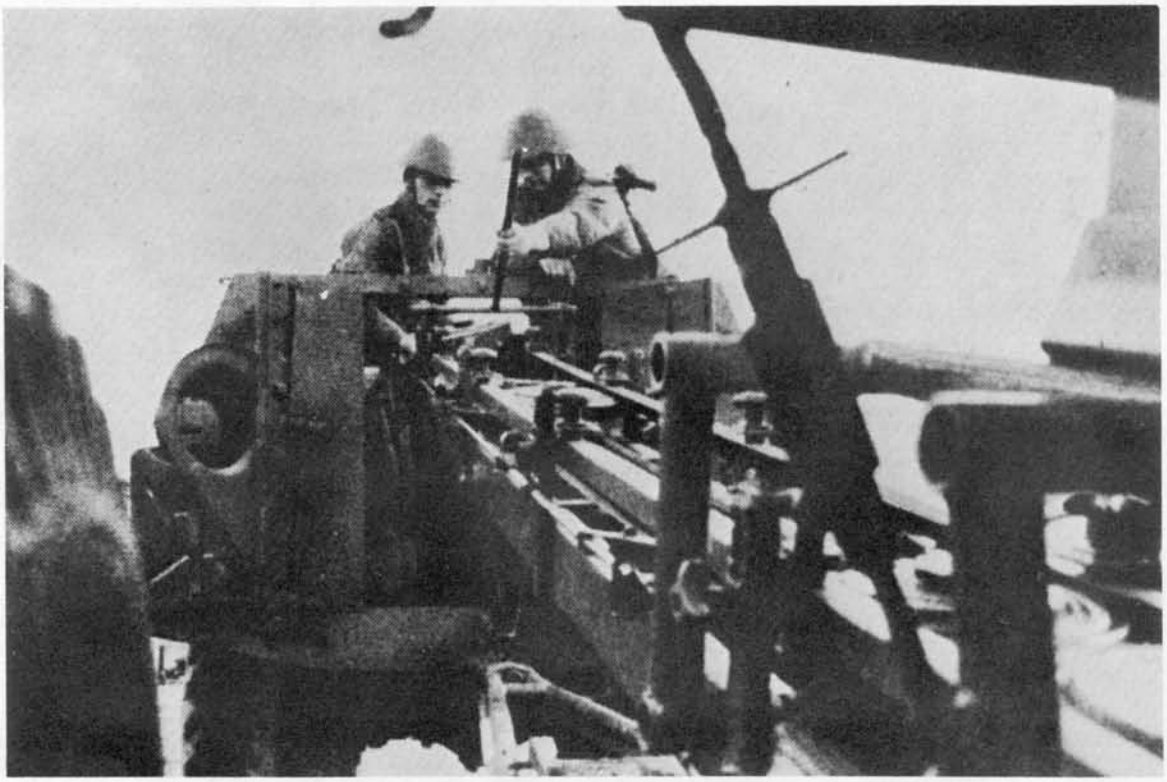


East German Mechanical Minelayer
MLG-60 Towed by BTR-152V

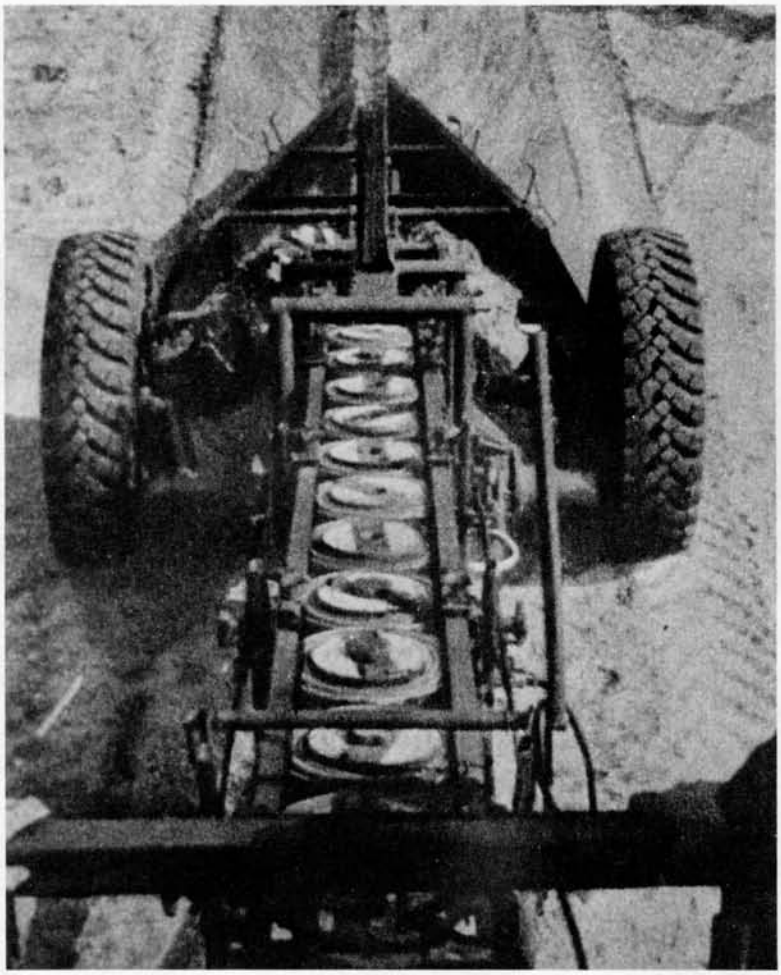




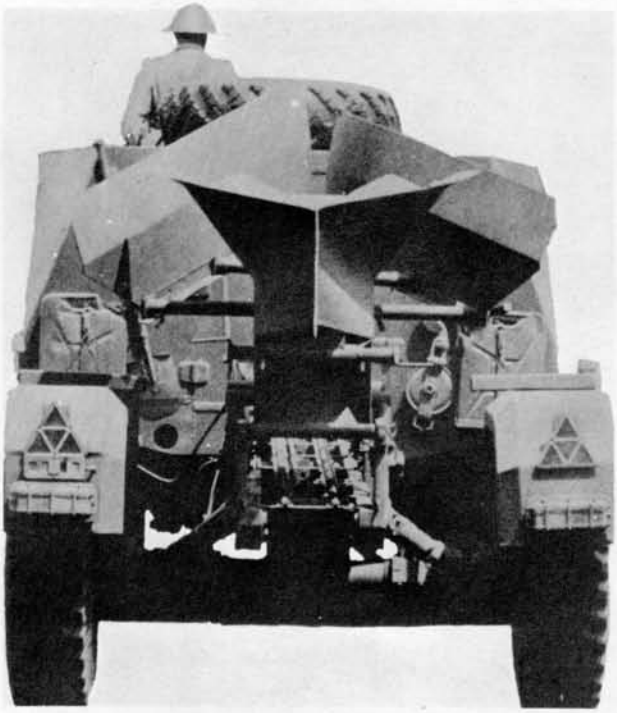
East German Mechanical Minelayer MLG-60



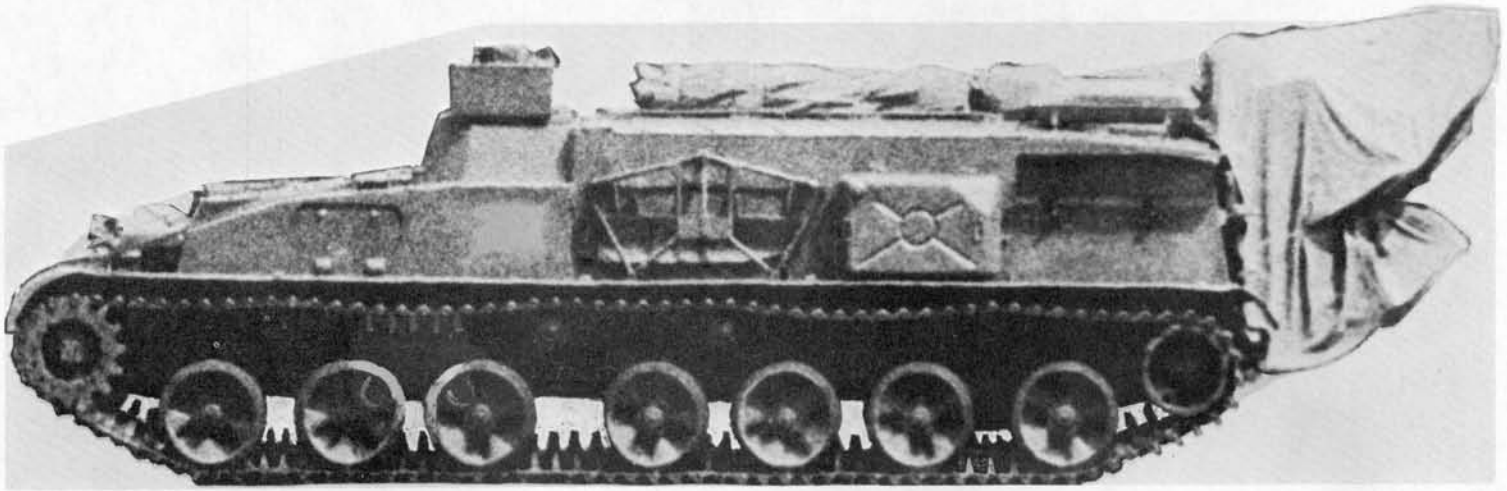
East German Mechanical Minelayer MLG-60



East German Mechanical Minelayer MLG-60



East German Mechanical
Minelayer MLG-60



Soviet Armored Tracked Mechanical Minelayer GMZ

ARMORED TRACKED MECHANICAL MINELAYER GMZ

The GMZ armored tracked mechanical minelayer is one of the latest and most sophisticated of Soviet mechanical mine-laying devices. In functioning it resembles the towed PMR-3 and MLG-60 minelayers, but instead of being towed behind the prime mover, the mine plow is attached to the rear of a fully armored tracked vehicle.

The tracked vehicle, which carries the supply of mines and the entire crew, has the same basic chassis as that of the transporter-erector-launcher for the SA-4 GANEF surface-to-air guided missile. The forward location of the engine allows sufficient space in the rear of the vehicle for mine stowage and for the mine plow mechanism.

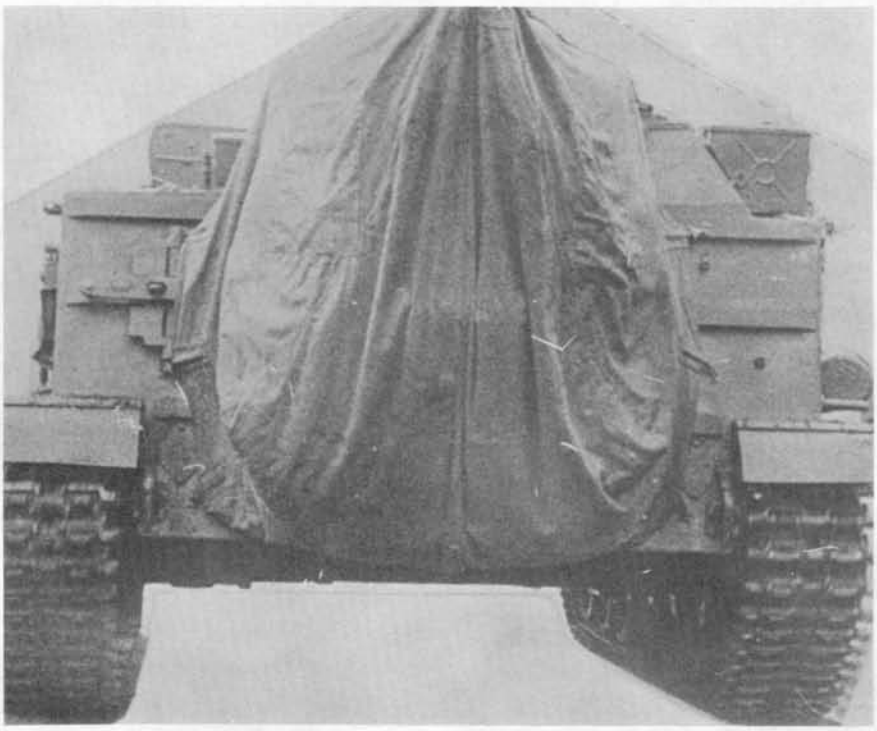
The GMZ is equipped with infrared night driving and other vision aids so that it can operate and lay mines under the cover of darkness. The vehicle can also be armed with a 14.5 mm KPVT heavy machinegun.

GMZ

weight	t	
length*	mm	7500
width	mm	3200
height**	mm	2500
track	mm	2660
clearance	mm	
track width	mm	540
ground contact	mm	5000
engine model		
horsepower		
cylinders		
fuel		diesel
cooling		water
speed	km/h	
cruising range	km	
fuel capacity	l	
fuel consumption	l/100km	
ground pressure	kg/cm^2	
trench	mm	
step	mm	
slope	°	
tilt	°	
ford	mm	
armor: glacis plate	mm/°	
upper hull side	mm/°	
crew		4
mine capacity		

*vehicle only, with plow in working position **9.1 m**
with plow in travel position **10.3 m**

**to top of plow in travel position
2.7 m to top of rear searchlight





Soviet Armored Tracked
Mechanical Minelayer GMZ



Soviet Armored Tracked Mechanical Minelayer GMZ

MINELAYING HELICOPTERS

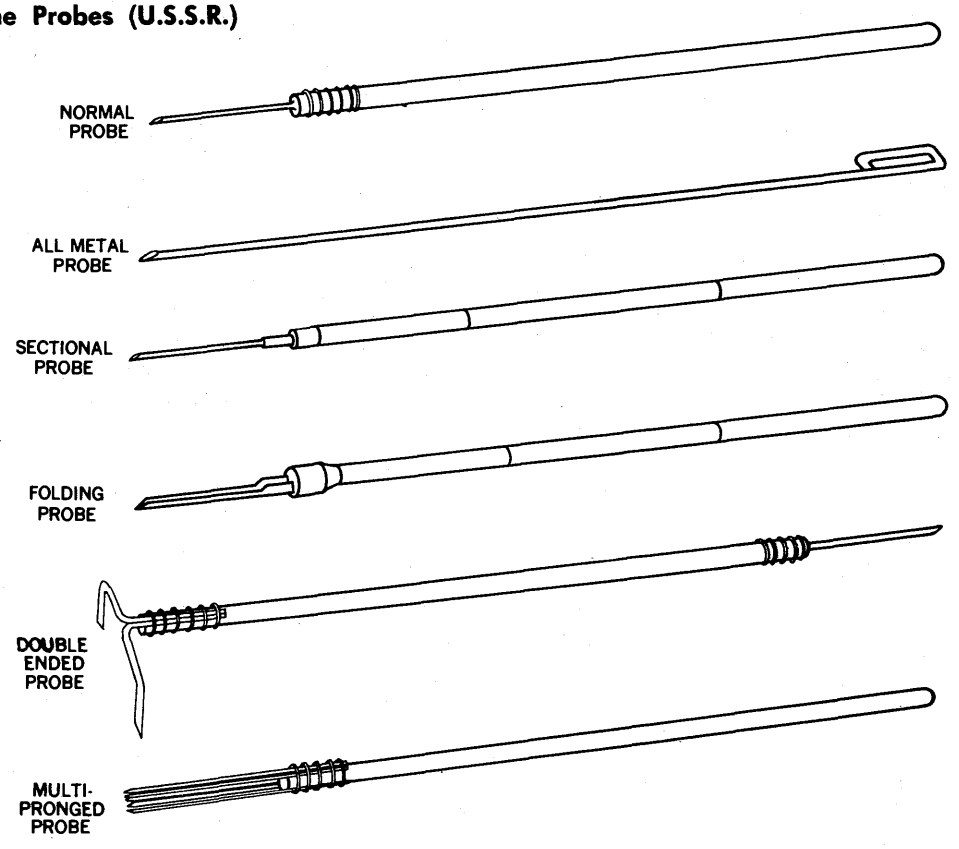
Warsaw Pact countries, especially Poland, have been experimenting with helicopter minelaying techniques. Helicopters such as the Mi-4 (HOUND) illustrated below are well-suited for this purpose, as they can carry approximately 200 metallic antitank mines. The mines, such as the TM-46 with the MVM fuze, are laid openly by means of a chute attached to the side of the aircraft. In spite of the disadvantages of open laying, this technique gives the tactical commander a quick reaction capability to lay a hasty antitank minefield a considerable distance from his unit.



Polish Troops Laying Antitank Mines from Helicopters

MINE DETECTION EQUIPMENT

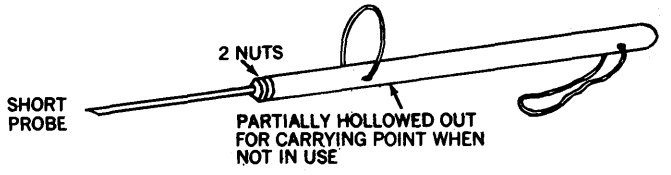
Mine Probes (U.S.S.R.)

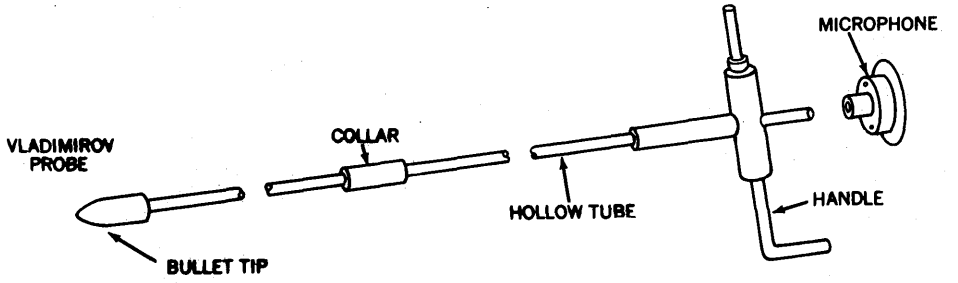


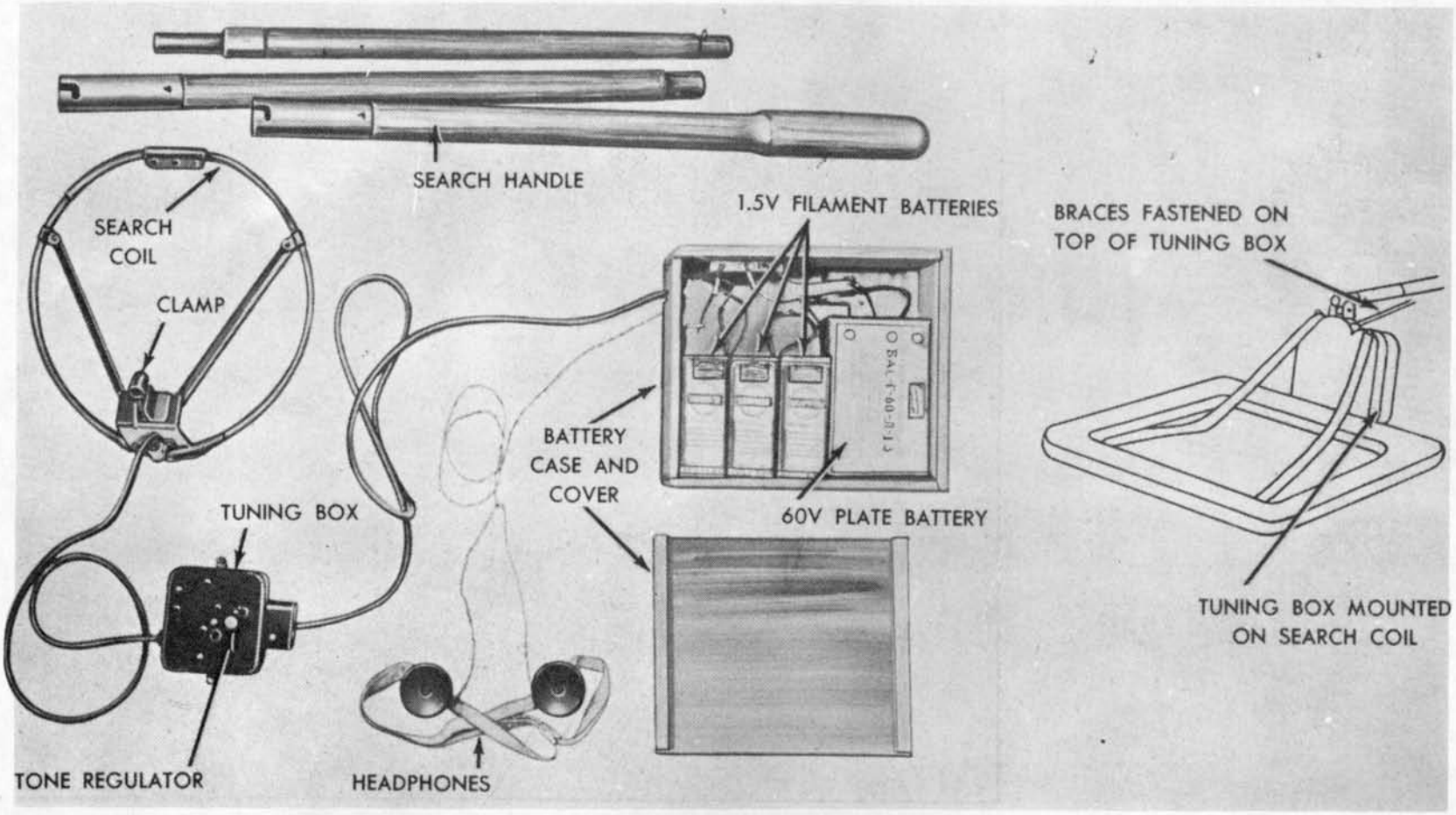
U.S.S.R Mine Probes

MINE PROBES

Mine probes were among the most important Soviet means of locating land mines during World War II. In many cases, the probes were used when electronic mine detectors failed. Many of the Soviet probes were improvised, e.g. bayonets, long knives, and sharp wooden poles. The eight standard probes are designated as: (1) wood, (2) metal, (3) sectional, (4) folding, (5) double-ended, (6) multi-pronged, (7) short, and (8) Vladimirov. The Vladimirov probe, the most complex of all, is used to detect delay fuzes and aerial bombs.







Soviet Mine Detector VIM-203M

MINE DETECTOR VIM-203M

The Soviet VIM-203M metallic mine detector is of World War II vintage. It operates on the beat-frequency oscillation principle and employs two tubes. Two models of the detector are in existence, one using a rectangular and the other a circular-shaped search coil. Both models are similar in operation and may be mounted either on a search handle or a rifle. The circular model, which is described below, is slightly heavier, has a higher "A" battery voltage, a longer continuous operating life (30 hours), and a reported detection range of from 20 to 30 cm for buried metallic mines.

Detector Head Assembly	38 cm diameter, weight 6.6 kg
Search Handle	1.83 m, three-section pole, or rifle
Tuning Box	Contains two oscillator-amplifier tubes mounted on search handle
Power Supply	Case contains an "A" battery of three 1.5-volt dry cells and a 60-volt "B" battery, carried in a haversack; weight 5.4 kg
Controls	Tone regulator located in tuning box
Aural Indicators	Headphones
Carrying Case	Disassembled detector packed in the one haversack containing the power supply
Total Weight	10 kg

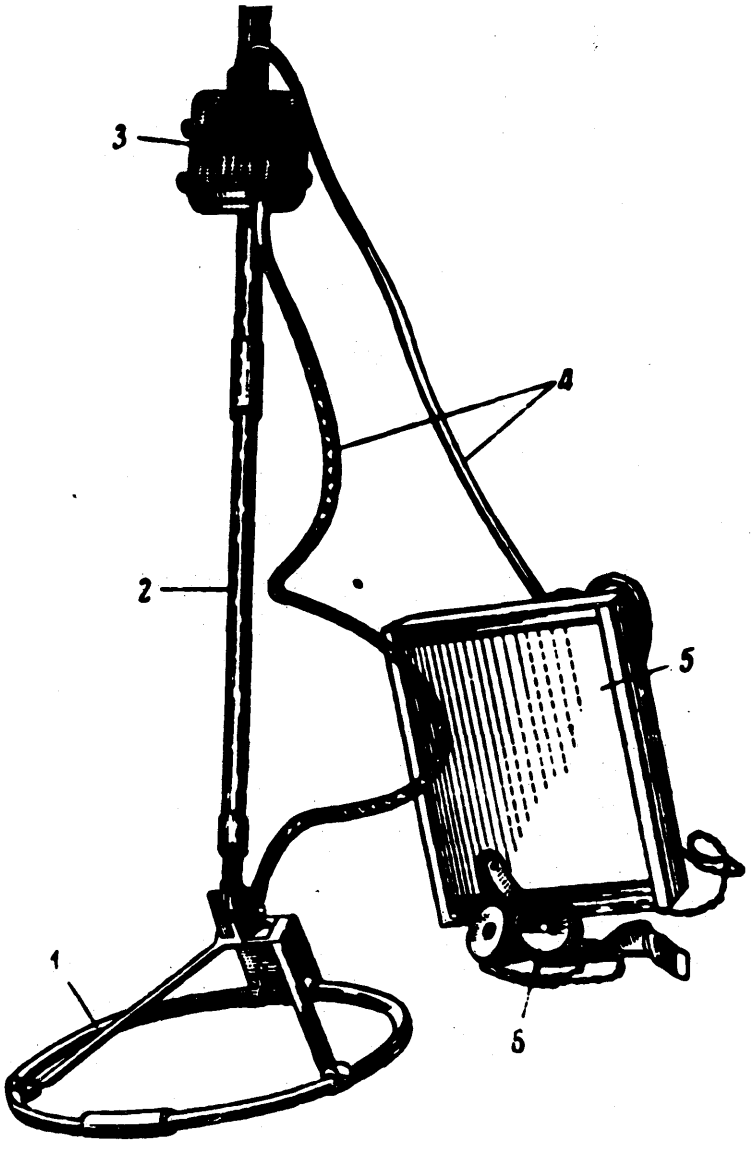


Soviet Mine Detector
VIM-625 or VIM-695 Model 1942

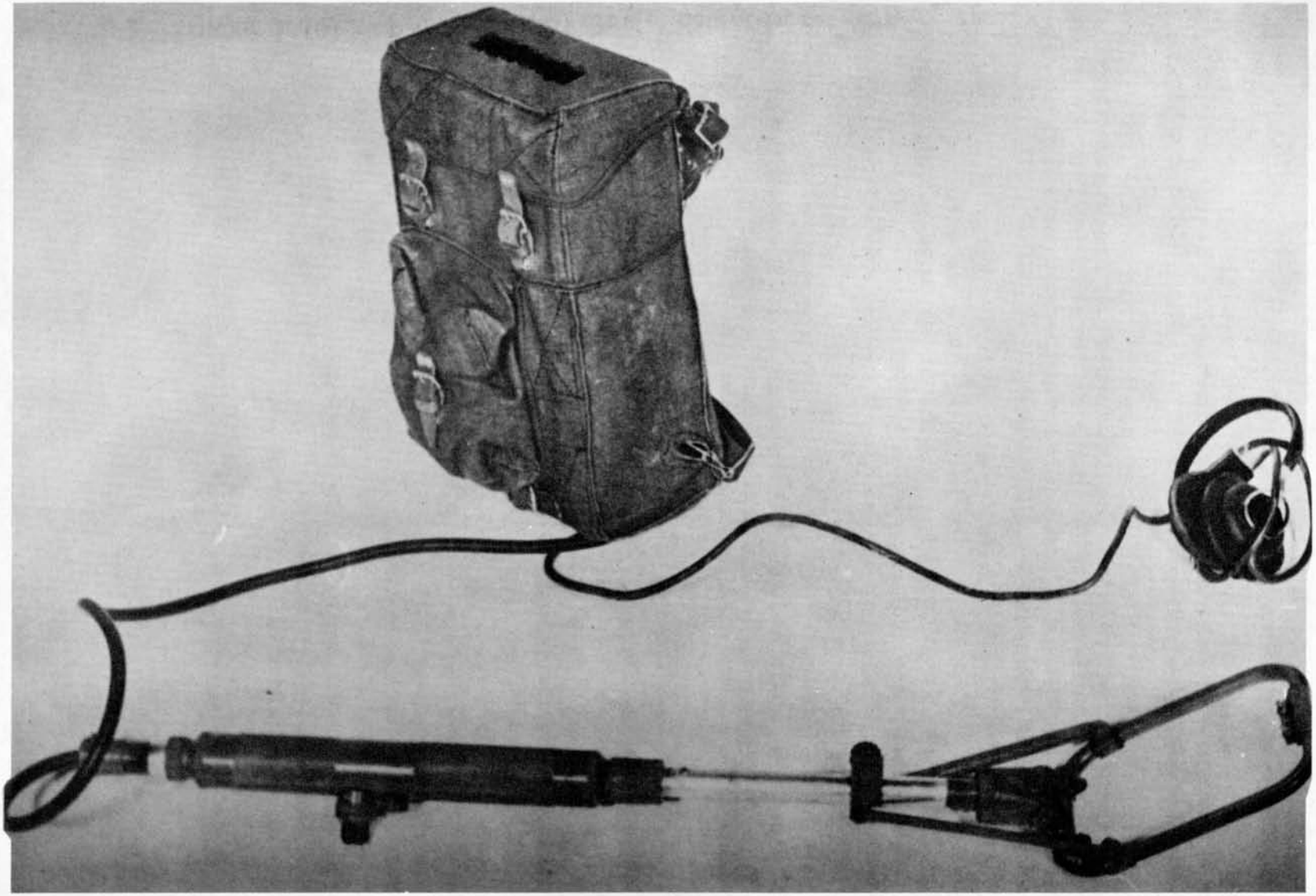
MINE DETECTORS VIM-625 MODEL 1942 AND VIM-695 MODEL 1942

These two Soviet World War II metallic mine detectors are identical in operation and very similar in appearance to the VIM-203M of the same vintage. The only recognizable difference is that the VIM-625 and VIM-695 have the tuning control located approximately in the center of the face of the tuning box, on the side away from the operator. Both models can be mounted on a rifle as well as a normal search handle. The continuous operating life is 10 hours.

Detector Head Assembly	38 cm in diameter, weight 6 kg, rubber insulated coil either circular or rectangular
Search Handle	Pole or rifle
Tuning Box	Mounted on search handle or on detector-head assembly, contains one oscillator-amplifier tube
Power Supply	Case contains "A" battery of 2.8-volt wet cell(s) and a "B" battery 60-volt dry cell; weight 5.1 kg
Controls	Tone regulator is located in center of the side of tuning box opposite operator
Aural Indicators	Headphones
Carrying Case	Contains power supply and detector
Total Weight	11 kg



Soviet Mine Detector
VIM--625 or VIM-695 Model 1942



Soviet Mine Detector UMIV-1

MINE DETECTOR UMIV-1

The UMIV-1 is a post-World War II Soviet metallic mine detector. It consists of the search assembly with handle, the back pack with control box, and the headset. The search assembly consists of a metal handle which is attached to a rectangular search head. The handle consists of four pieces, two of which are detachable. The upper part of the handle is slightly larger in diameter than the lower part. The switch for regulating the volume of the sound is located in the upper portion of the handle. The UMIV-1 can detect metallic objects at a depth of 45 cm. It cannot work under water.

Detector Head Assembly	22 cm long, 14.6 cm wide
Search Handle	Two pieces 66 cm long, four pieces 130 cm long
Tuning Box	Mounted in search handle containing two single-tube oscillators
Power Supply	Case contains 3-volt filament supply, and 70-volt plate supply
Controls	Tone regulator is located on upper search handle
Carrying Cases	One for power supply, one for spare parts
Total Weight	6.6 kg

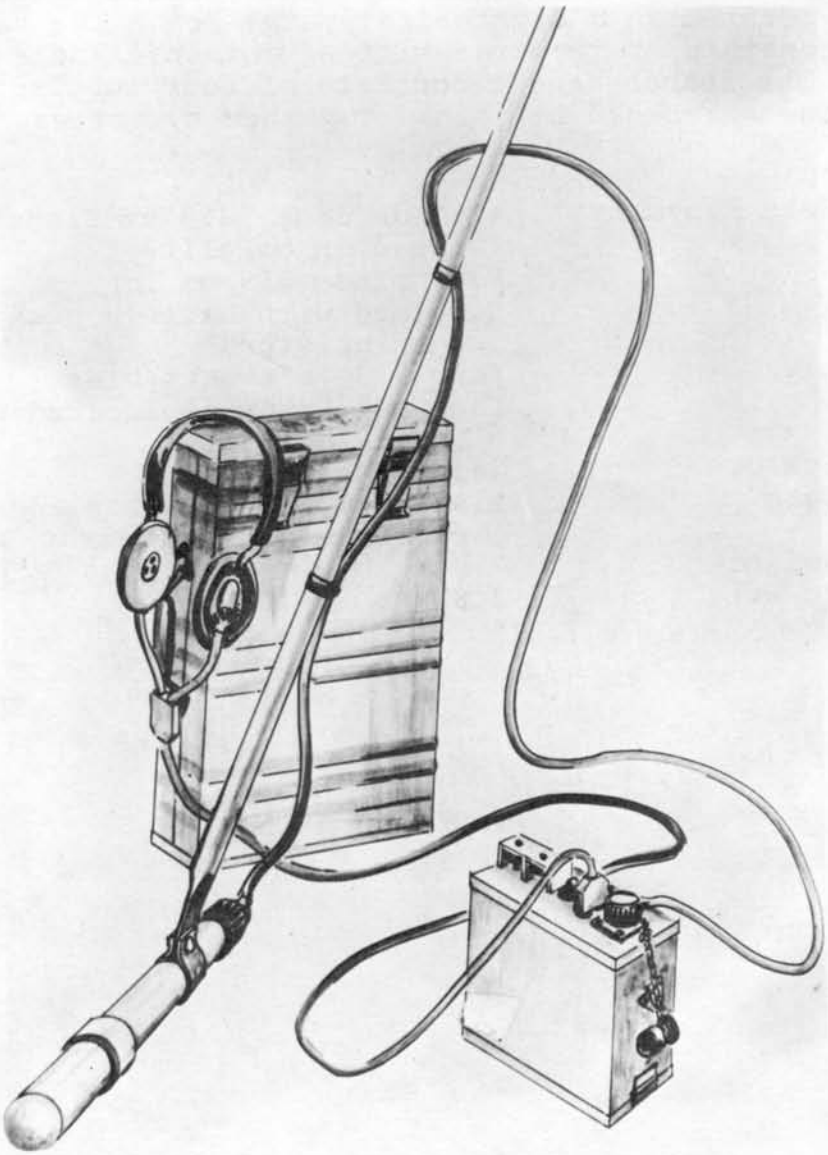


Soviet Mine Detector UMIV-1





Soviet Mine Detector UMIV-1

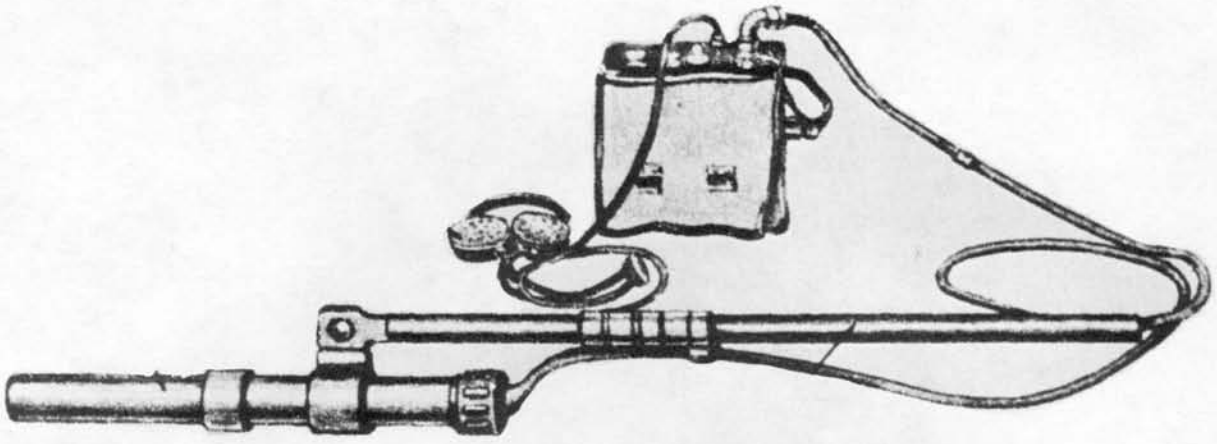


Soviet Mine Detector IMP

MINE DETECTOR IMP

The Soviet IMP mine detector is a lightweight, all-transistorized model capable of detecting metallic mines and mines that have metallic fuzes. The IMP also has an underwater detection capability up to 1 meter in depth. The detector set consists of a tuning box (amplifier), battery pack, headset assembly, and a detector carrying case. The amplifier system consists of five transistors and related components which are mounted in a lightweight metal box. The search assembly consists of two transmitting antennae and a receiving antenna. The search handle consists of four tubular aluminum sections which can be joined together by screws.

Detector Head Assembly	41.7 cm long, 3.8 cm diameter; encased in bakelite
Search Handle	Four piece 158 cm long
Tuning Box	Combined with battery pack, contains 5 transistors
Power Supply	Four 1.6-volt batteries
Controls	Tone regulator is located on top of tuning box
Aural Indicators	Headphones
Carrying Case	Dissassembled detector and tuning box carried in lightweight metal case
Detector Weight	7.2 kg
Extra Parts Weight	2.6 kg





Soviet Mine Detector IMP

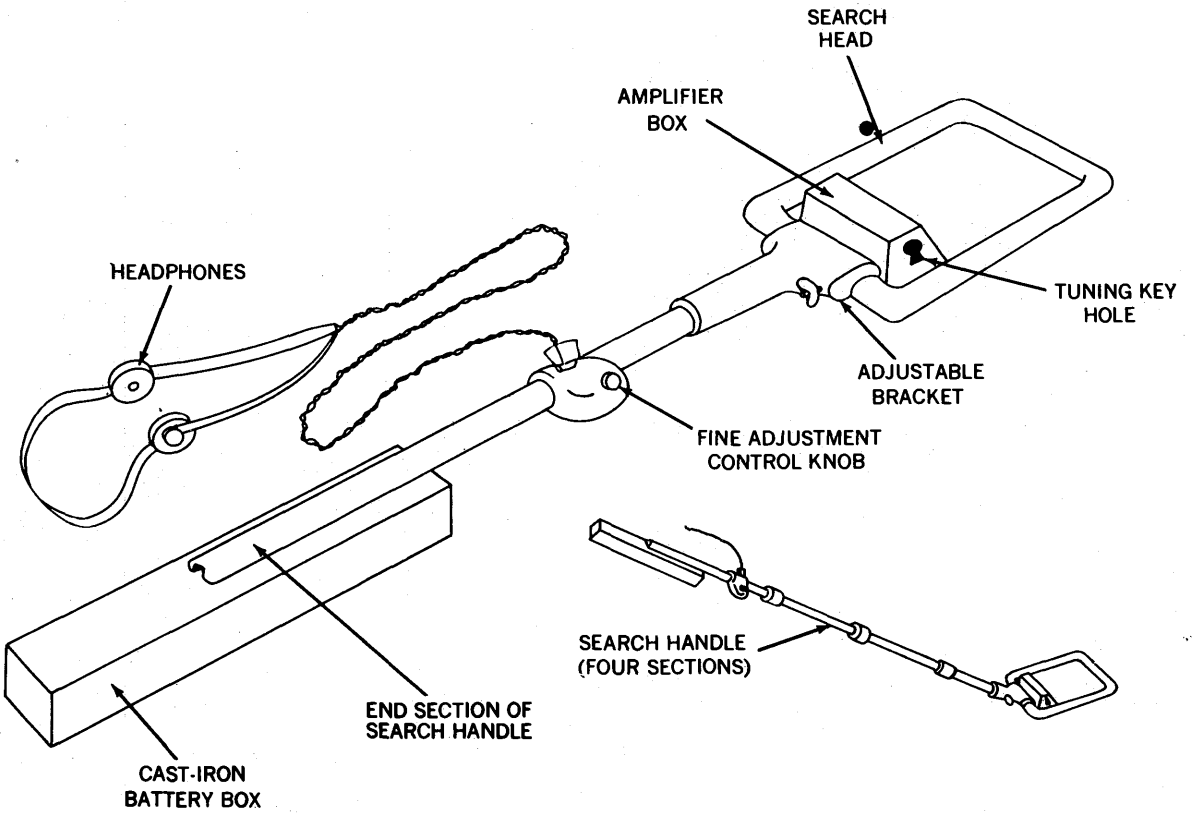


Bulgarian Mine Detector
VISF 1943 or 1944

MINE DETECTORS VISF MODELS 1943 AND 1944

The Bulgarian World War II metallic mine detectors VISF 1943 and 1944 were modeled after the German Berlin 40. The Model 1944 differs from the Model 1943 only in a minor change in the circuit which permits the use of a **easily obtainable** tube instead of the eight-element type. However, both models operate on the beat-frequency oscillator (heterodyne) principle.

Detector Head Assembly	41 cm long, 25.4 cm wide, fiber conduit
Search Handle	Two-jointed hollow wooden rods
Tuning Box	Wooden; contains two oscillator tubes
Power Supply	Dry cell "A" battery 1.5 **volts**; wet cell "B" battery 60 volts
Aural Indicators	Headphones
Carrying Case	Canvas haversack
Total Weight	9 kg

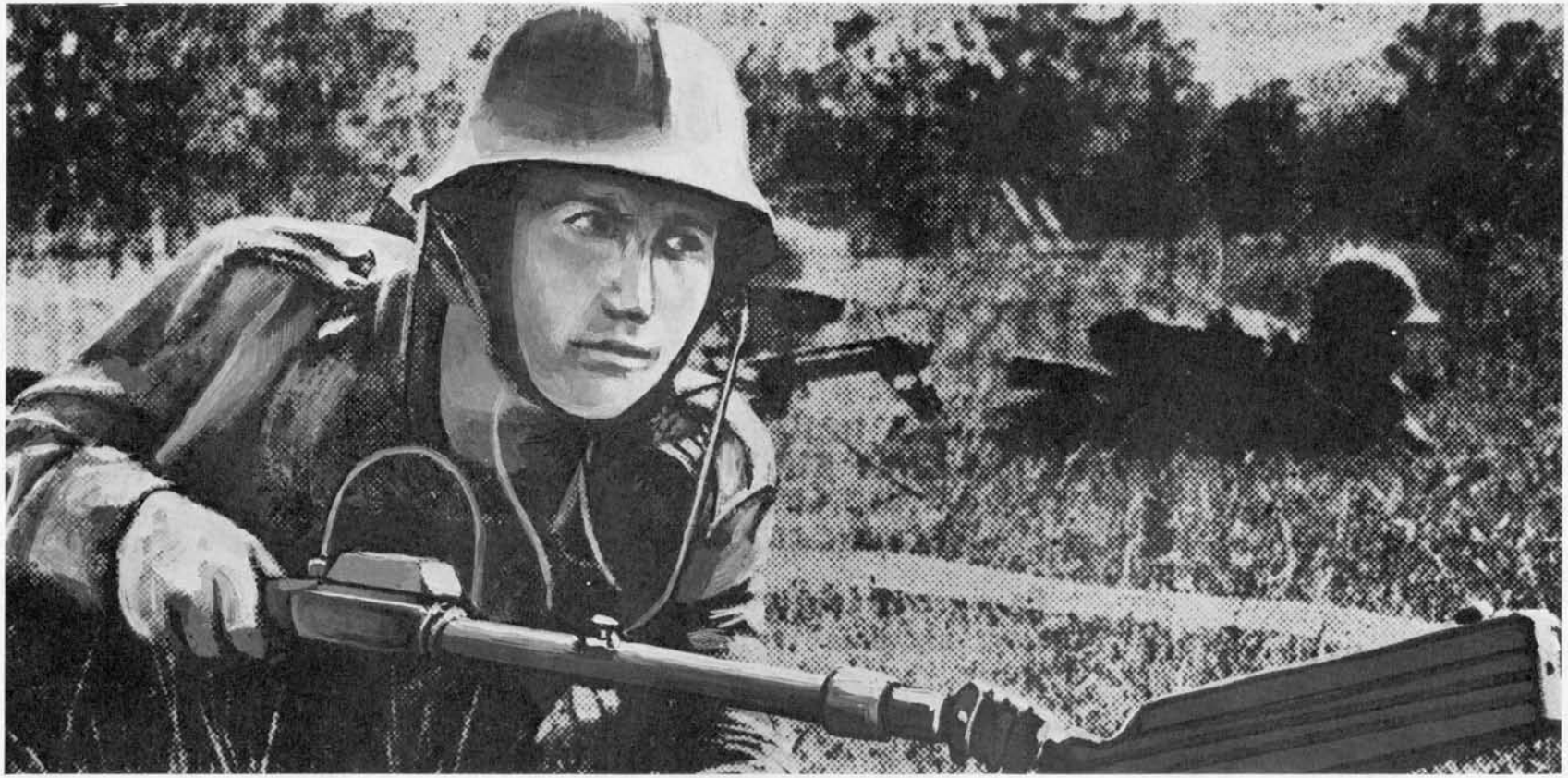


Bulgarian Mine Detector VISF Model 1946

MINE DETECTOR VISF MODEL 1946

This Bulgarian mine detector is an improved version of the Soviet World War II VIM-203. It differs from the earlier Bulgarian models in that it has all of the component parts attached to the search handle, has about twice the detection range, is considerably lighter, and has an adjustable handle.

Detector Head Assembly	Rectangular, hollow-wooden, metal-covered frame
Search Handle	Four-jointed hollow wooden rods
Tuning Box	Aluminum, containing two pentode oscillators and one pentode amplifier
Power Supply	Dry cell "A" battery 1.5 volts; wet cell "B" battery 60 volts
Controls	Tone regulator located on upper section of search handle
Aural Indicators	Headphones
Carrying Case	Canvas haversack
Total Weight	6.2 kg

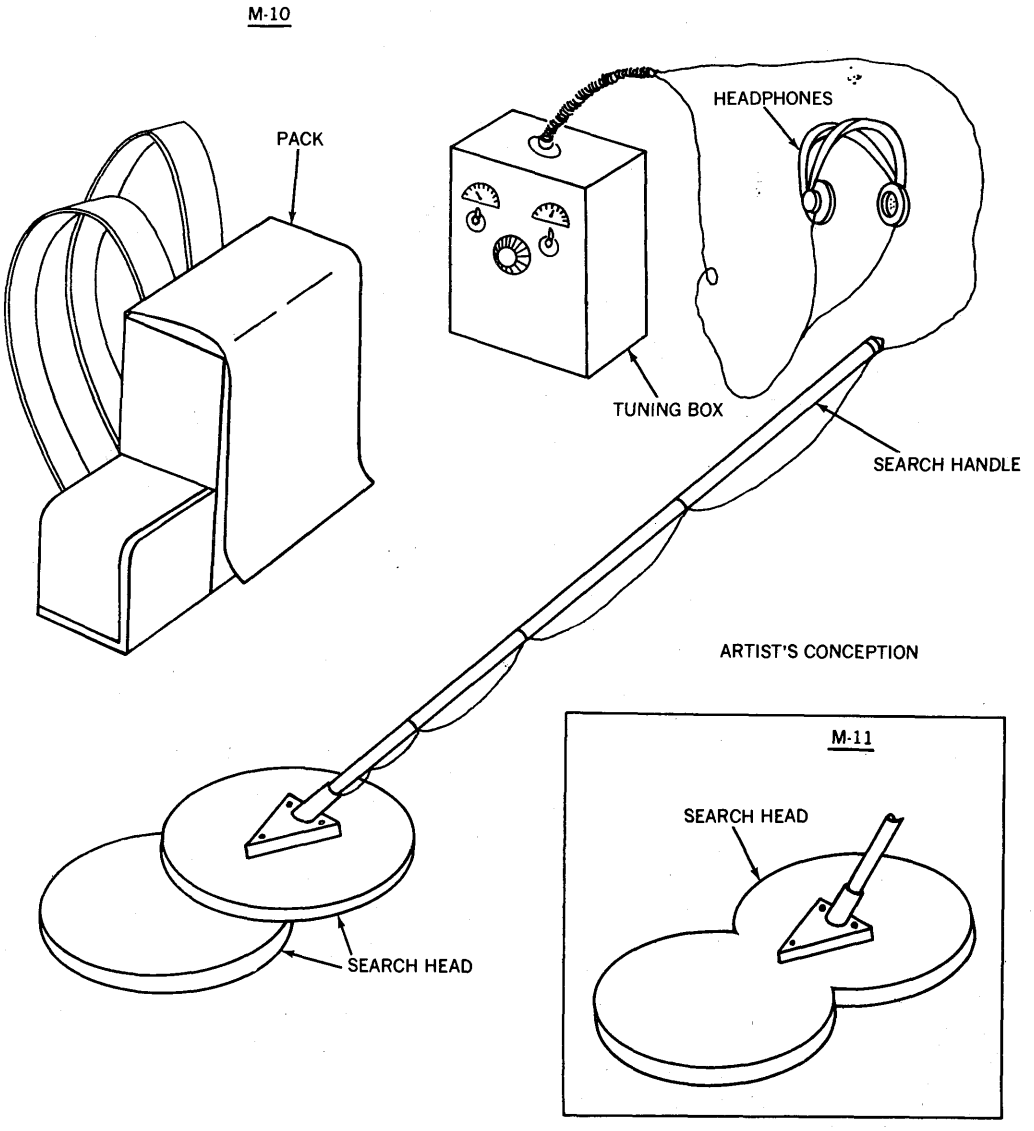


Bulgarian Mine Detector M62

MINE DETECTOR M62

The Bulgarian M62 mine detector is the newest model produced in that country. It is of the induction-coil, low-frequency type which can operate either on current from power grids or can use flashlight batteries. The detector has a range of 50 cm for mines of a diameter of 300 mm. It can detect metallic mines and mines with metallic fuzes.

Detector Head Assembly	Oblong shaped
Search Handle	
Tuning Box	
Power Supply	
Controls	
Aural Indicators	Headphones
Carrying Case	
Total Weight	2.5 kg

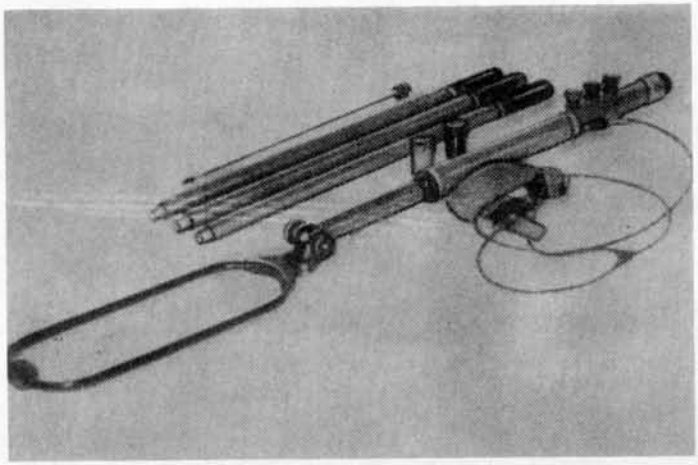


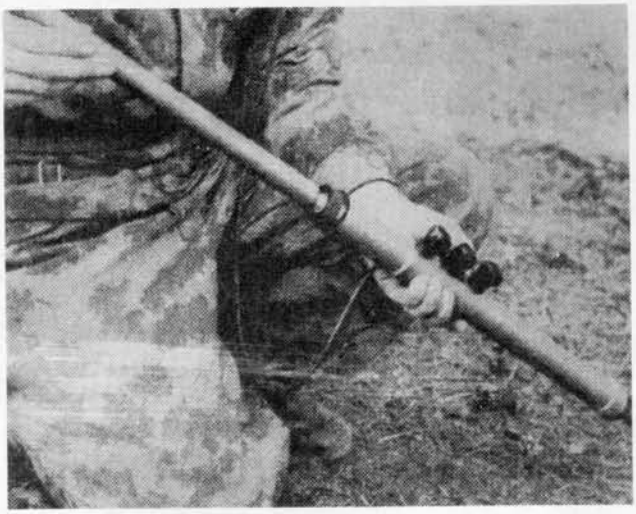
Czechoslovak Mine Detectors M-10 and M-11

MINE DETECTORS M-10 AND M-11

The Czechoslovak M-10 and M-11 mine detectors operate on the beat-frequency oscillation principle and differ only in the construction of the search head. The M-11, although of the same shape as the M-10, consists of a single, continuous plate.

Detector Head Assembly:	M-10	Two detachable plates 30 cm diameter, overlapping by 10 cm
	M-11	Single plate of same shape and dimensions
Search Handle		Four jointed aluminum alloy sections each 50 cm long
Tuning Box		Carried in pack
Power Supply		3 dry cells 20 to 25 volts
Controls		Tone regulator located in tuning box
Aural Indicators		Headphones
Total Weight		12 kg







East German Mine Detector MSG 64

MINE DETECTOR MSG 64

The East German MSG 64 metallic mine detector is a lightweight model of conventional operation, which is noteworthy in that the power supply and electronic components are all located in the detector head and search handle. It can be used underwater. Metal objects 5 cm in size can be detected at a distance of 18 cm.

Detector Head Assembly	Waterproof oval coil
Search Handle	3-piece 240 cm long
Tuning Box	Mounted in search handle, lower portion contains two oscillators
Power Supply	Four 1.2-volt dry batteries located in lower portion of search handle
Controls	Tone regulator is located on lower portion of search handle
Aural Indicators	Headphones
Carrying Case	Disassembled detector carried in camouflage-color water-repellent canvas case
Weight of Detector	2.35 kg
Total Weight	4.4 kg



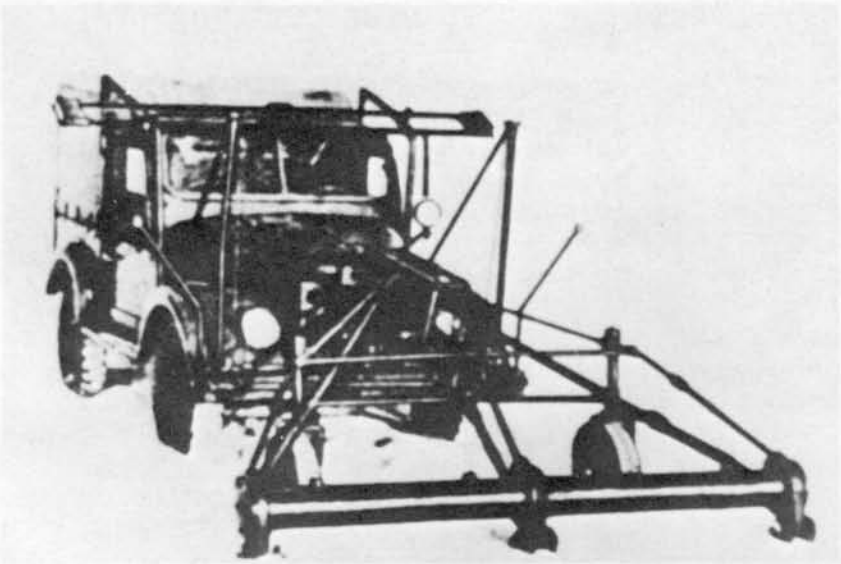


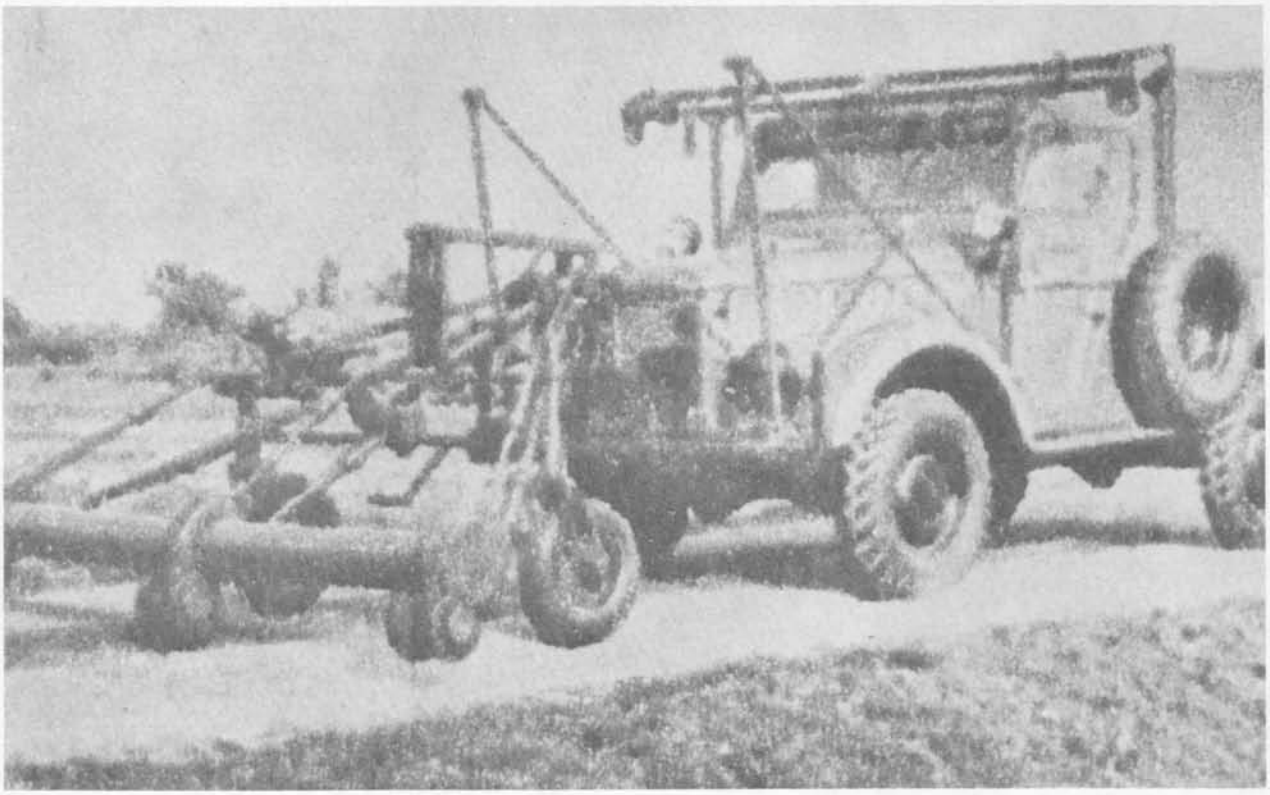
Soviet Vehicle-Mounted
Mine Detector DIM Travel Position

VEHICLE-MOUNTED MINE DETECTOR DIM

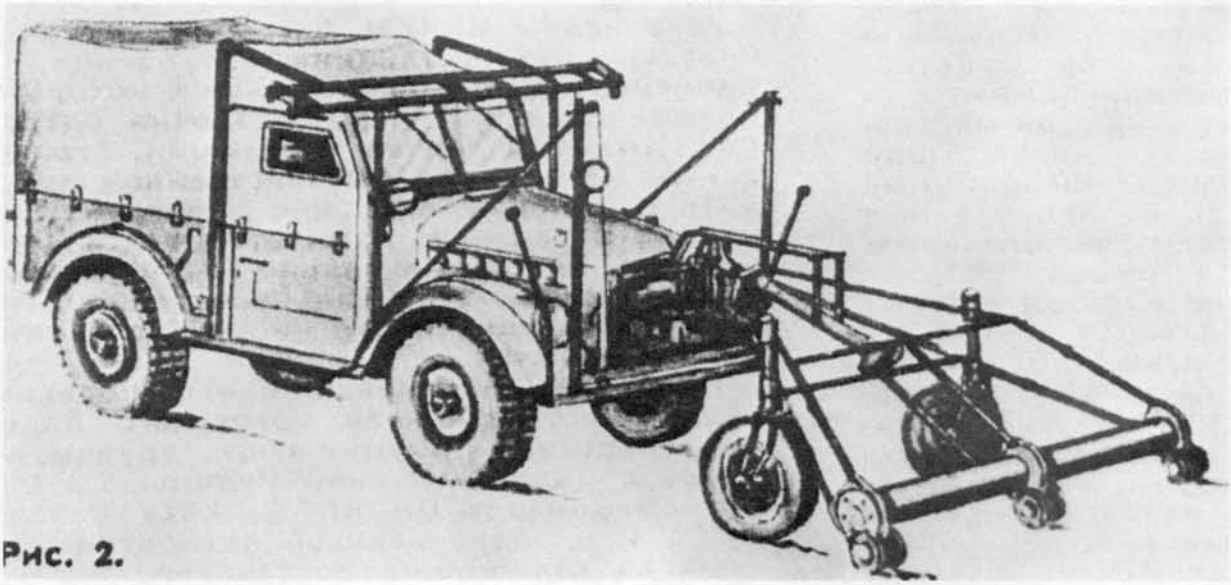
The Soviet DIM "road induction minesweeper" consists of a UAZ-69 truck modified to mount a nonmagnetic sensing head which is supported by a frame attached to the front bumper. It is very similar to mine detectors mounted on United States jeeps. Its primary role is to detect mines laid in roads or on airfields. Its cross-country usefulness is limited.

During travel the detector is rotated upwards and rearwards. During operation the detector is lowered and rests on two rubber-tired wheels. When operating, the detector can be set to operate in the center or to the right or left positions. Maximum operating speed of the vehicle is 10 km/h. On detecting a mine the vehicle is stopped automatically. Maximum detection depth is 25 cm, or 70 cm in fords. The width sweep is 2.2 meters. The DIM has a crew of two. Recently the new UAZ-469 truck has been used in place of the UAZ-69.

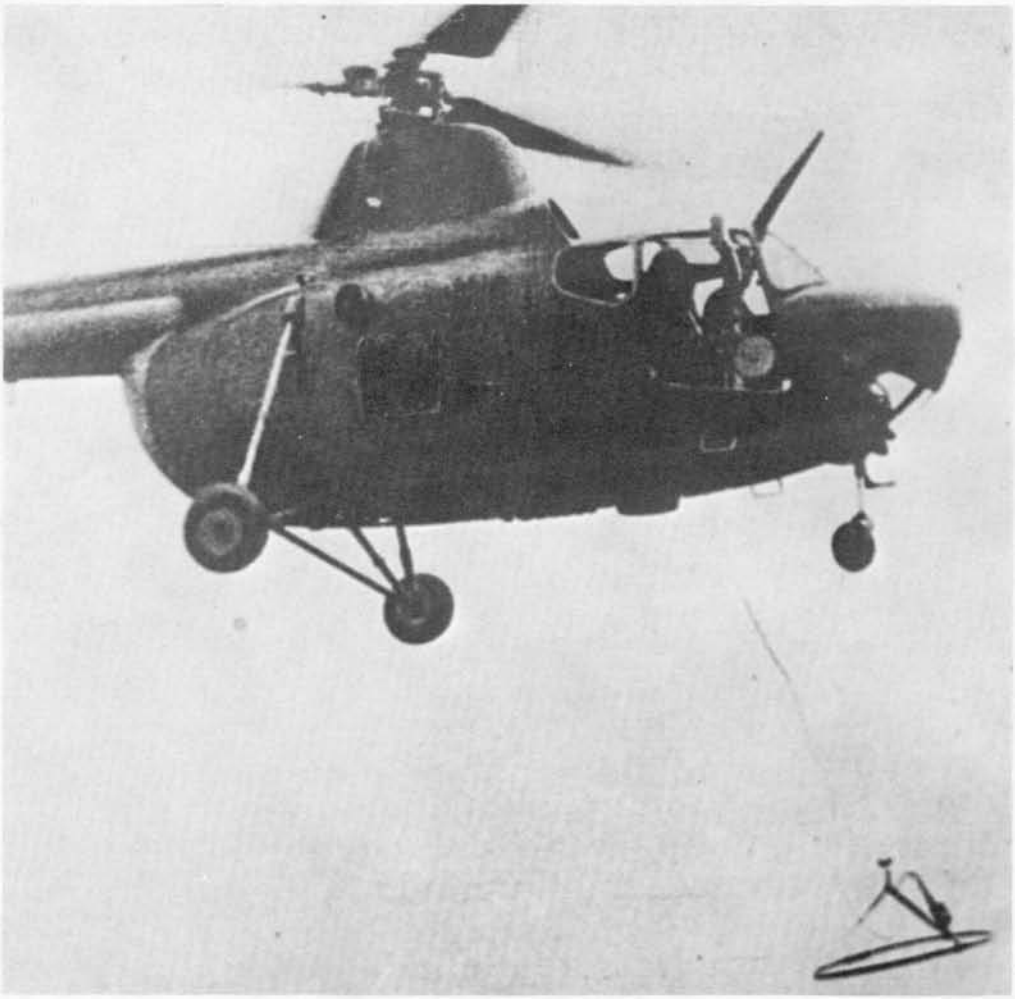




Soviet Vehicle-Mounted
Mine Detector DIM Operational Position



Soviet Vehicle-Mounted Mine
Detector DIM Operational Position



Helicopter with Mine Detector

MINE DETECTING HELICOPTERS

Warsaw Pact countries, especially Poland, have been experimenting with helicopters in the detection of minefields. The helicopter flies over a suspected minefield until a distinct pattern is determined. Once it has been determined that a minefield exists, breaching action can be initiated. The helicopter method of minefield location allows sufficient time for commanders to dispatch men and equipment in advance of their forces to breach the minefields.

MINEFIELD BREACHING EQUIPMENT

Mine Clearing Kits

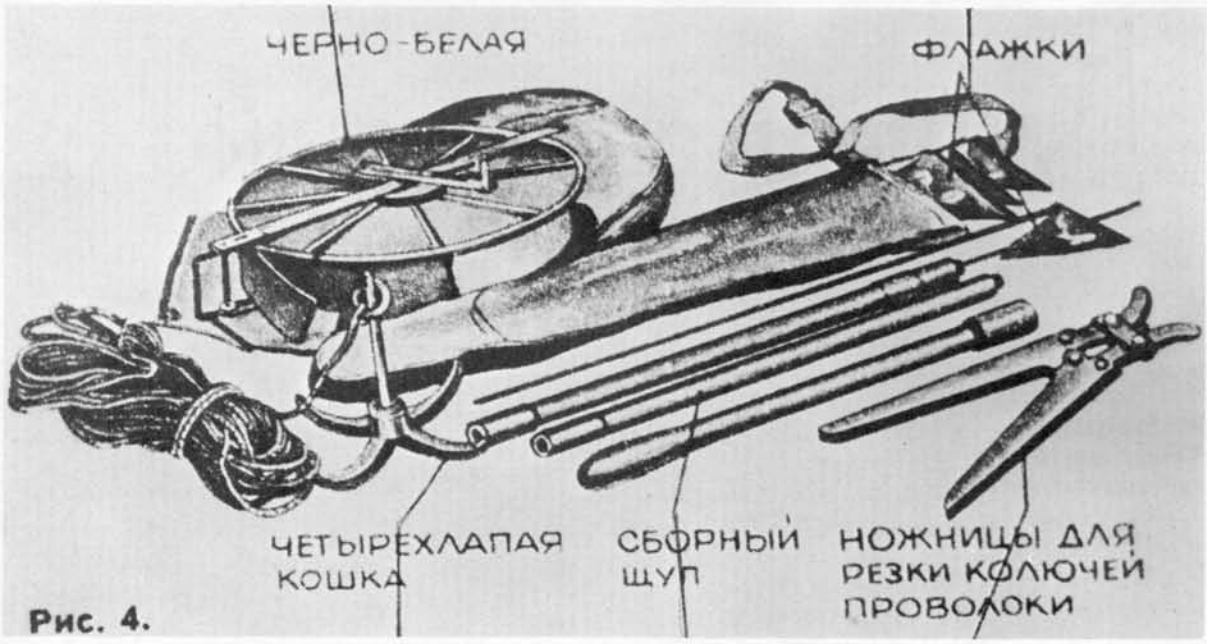
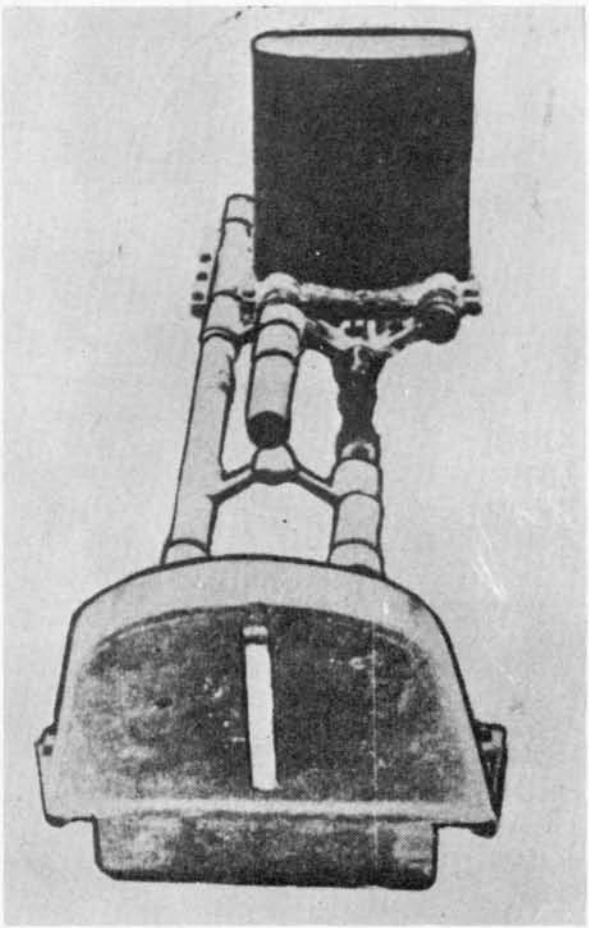


Рис. 4.

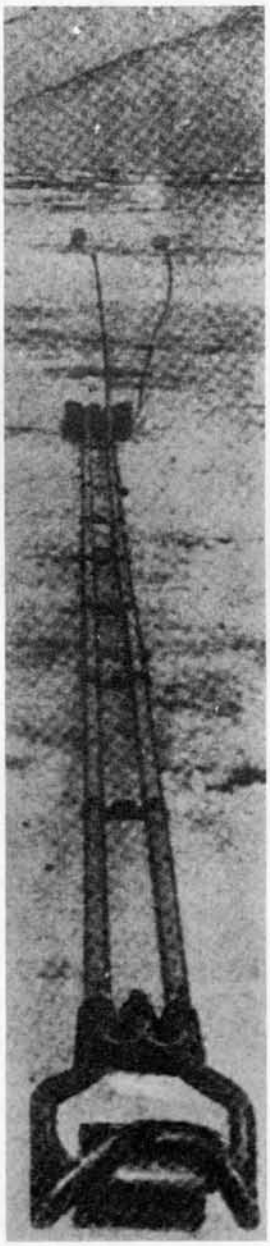
SOVIET MINEFIELD RECONNAISSANCE AND CLEARING KIT

A special manportable kit for the reconnaissance and clearing of minefields is issued within the Soviet Army. It consists of a sectional probe, a grapnel with cord, a wire cutter, a reel of black-white engineer tape and a set of minefield markers.

Various types of grapnels are issued, having two, three or four prongs.



Soviet
BDT Triplex



Soviet
BDT Duplex

BDT Linear Charges

EXPLOSIVE MINE-CLEARING DEVICES

East European Communist armies use a variety of explosive mine-clearing devices, ranging from simple improvised bangalore torpedos to sophisticated rocket-delivered devices launched from armored vehicles.

The simplest device is the hand-placed bangalore torpedo of limited length and effectiveness. The various factory-made bangalore torpedo sections, however, can be joined together into longer charges, and in turn, be made more powerful by forming them into duplex or triplex charges. In some cases these charges are also placed on carts for ease of emplacement and for maintaining a more favorable detonation height. Those charges which are not placed on carts are normally equipped either with a sled or placed on rollers. They are often fitted with a metal shield on the forward end to prevent premature detonation by the enemy defending the minefield.

One example of an explosive line charge is the Soviet BDT which is assembled in a rear area and towed by a tank (at speeds under 10 km/h) to the edge of the minefield and then pushed by the tank into the minefield. The BDT consists of three separate linear charges formed into a triplex charge, a nose section, and a detonator box. If desireable, the BDT may be used also as a single or duplex charge. Maximum length of the charge may not exceed 500 meters. The forward end section is fitted with a roller to facilitate emplacement in the minefield, and a metal shield is mounted above the roller to provide protection from premature detonation. The BDT can be detonated by either one or two methods -- firstly, by an electric blasting cap initiated through a firing cable connected to the batteries of the pushing tank; or secondly, by the detonation box which contains a number of percussion detonators connected by a booster charge which can be initiated by machinegun fire from the pusher tank. A triplex HDT line charge will clear a path 6 meters wide.

Other similar systems are also in use, such as the Soviet SPZ-2 and SPZ-4. The SPZ-2 uses an anchor placed at the forward edge of the minefield, or one which is delivered into the minefield by rocket. Single, duplex, or triplex charges can then be winched into the minefield to a maximum distance ranging from 300 to 500 meters depending on the type of charge. The SPZ-4 is used either with the tank pushing duplex or triplex charges (with or without cart) to a maximum of 500 meters, or with the tank (equipped with a mine-clearing plow or roller) towing

duplex or triplex charges (with or without carts) with a maximum length ranging from 300 to 500 meters. The towing mode is used to finish the clearing of minefield passages after preliminary clearing has taken place by means of rollers and/or plows.

The Czechoslovak Army also uses a special two-wheeled trailer which is towed by a tank with mine-clearing rollers or plows. The trailer lays a series of explosive cords behind the tank in those parts of the passage which is not cleared by the rollers/plows. The explosive cords are then detonated from inside the tank.

Various rocket-delivered linear charges and other explosive devices also exist. One of the simplest is the UZR-3, which consists of a UZ-3 triplex-charge bangalore torpedo with attached rockets. A more sophisticated device is carried on a box on the left rear fender of a medium tank. The box contains a delivery rocket and flexible explosive charge. This system has been identified with the Polish Army. The Czechoslovak Army has a variety of rocket-delivered systems. One is transported in a four-wheeled armored trailer towed behind a tank or armored personnel carrier. This system uses several rockets to deliver a mat of several flexible mine clearing explosive devices.

The Soviets also have a special mine-clearing armored vehicle in the form of a modified BTR-50PK armored personnel carrier. This vehicle has a special launcher for delivery rockets which emplace a rather large-diameter, flexible tube containing high explosives for mine clearing.

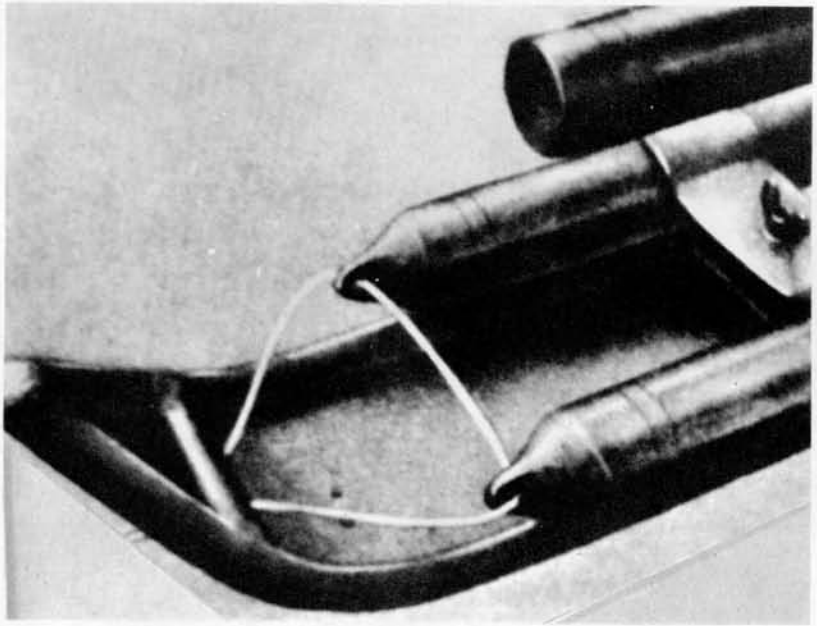


Rocket-delivered Mine-clearing
Explosive Line Charge, Mounted
On Polish T-54 Tank

CHARACTERISTICS OF LINEAR EXPLOSIVE CHARGES MADE UP OF UZ BANGALORE TORPEDO SECTION WHEN USED IN ANTITANK MINEFIELDS

	weight running meters kg		passage width	delivery distance*		
	HE	overall	m	winch	tank pushed m	tank towed m
single	2.65	5.10	2.5 - 3.0	300	---	---
duplex	5.30	11.00	4.0 - 5.0	300	500	300
duplex on cart	5.30	13.00	7.0 - 8.0	500	500	500
triplex	8.00	16.00	8.0 - 10.0	300	500	300
triplex on cart	8.00	18.00	10.0 - 12.0	500	500	500

*delivery speeds: winch 8 to 10 km/h; tank-pushed 100m/min, tank-towed 200 m/min



Soviet Bangalore Torpedo UZ-2
as Triplex Charge on Improvised Sled

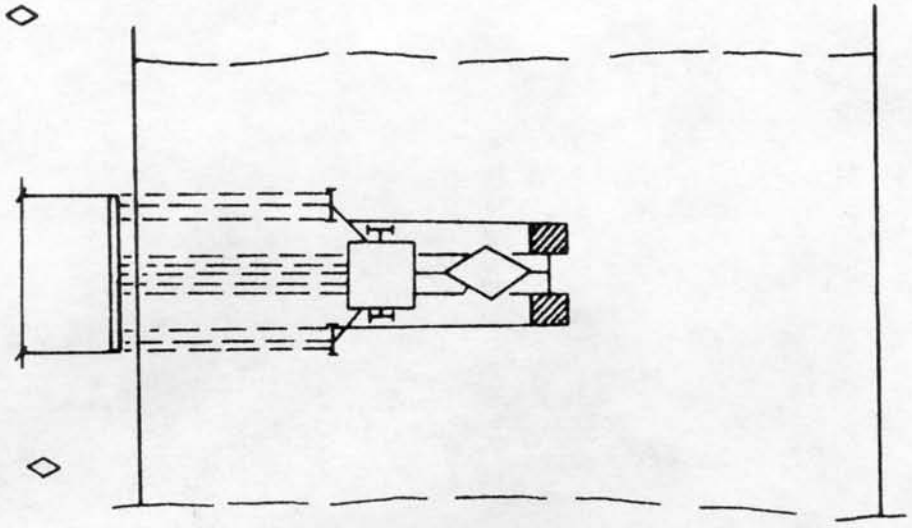
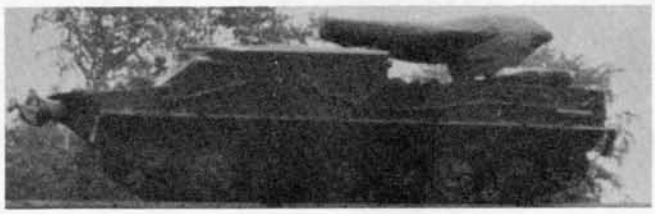


Diagram of Czechoslovak Tank-towed
Two-wheeled Trailer Dispensing
Explosive Mine-clearing Devices



Soviet BTR-50PK Armored Personnel Carrier
Modified as Launch Vehicle for Rocket-propelled
Explosive Mine-clearing Device



Czechoslovak OT-64 Armored Personnel Carriers Towing Armored Trailers with Rocket-propelled Explosive Mine-clearing Devices

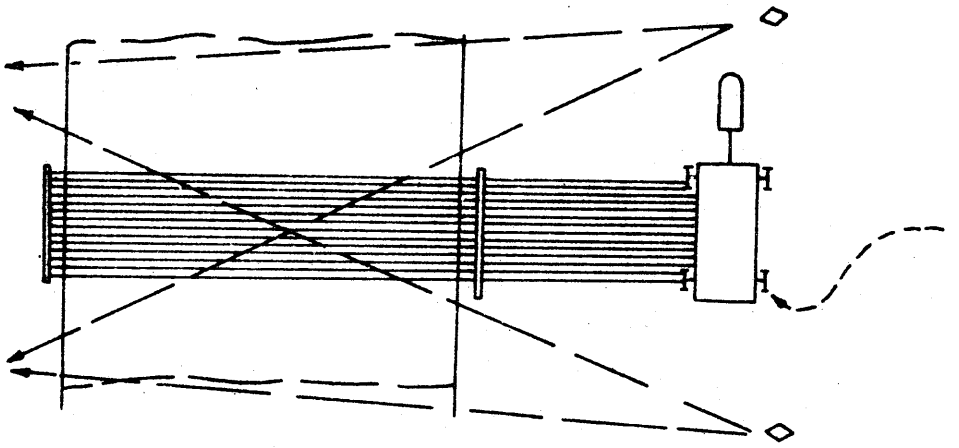


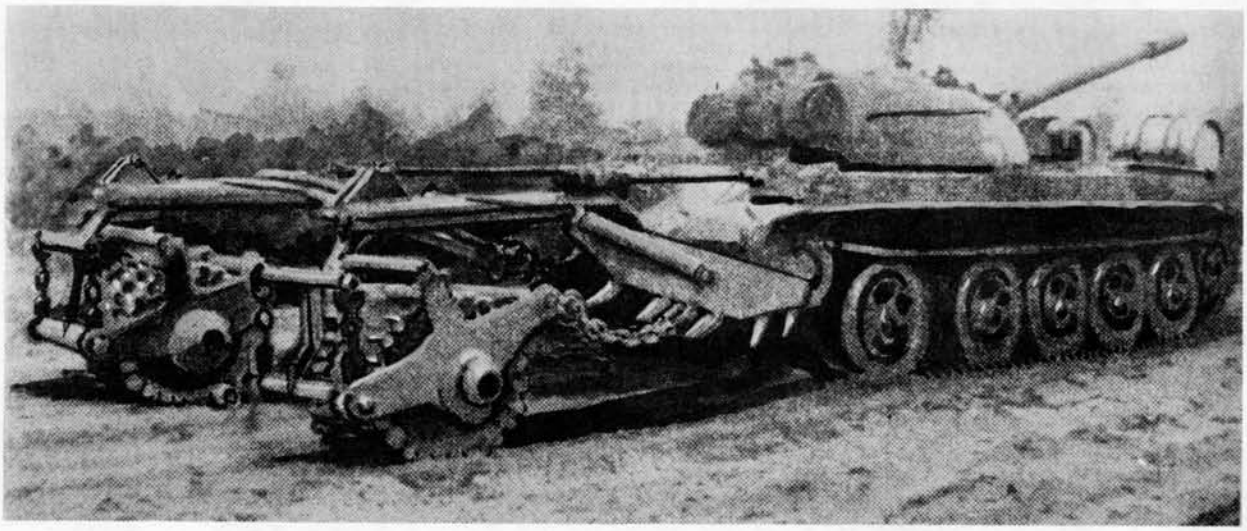
Diagram of Czechoslovak Rocket-propelled
Explosive Mine-clearing Devices in Operation



PT-54



PT-55



KMT-5

TANK-MOUNTED MINE-CLEARING ROLLERS AND PLOWS

Soviet Tank-Mounted Mine-Clearing Roller PT-3
Soviet Tank-Mounted Mine-Clearing Roller PT-54
Soviet Tank-Mounted Mine-Clearing Roller PT-54M
Soviet Tank-Mounted Mine-Clearing Roller PT-55
Soviet Tank-Mounted Mine-Clearing Plow RMT-4
Soviet Tank-Mounted Mine-Clearing Plow and Roller KMT-5
Czechoslovak Tank-Mounted Mine-Clearing Roller
Czechoslovak Tank-Mounted Mine-Clearing Plow

During World War II the Soviet Army used a variety of mechanical mine-clearing devices, the most common of which was the PT-3 roller system mounted on the T-34 medium tank. This equipment consisted of two roller sections each with several sheepsfoot rollers similar to those used to compact soil.

Although the PT-3 was used in the early postwar years, it was replaced during the 1950s by a new system, the PT-54. This system used smaller rollers mounted in an improved manner. Provision was also made to sweep tilt-rod fuzed mines which would not be affected by the rollers. The PT-54 was modified into the PT-54M, and later into the PT-55, which is the standard roller system today.

The PT-54/55 series of mine-clearing systems are all very similar and differ only in details. They are all made up of a varying number of knobbed rollers joined together into two roller sections attached to the bow of a medium tank. The drawing of the PT-55 system clearly illustrates the details. The earlier model, the PT-54, differed primarily in the design of the attachment arrangements and in the use of six rollers per section. This resulted in a heavier weight as compared to the PT-55, although the lane cleared was wider. A useful feature, which is also part of the roller systems, is a lane marker which cuts a furrow 80mm deep and 100mm wide, marking the cleared lane.

Since the late 1960s the Soviets have been using another mechanical mine-clearing system, the plow--often referred to by them as the "cutter" or "knife." This system consists of a 600mm-wide cutting device, fitted with teeth, mounted at an angle in the front of the tank track. This system, known as the KMT-4, has the advantage of much lighter weight, and less interference with the cross-country performance of the tank. In clearing mines it has the advantage of pushing them aside, even in cases where sophisticated fuzing could defeat the single pass of a roller system.

To combine the advantages of both plow and roller systems, the Soviets have introduced the KMT-5 system which uses the plow of the KMT-4, but in addition has a new type of roller system. The KMT-5 roller system has only three rollers per section (PT-54 - six; PT-55 - four), with the rollers and suspension mechanism of a new design. Although the combination is more cumbersome than the KMT-4 plow, it is more effective than either roller or plow alone, because of its improved design lighter than the old PT-54 roller system. The KMT-5 system also includes the lane-marking plow and the PSK set which marks the cleared lane at night by means of a luminescent substance.

The Czechoslovak Army uses mine-clearing rollers and plows of its own design. The rollers are not all the same thickness, and the antitilt-rod fuze device is a frame instead of a chain. The plow cutting device is also much larger than the Soviet model. It is not known if the two have been combined as in the Soviet KMT-5.

Mounting and dismounting of mechanical mine-clearing equipment can be a time-consuming job which requires a crane. To speed up the process the Soviets have introduced the KM-61 crane which is mounted on a KrAZ-214 truck which also carries the plows and/or rollers.

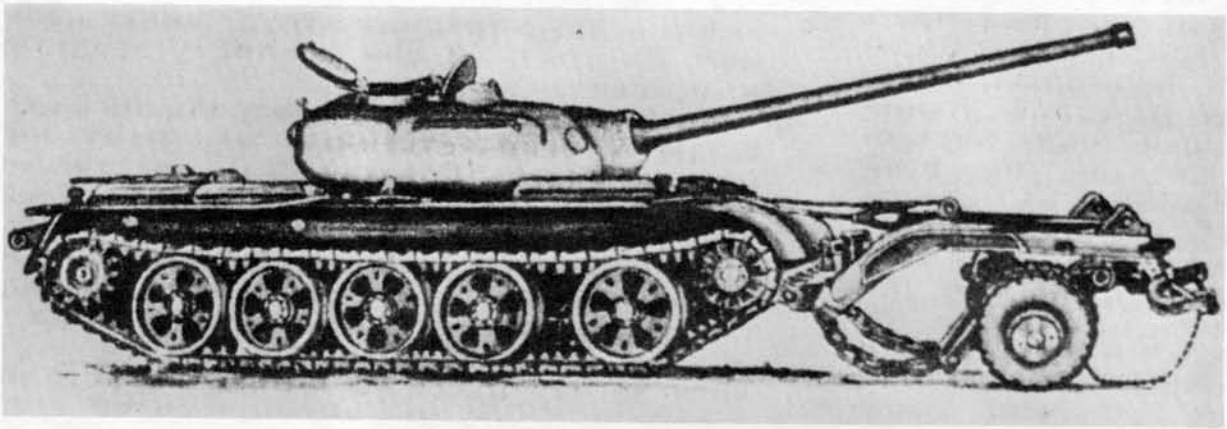
		PT-54	PT-54M	PT-55
weight	kg	8808	7000	6700
section weight	kg	3752	2700	
roller weight	kg	500	500	500
assembly width	m	3.9	3.8	
assembly length	m		2.64	
lane swept (each)	m	1.3	0.89	0.83
width unswept	m	1.2		1.7
operating speed	km/h	6-10		8-12
safe turning radius	m	40		85
ditch crossing	m	3.0		
attachment time	min	10-15	10-15	10-15

		KMT-5
weight	kg	7300-7500
roller section weight	kg	2265
plow section weight	kg	420
assembly width	m	4.0
assembly length	m	3.18
lane swept (each)	m	730-810
width unswept	m	2.1
operating speed	km/h	
safe turning radius	m	65
ditch crossing	m	2.5
attachment time	min	

KM-61 crane performance

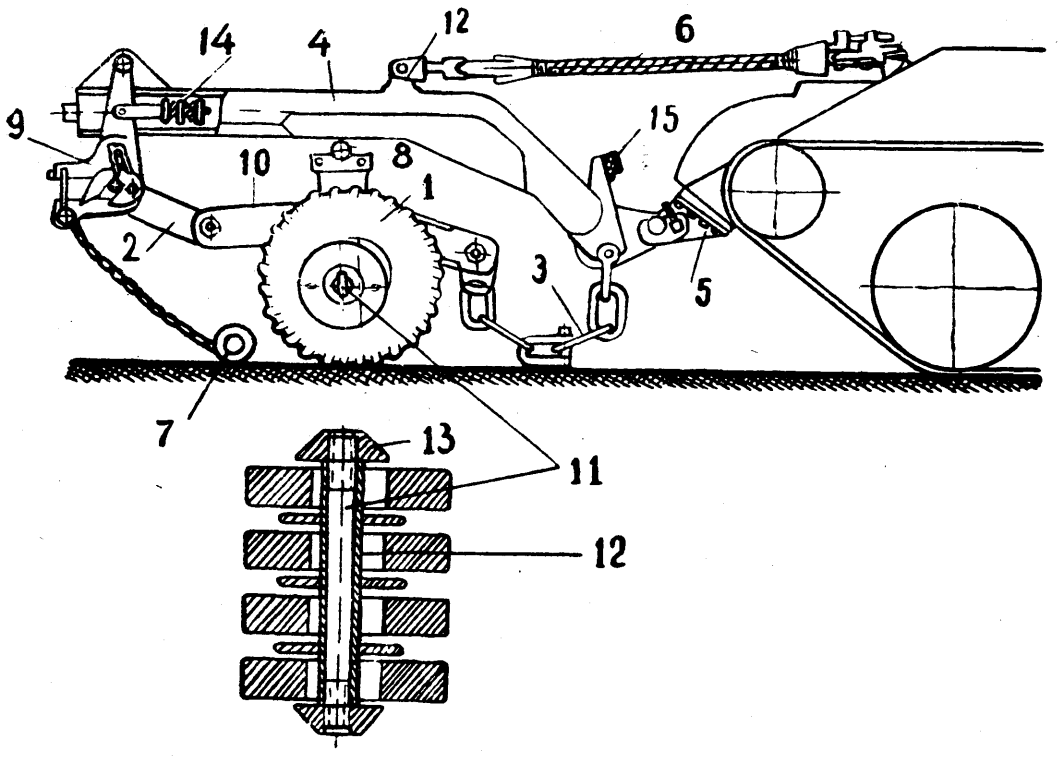
load	boom length	maximum lifting height
3200 kg	2000 mm	3230 mm
2750 kg	2500 mm	2780 mm
2000 kg	2800 mm	2390 mm

NOTE: Crane can be rotated a maximum of 80 degrees from forward axis of truck. Maximum slope of 4 degrees in any direction.



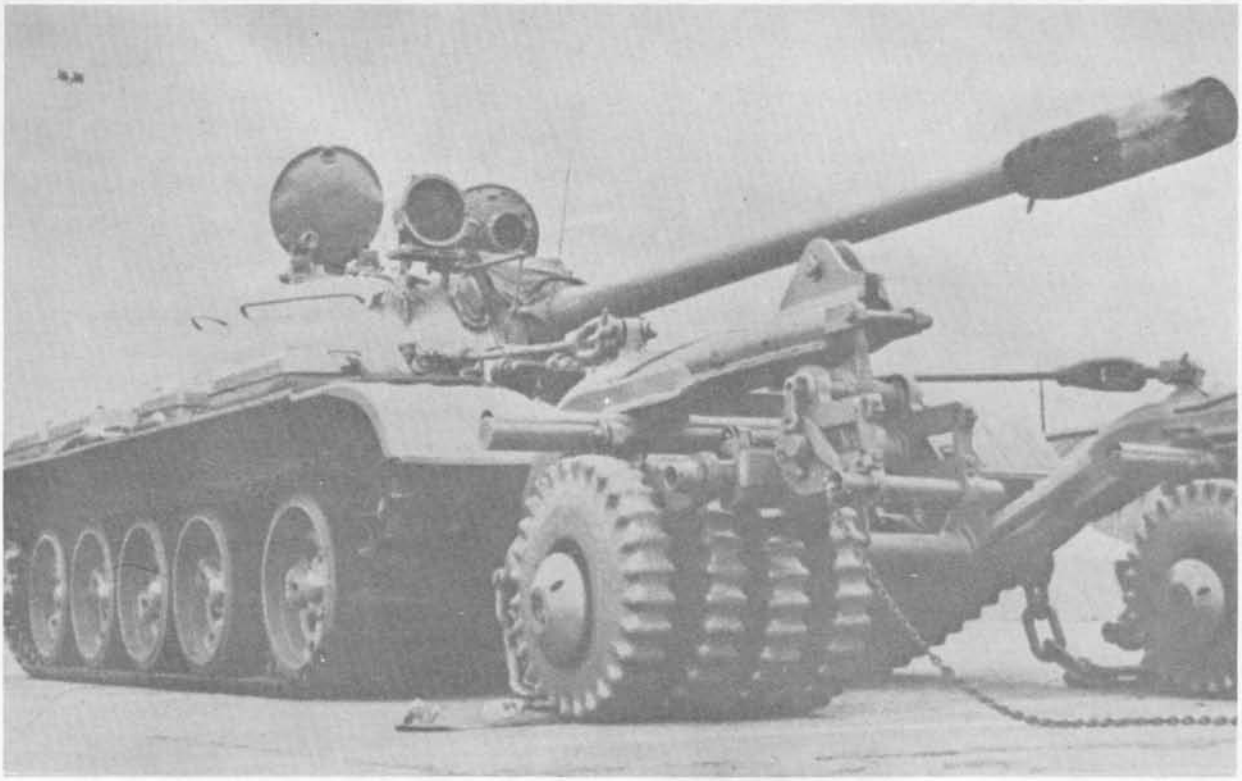


Soviet TP-55 Tank-mounted Mine-clearing Rollers

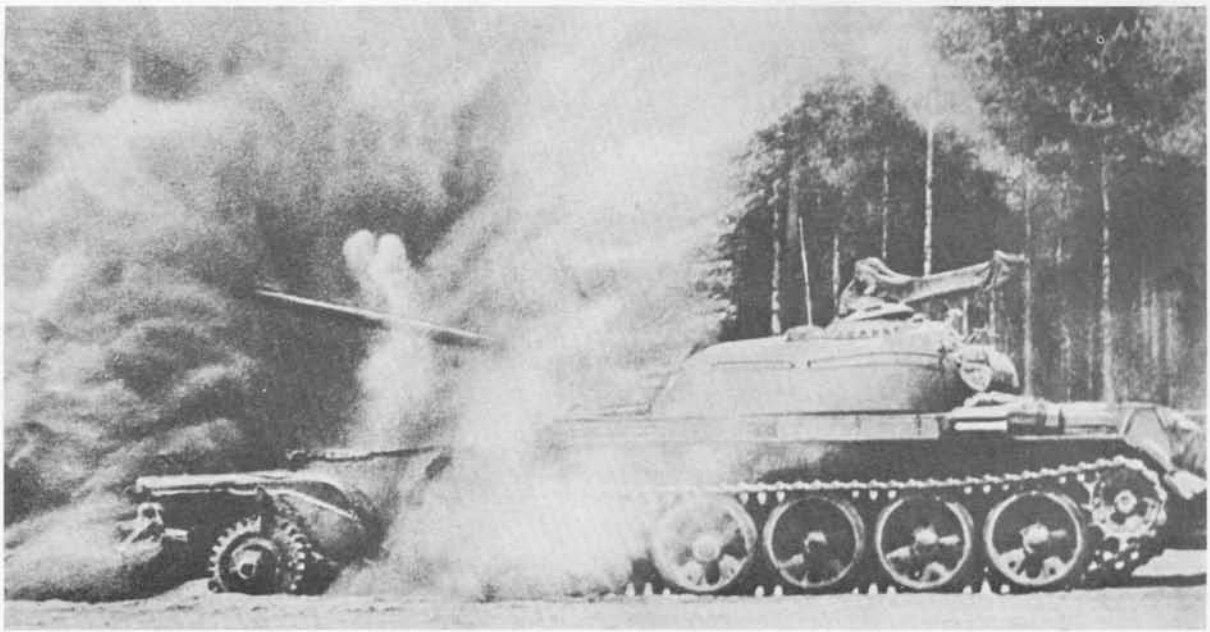


Soviet PT-55 Tank-mounted Mine-clearing Rollers

1. rollers linked into two sections
2. attaching device
3. reverse chains
4. push frame
5. mounting assembly
6. push-frame support cable
7. sweep device for tilt-rod fuzes
8. elastic dampers
9. harness device
10. rods hinged on side bars
11. axles
12. bushings
13. end nuts
14. damper
15. rubber buffers



Yugoslav T-55 Tank with Mine-clearing Rollers



T-54 Medium Tank Equipped with PT-55
Mine-clearing Rollers Exploding Mines



PT-55



PT-55



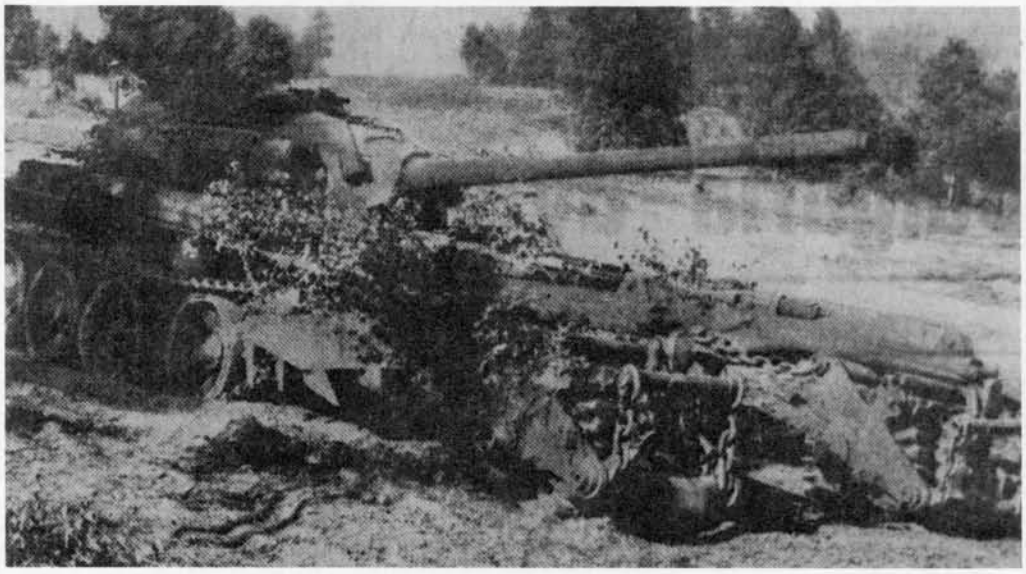
Bulgarian T-54 Tank with Mine-clearing Rollers PT-55



Early Model T-54 Tank with Mine-clearing Rollers PT-55



KMT-5 Mounted on T-54 Medium Tank



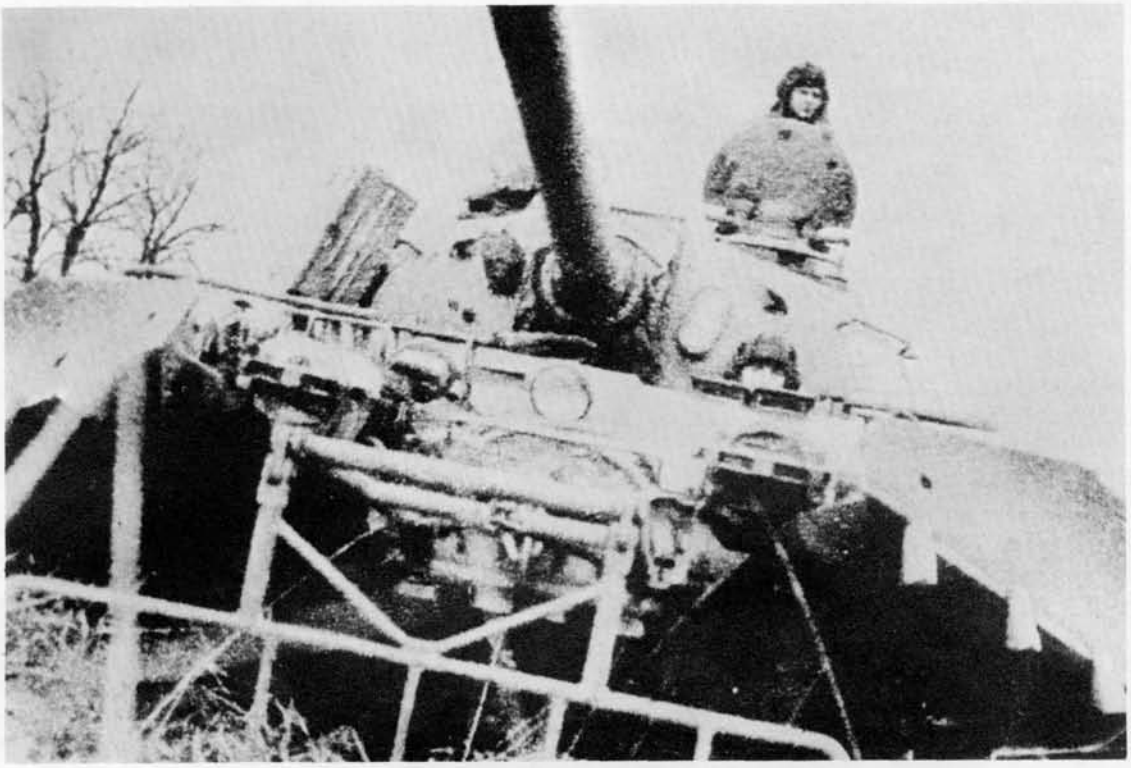
KMT-5 in Action



KMT-5



KMT-4



Czechoslovak Mine-clearing Plow



Czechoslovak
Mine-clearing
Roller

Czechoslovak
Mine-clearing
Roller



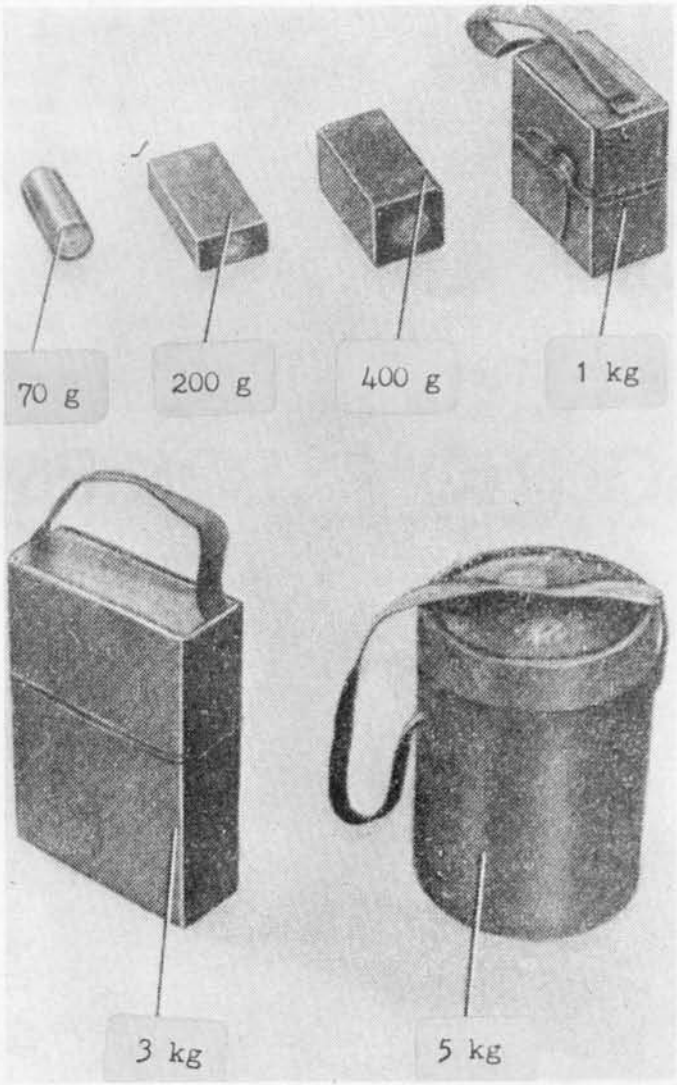


Czechoslovak
Mine-clearing
Plow

Soviet KM-61
Crane Vehicle



DEMOLITION EQUIPMENT



East German Individual
and Prepared Bulk Explosive Charges

70 g and 75 g cylindrical charges
200 g block charge
400 g block charge
1 kg bulk charge
3 kg bulk charge
5 kg bulk charge

TNT is the basic Soviet military explosive and is also used in other East European Communist armies. However, other military and commercial explosives may be encountered. Individual charges come either in cylindrical or block form. The standard cylindrical borehole charge is 75 g in the Soviet and Czechoslovak forces, while in the East German Army it is 70 g. This type of charge consists of pressed TNT wrapped in wax paper. The cast or pressed TNT block charges come in 200 g or 400 g sizes. These blocks may be wrapped in paper of different colors such as white, light yellow, light tan, pale pink, pale green, or pale blue. A purple spot on the paper denotes the location of the well for the blasting cap. These individual charges may also be used to prepare larger charges such as concentrated charges or bangalore torpedos. The 75 g borehole charge is also standard with the Soviet PMD-7 and PMD-7ts, and the Hungarian M49 and M62 antipersonnel mines. The 200 g block charge is used with the Soviet PMD-6, PMD-6M and PMD-57, the Czechoslovak PP-M-D, and the Yugoslav PMD-1 and PMA-1 antipersonnel mines. Both 200 g and 400 g block charges were used during World War II in a variety of other mines.

In addition to the individual cylindrical and block charges, various prepared bulk charges are also available. These are normally referred to as prepared concentrated charges. One type used by the Soviets consists of a wooden box containing thirty 400 g and sixty-five 200 g individual block charges. Other typical prepared bulk charges are the SZ-1 (1 kg), SZ-2 (3 kg), and a 5 kg model. The latter is cylindrical in shape and is a cratering charge. All have carrying handles. Similar charges are used in other armies. They do vary somewhat in detail, depending on the country and the date of manufacture.

East German Charges

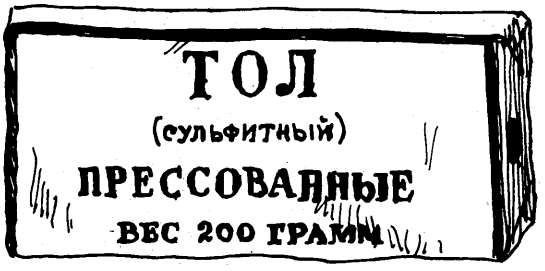
		70 g	200 g	400 g
length	mm	--	100	100
width (diameter)	mm	30	50	50
height	mm	70	25	50
fuze wells		1	1	1

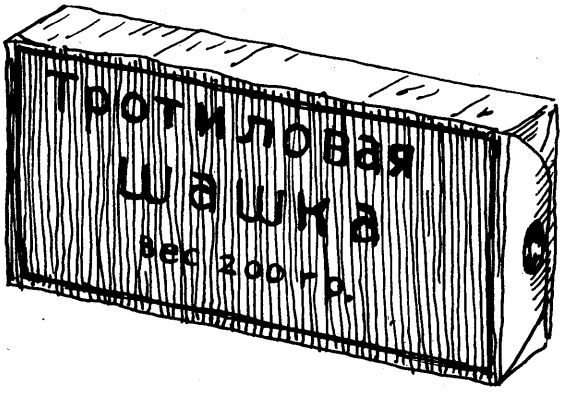
		1 kg	3 kg	5 kg
length	mm	127	237	--
width (diameter)	mm	108	148	170
height	mm	54	62	180
fuze wells		1	2	1

Soviet Charges

		SZ-1	SZ-2
weight	kg	1.4	3.7
weight HE	kg	1.0	3.0
length	mm	126	200
width	mm	116	142
height	mm	65	98

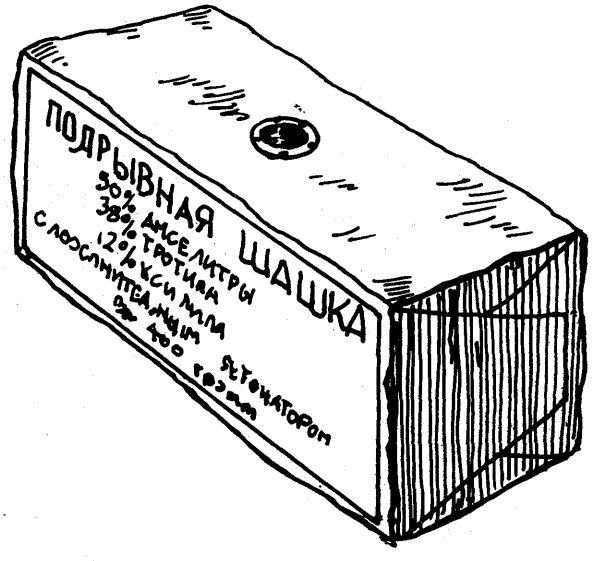

ТОЛ


ТОЛ
(сульфитный)
ПРЕССОВАННЫЕ
ВЕС 200 ГРАММ


Тротиловая
Шашка
вес 200 гр.

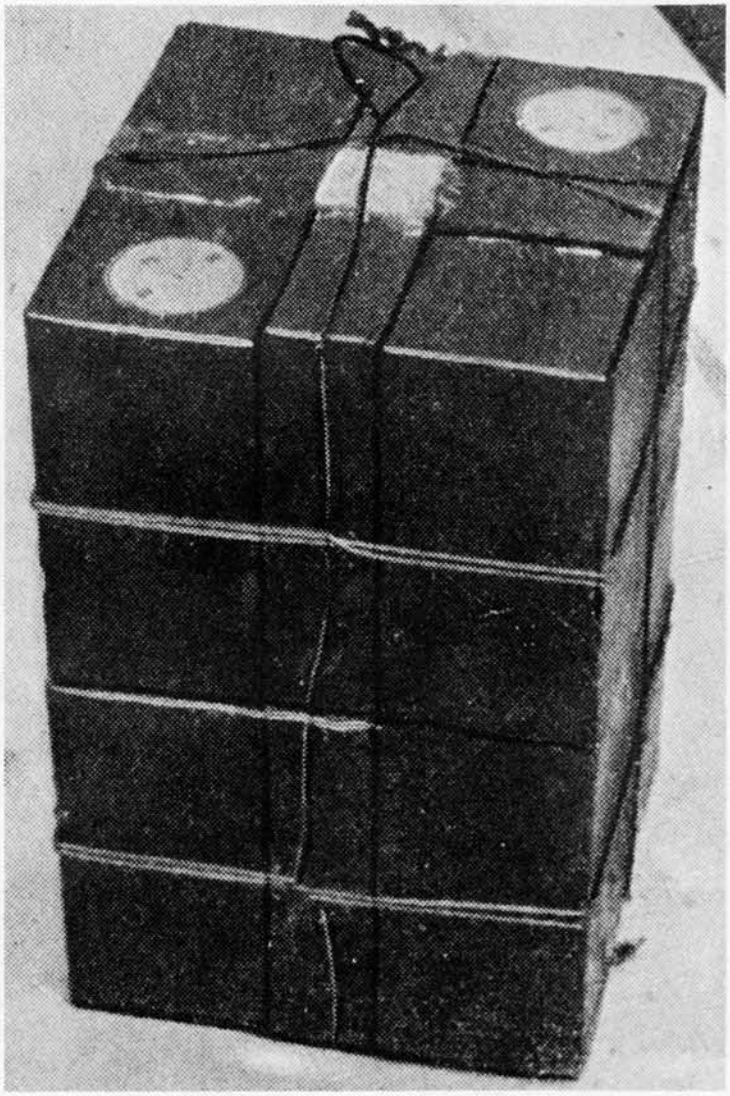


400 g



400 g

Soviet Individual Charges



East German Improvised Bulk
Charge Made up of 400g and 200g Blocks



Improvised Bangalore Torpedo

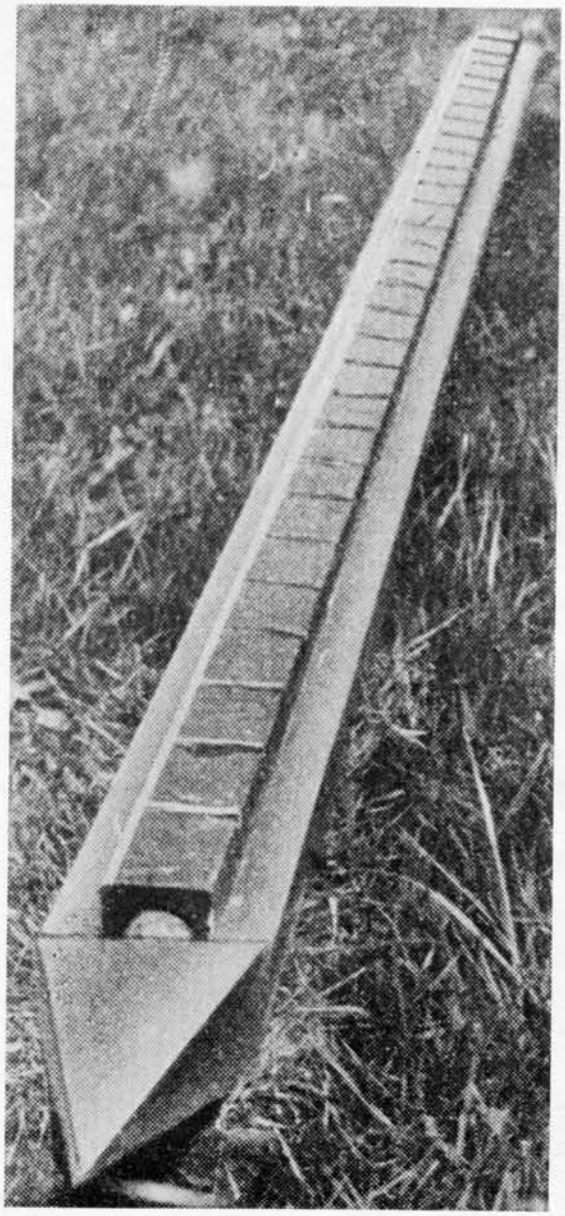
BANGALORE TORPEDOS

Improvised Bangalore Torpedos
Soviet Bangalore Torpedo UZ-1
Soviet Bangalore Torpedo UZ-2
Soviet Bangalore Torpedo UZ-3
Czechoslovak Bangalore Torpedo TN

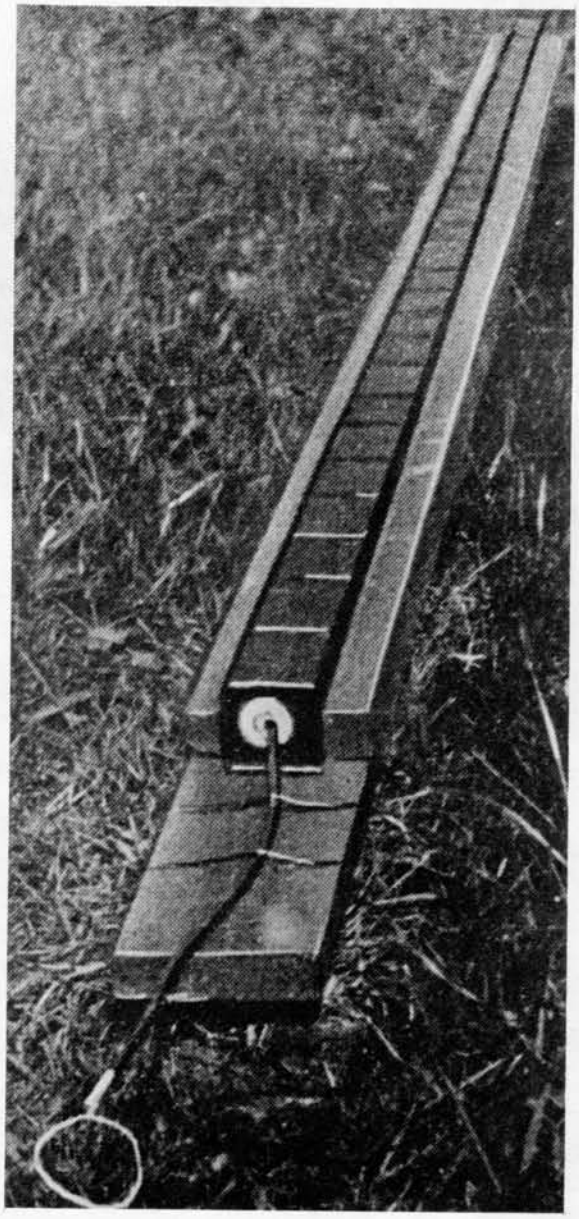
Bangalore torpedos, known in most armies as "elongated charges," can be either improvised or factory-made. The improvised types are constructed by placing a series of TNT blocks on a prepared wooden pole or stick. The 400g TNT block is commonly used for this purpose. The factory-made charges consist of metal tubular sections filled with high explosives. Connecting sleeves are used for the assembly of multiple sections and a conical-shaped nose facilitates forward motion. Threaded well caps are provided at the ends of each section to take a detonator which may be fired electrically or by any standard non-electrical means. When the torpedo is assembled the trail end is fitted with one of the above-mentioned firing devices and the leading end is fitted with the conical-shaped nose. Double or triple charges can be made by binding together the individual charges with special bindings.

		UZ-1	UZ-2	UZ-3
section length	m	1.0	2.0	3.0
diameter	mm		53	53
section weight	kg		5.0	10.2
section HE weight	kg		3.0	5.3

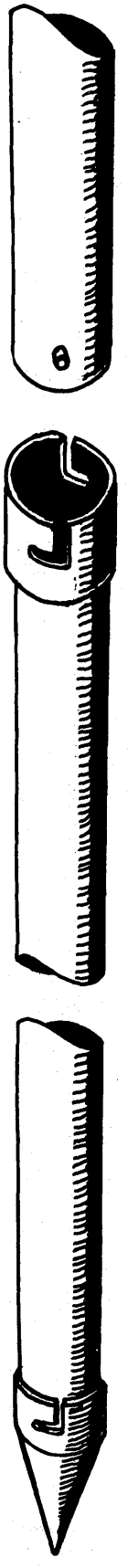
East German Improvised
Bangalore Torpedo Made-up of 400g Blocks



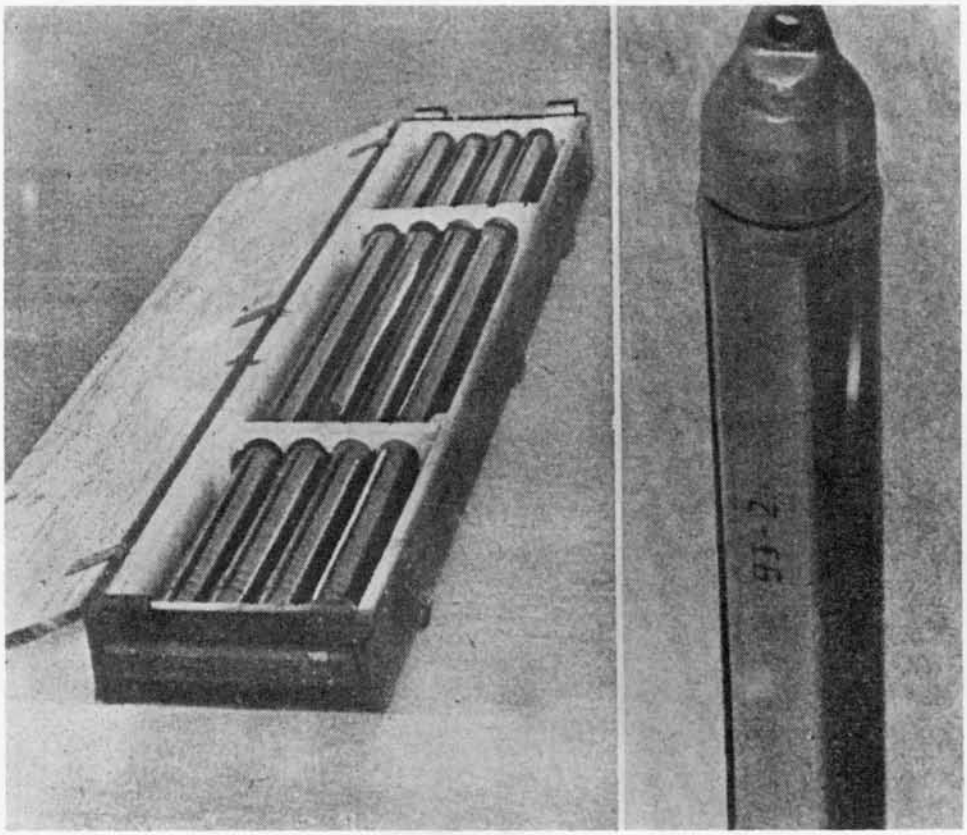
Front End with Nose Piece

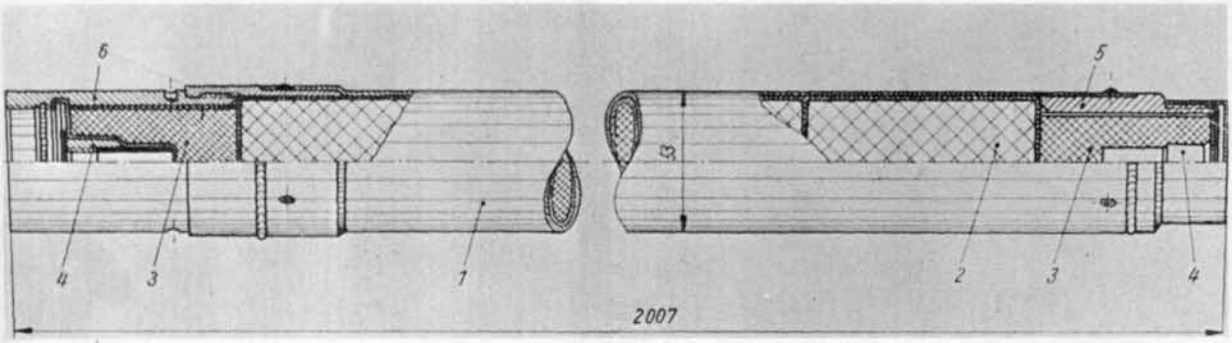


Rear End with Friction Igniter

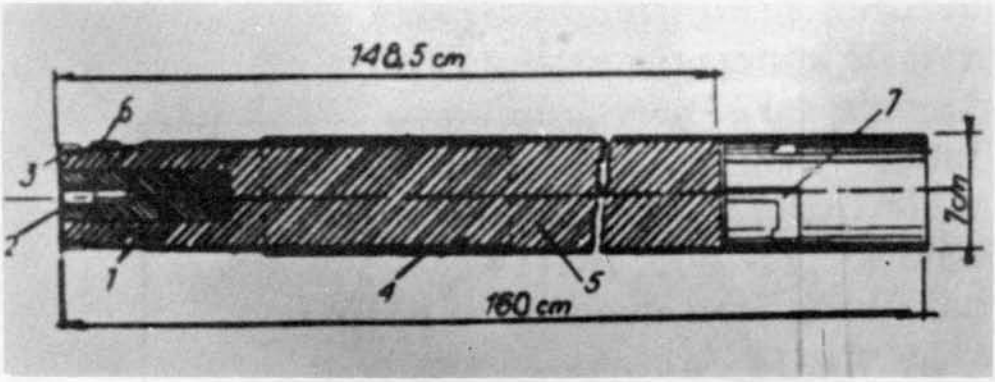


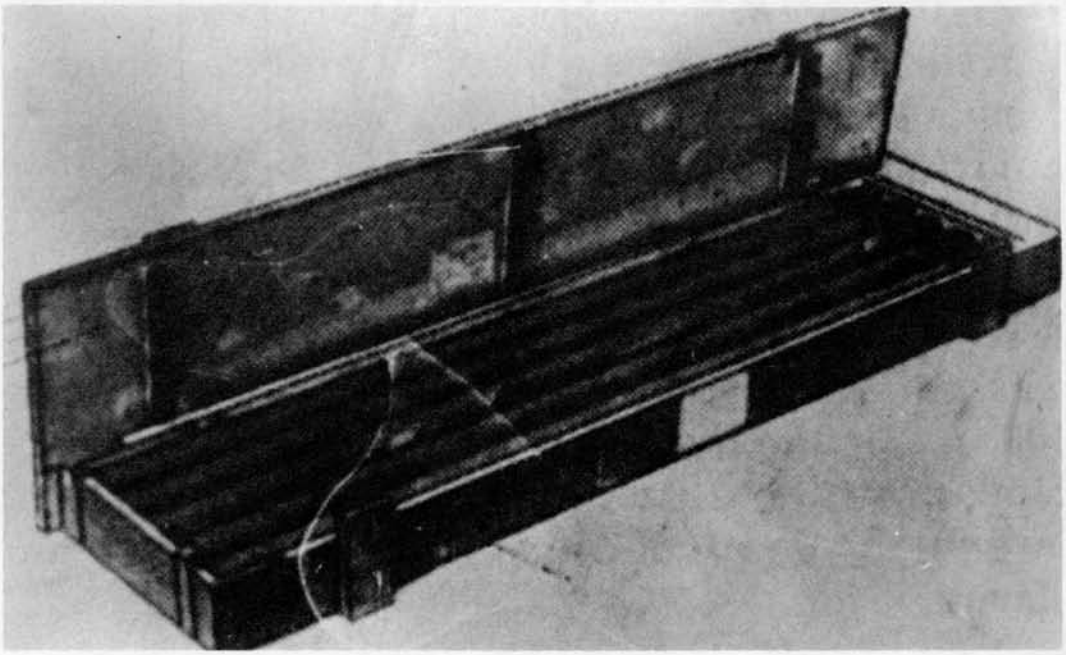
Soviet Bangalore Torpedo UZ-1



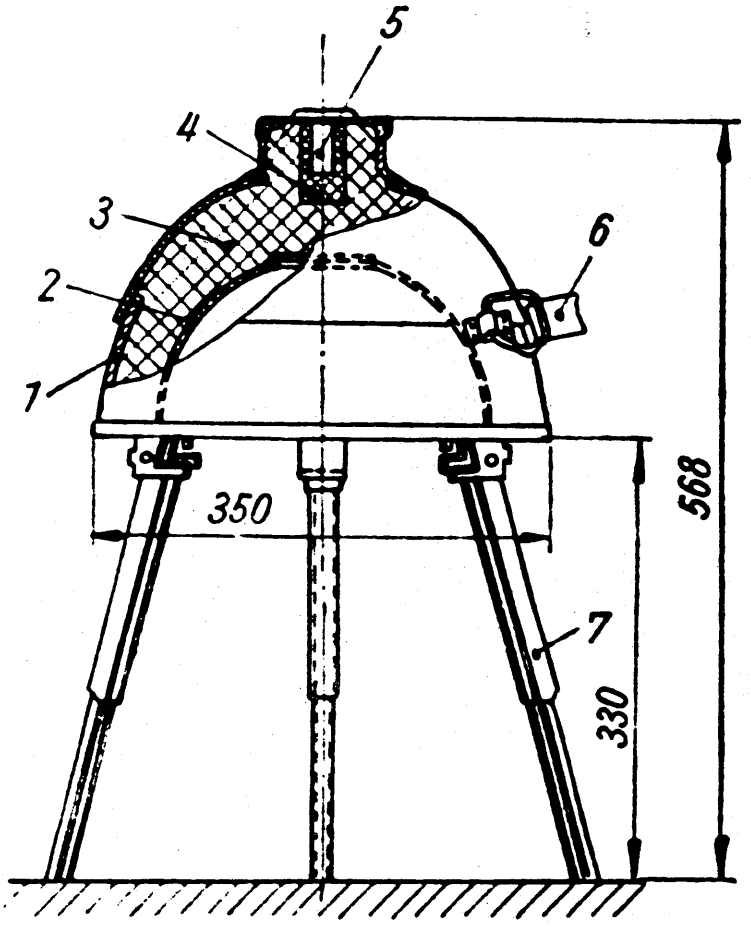


Soviet Bangalore Torpedo UZ-2





Czechoslovak Bangalore Torpedo TN



Soviet KZ-2 Shaped Charge

Soviet Shaped Charge KZ-2
Czechoslovak Shaped Charge PN-4
Czechoslovak Shaped Charge PN-14
Czechoslovak Linear Shaped Charge UTN-2
Czechoslovak Linear Shaped Charge UTN-600

The Soviet shaped charges of the KZ series are used primarily to penetrate armor and reinforced concrete fortifications. In the KZ-2 the charge is housed in a hemispherical, sheet-steel casing with a fuze well located in the top center of the charge. It can be detonated either by electrical or nonelectrical means. Another Soviet shaped charge is the KZ-U, which has an oblong form, and actually resembles an oversized linear charge.

Czechoslovak shaped charges of the PN series perform the same missions as the Soviet KZ-2, although they differ in appearance, being conical rather than hemispherical. The explosive is a 50/50 mixture of TNT and RDX.

Linear shaped charges, often referred to as cutting charges, are designed to create an extended cut in either steel or reinforced concrete. The fuze well is located in the top center, which also has a built-in booster charge. Normally, several charges are used to create a long cut. The Czechoslovak UTN linear shaped charges use an explosive 50/50 mixture of TNT and RDX.

		KZ-2	KZ-U
weight	kg	14.2	18
weight of HE	kg	9.0	12
height w/feet	mm	568	---
height w/o feet	mm	238	195
maximum diameter	mm	350	500x225*
penetration: armor	mm	300	120
reinforced concrete	mm	1300	1000

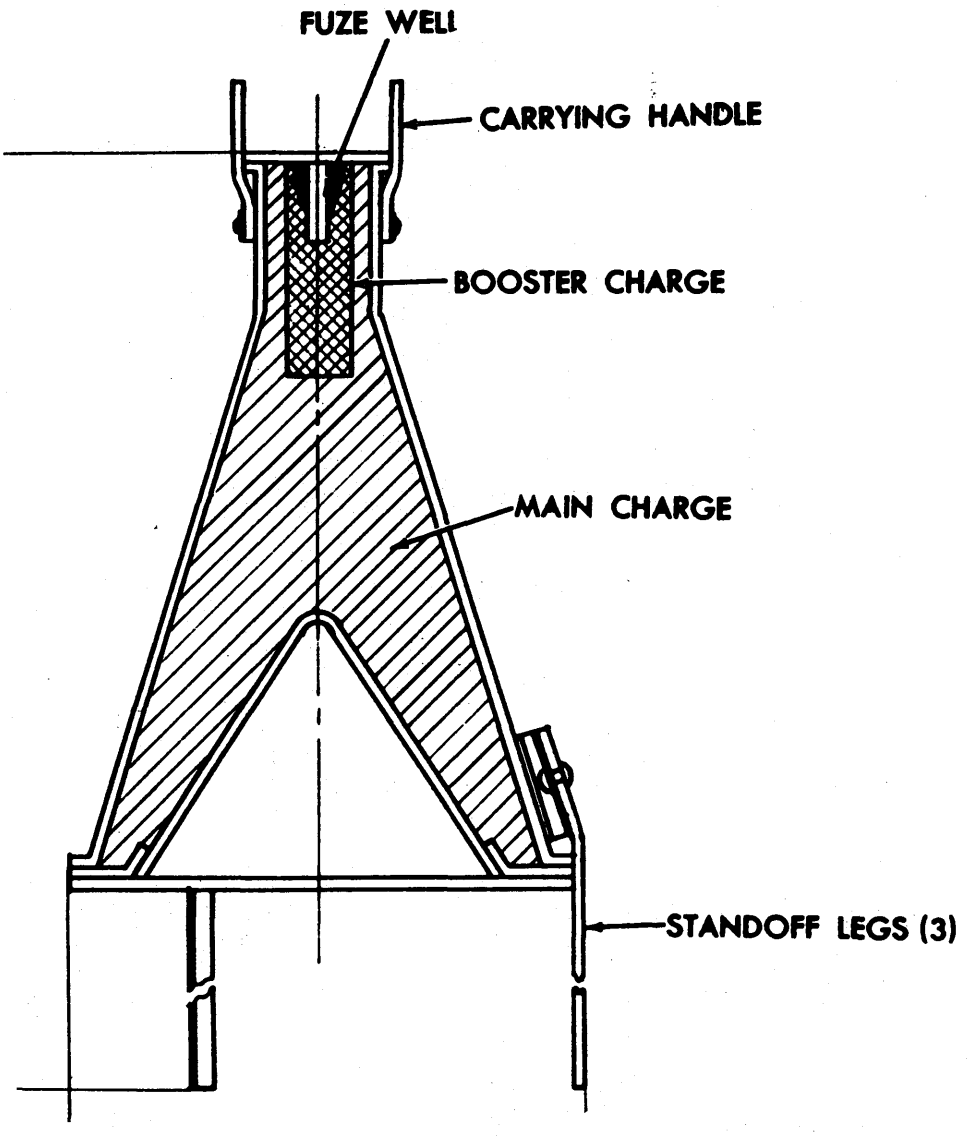
		PN-4	PN-14
weight	kg	6.4	22
weight of HE	kg	4.8	17
height w/feet	mm	460	750
height w/o feet	mm	340	500
maximum diameter	mm	205	320
penetration: armor	mm	500	500
reinforced concrete	mm	1000	1500

		UTN-2	UTN-600
weight	kg	2.8	0.95
weight of HE	kg	1.96	0.54
length	mm	200	100
width	mm	110	80
height	mm	120	95
penetration: steel	mm	750	50
reinforced concrete	mm	750	50

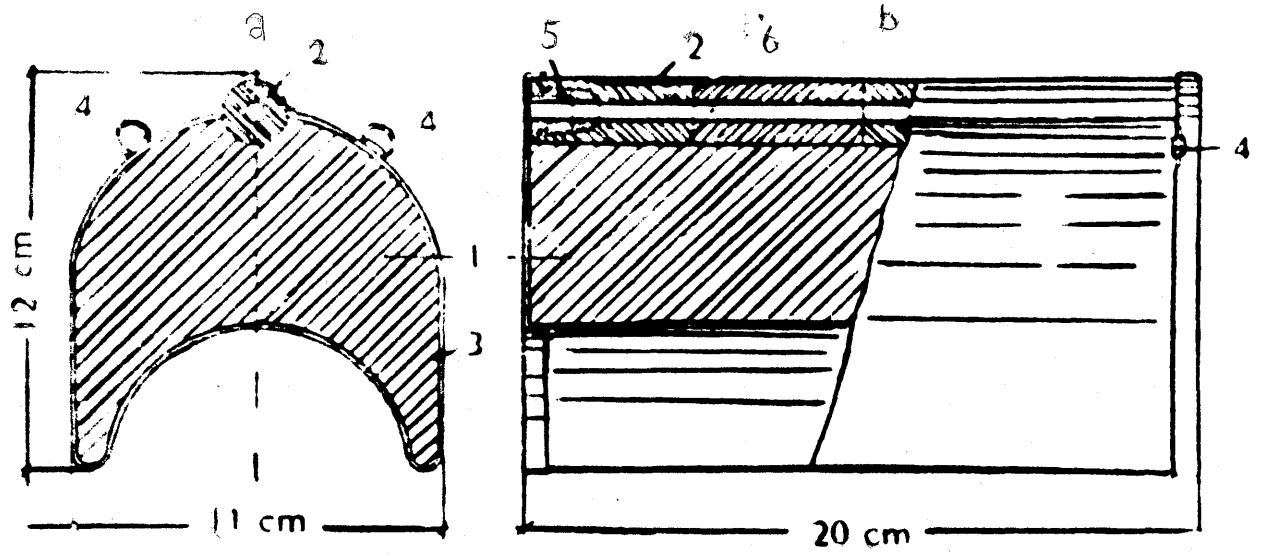
*length x width



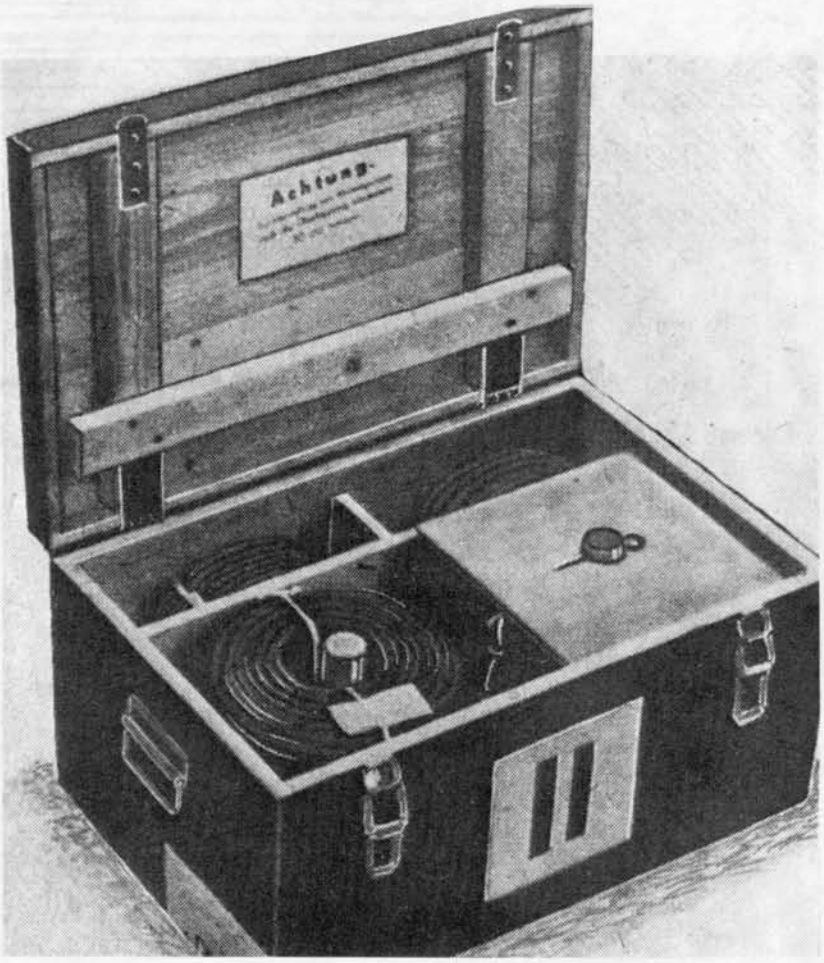
Czechoslovak Shaped Charge PN Series



Czechoslovak Shaped Charge PN Series



Czechoslovak Linear Shaped Charge UTN-2



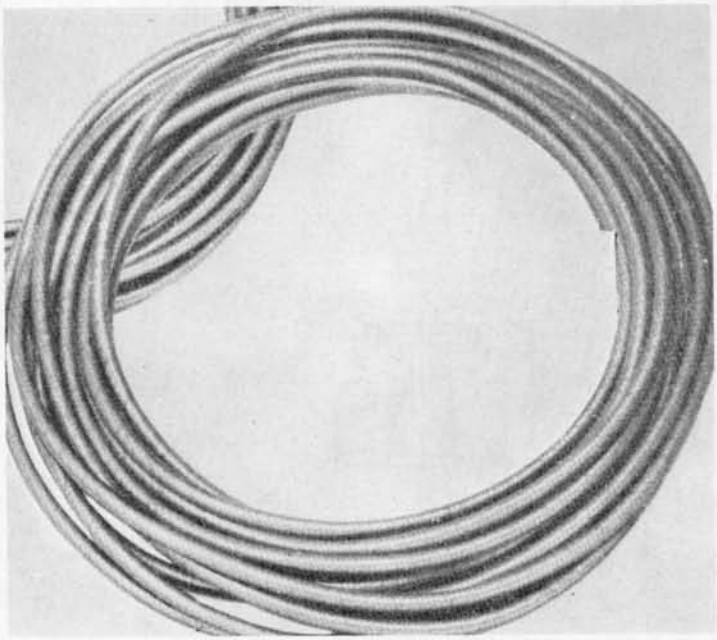
Detonating Cord
East German Packaging

DETONATING CORD

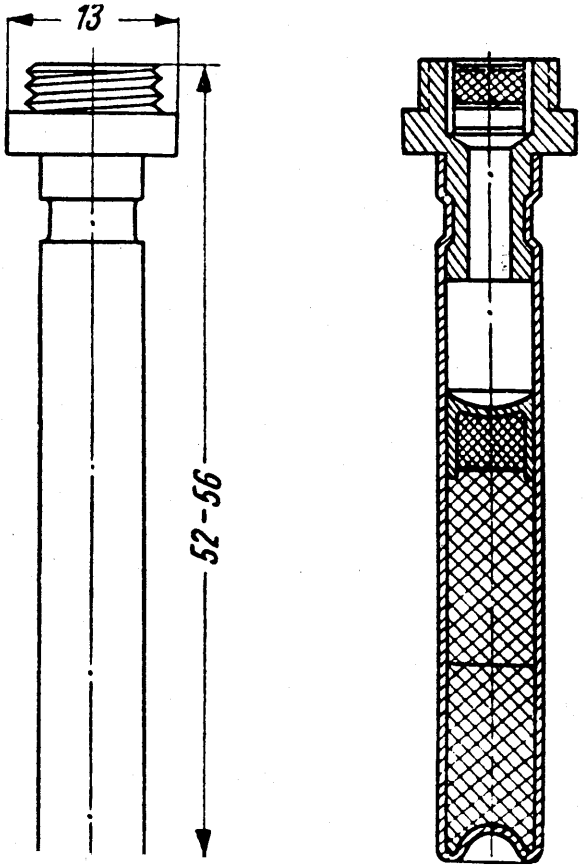
Detonating cord consists of a core of high explosive, usually PETN or RDX, in a textile tube coated with a thin layer of asphalt. On top of this is an outer textile layer finished with a wax gum composition or plastic coating. It will transmit a detonating wave from one point to another at a velocity between 6000 and 7000 m/s. Partially submerged water-soaked detonating cord will detonate if initiated from a dry end. Although it does not lose its explosive properties by exposure to low temperatures, the covering becomes stiff and cracks when bent. Detonating cord is used to prime and detonate other explosive charges. When its explosive cord is detonated by a blasting cap or other explosive device, it will transmit the detonation wave to an unlimited number of explosive charges.

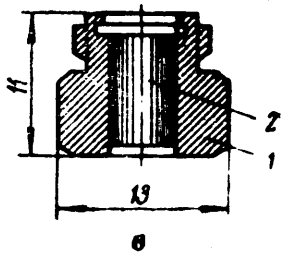
Warsaw Pact detonating cord is usually made of PETN. Although formerly different models of detonating cords often had different colors, such as white, red, or even green (Czechoslovakia), military detonating cord is now uniformly produced with a red plastic covering. Soviet detonating cords are designated by the letters "DSh" followed by numbers, while the Czechoslovak models are designated with the letters "Np" followed by a number.

Detonating cord should not be confused with time-blasting fuzes.



Detonating Cord





MD-6

Soviet Detonators

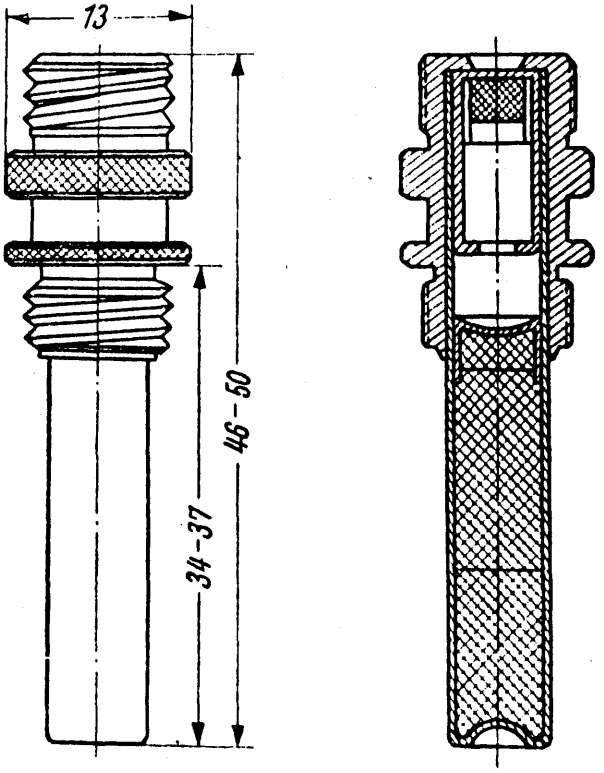
Soviet Detonator MD-2
Soviet Detonator MD-5M
Soviet Detonator MD-6
Soviet Detonator MD-6N
Soviet Detonator MD-9
Soviet Detonator MD-10

The Soviet MD-2 detonator was first used during World War II. It consists of a No. 8 nonelectric blasting cap and a KV-11 percussion cap assembled in a threaded plastic or metallic adapter. In this form it was assembled with the MUV pull fuze, and the VPF and MV-5 pressure fuzes and was used in a great variety of mines. The MD-2 also is used in conjunction with the PV-42 railway rod-pressure fuze and the ChMV-16 and ChMV-60 mechanical-delay fuzes.

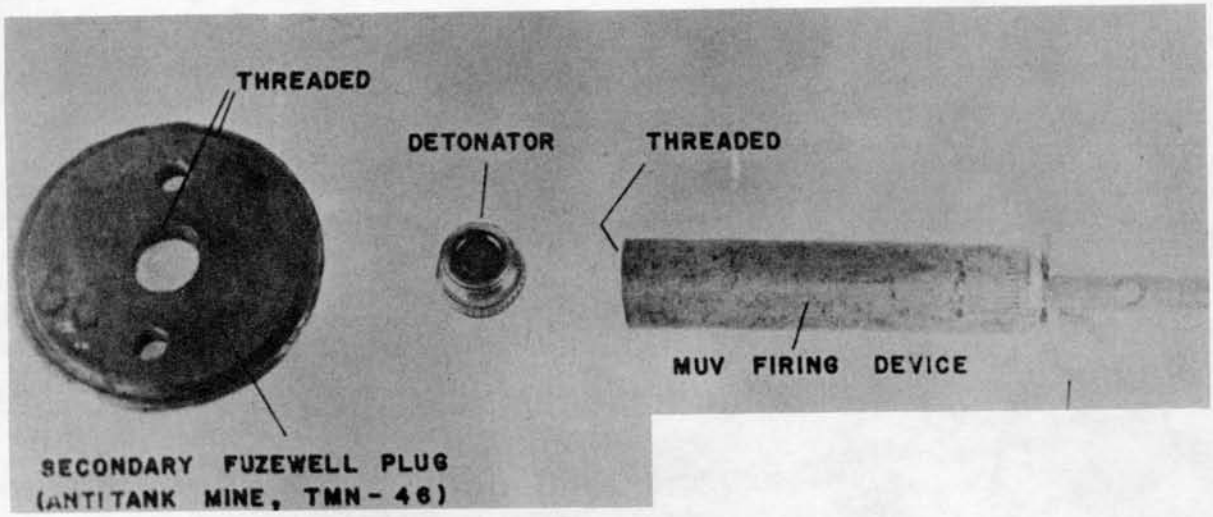
The MD-5M detonator is very similar to the MD-2 and also uses the No. 8 nonelectric blasting cap. It has been used with the PV-42, ChMV-16 and ChMV-60 fuzes.

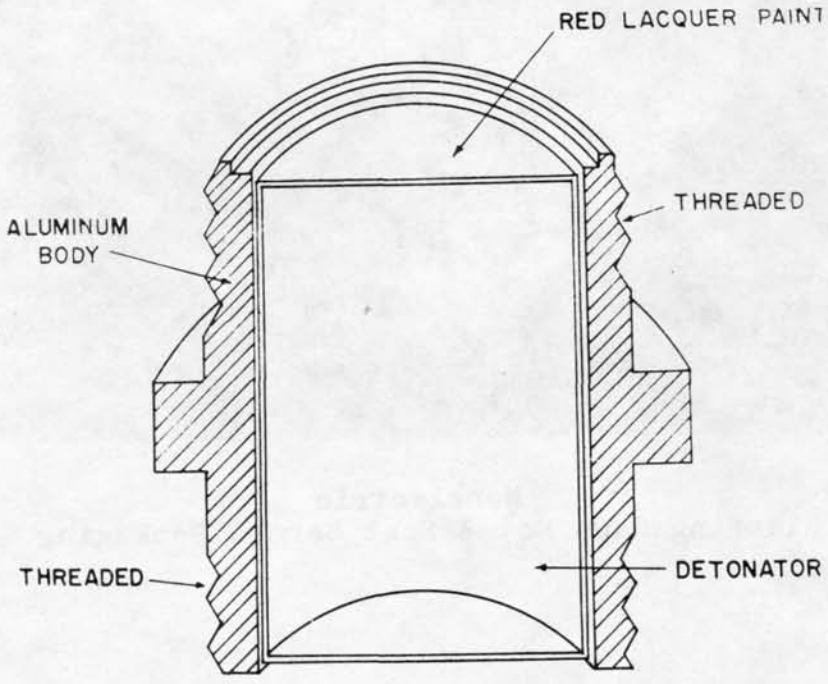
The MD-6 is a small detonator which is used in connection with the MV-5 and MVM pressure fuzes in the TM-46 and TMN-46 metallic antitank mines. The MD-6 detonator uses an M-1 percussion cap in place of the No. 8 nonelectric blasting cap. The MD-6N is a special version used in connection with antilifting devices in the TMN-46 mine.

The MD-10 detonator is used in connection with the VPDM-1M and VPDM-2 river-mine tilt-rod fuzes.

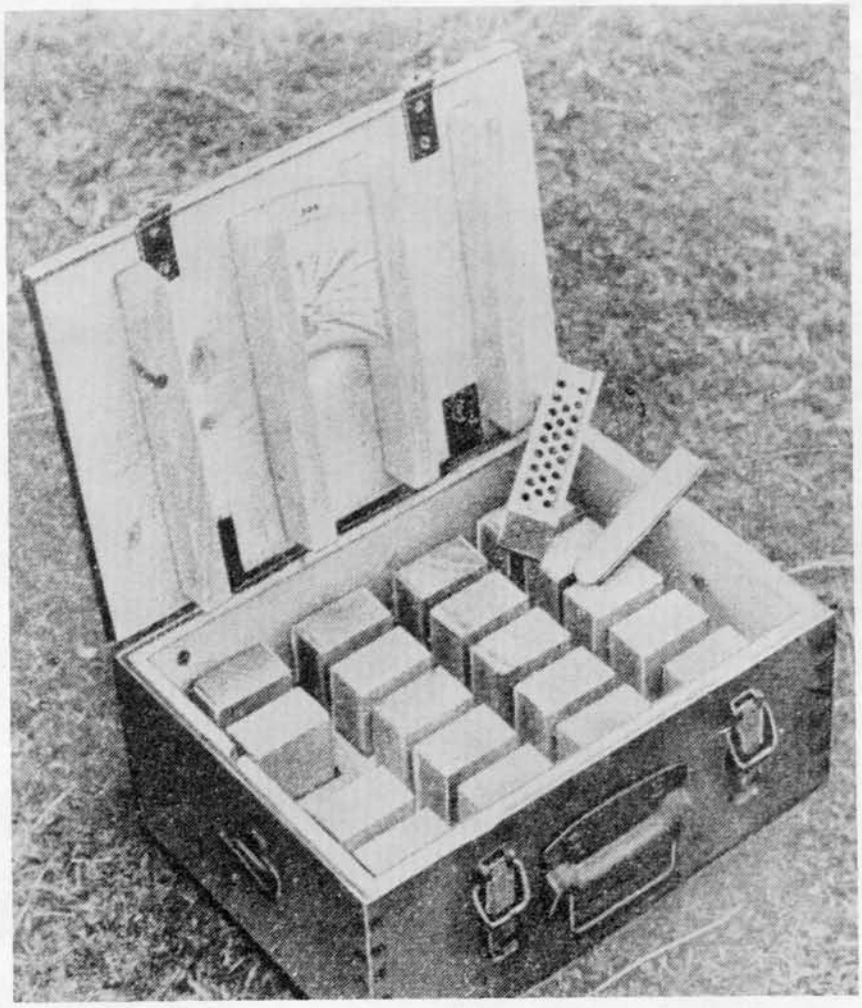


Soviet Detonator MD-5M





Soviet Detonator MD-6N



Nonelectric
Blasting Caps No. 8 East German Packaging

BLASTING CAPS AND ASSOCIATED DEVICES

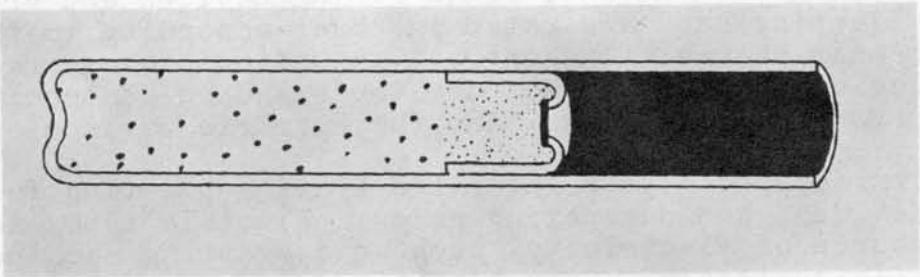
Blasting caps are designed for detonating high explosives. They are designed for insertion into cap wells, and are also the detonating element in certain firing devices and grenades. Blasting caps are rated in power according to the size of their main charge. In contrast to United States practice, the armies of the Warsaw Pact use the standard commercial No. 8 nonelectric blasting cap, and the electric version as well.

Nonelectric types may be initiated by time-blasting fuzes, firing devices, and detonating cords. Electric types are used when a source of electricity, such as a blasting machine or a battery, is available. Some electric caps have delay elements.

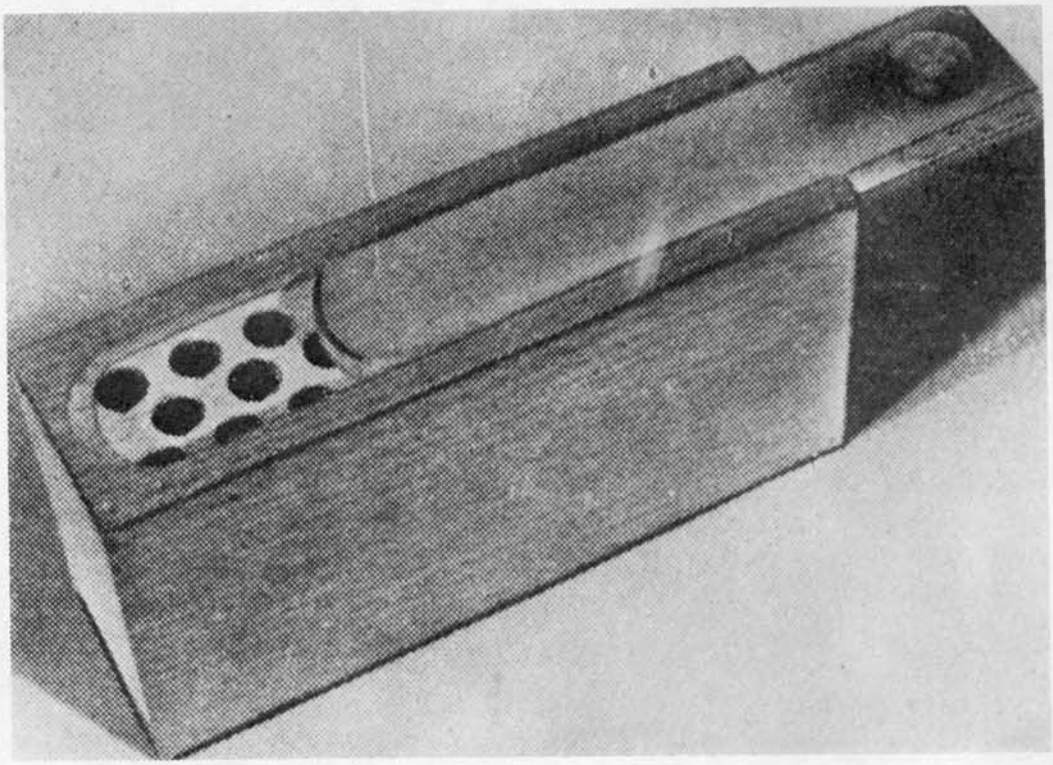
Blasting-cap bodies may be made of copper, aluminum, or cardboard. In East Germany copper is the preferred material. Nonelectric caps have a primary charge and a secondary charge. A typical cap has a diameter of 7 mm and a length ranging from 34 to 54 mm. Approximately 400 mg of fulminate of mercury forms the primary charge, which ignites initially, setting off the secondary charge of about 600 mg of PETN.

In Czechoslovakia the type Z nonelectric blasting cap is used. Made of aluminum,it is 44 mm long and 6.4 mm in diameter. The primary charge is lead azide instead of fulminate of mercury.

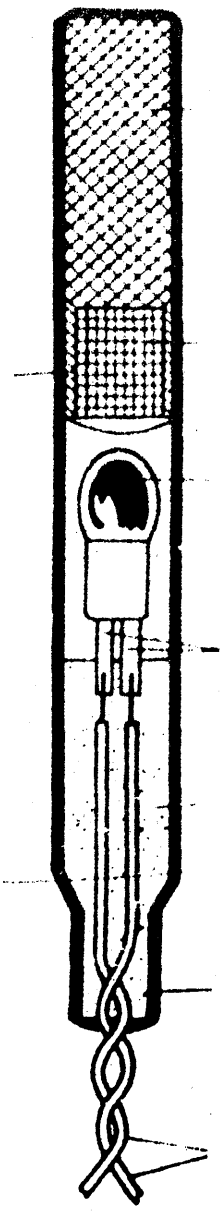
Through the use of adapters and electric squibs, electric blasting caps can be used in the same manner as nonelectric types. The Czechoslovak P-2 electric squib, for example, is used mainly for adapting antipersonnel mines with command firing devices.



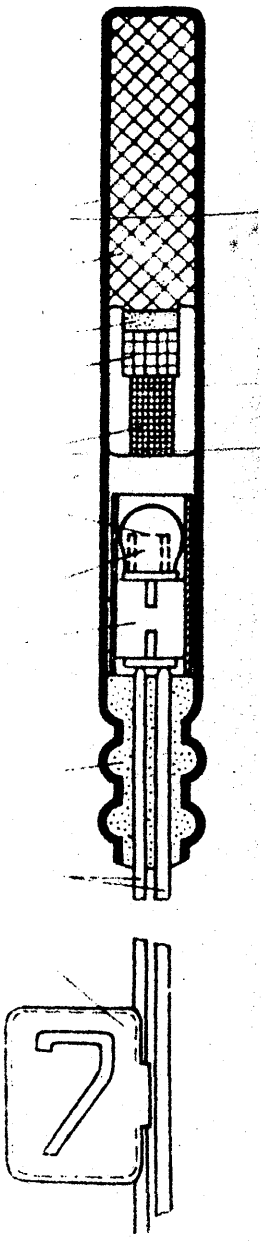
No. 8 Non-electric Blasting Cap



Box for Non-electric Blasting Caps

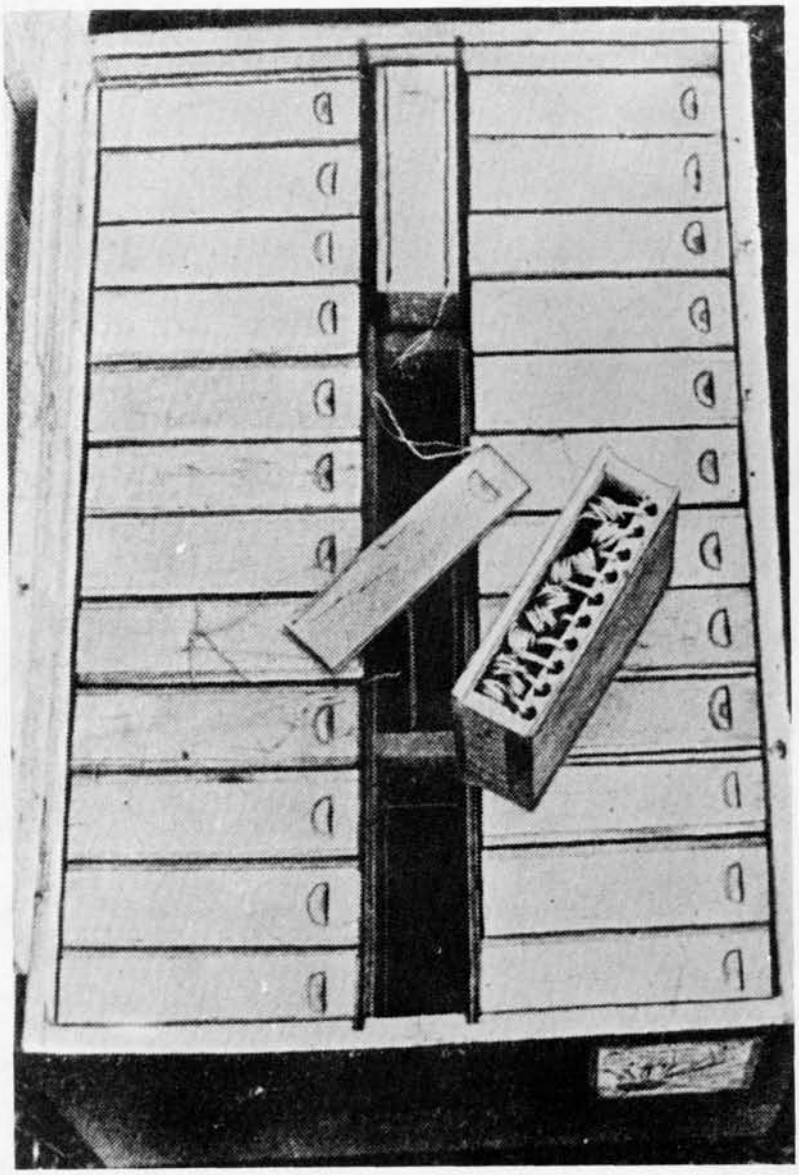


Without
Delay



With
Delay

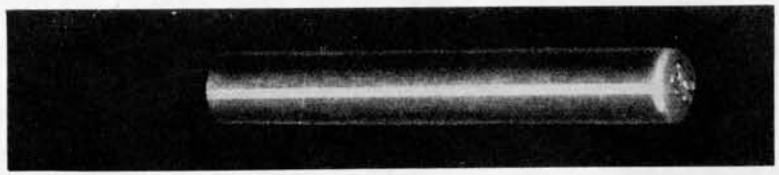
Electric Blasting Caps



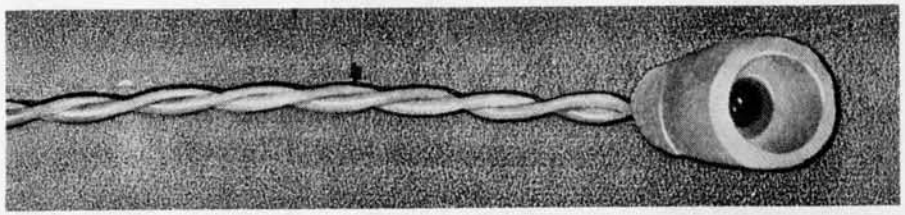
Electric Blasting
Caps No. 8 East German Packaging



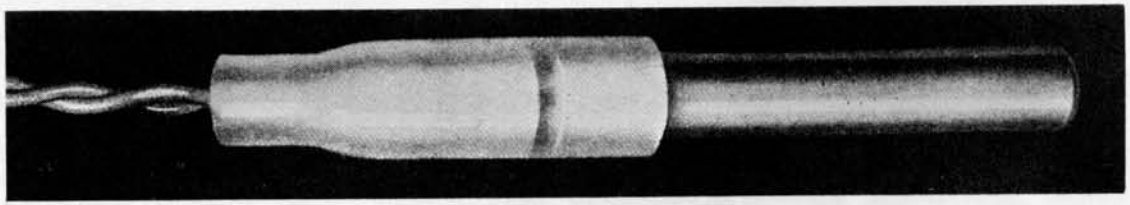
Electric Blasting Caps No. 8
East German Package



NON-ELECTRIC CAP

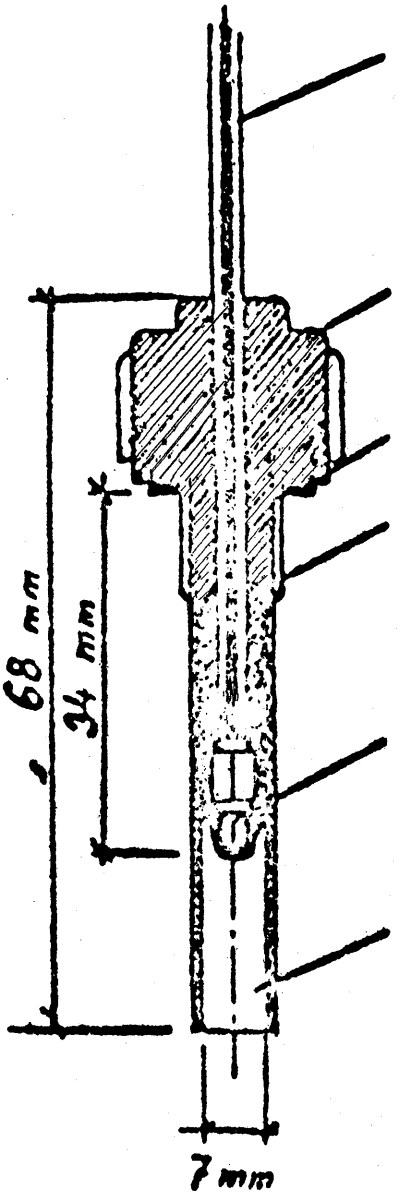


ELECTRIC DETONATOR
ADAPTER MT

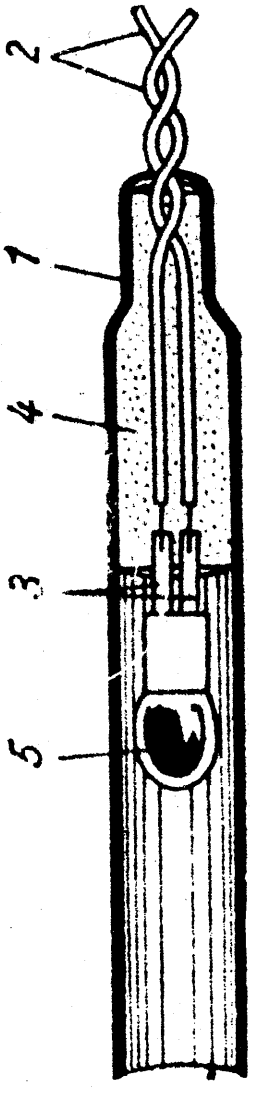


ADAPTER
WITH CAP

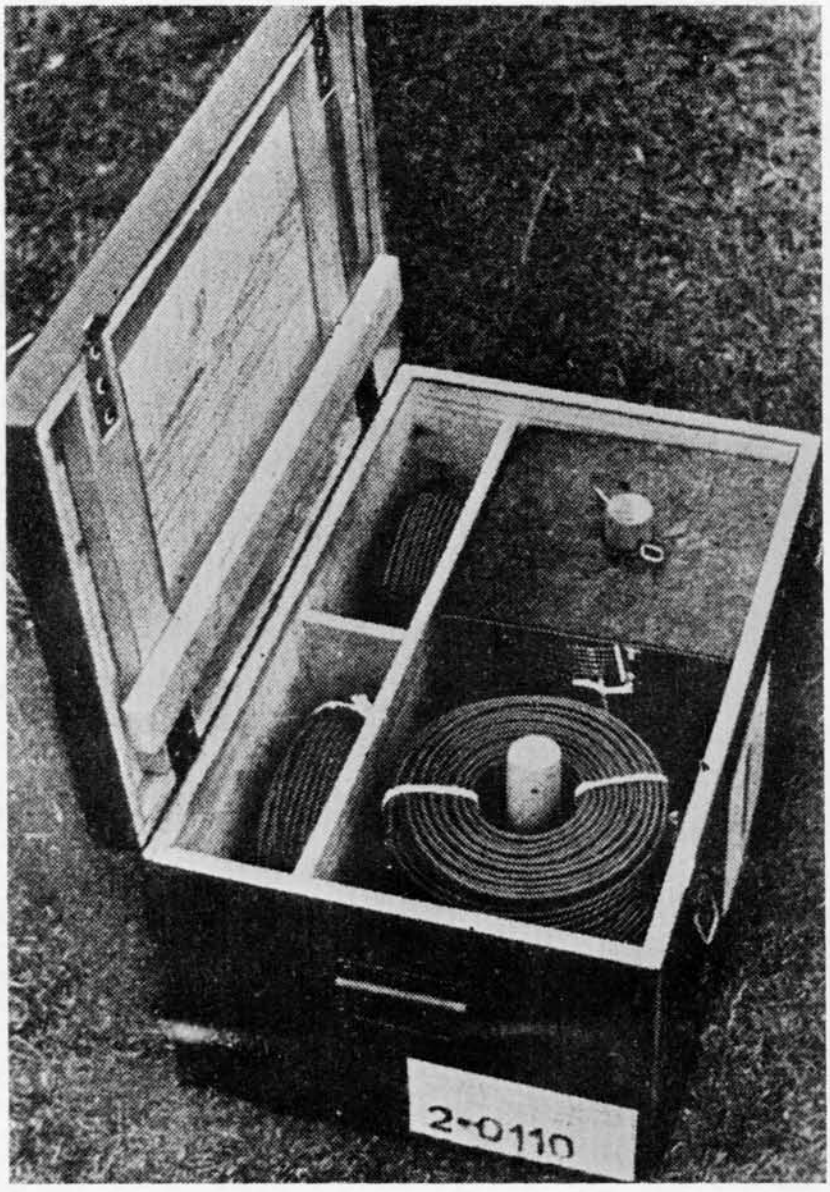
Czechoslovak MT



Czechoslovak
Electric Squib Fuze



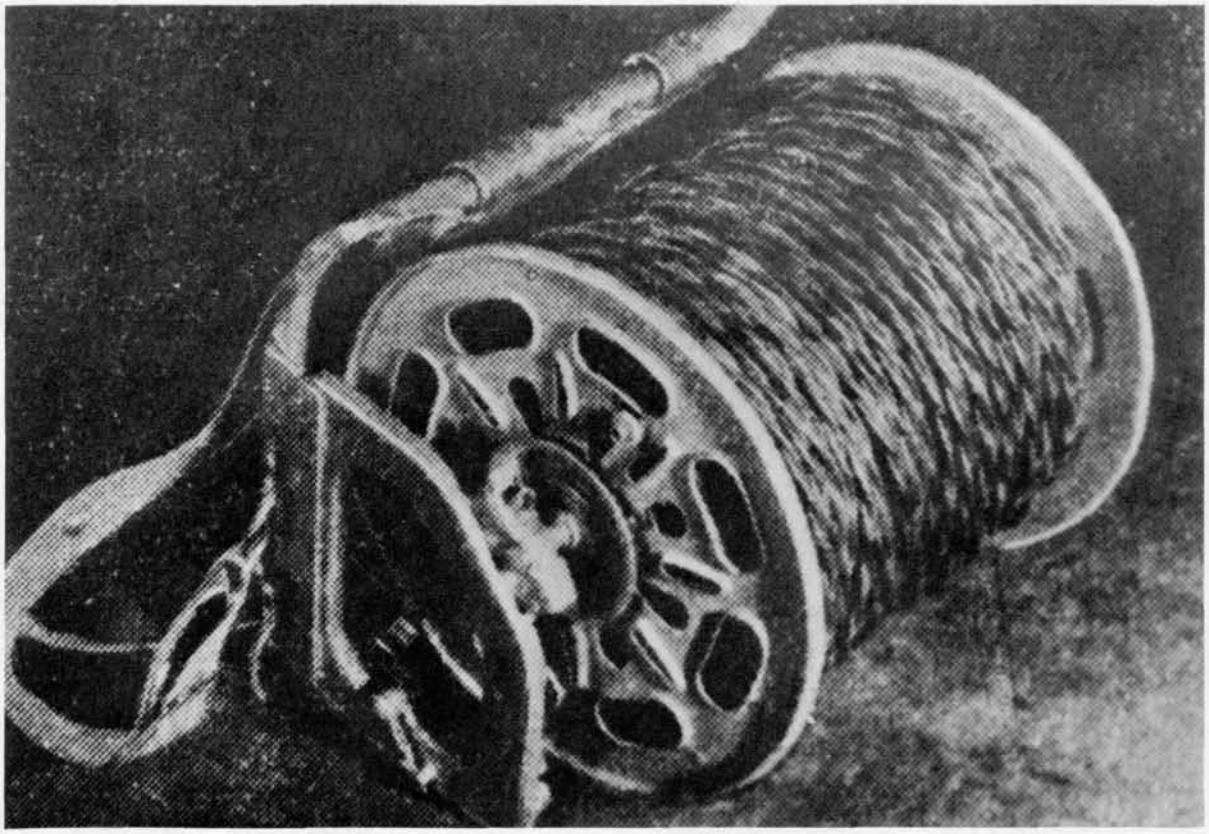
East German
Electric Squib



East German Time-blasting Fuze

TIME-BLASTING FUSE

Time-blasting fuses transmit a flame from a match or igniter to a non-electric blasting cap or other explosive charge, providing a time delay wherein personnel can retire to a safe distance prior to the explosion. Such fuses consist of black powder tightly wrapped with several layers of fiber and waterproofing material and may be any color. Burning rates vary for the same roll or different rolls depending on the atmospheric and climatic conditions. As a result each roll must be tested prior to use. In East Germany the legal standards call for a burning speed of 1 meter in 120 seconds, plus or minus 10 seconds. The standard color for currently-produced military time-blasting fuses in the Warsaw Pact is gray.

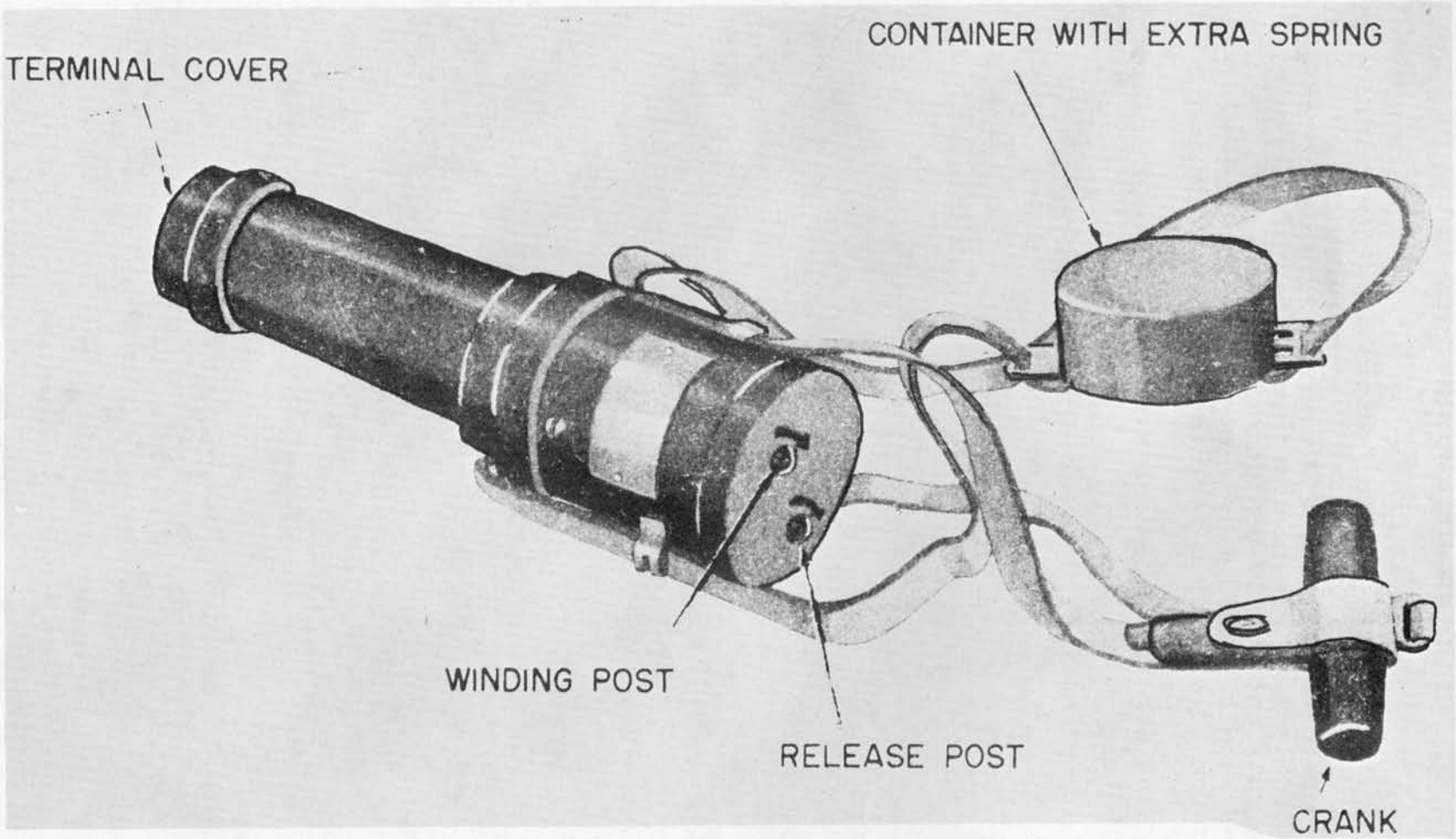


East German Electric Firing Wire

ELECTRIC FIRING WIRE

Electric firing wire, called "sapper wire" by Soviet engineers, consists of a copper wire core wrapped with two or three layers of rubber insulation, and covered with waterproofed, woven fabric or plastic. There are three types of firing wire: single, lightweight, and double-conductor. Single-conductor wire has a standard length of 200 m, while double-conductor has only 100 m. Signal wire is also used for demolition work in the Soviet Army.

In the East German Army, electric firing wire is called "demolition cable."



Soviet Blasting Machine PM-627

BLASTING MACHINES AND ASSOCIATED EQUIPMENT

Blasting machines are used as the source of electric power for the firing of electric blasting caps. Many types exist, some of which are used both commercially and in the military service.

The Soviet PM-1 and PM-2 machines are both low-tension electric generators patterned after older German models. The PM-1 can detonate 100 electric caps wired in series to a distance of 2000 m using standard firing wire. The PM-2 has an aluminum case which houses a steel magnet, armature, and gear assembly. There is a close resemblance between this machine and the United States 10-cap blasting machine. Both PM-1 and PM-2 are operated by turning a crank.

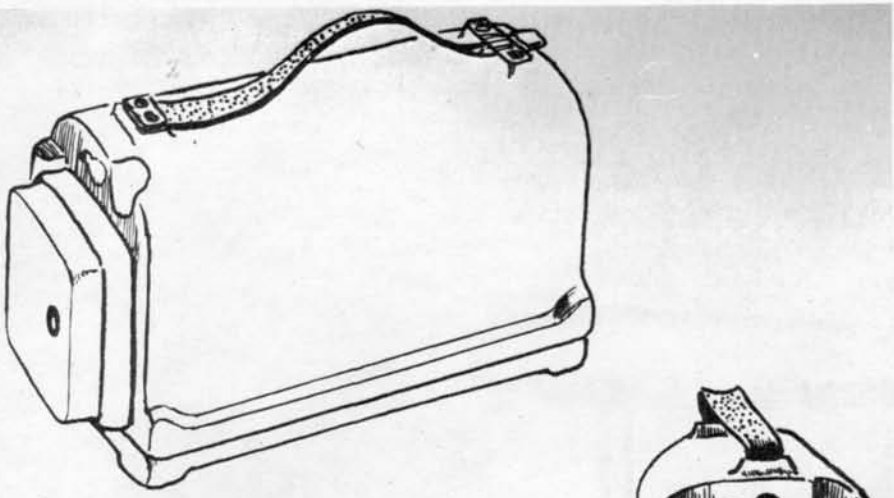
The Soviet PM-627 was developed after World War II. The machine consists of a metal case containing a generator unit, a centrifugal switch, and a gear assembly. A crank and extra spring (with case) are secured to the carrying strap. The PM-627 can set off 50 electric caps wired in series to a distance of 2000m using standard firing wire.

The Czechoslovak DEOS models are very similar to each other in design. Each machine consists of a case which houses a steel magnet, armature, and gear assembly. Both are crank operated. The DEOS-25 is capable of detonating 25 electric caps wired in series, while the DEOS-50 can handle 50 caps. The Czechoslovak military model (not illustrated), the RK-1, is in a waterproof, bakelite case composed of two sections. On the bottom there are two holders for the carrying strap. In series connection the RK-1 can fire 250 electric caps. The machine can be used in temperatures ranging from -40°C to +50°C, and is resistant to vibration. A newer model, the TZK 100 W, is also probably used.

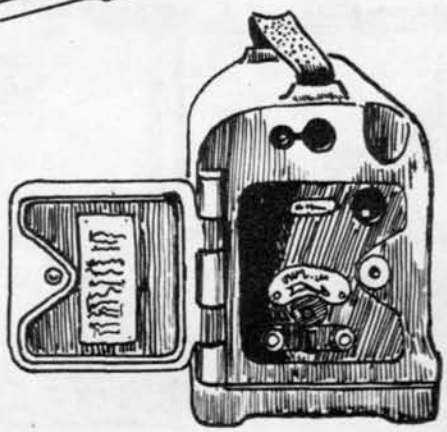
The East German Army has standardized the East German-produced M-524, which can detonate 100 caps. Other machines in use vary in capacity, with the older A models being replaced by the newer M models which are smaller in size. Those models with the mark (S) in front of the model number are safe against firedamp, the combustible gas formed by the decomposition of carbonaceous matter.

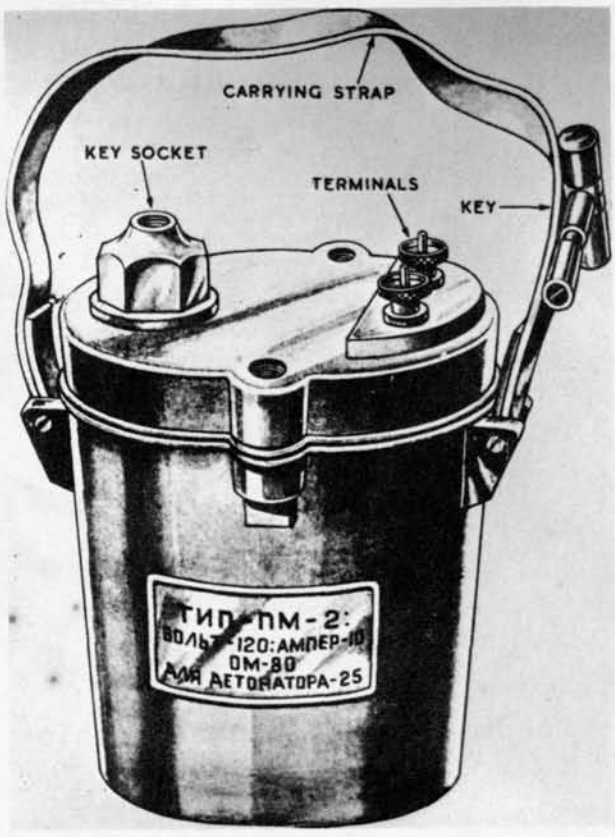
Other pieces of equipment used in connection with blasting machines are circuit-testing machines and blasting-protectors. In combat, the Soviet Army often employs electrically-controlled mines. Between the control point and the mines, there is often

up to 3000 m of firing wire. Because this net must be in the ground for weeks, and sometimes months, the Soviets have produced the GZU "thunder-protecting device" to protect each mine from premature detonation by lightning and other stray electric currents of more than 60 volts. The GZU consists of a plastic, cylindrical, bitumen-insulated case containing a neon tube with a 60-volt ignition potential, and a choke coil having 10 ohms resistance.



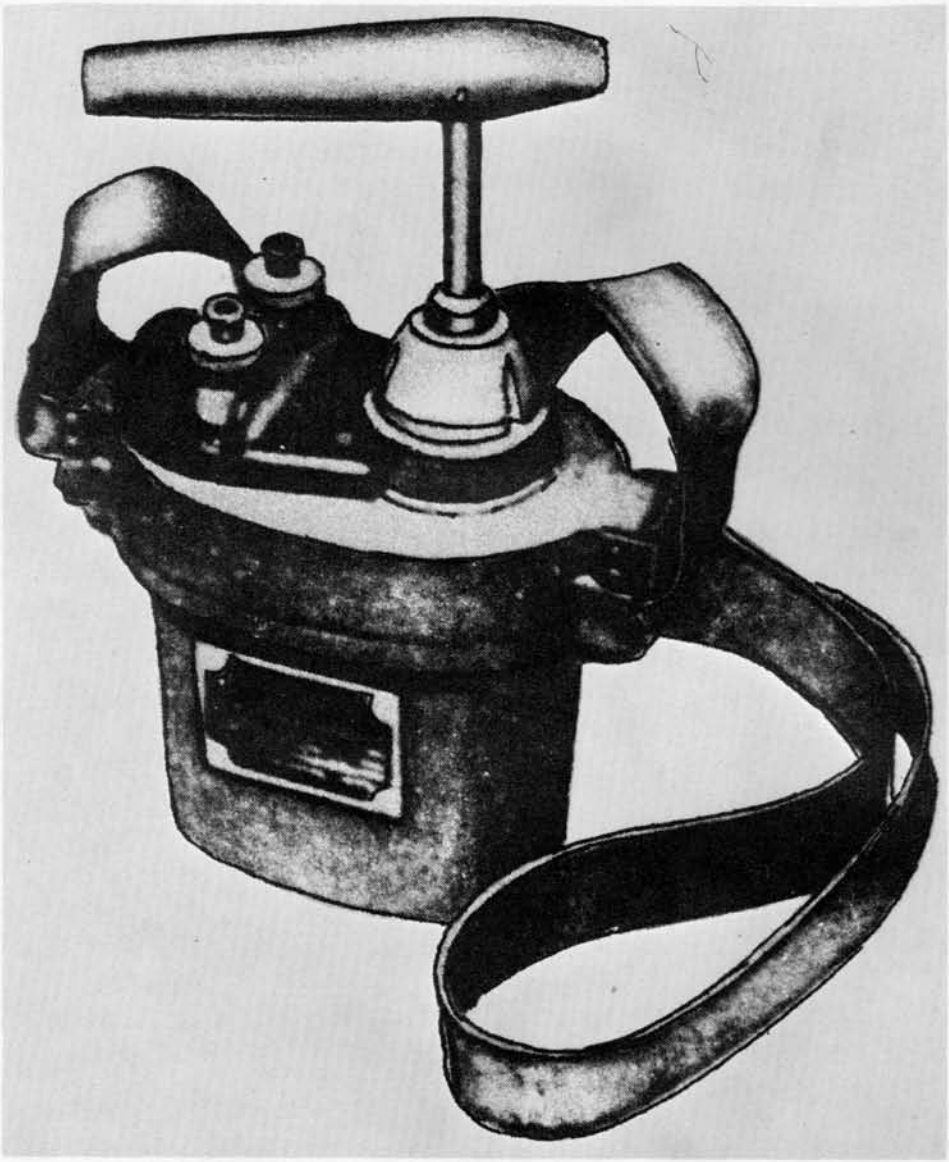
PM-1



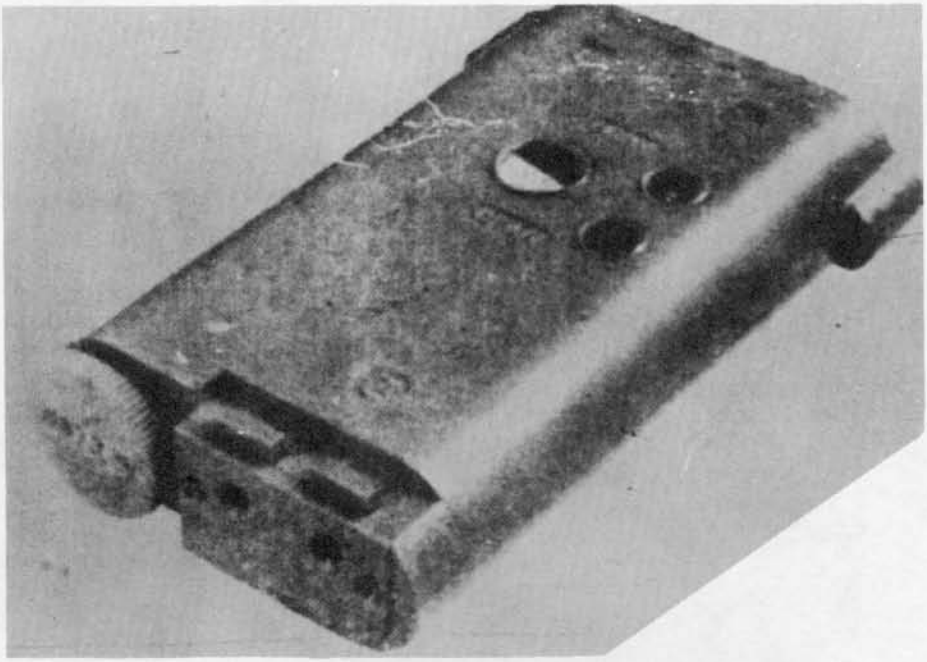


PM-2

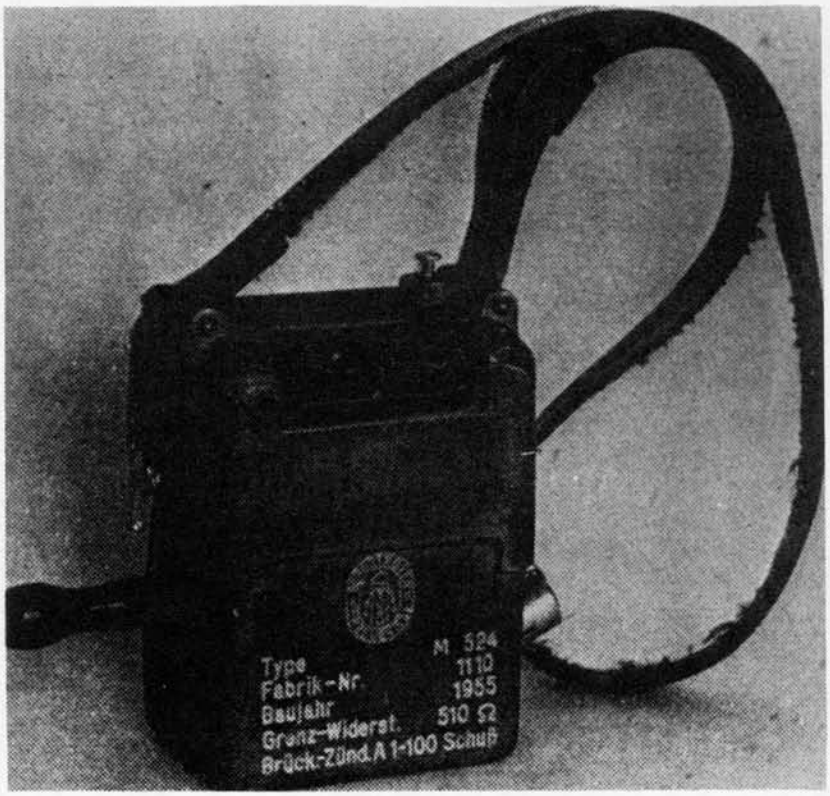
Soviet Blasting Machines



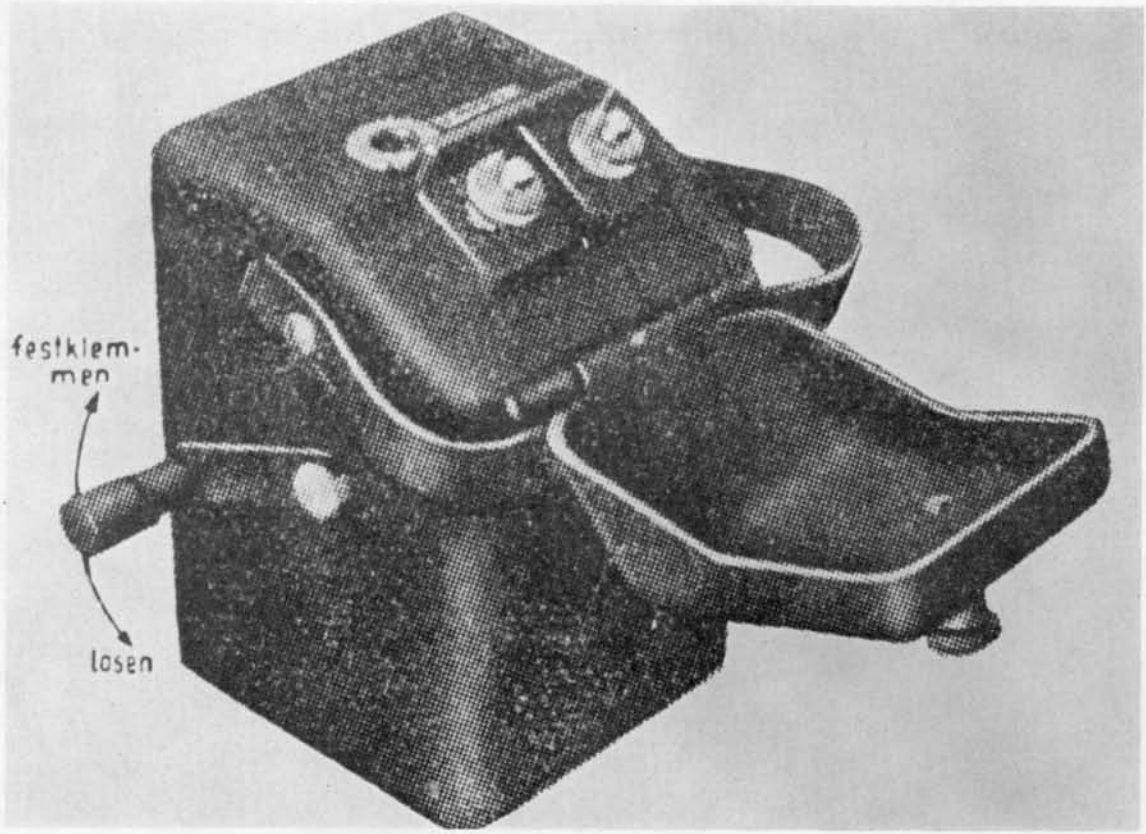
Czechoslovak Blasting Machine DEOS Series



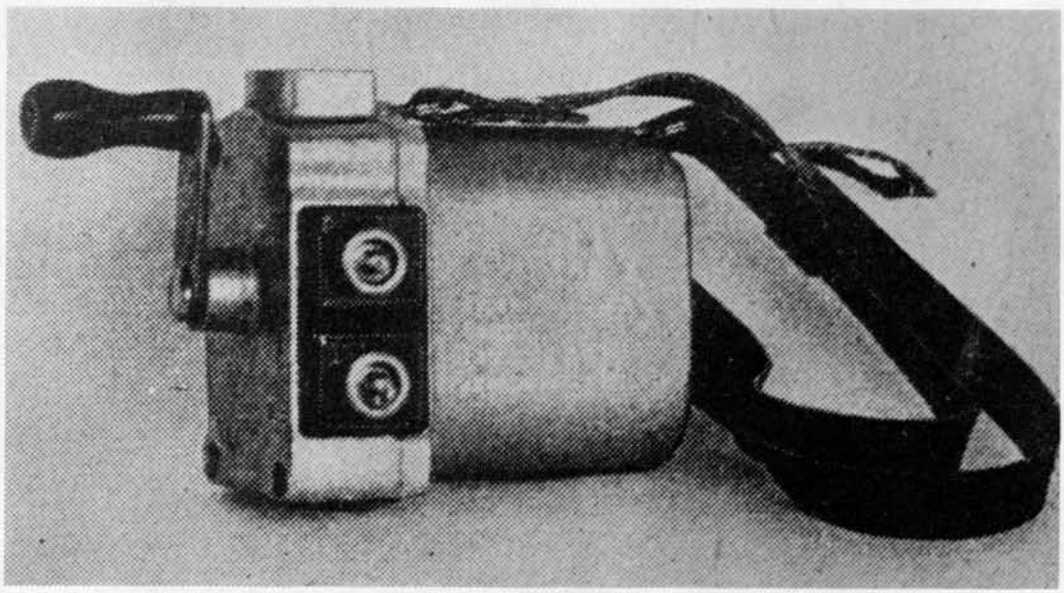
Czechoslovak Blasting Machine TZK 100W



East German Blasting Machine M 524

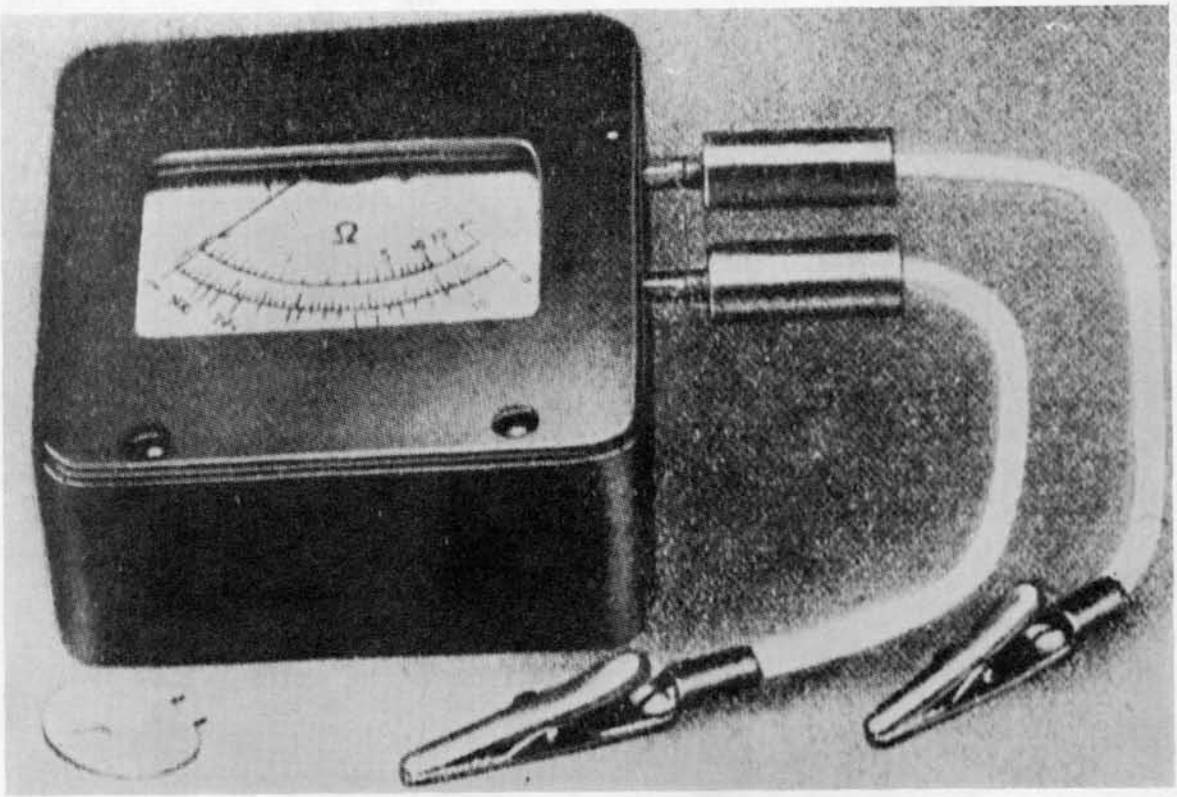


(S)A 5101K

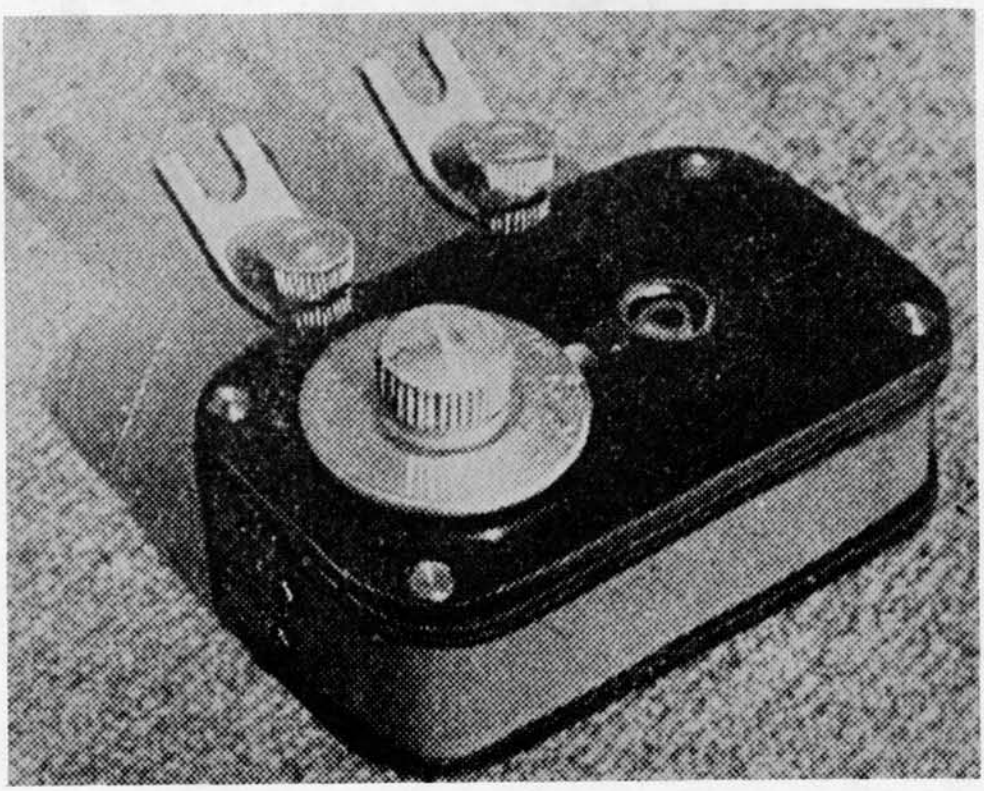


(S) M534K

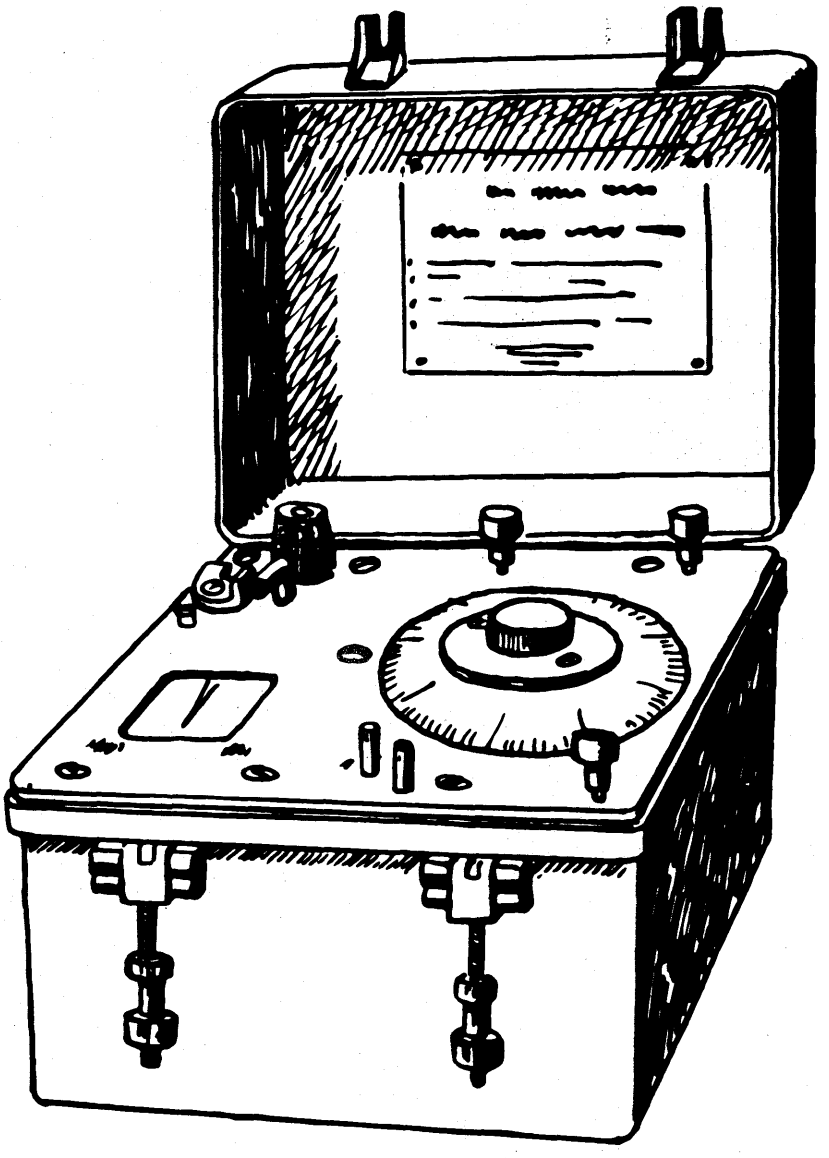
East German Blasting Machines



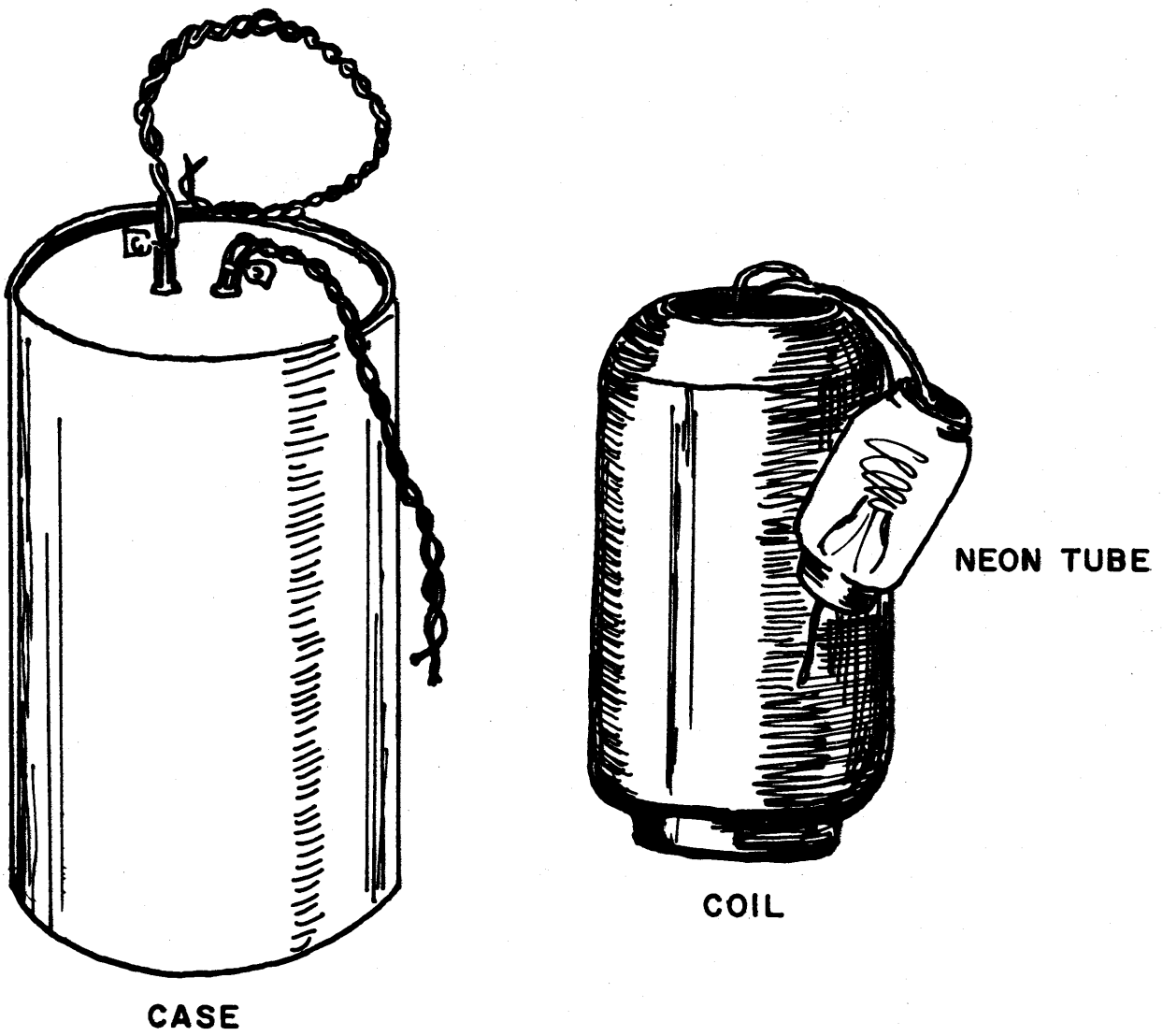
Circuit Tester Type 5201



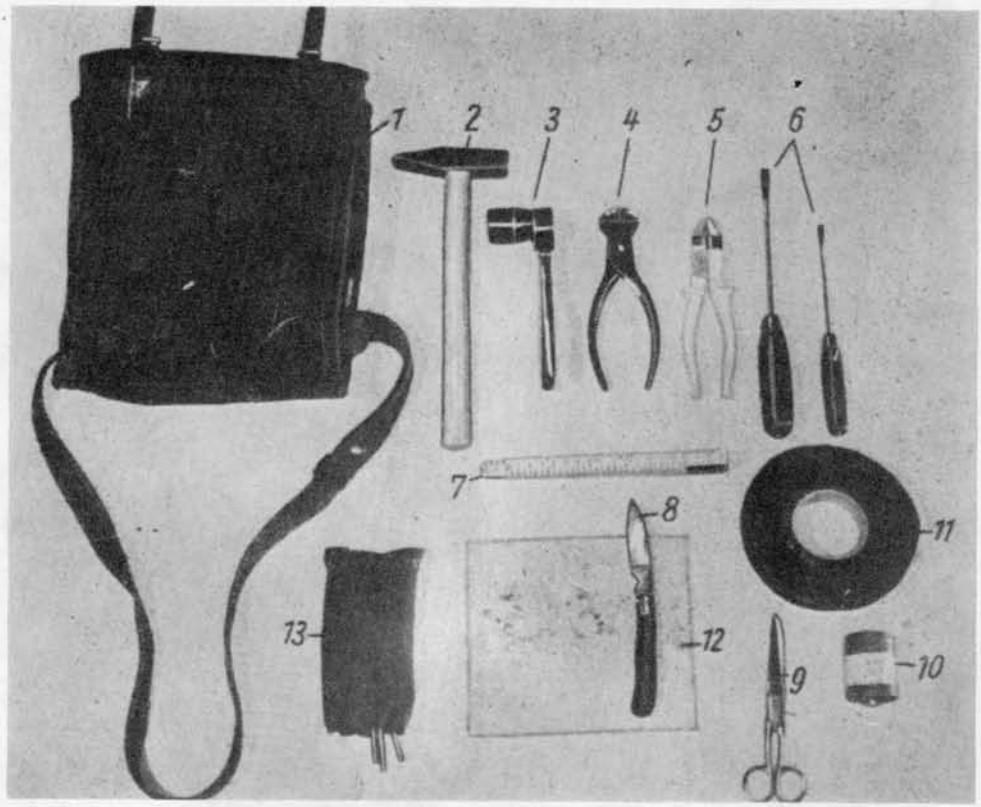
Blasting Machine Test Set 2P10
East German



Soviet Large-Ohmmeter LMV 47



Soviet Circuit Protector GZU



East German Demolition Accessories Kit

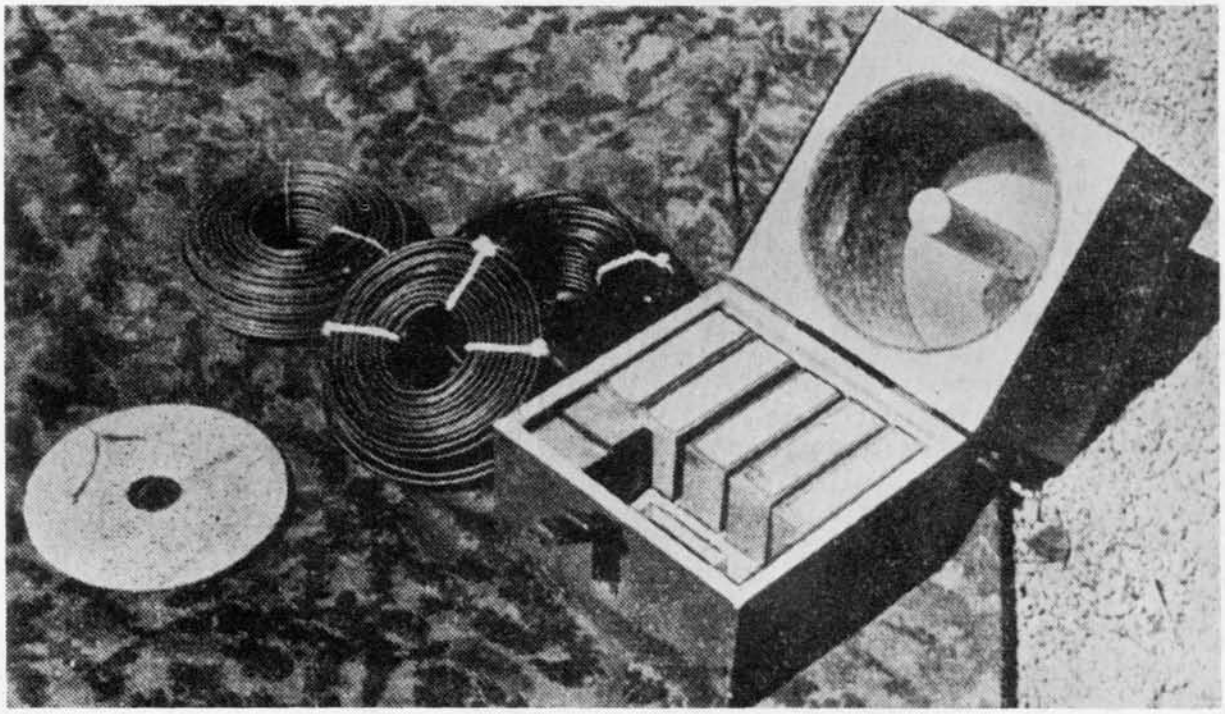
DEMOLITION ACCESSORIES SETS

Various types of demolition accessories sets are issued to engineer troops of the East European armies. Typical is the East German set which is illustrated on the opposite page. It has the following components:

1. Canvas carrying bag
2. Small hammer
3. Socket wrench
4. Crimpers
5. Insulating cutting pliers
6. Screwdrivers
7. Ruler
8. Demolition knife
9. Scissors
10. Sealing compound
11. Friction tape
12. Cutting board
13. Adapters

The Czechoslovak Army issues a more elaborate set called "T." It has the following components which are packed in a wooden chest:

--500 m of V-SUA firing wire
--Winding device with crank and reel
--RK-1 blasting machine
--VOMET Volt-ohmmeter
--KDX ohmmeter
--30 m of fabric tape
--2 steel tape measures
--10 m of friction tape
--Box of insulating paste
--Flashlight
--2 crimpers
--Electrician's knife
--Combination pliers
--20 m of plumb line
--Bag with threaded couplings
--Bag with protector tubes



East German Explosive-Initiating Demolition Set

EXPLOSIVE-INITIATING DEMOLITION SET

East European armies issue various types of explosive-initiating sets. Typical is the East German set illustrated on the opposite page. It consists of a wooden chest containing 50 non-electric blasting caps and 50 electric blasting caps in their original wooden boxes, plus 2 rolls of detonating cord and 1 roll of time-blasting fuze. The chest is marked with the Roman numeral "VI" on a white background.

DISTRIBUTION

	NO OF COPIES
1ST ARMD DIV - AETSKB - OB	038
1ST ARMD DIV - 2D BDE - S2	005
1ST BDE, 5TH INF DIV (MECH)	002
1ST BN (RANGER), 75TH INF	006
1ST CAV DIV - G2	010
1ST INF DIV - FT RILEY	050
1ST INF DIV - FWD	005
1ST SPT BDE	002
2D ACR - BRD-OPS	011
2D MI BN (ARS) (FLDA)	005
2D MI BN, DET D	004
2D SPT BDE	001
2D TANK BN-FMFLANT	003
3D ACR - S2	010
3D ARMD DIV - G2	250
3D INF DIV - G2	250
3D MARINE DIV	001
4TH ALLIED TAC AIR FORCE - OIN	001
4TH INF DIV	002
5TH ARTY GP	008
8TH INF DIV - G2	200
9TH TIS (LDD)	031
10TH SF GP (ABN) - FT DEVENS	004
10TH SF GP - DET A SPT BN	015
11TH ACR - S2	150
26TH TAC RECON WG (DOI)	003
32D AADCOM - G2	009
3D TAC FTR SQD	001
36TH TAC FTR WG - ALO	001
41ST ARTY GP	006
42D ARTY GP	001
48TH TAC FTR WG	001
52D TAC FTR WG	001
56TH ARTY BDE	001
56TH SP OPNS WG (PACAF)	002
60TH ORD GP	001
66TH MI GP - AEUMI-TB & OP	027
69TH ADA GP - HHB	001
70TH DIV (TNG)	001
82D ABN DIV - FT BRAGG	032
86TH TAC RECON WG (DOI)	001
101ST ABN DIV - AFZBDS (TAB)	025
130TH ENGR BDE	006

	NO OF COPIES
210TH FA GP	006
212TH FA GP	014
322D TAW-INTEL DIV	001
417TH MI DET	001
453D MI DET	001
469TH MI DET	001
479TH MI DET (STRAT)	001
497TH RTG	082
497TH RTG - LN OFC	043
502D USASA GP	002
504TH MI CO	002
519TH MI BN, CO D	001
529TH MI CO	001
544TH ARTW/DAAC	004
7602D AIR INTEL GP	007
V CORPS ARTY	050
V CORPS FOR III GE CORPS	004
V CORPS SPT CMD	002
VII CORPS - G2	025
VII CORPS ARTY	050
VII CORPS FOR II GE CORPS	001
VII COSCOM	001
AFAITC/TINAL	028
AFCENT - US LNO	001
AFSPCOMMCEN/SUR	002
AIR UNIV LIB MAXWELL AFB	001
ALCOM - J2	001
ARMED FCS STAFF COLLEGE	001
ASD-SYS ANAL - NATO DIV	001
ATLANTCOM	001
BERLIN BDE	050
CDR - UNIT JJ - APO 09742	001
CDR - UNIT MM - APO 09742	025
CINCPACFLT	001
CINCPAC -OID	001
DA-DAMI-DOA	001
DIA-DS-4C	280
DIA LN DET BOX 97	036
DMAAC/ADL	001
EIGHTH USA	005
EUDAC-OC	002
FIFTH USA	001
FMFLANT	001
FORSCOM	001
FORSIC	003
FSTC	110
FTD (NIIR)	003

	NO OF COPIES
FTD/PDYA (AREA B)	001
INTEL CEN - PAC	008
JNT REFUGEE OPN CEN - APO 09742	001
MASSTER - ATTN: SCIENCE ADVISOR	001
NAV AIR DEV CEN - SCI & TI OFF	001
NEVADA ANG (NMD-ARO-I)	012
NSA - L2231	001
OASD (PA&E) - EUR DIV	002
PACAF & PFIHS & DS	004
PICATINNY ARSENAL	002
SAMSO (IND)	001
SASCOM-NORTHAG/TWOATAF ELE	001
SHAPE - SURVEY SEC	001
SHAPE USNMR	002
SPEC AMMUNITIONS SPT COMD EUR	001
TEST & EVAL COMD	004
TRADOC	006
US ELE - ALLIED NAV FCS - SOUTH	001
USREDCOM	001
USA AIR DEF SCH - FT BLISS	001
USA ARMOR SCH - ARMOR AGCY	001
USA ARMOR SCH - FT KNOX	003
USA BAL RES LAB	025
USA BERLIN AND USCOB - DCSI	025
USA COMB ARMS COMBAT DEV ACTY	004
USA CONCEPTS ANAL AGCY	001
USA ELE AFCENT	001
USA ELE CENTAG	055
USA ELE CENTAG - ENG DIV	005
USA ELE LANDSOUTHEAST	002
USA ELE LIVE OAK	001
USA ELECT COMD	001
USA ELECT PROV GND	002
USA ENGR SCH - ENGR AGCY	001
USA ENGR SCH - FT BELVOIR	010
USA FA SCH	002
USA FRANKFORD ARSENAL	005
USA INF CEN STAFF GP BBOP	002
USA INF SCH - ATSH - CD - CS	010
USA JFK CEN - MA	002
USA JFK CEN - SW	001
USA LN GP EUR - (AIR FORCE LN)	011
USA LN GP - NORTHAG/BAOR	150
USA LN GP TO CCFFA	016
USA LOG CEN (PROV)- FT LEE	001

	NO OF COPIES
USA MATERIEL COMD - AMCRD-I	001
USA MATERIEL COMD - STITEUR	010
USA MISSILE COMD REDSTONE ARSENAL	005
USA MOBILITY EQUIP COMD	002
USA MUNITIONS COMD	001
USA ORD CEN & SCH	002
USA PERS SURVEY DET	004
USA SCI & TECH CEN - FAR EAST	002
USA SCTY EVAL GP (LNO)	020
USA ST & TAG	001
USA TANK AUTOMOTIVE COMD	006
USA TRAN SCH - FT EUSTIS-LIB	001
USA WAR COLLEGE	001
USA WEAPONS COMD	002
USACGSC - FT LEAVENWORTH	001
USAIC & SCH - ATSI - SE - DC - FT HUACHUCA	002
USAIC & SCH - CCU - FT HUACHUCA	002
USAIC & SCH - DCBTI - ASRC - CCS - FT HUACHUCA	002
USAIIC - FT MEADE	006
USAREUR & 7A CATC	001
USAREUR & 7A ODCSI - COLL DIV	004
USAREUR & 7A ODCSI - SYSTEMS DIV	001
USAREUR & 7A ODCSI - LNO-BONN	007
USAREUR & 7A ODCSI - LNO-MUNICH	007
USAREUR & 7A ODCSI - LNO-ROME	007
USAREUR & 7A ODCSI - PDN DIV	100
USARPAC - ODCSINT	001
USASAFS AUGSBURG	010
USASAFS AUGSBURG OPS	012
USASAFS BERLIN	008
USASETAF - G 2/3 - I & S BRANCH	001
USASRD ACSI	001
USATSAE	001
USDAO - AMER EMB APO 09777	001
USDAO - AMER EMB - BOX 335	002
USDAO - AMMAN	001
USDAO (ARMA) - BOX 36 FPO 09510	001
USDAO - ATHENS	003
USDAO - BELGRADE	001
USDAO - BRUSSELS	010
USDAO - BUCHAREST	001
USDAO - BUDAPEST	003
USDAO - CAIRO	001
USDAO - COPENHAGEN	001
USDAO - THE HAGUE	013

	NO OF COPIES
USDAO - HELSINKI	001
USDAO - LISBON	008
USDAO - LONDON	001
USDAO - MOSCOW	005
USDAO - PRAGUE	007
USDAO - ROME	001
USDAO - SOFIA	004
USDAO - TEL AVIV	002
USDAO - VIENNA	002
USDAO - WARSAW	006
USEUCOM - J2 - A/A	001
USEUCOM - J2 - P	006
USMLM	020
USN FCS EUR	001
USN EOD FAC	001
USN MED RSCH LAB	001
USN REP - GERMANY	002
USN WAR COLLEGE - CODE 1212	001
USNAVEUR	001
USPAC FLT NAVY NO 128	002
TOTAL	2776