Next 4 Page(s) In Document Denied

50X1

INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

50X1

S-E-C-R-E-T

50X1

COUNTRY USSR

REPORT

SUBJECT English-Translation of a Soviet Manual Entitled 130-mm Gun-Howitzer M-46 and 152-mm Gun-Howitzer M-47, Service Manual

DATE DISTR. 5 February 1964

NO. PAGES 1

REFERENCES

50X1

50X1-HUM

DATE OF INFO.

PLACE & DATE ACQ.

50X1-HUM

THIS IS UNEVALUATED INFORMATION. SOURCE GRADINGS ARE DEFINITIVE

1. A copy of an English translation of a Soviet manual entitled 130-mm Gun-Howitzer M-46 and 152-mm Gun-Howitzer M-47, Service Manual 50X1-HUM

50X1-HUM

The Russian-language version of the manual, published by the Military Publishing House of the Ministry of Defense, Moscow, 1962 50X1-HUM

50X1-HUM

Distribution of Attachment for Retention:

OO/FDD:	1 copy
OSI:	1 copy
ORR:	2 copies
Army:	4 copies
Army/FSTC:	6 copies
Navy:	1 copy
Navy/STIC:	1 copy
Air:	1 copy
Air/FTD:	1 copy
SAC:	1 copy
NSA:	2 copies

5
4
3
2
1

DIA	ARMY	NAVY	AIR	NSA	NIC	OCR	SAC
OO/FDD	Army/FSTC	Navy/STIC	Air/FTD				

(Distribution indicated by "#".)

INFORMATION REPORT INFORMATION REPORT

50X1-HUM

Next 1 Page(s) In Document Denied

50X1-HUM

MINISTRY OF DEFENSE USSR

130-mm GUN-HOWITZER M-46 and 152-mm GUN-HOWITZER M-47

S E R V I C E M A N U A L

50X1-HUM

TABLE OF CONTENTS

PART ONE

Description of the 130-mm Gun-Howitzer M-46 and the 152-mm Gun-Howitzer M-47

Note:

References made in the text to Cyrillic-lettered parts in photographs or diagrams have been transliterated into English, rather than transcribed in Cyrillic, in accordance with the following transliteration table:

А а	a	Р р	r
Б б	b	С с	s
В в	v	Т т	t
Г г	g	У у	u
Д д	d	Ф ф	f
Е е	ye	Х х	kh
Ж ж	zh	Ц ц	ts
З з	z	Ч ч	ch
И и	i	Ш ш	sh
Й й	y	Щ щ	shch
К к	k	Ъ ъ	"
Л л	l	Ы ы	y
М м	m	Ь ь	'
Н н	n	Э э	e
О о	o	Ю ю	yu
П п	p	Я я	ya

PART ONE

DESCRIPTION OF THE 130-mm GUN-HOWITZER M-46 AND THE 152-mm GUN-HOWITZER M-47

CHAPTER ONE

GENERAL INFORMATION

1. Mission and Combat Characteristics of the 130-mm Gun M-46 and the 152-mm Gun M-47

The 130-mm gun M-46 (Figures 1 and 2) and the 152-mm gun M-47 are designed:

- for combat with enemy artillery and mortars and the neutralization of infantry and tank concentrations

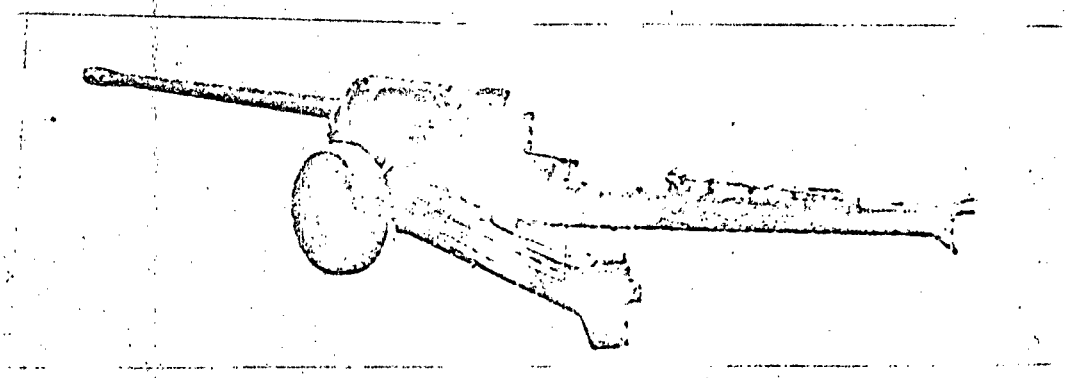


Figure 1. General view of the 130-mm gun M-46 in the firing position at 0° angle of elevation

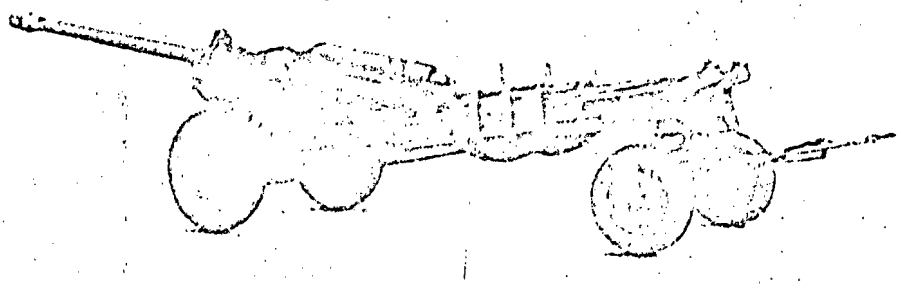


Figure 2. General view of the 130-mm gun M-46 in the traveling position

- for the destruction of permanent defensive ground installations and other hardened field type installations;

- for shelling the enemy rear;

- for combat with enemy self-propelled artillery and heavy tanks.

A separate cartridge charge with a high-explosive fragmentation [p 4] shell or an armor-piercing tracer shell is used in firing the M-46 and the M-47 guns.

Maximum range of the M-46 gun is about 27 km (with a muzzle velocity of 930 m/sec) and the maximum range of the M-47 - about 20.5 km (with a muzzle velocity of 770 m/sec).

The horizontal firing angle of both guns is 50° (25° to the left and to the right) and the vertical firing angles are from -2°30' to + 45°.

The rate of fire of the M-46 is from seven to eight rounds per minute, and that of the M-47 - five to six rounds per minute.

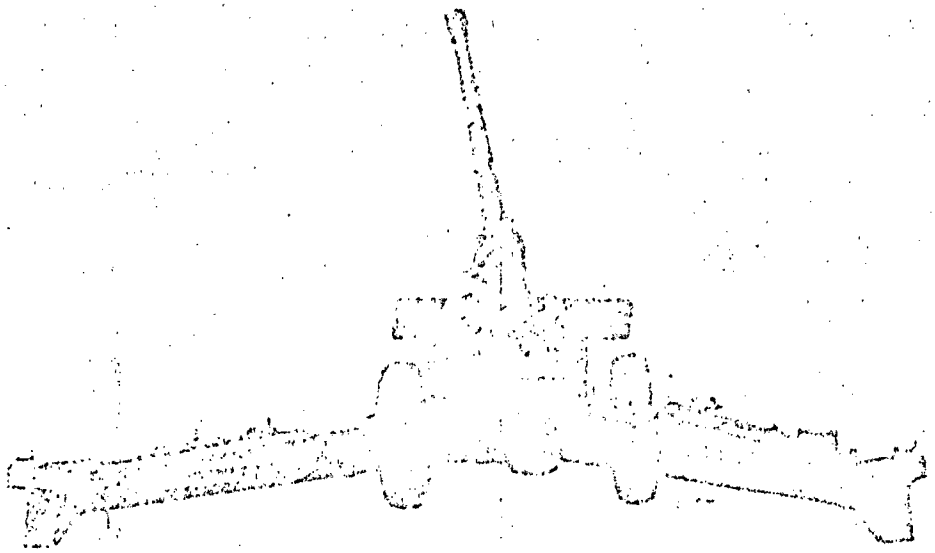


Figure 3. General view of the 152 mm gun M-47 in firing position with an angle of elevation 45°

The weight of both guns is the same: about 7,700 kg in firing position and about 8,450 kg in traveling position.

The guns are towed by a tractor. The medium artillery tractor AT-S is authorized for this use. Permissible speed for the guns on good roads is 50 km/hr and 10-20 km/hr on open terrain. The transition time for the M-46 and M-47 guns from firing position to traveling, and vice versa, is 3 to 4 minutes.

2. Brief Information on the Construction of the Guns

The 130-mm M-46 and the 152-mm M-47 guns differ with respect to design only in the construction of the loose tube barrels and muzzle brakes, and in the graduation markings of the sights; all other parts and components are identical.

This service manual gives the description of the construction of the 130-mm M-46 gun; however, all that is said about the 130-mm gun applies equally to the 152-mm M-47.

The gun consists of the following basic parts:

Barrel with loose tube, housing, breech ring, and muzzle brake. The housing has clamps for guiding the barrel along the cradle and for fastening the conterrecoil mechanism.

Late model guns have a monobloc-barrel [p 5]

Breech, block type, horizontally sliding, opening to the right. The breech is opened and closed by turning the breech mechanism lever. Firing is carried out by pulling the push rod, located on the cradle shield, which in turn turns the cocking lever of the firing pin.

Cradle, with the trunnions, lies in the trunnion bed of the top carriage to which it is fastened with clamp rings. The barrel recoils and returns along the cradle guide.

The recoil buffer is located in the cradle. The counterrecoil buffer rod is fastened in a stirrup, located in the front portion of the cradle. The elevating mechanism is attached to the lower side of the cradle.

Recoil buffer - hydraulic type. The buffer cylinder is fastended to the gibs of the cradle. The recoil buffer piston rod recoils during the firing together with the barrel. The buffer is filled with 28.7 liters of "steol M". The length of recoil is variable; it is controlled by a mechanism for varying the recoil distance depending on the angle of elevation.

At $-2^{\circ}30'$ to $+ 20^{\circ}$ barrel angles of elevation, long recoils of 1150 to 1320 mm take place; at angles of elevation of 34° to 45° - short recoils of 735 to 815 mm, and at angles of elevation between 20° and 34° - variable, from long to short, recoils.

Recuperator - hydro-pneumatic, fastened to the barrel gibs. The recuperator cylinders recoil with the barrel; however the rod, fastened to the cradle stirrup is stationary. Normal pressure in the recuperator is 56 ± 2 atm. The recuperator is filled with 21.6 ± 1 liters of "steol M."

The top carriage serves as the base for the tipping parts of the gun; it rests on the bottom carriage and is connected to it by a pintle about which it can rotate. The front gib keeps the carriage from turning over during firing.

The elevating and the traversing mechanisms are mounted on the top carriage. Both mechanisms are of the arc type. The hand wheels for the elevating and the traversing mechanisms are located on the left side of the top carriage.

Equilibrator - hydro-pneumatic, of the pusher type; it consists of two columns located behind the shield on the right and the left sides of the cradle. A compressed air tank is fastened to the top carriage for controlling the pressure. At a 45° angle of elevation, the pressure in the equilibrator is about 25 atm, and at a 20° 30' angle of depression - about 44 atm.

The bottom carriage is a steel casting and serves as the base for the rotating part of the gun.

The trails are hinged to the lower carriage. A suspension, consisting of two balance beams and a system of sleeves and levers which are connected to the lower carriage by flexible torsion shafts, is mounted on the lower carriage.

The trails are beams welded out of plate and angle iron. Forked knuckle joints are located on the forward part of the trails for connecting the trails to the lower carriage; winter spades are mounted on the end of the trails.

Summer spades are interchangeable. The ends of the trails, when in the traveling position, are fastened with a drawbar and connected to the limber.

Jacks - hydraulic, fixed to the trails, are used for raising and lowering the trails to and from the limber.

Winch - fixed to the right trail, is used for pulling the barrel into traveling position and for extending it back into firing position. [p 6]

Sighting devices consist of a mechanical sight and a panoramic sight. In addition, there is an optical sight designed for firing by direct laying. The sights are fixed to the cradle on the left side of the gun.

The shield assembly consists of a shield and a jacket made of armor steel. The shield is fastened to the upper carriage with brackets. A box for stowing the panoramic sight and extension of the panoramic socket and a case for the gun log book are attached to the shield.

The jacket protects the recuperator from bullets and shell fragments. The jacket is secured to catches on the barrel.

Wheel brakes are of the shoe type, pneumatically controlled from the prime mover.

The wheel brakes are designed for braking the gun during traveling. There is a manual control lever for braking the gun during traveling when the air brake controls fail and also for braking the gun when it is disconnected from the prime mover. During firing, the wheels are braked manually.

Wheel - single disk type with 1350 x 380 GK tires.

The limber has a pintle frame on which the rear trail assembly is mounted when in the traveling position. The frame of the pintle rocks in a transverse direction and rotates about its axis, making the movements of the gun and the limber independent and providing ease of handling.

Flexibility of movement is achieved with the hinged joint of the limber shaft. In traveling, the limber shaft is connected to the tow hook of the prime mover. The pintle frame is mounted on springs.

Before traveling, the gun is brought from firing position into traveling position, for which the trails are drawn together and mounted with a draw bar on the limber pintle and secured with a wedge. The barrel is disconnected from the recoil buffer and the recuperator from the cradle stirrup. By winch, the barrel is pulled back on the rests located on the trails and secured with a locking device and threaded tie rods.

The cusioning mechanism is automatically engaged when the trails are drawn together.

In exceptional cases, as well as for short distances, it is permissible to transport the gun without placing the barrel in traveling position; however, in these cases speed must not exceed 5 km/hr.

At the firing position the barrel is changed from traveling position to firing position, for which the tie rods and the locking device are released.

The barrel is pulled as far forward as possible with the winch and then connected with the buffer piston rod. The recuperator rod is connected with the cradle stirrup fitting.

Then, using the jacks, the trails are taken off the limber and drawn apart as far as possible. At this time the suspension is automatically disengaged.

The upper carriage traveling lock is removed from the seat in the bottom carriage by lifting the handle of the lock and turning it 90° to either side.

Detachable spades are attached to the rear trail assembly for firing under summer conditions.

In the wintertime small depressions are made in the frozen ground into which wooden blocks 0.8 m in length are placed directly under the winter spades.

The shells and charges are selected in accordance with the firing problem. [p 7]

Firing is always performed with the muzzle brakes screwed on; however, if the muzzle brakes are damaged, firing may be performed with the M-47 gun, using charges 2 and 3, and with the M-46 gun, using 2, 3 and 4.

3. General Instructions on Dismantling and Assembling the Gun

In dismantling and assembling a gun the following general rules should be followed

- T/E tools, in good working order, should always be used. In addition to these tools one should have a wooden or a lead hammer, a sledge hammer, a copper strip, and a set of small sticks made of hardwood for cleaning inaccessible places;

- when removing cotter pins, first bend the ends together with pliers; on replacement, bend them apart;

- removing or replacing nuts, make sure the wrench does not slip and damage any parts;

- for driving out conical pins use a copper drift-key; the cylindrical pins should be driven out with a punch whose diameter is approximately equal to that of the pin;

- bolts should be driven out only with a copper drift-key;

- excessive force should not be used where not necessary;

- be careful not to damage (scratch, nick) polished, ground, chrome-plated, and bearing surfaces, and do not allow sand, dirt, or other foreign matter on them;

- before disconnecting and disassembly of the mechanisms, their operation should be checked, and if they are in adjustment, the positions should be noted to facilitate adjustment during reassembly;

- when removing a mechanism from the gun or a part from a mechanism, attention should be paid to scribe marks; if there are none, inscribe them or mark the position of the parts with a prick punch;

- before unscrewing parts, unscrew the locking screws;

- when removing dowels, mark their positions with a punch, and so as not to damage their bent ends, place a screwdriver at an angle on the non-working end, and remove by lightly tapping the screwdriver;

- if a screw is locked by a prick-punch, place the blade of a screwdriver into the thread and remove the prick-punch by lightly tapping on the side of the blade with a hammer; then remove the screw with the screwdriver;

- when bearings are removed, tie their races;

- place parts and assemblies which have been disconnected and removed from the gun on racks or tables; do not mix the parts with those of other guns;

- wipe off all parts before assembling, and grease them if necessary;

- all phosphatized parts should be covered with a thin coat of grease;

- replace bolts, screws, and nuts;

- lock screws by prick-punching the thread;

- replace gaskets and correctly place and adjust the bearings;

- after assembly, check operation of mechanisms;

- replace grease during every disassembly;

The order of dismantling and assembling the gun is given in Chapter Twelve. [p 8]

The order of disassembling and assembling separate mechanisms is included in their descriptions.

4. Parts Numbering System

The gun is made up of separate parts: barrel, breech, cradle, etc.

These separate parts make up the assembly units designated on assembly drawings by the abbreviation "Sb".

Each separate unit (assembly unit) has its own number. For example, the barrel is Sb01; the breech, Sb02; the buffer, Sb08, etc. A list of the assemblies is given in Appendix 1 of this manual.

Every unit consists of separate sub-assemblies and parts which also have numbers within the unit. For example, the breech ring (part 3) of the barrel belongs to the first assembly unit; hence, the complete part number of the breech ring is 01-3.

The striker cover (part 30) belongs to the second assembly unit; thus, the complete part number of the striker cover is 02-30, and so forth.

A detachable or nondetachable combination of parts of a unit is called a subassembly. On the drawings these subassemblies are designated by the number of the unit with letters "Sb" in front and the subassembly number: for example, cocking lever - Sb02-4.

To make the use of this manual easier, the numbering system is simplified as follows:

On the drawings and in captions (to the left of the name) parts are designated by arbitrary numbers; the part number is shown in the caption after the name.

For example, in Figure 16 the striker cover is number 29; the caption reads "29 - striker cover (02-30)", 02-30 being the part number.

Letters are used to designate elements of parts on drawings; for example, "g - aperture for pinch bar (Figure 16)".

General purpose parts have their own numbers. For example, the bolt denoted by number 99 in Figure 22 has number A51000-15.

Tools and accessories have assigned numbers in both text and illustrations.

In correspondence with the supply unit, indicate the part number which is punched on each part (except small parts and fastenings).

Parts and units common to the M-46 and the M-47 are marked with number and index of the M-46.

When using this manual keep in mind that position of parts (right, left, front, back) is relative to direction of fire.

Position of the carriage wheels and limber (right or left) is determined relative to direction of movement of the gun in traveling position.

CHAPTER TWO

BARREL AND BREECH

There are two types of barrels for the 130-mm M-46 gun and the 152-mm M-47 gun: the loose tube and the monobloc. The monobloc barrel has the word "Monobloc" stamped on the breech end.

5. 130-mm M-46 Gun Barrel With Loose Tube

The barrel serves to direct the flight of the shell, impart a rotary motion to it, necessary for stability in flight, and to give the shell the required muzzle velocity (depending on the charge).

The barrel (Fig 4a) consists of the following basic parts: the tube 5, jacket 3, the breech ring 1, fore 10 and aft 8 clamps, and the muzzle brake 6.

The interior of the barrel 5 (Figs. 4a, 5, and 6) has a rifled section and a chamber. In the rifled section are forty grooves of constant curvature. The width of the grooves is 6 mm, depth is 2.7 mm, and the land width is 4.2 mm. The pitch of the rifling is 30 calibers.

The chamber has a main tapering conical section for the body of the cartridge case, a more curved conical section for the tapering end of the cartridge case, a cylindrical section for the mouth of the cartridge case, and an adjoining conical section for the shell band.

On the outside of the breech end of the tube is a collar b. One side of the tube, with the collar, rests against jacket 3, and the other side rests against breech ring 1. This collar prevents axial displacement of the tube. The tube is kept from turning by pin 11, set in a recess in collar b. The pin is secured to the tube with screw 18.

The muzzle end of the tube has threads for screwing on the muzzle brake and two holes e (Fig 6) for bolts 16 (Fig 4a) which hold the muzzle brake on.

The tube surfaces in contact with the jacket are polished and tapered to allow the tube to fit better into the jacket.

On the breech face are: a circular projection a (Fig 5) serving as the stop for the cartridge case flange, two slots v to accomodate the extractors, two slots g for the guide clips of the extractors, and four mutually perpendicular grooves d which determine the position of the axis of the bore when checking the sighting devices with a graticule. Similar grooves, designed for the same purpose, are also found on the muzzle face of the tube.

50X1-HUM

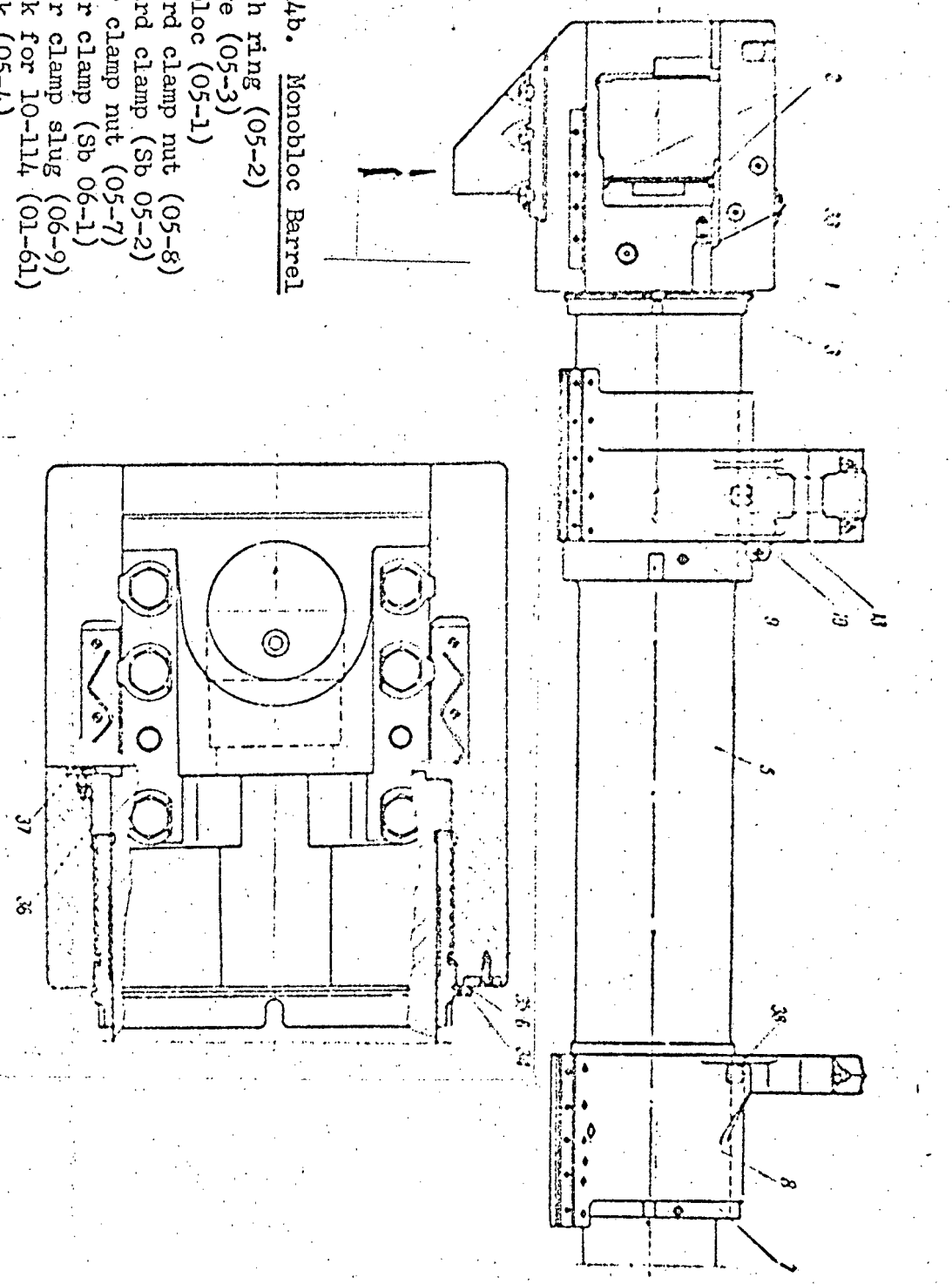


Fig 4b. Monobloc Barrel

1. breech ring (05-2)
3. sleeve (05-3)
5. monobloc (05-1)
7. forward clamp nut (05-8)
8. forward clamp (Sb 05-2)
9. after clamp nut (05-7)
10. after clamp (Sb 06-1)
13. after clamp slug (06-9)
33. check for 10-114 (01-61)
34. check (05-4)
35. screw (A61060-16)
36. pin (05-5)
37. screw (05-6)
38. forward clamp slug (06-10)
v. catch
g. grooves for extractors

50X1-HUM

Jacket 3 (Figs 4a and 7), together with the tube, absorbs the pressure of the powder gases during firing. The tolerance (0.05-0.15 mm) between the tube and jacket is taken up during firing.

The inside surface of the jacket has the same angle of taper as the tube surface over which it fits.

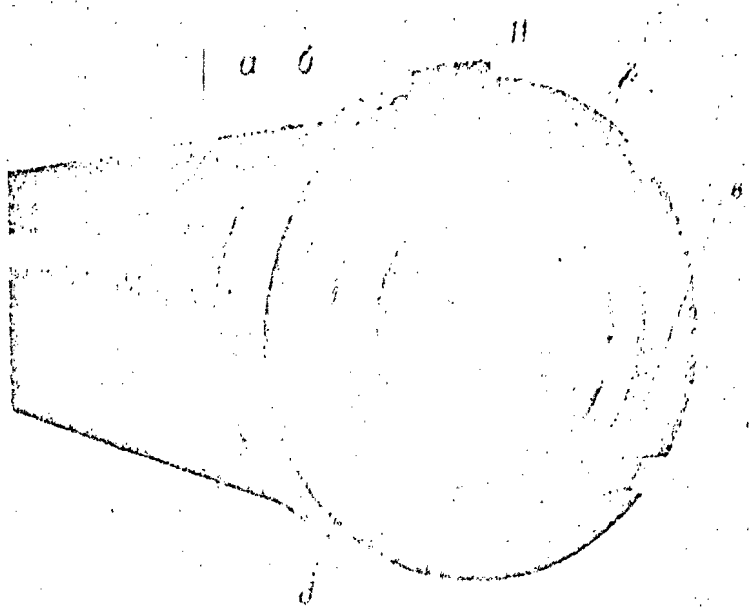


Fig 5. Breech End of Tube

11 - tube pin (01-5); a - circular projection for stop of cartridge case flange; b - tube collar; v - slots for extractors; g - slots for extractor guide clips; d - grooves for attaching graticule necessary for checking sighting devices.

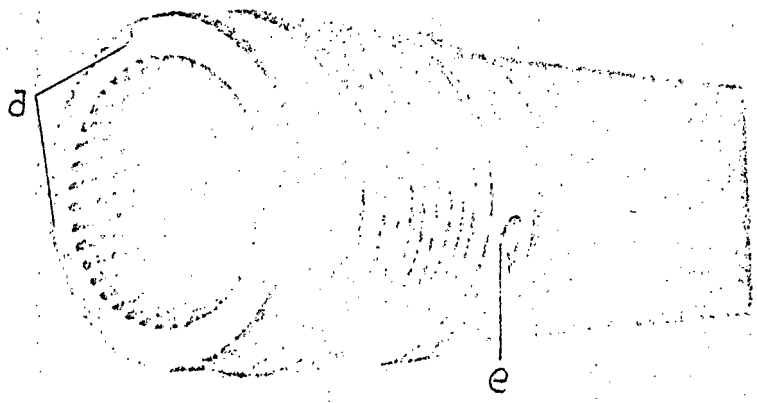


Fig 6 Muzzle End of Tube

d - grooves for attaching graticule necessary for checking sighting devices; e-recess for muzzle brake bolt.

Inside the breech end of the jacket is a circular groove to accomodate tube collar b and slot zh for pin 11.

On the outer surface of the jacket are: threads for screwing on the breech ring, slot i for check 12 of the breech ring, grooves to accomodate the rear and front guide rings, threads for the guide ring screws and two cylindrical recesses for slugs 13 which keep the rings from turning on the jacket.

In the breech end of the jacket there are two slots o for [p 13] the extractors and a cut n for the extractor pin.

Breech ring 1 (Figs 4, 8, 9, and 10) is designed to hold the components of the breech and also to connect the barrel to the buffer.

The forward end of the breech ring is screwed onto the jacket and is kept from unscrewing by check 12 with setscrew 19.

The breech ring has two plates (upper and lower) connected to each other by crosspiece b (Fig 8). The forward part of the breech ring and the plates of the breech ring with the crosspiece form a recess for the breech block.

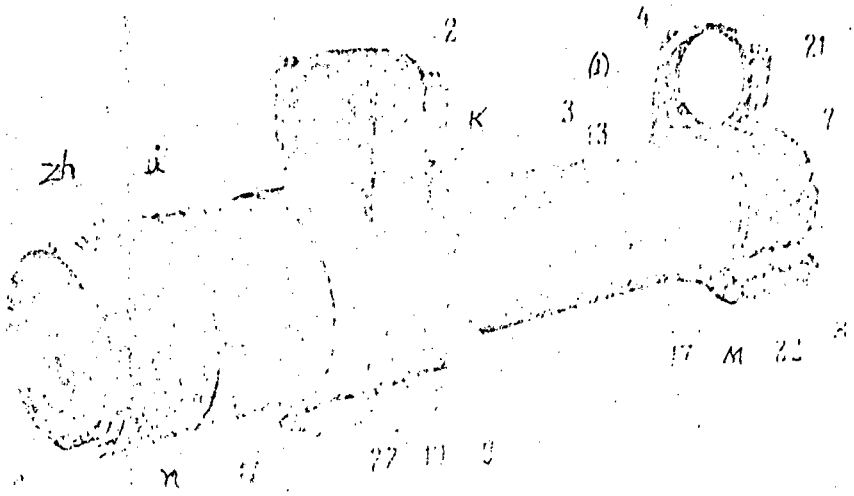


Fig 7. Jacket with Guide Rings

2 - rear ring cover (01-9); 3 - jacket (01-2); 4 - forward ring cover (01-16); 7 - forward ring nut (01-20); 8 - forward ring (Sb01-3); 9 - rear ring nut (01-19); 10 - rear ring (Sb01-2); 13 - ring slug (01-21); 17 - guide (01-12); 21 - nut (A51011-7); 22 - grease cup (72273-6); zh - groove; i - breech ring check groove; K, l - bolt recesses (recuperator shield); m - aperture for lever; n - extractor rest; O- extractor cutouts.

At the top of the breech ring, to the left and rear, is located a small, flat area a (Fig 10) for the gunner's quadrant; in the forward part is a depression t for the after cover of the recuperator and groove u for the breech ring check; on the right is depression f for the locking arm for opening and closing the breech, aperture s for the extractor pin, and next to it a threaded hole r for the setscrew of the extractor pin. On the left and right sides of the breech ring are grooves i for the clamps securing the barrel for traveling; in addition, there is an aperture p on the right for the shaft of the breech mechanism lever.

On the right side of the breech ring, secured with two screws, is lever catch 26, which holds the breech block in the closed position.

Also on the right side there are: a recess ch for the chain lug of the winch with a groove in it, a recess kh for the safety lock securing the barrel for traveling, a recess shch for the extractor pin safety lock with spring, bevel k for facilitating the insertion of the breech mechanism lever shaft into aperture p and the removal of the breech block from the breech ring, and groove zh for the breech mechanism lever arm.

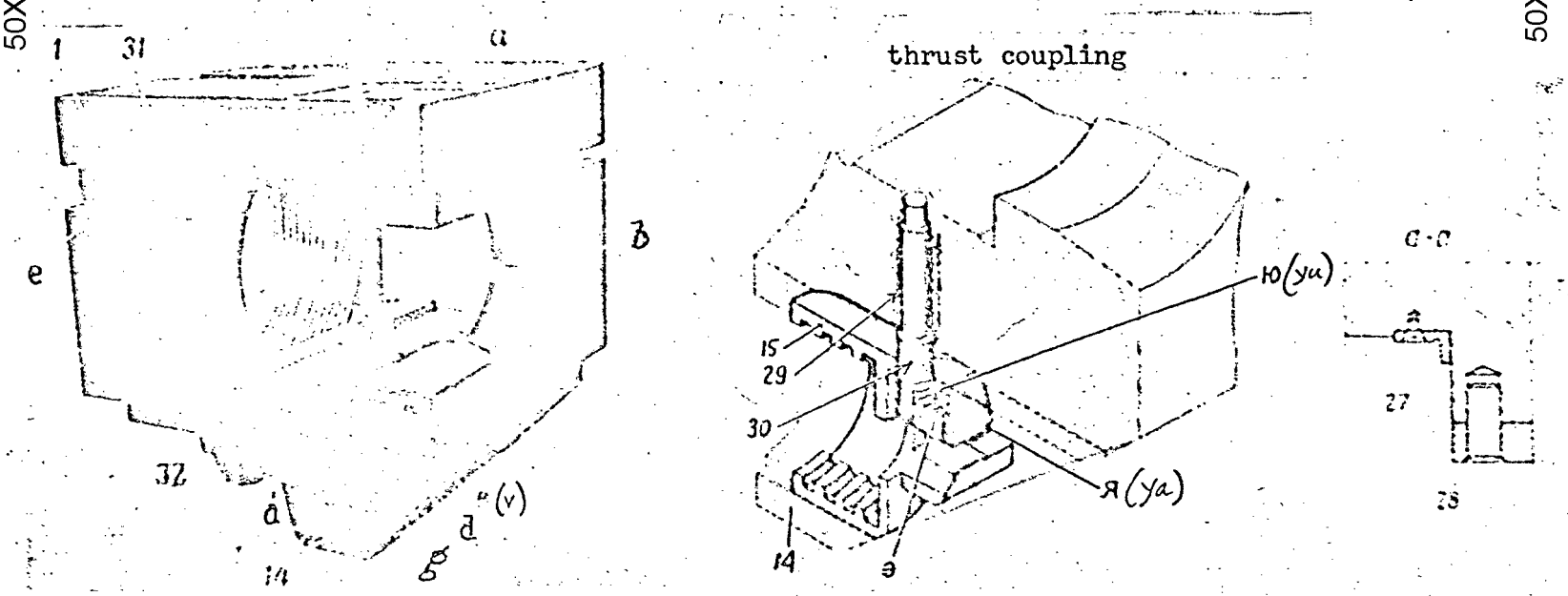


Fig 8. Breech Ring (left rear) and Thrust Coupling

[14]

1. breech ring (01-3)
14. breech lug (01-22)
15. thrust lock (01-29)
27. guide (01-52)
28. lug slug (01-24)
29. spring (01-27)
30. breech block check (01-26)
31. cocking lever (01-35)
32. screw (A 51060-8)

a. small flat area for gunner's quadrant
b. crosspiece
v. opening for screw of inertial safety device
g. notch for catch of inertial safety device
d. notch for securing breech block with inertial safety device
e. recess for firing mechanism
э, z and ya. recesses
yu. notch

[15]

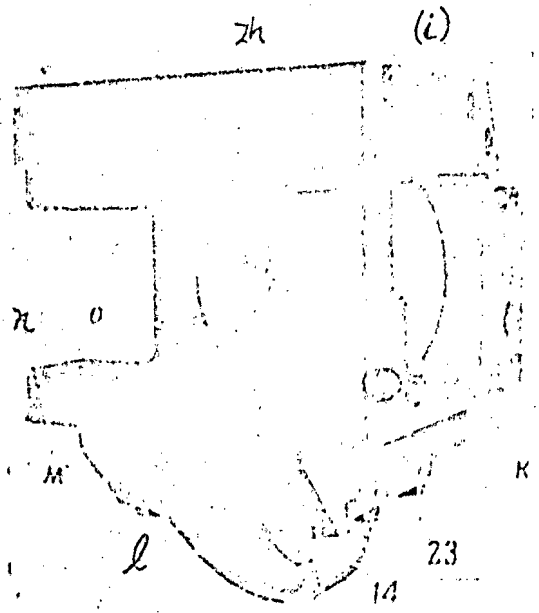


Fig 9. Breech Ring (right rear)

14. breech lug (01-22)
23. lug bolts (01-23)
zh. cut for breech mechanism lever arm
i. groove for barrel securing clamps
k. bevel to facilitate installation of breech mechanism level shaft
l. aperture for accommodating the thrust lock mechanism
m. recess for head of inertial safety device release
n. aperture to accommodate inertial safety device release
o. groove to accommodate breech operating cam of projectile latch

50X1-HUM

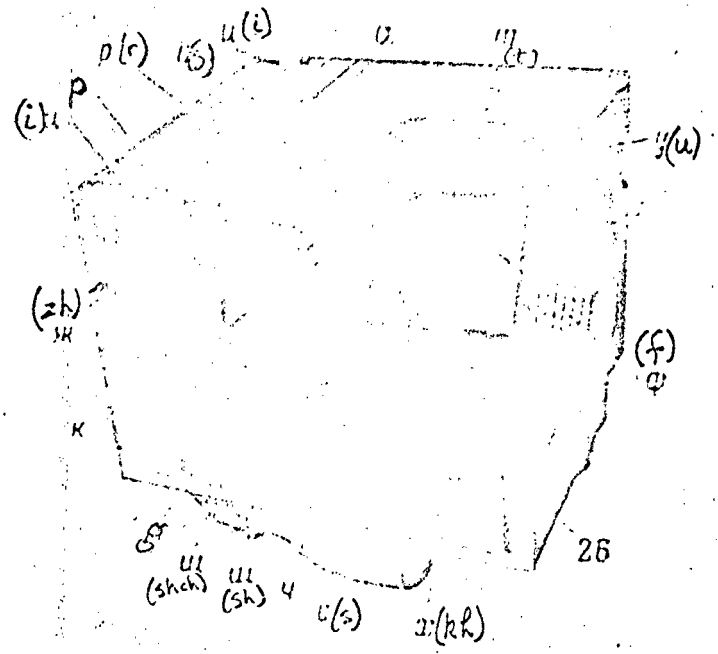


Fig 10. Breech Ring (right front)

26. lever catch (01-30)
a. small flat area for gunner's quadrant
g. notch for catch of inertial safety device
zh. groove for breech mechanism lever arm
i. grooves for barrel securing clamps
k. bevel to facilitate installation of breech mechanism lever shaft
p. aperture for breech mechanism lever shaft
r. threaded hole for screw of extractor pin safety lock
s. aperture for extractor pin
t. depression for after recuperator cover
u. groove for breech ring safety lock
f. depression for lock arm
kh. recess for safety lock (traveling position)
ch. recess for winch chain lug
sh. aperture for breech block safety lock
shch. recess for extractor pin safety lock

50X1-HUM

On the left side of the breech ring are: catch 31 (Fig 8), secured with two screws, for uniting the breech ring with the cradle shield, groove ye for the firing mechanism, a hole for screw 32 securing the breech-operating cam of the projectile retainer to the breech ring, groove o (Fig 9) under the cam (groove o is located on the forward side of the breech recess), hole v (Fig 8) for the screw of the inertial safety device release, and notch d for securing the block with the inertial safety device. [p 16]

On the lower left side of the after surface is a depression m (Fig 9) under the head of the inertial safety device release and an aperture n under the release.

Bronze guides 27 (Fig 8) are attached with screws to the lower part of the breech ring, which lies on the cradle guides.

On each side of the lower surface of the breech block recess is a shallow, tapered notch g (Fig 8) for the catch of the inertial safety device: on the right, to protect the catch from damage while putting the block in the breech ring; on the left, to secure the inertial safety device in the depressed position.

At the bottom, the breech ring has a lug 14 (Figs 8 and 9) for connecting the barrel with the buffer. Lug 14 is secured with six bolts 23 and two rods 28.

In the breech ring lug is a hole 1 (Fig 9) for thrust lock 15 (Figs 4 and 8), which comes up against the circular projection.

The nut of the buffer rod is connected to the thrust lock by means of two smooth segments and two round-ribbed segments - "club"-shaped- which are on the nut as well as on the lock. The barrel is connected to, or disconnected from, the buffer rod by turning the sliding lock 90° with a special wrench.

In the breech lug there is also a vertical aperture sh (Fig 10) opening onto the lower surface of the breech block recess. In the aperture is located breech block safety lock 30 (Fig 8) with spring 29. These components, together with lock 15, comprise the interlocking mechanism of the breech and buffer; this interlocking mechanism prevents the breech from opening when the barrel is not completely joined to the buffer.

For this purpose there are two grooves e and ya in the thrust lock at right angles to each other into which spring 29 causes the head of safety lock 30 to move. When the head moves into the shallow groove ya, the block is locked (traveling position); when the head moves into th groove e, the block is unlocked (firing position).

There is a notch yu in the head of the safety lock for a screwdriver to facilitate assembling and dismantling of the sliding connection.

There are guns in which gaskets have been placed between the bearing surfaces of the lug and breech ring. The gaskets are necessary in the installation of the lug at the factory.

There are also guns in which safety lock 33 (Fig 4b) is secured with two bolts to the top of the breech ring for locking the cover of the breech ring.

After ring 10 and forward ring 8 (Figs 4a and 7) fit onto the jacket. Nuts 9 and 7 prevent longitudinal movement of the rings, and slugs 13 prevent their turning.

The barrel, with its rings, lies on the directional cradle guides, along with it recoils and returns. To lessen the friction of recoil and return, bronze guides 17 are secured with screws to the barrel rings.

The upper parts of the rings and covers 2 and 4 form cylindrical [p 17] openings to which the recuperator is attached. The covers are secured to the rings by means of pins 20 and nuts 21.

Below the covers on both rings are threaded holes: hole l (on the forward clamp) and hole k (on the after ring) for bolts securing the reinforced jacket of the recuperator.

On the lower part of the rings are notches with openings in which are placed grease cups 22 for lubricating the cradle guides and rings.

On the lower part of forward ring 8, above the guides, are two openings m (one on each side) in which is placed a lever for turning the barrel (on rollers) when screwing on the breech ring.

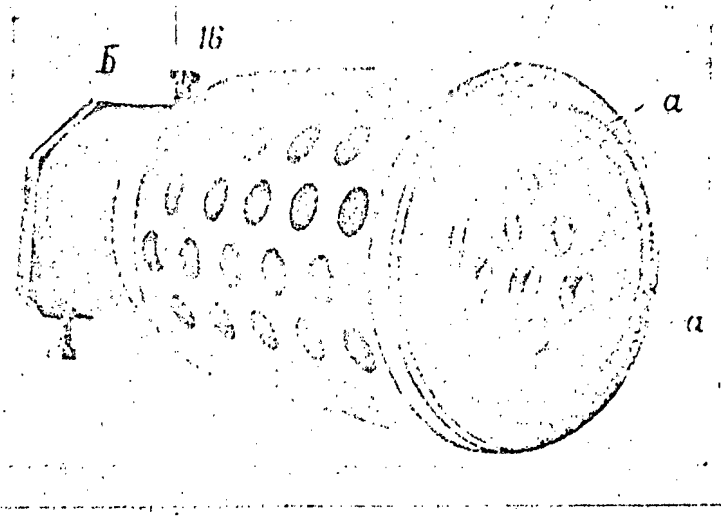


Fig 11. Muzzle Brake

16 - bolt (01-16); a - mark for checking sighting arrangement; b - collar.

The muzzle brake (Figs 4 a and 11) is designed to assist in counteracting recoil.

Muzzle brake 6 is screwed onto tube 5 and is secured with two bolts 16, which are kept tight by a wire.

The inside of the muzzle brake is machined. Its after selection is threaded (left) for screwing onto the tube, and there are two guide surfaces in front of and behind the threads for centering the brakes on the tube, and a circular shoulder for a stop in the muzzle face of the barrel.

The middle and forward interior sections of the muzzle brake form a single cylindrical cavity whose diameter is larger than the diameter of the outlet, with the result that a wall is formed, against which the gases strike during firing.

The basic braking action results from the escape of the gases through 20 openings on each side.

The muzzle brake absorbs around 35% of the force of recoil.

On the after end of the brake is a collar b (rectangular in shape, with beveled corners) with two threaded holes for lock bolts 16.

On the forward face of the muzzle brake are mutually perpendicular marks a for mounting crosshairs to check the sighting arrangement.

6. Barrel of 152-mm M-47 Gun With Loose Tube

The barrel of the 152-mm M-47 differs from that of the M-46 in only two details: the loose tube and the muzzle brake. In all other respects the barrels of both guns are exactly the same.

The loose tube of the M-47 differs from that of the M-46 in the dimensions of the chamber and rifled section of the bore, the diameter of the threads for securing the muzzle brake, and the outside diameters of the barrel forward of the jacket.

The outside diameter of that section of the loose tube which is in contact with the jacket is identical with the corresponding section of the M-46.

The loose tube of the M-47 is 500 mm shorter than that of the M-46. The rifled section has 48 grooves of constant twist with a pitch of 25 calibers.

The width of the grooves is 5.97 mm, the depth is 1.5 mm and the width of a land is 4 mm.

The muzzle brake of the M-47 differs from that of the M-46 only in its dimensions. In construction the muzzle brake of the M-47 is like that of the M-46.

Monobloc Barrel

The monobloc barrel (Fig 4b) consists of the following basic parts: monobloc 5, breech ring 1, sleeve 3 uniting the monobloc with the breech ring, fore 8 and aft 10 rings, and muzzle brake 6 (Fig 4a) screwed onto the muzzle and of the monobloc.

The interior construction of the monobloc is similar to the interior construttion of the loose tube.

The exterior of the monobloc has three carefully machined surfaces: one in the breech section for contact with the breech ring, and two in the middle section for contact with the fore 8 and aft 10 rings (Fig 4b).

The monobloc has a circular collar extending from the breech (external) which unites with the breech ring by means of a sleeve.

Sleeve 3 has a lock thread which screws into corresponding threads on the breech ring, and its end forces the circular collar of the monobloc into the recess of the breech ring, in this way eliminating the possibility of axial displacement of the monobloc relative to the breech ring. Pin 36 in the breech ring serves to prevent the monobloc from turning.

On the breech face of the monobloc are two rectangular slots g in which are placed upper 2 and lower 3 extractors (Fig 17) when the breech block is closed.

At the forward edge of the breech ring is a slot in which safety lock 34 (Fig 4b) is inserted and secured with screw 35. The safety lock has teeth which engage the teeth of sleeve 3, preventing the latter from unscrewing.

Fore 8 and aft 10 rings are slipped onto the monobloc. Nuts 7 and 9 prevent them from longitudinal displacement, and rods 13 and 38 prevent them from twisting.

7. Dismantling and Assembling of Barrel with Loose Tube

1. Remove the barrel with recuperator from the cradle, place it on a trestle, and disconnect the recuperator, as indicated in Capter 12.

2. Dismantle the breech piece by piece as indicated in Paragraph 10 of this chapter.

3. Remove breech-operating cam 24 (Fig 4a). To do this, unscrew screw 32 (Figure 8) and remove the cam from the slot in the breech ring.

[p 19]

4. Remove the muzzle brake. To do this:

- remove the safety wire;

- unscrew bolts 16 of the muzzle brake (Fig 4a) with wrench A52830-6;

- place a bar in one of the side openings of the brake; then striking the bar lightly with a mallet, remove the brake by carefully turning it in a clockwise direction (as one looks from the muzzle end of the barrel, since the muzzle brake has a left-hand thread). It is necessary to support the muzzle brake while unscrewing it, so that its weight will not damage the threads.

5. Unscrew the breech ring. To do this:

- remove screw 19 holding safety lock 12 of the breech ring;

- place a screwdriver against the upper edge of the safety lock of the breech ring and, striking it lightly, remove the safety lock.

- place the barrel on the trestle and, striking the upper left-hand edge of the breech ring with the mallet (over a copper buffer strip), remove (unscrew) it (the breech ring has a right-hand thread);

- place the barrel on rollers Sb42-34;

- insert a line in the recess of the breech ring, secure the other end to a crane or pulley, and tighten.

- turning the barrel on rollers Sb42-34 with bars placed in the opening of the forward clamp, unscrew the breech ring.

If the breech ring unscrews with difficulty, adjust (decrease or increase) the tension on the line with a pulley and slowly turn the barrel 1/4 to 1/2 turn in the opposite direction, after which continue unscrewing.

6. Remove the tube from the jacket. To do this:

- raise the barrel from the breech end by a pulley or crane, take the after roller out from under it and put a small trestle under the after clamp;

- raise the barrel from the muzzle end, put a small trestle under the forward clamp and, supporting the barrel with a pulley or crane, withdraw the tube from the jacket by striking the muzzle face (over a copper buffer strip) with a mallet. When the tube has been withdrawn from the jacket about 500 mm, put rollers under the breech and muzzle ends of the barrel and take out the trestles from under the clamps. Move the jacket to the extreme forward position, after which put the forward roller under the barrel aft of the jacket and remove the jacket.

7. Remove screw 18 holding pin 11 on the tube and take out the pin.

8. Remove sliding lock 15 (Fig 8) from the breech ring. To do this:

- with a screwdriver depress safety lock 30 on the breech block;

- remove lock 15, safety lock 30, and spring 29.

It is forbidden to remove the fore and aft rings from the jacket and breech lug 14 from the breech ring.

Before the barrel is assembled, the common surfaces of the tube and jacket and the threaded junctions of the breech ring and muzzle brake must be cleaned with gasoline or dry kerosene, carefully dried, and covered with a uniform layer of grease. Lubricating these parts with gun grease is not allowed.

Assembling Barrel

1. Slip the jacket over tube 5 (Fig 4a). To do this:

- fix pin 11 on the tube and secure it with screw 18;

- place a wooden block in the chamber of the tube so that it protrudes 300 to 400 mm from the breech face; put rollers Sb42-34 under the block and muzzle end of the tube at a distance approximately 2.5 m from the muzzle end and slip the jacket over the tube until it comes to a stop on the forward roller; [p 20]

- raise the forward end of the tube, put forward roller Sb42-34 under the muzzle face in order to ease the way for the jacket, and move the jacket toward the breech face of the tube until it comes to a stop at the collar; while putting on the jacket, line up the pin slot on the jacket with the pin on the tube; the jacket may not go in place because of the small clearance between it and the tube; final seating of the tube in the jacket is accomplished by screwing the breech ring onto the jacket;

- raise the after end of the tube and put after roller Sb42-34 under the jacket and remove the block from the chamber of the tube.

2. Screw on the breech ring. To do this:

- pass a line through the breech block slot, secure the other end to a crane or pulley, and raise the breech ring and slip it onto the jacket until it stops at the threads;

- turning the barrel on rollers Sb42-34 with bars placed in the apertures of the forward clamp, screw on the breech ring; if the breech ring goes on with difficulty, adjust (decrease or increase) the tension on the line with a pulley and slowly turn the barrel 1/4 to 1/2 turn in the opposite direction, after which continue screwing on the breech ring.

Screw on the breech ring until the slots on it and the jacket are completely aligned (as far as safety lock 12). During the final three turns it is permissible to strike the breech ring with a mallet, placing a copper buffer strip between the openings under the breech mechanism lever pin and the extractor pin.

3. Attach safety lock 12 to the breech ring and secure it [illegible] 50X1-HUM, 19.

4. Attach breech-operating cam 24 (Fig 4a) and secure it with screw 32 (Fig 8).

5. Fix lock 15 in the aperture of the breech ring lug. To do this:

- on the breech ring, fix safety lock 30 with spring 29 attached to it;

- With a screwdriver, push safety lock 30 down into the breech ring and attach lock 15.

6. Attach the muzzle brake. To do this:

- put a bar in the side opening of the muzzle brake; slip the latter over the tube, and, with the bar, screw it on until it stops at the forward end of the tube;

- put in bolts 16 of the muzzle brake with wrench A52830-6 and lock with wire.

7. Assemble the breech as indicated in Paragraph 10.

8. Place the barrel on the carriage as indicated in Chapter 12.

Dismantling of Monobloc Barrel

Disconnect the breech ring from the monobloc. To do this:

- determine the position of sleeve 3 relative to the breech ring (mark the sleeve and breech ring);

- remove screw 35;

- knock out safety lock 34 from its seat by prying it out with a screwdriver back of catch v;

- unscrew sleeve 3;

- supporting the breech ring with a pulley, disconnect it from the monobloc;

- unscrew 37 and remove pin 36.

50X1-HUM

Fig 12. Breechblock [p 21]

1 - breech block (02-14A); 2 - upper extractor (02-34A); 3- lower extractor (02-33A); 4 - slide pawl (02-5A); 5 - spring (02-19); 6 - spring catch (02-37); 7 - locking shaft (02-17); 8 - safety device for premature firing (02-18); 9 - release (02-42A); 10 - spring (02-12); 11 - cocking lever (Sb9204); 12 - breech mechanism lever (Sb-02-2A); 13 - extractor cam (02-15); 14 - lever safety lock (02-7); 15 - spring (02-12); 16 - cap (02-9); 17 - spring (02-8); 18 - extractor pin (02-35); 19 - extractor pin safety lock (02-11); 35 - screw (02-16); 36 - catch (02-22); 37 - pivot (A51041-22); 38 - setscrew (A51064-4); 39 - screw (02-44); a - bevel of safety device for permature firing; b - recess under head of release of inertial safety device; v - lug on handle of breech mechanism lever; d - notch for securing breech block with inertial safety device; e - groove for slide pawl of breech mechanism lever; zh - locking shaft cam.

[Figure on next page]

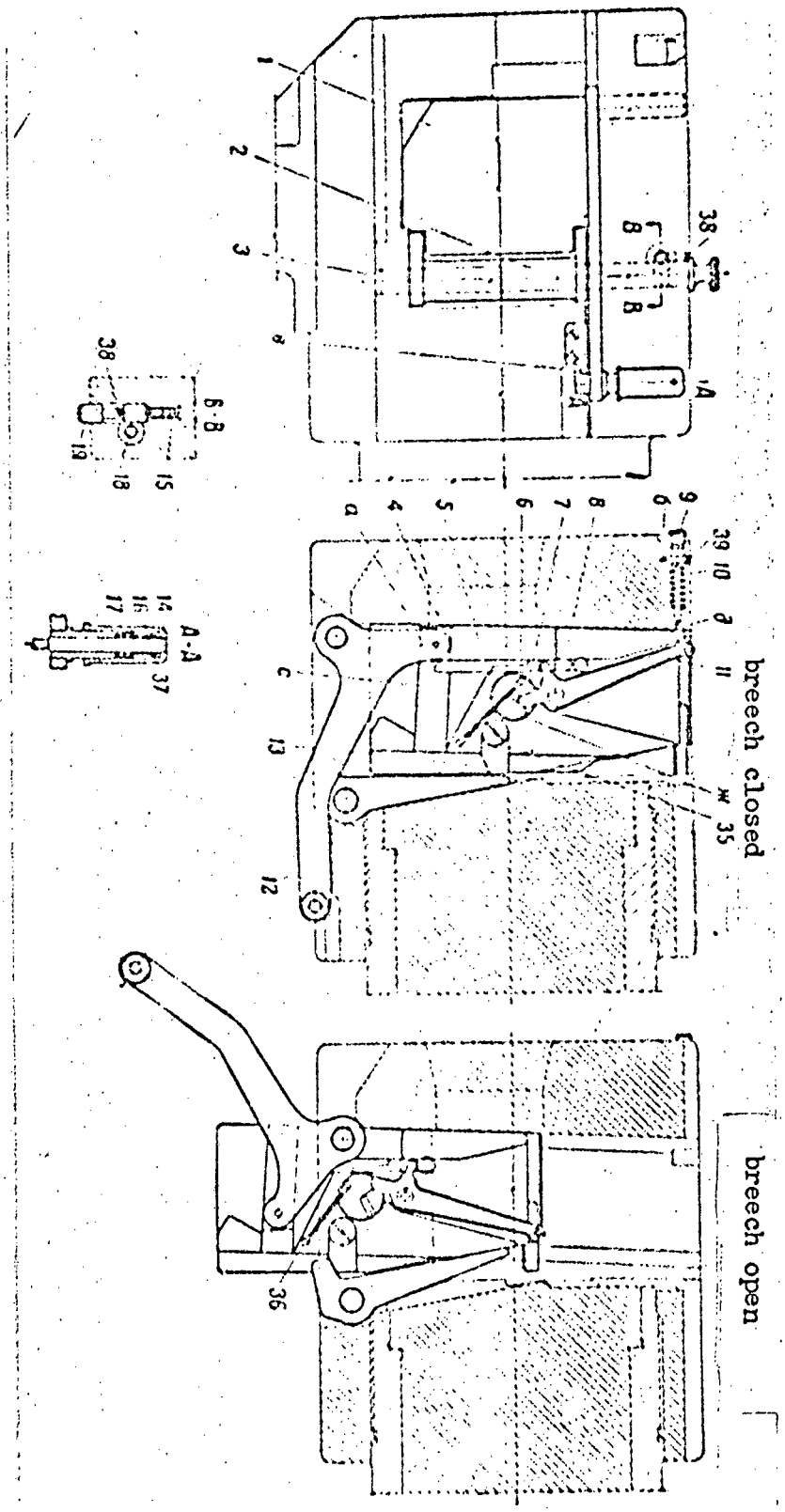


Fig 12. Breechblock (see preceding page)

The rest of the dismantling of the monobloc-type barrel is carried out in the manner described in Section 7.

Assembly is carried out in the reverse order. Before assembling, [p 22] the condition of the threads on the breech ring and sleeve is checked. This check is made by applying gauze, which will catch if there are scratches or burrs. Any scratches or burrs must be removed. Cover smooth and threaded contact surfaces of the monobloc, breech ring, and sleeve with grease.

8. Breech

The breech is designed to ensure that the bore is securely closed, firing takes place, and the empty cartridge case is extracted from the chamber.

The breech is a horizontal, block-type, opening to the right, and consists of the following mechanisms:

- closing;
- striker;
- ejecting;
- safety.

Closing Mechanism

The closing mechanism is designed to ensure that the bore is firmly closed during firing.

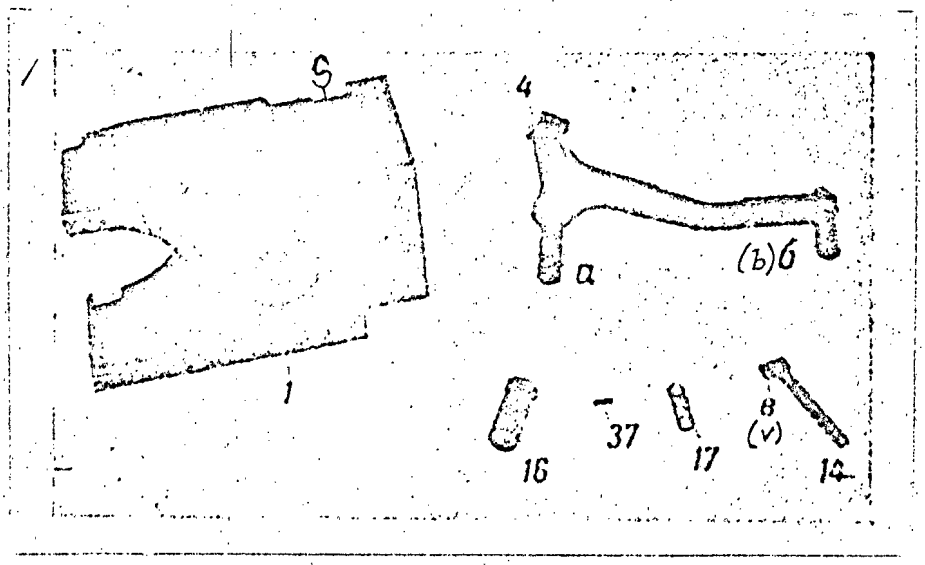


Fig 13. Closing Mechanism

1 - breech block (02-14A); 4 - slide pawl (02-5A); 14 - lever safety lock (02-7); 16 - cap(02-9) 17 - spring (02-8); 37 - pivot (A61011-22); a - shaft of breech mechanism lever; b - handle of breech mechanism lever; v - lug on handle of breech mechanism lever; s - groove for slide pawl of breech mechanism lever.

The breech block is in the form of a tetrahedron with a depression (tray) sh on the left to guide the projectile and cartridge case during loading and to guide the cartridge case during extraction.

In the center of the forward surface of the block (in the block face) is an opening d for the firing pin.

Opposite this opening on the other (after) side of the block is a central recess for the striker, with mainspring, and the striker cover.

To guide the movement of the striker spindle during cocking and firing, [p 24] recess f has a longitudinal groove u and two projections t for joining the striker cover with the block.

On the after side there are also: a hole g on the right for a bar to aid in removing the block during dismantling of the breech, a recess kh on the lower left for the inertial safety device, and a slot ts for the release of the inertial safety device if the release is retain
the block when the breech is opened.

At the top and bottom of the block immediately at its forward surface are located extractor cams 13, which are pressed into the recess and secured with screws 35.

On the block along both sides of the cams are notches for the extractors; of these, notches 1 are for the extractor bosses.

Also on the upper surface of the block are: groove s for slide pawl 4 of the breech mechanism lever, groove p for the safety device for premature firing, irregular notch m for the cocking lever, recess n for the shaft of the cocking lever, recess o for the locking shaft, catch 36 for fastening the spring which returns the locking shaft to its original position after firing, and small flat areas r over which the breech mechanism lever is located during opening and closing of the breech (areas r are located on the same level).

On the lower forward surface of loading tray sh is a notch ch with rectangular opening e for the projectile retainer.

On the lower surface of the block are cylindrical recess i for breech safety lock 30 (Fig 8) and notch zh (Fig 14) for the catch of the inertial safety device.

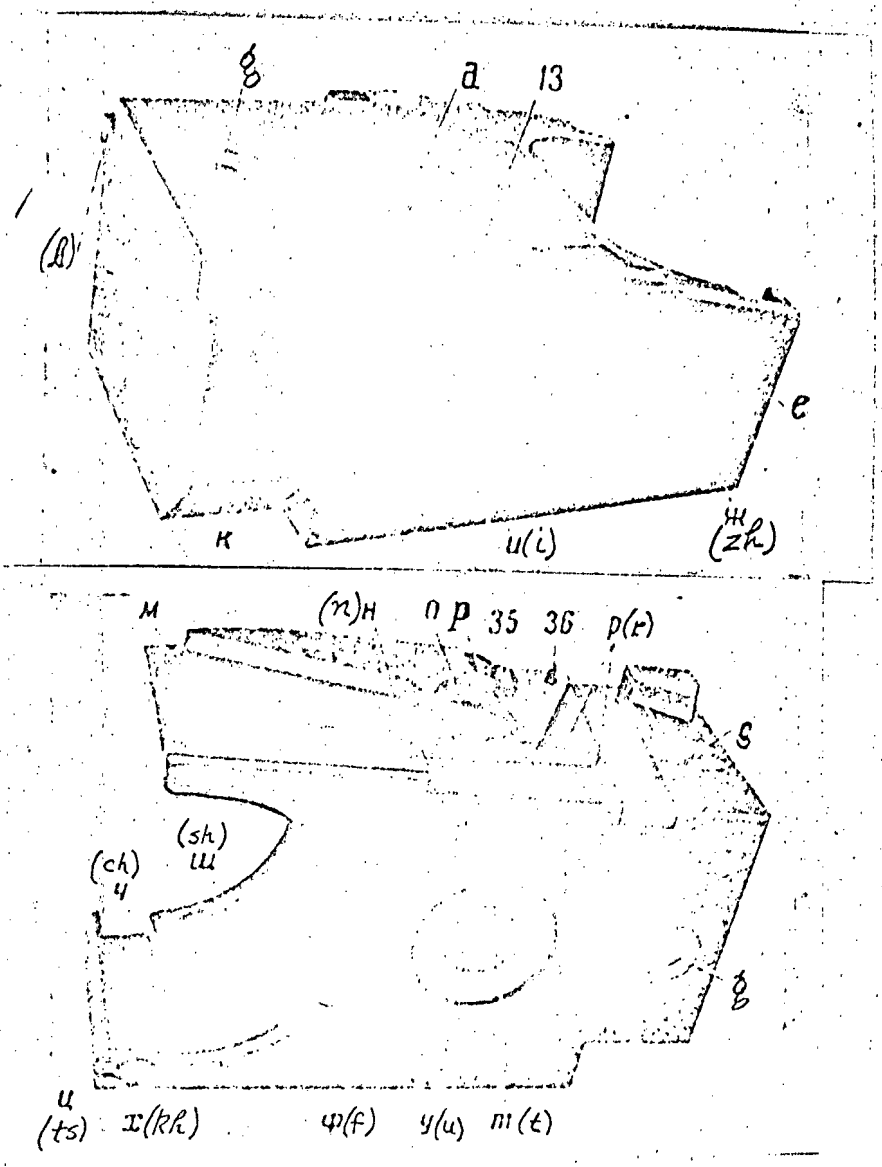
On the right side of that edge of the block formed by its lower and after surfaces is a notch k which allows the breech to open when the barrel is elevated to its maximum angle, in its extreme right position (along with trail).

Breech mechanism lever 12 with slide pawl (Figs 12 and 13) is designed for the opening and closing of the breech.

It is in the form of a double-armed lever on one side of whose short arm is welded shaft a (Fig 13) and on the other side is attached slide pawl 4. Shaft a serves as a hinge joining the breech mechanism level with the breech ring; and the slide pawl joins it with the block, in groove s of which it moves during opening and closing of the breech.

To handle 6, welded to the end of the long arm of the breech mechanism lever, are attached lever safety lock 14, cap 16, spring 17, and pivot 37.

Safety lock 14 has a lug 4 which engages catch 26 on the breech ring (Fig 10) when spring 17 causes the breech to close, preventing spontaneous opening of the breech.



13 - extractor cam (02-15); 35 - screw (02-16); 36 - catch (02-22); g - opening for pinch bar; d - opening for firing pin; e - opening for projectile retainer; zh - notch for catch of inertial safety mechanism; i - recess for block safety lock; k - notch; l - notches for ejector bosses; m - irregular notch for cocking lever; n - recess for shaft of cocking lever; o - recess for locking shaft; p - groove for safety device for premature firing; r - small, flat area; s - groove for slide pawl of breech mechanism lever; t - circular projections; u - longitudinal groove; f - recess for striker spindle; kh - recess for inertial safety device; ts - slot to prevent failure of inertial safety release; ch - notch for projectile retainer; sh - loading tray.

Fig 14. Breechblock (bottom front and top rear views) [23]

Striker Mechanism

The striker mechanism is designed to bring about firing.

The component parts of the striker mechanism are located in the central and vertical recesses of the breech block.

The striker mechanism consists of striker spindle 30 (Figs 15 and 16), intermediate cocking lever 27, spring 32, firing plunger 33, and pin 31, constituting the assembled unit Sb02-5 (designation on the drawing is "Striker Mechanism"); also main spring 28, striker cover 29, locking shaft 7 (Fig. 12), cocking lever 11, and spring 5. [p 25]

The forward part of striker spindle 30 (Fig 15) - the firing pin - is designed to deliver a blow on the primer cap of the cartridge case. At the top of the cylindrical after part of the striker spindle is an irregular horizontal notch a with a recess for intermediate cocking lever 27, and inside are recesses for firing plunger 33 (Fig 16) with spring 32 and main spring 28 (Fig 15).

In addition, there is a vertical opening under pin 31 in the striker spindle (Fig 16). Pin 31 has a flat head which fits in a longitudinal groove u in the central opening of the breech block (Fig 14) and ensures that the striker spindle cocks and fires properly.

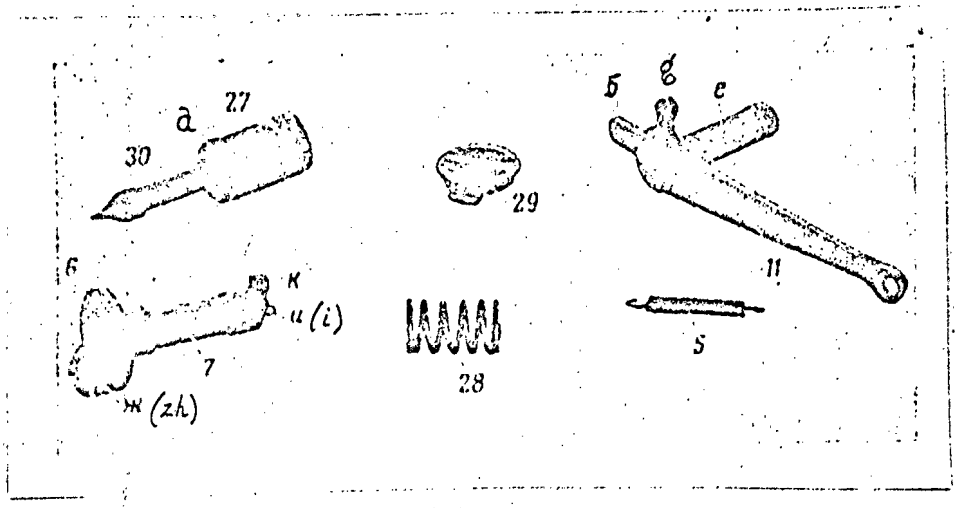


Fig 15. Striker Mechanism

5 - spring (02-19), 6 - catch (02-37), 7 - locking shaft (02-17), 11 - cocking lever (Sb02-1), 27 - intermediate cocking lever (02-21), 28 - main spring (02-29), 29 - striker cover (02-30), 30 - striker spindle (02-27A), a - irregular notch for rotation of intermediate cocking lever and lower cam of locking arm for engaging safety device, ye - shaft of cocking lever, zh - locking shaft cam, i - cam boss for cocking striker spindle after firing, k - cam boss for cocking striker spindle.

Main spring 28 (Fig 15) is designed to impart a sharp motion to the striker spindle, causing it to strike the primer cap. The main spring is compressed between striker spindle 30 and striker cover 29.

Striker cover 29 covers the central recess in the breech block. It is secured in the breech block by means of a thrust coupling.

Intermediate cocking lever 27, locking shaft 7, and cocking lever 11 serve to cock and fire the striker spindle.

Intermediate cocking lever 27 is held in place by firing plunger 33, acting on spring 32 (Fig 16). The lever rotates about its axis, causing the locking shaft to assume its original position.

Fig 16. Breech block [p 26]

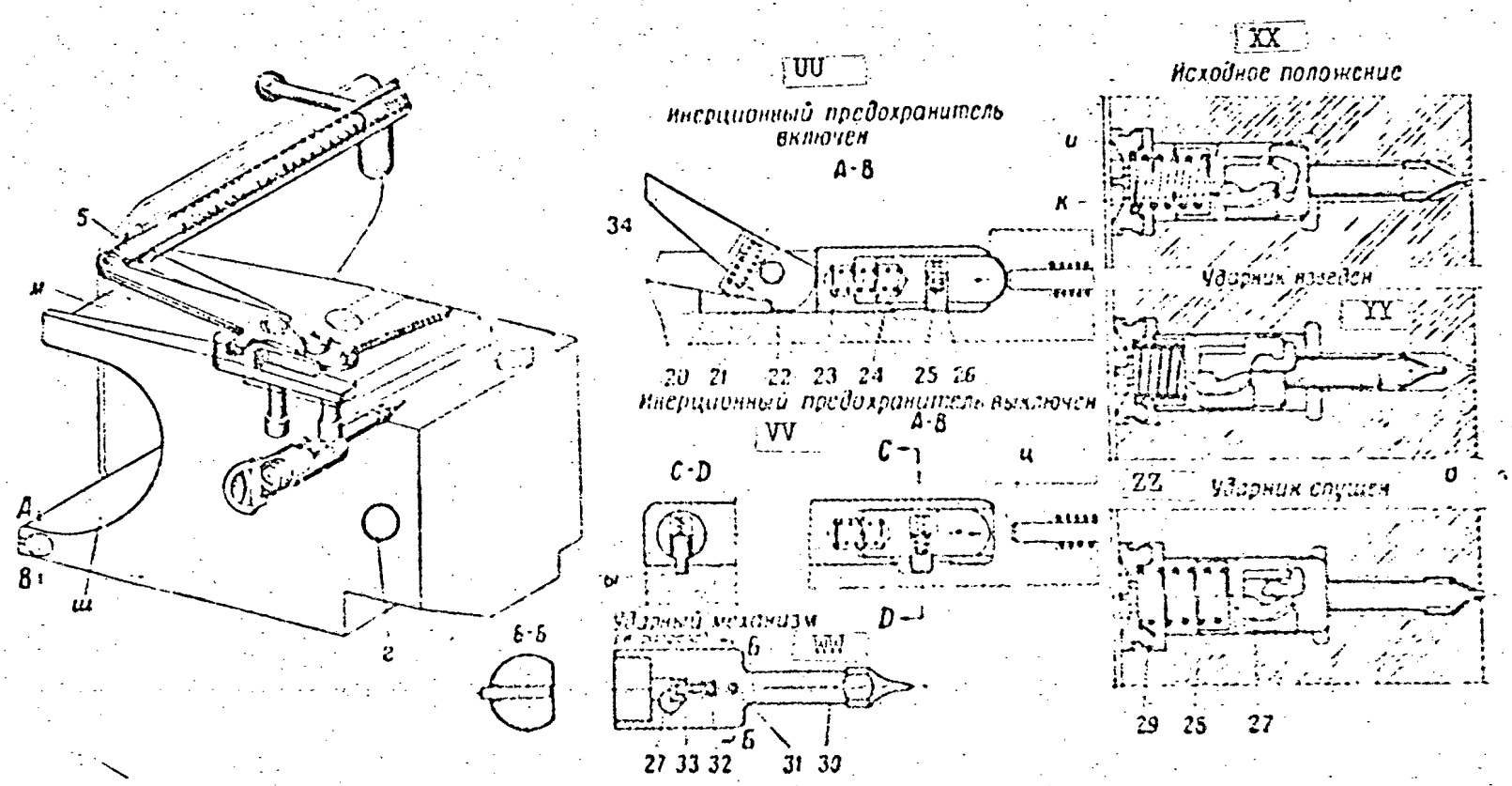
5 - push rod (Sb09-30); 20 - spring (02-39); 21 - firing plunger (02-40); 22 - retainer pin (02-41); 23 - spring (02-12); 24 - inertial safety device (02-31); 25 - spring (02-26); 26 - safety catch (02-32); 27 - intermediate cocking lever (02-24); 28 - main spring (02-29); 29 - striker cover (02-30); 30 - striker spindle (02-27A); 31 - cotter pin (92-28); 32 - spring (02-26); 33 - firing plunger (02-25); 34 - projectile retainer (02-38A); g - opening for pinch bar; d - opening for removal of firing pin; i - cam boss for extracting striker spindle after firing; k - cam boss for cocking striker spindle; m - irregular notch for cocking lever; shch - loading tray; ts - notch in breech ring for securing block with inertial safety device; y - notch for inertial safety catch.

UU - interial safety device engaged; VV - inertial safety device disengaged; WW - striker mechanism (cross section); XX - initial position; YY - striker spindle cocked; ZZ - striker spindle fired.

[Figure on next page]

Fig 16. Breechblock (see preceding page)

50X1-HUM



Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Locking shaft 7 (Fig 15) serves to cock and fire the striker spindle.

Locking shaft 7 has: a middle section; the shaft proper, located in the vertical recess of the breech block; a lower section with a cam having two bosses (semicircular boss i, serving to return the striker spindle to its original position after firing, and circular boss k which engages the intermediate cocking lever and cocks the striker spindle); and an upper section with cam zh and catch 6. Cam zh engages the cam of cocking lever 11. Spring 5, attached to catch 6, is designed to return the locking shaft and parts attached thereto to their original position after firing.

The shaft e of cocking lever 11 is located in the vertical recess of the breech block; the long arm and two short arms of the lever fit in a notch in the upper surface of the block. [p 27]

During firing, the long arm of the cocking lever is moved by a firing push rod, located on the cradle shield.

One short arm b of the cocking lever engages locking shaft cam zh, and the other, g, engages the safety device for premature firing.

At the end of the long arm of the cocking lever is an opening through which cocking lever 11 can immediately engage the firing lanyard for firing the gun in the event of damage to the firing push rod.

Extractor Mechanism

The extractor mechanism (Figs 12 and 17) is designed for extracting the empty cartridge case from the chamber of the barrel. The mechanism consists of upper 2 and lower 3 extractors, and pin 18 with safety lock 19, including spring 15 and setscrew 38.

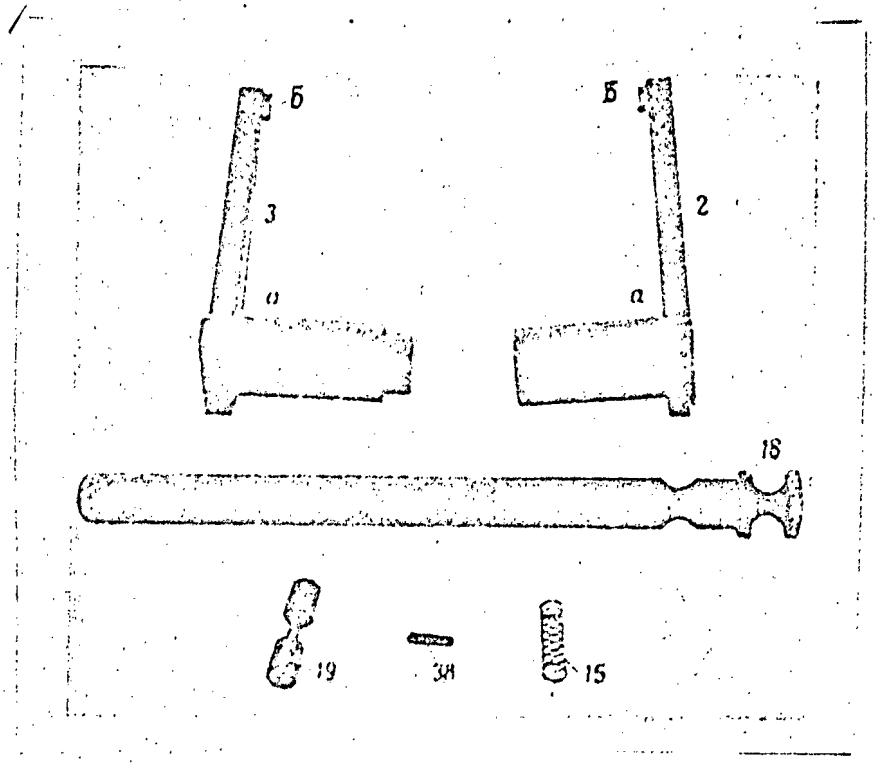


Fig 17. Extractor Mechanism

2 - upper extractor (02-34A); 3 - lower extractor (02-33A); 10 - spring (02-12); 18 - extractor pin (02-35); 19 - extractor pin safety lock (02-11); 35 - screw (A51064-4); a - protruding part of extractor; b - catch of extractor.

Upper 2 and lower 3 extractors fit in grooves in the breech face of the barrel. Each extractor has a protruding part a and a catch (pawl) b (Fig 17).

The extractors slip freely over extractor pin 18.

Extractor pin 18 is located in a vertical opening of the breech ring and held there by safety lock 19 with spring 15, placed in the recess on the right side of the breech ring. Safety lock 19 is held on the breech ring by screw 38.

Safety Mechanisms

Breech safety mechanisms include: [p 28]

- a safety device for premature firing;

- an inertial safety device;

- a projectile retainer.

The safety mechanisms are designed to prevent:

- firing when the breech is not fully closed (safety device for premature firing);

- opening of the breech without taking additional measures if firing has not occurred (inertial safety device);

Fig. [illegible] Safety Device for Premature Firing and Inertial Safety Device

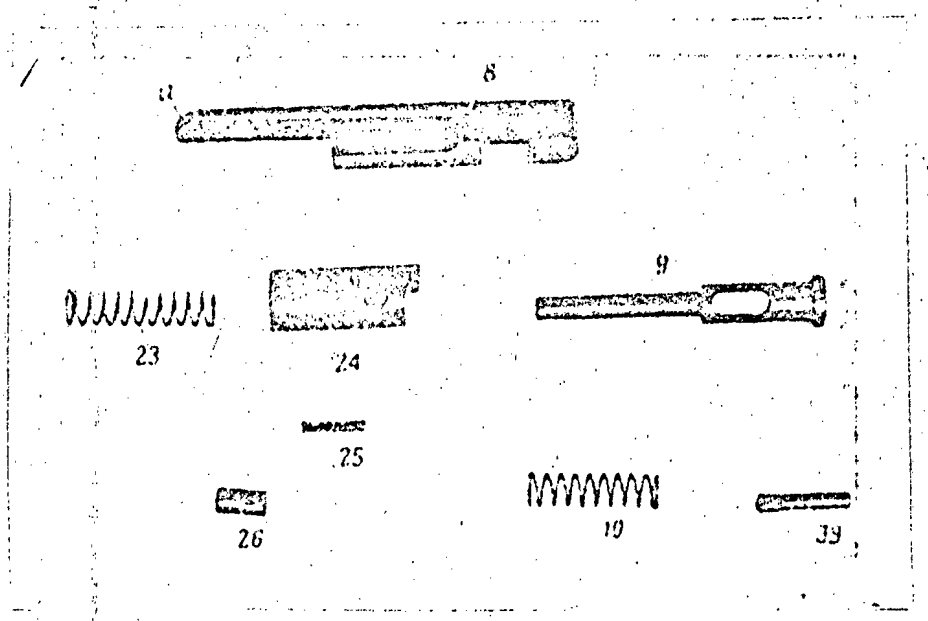


Fig 18. Safety Device for Premature Firing and Inertial Safety Device

8 - safety device for premature firing (02-18); 9 - release (02-42A); 10 - spring (02-12); 23 - spring (02-12); 24 - inertial safety device (02-31); 25 - spring (02-26); 26 - catch of safety device (02-32); 39 - screw (02-44); a - bevel of safety device for premature firing.

- dropping of the projectile from the chamber of the barrel during loading when the gun is sharply elevated (projectile retainer).

Safety device for premature firing 8 (Figs 12 and 18) fits in groove p (Fig 14) on the upper surface of the breech block. Safety device 8 (Fig 18) has a lateral groove, in which fits the short arm of the cocking lever, and a bevel a on the end.

The inertial safety device fits in recess kh (Fig 14), located on the after surface of the breech block; it consists of safety device 24 (Fig 16), with spring 23, and catch 26 with spring 25.

Safety device 24 is cylindrical in shape. Its after end is notched and its interior houses spring 25. In its forward part, parallel to the notch, is a recess which houses catch 26 with spring 25.

The inertial safety device also includes: safety catch 9 (Fig 12) with spring 10 and screw 39, situated in an opening on the after surface of the breech ring.

The striker spindle for the projectile is located in a notch on the lower forward part of the loading tray; it consists of retainer 34 (Fig 19), pin 22, firing plunger 21, and spring 20.

In the thick part of the retainer are: aperture a for pin 22, recess b for firing plunger 21 with spring 20, and stops v and g, which hold the retainer against the lateral sides of the notch in the recess of the breech block.

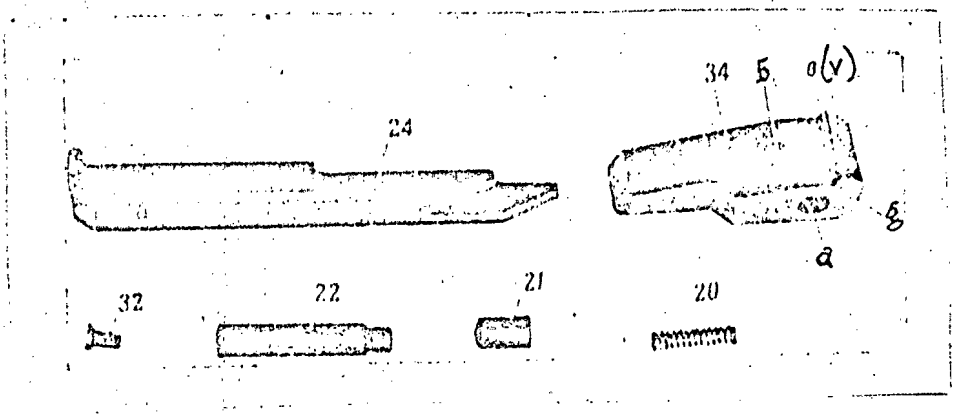


Fig 19. Projectile Retainer

20 - spring (02-39); 21 - firing plunger (02-40); 22 - retainer pin (02-41); 24 - breech-operating cam (01-32, see Fig 4); 32 - screw (A51060-8, see Fig 8); 34 - projectile retainer (02-38A); a - aperature for pin 22; b - recess for firing plunger with spring; v and g - stops.

In order that retainer 34 not impede the ejection of the empty cartridge case, a breech-operating cam 24 on the breech ring causes the retainer to return to its lower position when the breech is being opened.

Breech-operating cam 24 is located in a groove on the forward side of the breech block recess of the breech ring and held in place by screw 32 (Fig 8).

9. Operation of Breech Mechanisms

Operation of Breech-Closing Mechanism
(Figs 12 and 13)

When the breech is closed, the block is in the extreme left position, and lug v on the handle of the breech mechanism lever is engaged with a catch on the breech ring.

In order to disengage the lug from the catch to open the breech, it is necessary to push down on the handle and then pull the lever to the right and back as far as possible.

When the lever is turned, a slide pawl, engaging the short arm of the lever, moves along the groove of the breech block and pushes the block to the right. The block moves to the right until its cams 13 come up against projections a of the extractor (Fig 17).

To close the breech, it is necessary to push the lever forward and to the left until the lug on the handle locks behind the catch on the breech ring.

Operation of Striker Mechanism

Previous to firing, the firing pin of the striker spindle is recessed behind the forward face of the breech block.

The striker spindle is held in this position by projection i of the lower cam of the locking shaft (Fig 15).

To fire, it is necessary that push rod 5 (Fig 16), located on the [cartridge case] deflector, be pulled back. At the same time, the push rod turns cocking lever 11 (Fig 12), located on top of breech block 1.

When cocking lever 11 is turned, locking shaft 7, with projection k of the lower cam (Figs 15 and 16), presses on intermediate cocking lever 27 and draws back striker spindle 30, compressing the main spring. Further rotation of cocking lever 11 causes projection k of the lower cam of locking shaft 7 to slip off intermediate cocking lever 27.

Main spring 28 causes striker spindle 30 to move forward and strike [p 30] the primer cap, firing (the gun].

After firing, the striker mechanism returns to its original position; spring 5 causes locking shaft 7 to turn, so that boss k of the lower cam of the locking shaft cocks intermediate cocking lever 27 and positions itself in front of it. Then the locking shaft with boss i on the cam draws the striker spindle back, forcing the firing pin behind the face of the breech block. Cam zh on the upper part of the locking shaft returns cocking lever 11 and safety device for premature firing 8 to their original positions (Fig 12).

Operation of Extractor Mechanism

When the breech is opened, breech block 1 (Fig 12) with cams 13 of the extractors strikes bosses a (Fig 17) of extractors 2 and 3 and extracts the cartridge case by catches b.

In addition, the extractors limit the movement of the breech block when it is opened.

Operation of Safety Mechanisms

a) Operation of Safety Device for Premature Firing

Safety device for premature firing 8 (Figs 12 and 18) is located in a groove on the upper surface of the breech block, and when the breech is completely closed, cocking lever 11 causes it to slide along the breech when the firing push rod mechanism is pulled.

If the breech is not completely closed, the movement of the safety device is blocked by slide pawl 4 of the breech mechanism lever, so that the striker spindle cannot be cocked to fire.

If the breech does not completely close, then when the cocking lever with bevel a turns, the safety device presses against the slide pawl of the breech mechanism lever, turns the latter, and pushes it into place. At the same time, the breech mechanism lever engages the catch on the breech ring.

b) Operation of Inertial Safety Device

When the breech closes, a safety device catches in a notch ts on the breech ring (Fig 16) and prevents the breech from opening.

When the gun recoils during firing, inertial safety device 24 is held in the notch by inertia and presses against spring 23. Spring 25 causes catch 26 of the safety device to engage lower curved notch y in the breech ring and hold the safety device in a depressed position; the breech can now open.

If firing does not take place, inertial safety device 24 remains in notch ts of the breech ring. In this case it is impossible to open the breech; this serves as a warning of hang-fire.

There is a safety catch 9 in the breech ring (Figs 12 and 18) for opening the breech during periods of instruction and when firing blanks.

By pressing on the safety catch it is possible to depress the safety device and open the breech.

v) Operation of Projectile Retainer

Projectile retainer 34 (Fig 16) prevents the projectile from falling out of the chamber during loading (in the event of incomplete seating).

Then when the cartridge case is seated, its flange causes the projectile retainer to drop down; and when the breech is closed, the [p 31] forward part of the projectile retainer drops down under breech-operating cam 24 (Fig 4a).

When the breech is opened, the projectile retainer passes under the cam and cartridge case, allowing the ejection of the latter.

After the ejection of the cartridge case from the chamber, spring 20 (Fig 19) causes the projectile retainer to return to its original position.

10. Dismantling and Assembling of Breech

Dismantling and assembling of the breech may be done for purposes of inspection, cleaning, lubrication, and replacement of defective parts. It may also be done for purposes of training.

The order of dismantling and assembling of the breech is the same on both an assembled gun and a barrel removed from a gun.

When dismantling the breech on a barrel which has been removed from the gun, first turn thrust lock 15 (Fig 4a) with wrench Sb42-39 to the position required to join the barrel and the buffer.

Then safety lock 30 on the block (Fig 8) drops down, allowing the breech to open.

Dismantling of Breech

1. Disconnect the inertial safety device by means of the safety catch. /

2. Remove the extractor. To do this:

- depress safety lock 19 (Fig 12) of the extractor pin and remove pin 18 of the extractor [by pulling it up];

- open the breech and remove upper 2 and lower 3 extractors [by moving them to the right].

3. Remove the breech mechanism lever. To do this:

- turn breech mechanism lever 12 back as far as it will go and take out slide pawl 4 of the lever from groove ye;

- fix the block in the breech ring by hand, so that it occupies the position it occupies in a closed breech;

- turning the breech mechanism lever forward, take it out of groove zh (Fig 10) on the breech ring and, supporting it by hand, remove it [downwards].

4. Remove the breech block from the groove on the breech ring. To do this:

- disconnect (depress) the inertial safety device;

- carefully push the block to the right as far as opening g (Fig 16) in the right side of the block behind the face of the breech ring, put a pinch bar in the opening and, with a force of two men (gunners), remove the block from the groove on the breech ring, while the third gunner supports the block from below. If the block is not supported from below while being removed from the groove, it may turn around the pinch bar and hit the protruding part of cocking lever 11 (Fig 12) on the edge of the lower side of the breech ring and bend the cocking lever.

If the breech block is removed from an assembled gun, it is possible to use the right trail to support the block while it is being removed.

To do this, it is necessary to swing the protruding part of the gun along the right trail and elevate the barrel until the after lower edge of the block drops down to the level of the upper surface of the trail. Place a board or piece of plywood on the trail, remove the block, and place it on the board or plywood.

5. Remove the striker mechanism (Fig. 16) from the block. To do this:

- press on striker cover 29 with wrench Sb42-53, turn it 90° in [p 32] either direction, and remove it from the block;
- remove from the block main spring 28 and the striker mechanism (the striker mechanism may also be removed from the block of an assembled gun with the breech closed).

6. Remove locking shaft 7 (Fig. 12). To do this:

- turn the locking shaft with a screwdriver in a clockwise direction and remove cocking lever 11 from the block;
- remove safety device for premature firing 8;
- remove spring 5, turn the locking shaft in a clockwise direction as far as it will go and remove it from the block.

7. Remove the inertial device (Fig. 16) from the block. To do this:

- with a screwdriver, depress catch 26 of the safety device and, holding the catch, withdraw inertial safety device 24, together with the catch and springs 23 and 25;
- withdraw catch 26 with spring 25 from the safety device.

8. Remove the projectile retainer from the block. To do this:

- unscrew retainer pin 22 and remove it;
- remove projectile retainer 34, firing plunger 21, and spring 20 from the block.

When the breech is being dismantled for purposes of instruction, it is not recommended that the projectile retainer be removed.

Further dismantling is carried out only for repairs and is done in the following order:

1. Take the striker mechanism (Fig. 16) apart. To do this, depress firing plunger 33 as far as possible with rod A52822-6 and remove intermediate cocking lever 27, the firing plunger, and spring 32 from the striker spindle.

2. Take the breech mechanism lever apart. To do this:

- by pressing and turning cap 16 (Fig. 12), line up the opening on it with pivot 37, in the opening in safety lock 14 of the lever, and with a rod knock out the pivot from the opening;
- remove the cap, spring, and safety lock 14 from the breech mechanism lever.

3. Remove catch 9. To do this:
- take out screw 39 holding the catch;
- remove the catch with spring 10 from the breech ring.

Removal of the extractor cams from the breech block during dismantling of the breech is prohibited.

Assembling Breech

1. Assemble the striker mechanism (Fig. 16). To do this:
- fix spring 32 and firing plunger 33 in the recess of the striker spindle, depress the firing plunger with rod A52822-6 as far as possible, and replace intermediate cocking lever 27.

2. Assemble the breech mechanism lever. To do this:
- fix safety lock 14 (Fig. 12) on the handle of the breech machanism lever;
- put spring 17 and cap 16 on safety lock 14;
- by pressing and turning cap 16, line up its opening with the opening in safety lock 14 and with a rod drive in pivot 37.

3. Replace catch 9. To do this:
- put spring 10 on the catch and fix it in the recess of the breech ring;
- replace screw 39 holding the catch.

4. Assemble the projectile retainer. To do this:
- fix projectile retainer 34 (Fig. 16), with spring 20 and firing plunger 21, in the breech block;
-screw in retainer pin 22.

5. Assemble inertial safety mechanism. To do this:
- fix spring 23 in the recess of the breech block under the inertial safety mechanism;
- fix the inertial safety mechanism, with spring 25 and catch 26 attached thereto, in the recess of the breech and depress it until the catch fits into the notch on the lower surface of the breech block.

6. Replace the locking shaft. To do this:
- fix locking shaft 7 (Fig. 12) in the block and attach spring 5;
- fix safety device for premature firing 8;
- screw the locking shaft in a clockwise direction and fix cocking lever 11 in the recess of the breech block.

7. Replace the striker mechanism. To do this:
- fix the striker mechanism and main spring in the breech block
- put striker cover 29 (Fig. 16) in place with wrench Sb42-53.

8. Fit the block, with the assembled mechanisms, into the recess in the breech ring. To do this:

- place bar in opening in the block;
- raise the block and fit it into the recess in the breech ring so that it occupies the same position it would occupy when the breech is closed.

At this time, the thrust lock must be in the position it occupies when the safety lock on the block fits into the vertical opening in the breech ring.

9. Replace the breech mechanism lever. To do this:

- fix the lever shaft in the breech ring;
- disconnect the inertial safety mechanism;
- push the block to the right by hand until the slide on the breech mechanism lever lines up with the groove under the slide on the breech block, and fit the slide into the groove.

10. Replace the extractors. To do this:

- fix upper 2 and lower 3 extractors (Fig. 12) and close the breech;
- depress the safety lock of the extractor pin and fix extractor pin 18.

Chapter 3

CRADLE AND COUNTERRECOIL SYSTEM

II. Cradle

The cradle directs the barrel movement during recoil and return to battery, houses the recoil system, and is designed so that the counter-recoil rod and sighting devices may be attached to it. The cradle is the chassis of the tipping parts of the gun.

The cradle is held in the trunnion beds of the top carriage by its own trunnions and is meshed to the gear wheel of the elevating mechanism drive shaft through gear sector 18 (Fig. 20), which is fastened to the bottom section of trunnion yoke 21.

The basic parts of the cradle are cradle frame 22 with runners 8 welded to it, trunnion yoke 21, reinforcing plate 3, front inner connection 59 and rear inner connection 57 (Fig. 22), left bracket (Fig. 20), right bracket 118 (Fig. 21), and rear yoke 10 (Fig. 20).

Cut-off gear actuating collar 1 is fastened to bracket 25 (Fig. 20) by six bolts 116 and nuts 117 and to bracket 118 (Fig. 21) by two bolts 115 without nuts. The trunnion cap is fastened to the cut-off gear actuating collar by three bolts 113. Lock washers are used to prevent bolt loosening.

The recoil limiter, gear case 102 for compressing recoil packing, and counterrecoil mechanism testing chart 119, fastened to the cradle case by four screws, are all located on the right side of the cradle. [34]

Shield 7 (Fig. 20), firing mechanism, counterrecoil-firing mechanism interlock, and the recoil indicator 54, which fits over guide 53 (Fig. 22), are all located on the left side of the cradle.

Identification plate 11 (Fig. 20), on which are stamped the numbers of the cradle, recoil brake, recuperator, recoil rod, and recoil-brake throttling rod, is fastened with screws to the left side of the cradle. Plated 14 marked "travel" and plate 15 marked "battery" are also fastened to the left side of the cradle. The markings "travel" and "battery" denote position of lever 19 of the counterrecoil-firing mechanism interlock.

Bolt 105 (Fig. 22), located on the front underside of the cradle, is secured with a lock nut to prevent the recoil mechanism from turning in the cradle.

The cradle front is protected by cover 78 which is secured by three bolts 80 and nuts 79.

There are four service openings in the reinforcing plate 3 (Fig. 20) which are closed by covers 109 (Fig. 23) fastened with screws.

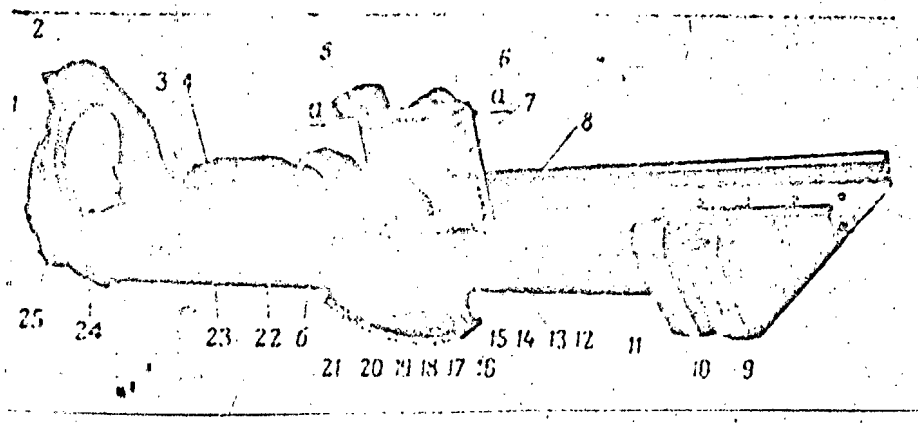
[Pages 35, 36, and 37 contain figures 20, 22, and 23. Figure 21 is missing but no pages are missing. There is no continuity of text ending page 34 and text starting page 38. There is no text on any of the pages containing the three diagrams].

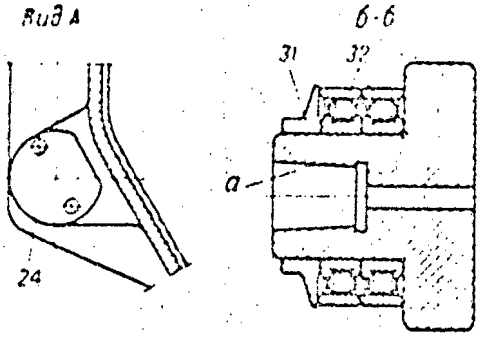
... to the rear yoke 10 (Fig. 20) supports are welded: right support 120 (Fig. 21) and left detent 9 (Fig. 20) by which the cradle rests on the tilting claw of the trail when the weapon is in the travelling position.

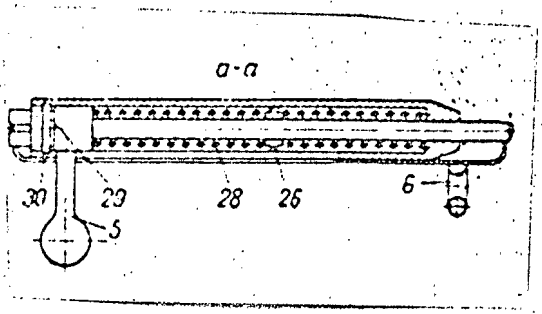
Cut-off gear actuating collar 1 (Fig. 20) with trunnion cap 2 is designed for fastening the counterrecoil rod to the bracket by means of bushing 60 (Fig. 22).

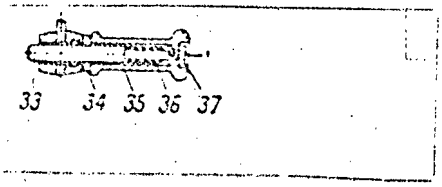
The counterrecoil-firing mechanism interlock is designed to prevent firing if the counterrecoil rod is not connected with bushing 60 of the cradle cut-off gear actuating collar, in which case, bolt plunger 5 (Fig. 20), acting on the cocking lever, is locked.

The counterrecoil-firing mechanism interlock consists of shaft 58 (Fig. 22), lever 19 with handle on the rear end of shaft 58, lock rod 42 and interjacent parts, lever 73 placed on the front end of shaft 58, and bushing 60 with bracket and interjacent parts.

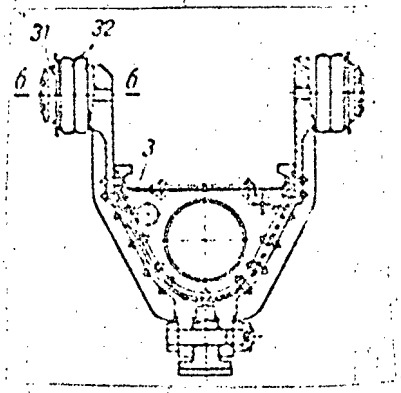








Lateral cross sectional view of lever 19



Cross sectional view of trunnion yoke

Fig 20. Cradle (left side)

Fig. 20. Cradle (left side)

1. (Sb09-8) Cut-off gear actuating collar
2. (09-44) Trunnion cap
3. (09-26) Reinforcing plate
4. (09-198) Coupling
5. (Sb09-30) Bolt plunger
6. (09-28) Ring lug
7. (Sb09-18) Shield
8. (09-2) Cradle runner
9. (09-32) Left detent
10. (Sb09-29) Rear yoke
11. (09-132) Identification plate
12. (A51000-25) Bolt
13. (09-210) [Testing] chart
14. (09-136) Plate
15. (09-135) Plate
16. (A51011-10) Nut
17. (09-37) Bolt
18. (09-50) Gear sector
19. (Sb09-38) Lever with handle
20. (09-16) Bracket
21. (Sb09-2) Trunnion yoke
22. (09-1) Cradle frame
23. (09-197) Bracket
24. (09-75) Cover
25. (09-22) Left Bracket
26. (09-160) Insert
28. (09-85) Spring
29. (09-98) Buffer
30. (09-90) Plug
31. (09-129) Packing nut
32. (No 2218) Roller bearing
33. (09-65) Stop
34. (09-66) Barrel
35. (09-65) Cap
36. (09-437) Spring
37. (A51013-3) Nut

a. Conical recess
b. Threaded bore

50X1-HUM

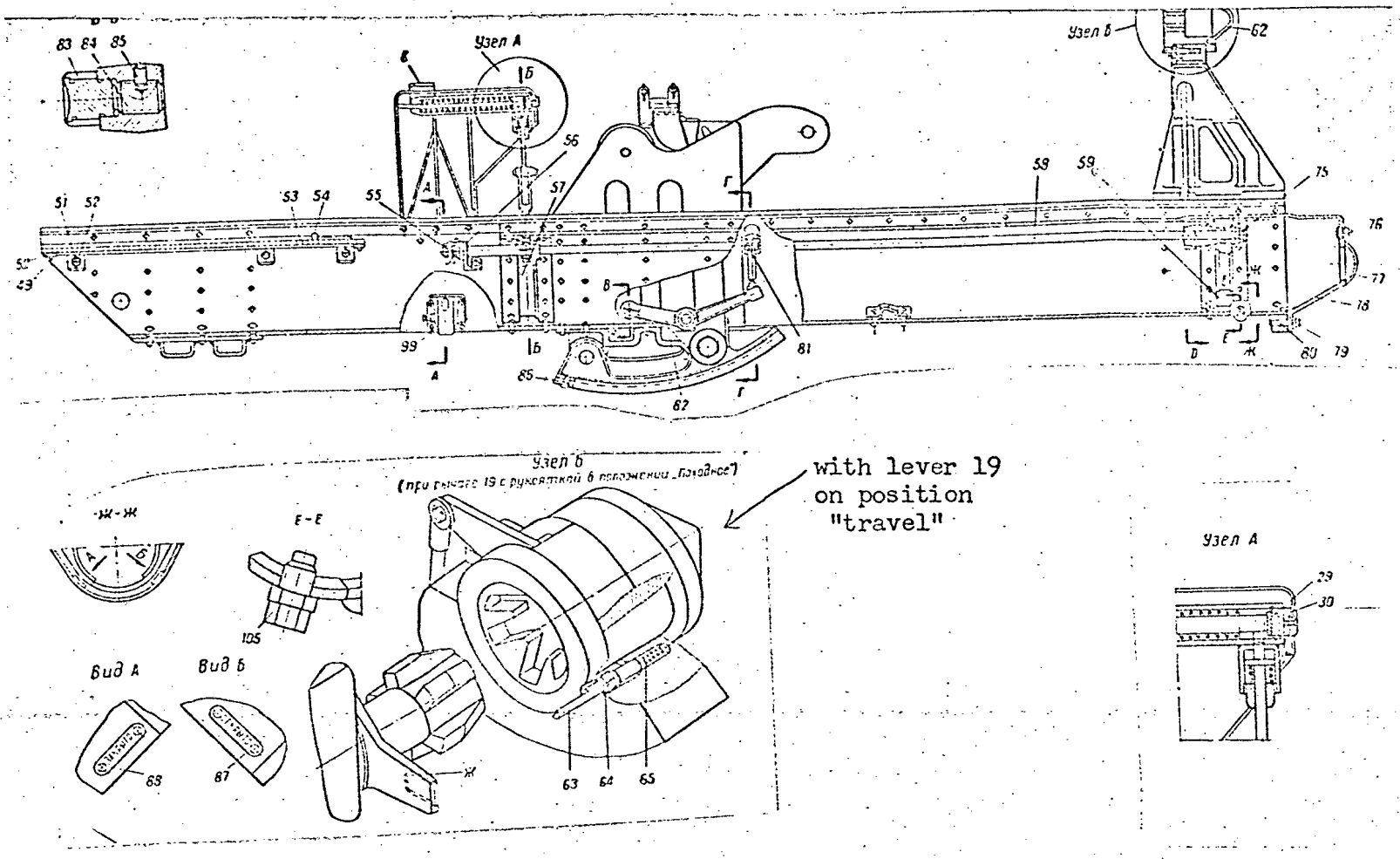


Fig 22. Cradle (right side, cross-sectional view)(Part 1)

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

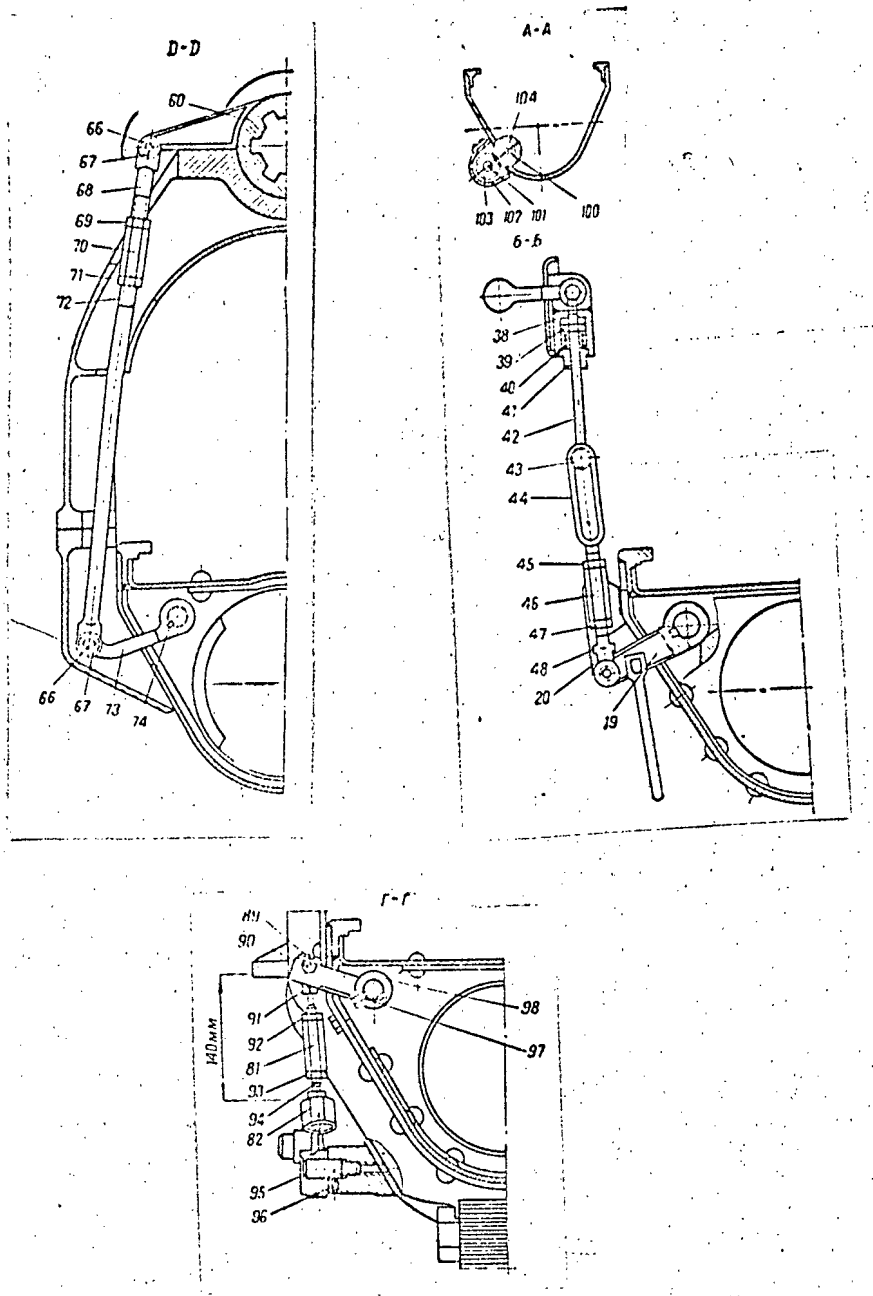


Fig 22. Cradle (right side, cross-sectional view)(Part 2) [37]

Fig. 22. Cradle (right side, cross-sectional view) [37]

19. (Sb09-38) Lever with handle
20. (09-16) Bracket
29. (09-98) Buffer
30. (09-90) Plug
38. (09-83) Insert
39. (09-96) Washer
40. (09-95) Spring
41. (09-94) Nut
42. (09-93) Lock rod
43. (09-97) Pivot Bolt
44. (09-80) Top connecting rod
45. (09-137) Top lock nut
46. (09-73) Adjusting nut
47. (09-72) Bottom lock nut
48. (09-79) Bottom connecting rod
49. (A51062-9) Bolt
50. (A51011-1) Nut
51. (A51000-15) Bolt
52. (A51011-3) Nut
53. (09-53) Recoil indicator guide
54. (Sb09-13) Recoil indicator
55. (09-204) Detent
56. (Sb09-6) Bracket
57. (Sb09-4) Rear inner connection
58. (Sb09-5) Shaft
59. (Sb09-7) Front inner connection
60. (Sb09-10) Bushing with bracket
61. (A51060-7) Screw
62. (09-146) Cover
63. (09-48) Catch
64. (09-49) Nut
65. (09-47) Spring
66. (A51620-118) Pivot bolt
67. (A51021-5) Washer
68. (09-74) Top connecting rod
69. (09-137) Top lock nut
70. (09-73) Adjusting nut
71. (09-72) Bottom lock nut
72. (09-71) Bottom connecting rod
73. (09-62) Lever
74. (A51050-24) Key
75. (A51011-7) Nut
76. (Sb09-35) Plug
77. (Sb09-31) Cover
78. (Sb09-25) Front cover
79. (A51011-4) Nut
80. (09-35) Lug bolt
81. (09-73) Adjusting nut
82. (09-105) Bell crank
83. (09-107) Roller
84. (09-108) Roller axle
85. (A51063-40) Set screw
86. (09-143) Stop
87. (09-152) Plate
88. (09-151) Plate
89. (09-102) Ball joints
90. (A51063-40) Set screw
91. (09-101) Top push rod
92. (09-137) Lock nut
93. (09-72) Lock nut
94. (09-106) Bottom push rod
95. (09-111) Crank bolt
96. (A51064-3) Set screw
97. (A51064-3) Set screw
98. (09-100) Top crank
99. (A51000-15) Bolt
100. (09-124) Pivot bolt
101. (09-120) Axle
102. (09-117) Gear case
103. (09-123) Gear
104. (09-125) Gear
105. (A51069-9) Bolt
v. Guide boss
zh. Coupling nut lever

50X1-HUM

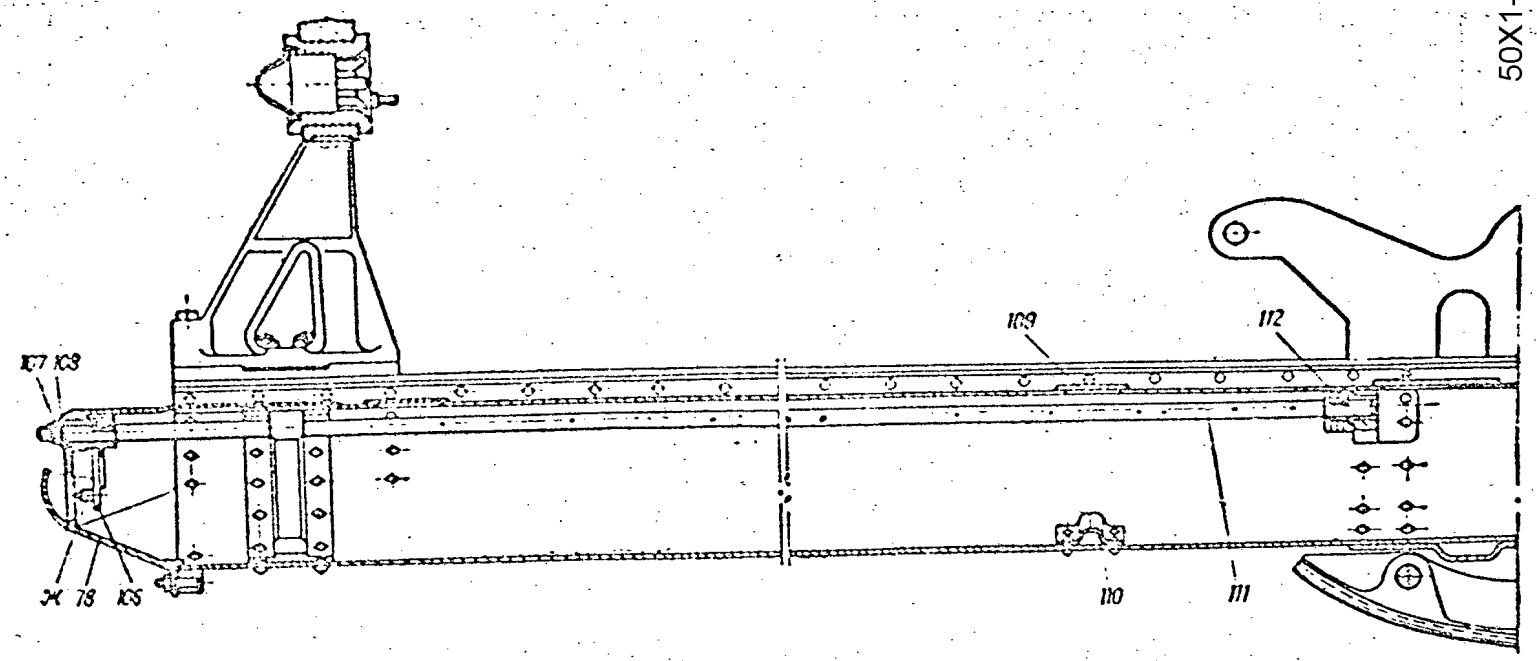


Fig 23. Cradle (left side, cross-sectional view)

78. (Sb09-25) front cover
106. (09-112) lever arm
107. (A51011-7) nut
108. (A51021-9) washer
109. (09-141) cover
110. (09-25) guide
111. (09-140) recoil limiter shaft
112. (Sb09-3) bracket
zh. lug bolt

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

To this same mechanism belong parts located inside insert 38 which is welded to the cradle shield. These include nut 41, spring 40, and washer 39 which fastens the top end of lock rod 42 to insert 38.

Interjacent parts between lever 73 and bushing 60 with bracket are two pivot bolts 66, two washers 67, two cotters, bottom connecting rod 72, bottom lock nut 71, adjusting nut 70, top lock nut 69, and top connecting rod 68.

Interjacent parts between lever 19 and lock rod 42 are the lever stop, bottom connecting rod 48, bottom lock nut 47, adjusting nut 46, top lock nut 45, top connecting rod 44, and pivot bolt 43.

Stop of lever 19 consists of cap 35 (Fig. 20), barrel 34, which is screwed into the end of bottom connecting rod 48 (Fig. 22) thereby connecting it to the lever, stop 33 (Fig. 20), spring 36, and nut 37.

Shaft 58 (Fig. 22), with its ends in the bushings, has one end fitted in the front inner connection 59 and the other end in bracket 56 and rear connection 57. The shaft is prevented from longitudinal movement by nut 75 secured in front with a cotter pin and in back by detent 55, fastened with a joint pin.

In the travel position, detent 55 prevents recoil rod from disengaging from the recoil cylinder and, resting with its chamfer on the chamfer of the thick section of plate spring 57 (Fig. 25), is fastened to the plate of the recoil buffer.

In addition to the counterrecoil—firing mechanism interlock there is catch 63 (Fig. 22) with spring 65 which is held tight by nut 64 located in the top section of the cut-off gear actuating collar.

Catch 63 does not allow bushing 60 with bracket to rotate if the gun barrel, when changed from traveling to battery position, did not reach its forward position, since the catch, with its cylindrical part, engages in the semicircular groove on the front shoulder of the bushing.

With the gun barrel in the forward position, the connecting nut of the recuperator with its lever "zh" presses on catch 63 and pushes it into the recess of the cut-off gear actuating collar. Then the cylindrical section of the catch disengages behind the bushing shoulder, and the semicylindrical part of the catch is opposite the semicircular groove. Now bushing 60 can be turned and connected with the recuperator rod.

Catch 63, having been placed with its semi-cylindrical end in the recess of lever "zh" of the connecting nut (Fig. 22) of the recuperator, does not allow the recuperator rod to turn while firing.

In the battery and traveling positions of the weapon, the interlock [39] mechanism is locked by the stop of lever 19 and bracket 20 (Fig. 20).

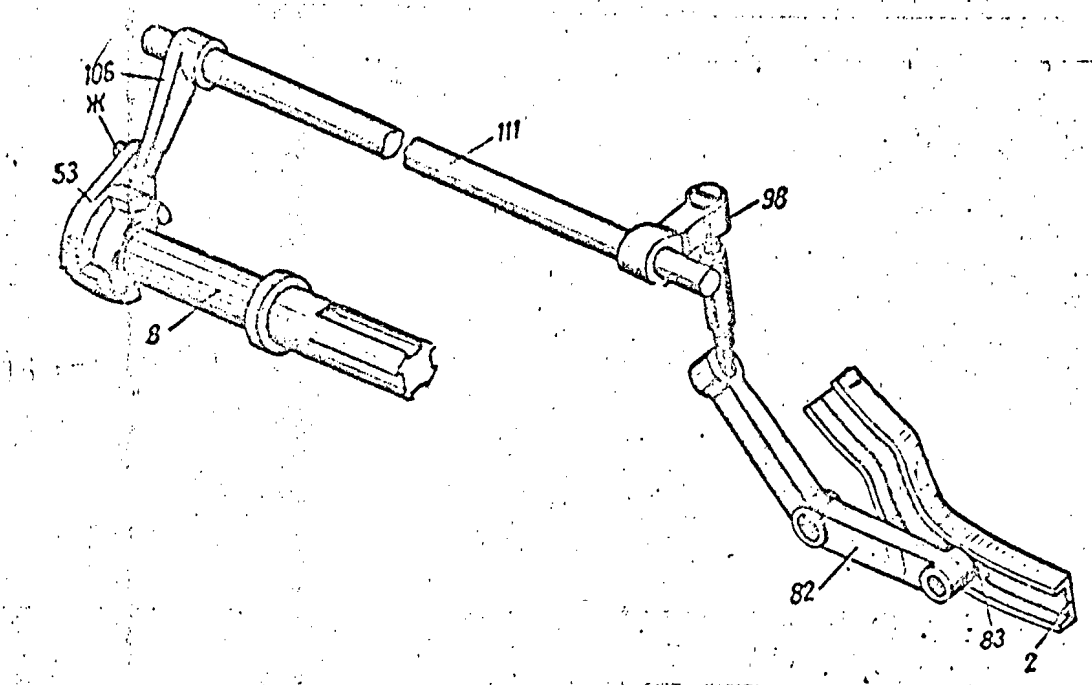


Fig 24. Recoil-limiter Mechanism

[39]

2. slideway (17-20)
8. throttling rod (08-28)
53. lever arm (08-40A)
82. bell crank (09-105)
83. roller (09-107)
98. top crank (09-100A)
106. lever arm (09-112A)
111. shaft (08-140A)
Zh. pin

There are two openings, one above the other, in the bracket, and opposite them are plates marked "travel" and "battery", which are fastened to the cradle frame and indicate the direction to switch lever 19 after having disengaged stop 33 from the opening in bracket 20.

Recoil Limiter Mechanism

The recoil limiter mechanism shortens the length of recoil when the gun is firing at large angles of elevation, in order to prevent the breech from striking the ground.

The recoil limiter mechanism consists of slideway 2 (Fig. 24) welded to the right side plate of the top carriage, bellcrank 82 fastened to crank bolt 95 (Fig. 22) which is screwed into the lug welded to the trunnion yoke of the cradle, ball joints 89 (top and bottom) with push rods 94 (bottom) and 91 (top) inserted in them, adjusting nut 81 with lock nuts 92 and 93, top crank 98, and shaft 111 which is located inside the cradle on the right side. Shaft 111 passes through the opening in the front inner connection with its ends in the bushings, front end in cover 78 (Fig. 23) and rear end in bracket 112. Shaft 111 is prevented from longitudinal movement by washer 108 and pressure nut 107 secured with cotter pin.

Lever arm 106 is attached to the front end of shaft 111 and is fastened to lever arm 53 (Fig. 24) by pin Zh at the end of the throttling rod at the recoil brake.

Roller 83, fitted in the shaped slot of slideway 2 (Fig. 24), is 407 fastened to the rear end of bellcrank 82 by means of roller axle 84, which is secured by set screw 85.

Crank bolt 95 (Fig. 22) of bellcrank 82 is locked by set screw 96 and the ball joints 89, by set screws 90.

Recoil indicator guide 53 (Fig. 22) is fastened to the left side of the cradle frame by bolts 51 with nuts 52 and cotter pins.

Graduations on guide 53 indicate length of recoil in millimeters. The distance between two graduations is equivalent to 10 mm of recoil. Graduations are marked for recoil of 700 to 1,380 mm.

Standard long recoil is 1,150-1,320 mm and short recoil is 735-815 mm. The marking "stop" indicates long recoil which is 1,350 mm and upon attaining this length of recoil it is necessary to cease firing, otherwise, the recoil and counterrecoil rods may be broken. The graduated line of the recoil indicator 54 shows recoil length on the index of guide 53. Recoil indicator 54 is pulled back during recoil by carrier rod 25 (Fig. 4a) which is welded to the left underside of the rear barrel lock.

A plate spring is fastened to the recoil indicator 54 (Fig. 22) by two rivets. This spring prevents indicator movement caused by inertia during barrel recoil. Bolts 49, secured by nuts 50 and cotter pins, are installed in the ends of the indicator. These bolts hold the indicator on the guide line.

The gear housing is designed to compress the packing of the recoil rod. It consists of housing 102 fastened to the cradle frame by bolts 99 and washers, gears 103 and 104, axle 101, and axle bolt 100. Gear 104 is meshed with the pinion of the recoil packing-rod nut 23 (Fig. 25).

Shield 7 (Fig. 20) serves to prevent the gunner from being struck by the recoiling barrel during firing.

The firing mechanism is located on the shield and consists of bolt plunger 5 with handle, two springs 28, inserts 26, buffer 29 and plug 30.

On the top section of the shield is guide boss "v" (Fig. 21) in which hook 31 (Fig. 8), located on the left side of the breech ring, engages.

In addition, a plate 13 (Fig. 20) is fastened to the shield with the inscription, "Release counterrecoil—cutoff gear actuating collar connection before operating elevating mechanism and before dropping trail."

Violation of this instruction can lead to barrel rotation and weapon damage if the counterrecoil rod is not connected with the cradle.

Ring 6 is welded to the shield at the same height as the bolt plunger with an opening in the hinge through which the firing lanyard passes.

Front cover 78 (Fig. 22) has an opening for filling the recoil mechanism with fluid and for checking fluid level. In addition, the front end of shaft 111 (Fig. 23), in the recoil limiter mechanism, is fastened to this cover.

An opening has been cut in the top section of the front cover for access to the recoil valve. This opening is sealed with plug 76 (Fig. 22) which is attached to the cover by a chain.

Cover 77, closing the center hole, is attached by a hinge to the front cover. In the closed position, cover 77 is fastened by cotter pin 114 (Fig. 21) inserted in the opening of the hinge and attached to the front cover 78 by a chain. 417

12. Cradle Dismantling and Assembly

Dismantling the cradle involves only the dismantling of the firing mechanism, removing the cradle front cover and gear housing.

In addition, bellcrank 82 (Fig. 22) is removed in the order given in chapter 12 when the piece is dismantled in large sections from the cradle.

The firing mechanism is dismantled with lever 19 (Fig. 20) in "battery" position.

To dismantle the firing mechanism:

- take out the wire and screw out plug with buffer 29 using wrench A52830-5;

- remove bolt plunger 5 with the two springs 28 and insert 26.

To remove front cover of the cradle;

- remove pins and unscrew nut 79 (Fig. 22) with wrench A58230-5 which fastens front cover 78 to the cradle;

- unpin nut 107 (Fig. 23) and unscrew it with wrench A52830-6;

- remove washer 108 from the front end of shaft 111 of the recoil limiter and remove front cradle cover.

To remove gear housing, unscrew the four bolts 99 (Fig. 22) with wrench A52830-4 which fasten the gear housing to the cradle.

Further dismantling of the gear housing is done in the event of repair or parts replacement.

Dismantling of the recoil limiter mechanism and counterrecoil-firing mechanism interlock is done only in the case of repair or parts replacement.

To dismantle recoil limiter mechanism:

- remove front cover 78 (Fig. 22) of the cradle;

- remove lever arm 53 from the front end of the recoil counter rod;

- remove lever arm 106 (Fig. 23);

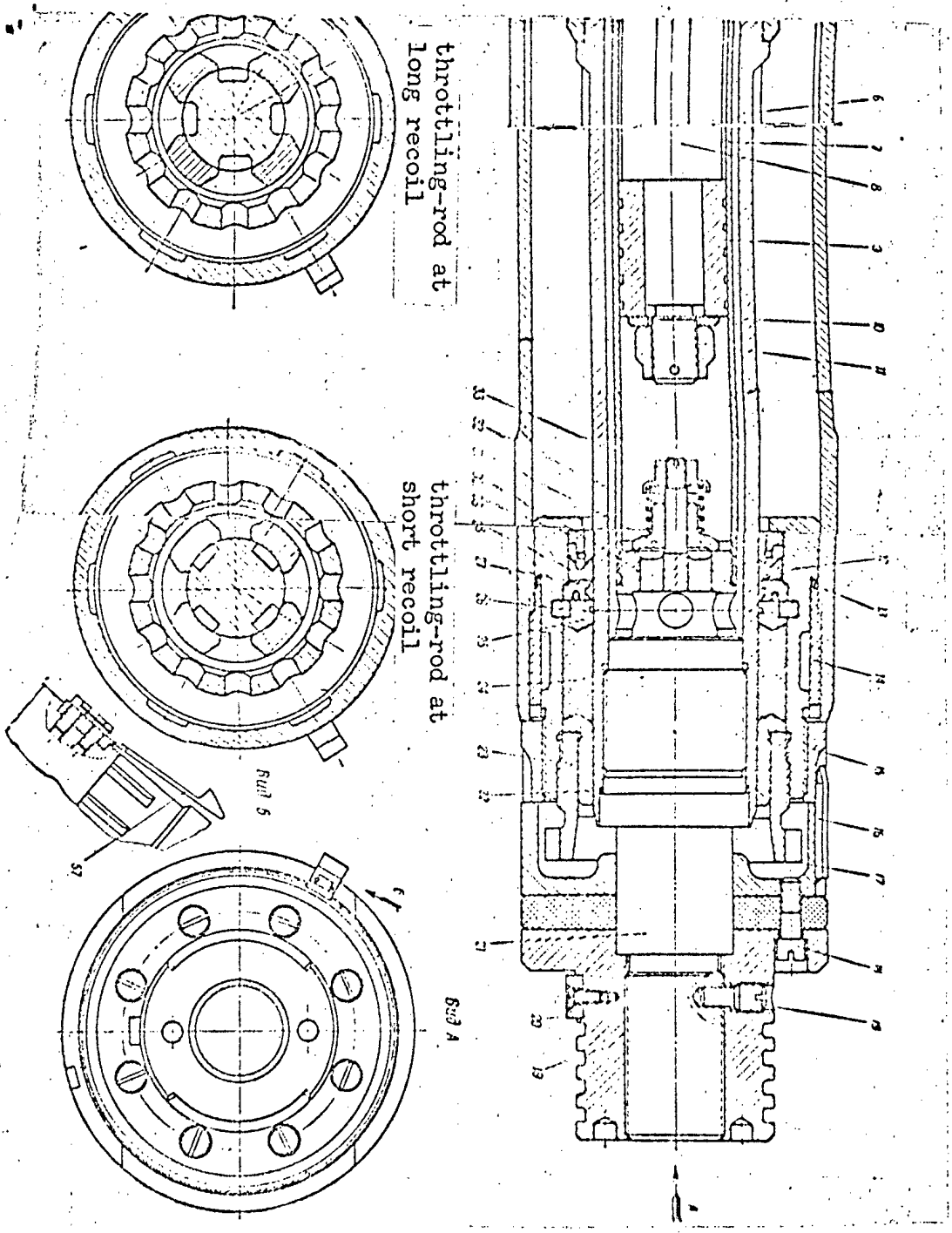


Fig 25. The Recoil Brake (part 1)

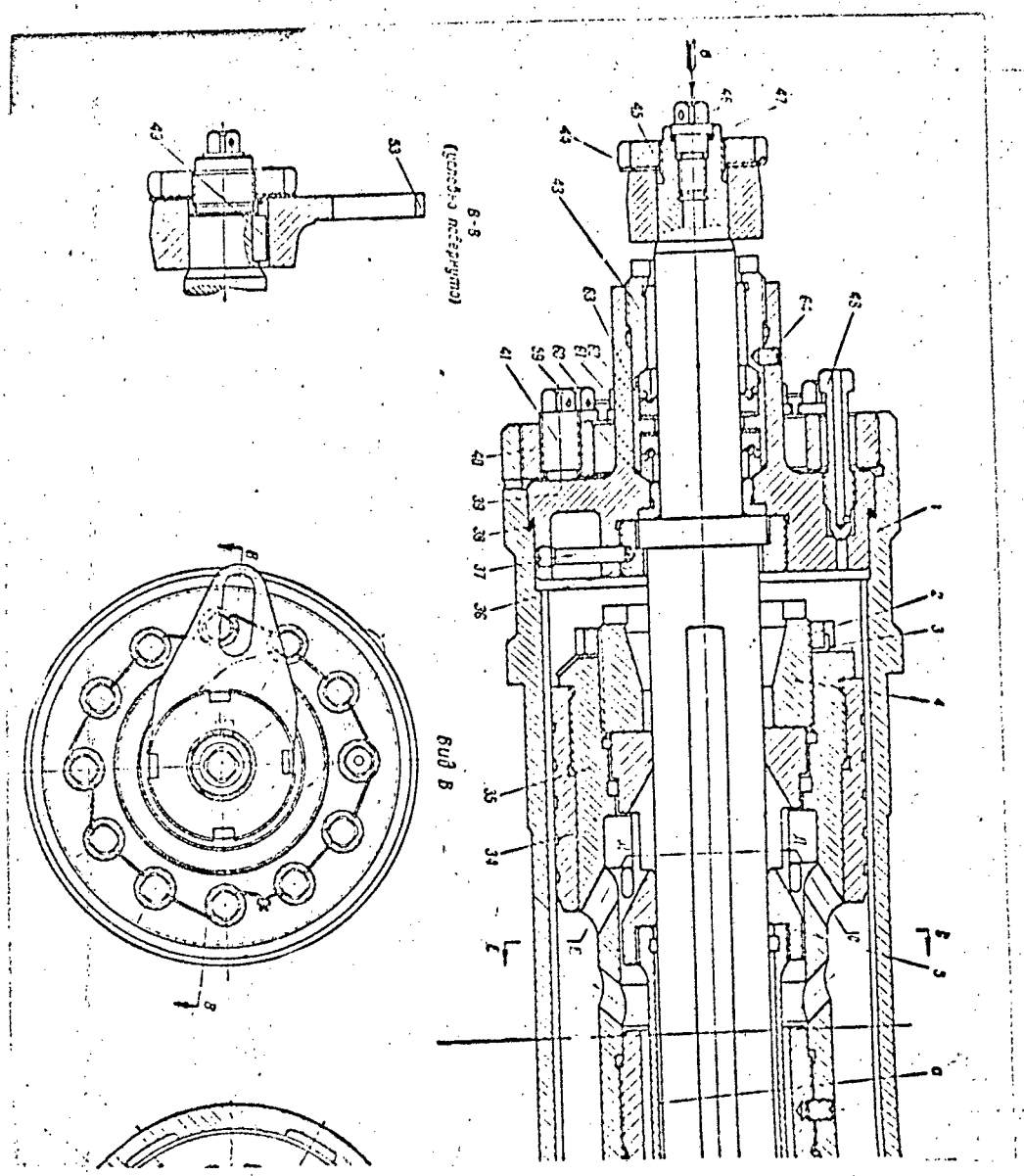


Fig 25. The Recoil Brake (part 2)

Fig 25. The Recoil Brake

1. brake cylinder (08-01)
2. lock washer (08-32)
3. washer (08-33)
4. nut (08-31)
5. bushing (08-34)
6. recoil piston rod (08-12)
7. inside tube (08-22)
8. throttling rod (08-29)
9. throttling rod guide (08-35)
10. washer (A51021-13)
11. nut M27 (A51011-40)
12. stuffing boc
13. copper washer
14. nut
15. nut (08-11)
16. screw
17. key (08-50)
18. buffer plate
19. rod nut with buffer (Sb08-12)
20. key (08-55)
21. piston
22. packing washer
23. nut(08-7)
24. gland (08-6)
25. washer (08-5)
26. segment (08-68)
27. babbitt-edged washer (Sb08-13)
28. rubber collar (08-4)
29. collar-seating washer (08-3)
30. buffer piston (08-17)
31. buffer valve (08-18)
32. spring (08-19)
33. valve nut (08-20)
34. bronze jacket (08-16)
35. screw-on head (08-14)
36. nut (08-29)
37. set screw (08-30)
38. copper washer (08-45)
39. front cover (Sb08-7A)
40. nut (08-46)
41. screw
43. packing nut
46. screw
47. copper washer
48. valve (08-48)
49. key (A51050-35)
53. lever (08-40A)
57. spring (08-75)
59. rubber packing washer
60. collar-seating washer (08-101)
61. leather washer (08-103)
62. collar (08-104)
63. guide (08-100)
64. screw

104. gear

- release shaft 111 of the recoil limiter by loosening set screw 97 (Fig. 22) several revolutions with a screwdriver. Pull shaft 111 (Fig. 23) from the front while simultaneously striking top lever arm 98 (Fig. 22) across the copper drift with a hammer (strike the lever arm in the direction of the rear section of the cradle) and knock the lever arm from the shaft key;

- unscrew recoil limiter shaft 111 (Fig. 23) from the cradle and remove top lever arm 98 (Fig. 22).

To dismantle the counterrecoil-firing mechanism interlock:

- bend down the ends of the lock washers and unscrew the three bolts of the trunnion cap 2 (Fig. 21) with wrench A52380-5. Remove the washers and trunnion cap 2;

- remove cotter pin and pivot bolt 66 (Fig. 22) with washers 67 of top connecting rod 68 and bottom connecting rod 72 and remove these rods by disconnecting their couplings. To remove the pivot bolt of connecting rod 72, remove cover 24 (Fig. 20) from bracket 25 of the cutoff gear actuating collar;

- remove insert 60 (Fig. 22) with bracket;

- take out cotter pin and pivot bolt 43 with washer of lock rod 42. Remove wire and unscrew nut 41 with wrench A52830-5; [427]

- remove lock rod 42 with nut 41, spring 40, and washer 39;

- remove cotter pin and unscrew nut 75, holding shaft 58, with wrench A52830-6 and knock out shaft 58 with keys by striking the copper drift with a hammer;

- remove lever arm 19 with handle and its connecting parts, and also lever arm 73;

- remove detent 55 from shaft 58 when replacing is necessary.

Removal of cutoff gear actuating collar 1 (Fig. 21), gear segment 18 and shield 7 (Fig. 20) from the cradle is done only when their replacement is required.

Assembly of the counterrecoil-firing mechanism interlock is done in the following order:

- fit detent 55 onto shaft 58 using a copper drift and hammer and secure it with a pin;

- insert pins and, after placing shaft 58 in the cradle, fit lever 19 with handle and lever 73 on the shaft. Screw nut 75 on the front end

of the shaft with wrench A52830-6 and insert a cotter pin. The levers are put on shaft 58 using a copper drift.

- install lock rod 42 with nut 41, spring 40, and washer 39; screw nut 41 into the recess of insert 38 of shield 7 (Fig. 20) with wrench A52830-5 and connect lock rod 42 with lever 19 with handle to pivot bolt 43 via top connecting rod 44 and interjacent parts. Place washer on pivot bolt 43 and insert cotter pin. Secure nut 41 with wire.

- install bushing 60 with bracket in the cutoff gear actuating collar. Install actuating collar trunnion cap 2 (Fig. 21) and, with wrench A52830-6, fasten it with bolts 113 and washers;

- install top 68 (Fig. 22) and bottom 72 connecting rods in place with parts attached to them and secure them, using pivot bolt 66, washers 67, and cotter pins. Install cover 24 (Fig. 20) with bracket 25 of the cutoff gear actuating collar.

After assembling the firing mechanism, the safety mechanism is adjusted. Adjustment is made with lever arm 19 with handle in two positions, "travel" and "battery."

In the "travel" position:

- bushing 60 (Fig. 22) with bracket should be locked with lock rod 63 which is achieved by a corresponding adjustment of the lengths of the connecting rods (top 68 and bottom 72) with the aid of adjusting nut 70;

- bolt plunger 5 (Fig. 20) should be locked by lock rod 42 (Fig. 22) which is achieved by a corresponding adjustment of the length of connecting rods (top 44 and bottom 48) with the aid of adjusting nut 46.

In "battery" position, free movement of plunger bolt 5 (Fig. 20) should be provided [lock rod 42 (Fig. 22) should be down].

Assembly of the recoil limiter mechanism is done as follows:

- install shaft 111 (Fig. 23) of the recoil limiter in the cradle and place top crank 98 on it after aligning the grooves (Fig. 22). The lever arm is fastened by set screw 97. A hammer may be used to fit this arm on the shaft by striking a copper drift placed on the lever arm;

- place lever arm 106 (Fig. 23) on the front end of shaft and connect it with lever arm 53 (Fig. 24) of the recoil mechanism. Lever arm 106 is placed on the shaft after installing the recoil mechanism in the cradle.

- after final installation of lever arm 53 on the counterrecoil rod. install front cover 78 (Fig. 22) and fasten it with nuts 79, using wrench A52830-5, and insert cotter pins;

- on the front end of the recoil limiter shaft, which projects beyond the front cover of the cradle, place washer 108 (Fig. 23) and tighten nut 107 as much as possible with wrench A52830-6, then back the nut off one-half revolution to allow free rotation of shaft 111 and insert cotter pin.

The trigger mechanism is assembled in the following order:

- slip spring 28 together with insert 26 over rod 5 (Fig. 20) and attach them in the cradle side plate 7;

- with wrench A52830-5, screw in plug 30 together with its captive cushion 29 and secure it with wire.

The gear housing is installed after the recoil brake has been installed in the cradle. The gear box is installed by drawing up the four bolts 99 (Fig. 22) with wrench A52830-4, after seating the gasket properly.

13. Counterecoil Mechanism

The counterrecoil mechanism does the following:

- absorbs the energy of the motion of the recoiling parts of the gun during firing, thus reducing the destructive effect of firing on the carriage and providing a stable gun during firing;

- returns the recoiling parts (counterrecoil) to battery after firing;

- holds the recoiling parts in battery for all elevation angles attainable with the carriage design.

The counterrecoil mechanism consists of a hydraulic recoil-counterrecoil brake and a pneumatic-hydraulic recuperator with a spring-actuated valve for additional counterrecoil braking.

For the sake of brevity, and since the major portion of the energy absorbed during firing is done by the recoil brake, the recoil-counterrecoil brake is referred to simply as the "recoil brake."

The recoil brake is installed in the cradle, and the recuperator in the guide rings. The recoil brake rod and the recuperator cylinder move in recoil along with the gun tube.

Recoil Brake

The recoil brake absorbs the kinetic energy of the recoiling parts of the gun during recoil and brakes the counterrecoil during the return of the recoiling parts to battery.

The recoil brake has the following main parts: cylinder 1 (Figs. 25 and 26), rod 6, inside tube 7, throttling bar 8.

The cylinder 1 is attached to the front inside cradle coupling at one end by means of a sliding joint and is kept from rotating by screw 105 (Fig. 22).

The other end of the recoil brake cylinder is attached to the rear inside cradle coupling.

The inside of the cylinder has six grooves of varying depth.

The front of the cylinder is closed by the front cover 39 (Fig. 25), which is held by nut 40 and screw bolts 41.

The front cover houses the flanged throttling-bar packing, which 447 consists of two collars 62, two leather washers 61, two collar-seating washers 60 inside guide 63, and a rubber packing washer 59.

In the top of the front cover there is an opening to allow air to escape when fluid is put into the recoil brake; this opening is closed by screw 48.

The rear of the recoil-brake cylinder is closed by the stuffing-box 12, which is secured by nut 15. Inside the stuffing-box is the brake-rod packing, consisting of the collar-seating washer 29, rubber collar 28, washer 27 (babbitt-edged) plus segment 26, washer 25, gland 24 and nut 23 (Figs. 25 and 27). The back of the nut 23 is in the form of a gear which meshes with gear 104 of the cradle gear box (Fig. 22).

The front cover 39 (Fig. 25) and stuffing-box 12 are sealed by copper washers 38 and 13 held by screws 41 (cover 39) and nuts 14 and 15 (stuffing-box 12).

The recoil-piston rod 6 has, at the front end, a screw-on head 35 with bronze jacket 34, on the outer surface of which are five circular grooves. A recoil-piston-rod piston 21, together with the packing washer 22, screws into the rear end of the recoil-piston rod.

Both the head and the shaft are set on high-tin solder.

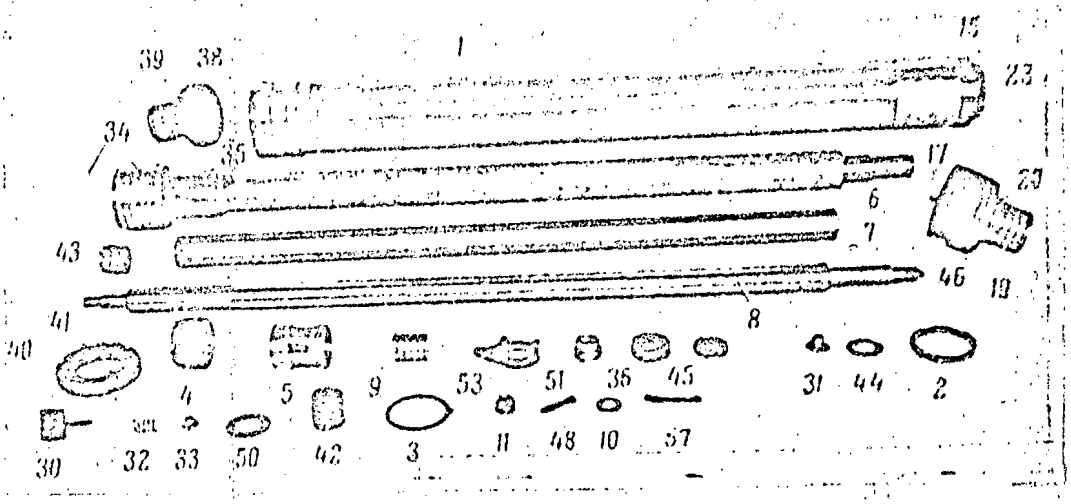


Fig 26. Parts to the Recoil Brake [447]

1. brake cylinder (08-01)
2. lock washer (08-32)
3. washer (08-33)
4. nut (08-31)
5. bushing (08-34)
6. recoil piston rod (08-12)
7. inside tube (08-22)
8. throttling rod (08-29)
9. throttling rod guide (08-35)
10. washer (A51021-13)
11. nut M 27 (A51011-40)
15. nut (08-11)
17. key (08-50)
19. rod nut with buffer (Sb08-12)
20. key (08-55)
23. nut (08-7)
30. buffer piston (08-17)
31. buffer valve (08-18)
32. spring (08-19)
33. valve nut (08-20)
34. bronze jacket (08-16)
35. screw-on head (08-14)
36. nut (08-29)
38. copper washer (08-45)
39. front cover (Sb 08-7A)
40. nut (08-46)
41. screw (08-47)
42. gland (08-25)
43. nut (08-27)
44. washer (08-41)
45. nut (08-42)
46. screw (08-72)
48. valve (08-48)
50. washer (08-62)
51. projection (08-61)
53. lever (08-40A)
57. spring (08-75)

The piston-rod head has 20 holes for the passage of fluid forward (12 holes), and backward (8 holes).

The rod nut 19, with the buffer, is screwed on the back end of the rod 6; the nut, which is secured by screw 16, connects the recoil brake with the tube. The buffer plate 18 is connected to it by screws 65. 457

At the top of the buffer plate 18 is a key 17, which holds it and the nut/buffer combination from rotating with respect to the brake cylinder. At the bottom of the rod nut 19 there is a key 20, which keeps it from rotating with respect to the breech lug. A plate spring 57, which engages the cradle cam 55 (Fig. 22), is attached by screws to the buffer plate 18 and holds the recoil piston rod from coming out the back when on the march.

The inside tube 7 (Fig. 25) fits into the recoil piston rod 6 and its attached components, bushing 5, nut 4, lock nut 2, and lock washer 3.

The inside tube 7 has a hexahedral outer surface. Inside the tube are two throttling grooves a. At the back end of tube 7 are the buffer piston 30 and valve 31, spring 32, valve nut 33 and its cotter pin.

Throttling bar 8 fits inside the inside tube 7. The throttling bar guide 9 fits over the throttling bar and is held by nut 11, washer 10 and a cotter pin. At the front end, the throttling bar is attached to the front cover 39 by nut 36, which is secured by set screw 37.

The outside surface of the throttling bar 8 has four throttling grooves (long-recoil grooves).

The front part of the throttling bar 8 has an opening for filling the recoil brake with fluid. The opening is closed by screw 46 with a copper washer 47. On the front end of bar 8 is the lever 53 with a key 49, which is held in place by nut 45 and lock washer 44.

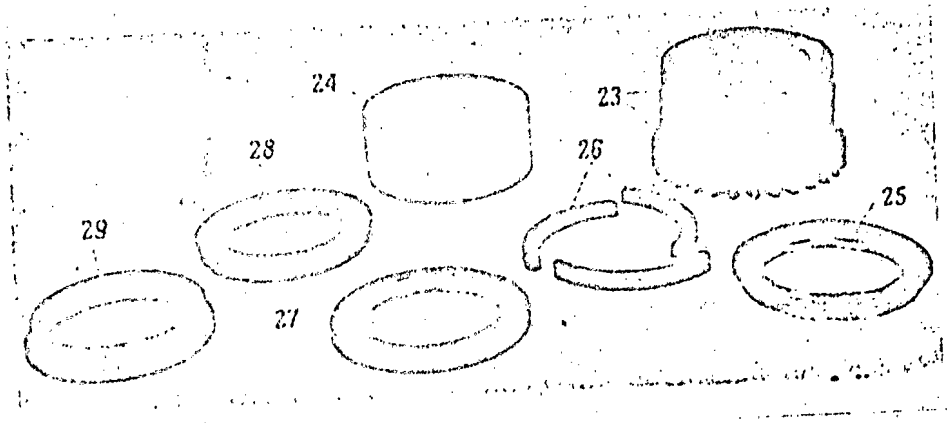


Fig 27. Parts to the Packing of the Recoil Brake Rod [457]

23. packing nut (08-7)
24. gland (08-6)
25. washer (08-5)
26. segments (08-68)
27. babbitt-edged washer (Sb08-13)
28. rubber collar (08-4)
29. collar-seating washer (08-3)

The throttling rod plus piston unit 5, in the assembled condition, consists of the rod 75, piston 74 and piston seals.

The rod 75 is attached to piston 74 by threads and high-tin solder. The piston is locked by screw 76; the piston seals consists of the collar-seating washers 54 and 56, two rubber collars 57, ring 58, casing 62, gland 59 and ring 60. Gland 59 is held by nut 61, which is locked by plug 53 and screw 52.

Washer 54 is kept from backing off by plug 53 and screws 52; washer 56 is kept from backing off by screw 55.

Casing 62 on piston 74 is secured by screw 77. /48/

Connecting nut 19 screws on the front end of rod 75 and is held by stop 18 and two screws 79. The connecting nut 19 connects the recuperator rod to the cradle-collar bushing. In order to prevent the rotation of the recuperator rod when the gun is in the traveling position, which would lead to a misalignment of the slots in connecting nut 19 and the cradle-collar bushing when the tube undergoes counterrecoil, connecting nut 19 is locked in position by key 22, which is attached to the front cover by bolt 78.

14. Operation of the Recoil-Limiter Mechanism

This mechanism, which changes the length of recoil, (Fig. 24) consists of the roller 83 on the bell crank 82 which fits into the slot in the slideway 2 of the upper carriage with two sections, each with a different radius of curvature but with a common center in the axis of the cradle trunnions (long-recoil and short-recoil sections). When the handwheel of the pointing mechanism is rotated, the recoil-limiter mechanism moves with the cradle. The roller moves in the slideway, which causes the bell crank 82 to rotate, and shaft 111, turning with it, changes the length of recoil.

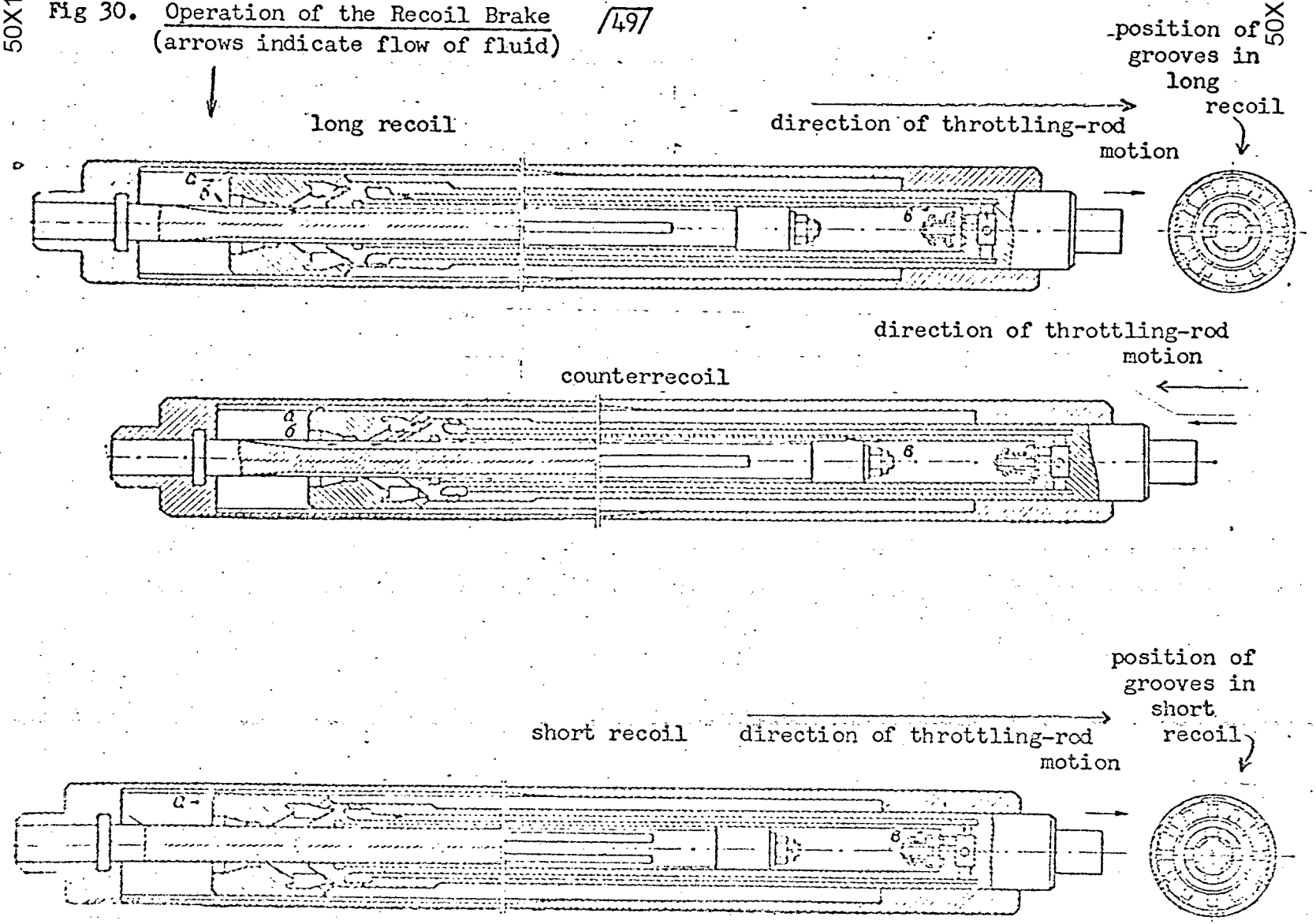
Shaft 111, in turn, through levers 106 and 53, rotates the throttling rod 8, as a result of which the rod grooves are either opposite the openings in the bushing 5 (Fig. 25), which corresponds to long recoil, or are completely covered by the bushing, which corresponds to short recoil.

A partial covering of the grooves in the throttling rod corresponds to a recoil which varies from long to short.

When the gun is fired, the throttling rod tends to rotate under the effect of the jet of fluid flowing through the throttling-rod grooves. At this time, the bell crank 82 (Fig. 24), through its roller, which moves in the slideway, and through levers 98, 106, 53 and shaft 111, prevents the throttling rod from rotating.

50X1-HUM

Fig 30. Operation of the Recoil Brake (arrows indicate flow of fluid)



Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

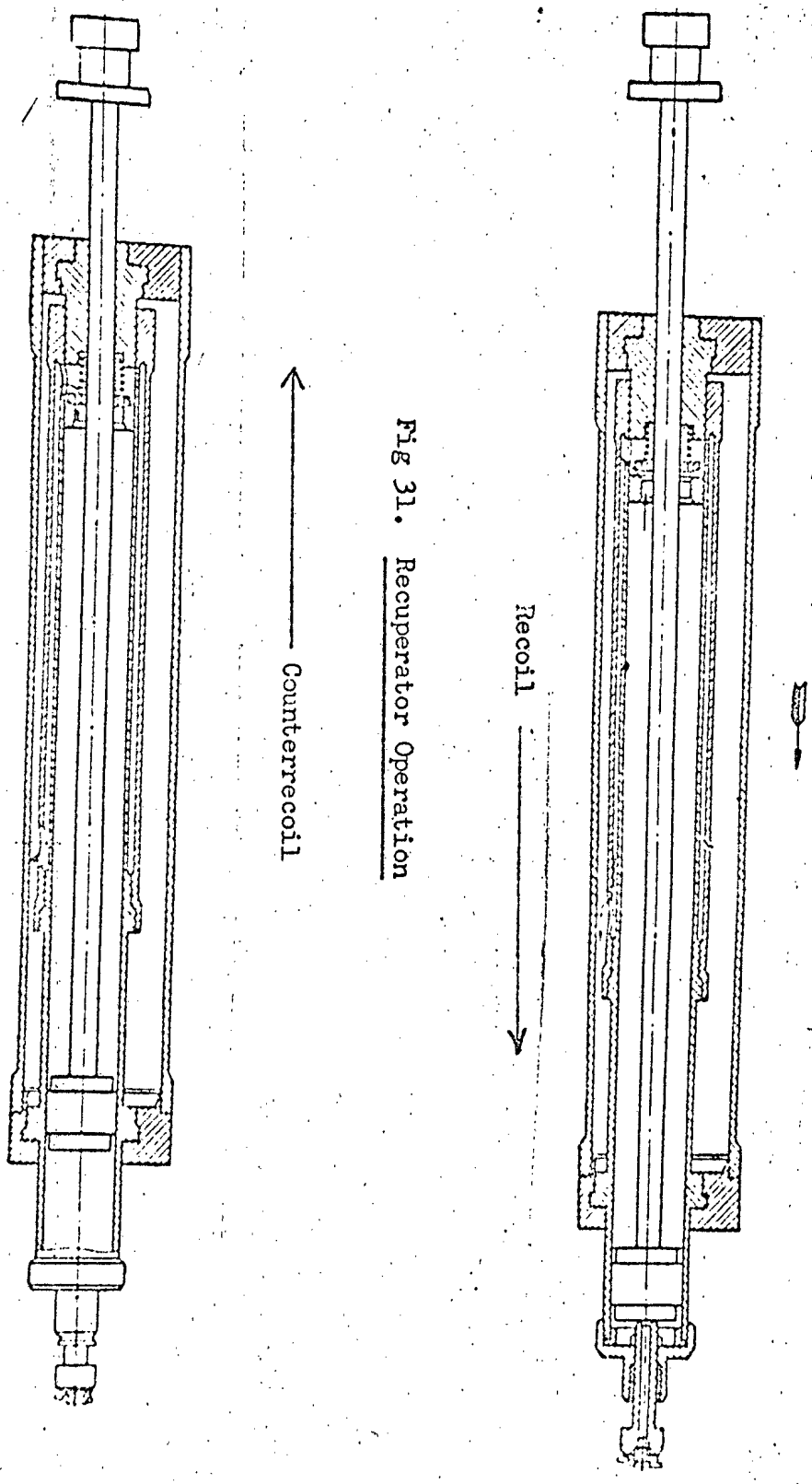


Fig 31. Recuperator Operation

/50/

The recoil-limiter mechanism is designed so that long recoil (1150-1320 mm recoil) occurs at pointing angles of minus 2°30' to plus 20° depression and elevation, respectively, whereas intermediate recoil occurs at pointing angles of 20 to 40 degrees, and short recoil (735-815 mm recoil) occurs at pointing angles of 34-45 degrees.

15. Operation of the Counterrecoil Mechanism During Recoil

During recoil (Figs. 30 and 31), the fluid in the recoil brake cylinder flows out of the space behind the piston into the space in front of the piston via the following routes:

- through the grooves of variable cross section on the brake cylinder along the bronze jacket into the front part of the cylinder (forward motion of fluid);

- through the front openings in the piston and the annular groove on the outside surface of the bushing into the bushing opening and on through the grooves of varying cross section on the throttling rod into the front part of the cylinder (forward motion of fluid);

- through the back openings in the piston along the edge of the inside tube toward the buffer valve of the counterrecoil brake (return motion of fluid). Here the fluid forces out the buffer valve of the /51/ counterrecoil brake and occupies the space vacated during recoil by the inside tube (forward motion of fluid).

During Long Recoil

At the beginning of the recoil motion, the paths a, b and v are open to a passage of fluid. However, since the length of the variable grooves on the inside surface of the recoil brake cylinder correspond only to the length of short recoil, as soon as the piston jacket reaches the smooth (without grooves) surface of the brake cylinder, only paths b and v remain open to the passage of fluid.

Intermediate Recoil

At angles of gun elevation greater than 20 degrees, the throttling rod of the recoil brake begins to rotate under the influence of the recoil-limiter mechanism, and the grooves in the throttling rod are gradually covered by the bushing. At an elevation angle of about 34 degrees the bushing has completely covered the grooves in the throttling rod, at which time the fluid flows only through paths a and v.

As a result of this gradual covering of the throttling bar grooves by the bushing in the range of elevation angles 20-34 degrees, the length of

recoil gradually diminishes from that of long recoil to that of recoil. 50X1-HUM

Short Recoil

Short recoil begins at an elevation angle of about 34 degrees, when the bushing completely covers the long-recoil grooves in the throttling rod, and path b is closed to the passage of fluid.

Path a, as indicated earlier, is open only for short recoil, since there are no grooves further down the recoil cylinder.

Path v is open for all lengths of recoil.

During recoil, the recuperator contributes to the braking action of the recoil brake, since the fluid is expelled from the working cylinder by the piston and forced into the air cylinder, compressing the air in the cylinder more and more as it enters.

Counterrecoil

At the end of the recoil stroke, the air which has been compressed in the recuperator expands, and the fluid flows out of the air cylinder back into the working cylinder. The recuperator cylinder moves forward under the pressure of the air and carries the tube, to which it is connected, along with it.

The brake rod and piston restore the vacuum as they move out of the cylinder.

After the vacuum has been restored, the piston compresses the fluid, forcing it out of the space in front of the piston to the space behind the piston by the following paths:

- along the grooves of variable cross section on the inside wall of the brake cylinder (during long and short recoil);

- along the grooves in the throttling rod through the opening in the bushing and the front hole in the piston (long and intermediate recoil only);

- along the grooves of variable depth on the inside wall of the inside tube.

During long and intermediate recoil, paths a, b and v are open, although path a opens only when the piston moves up to the grooves of variable depth on the inside wall of the brake cylinder. 50X1-HUM

During short recoil, only paths a and v are open. Since the cross sectional area of the openings on paths a and b are large by comparison with the slower motion of counterrecoil, only a very small part of the energy of counterrecoil is absorbed by the flow of fluid through these openings.

The major portion of the energy of counterrecoil is absorbed in path a by the flow of fluid along the grooves of the inside tube.

At the moment counterrecoil commences, buffer valve 31 (Fig. 25) is compressed by spring 32 against buffer piston 30, covering the opening in it and impeding the flow of fluid into the hollow brake rod.

The brake rod, by pushing against the throttling rod, forces the fluid to flow forward along the variable grooves on the inside wall of the inside tube.

At the same time in the recuperator, the fluid which has flowed out of the air cylinder into the working cylinder compresses valve 33 (Fig. 28) against the valve seat 34, which provides a passage for fluid only through the hole in the valve. Since the openings are small, the counterrecoil motion is slowed down without sacrificing the smoothness of the counterrecoil stroke.

16. Function of Interlocking Mechanisms

Interlocking mechanisms (Fig. 32) include the mechanism for interlocking the breechblock with the recoil brake and the mechanism for interlocking the recuperator with the trigger mechanism.

In order to make it impossible for the gun to fire when the gun tube is not completely joined to the recoil brake and the recuperator is not completely joined to the cradle, there are special mechanisms on the gun which make it impossible to open the breech if the gun tube is not joined to the recoil brake, and impossible to operate the trigger mechanism if the recuperator rod is not attached to the cradle yoke bushing.

Function of the Breechblock-to-Recoil-Brake Interlocking Mechanism

In the barrel thrust lock 15 (Fig. 8) there are two grooves ∋ and ∀ with different depths; in one of these grooves, depending on the position of the thrust lock, fits the head of breechblock detent 30. The latter passes through an opening in the breech lug and breech ring into the wedge slot and, when the recoil brake rod is disconnected, locks the breechblock. In addition, the detent, the head of which fits into the slot in the thrust lock, holds it in a given position.

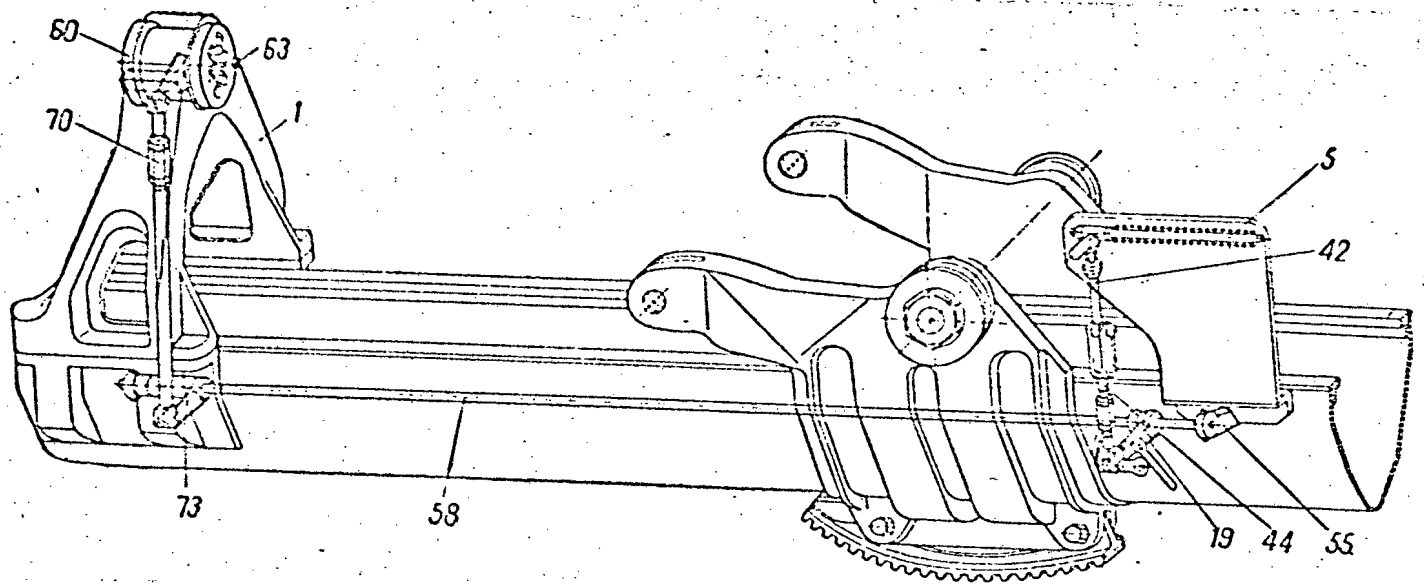


Fig 32. Interlocking of Recuperator and Trigger Mechanism

1. yoke (Sb 09-8
5. tappet (Sb 09-30)
19. hand lever crank (Sb 09-14)
42. lock (09-93)
44. upper connecting rod (09-80)
55. cam (09-204)
58. shaft (Sb 09-5)
60. bushing with cradle bracket (Sb 09-10)
63. stop (09-48)
70. front connecting rod (Sb 09-16)
73. crank (09-60)

To connect the recoil brake rod to the barrel, turn detent 30 of (upward) with wrench S642-39 and rotate the thrust lock 90 degrees clockwise. The breechblock detent is forced by spring 29 into the deeper slot ∋ in the thrust lock; the breech can be opened.

Function of the Recuperator-to-Trigger-Mechanism Interlocking Mechanism

Hand lever crank 19 (Fig. 32) connects the recuperator rod with the cradle yoke 1 and is connected by the intermediate parts to lock 42, as well as to bushing 60 of cradle yoke 1 by means of crank 73, shaft 58 and intermediate parts. When the hand lever crank 19 is in the traveling position, stop 42 fits into the recess in tappet 5 and locks it so that an accidental firing of the piece will not be possible when the recuperator is disconnected.

Furthermore, in the yoke 1 there is a stop 63, which prevents the bushing plus bracket 60 from turning if the tube does not return to 547 battery during counterrecoil.

17. General Information On the Disassembly and Assembly of Counterrecoil Mechanisms

1. Counterrecoil mechanisms should be disassembled not less than once every two years in a place that is covered, dry and clean.

2. The parts are to be placed on wooden tables with ledges or on clean wooden shelves.

3. Clean materials used to clean the parts of counterrecoil mechanisms should be clean and entirely free of hard particles and moisture. Cleaning materials should be stored in covered boxes, bags, etc.

4. During every overhaul, carefully examine the collars, since the appearance of even very slight breaks, films, cracks, etc., can cause a leakage of fluid, drop of pressure and other impairments of normal operation of the counterrecoil mechanisms. If such even slight faults appear, the collars should be replaced.

5. No dents or protrusions are permitted in and on the surface of the parts.

6. Tool marks on parts of the counterrecoil mechanisms produced during machining, such as worn spots, slight grooves, etc., are admissible.

7. Check for surface corrosion of parts during each disassembly.

8. The fluid from the recoil brake and recuperator should be poured off into a separate container; do not pour it into a container with fluid that is not to be used. 50X1-HUM

9. During disassembly do not touch working surfaces with the bare hands; put on clean linen or calico gloves or cover parts with clean rags.

10. See that no sand or filings get on the parts.

11. When the front cover of the recoil brake, the gland casing and working cylinder of the recuperator are being tightened, the screws should be tightened to the limit alternately (opposite ones in pairs). The same applies to tools for extracting the front cover of the recoil brake, gland casing and working cylinder of the recuperator.

12. Before filling the counterrecoil mechanisms with fluid that is in use, carefully filter the fluid and check its alkalinity. Counterrecoil mechanisms may be filled only with alkaline steol-M fluid.

13. When fluid is being poured into counterrecoil mechanisms, make sure that no sand or other solid particles get into the cylinders; pouring should be done through a sieve and 4-ply gauze.

Testing Steol-M Fluid for Alkalinity

Pour two or three cubic centimeters of the fluid to be tested into a clean vessel (glass, saucer, cup) and add two or three drops of an alcohol solution of phenolphthalein.

If the steol-M turns red, this indicates an alkaline reaction; if it does not turn red or turns a very pale red, this indicates that the steol is neutral.

The artillery technician in the artillery shop tests fluid for alkalinity. /55/

A neutral fluid, particularly an acid fluid, is not suitable for use in counterrecoil mechanisms.

18. Disassembly and Assembly of the Recoil Brake Disassembling the Recoil Brake

1. Withdraw the brake rod in such a way that key 17 (Fig. 25) on buffer plate 18 will move out of the slot in brake cylinder nut 15, and use a screwdriver to unscrew lock screw 16 from rod nut 19, and use wrench A52832-26 to remove the rod nut with buffer.

2. Remove front cover 39 (remove lever 53; see Chapter 12) as follows: 50X1-HUM

- place a clean dish under the front end of the recoil brake cylinder;

- remove valve 48 with wrench S642-49;

- remove the securing wire and, with wrench S642-52, and a jack handle slipped over the wrench for leverage, back off screws 41 a few turns and remove nut 40;

- remove screw 64;

- use wrench S642-61 to unscrew packing nut 43 and replace it with the S642-45 tool (Fig. 33) for disassembling the recoil brake; after tightening the tool bolts with wrench A52830-5, gradually unscrew the front cover 39 (Fig. 25) together with the throttling bar; pour the fluid out of the recoil brake into a clean dish.

3. Remove front cover from throttling bar 8 as follows:

- use screwdriver to remove the set screw 37;
- unscrew nut 36 with wrench 42-233;
- remove front cover from the bar by tapping lightly on it with a hammer through a strip of copper.

If the collar packing of the throttling bar is replaced by a lifting handle, remove the collar-seating washer 60 and guide 63 together with the collars 62, washers 61, after which remove the second collar-seating washer 60 and the rubber washer 59.

4. Remove the throttling bar as follows:

- use wrench A52832-26 to remove nut 23 together with the bronze bushing pressed into it;

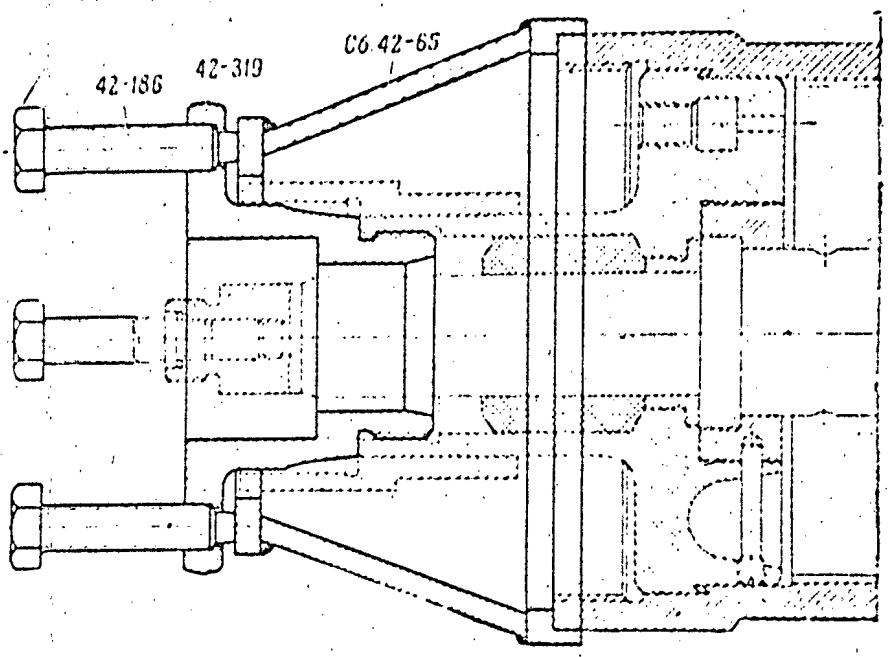
- screw collar 42-191 on the end of the rod and, by lightly tapping with a hammer on the cap through a copper strip, push the rod forward until the front face of the bronze jacket of the throttling rod coincides with the front face of the brake cylinder;

- bend out the tabs of lock washer 3 and use wrench A52832-26 to remove lock nut 2, while using wrench A52832-24 to hold nut 4 from turning off;

- remove nut 4 with wrench A52832-24;
- remove throttling bar 8 together with the parts attached to it.

5. Use lifting handle 42-300 to remove inside tube 7 from the throttling bar.

I



II

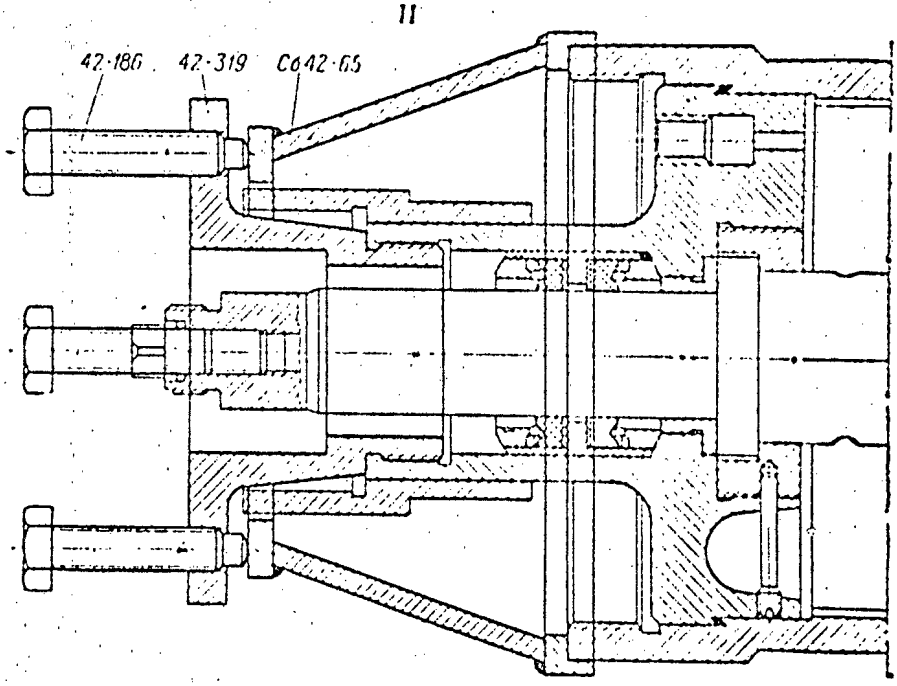


Fig 33. Tool (Sb 42-45) For Disassembling Recoil Brake

42-186: bolt 42-319: drawing ring /567

Sb 42-65 thrust barrel

6. By lightly tapping on the collar on the end of the bar with a hammer through a copper strip, force the throttling bar through the stuffing box and remove it from the recoil brake cylinder.

7. Remove the parts on the throttling rod as follows:

- remove the cotter pin and use wrench A52830-7 to remove nut 11;

- remove washer 10, throttling-bar guide 9, bushing 5, lock washer 3, nut 4, lock nut 2 and nut 36.

8. Disassemble buffer valve 31 as follows: /57/

- using tap wrench A52844-3, unscrew the buffer piston and valve as one piece and remove from the inside tube;

- remove cotter pin and use wrench A52830-5 to remove nut 33;
- remove spring 32 and buffer valve 31.

9. If the gland or collar is to be replaced, disassemble the packing of the throttling bar as follows:

- remove gland 24 with tool 42-300;

- remove washer 25, then use tool 42-300 to remove segment 26, remove washer 27, collar 28 and collar-seating washer 29.

When the recoil brake is being overhauled, the stuffing box 12 must not be removed, and nut 15 must not be unscrewed.

The stuffing box 12 may be removed:

- to replace the copper packing washer 13, when a leak through the stuffing-box packing has been discovered;

- to replace a damaged brake cylinder or stuffing box.

Likewise, bronze jacket 34, screw-on head 35 and piston 21 may not be removed when the recoil brake is being disassembled.

These operations are performed only when damaged parts must be replaced and are done only at the factory or repair shop.

Assembly of the Recoil System

If the piston rod packing had been taken apart, assemble the recoil system in the following sequence:

- insert collar back-up ring 29 (Fig. 25) in packing cylinder 12;

- insert guide 42-169 in packing cylinder and through the guide insert collar 28;

- pull guide 42-169 out of packing cylinder;
- install washer 27;

- install segments 26, first lubricating them with gun oil for ease of installation;

- install ring 25, packing 24 and, with wrench A52832-26, screw in nut 23 with bronze bushing until it comes to rest against packing 24; packing should not be compressed to facilitate further assembly operations.

2. Assemble the run-out valve assembly as follows:

- on shank 30 of the assembly, place run-out valve 31 and spring 32; screw on nut 33 with wrench A52830-5 and install cotter pin;

- with tap wrench A52844-3 screw shank 30 into inner cylinder 7.

3. Install inner cylinder 7 in the recoil rod.

4. Assemble counterrecoil rod 8 and its parts as follows:

- on the counterrecoil rod place nut 36, lock nut 2, nut 4, lock washer 3, insert 5, sleeve 9 of counterrecoil rod and washer 10;

- using wrench A52830-7, screw on nut 11 tightly, then back it off 1/6 of a turn and install a cotter pin. When this is done, sleeve 9 should rotate freely on the counterrecoil rod.

5. Install the counterrecoil rod in the cylinder as follows:

- insert counterrecoil rod with parts assembled on it into the inner cylinder; in this case the keys on insert 5 should slide into corresponding grooves on the rod head;

- with wrench A52832-24, screw on nut 4 tightly and then back it off 1/12 of a turn (30°); /587

- holding nut 4 with wrench A52832-24, screw on lock nut 2 50X1-HUM
wrench A52832-26 and lock it with washer 3.

6. Install rod in recoil cylinder as follows:

- screw guide 42-191 on end of rod;

- place recoil cylinder in working position, in which case the slide ribs on the outer surface of the recoil cylinder should be to the side, and the groove under screw 105 (Fig. 22) for anchoring the cylinder in the carriage should be down and to the right;

- place recoil piston rod in working position (the line on the rear end of the recoil piston rod should be in a horizontal position);

- insert the recoil piston rod in the cylinder, balancing it with the counterrecoil rod; holding up the piston rod with the copper drift, carefully insert it in the rod packing (careless installation of the rod in the packing could result in damage to the collar);

- by striking the front end of nut 4 (Fig. 25) with a hammer using the copper drift, advance the recoil rod into the recoil cylinder until guide 42-191 emerges from the packing;

- screw guide 42-191 off piston rod 6;

- compress packing 24 by tightening packing case nut 24 with wrench A52832-26 with a force of approximately 10-15 kg.

7. Install the front cap on the counterrecoil rod as follows:

- assemble the collar packing and install it in front cap 39; in sleeve 62 place leather rings 61, collars 62 and collar back-up rings 60; on the protruding portion of collar back-up ring 60 install rubber ring 59;

- carefully move the collar packing into front cap 39; with wrench Sb42-61, screw down nut 43 tightly and lock it with screw 64;

- place packing ring 38 on front cap 39;

- carefully fit cap 39 on the counterrecoil rod and move it until it comes to rest against the shoulder of the counterrecoil rod (careless installation of the cap could damage the collar packing); with wrench 42-233 tighten nut 36 and lock it with set screw 37.

8. Install front cap 39 by inserting into the recoil cylinder while checking to see that the air exit opening in the front cap will be facing upward with the recoil cylinder in working positions. 50X1-HUM

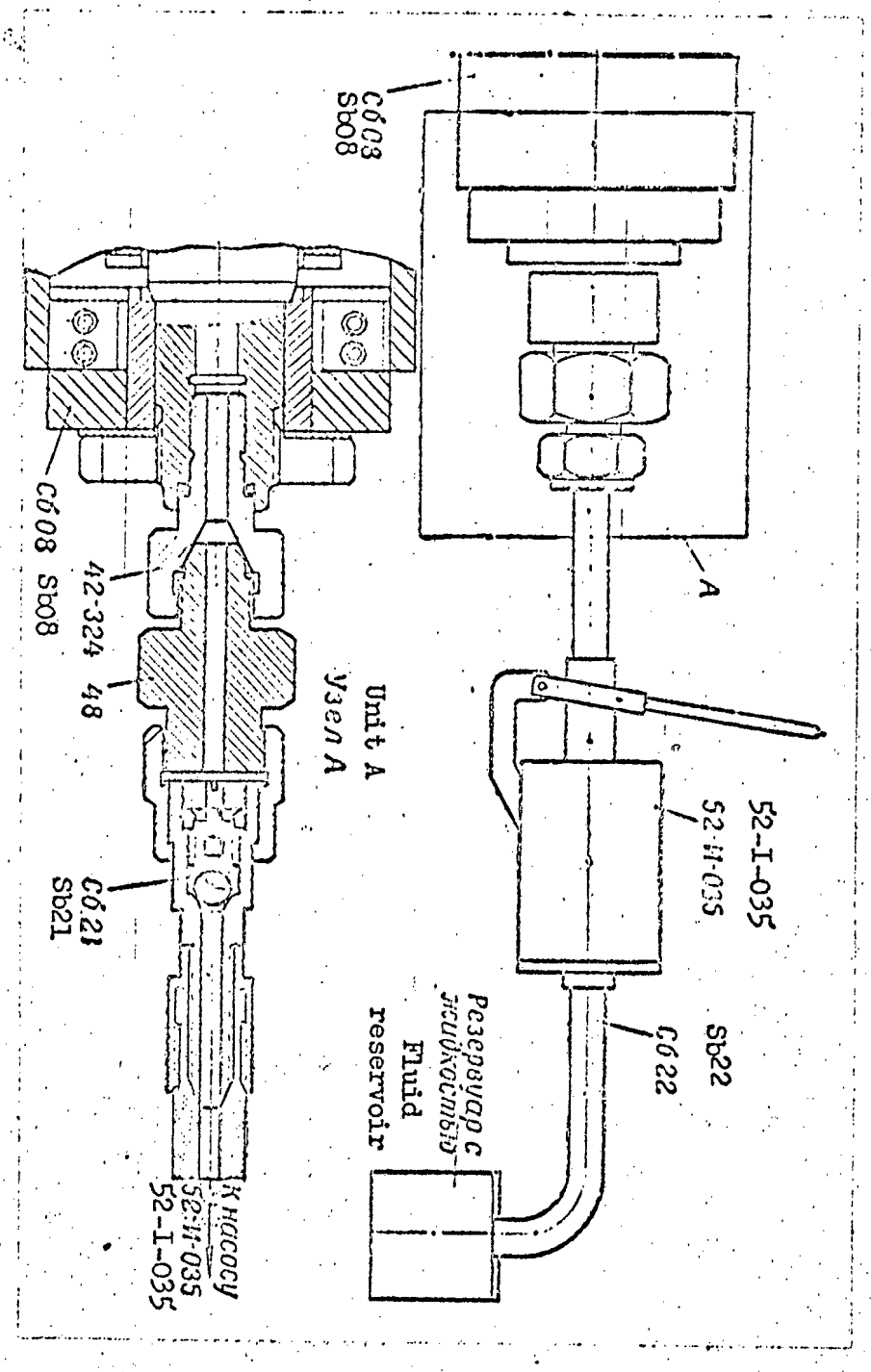


Fig. 34. Filling the Recoil Cylinder With Fluid. [59]

Sb08 - recoil cylinder; 48 - nipple; Sb21 - hose; Sb22 - intake hose; 52-I-035 - pneumatic-hydraulic pump; 42-324 - adapter.

Final adjustment of the front cap and compression of the packing ring 38 is done in the following sequence:

- screw on the nut, and with either wrench Sb42-49 or Sb42-52, smoothly screw in the four screws 41 (in opposing pairs) several turns;

- unscrew these bolts to the initial positions and screw on nut 40;

- again screw down nut 40 in the above indicated order until considerable force is required to turn in screws 41, from this point tightening of front cap 39 is accomplished by means of all screws 41; when the nut becomes seated (approximately flush with the end of the recoil cylinder), screw in screws 41 as tight as it is possible for one person, using a jack handle to turn wrench Sb42-52;

- safety screws 41 with lockwire.

Note: When screwing on nut 40 it must be made certain that the opening in nut 40 for valve 48 lines up with the opening for the valve in the front cap.

9. Install piston rod nut 19 with buffer as follows: /607

- screw on piston rod nut with buffer on the rear end of the piston rod;

- line up markings on end of the piston rod nut with buffer with the marking on the end of the recoil piston rod and install set screw 16.

10. Install lever 53 with key 49 after installation of recoil cylinder on carriage and installation of lever 106 (Fig. 23) on shaft 111 for changing the length of recoil.

In this case lever 106 is brought in to engage with the slot of lever 53; put on the lock washer, screw on nut 45 (Fig. 45) with wrench A52832-22 and lock it with lock washer 44; check rotation of the counter-recoil rod.

The counterrecoil rod should turn under the action of one person applying manual force to the end of lever 53.

11. Fill the recoil cylinder with fluid as follows:

- Adjust the recoil cylinder in such a position that its front end is higher than the rear end by no less than 500 mm; /617

- install packing ring 47 (if it has been removed) in the fr opening of the counterrecoil rod and screw on adapter 42-324 with wrench A52830-6 (Fig. 34);

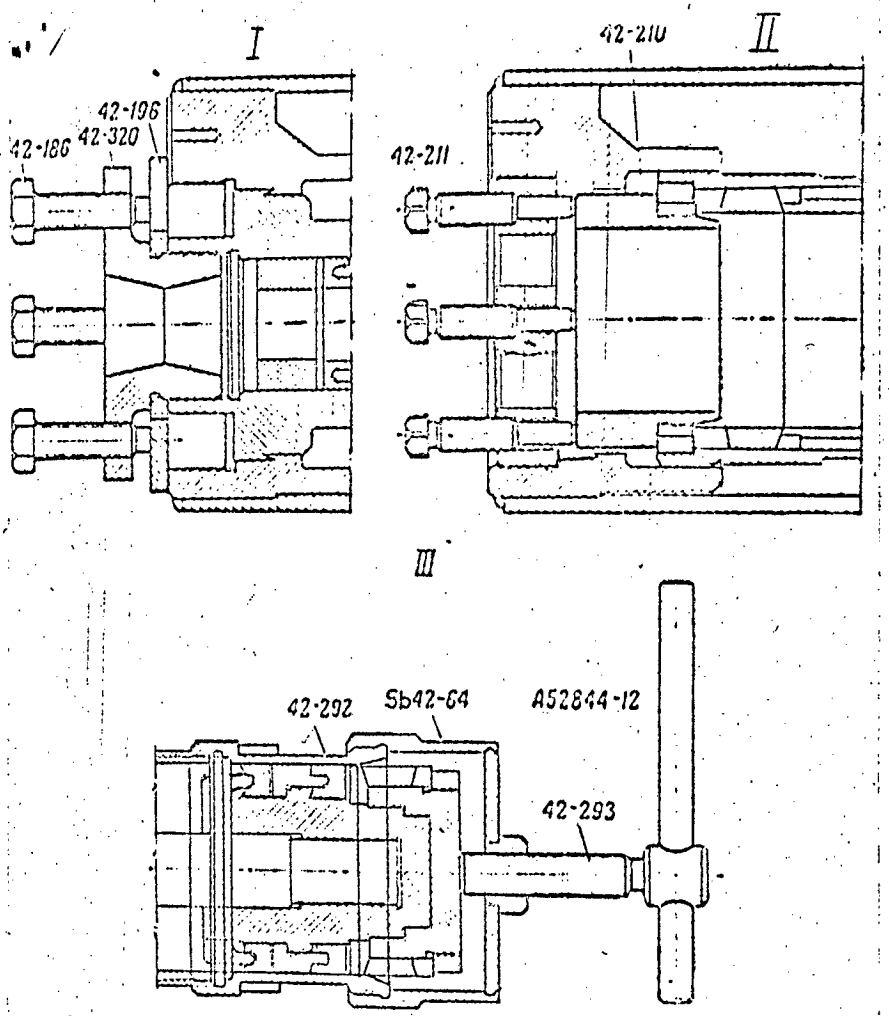


Fig. 35. Tools. /607

I - tool for disassembling the counterrecoil mechanism (Sb-42-48); 42-186 - bolt; 42-196 - thrust disc; 42-320 - extractor ring; II - tool for disassembling the counterrecoil mechanism (Sb42-55); 42-210 - thrust ring; 32-211 - bolt; III - tool for forcing in rod with piston (Sb-42-62); 42-292 - connecting sleeve; 42-2293 - screw; Sb42-64 - housing; A52884-12 - wrench, 16x200.

- screw nipple 48 in adapter 42-324 with wrench A52830-6;

- screw hose Sb21 in nipple 48 and connect the other end of the hose to pump 52-11-035;

- connect intake hose Sb22 to the pump;
- open valve 48 with wrench Sb42-49 (Fig. 25);

- pour clean Steol M-grade fluid into a can, lower hose Sb22 into it and pump (after setting pump valve on "zh") until the recoil cylinder is full (until fluid begins to flow from valve 48);

- shut off valve 48 with wrench Sb42-49;

- unscrew adapter 42-324, remove pumps with hoses and tighten nut 46.

Final checking of the amount of fluid in the recoil cylinder is done on the fully assembled gun, as instructed in Chapter 14.

19. Disassembly and Assembly of the Counterrecoil Cylinder

Disassembly of the Counterrecoil Cylinder

1. Release the air as follows:

- place counterrecoil cylinder in working position and raise it by its rear end so the cylinder is tilted at an angle of not less than 2-3° to the horizontal; this is necessary so that the fluid level in the pneumatic cylinder of the counterrecoil cylinder would be below the level of the end of tube 35 (Fig. 28); otherwise fluid will flow out of the valve;

- remove the wire which locks plug 48 and valve 51;

- unscrew plug 48 with wrench Sb42-49; open valve 51 and release air from counterrecoil cylinder.

2. Remove connecting nut 19 as follows:

- remove lock wire and unscrew bolt 78 holding bushing key 22; remove it from the front cap of the counterrecoil cylinder;

- unscrew connecting nut 19 from piston rod.

3. Remove cap 68 as follows:

- remove lock wire and, with wrench A52830-2, unscrew the bolts holding dome 65; remove dome 65. (Wrench 42-325 is available for certain caps to facilitiate unscrewing bolt 81 (Fig. 28) to remove dome 65.)

- unscrew lock screw 73 and with wrench A52832-26 unscrew cap 68 together with parts assembled on it;

- when necessary, replace or repair parts removed with cap 68 (nut 69, ring 67, packing 66, bushing 64 with leather ring 72 and rubber sealing ring 63, adjusting bolt 70).

4. Remove packing case 17 as follows:

- place a clean container under the front end of the counter-recoil cylinder;

- with wrench A52830-8 unscrew nut 24 with bronze bushing from packing casing 17;

- remove lock wire and with wrench Sb42-49 loosen screws 20 /62/ and unscrew nut 21 with screws 20;

- on packing casing 17 place disc 42-196 of the tool Sb42-48 (Fig. 35) for disassembling the counterrecoil cylinder and screw-extractor ring 42-320 into packing casing 17;

- screw in bolts 42-186 with wrench A52830-5, extract packing casing (Fig. 28) from front cap 1 of counterrecoil cylinder;

- remove valve spring 32 and valve 33;
- pour fluid out of counterrecoil cylinder into the clean container.

5. Extract rod with piston by tapping with a hammer on a copper drift held against the end of the rod and then by knocking out the rod with piston from the counterrecoil cylinder.

6. Disassemble packing casing as follows:

- remove washer 24;
- remove packing 25 with hook 42-300;
- remove ring 26, segments 27, washer 28 with babbit lining, and collar 30;

- with a screwdriver unscrew screw 80, which holds collar

back-up ring 31, and with wrench 42-233 unscrew collar back-up ring 31, remove second collar 30 and collar back-up ring 29.

7. Disassemble the counterrecoil piston as follows:

- remove lock wire and unscrew locking screws 52 which are screwed into casing 62, remove stop 53, unscrew nut 61 with wrench Sb42-60, and remove ring 60 and packing 59 with a screwdriver;

- unscrew screw 77 which holds casing 62, unscrew casing 62 with wrench A72931-I2, remove ring 58 and collar 57;

- remove lock wire and unscrew locking screws 52 (from the piston rod side), remove stop 53, unscrew collar back-up ring 54 with wrench A52832-24, and remove second collar 57;

- unscrew screw 55 and collar back-up ring 56. Do not [attempt] to remove piston 74 from piston rod since it is brazed on.

8. Remove working and intermediate cylinders as follows:

- remove lock wire, loosen screws 11 with wrench Sb42-52 and unscrew nut 10 with screws; remove ring 8;

- insert thrust ring 42-210 of tool Sb42-55 for disassembling the counterrecoil cylinder (Fig. 35) into working cylinder from the front end, screw in nut 21 (Fig. 28), install bolts 42-211 (Fig. 35) of tool Sb42-55 in nut 21 in place of the four screws 20, and, by screwing in bolts 42-211 with wrench Sb42-49, push out and extract working cylinder 3 (Fig. 28) with intermediate cylinder 4 from the counterrecoil cylinder;

- unscrew nut 21 and replace bolts 42-211 (Fig. 35) of tool Sb42-55 in it by screws 20 (Fig. 28).

9. Separate intermediate cylinder 4 from working cylinder 3 as follows:

- remove lock wire and unscrew nut 15 of packing casing with wrench 42-301, extract ring 14 and packing 13 with hook 42-300;

- holding working cylinder 3 with wrench A52832-24 to prevent turning, unscrew intermediate cylinder 4 from working cylinder with wrench A52832-26; take packing ring 6 off working cylinder;

- extract ring 12.

10. Disassemble the valve device as follows:

- unscrew valve 51 completely with wrench Sb42-49;

- loosen lock nut 49 with wrench A52830-6 and unscrew nut 50 with lock nut 49;

- remove ring 46 and leather rings 47 with wrench A52435-21. /637

When overhauling the counterrecoil cylinder, do not remove the blocks holding valve seat 34 or remove valve seat 34 (blocks welded to seat 34).

Disassembly of the inspection window is permissible only in the case when air or fluid leakage is detected, or if the window is damaged.

When air or fluid leakage is detected, an attempt must be made to correct this defect by compressing leather packing rings 42 (Fig. 28) by installing an additional packing ring.

To compress packing rings 42, it is [first] necessary to unscrew plug 36 and look into the opening to see if there is a gap between glass 40 and spacer ring 39.

If there is a gap, then it is necessary to do the following:

- remove lock wire, unscrew two screws 44 and remove check 43;

- with wrench A52832-21 tighten screw 37 so as to eliminate the gap between the glass and spacer ring 39;

- check for any air leakage through the packing, using a soap solution and turning the counterrecoil cylinder so that the inspection window faces upward for convenience [of viewing].

If it was not possible to eliminate air leakage by the above indicated method, then it is necessary to install an additional ring 52 as follows:

- release air from the counterrecoil cylinder as indicated in paragraph 1;

- unscrew nut 37 and extract pressure ring 38 with spacer ring 39;

- install additional packing ring 42, taken from ZIP repair kit;
- install pressure ring with spacer ring 39 placed in it;
- screw down nut 37 until ring 42 is tightly compressed;

- compress packing rings 42 by tightening nut 37 with wrench A52832-21.

For a hermetic seal, when assembling the inspection window there should be a gap of 0.5 to 1.5 mm (Fig. 28) between inspection glass 40 and spacer rings 39, if the number of packing rings 42 was not increased.

To provide this clearance, it is permissible to increase or decrease the number of packing rings as follows:

- install check 43 and tighten it with screws 44; screws 44 are safetyed with lock wire;

- screw in plug 36 with wrench Sb42-52.

2. Assemble working cylinder 3 with intermediate cylinder 4 as follows:

- put packing ring 6 on working cylinder 3;

- with wrench A52832-26, screw intermediate cylinder 4 on the working cylinder while holding the latter with wrench A52832-160 to prevent turning and then compress copper sealing ring 6 by striking wrench with a hammer;

- install ring 12, packing ring 13 and ring 14 of the packing casing;

- with wrench 42-301 screw on nut 15 and safety it with wire.

3. Install working cylinder with intermediate cylinder in the air cylinder as follows:

- in rear cap 9 install packing ring 7 (if it had been removed in disassembly);

- install assembled working and intermediate cylinders in air cylinder of counterrecoil mechanism, in which case the inspection window in the intermediate cylinder should be located below with the counterrecoil cylinder in working position;

- install ring 8 with bevel inward and screw in nut 10 with screws 11;

- with wrench Sb42-49 or Sb42-52 screw in screws 11 as tightly as possible and safety with lock wire.

Screwing on nut 10 and screwing in screws 11 should be done 50X1-HUM sequence indicated in paragraph 18 (see "Assembly of the Recoil System", No 8 - Installation of front cap 39 of recoil cylinder).

4. Assemble counterrecoil piston as follows:

- screw on collar back-up ring 56 and lock it with screw 55; prick-punch the screw;

- install collar 57 (from the rod side), screw on collar back-up ring 54 with wrench A52832-24, install check 53 and fasten it with screws 52; safety screws with lock wire;

- install second collar 57 and ring 58;

- with wrench A72931-12 screw on housing 62 and lock it with screw 77;

- install packing 59, ring 60 and screw on nut 61 with wrench Sb42-60;

install check 53, fasten it with screws 52 and safety screws 52 with lock wire;

5. Assemble packing case as follows:

- install collar back-up ring 29, collar 30, and with wrench 42-233 screw on collar back-up ring 31 and lock it with screw 80;

- in packing case 17, insert guide 42-2 and through it install the second collar 30; remove guide 42-2 from packing case;

- install washer 28, segments 27, ring 26, packing 25 and washer 24;

- with wrench A52830-8 screw nut 24 down against washer 24.

Do not compress the packing for further ease of assembly.

6. Install the packing case as follows:

- in working cylinder 3, install valve 33 and spring 32;

- fit packing ring 16 on packing case (if it had been removed during disassembly);

- install packing case in front cap of recoil cylinder (packing case can be installed by tapping gently with a hammer using a copper drift);

- screw on nut 21 with screws 20;

- by screwing in screws 20 with wrench Sb42-49 or Sb42-52, tighten packing casing 17;

- safety screws 20 with lock wire.

Screwing on nut 21 and screwing in screws 20 should be done in the sequence indicated in paragraph 18 (See "Assembly of the Recoil System", No 8 - Installation of front cap 39 of the recoil cylinder).

7. Install the rod with piston as follows:

- screw cap 42-1 on rod;

- place rod with piston in tool Sb42-62 (Fig. 35), screw nut 42-292 with wrench A52832-21 on rear portion of working cylinder and, using the tool, force in rod with piston into the counterrecoil cylinder;

- unscrew cap 42-1 from rod.

8. Install connecting nut 19 (Fig. 28) as follows:

- screw connecting nut 19 on rod, install check 18, tighten it with screws 79 and safety with lock wire;

- with wrench A52832-21 turn connecting nut 19 together with rod so that the groove under key 22 in connecting nut 19 will be located on top;

- install key 22, tighten it with bolt 78; safety the bolt with lock wire;

- tighten nut 23 with wrench A52830-8.

9. Install cap 68 as follows:

- in the cap, place packing 66, ring 67 and with wrench A52830-8 screw on nut 69 and screw in regulating bolt 70 (the final position of the regulating bolt is determined on the assembled system);

- in cap 68 insert bushing 64, packing ring 63 and leather ring 72; /667

- with wrench A52832-24 screw cap 68 with parts assembled in it on the working cylinder and lock with screw 73;

- install dome 65 on cap 68 and tighten it with bolts (screw in bolts with wrench A52830-2);

- safety bolts and the screw with lock wire.

10. Assemble the valve mechanism as follows:

- insert ring 46, leather rings 47 and a second ring 46;
- with wrench A52830-6 screw on nut 50 with lock nut 49;
- with wrench Sb42-49 screw in valve 51.

11. Fill the counterrecoil cylinder with Steol M fluid as follows:

- set counterrecoil cylinder horizontally in working position;
- with wrench Sb42-49 open valve 51;

- with wrench A52830-5 connect appliance Sb42-25 with manometer (Fig. 36);

- set pump valve in "zh" (fluid) [position];

- connect one end of intake hose Sb22 (Fig. 34) to the pump and put the other end in the can with Steol M;

- pump 21.6 liters of Steol M into counterrecoil cylinder.

12. Fill the counterrecoil cylinder with air as follows:

- switch valve of pump to "v" (air) [position] and disconnect intake hose Sb22 from pump;

- pump air into counterrecoil cylinder to 56±2 atm pressure;
- close valve 51 with wrench Sb42-49;
- remove appliance Sb42-25 and disconnect pump from it;

- bleed, as indicated in paragraph 69 ("Reducing fluid and air in the counterrecoil cylinder");

- install plug 48 (Fig. 28);

- safety plug 48 and valve 51 with lock wire.

Final checking of the quantity of fluid and air pressure in the counterrecoil cylinder is performed on the assembled piece, as indicated in Chapter 14.

[p 66]

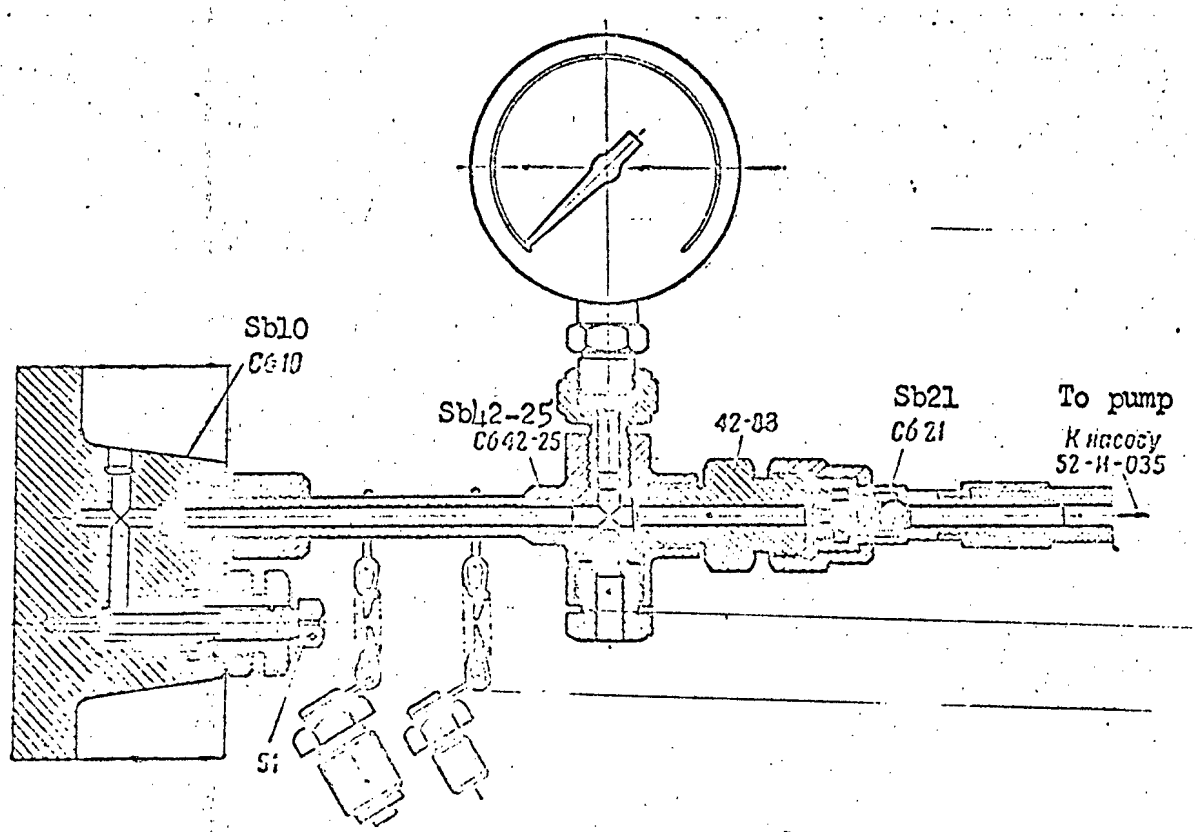


Fig. 36. Adding fluid or air to the counterrecoil cylinder.

Sb10 - counterrecoil cylinder; Sb42-25 - appliance for filling with manometer; 42-83 - adapter; Sb21 - hose; 51 - valve (10-57)

CHAPTER FOUR

50X1-HUM

TOP CARRIAGE AND SHIELD ASSEMBLY

20. Top Carriage

The top carriage is designed to hold the tipping parts of the gun, the training and pointing mechanisms, equilibrator and shield assembly.

The top carriage 1 (Fig. 37-42) is a complex steel casting consisting of a base and left and right side plates which are reinforced with contour edges and stiffening ribs and are connected at the front of the carriage by a housing. (69)

On the top carriage plates are seats for cradle trunnions which are enclosed by trunnion-caps 4 (Fig. 37). Each trunnion-cap is fastened to the top carriage by two pins 3 with cotterpinned nuts 5.

On the left top carriage plate are the rectangular hole a for the cylindrical spur gear of the elevating-mechanism worm drive, hole b for the traversing mechanism drive, hole c for the elevating mechanism crankshaft, and two cutouts for weight reduction. The majority of the holes can be used for access inside the carriage when the cradle and barrel are placed on it. The four holes d are for bolts that fasten the housing of the sights.

Pivot bearing 55 is welded externally to the left plate and braces the left strut of the shield.

The pointing mechanism worm fits into hole l (Fig. 39) in the tongue inside of the left plate. Groove m, which was made on the cylinder with the stopping device (57), serves as a guide for the key of the assembled worm when it is inserted into hole l.

The right top carriage plate has five cutouts for weight reduction and one aperture g (Fig. 38) for regulating the bearings of the elevating-mechanism crankshaft. Area Rh is the base of the collars for fastening the compressed-air cylinder, and the distributor 8 (Fig. 52) of the equilibrator is fastened to area r with two apertures.

Pivot bearing 55 (Fig. 37) is welded externally to the right plate and braces the right strut of the shield.

Lug 56, with the through hole, absorbs stress from the bolt of the upper right bracket of the shield during operation of the winch. Guide 2 of the recoil-limiter mechanism is welded to the right plate from the inside. The six apertures k on the flanges of the right and left plates brace the upper brackets of the shield assembly.

50X1-HUM

In the bottom of the top carriage are hole f (Fig. 38) with shoulders (p 70) alor
and

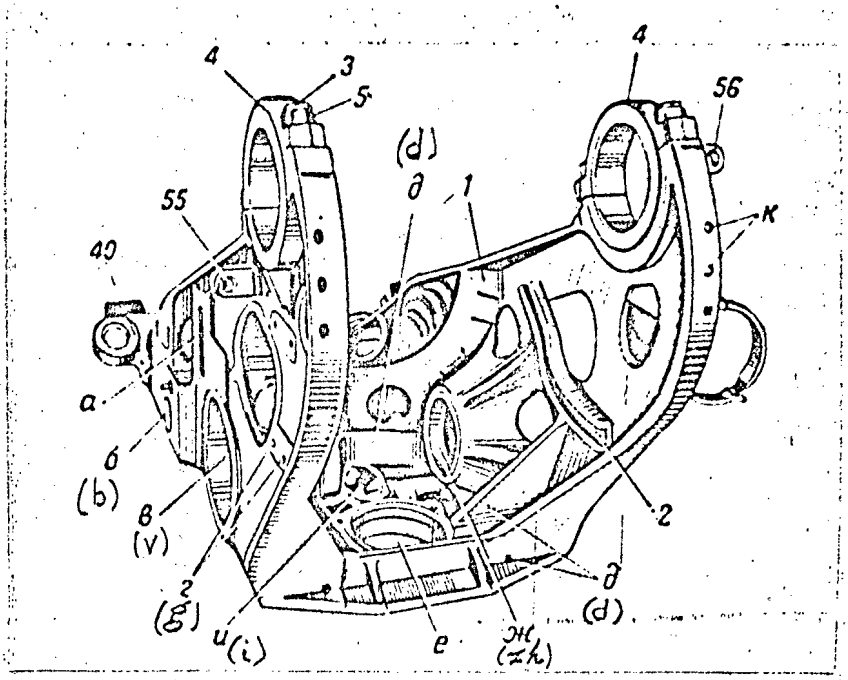


Fig. 37. Top Carriage (rear view)

[68]

1. top carriage (17-1)
2. guide (17-20)
3. trunnion-cap pin (17-2)
4. trunnion cap (17-3)
5. nut (A51011-8)
40. equilibrator brackets (17-90 and 17-91)
55. pivot bearing (17-84)
56. lug (17-100)

a. hole for cylindrical pinion of pointing-mechanism worm drive;
b. hole for training-mechanism drive;
v. hole for pointing-mechanism crankshaft;
g. holes for bolts to housing for sights;
d. holes for flow of water;
e. hole under pivot bearing 7 (See Fig 41 and 42);
zh. hole for adjusting crankshaft bearing;
i. holes for lubricating;
k. holes for fastening upper brackets of shield.

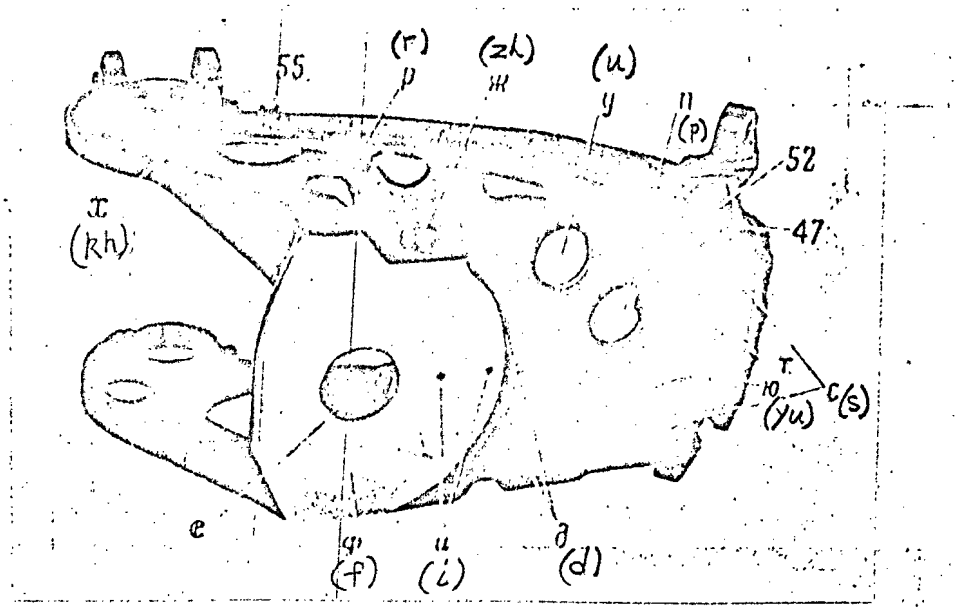


Fig. 38. Top Carriage (bottom view) [69]

47. journal-box housing (17-80)
52. screw (A51060-16)
55. pivot bearing (17-84)

d. holes for flow of water;
e. hole under pivot bearing 7 (See Fig. 41 and 42);
zh. hole for adjusting crankshaft bearing;
i. holes for lubricating;
p. hole under housing of training mechanism;
r. area under equilibrator distributor;
s. holes under rollers;
t. hole under locking device for traveling position;
u. cutout for weight reduction;
f. seat;
kh. area under cylinder collar;
yu. forward seat.

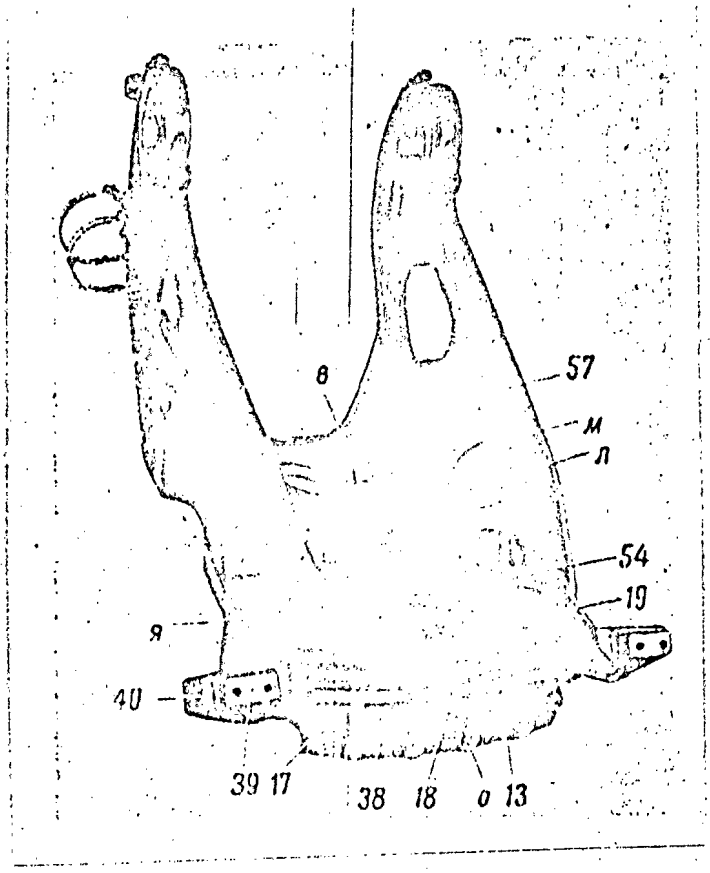


Fig. 39. Top Carriage (front view) [70]

13. front holding device (17-70)
17. bolt (A51000-56)
18. spring washer (A51027-9)
19. cup (17-7)
38. locating pin (17-73)
39. bracket (17-56)
40. equilibrator brackets (17-90 and 17-91)
54. depression angle limiter (17-74)
57. stopping device (17-78)

v. hole under crankshaft;
l. hole under worm of pointing mechanism;
m. scribe mark for installing worm;
o. hole for flow of water;
ya. keyway.

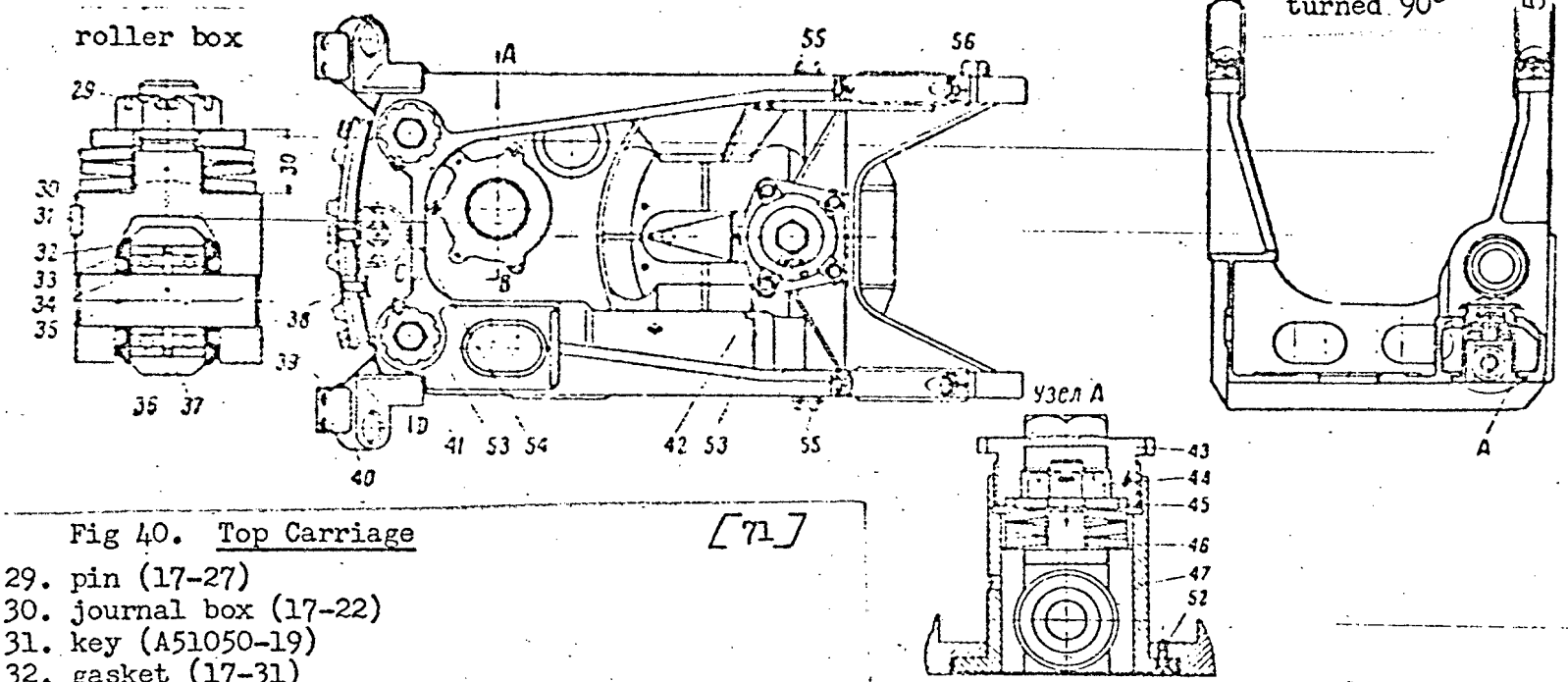


Fig 40. Top Carriage

[71]

29. pin (17-27)
30. journal box (17-22)
31. key (A51050-19)
32. gasket (17-31)
33. gasket (17-30)
34. ball bearing No 205
35. spindle (17-32)
36. roller (17-28)
37. collar (17-33)
38. locating pin (17-73)
39. bracket (17-56)
40. equilibrator brackets(17-90, 17-91)
41. locking plate (17-72)
42. locking plate (17-67)
43. clamping nut (17-53)
44. nut (17-26)
45. washer (17-25)
46. plate spring (17-24)
47. journal-box housing (17-50)
52. screw (A51060-16)
53. screw (A51066-9)
54. depression-angle limiter (17-74)
55. pin (17-84)
56. lug (17-100)

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

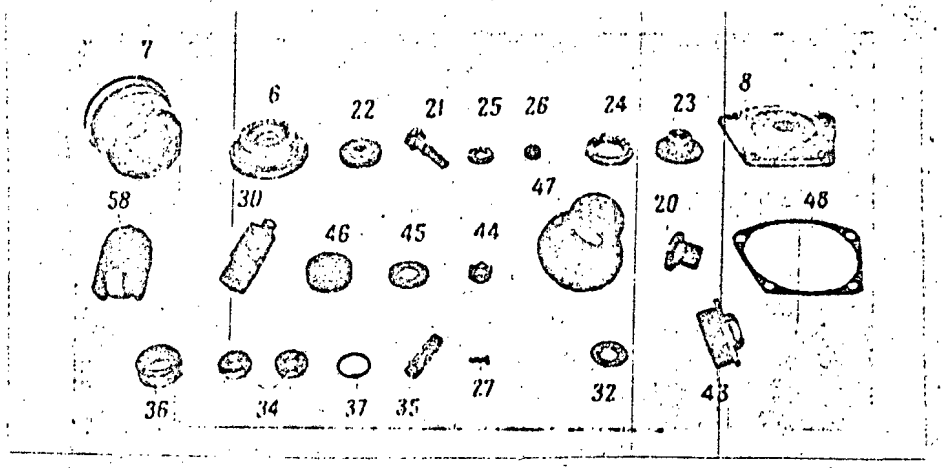


Fig 41. Parts of the Top Carriage [72]

1. nut (17-63)
7. pivot bearing (17-62)
8. pivot bearing cover
20. adjusting bolt
21. bolt (17-35)
22. plate spring (17-36)
23. thrust washer (17-37)
24. bearing No 8211
25. washer (17-38)
26. nut (17-39)
27. set screw (17-76)
30. journal box (17-32)
32. gasket and gland (17-31 and 17-30)
34. ball bearing No 205
35. spindle (17-32)
36. roller (17-28)
37. collar (17-33)
43. clamping nut (17-53)
44. nut (17-26)
45. washer (17-35)
46. plate spring (17-24)
47. journal-box housing (17-50)
48. gasket (17-33)
58. journal box (17-22) with roller (17-28)

Located at the front of the base are hole p, which is the seat of the traversing-mechanism box, two holes s under housing 47 of the roller box, hole t under cup 19 (Fig. 42) of the locking device for fastening the top carriage in traveling position, and cutout u (Fig. 38) for weight reduction. 50X1-HUM

Front holding device 13 (Fig. 39) is joined to the front part of the carriage by three bolts 17 and four pins 38. The hole o in the holding device discharges the water.

Brackets 40 are welded to both sides of the front. They support the columns of the equilibrator. Both halves of the shield assembly are attached at the bottom to brackets 39.

Limiter 54 controls the depression angle of the tipping part of the gun.

Rollers 36 (Fig. 40 and 41) at the front of the base of the top carriage facilitate rotation of the top carriage during operation of the training mechanism.

When the top carriage rotates, the rollers move along the race of the traversing arc which is fastened to the bottom carriage. They serve as two fulcrums of the top carriage (before firing). A third fulcrum is the pintle around which the top carriage rotates on the bottom carriage.

Roller journal boxes 30 are located in the journal-box housings 47, each of which is fastened with three screws 52 to the base of the top carriage. Rollers 36 are in journal boxes. Two ball bearings 34 are at the spindle of each roller. The ball bearings are protected from contamination by disks 32 with gaskets. To prevent pulling of the rollers with the journal boxes, there is a dowel 31 in the housing on the journal box, as well as a key way ya (Fig. 39) on the perforated plate under the journal box in the top carriage.

Three plate springs 46 and washer 45 (Fig. 40 and 41) fit on the cylindrical part of the journal box; the springs are held by nut 44. (72)

In journal-box housing 47 a wing nut 43 presses against washers 45. Nut 43 is kept from turning by locking plate 41.

The wing nuts 43 are tightened by raising or lowering the front part of the top carriage, that is, by increasing or reducing the amount of gap between the contact surface of the top and bottom carriages.

Pivot bearing 7 and front holding device 13 (Fig. 42) connect the top carriage with the bottom carriage.

Pivot bearing 7 passes through a hole in the bottom of the top carriage into a hole in the bottom carriage to a stop at an annular ledge. Nut 6 rests with its collar on the bottom carriage, restrains the pivot bearing from axial movement; it screws into the bottom of the pivot bearing. 50X1-HUM is plugged with screw 27; the pivot bearing is held by pin 28 which fits into the recess in the bottom carriage.

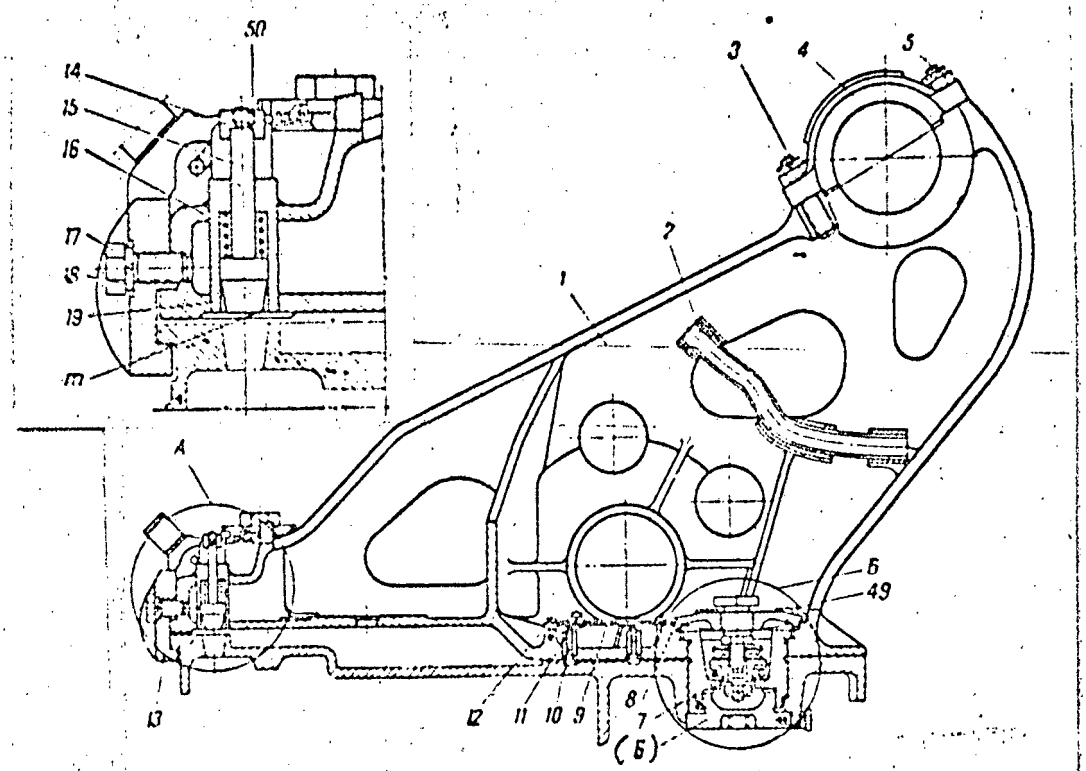
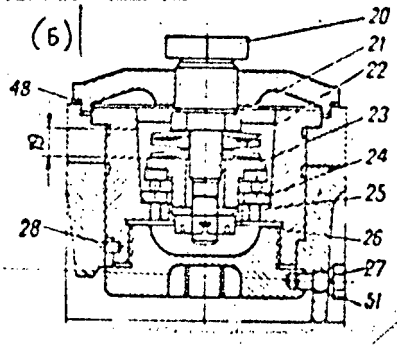


Fig 42. Top Carriage



1. top carriage (17-1)
2. guide (17-20)
3. trunnion-cap pin (17-2)
4. trunnion cap (17-3)
5. nut (A51001-8)
6. nut (17-36)
7. pivot bearing (17-62)
8. pivot-bearing cover (17-42)
9. cover (17-46)
10. wick (17-45)
11. washer (17-49)
12. screw (A51066-9)
13. front holding device (17-70)
14. hand lever (Sb 17-4)
15. locking device (17-9)
16. spring (17-8)
17. bolt (A51000-56)
18. spring washer (A51027-9)
19. cup (17-7)
20. adjusting bolt (17-43)
21. bolt (17-35)
22. plate spring (17-36)
23. thrust washer (17-37)
24. bearing No 8211
25. washer (17-38)
26. nut (17-39)
27. set screw (17-76)
28. pin (A51041-75)
48. gasket (17-33)
49. bolt (51000-47)
50. screw (A51063-5)
51. lock washer (A51027-6)
m. hole under locking-device cup

center of the pivot bearing on thrust ball bearing 24 (Fig. 41 and 42) 50X1-HUM
The pivot bearing spring consists of a bolt 21 with three plate springs 22 placed on it, a thrust washer 23, and washer 25 fastened with nut 26; resting against the head of bolt 21 is an adjusting bolt 20, which is screwed into pivot bearing cover 8, which in turn is fastened to the base of the top carriage with four bolts 49.

When adjusting bolt 20 is screwed into pivot bearing cover 8, it presses against the head of bolt 21, and through it, against the plate springs, thereby providing free play between the top and bottom carriages. Because of this free play and the free play created by the rollers, there is free rotation of the top carriage in relation to the bottom carriage to allow operation of the training mechanism.

The locking device for fastening the top carriage in the traveling position consists of cup 19, spring 16, locking device 15, and hand lever 14.

On the cup are two projections with slots into which hand lever 14 enters when the locking device is disengaged. To disengage the locking device, raise it by the hand lever and turn it 90 degrees to any side. When this is done, hand lever 14 must be folded at its hinged joint. If this is not done, the hand lever can be broken by the cradle when the gun barrel is depressed.

When engaged, the locking device enters the conical aperture in the bottom carriage and locks the top and bottom carriages in the traveling position.

21. Dismantling and Assembly of the Top Carriage

The top carriage is dismantled only for technical inspection and for eliminating defects.

1. The top carriage can be separated from the bottom carriage when the barrel with the cradle, the equilibrator, and shield assembly are removed.

In order to separate the top carriage from the bottom carriage, it is necessary to remove the front holding device and the pivot bearing as follows:

— switch off the locking device for fastening the top carriage in the traveling position;
— disconnect from holding device 13 (Fig. 42) the tube connecting the equilibrator cylinders;
— with wrench A52830-6 unscrew bolts 17 which fasten the front holding device to the top carriage, and remove spring washers 18; 50X1-HUM
— with a punch, carefully separate the holding device from locating pins 38 (Fig. 39).

— separate locking plate 42 (Fig. 40), after removing the unscrewing screws 53;

50X1-HUM

— unscrew adjusting bolt 20 (Fig. 42) two or three turns with wrench 42-250;

— with wrench A52830-5 unscrew bolts 49 which hold pivot bearing cover 8, and remove this cover with gasket 43;

— unscrew screw 27 and lock nut 6 with wrench A52830-5; unscrew nut 6 from pivot bearing 7 with wrench Sb 42-7 and remove the pivot bearing.

Remove the top carriage with the training and pointing mechanisms from the bottom carriage.

When the top carriage is removed, the smooth seats at the base of the carriage must be protected from dents and scratches.

3. Dismantle the pivot bearing spring as follows:

— remove the pin and unscrew nut 26 with wrench A52830-6, clamping the head of bolt 21 in a vise;

— separate bolt 21, washer 25, thrust washer 23, and plate springs 22.

4. Dismantle the rollers (Fig. 40) as follows:

— remove locking plates 41 after first removing the wire and unscrewing lock screws 53;

— unscrew clamping nuts 43 with wrench 42-250;

— remove the roller journal boxes and remove keys 31;

— remove spindles 35 from the journal boxes and separate rollers 36, gaskets 37, and gasket discs 32;

— dislodge pins 29 and unscrew nuts 44, bracing the journal box in a vise;

— remove washers 45 and plate springs 46;

— if the bearings must be replaced, dislodge ball bearings 34 and collars 37 from the rollers with a copper drift.

The rollers can also be removed when the gun is assembled. (75)

When dismantling rollers, first elevate the barrel in order to ensure free access to the rollers; secure the pointer's handwheel by wire or rope, and remove the rollers in accordance with the above procedure.

Dismantle the locking device for the traveling position as follows:

— pull the locking device up and unscrew hand lever 14 (Fig. 42) after unscrewing screw 50;

— remove locking device 15 and spring 16.

The grease box is dismantled as follows:

50X1-HUM

— unscrew screws 12 after removing the wire;

— remove cover 9 and take out wick 10.

Assembly of the Top Carriage

Assemble the locking device for the traveling position as follows:

— insert locking device 15 (Fig. 42) with the spring in cup 19;
— screw on hand lever 14 and fasten it with screw 50; secure the screw.

2. Assemble the rollers as follows:

— replace collars 37 and ball bearings 34 in rollers 36 (Fig. 40) (if they were removed during dismantling);
— insert the rollers together with the bearings into journal boxes 30 along with gaskets 33 and disks 32 and replace spindles 35;
— place in the journal boxes plate springs 46 and washers 45, and screw in nuts 44 with wrench A52830-7 so that the distance from the upper surface of the washer to the journal box is 30 mm; fasten nuts 44 with pins, and spread the ends of the pins;
— place keys 31 in the recesses of journal boxes 30 and set the journal boxes in housings 47.

If journal-box housings 47 were separated from the carriage:

— insert journal-box housings 47 in the apertures of the carriage from the bottom, fasten with screws 52, and secure the screws;
— screw on the nuts 43 with wrench 42-250.

Nuts 43 are again tightened and locked with locking plates in the assembled state after the barrel has been placed and the free play between the seats of the carriages has been adjusted.

3. Assemble the pivot bearing spring as follows:

— place plate springs 22 on thrust washer 23 (Fig. 42); insert bolt 21, and place washer 25;
— screw on nut 26 with wrench A52830-6 so that the height of the plate-spring section is 19 mm; cotter nut 26.

4. Assemble the grease box as follows:

— soak wicks 10 in spindle oil and insert them in the small cups of the grease box;
— fill the grease box with a mixture of 70 percent spindle oil and 30 percent gun grease.
— fasten cover 9 with screws 12 and lock the screws with wire.

Procedures for setting the top carriage on the bottom carriage and regulating the free play between the seats of the carriages are given in Chapter 12.

22. The Shield Assembly

50X1-HUM

The shield assembly (Fig. 43) protects the gun crew and gun mechanisms from bullets and small fragments and from the effect of the muzzle wave.

The shield assembly consists of the left 1 half of the shield, the (76) right 13 half of the shield, and the casing 46.

Both halves of the shield are fastened on the top carriage, and the lower part of each of them is fastened with two bolts 27 to brackets 39 (Fig. 40), which are located in the front portion of the top carriage. The top portion of the left and right halves of the shield is suspended on brackets by pivot bearing 9 (Fig. 43), which is riveted to the halves of the shield. The top end of the bracket is slipped into the lug of the pivot bearing and is connected to it by axle pin 3.

Brackets 10 and 12 are fastened to the left and right flanges of the top carriage with three bolts 19.

To make the shield inflexible on the gun, both halves of the shield are also fastened with braces 8 and 14 which are connected at the bottom ends by pivot bearing 55 (on the top carriage) and axle-pin 3. The top ends of the braces are fastened by axle-pin 3 in pivot bearing 2 which is riveted to each half of the shield.

On the left side of the shield are two holes. The large hole, which is covered by shield door 6, is for using the sight S71-35 (S71-96); the small hole, which is covered by shield door 4, is for using sight OP-4-96).

Both shield doors are locked with catches 5 in both closed and opened positions.

A battery holder 48 is fastened with three bolts 28 on the lower part of the left half of the shield from the inner side.

On the right half of the shield on the inner side is case 15 for the panoramic sight and sight extension. The case is fastened to the shield with four bolts 37. There is also a box 16 for documents, which is fastened on lugs to the shield by three bolts 28.

Light reflectors 17, fastened to hinge 44 by catch 43, are located on both halves of the shield in front at the upper corners.

For concealment in the firing position, the reflectors are turned 180 degrees and are fastened on support 42 with catch 43.

The jacket 46 on the recuperator cylinder is made of armored steel with a thickness of 4 mm.

50X1-HUM

At the rear, the jacket is fastened by two bolts 39 to the rear holding device of the barrel. Riveted along the sides toward the front end of the

Welded to the right bracket 12 of the shield is a bracket 30 fc50X1-HUM connecting the winch rod when the barrel is moved from traveling to firing position, or vice versa. In such a move, eye 7 (Fig. 67) of the winch rod is set into the lug of bracket 30 (Fig. 43) and is connected by locking device 31. Bolt 41 passes through the opening of bracket 30. Through a lug 56 (Fig. 40), the bolt fastens bracket 30 (Fig.43) to the top carriage.

In assembled form, the locking device consists of housing 32 welded to bracket 30, cap 33, spring 35, and lock 31. Spring 35 holds the lock in the operating position. The cap and lock are connected by the threaded stem of the lock which is held by nut 34.

Removal of Shield Assembly

Separate one half of the shield from the top carriage as follows:

— remove the cotter pins and with the wrench A52830-5 unscrew nuts 22 (Fig. 43) from bolts 27 which fasten the lower part of the shield, and remove these bolts;

— separate left 8 and right 14 braces by removing the cotter pins from axle 3 and punching them from the holes with a knock-out rod;

— while holding half of the shield on both sides, remove or punch out with a knock-out rod upper axle-pins 30 of brackets 10 and 12 and remove the shield.

Upper brackets 10 and 12 are removed from the top carriage only when necessary. To remove them, unscrew, with wrench A52830-5, nuts 21 from bolts 19; remove these bolts, and separate the left bracket from the top carriage. To separate the right bracket from the carriage, it is necessary in addition to remove the cotter pin and unscrew nut 40 from bolt 41 with a wrench. After removing the bracket, do not separate bolt 41 from the lug of the top carriage if not necessary; it must be fastened to the lug by nut 40.

Remove the jacket from the rear and front holding devices of the barrel (Fig. 43) as follows:

— straighten the tabs of lock washers 38 and unscrew bolts 39 with wrench A52830-5;

— remove the cotter pins and unscrew nuts 22 with wrench A52830-5;

— remove bolts 24 and separate jacket 46 from the locking devices of the barrel. (77)

Mounting the Shield Assembly on the Top Carriage (78)

Mount the shield assembly on the top carriage (with the equilibrator columns set in place) as follows:

50X1-HUM

1. Fasten the left 10 and right 12 brackets to the top carriage (if they were removed) as follows: superimpose the bracket on the holes in the top carriage, insert bolts 19, place lock washers 20 with the bolt heads on r

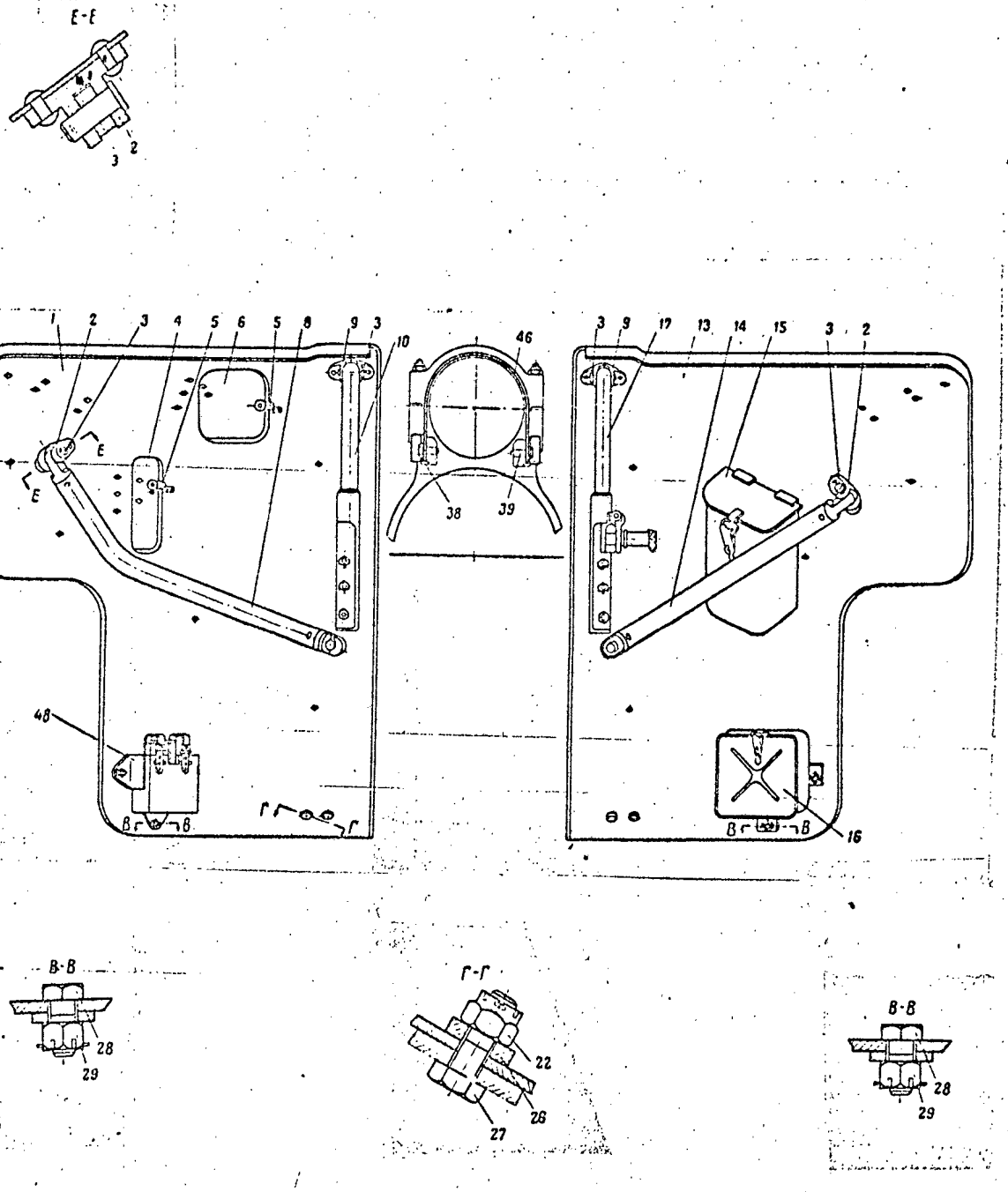


Fig. 43. The Shield Assembly (part 1)

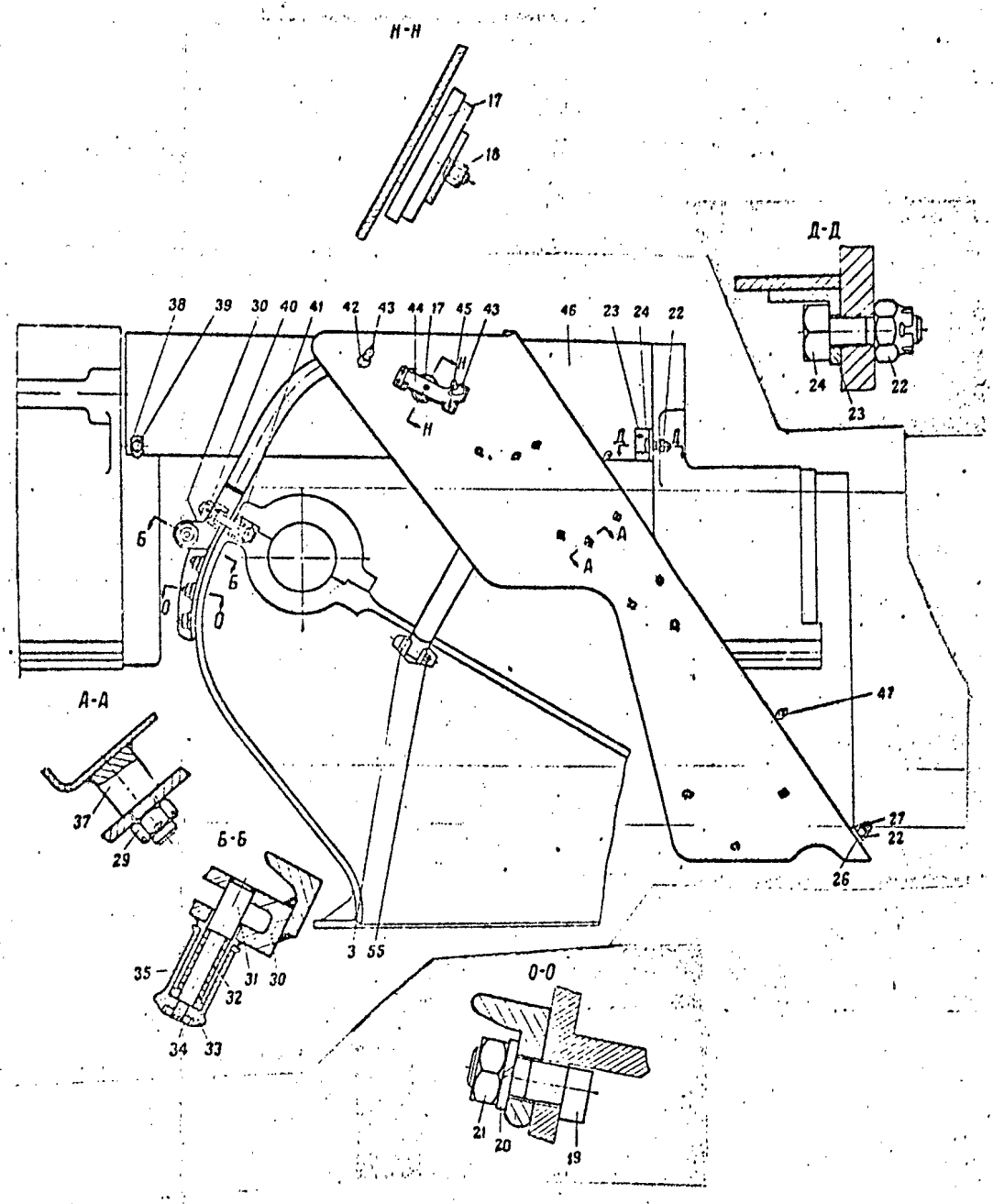


Fig 43. The Shield Assembly (part 2) [77]

Fig. 43. The Shield Assembly [77]

1. left half of shield (27-21)
2. pivot bearing (27-131)
3. axle pin (27-124)
4. shield door (Sb 27-41)
5. catch (27-4)
6. shield door (Sb 27-3)
8. shield brace (Sb 27-42)
9. pivot bearing (27-135)
10. left bracket (Sb 27-45)
12. right bracket (Sb 27-44)
13. right half of shield (27-30)
14. shield brace (Sb 27-11)
15. case for panoramic sight and sight extension (Sb 27-26)
16. documents box (Sb 27-34)
17. light reflector (Sb 27-35)
18. nut A51011-34
19. bolt (27-122)
20. lock washer (A51027-8)
21. nut (A51010-3)
22. nut (A51011-4)
23. angle plate (27-41)
24. bolt (27-160)
26. washer (27-175)
27. bolt (27-174)
28. bolt (A51000-14)
29. nut (A51011-3)
30. bracket (27-182)
31. locking device (27-130)
32. housing (27-128)
33. cap (27-127)
34. nut (A51013-4)
35. spring (27-139)
37. bolt (27-167)
38. lock washer (A51024-46)
39. bolt (A51000-25)
40. nut (27-186)
41. bolt (27-185)
42. support (27-165)
43. catch (A51324-5)
44. light reflector hinge (Sb 27-39)
45. angle plate (Sb 27-38)
46. jacket (27-40)
47. eye (27-27)
48. battery holder (A72903-3)
55. pivot bearing (17-84)

If bolt 41 of bracket 30 has been removed, it must be inserted in the lug of the top carriage before the cradle is mounted on the top carriage. otherwise, it would be impossible to insert it in the lug without removing the cradle.

When mounting right bracket 12, tighten bolt 41 with nut 40 by using wrench A52830-5, and insert the cotter pin.

2. Mount left 1 and righ 13 halves of the shield on the top carriage as follows:

— holding half of the shield, align the top holes of brackets 10 and 12 with the hole of pivot bearing 9, insert axle-pin 3 in the holes and insert the cotter pin;

— line up the two bottom holes in the halves of the shields with the openings on brackets 39 (Fig. 40) of the top carriage, insert bolts 27 (Fig. 43), position washers 26, and screw on the nuts with wrench A52830-5; cotter the nuts;

— superimpose the apertures of left 8 and right 14 braces with the holes in pivot bearing 2, insert axle-pins 3 into the holes, and place the cotter pin.

If the braces have been separated from the top carriage, line up the bottom holes of the braces with the holes in pivot bearing 55 of the top carriage, insert the axle-pin 3, and place the cotter pin.

3. Mount the jacket 46 on the holding devices of the barrel as follows:

— lay the jacket on the recuperator cylinder and, after lining up the holes in the jacket with those on the rear holding device of the barrel, insert bolts 39 after placing lock washers 38 on them; tighten the bolts completely with wrench A52830-5 and lock them with the lock washer.

— line up the holes in angle plates 23 with those on the front holding device of the barrel, insert bolts 24, tighten the nuts with wrench A52830-5, and place the cotter pin.

CHAPTER FIVE

THE ELEVATING, TRAVERSING AND EQUILIBRATOR MECHANISMS

23. The Elevating Mechanism

The elevating mechanism (Fig 44-47), which elevates and depresses the gun barrel, consists of a crankshaft, worm gearing with axle brake, a pair of spur gears, two ball joints with shafts, a bevel gear and a hand wheel.

The crankshaft 7 (Figs 44 and 45) of the spur gear is coupled with the arc of the cradle.

On the right side, the crankshaft rests on a pair of conical bearings 9 which fit inside the adjusting collar 1.

The conical bearings are attached to the shaft by the nut 5 and washer 8.

The flanged collar 3 and the gasket 11 are used to adjust the conical bearing 9.

The outside of the flanged collar 3 has threads which fit the collar 12 of the upper carriage.

Turning the flanged collar 3 in or out moves the shaft 7 axially, which adjusts the meshing of the worm gearing.

The conical bearing 9 is protected from contamination by the gland 13. The right end of the crankshaft is closed by cover 4, which is attached by means of screws 2 to the flanged collar 3.

On the left side, the crankshaft rests on ball bearing 16. The ball bearing is protected from contamination by the gland 15, which is slipped onto the packing ring 14.

Worm wheel 22, which is held by lock nut 24, is at the left, slotted end of the crankshaft.

The worm gearing consists of the worm wheel 22 and the worm (plus shaft) 39.

The worm shaft rests on two needle bearings 41. The rear needle bearing 41 extends inside the upper carriage housing and is held on the worm shaft by washer 37.

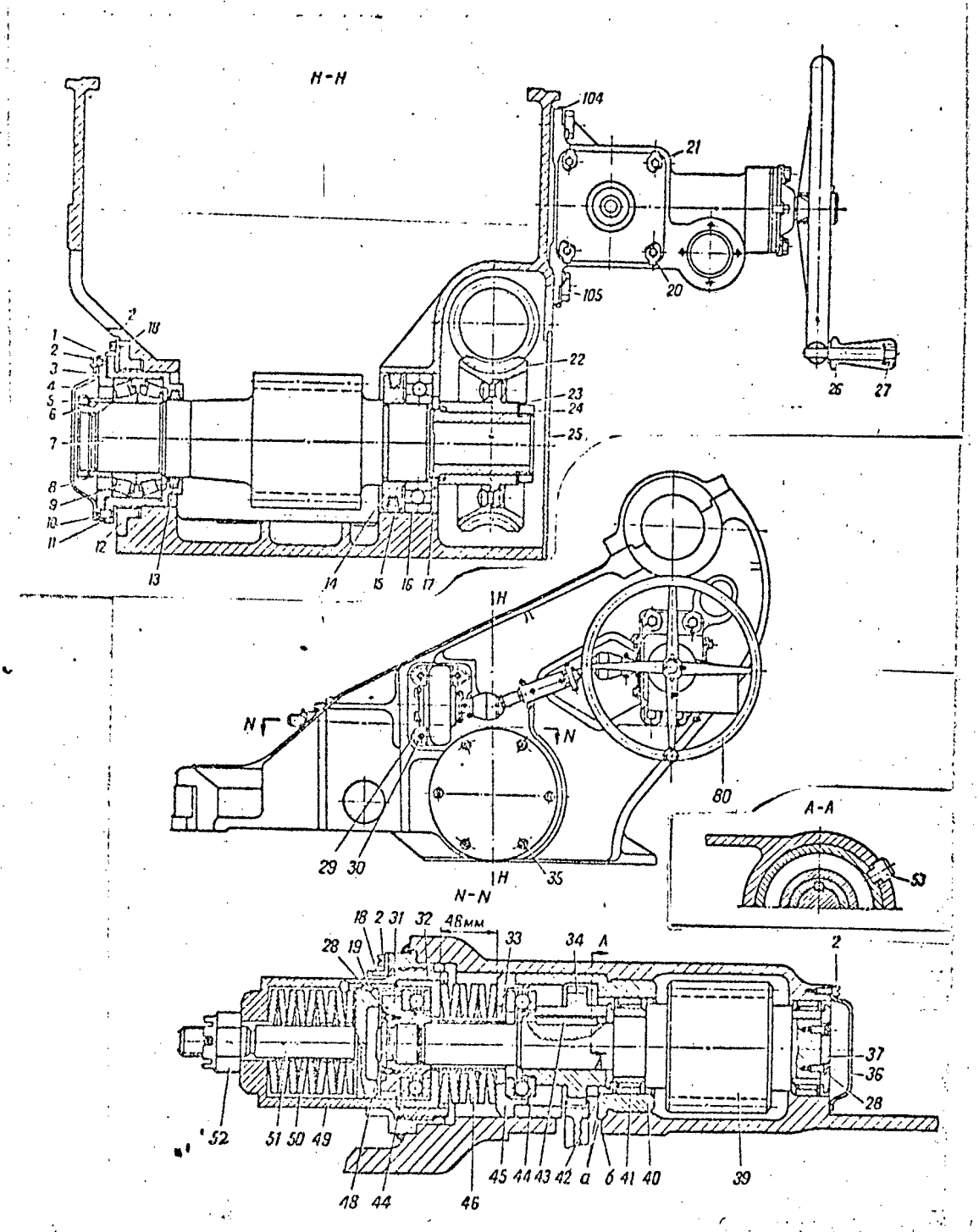


Fig 44. Pointing (Elevating) Mechanism

Fig 44. Pointing (Elevating) Mechanism

1. adjusting collar (21-2)
2. screw (A51066)
3. flanged collar (21-7)
4. cover (21-11)
5. nut (21-9)
6. lock washer (21-8)
7. crankshaft (21-1)
8. ring (21-5)
9. conical bearing No 7216
10. screw (A51060-)
11. gasket (21-6)
12. upper carriage collar
13. packing gland (21-3)
14. packing ring (21-14)
15. packing gland (21-15)
16. ball bearing No 218
17. ring (21-96)
18. locking tab (21-91)
19. key (A51050-19)
20. lock washer (A 51024-44)
21. screw (A51000-6)
22. worm wheel (S 621-4)
23. lock washer (21-17)
24. lock nut (21-18)
25. cover (17-59)
26. hand grip (21-81)
27. nut (21-82)
28. screw (A51060-8)
29. lock nut (A51024-45)
30. bolt (A 51000-16)
31. nut (21-84)
32. thrust collar (21-29)
33. spreader (21-28)
34. gear (21-160)
35. nut (A51060-7)
36. cover (21-69)
37. washer (21-43)
39. worm shaft (21-22)
40. guide bushing (21-24)
41. needle bearing No 54810
42. washer (21-66)
43. key (A15050-26)
44. ball bearing No 8211
45. collar bushing (21-83)
46. Belleville (disk) spring (21-30)
48. locking tab (21-33)
49. cover (21-83)
50. Belleville (disk) spring (21-86)
51. brake disk (21-85)
52. nut (21-97)
53. limiter (17-78)
80. handwheel (S621-9V)
104. lock washer (A51024-48)
105. bolt (A51000-45)

a and b. grooves which provide a common channel for the guide bushing 40 and limiter 53.

50X1-HUM

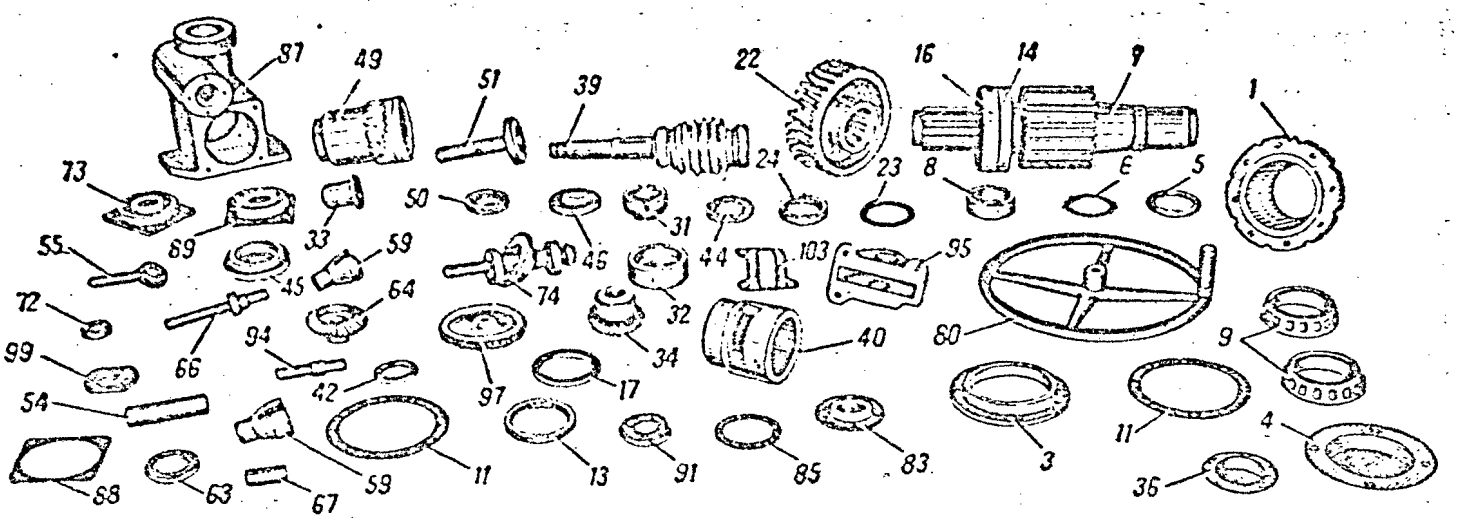


Fig 45. Parts to the Pointing (Elevating) Mechanism

[p 79]

1. adjusting collar (21-2)
3. flanged collar (21-7)
4. cover (21-11)
5. nut (21-9)
6. lock washer (21-8)
7. crankshaft (21-7)
8. ring (21-5)
9. bearing No 7216
11. gasket (21-6)
13. packing gland (21-3)
14. packing ring (21-14)
16. bearing No 218
17. ring (21-96)
22. worm wheel (S621-4)
23. lock washer (21-17)
24. lock nut (21-18)
31. nut (21-34)
32. thrust collar (21-29)
33. spreader (21-28)
34. gear (21-160)
36. cover (21-69)
39. worm and shaft (21-23)
40. guide bushing (21-24)
42. washer (21-66)
44. bearing No 8211
45. collar bushing (21-31)
46. Belleville (disk) spring (21-33)
49. cover (21-83)
50. Belleville (disk) spring (21-86)
51. brake disk (21-85)
54. sleeve (21-75)
55. ball-joint ball (21-53)
59. forked socket (21-61)
63. washer (21-98)
64. gear (21-40)
66. shaft (21-38)
67. bushing (21-39)
72. bearing No 204
73. cover (21-48)
74. gear (21-100)
80. handwheel (S621-9)
83. cover (21-55)
85. gasket (21-62)
87. housing (21-37)
88. gasket (21-65)
89. cover (21-44)
91. cover (21-72)
94. shaft (21-68)
95. housing (21-67)
97. spur gear (21-70)
99. cover (21-74)
103. gasket (21-88)

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

The rear end of the worm shaft is closed by cover 36, which is held by screws 2.

The front needle bearing 41 fits into the guide bushing 40, which is notched to accommodate gear 97 (Fig 46) and is prevented from rotating by the limiter 53 (Fig 44), which is welded to the upper carriage. [p 80]

Washer 42, gear 34, ball bearing 44, collar bushing 45, spreader 33, and a shock absorber consisting of six Belleville (disk) springs 46 all fit on the worm shaft 39.

The springs rest on the thrust collar 32 with ball bearing 44, and are held under compression by nut 31 at a fixed length of 48 mm, as shown on Fig 44. Nut 31 is kept from turning by locking tab 48.

The axle brake of the worm shaft consists of the cover 49, (which is screwed onto the collar of the upper carriage) twelve Belleville (disk) springs 50 and brake disk 51 (with its shank), which is held fast by nut 52.

The cover 49 is prevented from rotating by the locking tab 18, and the brake disk by key 19.

Spur gear 97 (Fig 46) is attached to shaft 94 in housing 95 and is meshed with gear 34 (Fig 44), which slips on the worm shaft. Shaft 94 (Fig 46) rests on ball bearing 72. Housing 95 is closed by covers 91 and 99, which are attached by bolts 102. Housing 95 is attached to the upper carriage by three bolts 30 (Fig 44).

The ball joint and shaft comprises the shaft 66 (Fig 46), ball-joint ball 55 and socket liner 58, which is connected with the joint by axle 56.

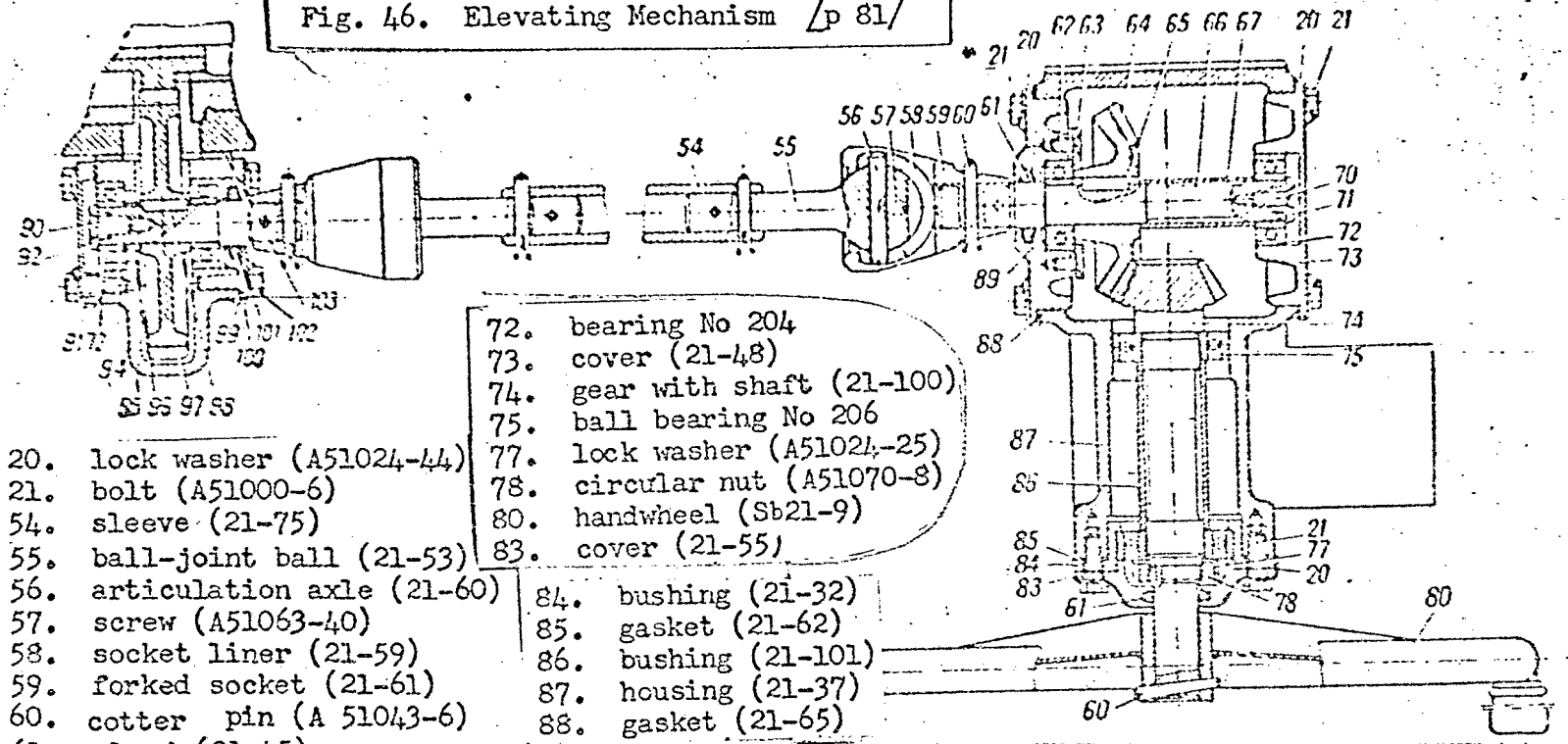
The two ball joints are connected by the sleeve 54, which is attached to the ball shafts by conical pins at each end.

The rear forked socket 59 is attached to the shaft 66, and the front forked socket is attached to shaft 94, both by means of conical pins 60.

A bevel gearing is inside housing 87; it consists of the gear 64 welded to shaft 66, and gear 74 with its shaft. Shaft 66 rests at both ends on ball bearing 72, which are capped by covers 72 and 89. The rear ball bearing 72 is kept from moving in the axial direction by washer 71 and bushing 67, which, at its other end, rests against the bevel gear 64, which is kept from rotating on its shaft by key 65.

50X1-HUM

Fig. 46. Elevating Mechanism /p 817



20. lock washer (A51024-44)
21. bolt (A51000-6)
54. sleeve (21-75)
55. ball-joint ball (21-53)
56. articulation axle (21-60)
57. screw (A51063-40)
58. socket liner (21-59)
59. forked socket (21-61)
60. cotter pin (A 51043-6)
61. gland (21-45)
62. screw (A51060-8)
63. washer (21-98)
64. gear (21-40)
65. key (A51050-23)
66. shaft (21-38)
67. bushing (21-39)
70. screw (A51060-13)
71. washer (21-52)
72. bearing No 204
73. cover (21-48)
74. gear with shaft (21-100)
75. ball bearing No 206
77. lock washer (A51024-25)
78. circular nut (A51070-8)
80. handwheel (Sb21-9)
83. cover (21-55)
84. bushing (21-32)
85. gasket (21-62)
86. bushing (21-101)
87. housing (21-37)
88. gasket (21-65)
89. cover (21-44)
90. screw bolt (A51060-13)
91. cover (21-72)
92. washer (21-52)
94. shaft (21-68)
95. housing (21-67)
96. ring (21-76)
97. spur gear (21-70)
98. key (A51050-23)
99. cover (21-74)
100. lock washer (A51024-44)
101. gland (21-45)
102. bolt (A511000-6)
103. gasket (21-88)

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

The front ball bearing 72 is protected from contamination 50X1-HUM the gland 61; the outside race of the ball bearing is held from shifting by washer 63. Covers 73 and 89 are attached to the housing 87 by four bolts 21.

Bevel gear 74 and its shaft rest against ball bearing 75. The right hand bearing fits into the extension of housing 87, and the left hand bearing into bushing 84. The bearings are held apart by bushing 86 and are held against the gear-plus-shaft piece by nut 78.

The inside of the housing extension is protected from contamination by cover 83 with its gland 61. The cover is attached to the housing extension by four bolts 21.

The meshing of the bevel gearing is regulated by a set of gaskets 85 and 88.

The handwheel 80 slips onto the cylindrical shaft of the gear-plus-shaft piece 74 and is held there by the conical pin 60.

(There are guns with handwheels 80 (Fig 44) having three spokes instead of four, for convenience in operating the range setter of sight S 71).

The housing 87 is attached to the upper carriage by four bolts 105 (Fig 44).

24. Operation of the Elevating Mechanism

[p 82]

When the handwheel of the elevating mechanism is rotated, the motion is transmitted through the bevel gearing, the ball and socket joints with their shafts, and the spur gears to the worm shaft, worm, worm wheel, then to the crankshaft, which is meshed with the geared elevating arc of the cradle (Fig 47).

During the occasional changes of gun position, the worm shaft can be shifted in the axial direction whereby the disk springs 46 (Fig 44) will by compressed, which will reduce the force of impact in the gearing and protect the gears from damage.

The axle brake of the worm shaft acts as follows: When worm shaft 39 moves axially, nut 31 rests against the face of the brake disk 51 and brakes the worm shaft and retains the angle at which the barrel has been aimed.

25. Disassembly and Assembly of the Elevating Mechanism

50X1-HUM

The elevating mechanism may be taken apart only for periodic inspection, and lubrication in case of faulty operation and to replace

Dismantling the mechanism for drill or instruction is forbidden.

Before beginning the dismantling, remove from the gun the barrel, equilibrator and cradle in the order given in Chapter 12.

When the elevating mechanism is dismantled, the parts must be marked with scribe marks in order that factory adjustment of the mechanism will not be disturbed, particularly in those cases when parts are to be put back in their original place, rather than be replaced.

In such cases, the presence of these lines (marks) will make it possible to dispense with subsequent adjustment, or at least greatly reduce the adjustment time.

Disassembly

1. Remove the ball joints of the elevating and traversing mechanisms (Fig 46) as follows:

knock out the cotter pins 60, after first squeezing their ends together, and remove sleeve 54;

separate ball-joint ball 55 from the forked socket 59;

When separating the washers 58 from the ball 55, unscrew screw 57 and knock out the axle 56 of the ball-joint ball;

knock out the cotter pins 60 of the forked socket 59 and separate the forked socket from shafts 66 and 94.

Likewise remove the drive shafts together with their ball joints from the traversing mechanism.

Since the cotter pins for connecting the forked sockets to the shafts 66 and 94 and for connecting the sleeves to the ball-joint balls are not uniform, these parts should be marked during disassembly to facilitate their correct positioning when they are put back.

2. Remove the housing of the bevel gears as follows:

Bend back the nubs of the lock washers 104 (Fig 44) and, with wrench A52830-5, remove bolts 105; remove housing 87 of the bevel gears (Fig 46).

3. Remove housing 95 of the spur gears as follows:

7. shaft (21-1)
22. worm wheel (Sb 21-4)
34. spur gear (21-160)
39. worm and shaft (21-22)
54. sleeve (21-75)
55. ball-joint ball (21-58)
59. forked socket (21-61)
64. bevel gear (21-40)
66. shaft (21-38)
74. gear with shaft (21-100)
80. handwheel (Sb 21-9)
94. shaft (21-68)
97. spur gear (21-70)

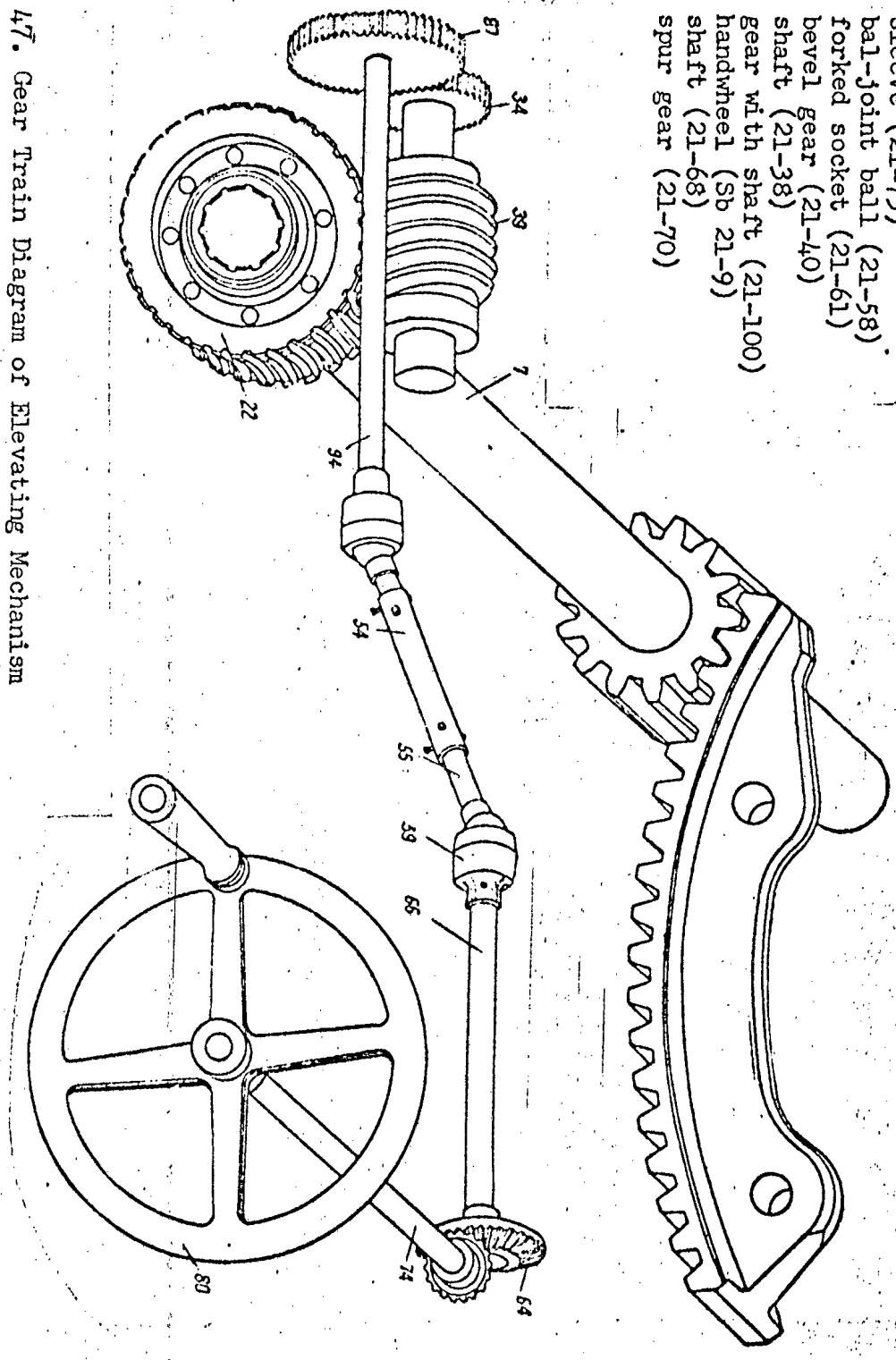


Fig 47. Gear Train Diagram of Elevating Mechanism

Bend back the nubs of lock washers 29 (Fig 44) and, with wrench A42840-23, remove bolts 30; remove housing 95 (Fig 46) of the spur gears and gasket 103. [P 84]

4. Remove worm shaft 39 (Fig 44) as follows:

Remove the wire and screws 2 which hold back locking tab 18 of cover 49, and remove the locking tab; remove the wire and screws 2, and separate cover 36 from the upper carriage; unscrew cover 49 with wrench S642-5 and remove the axle brake parts with the cover; mark a small letter "a" on the face and on the surface of the guide bushing, and the small letter "b" on the wall of the opening in the upper carriage in order to guarantee a correct fitting of the groove in the guide bushing 40 with the limiter 53; after turning the worm shaft by its nut 31 counterclockwise with wrench A52832-22, remove it from the upper carriage together with the parts attached to it. When the worm shaft is being removed, the crank shaft should be kept from moving by means of a copper knock-out rod placed between the teeth of the spur gear on the drive shaft and the edge of the upper carriage.

5. Dismantle the worm shaft 39 (Fig 44) as follows:

Secure the worm shaft in a vise with copper jaw plates and after turning off screws 28, remove the locking tab 48; with wrench A52832-22, turn off nut 31 and remove from the worm shaft ball bearing 44, thrust collar 32, springs 46, spreader 33, collar bushing 45, ball bearing 44, guide bushing 40, spur gear 34, key 43, washer 42, and needle bearing 41; the guide bushing 40 and spur gear 34 are removed together by tapping with a hammer against a wooden block placed against the end of the worm shaft; remove screws 28 and washer 37; remove the second needle bearing 41 (needle bearings 41 removed only when absolutely necessary and then with extreme caution so as not to loosen the needles).

6. Dismantle the axle brake of the worm shaft (Fig 44) as follows: holding cover 49 in a vise with copper jaw plates, use wrench A52830-7 to remove nut 52, after withdrawing the pin; remove from cover 49 the brake disk 51 together with the key 19 and the Belleville (disk) springs 50.

7. Remove the crankshaft as follows: remove the wire, turn off screw 2 and remove cover 4; turn off screw 35 and remove cover 25; bend back the (lug of) lock washer 6 and, with wrench A52832-24, turn off nut 5, after having first placed a copper knock-out under the tooth of the crankshaft spur gear to keep the shaft from turning; remove washer 6 and ring 8; unscrew screws 10 and remove flanged collar 3 and gasket 11; remove the wire, screws 2 and locking tab 18 which retains adjusting collar 1; to avoid impairment of the meshing when

reassembling, make a scribe mark on the grooving plane of the adjusting collar 1 and on locking tab 18; use wrench S642-69 to remove adjusting collar 1 together with conical bearings 9; by tapping with a hammer on the copper knock-out piece, then knock the crankshaft, together with the parts assembled with it, out of the upper carriage in the direction of the worm gear.

8. Dismantle the crankshaft as follows: clamp the crankshaft in [p 85] a vise with copper jaw plates; bend back the lock washer 23 and use wrench A52830-79 to remove lock nut 24, then remove lock washer 23; remove worm wheel 22 and ring 17; if ball bearing 16 has to be replaced, remove it and the packing ring 14 together with the gland 15.

9. Dismantle the housing of the spur gearing (Fig 46) as follows: Bend back the tab on the lock washer 100, use wrench A52830-2 to remove bolts 102 and remove covers 91 and 99; remove screw 90 and washer 92; use copper knock-out piece to tap out shaft 94 together with the bearing and remove gear 97.

10. Dismantle the housing of the bevel gearing (Fig 46) as follows: Knock out the cotter pin 60 and remove the handwheel 80; bend back the ends of the lock washers 20 and use wrench A52830-2 to remove bolts 21 of covers 73 and 83, then remove the lock washers and covers 73 and 83; remove bushing 84 together with ball bearings 75, gear and shaft 74, bushing 86 and gaskets 85; clamp the shaft of gear 74 in a vise with copper jaw plates; bend back (the tabs of) lock washer 77 and, with wrench A52832-19, remove nut 78; remove lock washer 77 and separate ball bearings 75 and bushing 86 (if the ball bearing has to be replaced) from gear 74 and its shaft; bend back lock washers 20 and remove bolts 21; remove cover 89 with gaskets 88 and the parts assembled on them; when exchanging ball bearings 72, remove screw 70, washer 71, ball bearing 72, bushing 67, gear 64, key 65, screws 62, washer 63 and shaft 66 (together with the bearing) from cover 89; remove gland 61 from the cover.

Assembly

1. Assemble the housing of the bevel gears as follows: Slip ball bearing 75, bushing 86, bushing 84, second ball bearing 75, and lock washer 77 on the shaft of gear 74 and use wrench A52832-19 to draw up nut 78, then lock it with lock washer 77; insert gland 61 into cover 89; slip ball bearing 72 and cover 89 on shaft 66; position washer 63 and fasten it with the four screws 62; prick-punch the screws; place the key 65 on shaft 66; slip on gear 64, bushing 67, ball bearing 72, washer 71, and tighten screw 70; prick-punch the screw; position cover 73 on housing 87 and attached it with the four bolts 21 with lock washers 20; lock the bolts; spread a thin layer of gun grease on gears 64 and 74 and the parts assembled with them

and housing 87 (under the cover 89 and bushing 84, position gaskets 88 and 85 at the same thickness as before disassembly), then insert gears 64 and 74 and their associated parts into housing 87; position cover 89; use wrench A52830-2 to tighten bolts 21 and lock their washers 20; place gland 61 in cover 83; fit the cover into bushing 84 and, with wrench A52830-2, tighten bolts 21 with lock washers 20; lock the bolts; put on handwheel 80 and lock it with its cotter pin 60. By turning the handwheel, test the operation of the bevel gearing. The handwheel sould turn smoothly without sticking. [p 86]

2. Assemble the spur gearing as follows: Slip ball bearing 72 on shaft 94 and insert key 98; place spur gear 97 into housing 95, then insert shaft 94 with key 98 into the gear and slip ring 96 on shaft 94; position second ball bearing 72, washer 92 and tighten them with screw 90, then prick-punch the screw; set up cover 91 and cover 99 together with gland 101; place the lock washers and use wrench A52830-2 to draw up bolts 102, which hold the covers, and lock them; slip forked socket 59 on shaft 94 and lock it with the two cotter pins 60.

3. Assemble the crankshaft 7 (Fig 44) as follows: put the crankshaft in a vise with copper jaw plates; slip packing ring 14, together with gland 15, ball bearing 16, ring 17 (face toward the bearing), worm wheel 22, lock washer 23 onto crankshaft 7 and use wrench A52830-79 to tighten lock nut 24, then lock it.

4. Install the crankshaft as follows: Install the crankshaft together with its associated parts in the upper carriage; place gland 13 conical bearings 9 together and slip them on the crankshaft and screw on with wrench Sb42-69; position ring 8 and lock washer 6, and tighten nut 5 with wrench A52832-24, then lock it; position gaskets 11 and bushing 3, and attached them with screws 2, then lock the screws with a wire; while turning the adjusting collar 1, use wrench S642-69 to bring the mark on its grooving into coincidence with the mark on locking tab 18.

5. Assemble the worm shaft 39 as follows: Secure the worm shaft in a vise with copper jaw plates; slip needle bearings 41 and washer 42 on the worm shaft 39, position key 43 and, by tapping with a hammer against a copper knock-out piece, work the guide bushing 40 onto the bearing; set up gear 34, ball bearing 44, bushing 45, spreader 33, disk (Belleville) springs 46, thrust collar 32, ball bearing 44 and, with wrench A52832-22, tighten nut e1 until the spread of the disk springs is 48 millimeters; position locking tab 48 and tighten it with screws 28, then prick-punch the screws; (To facilitate tightening, take the handle from the jack and slip it over the end of wrench A52832-22). slip the second needle bearing 41 over the opposite end of the worm shaft, position washer 37 and attach it with screws 28 and prick-punch the screws.

6. Assemble the axle brake of the worm shaft as follows: Insert 50X1-HUM disk springs 50 and brake disk 51, with the key 19, into housing 49; tighten nut 52 with wrench A52830-7.

7. Install the worm shaft 39 as follows: Insert the worm shaft into the opening in the upper carriage, bringing the mark on the surface of bushing 40 into coincidence with the mark "m" (Fig 39) on the upper carriage, until the shaft is all the way in; lock the crank shaft with a copper knock-out piece placed between the spur gear of the crankshaft and the edge of the upper carriage; using wrench A52832-22 on nut 31 (Fig 44) turn the worm shaft carefully counterclockwise on its axis into the worm wheel, during which time the groove of the guide bushing 40 should move into limiter 53 (which can be oriented by means of the marks "a" and "b" (Fig 44) that align the groove in the guide bushing 40 and limiter 53); use wrench Sb42-5 to screw cover 49 of the axle brake of the worm shaft, together with its associated parts, into the opening in the upper carriage; remove the knock-out piece holding the shaft still. [p 87]

8. Assemble the spur gear housing as follows: Place gasket 103 (Fig 46) and housing 95, then the lock washers 29 (Fig 44) and, with wrench A52840-23, tighten bolts 30 and then lock them.

9. Assemble the bevel gear housing as follows: Mount the bevel gear housing on the upper carriage; position lock washers 104 and, with wrench A52830-5, tighten bolts 105 and then lock them; slip forked socket 59 on shaft 66 (Fig 46) and lock it with cotter pins 60; insert the ball joint balls 55 together with the socket liners 58 and axles 56; connect the shanks of balls 55 with the sleeves 54 according to the two scribe marks made during disassembly, and lock with cotter pins 60.

10. Assemble covers 4 and 25 (Fig 44) as follows: Attach cover 25 to the upper carriage with screws 35 and prick-punch the screws; set up and fasten cover 4 with screws 2 and lock the screws with wire. After assembly, test the operation of the elevating mechanism by rotating the handwheel in both directions (15-20 full turns in each direction); the wheel should turn smoothly without jamming.

If the position of the worm wheel 22 must be adjusted, turn up or back off adjusting collar 1 with wrench Sb42-69, after first disengaging the thrust bearings by turning cover 49.

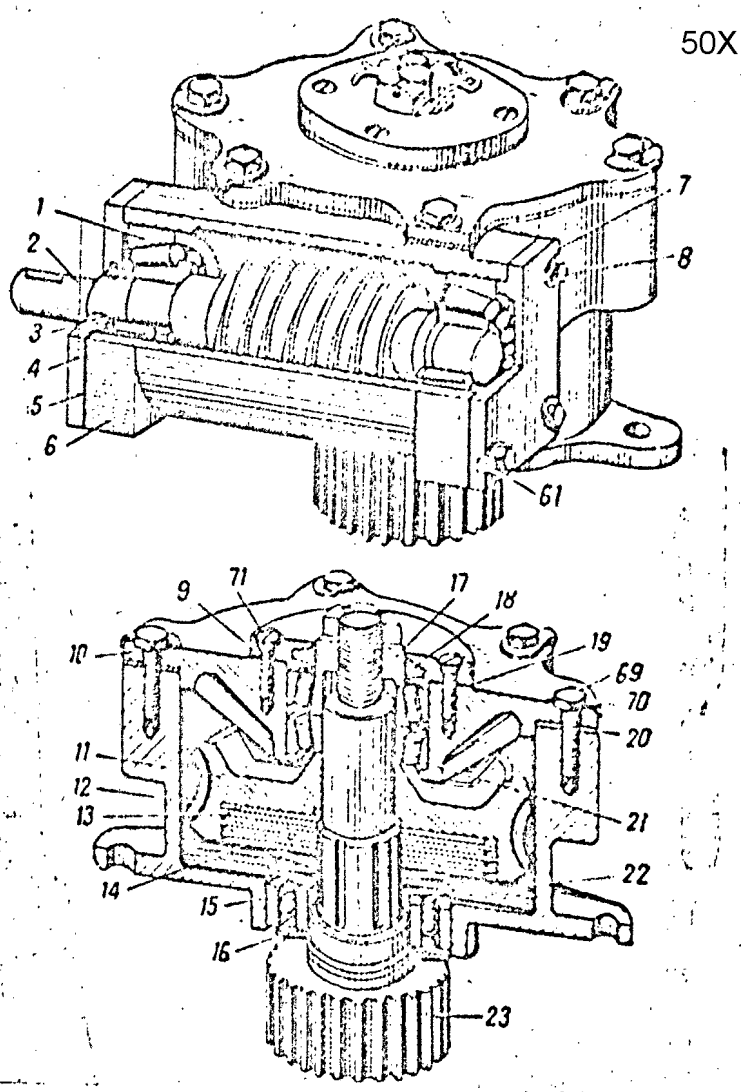
After adjusting cover 49, tighten the bearings (without impairing the [already tested] operation of the elevating mechanism, lock cover 49 with locking tab 18 and fasten it with screws 2; then connect the screws with a wire.

50X1-HUM

Fig 48.

Worm Gear Transmission

[p 88]



1. bearing No 7606
2. worm (22-4)
3. gland
4. cover (22-16)
5. gasket (22-19)
6. worm housing (22-2)
7. cover (22-18)
8. bolt (A51000-16)
9. cover (22-14)
10. housing cover (22-11)
11. worm wheel (22-3)
12. clutch plate (22-9)
13. clutch plate (22-10)
14. clutch plate (22-8)
15. ball bearing No 210
16. washer (22-29)
17. nut (22-13)
18. gland (22-15)
19. gasket (22-26)
20. gasket (22-6)
21. (roller) bearing No 7207
22. disk spring (22-7)
23. shaft with spur gear (22-1)
61. lock washer (A51024-45)
69. bolt (A51000-25)
70. lock washer (A51024-46)
71. screw (A51060-16)

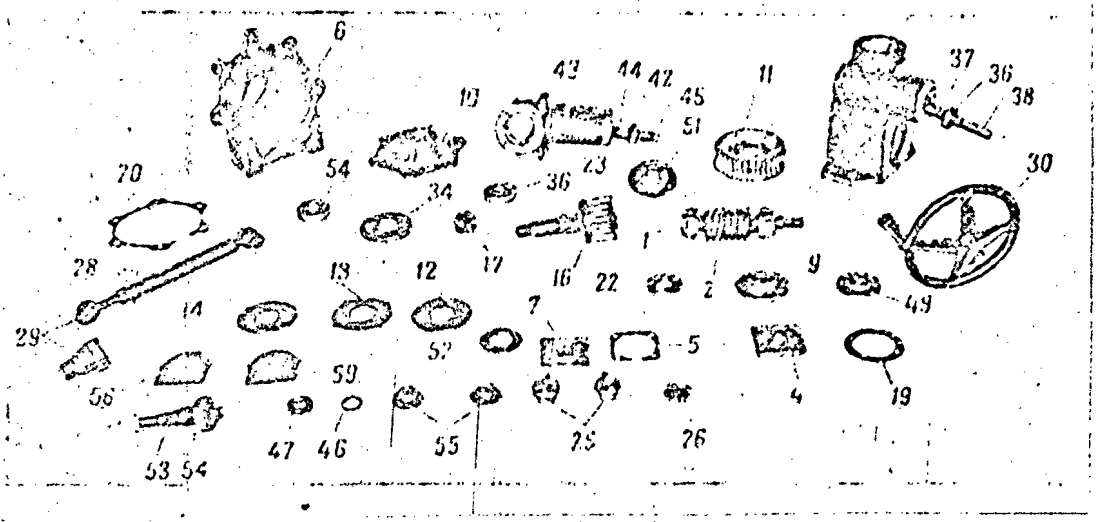


Fig 49. Parts of Traversing Mechanism [p 89]

1. bearing No 7606
2. worm (22-4)
4. cover (22-16)
5. gasket (22-19)
6. worm housing (22-2)
7. cover (22-18)
9. cover (22-14)
10. housing cover (22-11)
11. worm wheel (22-3)
12. clutch plate (22-9)
13. clutch plate (22-10)
14. clutch plate (22-8)
16. washer (22-29)
17. nut (22-13)
19. gasket (22-26)
20. gasket (22-6)
22. disk spring (22-7)
23. shaft with spur gear(22-1)
25. dog clutch (22-65)
26. spider (22-66)
28. sleeve (22-49)
29. ball joint and shaft (Sb 21-5)
30. handwheel (Sb 22-6)
34. cover (22-40)
36. bearing No 204
37. tube (22-72)
38. shaft (22-58)
42. bearing No 204
43. housing (22-30)
44. tube (22-39)
45. shaft (22-31)
46. washer (A51024-25)
47. curcular nut (A51970-8)
49. cover (21-55)
51. bushing (21-32)
52. gasket (21-62)
53. shaft (22-48)
54. bearing No 206
55. gear (22-34)
56. gasket (22-44)
59. cover (22-45)

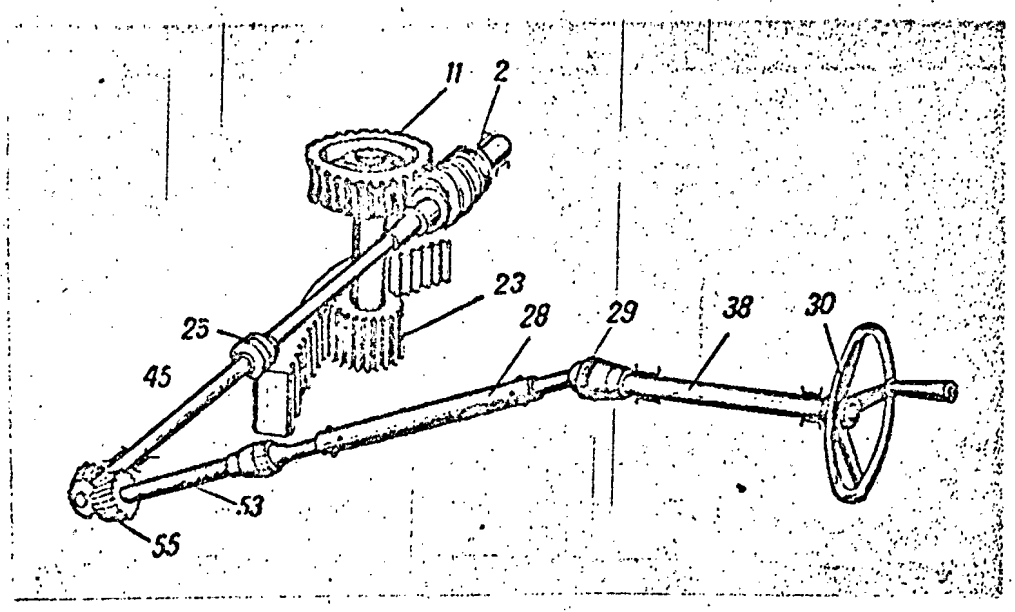


Fig 51. Drive Train of Traversing Mechanism [p 90]

2. worm (22-4)

11. worm wheel (22-3)

23. spur plus shaft (22-1)

25. dog clutch (22-65)

28. sleeve (22-49)

29. ball joint and shaft (Sb 21-5)

30. handwheel (Sb 22-6)

38. shaft (22-58)

45. shaft (22-31)

53. shaft (22-48)

55. gear (22-34)

Lock adjusting collar 1 with locking tab 18, which is fastened by screws 2; connect the screws with a wire. 50X1-HUM

The final adjustment of the elevating mechanism is done only after the gun has been fully assembled, and as explained in Chapter 12.

26. Traversing Mechanism

The traversing mechanism (Fig 48-51) moves the gun in the horizontal plane; it consists of a worm gear transmission and bevel gears with shafts and a handwheel.

The gears of the worm gear transmission are meshed with the traversing arc attached to the lower carriage.

The worm gear transmission (Figs 48 and 49) is make up of the worm 2, worm wheel 11, and shaft 23 with its spur gears assembled in housing 6 of the worm gear transmission housing.

The worm rests on two bearings 1 held together by covers 4 and 7.

The worm wheel 11 is mounted on shaft 23, to which the spur gear is also attached, and is connected to the shaft by a clutch made up of three steel clutch plates 12, one steel clutch plate 14, and three brass clutch plates 13. The plates are brought together by means of a splined engagement in which the steel plates engage with the shaft and the brass plates with the worm wheel.

The clutch plates are pressed together by Belleville (disk) springs 22. The purpose of the clutch is to protect the parts of the training mechanism from breakdowns during excessive overloading of the gun.

The spur gear shaft 23 rests against bearings 21 and 15. Bearings 21 are housed inside cover 10 and are attached to cover 9. On the end of shaft 23 is the nut 17 which holds the spur gear shaft in its housing 6 and regulates the clutch pressure.

Glands 3 and 18 and washer 16 protect the bearings from contamination.

Bevel gears 55 (Fig 50) are inside the bevel gear housing 43. The gears are on shafts 45 and 53, which rest on bearings 42 and 54. The bearings are held by covers 41 and 49.

In order to regulate the meshing of the bevel gears, one of the bearings is mounted inside a bushing 51, which is inside housin 50X1-HUM and is held by the same bolts that hold down cover 49. Under the

bushing is a gasket 52. The housing is attached to the upper carriage by bolts 32, and is prevented from rotating in relation to the upper carriage by pins 60.

Shaft 45 is connected with the worm 2 (Fig 48) by two dog clutches 25 (Fig 50) and spiders 34.

Handwheel 30 fits on shaft 38, which rests on ball bearings 36, which are fastened by covers 34.

The bearings are enclosed in housing 87 (Fig 46). Glands 35 (Fig 50) protect the bearings 36 from contamination.

The ball-plus-shaft pieces 29 are connected to shafts 38 and 53 which are connected to the sleeve 28 which is likewise attached to the shafts by cotter pins 27. The ball and shaft pieces 29 are arranged the same as those in the elevating mechanism. [P 90]

27. Operation of the Traversing Mechanism

When the handwheel of the mechanism is turned, the motion is transmitted through the shaft 38 (Fig 51), the ball and socket joints and bevel gearing to the worm and worm wheel, and then through the clutch to spur shaft 23; the spur of shaft 23 is meshed with the traversing arc attached to the immobile lower carriage and rotates the upper carriage together with the cradle and gun barrel attached to it, thus providing a training movement of the gun in any given direction.

The clutch which is inside the worm gear housing operates as follows:

Worm wheel 11 (Fig 48) is connected to shaft 23 by the clutch plates stressed by the Belleville (disk) springs. As a result of the spring action, friction is produced between the clutch plates which inhibits the rotation of the plates and, consequently, prevents the rotation of the worm wheel with respect to the spur shaft.

When excessive overloads are put on the gun, however, and the forces exerted upon the mechanism exceed the admissible, the friction between the plates becomes insufficient to keep the plates from turning.

In this case, the plates rotate and, as a result, the worm turns in relation to the spur shaft, which prevents damage to the parts of the mechanism.

28. Disassembly and Assembly of the Traversing Mechanism

50X1-HUM [P 91]

The mechanism may be disassembled only for technical inspection and for the correction of [illegible]

Recuperator

The recuperator returns (counterrecoils) the recoiling parts of the gun to battery after firing and holds them in battery at all angles of elevation permitted by carriage design.

The recuperator has the following main parts:

air cylinder 2 (Figs 28 and 29),
working cylinder 3,
intermediate cylinder 4,
throttling rod plus stem 5.

The air cylinder 2 is closed by the front cover 1 and the back cover 9, which are welded to it.

In the front cover 1, nut 21 and screws 20 hold the gland casing 17 with the packings for the recuperator rod. There is a sealing ring 16 between the gland casing 17 and cover 1. /467

The recuperator rod is sealed by collar-seating ring 29 and collar-seating ring 31, two collars 30, babbitt-edged washer 28, segments 27, ring 26, gland 25, washer 24 and nut 23 with bronze bush. The collar-seating ring 31 is secured by screw 80.

The back cover 9 has one opening for the attachment of the working cylinder 3 and two sockets connected by ducts (Fig. 28, Section VV). One socket is where the nipple of the air-hydraulic pump fits and the other takes the cut-off valve 51 and packing, which consists of two brass rings and leather washers 47 held by nut 50 (secured by lock nut 49). Valve 51 and plug 48 are secured by a wire.

The socket for the instrument (pump) is connected to the air-cylinder cavity through the hydroseal tube 35 (Fig. 28, Section BB), which is attached to the rear cover 9. On the outside, the socket for the pump connection is closed by plug 48.

In the right wall of the air cylinder 2 there is a sighting window for checking the amount of fluid in the recuperator. The sighting window consists of a bushing plus shield 41, sighting glass 40, two gasket rings 39, five or six packing washers 42, thrust ring 38 and nut 37, secured by stop 43 with screws 44. The sighting window is closed by plug 36.

There are guns in which nut 37 has greater thread length as a safety factor in disassembling the sighting window. There is a corresponding change in the thrust ring 38 also.

The back end of the working cylinder 3 is connected to the back cover 9 of the air cylinder 2 by means of nut 10 and screws 11. In order to

prevent the bearing surface of the working cylinder from being mashed by screws 11, washer 8 is placed between the screws and nut 10. Between the working cylinder 3 and the back cover 9 there is a packing ring 7, which provides a hermetic seal.

The penetration of fluid into the gap between the working cylinder 3 and the gland casing 17 is prevented by a stuffing box in the front part of the cylinder; this stuffing box is made up of ring 12, gland 13, packing ring 14 and nut 15, which is secured by wire.

In the front part of the working cylinder 3 there is a valve mechanism which slows down the passage of fluid from the air cylinder into the working cylinder, thereby providing a smoother recoil motion.

The valve mechanism consists of the valve seat 34 (fitted into the working cylinder by 4 lugs), valve 33 and spring 32.

In front of the valve there are three openings e in the working cylinder for the passage of fluid.

The back end of the working cylinder is closed by cover 68 with adjusting bolt 70; a threaded hole running through bolt 70 is used to admit fluid into the space beyond the piston during simulated recoil. Between the bolt 70 and cover 68 there is a stuffing box consisting of the fitting 66 and ring 67, held down by nut 69.

The opening in the bolt is closed by plug 71, which has a screen to protect the hole from contamination. The plug is attached to the bolt by a small chain. Bolt 70 is prevented from rotating by cap 65 and two bosses $\mathcal{A}$ which fit into the gap $\mathcal{M}$ in cover 68 and four bolts secured by wire. [47]

A rubber packing ring 63, inserted through bushing 64, and a leather washer 72 provide a seal between cover 68 and working cylinder 3.

Cover 68 on the working cylinder is secured by screw 73.

There are guns in which cover 68 is held to the working cylinder by a catch 33 (Fig. 1b).

The intermediate cylinder 4 prevents the penetration of air into the working cylinder 3 during firing at high angles of elevation.

The intermediate cylinder 4 is screwed on the working cylinder. There is a copper packing ring 6 between these two cylinders.

At one end of the intermediate cylinder there is an opening for introducing fluid.

The other end of the intermediate cylinder is at front cover 1.

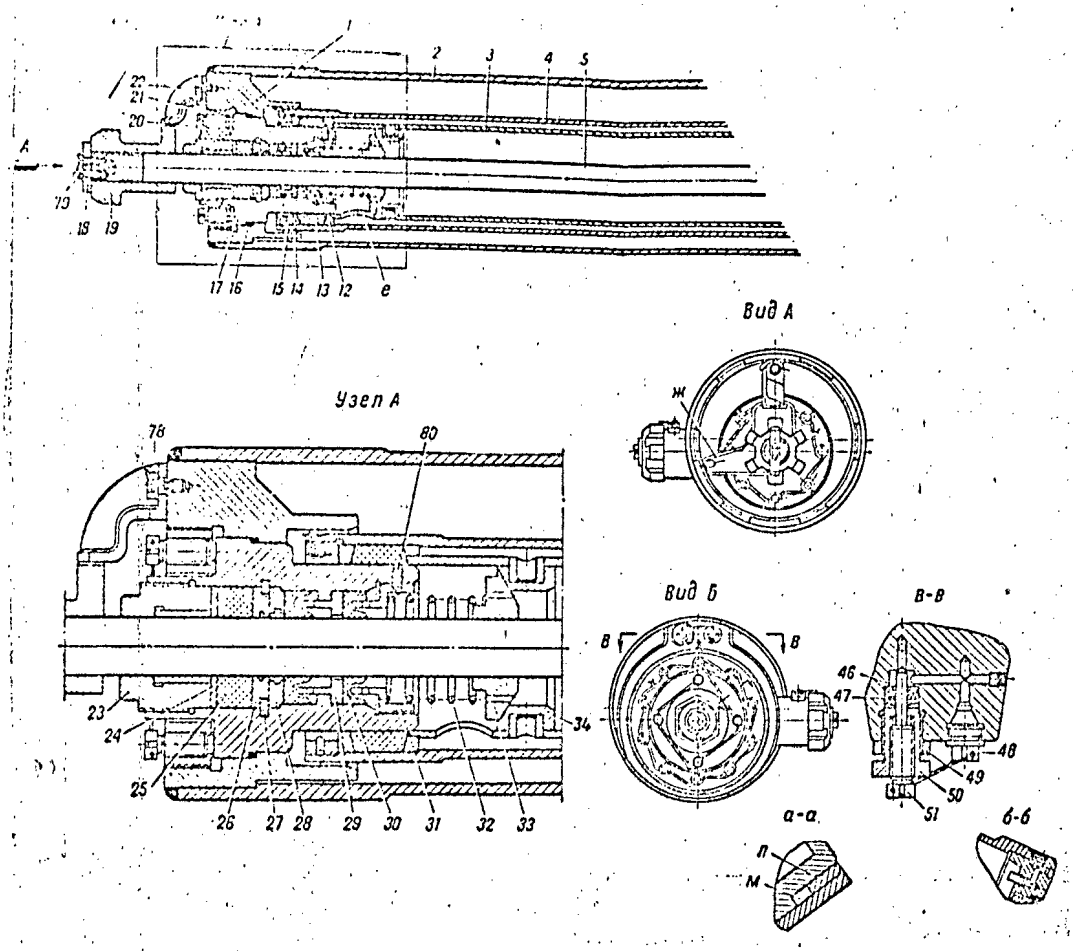


Fig 28. The Recuperator (part 1) /47/

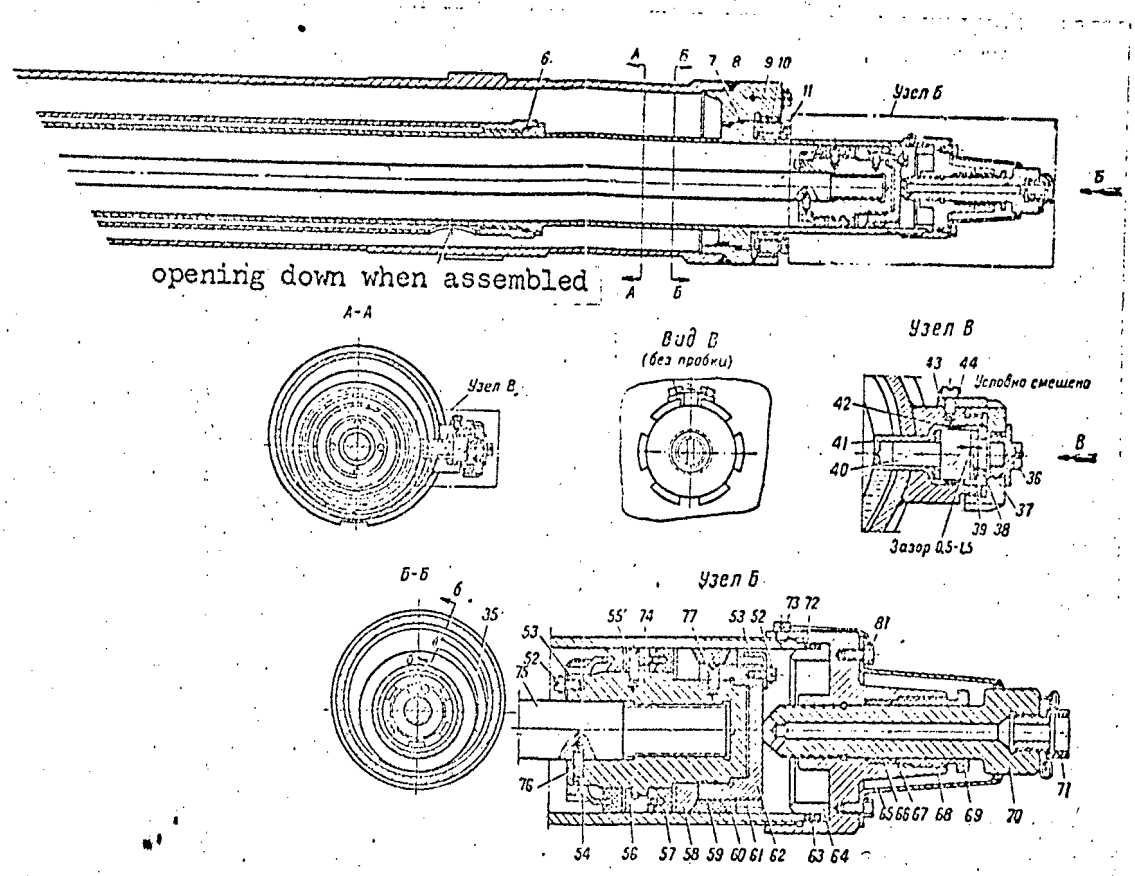


Fig 28. The Recuperator (part 2)

Fig 28. The Recuperator /477

1. front cover (10-1)
2. air cylinder (10-3)
3. working cylinder (10-4)
4. intermediate cylinder (10-9)
5. throttling rod plus piston (Sb10-15)
6. packing ring (10-8)
7. packing ring (10-53)
8. washer (10-128)
9. rear cover (10-2)
10. nut (10-29)
11. screw (10-27)
12. ring (10-10)
13. gland (10-11)
14. packing ring (10-12)
15. packing nut (10-13)
16. packing ring (10-25)
17. stuffing box (10-75)
18. stop (10-85)
19. connecting nut (10-65)
20. screw (10-27)
21. nut (10-26)
22. key (10-30)
23. nut (Sb610-13)
24. washer (10-102)
25. gland (10-80)
26. ring (10-79)
27. segment (10-46)
28. washer (Sb10-8)
29. collar seating ring (10-76)
30. collar (10-77)
31. collar-seating ring (10-78)
32. valve spring (10-24)
33. valve (10-23)
34. valve seat (10-6)
35. tube (10-63)
36. plug (10-110)
37. nut (10-109)
38. thrust ring (10-108)
39. gasket ring (10-105)
40. sight glass (10-106)
41. bushing plus shield (10-104)
42. packing ring (10-107)
43. stop (10-111)
44. screw (A51066-7)
46. ring (10-103)
47. leather washer (10-54)
48. plug (10-58)
49. lock nut (10-56)
50. nut (10-55)
51. valve (10-57)
52. screw (A51066-7)
53. plug (10-91)
54. collar-seating washer (10-87)
55. screw (A51063-9)
56. collar-seating washer (10-86)
57. collar (10-83)
58. ring (10-97)
59. gland (10-98)
60. ring (10-99)
61. nut (10-100)
62. casing (10-101)
63. packing ring (10-115)
65. cap (Sb10-20)
66. stuffing-box fitting(10-117)
67. ring (10-118)
68. cover (10-114)
69. nut (10-119)
70. adjusting bolt (10-120)
71. plug (Sb10-16)
72. leather washer (10-127)
73. set screw (10-62)
74. piston (10-96)
75. rod (10-32)
76. screw A51063-13
77. screw A51063-9
78. bolt 51001-42
79. screw A51066-137
80. screw A51063-9
81. bolt 51002-178

e. hole
Zh. arm
l. boss in cap 65
m. slot in cover 68

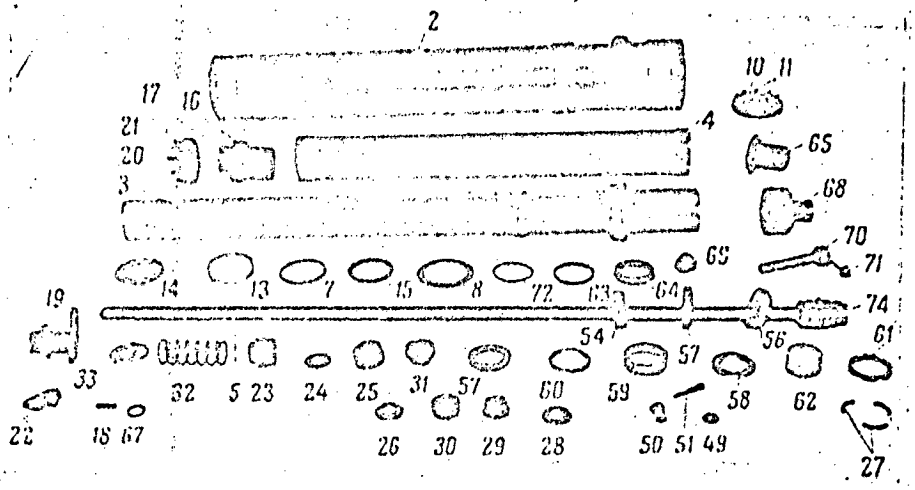


Fig 29. Recuperator Parts

2. air cylinder (10-3)
3. working cylinder (10-4)
4. intermediate cylinder (10-9)
5. throttling rod plus piston (Sb 10-15)
7. packing ring (10-53)
8. washer (10-128)
10. nut (10-29)
11. screw (10-27)
13. gland (10-11)
14. packing ring (10-12)
15. packing nut (10-13)
16. packing ring (10-25)
17. stuffing box (10-75)
18. stop (10-85)
19. connecting nut (10-65)
20. screw (10-27)
21. nut (10-26)
22. key (10-30)
23. nut Sb 10-13
24. washer (10-102)
25. gland (10-80)
26. ring (10-29)
27. segments (10-46)
28. washer (Sb 10-8)
29. collar-seating ring (10-76)
30. collar (10-77)
31. collar-seating ring (10-78)
32. valve spring (10-24)
33. valve (10-23)
49. lock nut (10-56)
50. nut (10-55)
51. valve (10-57)
54. collar-seating washer (10-87)
56. collar-seating washer (10-86)
57. collar (10-83)
58. ring (10-97)
59. gland (10-98)
60. ring. (10-99)
61. nut (10-100)
62. casing (10-101)
63. packing ring (10-115)
64. bushing (10-116)
65. cap (Sb 10-20)
68. cover (10-114)
69. nut (10-119)
70. adjusting bolt (10-120)
71. plug (Sb10-16)
72. leather washer (10-127)
74. piston (10-96)

The mechanism may be disassembled together with the barrel and cradle, or independently.

Disassembly

1. Remove the bevel gear housing (if it has not been separated earlier) as follows: Knock out cotter pins 27 (Fig 50), after first bringing together the spread ends, and remove sleeve 28; knock out the cotter pins and remove ball joints 29, together with their shanks, from shaft 53 of the bevel gear housing and from shaft 38 of housing 87 (Fig 46).

Since the cotter pins which connect ball joints 29 with shafts 38 and 53 and with sleeve 28 are not identical, scribe marks must be made during disassembly to facilitate return to the correct places during subsequent assembly.

2. Remove shaft 38 and handwheel 30 (Fig 50) as follows: Knock out cotter pins 27 and remove handwheel 30; bend out the tabs of lock washers 62 and use wrench A52830-2 to remove bolts 63, then remove covers 34; remove shaft 38 together with bearings 36, tube 37 and bushing 33; remove bushing 33; if bearings are to be replaced, remove bearing 36, tube 37 and the second bearing 36 from shaft 38.

3. Remove the bevel gear housing as follows: bend out the tabs of lock washers 61; use wrench A52830-4 to remove bolts 32 and remove the bevel gear housing from the upper carriage; remove screws 64 which hold the dog clutches on the shafts of the bevel gear housing and worm gear housing; remove the dog clutches 25 and spider 26.

4. Disassemble the bevel gear housing as follows: Bend out the tabs of lock washers 66 and, with wrench A52830-2, loosen bolts 65, which hold cover 59, and remove them together with gasket 56; bend out the tabs on washer 40 and, with wrench A52830-2, loosen bolts 50 and remove cover 49; remove bushing 51 together with shaft 53, gear 55 and bearings 54; remove gasket 52; unscrew screw 67 which holds washer 57, remove this washer and gear 55; if bearings 54 are to be replaced, remove them and bushing 51 from shaft 53; bend out the tabs of lock washers 40, loosen bolts 50 and remove cover 41; while holding shaft 45, unscrew screw 67, which holds washer 57, remove washer 57 and the second gear 55 from the shaft; if the bearings are to be replaced, remove key 58 and knock shaft 45 out of tube 44 and bearing 42 out of the housing by tapping with a hammer on a copper knock-out piece at the end of the shaft; remove tube 44 and bearing 42 from the shaft 45; knock out the second bearing 42.

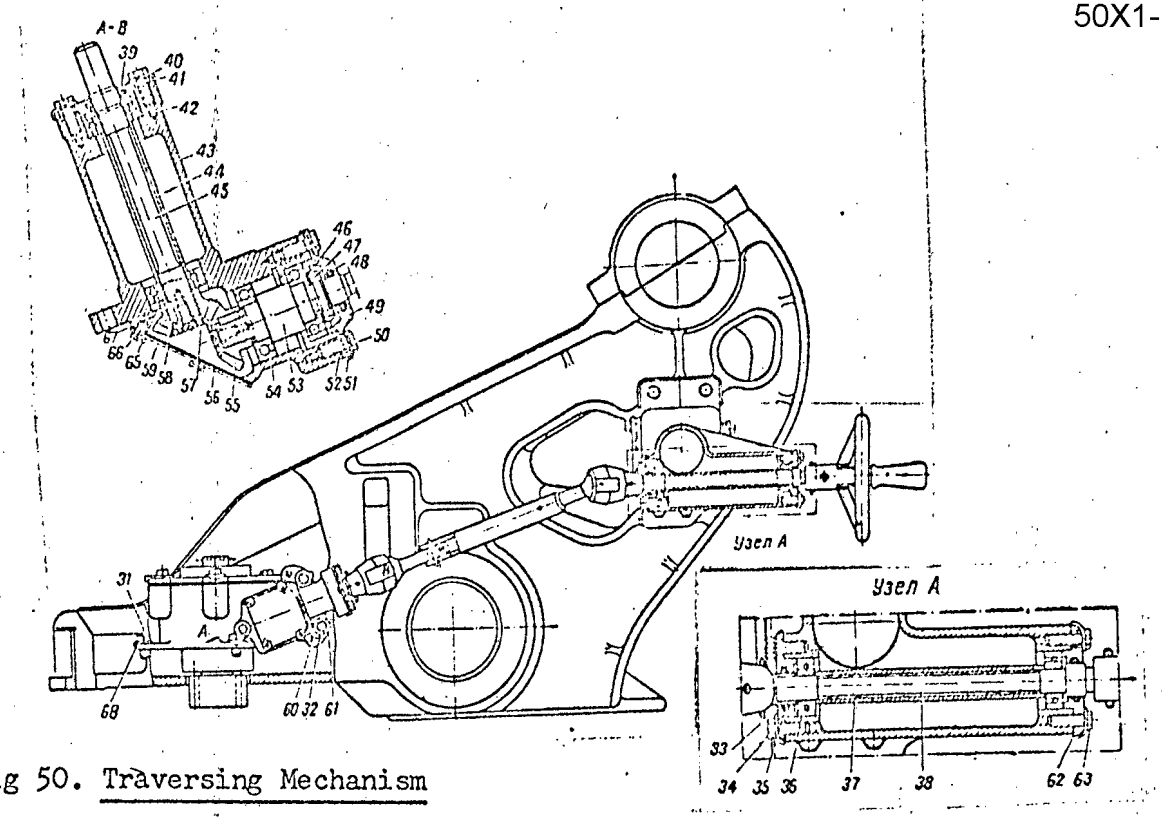


Fig 50. Traversing Mechanism

[p 91]

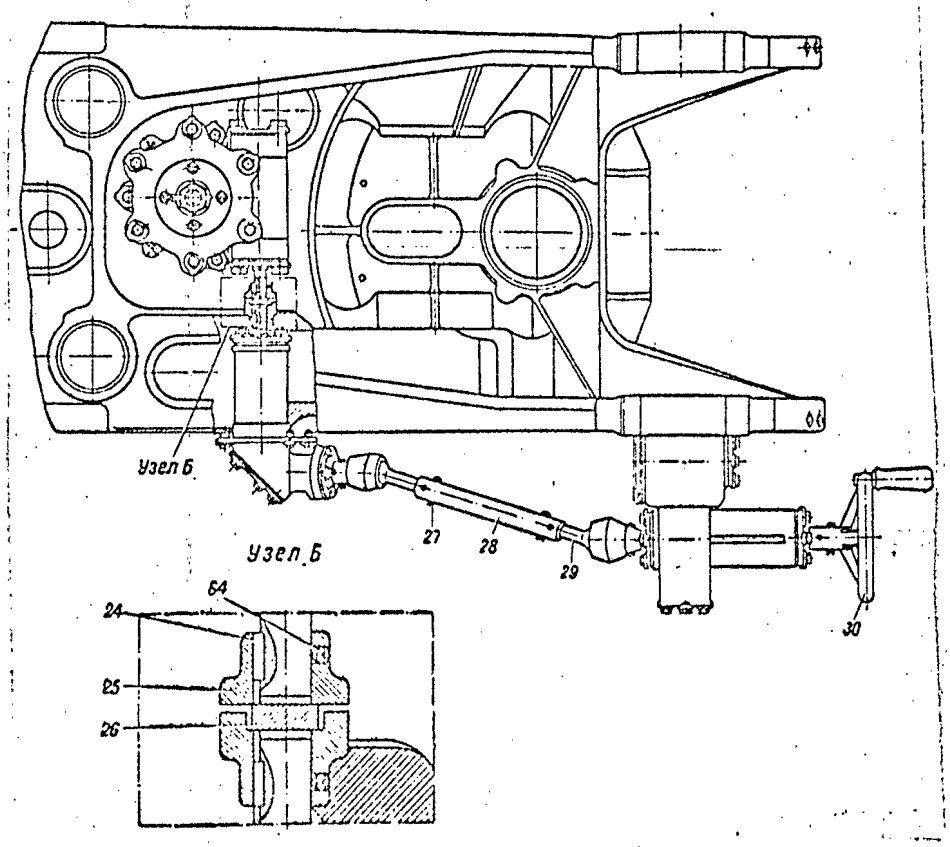


Fig 50. Traversing Mechanism

24. key (A51050-220)
25. dog clutch (22-65)
26. spider (22-66)
27. cotter pin (A51043-6)
28. sleeve (22-49)
29. ball joint and shaft (Sb21-5)
30. handwheel (Sb22-6)
31. bolt (A51000-35)
32. bolt (A51000-16)
33. bushing (22-41)
34. cover (22-40)
35. gland (21-45)
36. ball bearing No 204
37. tube (22-72)
38. shaft (22-58)
39. gland (21-45)
40. lock washer (A51024-44)
41. cover (22-40)
42. ball bearing No 204
43. housing (22-30)
44. tube (22-39)
45. shaft (22-31)
46. washer (A51024-25)
47. circular nut (A51970-8)
48. gland (21-45)
49. cover (21-55)
50. bolt (A51000-6)
51. bushing (21-32)
52. gasket (21-62)
53. shaft (22-48)
54. ball bearing No 206
55. gear (22-34)
56. gasket (22-44)
57. washer (21-52)
58. key (A51050-220)
59. cover (22-45)
60. bayonet pin (22-71)
61. lock washer (A51024-45)
62. lock washer (A51024-44)
63. bolt (A5100-6)
64. screw bolt (A51063-8)
65. bolt (A51000-1)
66. lock washer (A51024-43)
67. screw bolt (A51060-13)
69. lock washer (A51024-47)

5. Remove the worm gear housing as follows: Bend back the tabs of lock washers 68 and, with wrench A52840-43, remove bolts 31; use a pinch bar to remove the housing from the upper carriage. [p 92]

6. Disassemble the worm gear housing as follows: Bend back the tabs of lock washers 61 (Fig 48) and, with wrench A52830-4, remove bolts 8 which hold covers 4 and 7 and remove the covers together with gaskets 5; remove the pin and, with wrench A52830-6, remove nut 17; bend back lock washer 70 and, with wrench A52830-5, remove bolts 69 which hold cover 10, and remove the cover together with the parts attached to it; remove gasket 20; by tapping lightly with a hammer on a copper knock-out piece at the end of shaft 23, knock out the shaft together with the gears, washer 16, bearing 15 and Belleville springs 22; by tapping lightly with a hammer on a copper knock-out piece at the end of the worm, knock the worm 2 and bearings 1 out of the housing; remove worm wheel 11 and the clutch plates 12, 13, and 14; by tapping with a hammer on a copper knock-out piece, remove from the worm 2 the inside washer of bearing 1 located on the side opposite the dog clutch 25 (Fig 50); if a replacement is necessary, remove from the worm the second bearing 1 (Fig 48); if the bearing 15 has to be replaced, remove it from shaft 23 together with the gears and remove washer 16; if bearings 21 must be replaced, remove screws 71 holding cover 9, remove the cover, gaskets 19 and bearings 21.

Before the mechanism is reassembled, all parts must be cleaned and lubricated. The clutch plates rubbed dry, and not greased.

Assembly

1. Assemble the worm gear housing as follows: Place bearings 21 (Fig 48) in housing cover 10, position gaskets 19, cover 9 and fasten with screws 71, then prick-punch the screws; slip washer 16 and bearing 15 on spur gear shaft 23 and place the unit into the housing; slip three Belleville springs 22 and clutch plates 14, 13, and 12 on the shaft; when installing the clutch plates, first put in the thick steel plate, then the others and make sure that the steel and brass plates alternate; slip the worm wheel 11 on the spur gear shaft 23; put cover 10 and the parts attached to it on shaft 23, after first positioning gaskets 20; attach the cover with bolts 69 and lock the bolts with lock washers 70; use wrench A52830-7 to turn up nut 17 until the horizontal scribe mark on the edge of the nut coincides with the center of the bottom of the cotter pin hole; this guarantees the correct stress exerted by the Belleville springs on the clutch plates; before tightening nut 17 check to see that the grooves in spur shaft 23 coincide with the grooves in the upper clutch plate 12; misalignment can result in damage to the plate; place worm in housing, put onto worm journal the inside roller-bearing races 1, position the holders with the rollers and the inside races, then pp ition gasket 5 and covers 4 and 7, after first inserting gland 3 . [p 93]

into cover 4; use wrench A52830-4 to tighten bolts 8 holding the covers and lock them with lock washers 61.

2. Install the worm gear housing as follows: Install the housing in the receiver of the upper carriage; draw up bolts 31 with wrench A52840-43 and lock their lock washers 68 (Fig 50).

3. Assemble the bevel gear housing as follows: Slip bearing 42 and tube 44 on shaft 45 and place the shaft into housing 43; slip the second bearing 42 on the shaft, insert key 58, gear 44 and washer 57 and attach with screw 67, then prick-punch the screw; place gland 39 in cover 41, install cover 41 and use wrench A52840-10 to tighten bolts 50, then lock the bolts with lock washers 40; slip bearing 54 on shaft 53; then insert key 58, gear 55 and washer 57 and attach with screw 67, then prick-punch the screw; insert shaft 53 and the parts attached to it into housing 43; insert the second bearing 54 into bushing 51, position the gaskets 52 and place the bushing together with the bearing into housing 43; put on washer 46 and, with wrench A52832-19, tighten nut 47 and lock it with lock washer 46; place gland 48 into cover 49, put the cover in place and, with wrench A52830-2, tighten bolts 50 and lock them with lock washers 40; position washer 56 in cover 59; with wrench A52840-10 tighten bolts 65 and lock them with lock washers 66; install ball joint and shaft 29 on shaft 32 and attach with cotter pins 27 and spread the ends.

4. Install the bevel gear housing as follows: Put key 24 on shaft 45 of the bevel gear housing and place dog clutch 25 (Fig 50) on worm 2 (Fig 48) of the worm gear housing, attach the spider 26, and secure the dog clutch with screws 64; prick-punch the screws; place the bevel gear housing into the upper carriage, fitting the two openings with bayonet pins 60 simultaneously, and with wrench A52840-23 tighten bolts 32, then lock them with lock washers 61.

5. Install shaft 38 and handwheel 30 as follows: Slip bearing 36 on shaft 38 and place shaft 38 into housing 87 (Fig 46), then put on tube 37 (Fig 50), the second bearing 36 and bushing 33; place gland 35 into cover 34, put the cover on housing 87 (Fig 46) and, with wrench A52830-2, tighten bolts 63 and lock them with lock washers 62; install ball joint and shaft 29 and attach it with conical (cotter) pins 27 and spread the ends of the cotter pins; slip handwheel 30 on the shaft and secure it with two cotter pins, then spread the ends of the pins.

6. Connect the handwheel shaft 38 with the bevel gear housing as follows: Install sleeve 28 according to the scribe marks made during dismantling and attach it with four cotter pins 27; spread the ends of the cotter pins; check the operation of the assemble training mechanism; the handwheel should turn smoothly without jamming.

If necessary, the worm and bevel gearing can be adjusted by changing the thickness of gasket 20 (Fig 48) and gasket 52 (Fig 50).

29. The Equilibrator

The equilibrator (Figs 52-55) provides a condition of equilibrium for the pivoting part of the gun and ease of operation of the elevating mechanism.

The equilibrator consists of the right column 5 (Figs 52 and 53) and the left column 7 and the bottle 1.

The bottle is connected with the right column by the distributor and tubes 3 and 4. The right and left columns are connected by connecting tube 6.

The right column of the equilibrator consists of the outer cylinder 19 (Fig 54) and the piston 25.

The outer cylinder 19 (Figs 53 and 54) is terminated at the top by the top support 27, in which there is an eye to provide connection between the equilibrator and the cradle. Bearing 28 fits into this eye and is held by washer 30.

Gland 29 protects bearing 28 from contamination. In the lower part of the outer cylinder there are two bushings 14 and 18 to guide the piston and packing consisting of collar 15, collar seating ring 16 and sleeve 11 with gland 13.

Gland 13 removes sand and dust from the piston surface when the elevating mechanism is being operated. It must be remembered that the gland is not designed to remove dirt from the piston surface; for this reason, dirt and other contaminants should be wiped off with a rag before the elevating mechanism is operated.

At the side of the outer cylinder there is a nipple with a tap 38 for checking the level of the fluid. The piston head 37 of the right piston is at the bottom, and the top of the piston is covered by casing 26. At the head of the piston there is a valve for introducing air into the mechanism, an opening for connecting up the connecting tube 6 and a ball pivot by which the piston is attached to the upper carriage. The valve consists of the valve itself 36, washer 32, leather washer 33, nut 34 and lock nut 35.

The piston head also has an opening to provide a means of connecting tube 4, which extends from distributor 8 (Fig 52). The opening v (β) in Fig 53 is used to introduce both pistons and to solde
tube 20, which is used to feed fluid into the outer cylinders in order to maintain their pressures.

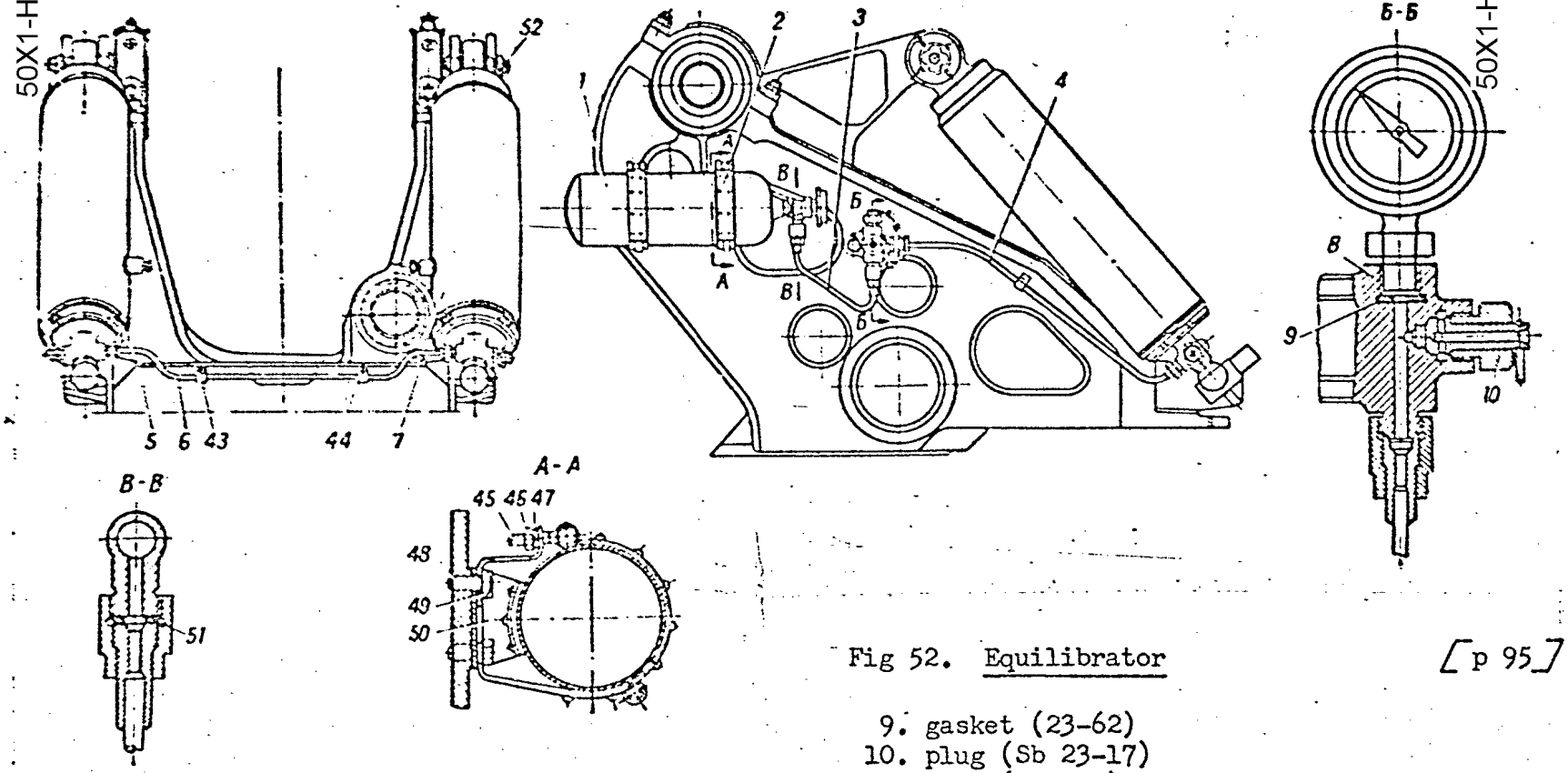


Fig 52. Equilibrator

[p 95]

1. bottle
2. clip (Sb 23-19)
3. tube (Sb 23-16)
4. connecting tube (Sb 23-21V)
5. right column (Sb 23-4)
6. connecting tube (Sb 23-22)
7. left column (Sb 23-5)
8. distributor (23-33)
9. gasket (23-62)
10. plug (Sb 23-17)
43. clip (23-128)
44. screw (A51061-11)
45. swing bolt (23-171)
46. nut (A51010-5)
47. spring washer(A51027-5)
48. bolt (A51000-36)
49. lock washer (A51024-47)
50. bottle cradle (Sb 23-18)
51. gasket (23-160
52. shaft (23-22)

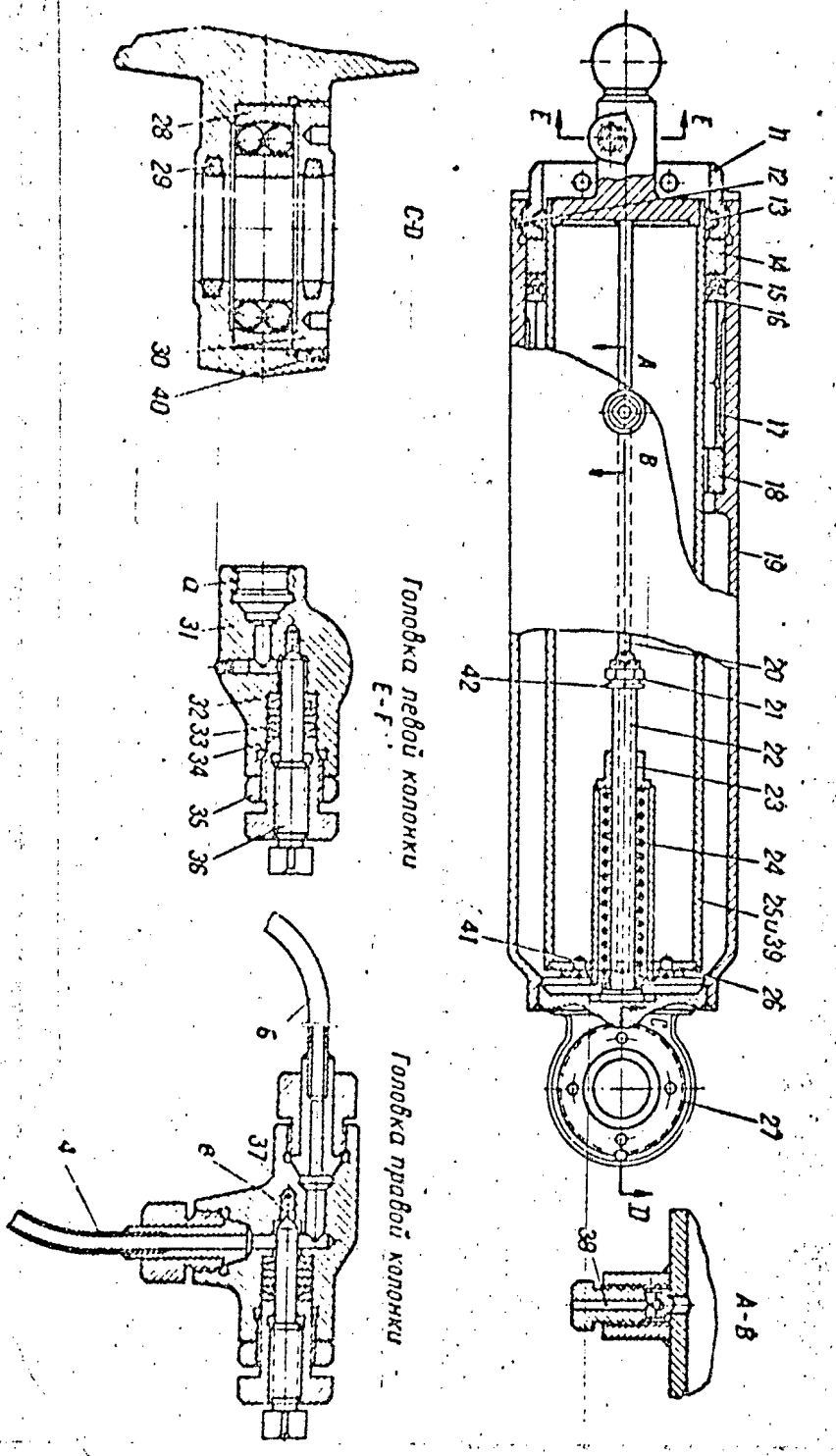


Fig 53. Equilibrator

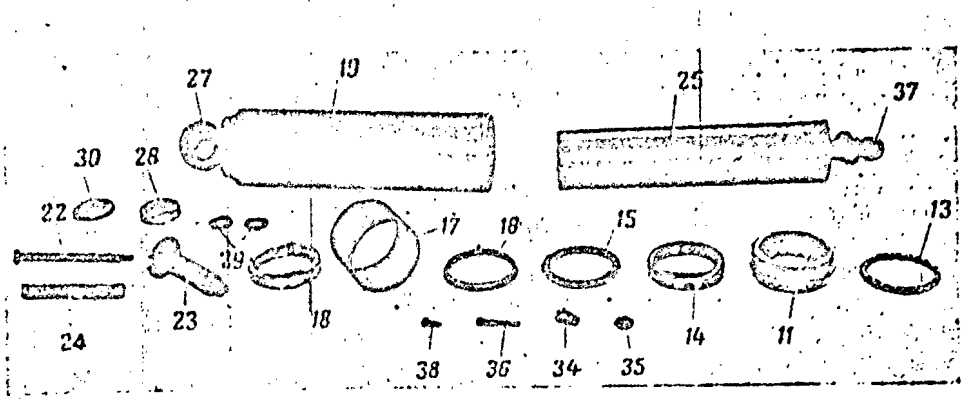
[p 96]

Fig 53. Equilibrator Mechanism (legend)

[96]

4. connecting tube (Sb 23-21)
6. connecting tube (Sb 23-22)
11. sleeve (23-6)
12. screw (A51065-4)
13. gland (23-63)
14. bushing (23-12)
15. collar (23-74)
16. collar seating ring (23-11)
17. bushing (23-13)
18. bushing (23-10)
19. outer cylinder (23-146)
20. tube (23-16)
21. nut (A51011-5)
22. piston pin (23-141)
23. barrel (S 623-20)
24. spring (23-143)
25. right piston (Sb 23-1)
26. casing (23-5)
27. top support (23-17)
28. ball bearing No 1308
29. gland (23-20)
30. washer (23-19)
31. left piston head (23-2)
32. washer (10-103)
33. leather washer (10-54)
34. nut (23-55)
35. lock nut (10-56)
36. valve (10-57)
37. right piston head (23-1)
38. tap (23-23)
39. left piston (Sb 23-2)
40. screw (A51065-4)
41. screw (A51060-12)
42. washer (A 51021-6)

a. opening for connecting tube 6
b. opening under tube 20.



[97]

Fig 54. Parts of the Equilibrator Mechanism

11. sleeve (23-6)
13. gland (23-63)
14. bushing (23-12)
15. collar (23-74)
16. collar seating ring (23-11)
17. bushing (23-13)
18. bushing (23-10)
19. outer cylinder (23-146)
22. piston pin (23-141)
23. barrel (Sb 23-20)
24. spring (23-143)
25. right piston (Sb 23-1)
27. top support (23-17)
28. bearing No 1308
29. gland (23-20)
30. washer (23-18)
34. nut (23-55)
35. lock nut (23-55)
36. valve (10-57)
37. right piston head (23-1)
38. tap (23-23)

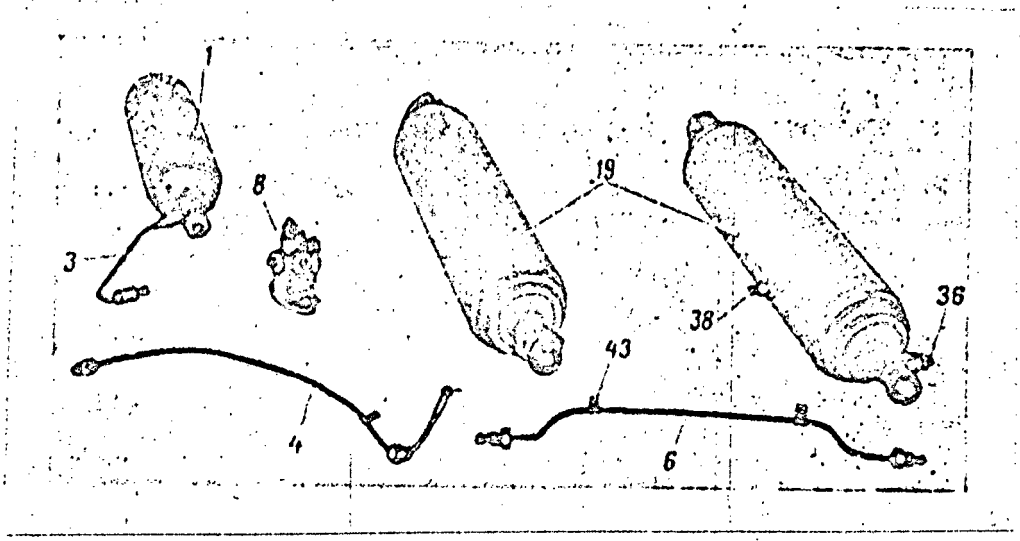


Fig 55. Equilibrator Mechanism [p 97]

1. bottle
3. tube (Sb 23-16)
4. connecting tube (Sb 23-21)
6. connecting tube (Sb 23-22)
8. distributor (23-33)
19. outer cylinder (23-146)
36. valve (10-57)
38. tap (23-23)
43. clip (23-128)

Barrel 23 is attached to spring 24 and piston pin 22 in the cover at the top of the piston.

The purpose of spring 24 is to provide supplementary equilibration to the pivoting part of the gun at small angles of elevation. At the side of barrel 23 there are openings for the passage of air into the piston.

The left column of the equilibrator consists of outer cylinder 19 and piston 39. The outer cylinders of the right and left columns are identical.

The left piston 39 differs from the right piston 25 only in that the head 31 of the left piston does not have the opening for connecting up the tubes coming from the distributor 8 (Fig 52); otherwise the two pistons are identical. [p 97]

Bottle 1 (Figs 52 and 55) is mounted on the right side of the upper carriage and is used to regulate the pressure in the equilibrator. Tube 3 connects the bottle with the distributor 8. The bottle rests against the bottle-cradle 50 and is held by the clips 2, which are tightened by swing bolts 45. The bottle cradle and the clips are attached to the upper carriage by bolts 48.

Distributor 8 is used to adjust the manometer during an adjustment of pressure inside the equilibrator and to adjust plug 10 which exhausts air, and to connect up connecting tubes 3 and 4 coming from the bottle and the right column of the equilibrator.

The middle parts of tubes 4 and 6 are attached to the upper carriage by clips 43 and screws 44. [p 98]

There are guns in which connecting tube 4 has two compensating loops to facilitate the functioning of the tube.

30. Operation of the Equilibrator

Air compressed in the columns of the equilibrator attempts to expand and to push up the outer cylinder, since the inner cylinder (piston) is held in the bracket of the upper carriage by the ball pivots.

The outer cylinders, which are connected to the cradle, transmit this action to the cradle and barrel and, when the equilibrator mechanism is properly adjusted, reduce the overbalance of the muzzle end of the barrel by producing a negligible overbalance of the breech or muzzle end of the barrel.

When the angle of elevation of the gun is increased, the compressed air in the equilibrator acts upon the outer cylinder, thereby pushing the forward part of the cradle upward, which facilitates the operation of the elevating mechanism.

When the angle of elevation is reduced, the pressure of the air in the equilibrator is increased as a result of its decrease in volume. Thus a slight overbalance of the breech or muzzle end of the gun is maintained, which is easily overcome by the elevating mechanism.

31. Disassembly and Assembly of the Equilibrator

Disassembling the equilibrator mechanism is permitted only for technical inspection or to correct failures.

Disassembly

1. Remove the equilibrator from the gun in the order described in Chapter 12.

If the equilibrator is removed for disassembly, the air should be discharged from it.

2. Remove the pistons from the outer cylinders and pour the fluid out of them into a clean jar. If the pistons are tight and difficult to remove by hand, pry them loose with a lever inserted between the projections of the valve and sleeve 11 (Fig 53).

3. Disassemble the outer cylinder as follows: unscrew screw 12 and use wrench A52832-160 to remove sleeve 11 together with gland 13; remove bushing 14, collar 15, collar seating ring 16, bushing 17, and bushing 18; if bearing 28 is to be replaced, remove screw 40 and use wrench 42-233 to remove washer 30; remove ball bearing 28.

4. Disassemble the right 25 and left 39 pistons as follows: remove screws 41 and take out barrel 23 together with the parts attached to it; remove the cotter pin and use wrench A52830-5 to remove nut 21; remove washer 42 and piston pin 22, then spring 24 from the barrel 28; if parts of the valve are to be replaced, use wrench Sb42-52 to remove valve 36; use wrench A52830-6 to remove lock nut 35; use wrench A52830-5 to remove nut 34 and, with wrench A53435-21, remove washers 33 and 32; remove tap 38 from the outer cylinders.

Assembly

1. Assemble right 25 and left 39 piston (Fig 53) as follows: Place the brass washer 32, four leather washers 33 and the second brass washer 32 into position, then use wrench A52830-5 to tighten nut 34, and wrench A52830-6 to tighten lock nut 35 on nut 34, and use wrench Sb42-52 to screw in the valve 36; place spring 24 and piston pin 22 into barrel 23, place washer 42 into position and use wrench A52830-5 to tighten nut 21, then lock the nut with its cotter pin. Insert barrel 23 and the parts attached to it into cover 26, secure the cover with screws 41 and prick-punch the screws.

2. Assemble the outer cylinder as follows: Place bearing 28 into position and use wrench 43-233 to draw up washer 30, then secure it with screw 40, and prick-punch the screw; place bushing 18, bushing 17 and collar seating ring 16 into the outer cylinder; place funnel 42-171 into the cylinder and guide collar 15 into place through the funnel, then remove the funnel 42-171; place bushing 14 into position and use wrench A52832-160 to screw in bushing 11 and gland 13, then fasten with screw 12.

3. Assemble the outer cylinders together with the pistons as follows: use wrench Sb42-52 to open valves 36; place the pistons in the outer cylinders; pour 0.5 liter of steol-M fluid through the holes under tap 38 into the outer cylinders; use wrench Sb42-52 to close valves 36; screw taps 38 into the holes in the outer cylinders.

4. Install the equilibrator mechanism on the gun as indicated in Chapter 12.

The adjustment of pressure inside the equilibrator mechanism is done after the gun has been fully assembled. The procedure is given in Chapter 14.

CHAPTER SIX

[100]

BOTTOM CARRIAGE AND TRAILS

32. Bottom Carriage

The bottom carriage serves as a foundation for the traversing part of the gun, as a connecting link to the trails and as housing for the suspension.

The bottom carriage is in the form of a steel casting. On the upper surface of the bottom carriage are two supporting areas ye and l (Fig. 56) on which the top carriage rests during firing. In the middle of area ye is a hole zh for the top-carriage pivot. The area ye has two curved lubrication grooves i. Area l has a recess u (Fig 57) for the top-carriage lock used during transportation of the gun.

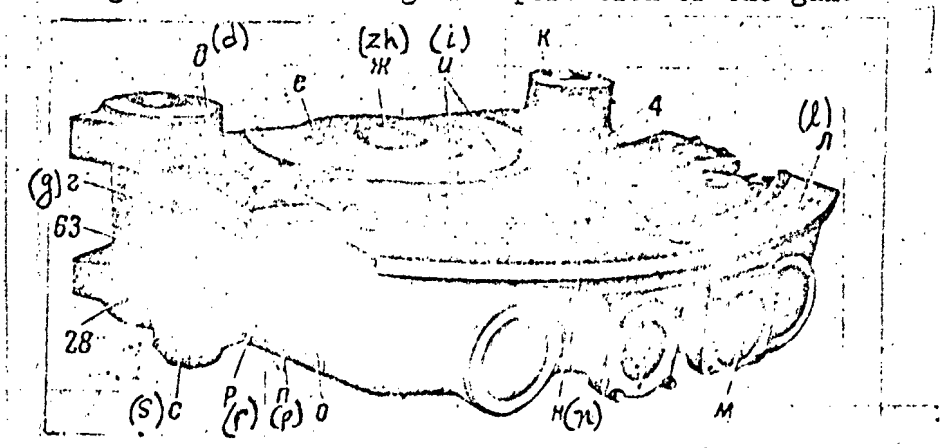


Fig. 56 Bottom Carriage (from above).

4 - slug (18-49), 28 - grease cup (A-72273-6), 63 - lever shaft (18-167), g - lightening hole, d - eye, ye - supporting area, zh- opening for the pivot, i - grooves, k - eye, l- bearing area, m - recess for the air tank of wheel brake, n - check projection for front grip of top carriage, 0 - rocker-arm-travel limiter, p - buffer mounting shelf, r - window for housing the suspension, s- check lug.

The top of the carriage has three windows which lighten the structure and facilitate cleaning; the middle window f is open, while the two end windows are covered by lids 31.

On the upper right side of the carriage are four holes for bolts 72 which fasten the control valve of the wheel brake.

On the left and right side of the saddle are eyes d and k [illegible] [101]
with vertical holes for fastening the trails to the bottom carriage. On each of these eyes are two bosses with supporting surfaces Shch (Fig. 57)

on which rest the supporting surfaces ye of the trails (Fig. 63), when gun is in firing position. On the eyes d and k are two grease cups 28 for lubricating the hinge bolts of the trails.

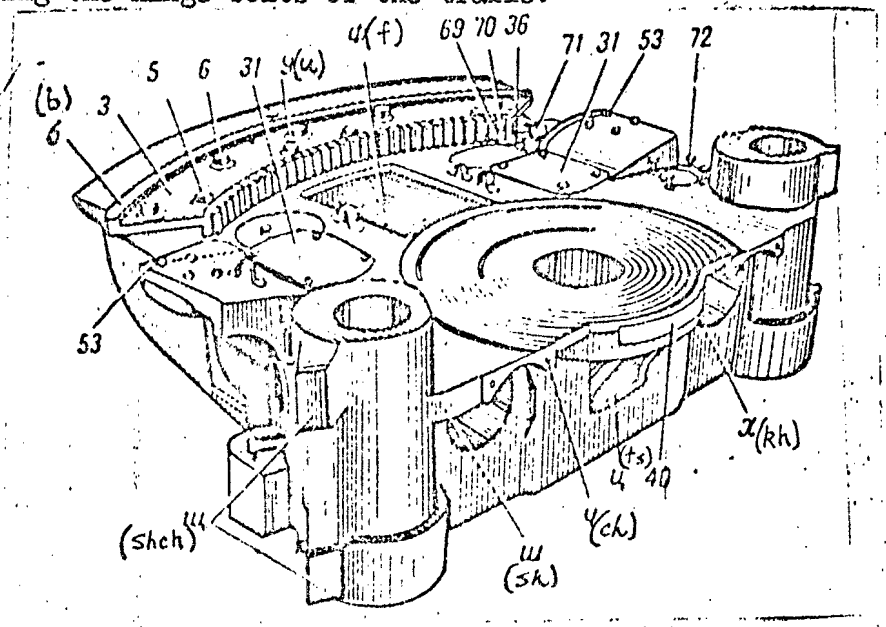


Fig. 57. Bottom Carriage (from top and back)

3 - arc (18-47), 5 - special bolt (18-48), 6 - lock washer (A 51023-9), 31 - lid (18-168), 36 - roller (26-30), 40 - strip (18-5), 53 - nut (A51011-3), 69 - check 18-3), 70 - screw (A51060-10), 71 - shield (18-14), 72 - bolt (A51002-15), b - arc track; u - recess for the trail lock, f - window for mounting and cleaning, kh - window for housing the suspension, ts - window for mounting and cleaning, ch - tapped hole, Sh- supporting surface, shch - supporting surface.

On the right and left sides are bosses s with holes for locks 52 (Fig. 58), which clamp the trails in firing position. The locks 52 are connected to levers 21 and 29 which rotate on shafts 63 welded to the side walls of the front part of the bottom carriage. The levers 21 and 29 have bushings with openings into which are inserted small bars when the locks are disengaged.

Some guns have composite locks 52 (Fig. 58, sect. "bb" - II var.); which improve the smoothness of its travel in the seat of the bottom carriage. The composite lock consists of a cylinder 69, rod 70, spring 51 and bushing 71.

On the right and left side of the carriage are shelves n (fig. 56) on which are mounted rubber buffers 55 (Fig. 58). On the march these buffers absorb shocks from the rocker arm which are not fully absorbed by the torsion bars. These rubber buffers 55 are fastened by bolts 54 and nuts 53. Close to the shelves n (fig. 56) are located checks o which restrict the upper movement of the rocker arm. Under these shelves are located windows r for mounting the suspension mechanism, and windows g for reducing the weight of the carriage.

In the upper front part of the carriage the traversing arc 3 (Fig. 57) with nine bolts 5 (Fig. 57) and two slugs 4 (Fig. 56). The bolts 5 are locked by washers 6.

The arc has a track b to support the rollers of [102] the top carriage. At the bottom land of the arc gear are fastened two checks 69 by screws 70 which limit the rotation of the top carriage on the bottom carriage.

On the top of the carriage axle is mounted a shield 71 with roller 36 to hold the cable of the wheel brake.

The protruding front part of the carriage has a highly machined surface and forms a projection n (Fig. 56) for the support of the front grip of the top carriage.

On the front wall of the bottom carriage are four cylindrical openings; two of these openings are located in square bosses (one of which m houses the wheel-brake air tank, and the other the stop signal), and the two extreme openings with bronze bushings house the suspension mechanism.

At the back of the bottom carriage is a window Ts (Fig. 57) for mounting and cleaning. To the left and right of this window are two openings Kh for housing the suspension. Each of them has two holes ch for fastening check plates 38 (Fig. 58) of the suspension-regulating levers 27 and 39. Near these openings are located supporting surfaces Sh (Fig. 57) on which the carriage stops Zh (Fig. 57) rest when the gun is in the traveling position. At the back of the carriage, on the arc surface, is a strip 40 (Fig. 57) with graduations in thousandths for coarse azimuth sighting of the gun.

In the lower middle part of the carriage are two windows for mounting and lightening. The front window is covered by a lid 61 (Fig. 58). At the bottom of the carriage there are six windows for lightening, two of which are covered by lids 59.

The suspension mechanism (Fig. 58 and 59 consists of two identical mutually coupled parts (right and left) housed in the right and left parts of the bottom carriage.

The suspension mechanism consist of two torsion bars 7, coupled to the wheels by front busings 8, right 13 and left 1 rocker arms.

The torsion bars are connected to the bottom carriage by the right 27 and left 39 regulating levers, housing 46 and tie screws 47, also by the right 25 and left 37 rear bushings with levers.

The right 25 and left 37 rear bushings with levers are connected to each other by the parallelogram connecting rod (42).

On the rear bushings 25 and 37 with levers are mounted right 16 and left 30 levers for locking in firing position and openings for disengaging pins 15 the suspension.

The torsion bars 7 are in the form of steel rods with slotted heads at the ends. The front ends of the torsion bars 7 are coupled with the front bushings 8, while the rear ends are coupled with right 27 and left 39 regulating levers.

The front bushings 8 (Fig. 58) are in the form of tubes with slotted ends. On the front and rear ends are external slots for coupling with the rocker arms; on the front ends are internal slots for coupling to the torsion bars 7.

The outer surface of front bushings 8 has two highly finished surfaces with which bushings 8 rest on the bronze bushings of the bottom carriage.

The right 13 and left 1 rocker arms (Fig. 58) are in the form of hollow steel castings with pressed in journals 65 and bushings 12. The [103] pins 65 are welded to rocker arms and are intended for setting the wheel of the carriage.

The bushings 12 are fastened by four slugs and four bolts 10. The internal surface of the bushings 12 have slots for coupling with the slots of the front bushings 8.

The rocker arm eyes have internal slots for fastening front bushings 8. On the upper side of the rocker arms are bearing surfaces g (fig. 59) which rest on the buffers 55 (fig. 58) and take the heavy jolts in transportation.

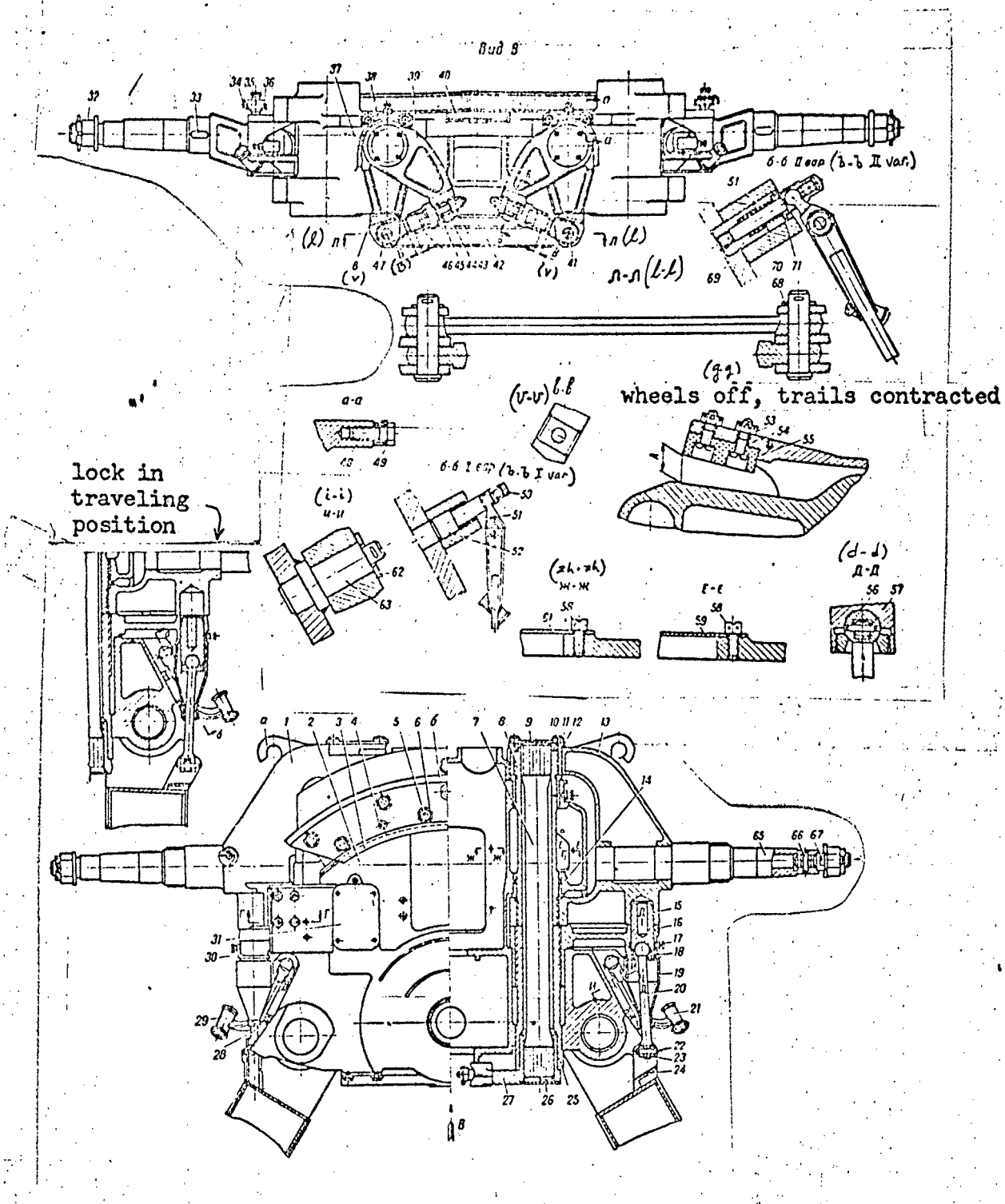


Fig 58. Bottom Carriage with Suspension Mechanism

50X1-HUM

Fig. 58 [102]

Bottom Carriage with Suspension Mechanism.

1. Left rocker arm with journal (Sb18-10)
2. bottom carriage (Sb18-1)
3. arc (18-47)
4. slug (18-49)
5. special bolt (18-48)
6. lock washer (A51023-9)
7. torsion bar (18-32)
8. front bushing (18-101)
9. lid (18-92)
10. bolt (A51000-32)
11. lock washer (A51024-46)
12. bushing (18-92)
13. right rocker arm with journal (Sb18-11)
14. bushing (18-2)
15. pin (18-18)
16. right lock lever for firing position (18-16)
17. grease cup (A72273-6)
18. nut (18-20)
19. connecting rod jacket (Sb45-6)
20. connecting rod (18-74)
21. right lever of the lock (Sb18-12)
22. shaft (18-77)

23. shaft (18-76)
24. bracket (right 18-75, left 18-79)
25. rear right bushing with lever (18-26)
26. lid (18-35)
27. right regulating lever (18-28)
28. grease cup (A72273-6)
29. left lever of the lock (Sb18-13)
30. left lock lever for firing position (18-17)
31. lid (18-168)
32. nut (18-11)
33. cutter pin (18-69)
34. shield (18-14)
35. nut (A51011-4)
36. roller (26-30)
37. rear left bushing with lever (18-27)
38. lock strip (18-30)
39. left regulating lever (18-29)
40. plate (18-5)
41. shaft of the parallelogram connecting rod (18-38)
42. parallelogram connecting rod (18-37)
43. special not (18-45)
44. shaft (18-44)
45. thrust washer (18-43)
46. housing of the tie rod (18-42)

47. screw of the tie piece (18-39)

48. bolt (A51000-48)

49. lock washer (A51004-48)

50. lock nut (18-164)

51. spring (18-163A)

52. lock (18-162)

53. nut (A51011-3)

54. special bolt (18-51)

55. buffer (18-50)

56. ball joint (18-21)

57. pin (A51012-15)

58. screw (A51065-9)

59. lid (18-172)

61. lid (18-170)

62. washer (A51001-6)

63. lever shaft (18-167)

65. journal (18-157)

66. cutter pin (A51041-32)

67. pin (18-8)

68. washer (18-40)

69. lock cylinder (18-175)

70. lock rod (18-176)

71. bushing (18-177)

a. rock r arm hook b. arc v. bearing surface

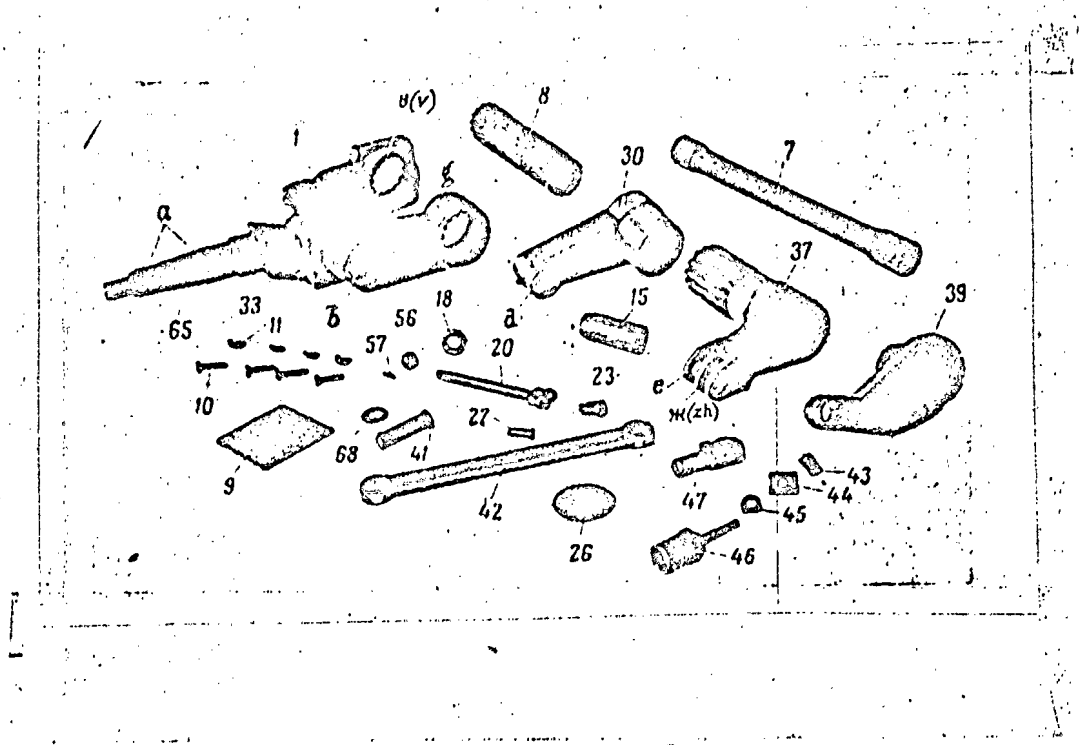


Figure 59. Parts of the Suspension Mechanism

1 - left rocker arm with journal (Sb18-10), 7 - torsion bar (18-32), 8 - front bushing (18-101), 9 - strip (18-92), 10 - bolt (A51000-32), 11 - lock washer (A51024-46), 15 - pivot (18-18), 18 - nut (18-20), 20 - connecting rod (18-74), 22 - shaft (18-74), 23 - shaft (18-76), 26 - lid (18-35), 30 - left lever of firing-position lock (18-17), 33 - cotter pin (18-69), 37 - left rear bushing with lever (18-27), 39 - left regulating lever (18-29), 41 - connecting rod shaft of the parallelogram (18-38), 42 - the parallelogram connecting rod (18-37), 43 - special nut (18-45), 44 - roller (18-44), 45 - bearing washer (18-43), 46 - tie housing (18-42), 47 - tie screw (18-39), 56 - ball and socket bearing (18-21), 57 - pivot (A51042-15), 65 - journal (18-157), 63 - washer (18-40), a - cylindrical surfaces; b - receptacles for the pin disengaging the suspension; v - bearing surface; d - annular groove, ye - eye, zh - eye, g - bearing surface

There are also bearing surfaces v (Fig. 59) with which the rocker arms rest on the checks o (Fig. 56) of the bottom carriage after the full compression of buffers 55 (Fig. 58).

On the front parts of the rocker arms are hooks (Fig. 60) for attaching the pulling cables.

Behind the rocker arms are recesses b (Fig. 59) for pins 15 used in disengaging the suspension.

The rocker arm journals 65 have cylindrical surfaces on which are mounted disks of the wheel brake. On each of these surfaces are two cotter pins 33 to prevent the rotation of the wheel brake disks. On the journals 65 are also cylindrical surfaces "a" on which are placed the bearings of the carriage wheels. At the ends of the journals are threaded pins 67 (Fig. 58) locked in position by cotter pins 66. The nut 32 is screwed on the pin 67 and holds the carriage wheel on the journals of the rocker arms.

On the upper parts of the rocker arms are mounted rollers 36 with shields 34 for the wheel brake cable.

The right 27 and left 39 regulating levers (Fig. 58) serve to [104] regulate the suspension. The control levers have bushings with slots which are connected to the slots of the torsion bars. The lower part of the levers have eyes and surfaces for mounting the adjusting parts of the suspension.

The upper part of the lever has a recess for check plate 38.

The right 16 and left 30 levers of firing-position lock (Fig. 58) serve to disengage the suspension during firing of the gun. The levers 16 and 30 have cylindrical openings for guide pins 15, which disengage the suspension.

These openings have internal annular grooves for lubrication from grease cups 17.

The levers 16 and 30 have slots for connection to the right 25 and left 37 rear bushings. The levers 16 and 30 have outer annular grooves d (Fig. 59) for holding the jacket 19 (Fig. 58).

The right 25 and left 37 rear bushings with levers (Fig. 58) connect the levers 16 and 30 of the firing-position lock to regulating levers 27 and 39 and the parallelogram connecting rod 42. The lever 25 and 37 bushings have slots for coupling to the levers 16 and 30 of the firing-position lock. The bushings have holes for passing the torsion bars.

In the lower part of the levers are eyes ye and zh (Fig. 59). The eyes Zh are used to fasten the adjusting parts of the suspension and the eyes ye are used to fasten the parallelogram connecting rod 42. The surfaces v on the levers (Fig. 58) are used to lock bushings 25 and 37 with their levers relative to the bottom carriage in the traveling position. The trail rests v rest on these surfaces (Fig. 63) during transportation.

The parallelogram connecting rod 42 (Fig. 58) has a rectangular cross section and eyes on its ends. The parallelogram connecting rod connects the right and left parts of the suspension.

The rear bushings 25 and 37 are connected to regulating levers 27 and 39 by shaft 41 of the parallelogram connecting rod, special nut 43, shaft 44, thrust washer 45, tie housing 46 and tie screw 47.

For disengagement of the suspension in firing position pins 15 are provided which are connected by the connecting rods and shaft 22 and 23 to the trails. The connecting rods 20 have ball joints 56 fastened by pins 57. Nut 18 connects connecting rod 20 with pin 15. Jackets 19 portect connecting rods 20 from dirt.

33. Operation of the Suspension Mechanism

In the traveling position, the trails are drawn together and their rests v (Fig. 63) rest against surfaces v (Fig. 60) of bushings 25 and 37 with levers, so that the rear bushings with levers cannot move with respect to the bottom carriage. The rear ends of torsion bars 7, coupled through regulating levers 27 and 39, housings 46 and tie screws 47 to rear bushings 25 and 37, are also fixed with respect to the bottom carriage.

Jolts from the wheels during transportation of the gun turn rocker arms 1 and 13, connected through the front bushings 8 to the front ends of the torsion bars 7, thus twisting these bars (on Fig. 60 pins 15 are shown in the firing position). The torsion bar is thus twisted by an angle equal to the angle of rotation of the rocker arm and absorbs the energy of impact during transportation of the gun. The excess impact [105] energy not absorbed by the torsion bars is absorbed by rubber buffers 55 (Fig. 58) mounted on the bottom carriage. When strong jolts cause rubber buffers 55 to be compressed to the limit, a further travel of the rocker arms upward is prevented by checks o (Fig. 56) on the bottom carriage, on which also rest the rocker arm surfaces v (Fig. 59).

When the trails are pulled apart, checks v on the trails (Fig. 63) recede from surfaces v (Fig. 60) of rear bushings 25 and 37, making possible for the latter to turn with respect to the bottom carriage.

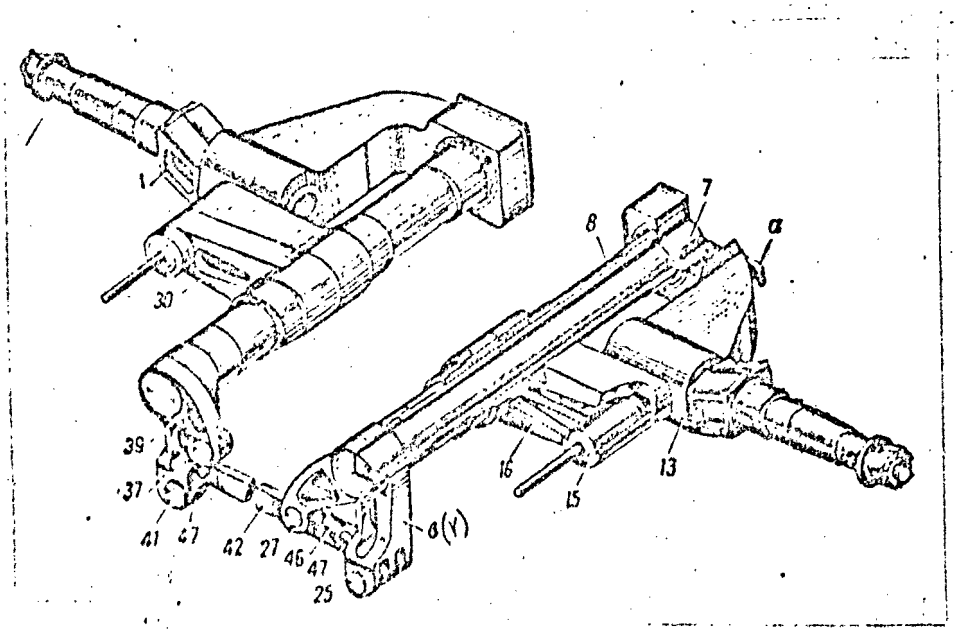


Fig. 60 Diagram of the Gun Suspension Mechanism

1 - left rocker arm with journal (Sb 18-10), 7 - torsion bar (18-32), 8- front bushing (18-101), 13 - right rocker arm with journal (Sb18-11), 15 - pivot (18-18), 16 - right lever of firing-position lock (18-16), 25 - right rear bushing with lever (18-26), 27 - right regulating lever (18-28), 30 - left lever of firing-position (18-17), 37 - rear bushing with lever, left (18-27), 39 - left regulating lever (18-29), 37 - rear bushing with lever, left (18-27), 39 - left regulating lever (18-29), 41 - connecting rod shaft of the parallelogram (18-38), 42 - parallelogram connecing rod (18-37), 46 - tie rod bearing (18-42), 47 - tie rod screw (18-39), a - rocker arm hook; v - bearing surface.

When the trails are pulled apart, pivots 15 for disengaging the suspension (fixed on the trails) move forward and enter the receptacles b (Fig 59) of the rocker arms, thus locking levers 16 and 30 (Fig. 60) of the firing-position locks to the rocker arms. Now the suspension is disengaged because the front and rear ends of the torsion bars are rigidly fixed and cannot move with respect to each other.

In the firing position, the right and left halves of the suspension mechanism form a rigid systems tied by parallelogram connecting rod 42 and are capable of rocking 6° (about 3° up and 3° down) relative to the bottom carriage.

Such an allowance for movement permits proper setting of the gun on an uneven surface. This is achieved in the following manner:

When the trails are spread apart for firing position, the checks v of the trails (Fig. 63) recede from surfaces v on lever bushings 25 and 37 (Fig. 58). This permits a free rotation of bottom carriage and trails relative to the left and right rocker arms which are tied together by levers with bushings 25 and 37 and connecting rod 42, thus forming a closed system — a parallelogram.

When the gun is set on the ground with different inclinations under [106] the wheels and the trail spades, there can be a certain turning of the trails, together with the bottom carriage, relative to the rocker arms and the parts coupled with them. Such turning of the trails occurs until the two trail spades firmly rest on the ground; then the gun sits firmly on the ground.

The design of the bottom carriage and of the suspension mechanism permits a firm anchoring of the gun on the ground with up to 3 degrees difference of inclination under the wheels and under the trail spades.

34. Disassembly and Assembly of the Bottom Carriage

The bottom carriage should be disassembled only for technical inspection or repair.

Before disassembling the bottom carriage, remove from the gun the sight, shield, barrel, cradle, equilibrator and top carriage, in the order indicated in Chapter 12.

Disassembly

1. Set the bottom carriage on blocks and remove the wheels and the wheel brake, as indicated in Chapter 12, also bring the trails together.

2. Remove the torsion bars as follows:
Bend back lock washers 11 (Fig. 58), remove bolts 10 with wrench A52830-5 and remove lids 9;

— measure the distance A between the lower surface of the buffer and the upper surface of the rocker arm, and the distance B and V between the housing 46 and tie rod screws 47:

— mark the right torsion bar with paint or inscribe "Pr" and "L" on the left bar;

— with wrench Sb42-52 screw in screw 42-36 of tool Sb42-9 (Fig. 61) into the hole at the end of the torsion bar and, by turning nut A51010-10 with wrench A52830-6, extricate the torsion bars.

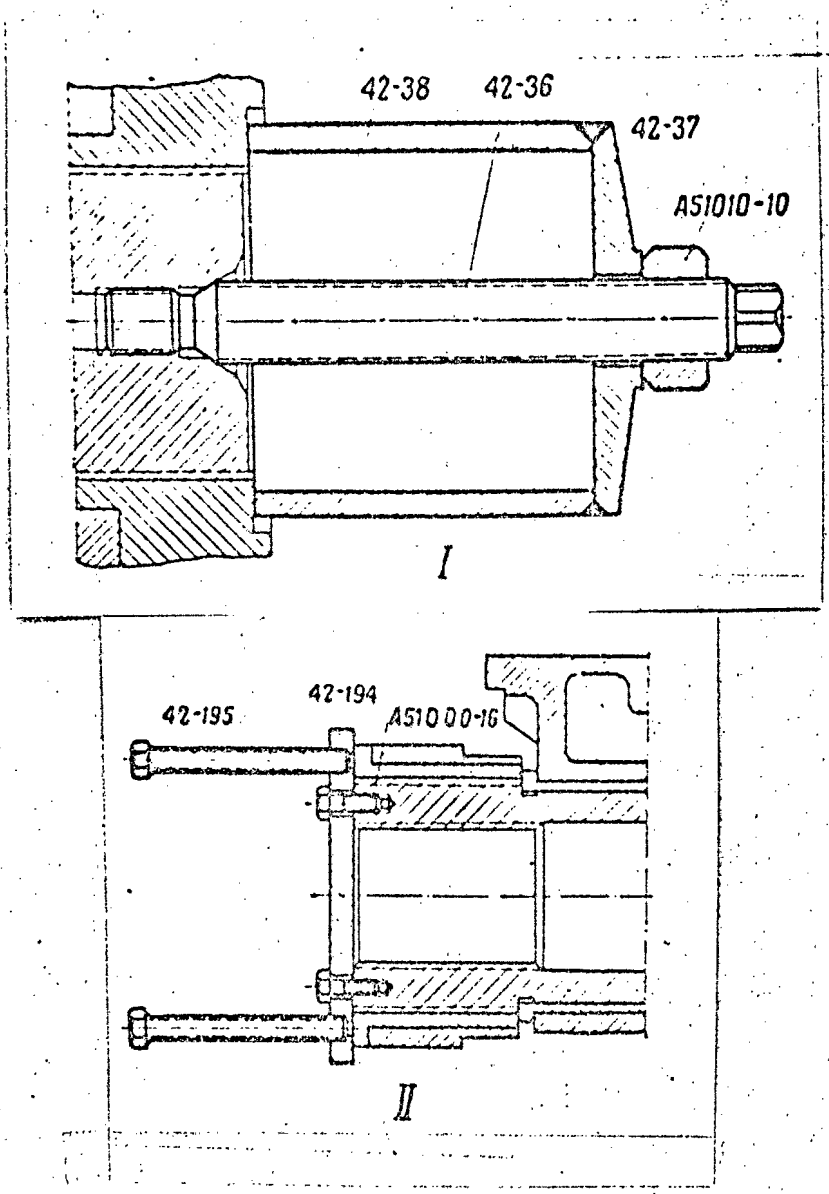


Fig 61. Tools

I - Tool for removing the torsion bars (Sb 42-9)
42-36 - screw; 42-37 - washer; 42-38 - bushing; A51010-10 - nut;

II - Tool for removing front bushing 8, on Fig 58 (Sb 42-50)
42-191 - plate; 42-195 - bolt; A51000-16 - bolt M 10 x 30

During the extraction of the torsion bars the rocker arms should be supported to prevent damage to the slots. If the extraction of the rear end of the torsion bar through the front slot opening becomes difficult, it is necessary to remove the screws holding lid 26 (Fig. 58) and to remove the lid; then force the torsion bar forward by tapping lightly on the end with a blunt part of a rod.

3. Remove the rocker arms as follows:

— on the front ends of bushings 8 mark "Pr" on the right bushing and "L" on the left bushing; also make scribe marks indicating the position of bushing slots relative to the rocker arms;

— set up plate 42-194 of tool Sb42-50 (Fig. 61) and screw bolts A51000-16 into front bushing 8 (Fig. 58) with wrench A52830-4;

— by screwing bolts 42-195 with wrench A52830-5 into plate 42-194, while supporting the rocker arms, extract front bushings 8;

— remove right 13 and left 1 rocker arms.

4. Remove connecting rod 42 of the parallelogram as follows:

— spread out the trails;

— remove the cotter pins and washers 68 and, by hammering on the end of shaft 41 (over a copper rod), force out shafts 41 of the parallelogram connecting rod;

— remove parallelogram connecting rod 42.

5. Remove and disassemble the right 27 and the left 39 regulating levers as follows:

— bend back lock washers 49, loosen bolts 48 with [108]
wrench A552830-5 and remove the lock strips 38;

— remove the cotter pins, loosen nuts 43 with wrench A52830-6, remove tie-rod housings 46 and shafts 44, and remove lock washers 45,

— remove the regulating levers 27 and 39,

— remove tie-rod screws 47.

6. Remove right 25 and left 37 rear bushings with levers and right 16 and left 30 levers of the firing-position lock.

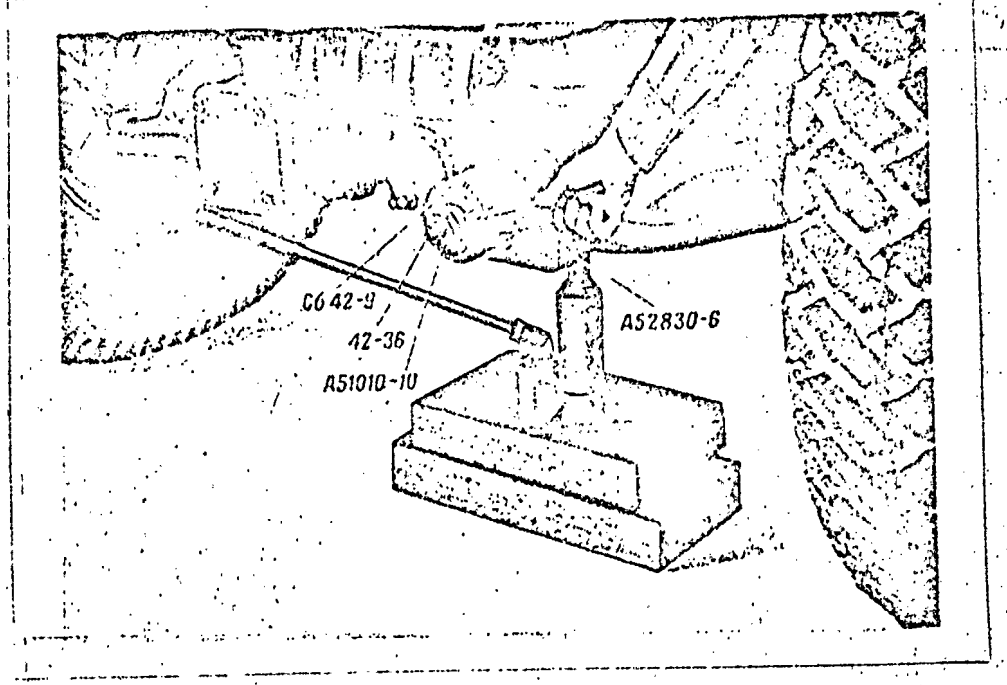


Fig. 62. Removal of the Torsion Bar.

Sb42-9 — tool for extraction of the torsion bars; 42-36 — screw; A51010-10 nut; A552830-6 — wrench

7. Remove locks 52 as follows:

— remove the cotter pins, unscrew nut 50 of the lock with wrench A52830-6, remove lock 52 and spring 51;

—remove cotter pins from lever shafts 63, remove washers 62 and right 21 and left 29 levers of the lock.

8. Remove buffers 55 as follows:

— remove the cotter pins; unscrew nuts 53 with wrench A52830-4; remove bolts 54 and take off buffers 55.

The removal of arc gear 3 is forbidden.

If it is necessary to replace the torsion bars on the assembled gun, proceed as follows:

1. Bring the trails together.

2 Set a jack on a wooden block under the bottom carriage (Fig. 62) on t[illegible] side of the gun where the torsion bar has to be replaced. Lift

the bottom carriage so that the torsion bar will be relieved from the weight of the gun (this corresponds roughly to a rotation of the rocker arm by 4°40"). Now the rocker arm will be somewhat inclined downward, but will not touch the check on the bottom carriage (wheel touching the ground).

3. Bend back lock washers 11 (Fig. 58); unscrew bolts 10 with wrench A52830-5 and remove lid 9.

4. Unscrew the bolts holding lid 26 and remove the lid. [109]

5. Screw in screw 42-36 of tool Sb42-9 into the threaded hole at the end of the torsion bar with wrench Sb42-52 (Fig. 61) and by turning nut A51010-10 with wrench A52830-6, remove the torsion bar.

If great force needs to be applied to wrench A52830-6 then the torsion bar has not been fully relieved of the load. In this case it is necessary to lift or lower the bottom carriage with the jack in order to find a position where the nut of the tool can be turned easily with only one hand.

If the torsion bar is broken, then the broken part is removed by mounting tool Sb42-9 from the opposite side, as indicated above.

6. Install the new torsion bar as follows:

— insert the new torsion bar into the seat of front bushing 8 (Fig. 58) and, by lightly hitting with a hammer on a copper strip placed over the end of the torsion bar, force it into place; at the same time, by operating the jack (lowering and lifting the bottom carriage) find a position of the rocker arms where the slots on the torsion bars will engage the slots on regulating levers 27 and 39 respectively.

7. Replace lid 26 and fasten it with screws.

8. Replace lid 9, screw in bolts 10 with wrench A52830-5 and lock them with washers 11.

9. Lower the bottom carriage and remove the jack.

After this, the gun can be transported again. Upon arrival at destination, it is necessary to adjust the suspension mechanism as indicated in chapter 12.

If the torsion bar replacement was made while the gun was in firing position, then the adjustment of the suspension mechanism should be made immediately after replacement.

Assembly

The bottom carriage is assembled after the trails are coupled to it, as indicated in Chapter 12.

1. Replace buffers 55 (Fig. 58); insert the bolts 54, screw on the nuts 53 with wrench A52830-4 and insert the cotter pins.

2. Insert the locks 52 as follows:

— place the right 21 and left 29 lock levers on the shaft 63, replace the washers 62 and insert the cotter pins into the shafts 63 of the levers;

— set up the locks 52 with springs 51, screw on the lock nuts 50 with wrench A52830-6 and insert the cotter pins.

3. Install right 16 and left 30 levers of the firing-position locks and replace right 25 and left 37 rear bushings with the levers so that the firing-position levers will be horizontal, and the lever of the rear bushing in the lower position (at an angle of 90° to the lever of the firing-position lock).

4. Insert front bushings 8 as follows:

— replace right 13 and left 1 rocker arms and force front bushing 8 by lightly hammering on a copper strip placed over the bushing end. Front bushings 8 are installed in accordance with the markings or inscriptions "Pr" or "L" and by bringing together the punch marks on the bushings and the rocker arms.

5. Assemble and install right 27 and left 39 regulating levers [110] as follows:

— insert into the regulating levers shafts 44, washers 45 and tie-rod housings 46; screw on nuts 43 with wrench A52830-6 and insert the cotter pins.

— screw bolts 47 into tie-rod housing 46;

— place the regulating levers with mounted components into the rear bushings with the levers;

— replace lock strip 38; screw in bolts 48 with wrench A52830-5 and lock them with washers 49.

6. Replace the connecting rod 42 of the parallelogram; insert shafts 41 of the connecting rods and insert the cotter pins.

7. Install the torsion bars as follows:

— bring the trails together;

— adjust the tie rods by setting proper spacing B and V between the ends of housing 46 and connecting rod screw 47;

— insert the torsion bars into front bushings 8,

— install the torsion bar with proper mark or inscription "Pr" on the right side of the bottom carriage, and the torsion bar with proper marking or inscription "L" on the left side. The torsion bar ends with markings or inscriptions should be placed in the front part of the bottom carriage; force the torsion bar into place by lightly hammering on a copper strip placed over the ends of the bars; by swinging the rocker arms, find a position where the torsion bar slots will line up with the slots of the regulating levers; during this operation a proper distance A between the lower surface of the buffers and the upper surface of the rocker arms should be maintained;

— replace lids 26 and fasten them by screws;

— replace lids 9, screw in bolts 10 with wrench A 52830-5 and clamp the bolts by washers 11.

8. The disengaging pins of the suspension are installed during the assembly of the gun. The manner of installation is described in Chapter 12.

The suspension mechanism is adjusted on the completely assembled gun. The manner of adjustment is described in Chapter 12.

35. Trails

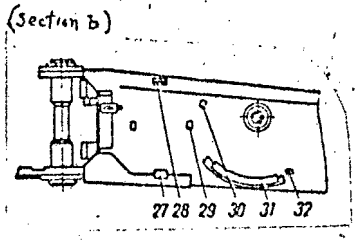
The trails consist of the following main parts: the right 34 and left 38 trails (Fig. 63) and two spades 50.

The trails are connected to the bottom carriage by hinge bolt 2, which is fixed by bolt 15 and lock washer 16.

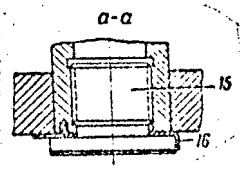
The trails are of welded construction and have box-type section. The trails have upper "a" and lower "b" hinged parts by which the trails are coupled to the bottom carriage. On the upper hinged parts "50X1-HUMecks 17 which prevent the hinge bolt 2 from rotating.

Figure 63 Trails

1. nipple (A52264-36)
2. hinge bolt (19-100)
3. terminal block (Sb19-100)
4. sheath of electric wire (19-611)
5. electric wire (19-560)
6. hose (rubber-canvas. 13, Ye-5000 GOST 73-40)
7. cap (19-590)
8. tube (19-425)
9. rack (Sb19-6)



10. screw with a tap wrench (Sb19-129)
11. bracket (Sb19-125)
12. sheath of the air pipe (19-613)
13. coupler (Sb19-105)
14. hammer support (19-678)
15. bolt (19-163)
16. lock washer (19-102)
17. check (19-227)
18. lock (Sb19-116)
19. supports (19-629)
20. winch base (Sb19-130)
21. holder (Sb19-110)
22. tube (19-425)
23. cap (19-552)



24. spring contact (19-687)
25. recess (19-71)
26. lock (Sb19-107)
27. hook (19-610)
28. hook (19-603)
29. support (19-227)
30. check (19-689)
31. clamp (19-619)
32. check (19-689)
33. lock (Sb19-115)
34. right trail (Sb19-5)
35. pin (19-617)
36. bracket (Sb19-42)
37. jack lever (Sb 24-16)
38. left trail (Sb19-4)
39. lock (Sb19-76)
40. right support (19-438)
41. left support (19-439)
42. tie rod (Sb19-35)
43. lock (right Sb19-63, left Sb19-64)
44. check (right Sb19-126, left Sb19-127)

45. rammer box (Sb19-12)

On the lower hinged parts b are checks v which, when the gun is in the traveling position, clamp right 25 and left 37 rear bushings to the levers of the bottom carriage. (Fig. 58). On the lower hinged parts of the trails are eyes with holes d (Fig. 63) for locks 52 (Fig. 58) of the Bottom carriage which fix the trails in the firing position. Close to the holes d (Fig. 63) are surfaces g on which rest the lower end surfaces of locks 52 (Fig. 58) when the trails are brought together. Between the hinged parts are checks ye (Fig 63), two on each side of the trail, which rest on the support areas "Shch" of the bottom carriage [111] when the trails are in firing position. Brackets 24 (Fig. 58) for the pins of the suspension disengagement are welded to the trails between the checks ye (Fig 63).

47. trail/handle (Sb19-62)

48. pivot (19-445)

49. clamp ring (Sb19-70)

50. spade (Sb19-51)

51. cog (19-517)

52. screw (Sb19-92)

53. coupling (19-518)

54. bushing (19-518)

55. left bracket (Sb19-90)

56. right bracket (Sb19-93)

a. upper hinge part

b. lower hinge part

v. check

g. surface

d. lock hole

ye. check

zh. check

i. groove

k. rear side

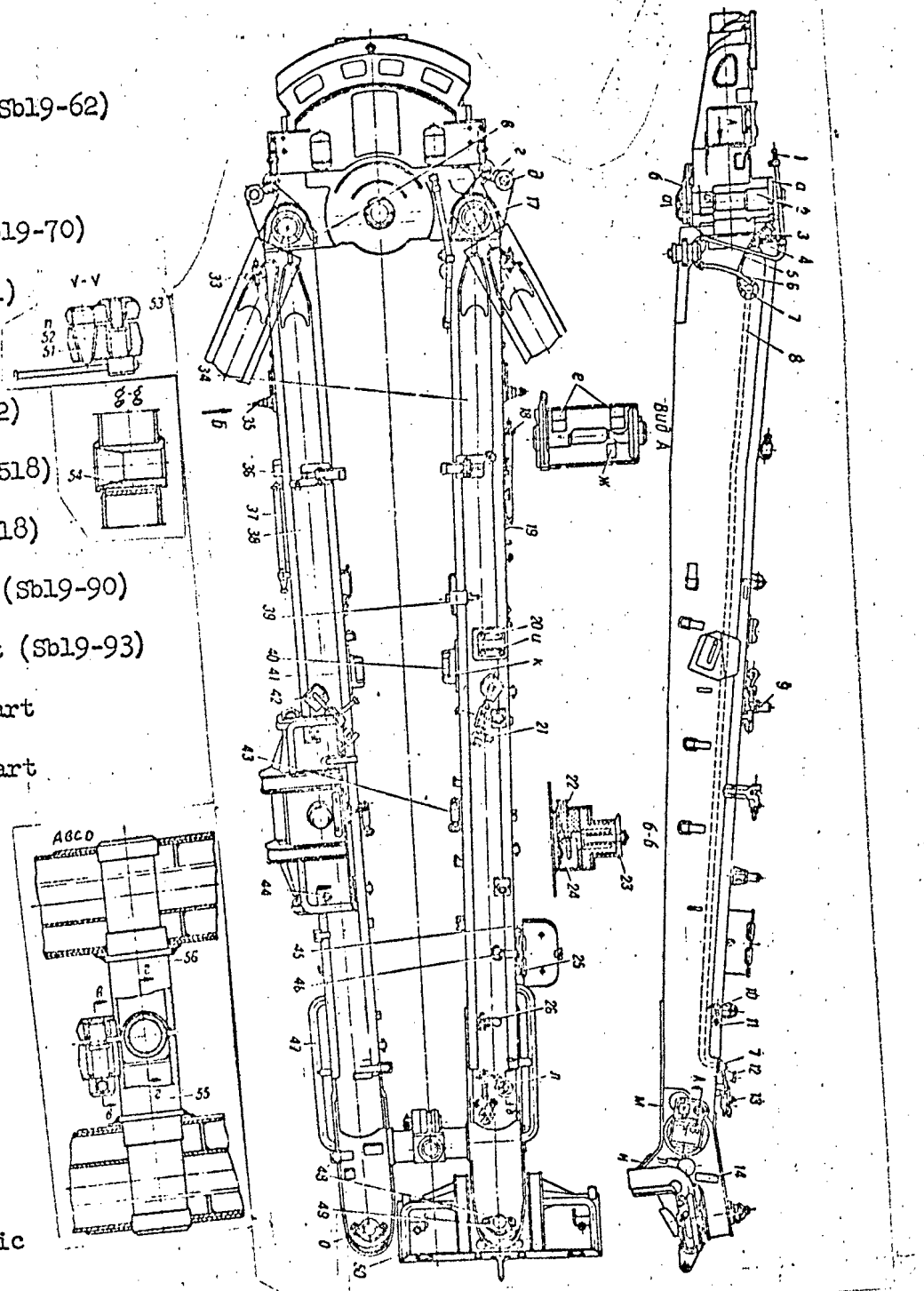
l. plug, electric

m. support plate

n. support plate

o. spade mounting hole

p. r



Between the hinged parts of the trails are checks Zh (Fig. 63) on which the areas Sh of the bottom carriage (Fig. 57) rest when the trails are in the traveling position.

On the upper surfaces of the trails are brackets 36 (Fig 63) with folding paws on which the cradle rests with its checks 9 (Fig 20) and 120 (Fig 21) when the gun is in traveling position. In the firing position, these paws are thrown off the trails and are clamped by spring locks (Fig. 63) on brackets 36.

For the purpose of looking the barrel in the traveling position there are on the inside of the trails supporting surfaces 40 right under the breech and threaded tie rods 42 which fasten the breech to the supporting surface 40.

On the right trail there is a lock 39 which, in the traveling position, enters recess kh of the breech (Fig 10), preventing the barrel from moving forward. Rear sides k of supporting surface 40 (Fig 63) hold the barrel from moving backward in the traveling position.

In the firing position, tie rods 42 are fastened to holder 21 on the trails.

The rear end of the trails has a draw bar which is used to couple the trails to the limber for traveling. The draw bar consists of two brackets 55 and 56 welded to the trails.

On bracket 56 is a bushing 54 which is placed over the pin of the limber frame, cog 51 and threaded coupling 53. Bracket 55 has a semi-circular groove to accomodate bushing 54, and a receptacle for cog 51 and screw 52.

When the trails are drawn together, cog 51 enters the receptacle "p" (preventing sagging of one trail with respect to the other) and bushing 54 enters a semi-circular groove on bracket 55; after this the trails are tightened by screw 52.

For coupling to the limber, the trails have support plates m and n which lie on rests a and b of the limber in the traveling position (Fig 104).

The rear ends of the trails terminate with permanent (winter) spades. The rear ends of the trails also have vertical through holes o (Fig 63) for fastening pivots 48 of the removable (summer) spades 50. The spade pivots 48 are fastened by clamp rings 49 with spring locks.

In the traveling position, removable spades 50 are mounted on trail racks 9 equipped with pins and locks 43. Spades 50 are placed over the pins of rack 9 and are clamped by locks 43 on the trails and locks 44 on the spades.

On the front part of the trails are pins 35 and clamps 31 for attaching the jacks. Pins 35 have a self-guiding cylindrical portion which fits under the jack, and a threaded portion for nut 26 (Fig 69) which holds the jack on the trail.

A turning of the jack on the pin is restricted by checks 32 and 30 (Fig 63). In the traveling position, the jacks are fastened by locks 33.

The trails have hooks 27, 28 and support 29 (Fig 63) to hold jack plate 50 (Fig 69). In the traveling position the jack plate is also held in place by the jack cylinders.

The winch base 20 and lock 26, with a spring catch to hold the winch [112] while the gun is in firing position, are on the right trail.

There is a groove i on the base for mounting the winch housing, and four tapped holes for fastening bolts.

Inside the right trail is a tube 8 which is closed by a cap 7 at the outlet. This tube contains air hose 6 of the wheel brake and electric wire 5 of the stop signal.

At the front part of the trails air hose 6 terminates with nipple 1 and in the rear part with coupler 13, which is connected to the coupler of hose 8 (Fig.104) located on the limber. Hose 6 (Fig. 63) is connected to coupler 13 by a collar and is protected by sheath 12.

Electric wire 5 is connected in the front part of the trails to terminal block 3 mounted on the inside of the trail; the wire is protected by a sheath 4.

On the rear part of the trail, electric wire 5 terminates in a plug 1 and is covered by a spring cap 23.

Cap 23 serves as a lock for socket 35 of the electric wire from the limber (Fig. 104), after plug 1 is connected to socket 35. Cap 23 also serves as protection for the plug.

Electric wire 5 is placed in metal tube 22 for protection. Clos 50X1-HUM
plug 1 is a spring contactor 24 which establishes electrical coupling betwe n the gun and the tractor thus ensuring the continuity of electric circ it from the tractor to the stop signal mounted on the front part of the

On the outer side of the right trail there is a recess 25 for mounting the air-hydraulic pump 52-I-035. The same recess is used for mounting box 45, which houses the rammers. Box 45 is clamped by spring lock 46.

When it is necessary to operate the pump 52-I-035, the box should be removed from recess 25, and the air-hydraulic pump 52-I-035 placed into the recess.

To facilitate the change of the trails from traveling to firing position or vise versa, the rear ends of the trails are equipped with handles 47. On the outside of the right and left sides of the trails are supports 19 and spring locks 18 for fastening jack levers 37.

Bracket 57 (Fig 64), rest 58, and holder 59 fasten winch crank Sb20-5.

The trails also have other provisions for fastening tools and parts belonging to the gun:

— support 77 (Fig. 65), holders 78 and 82, and head support 83 fasten rod Sb41-4 and head Sb41-5 of the rammer;

— punch support 77, support 81 and holder 80 fasten punch Sb41-36;

— supports 69 and 76 and holder 74 fasten hand spike Sb41-39;

— support 70 and holder 75 fasten crowbar 41-116;

— supports 63 and 65 and holder 64 fasten spades A72932-40 (Fig 64);

— holders 66 and 68 and cleat 67 fasten pick Sb41-45; [113]

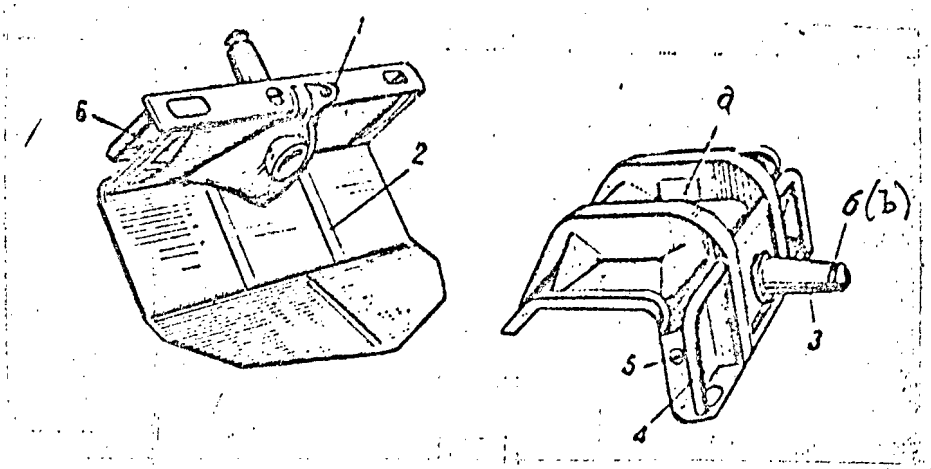
— bracket 11, support hammer 14 and screw 10 with tap wrench (Fig 65) fasten hammer Sb41-46;

— pin 60 (Fig 64), check 61, with chain, and two plates 62 fasten wrench 42-250;

— recesses 71 (Fig 65) and 73 and holder 72 fasten wrench Sb42-39.

Spades 50 (Fig. 63) are used when firing from soft ground.

The spades consist of main plate 2 (Fig 66) reinforced 50X1-HUMes and ribs.



[112]

Fig. 66 Spade

1. eye (19-194); 2 - plate (19-180); 3 - pivot (19-445);

4. handle (19-192 and 19-444); 5 - check (19-212);

6. cover plate (19-200); a - bearing surface; b - annular groove.

In the firing position the spades are fixed to the trails by pivots 3 with annular groove b into which are fitted clamp rings 49 on the rear of the trails (Fig. 63)

During firing, the stress is transmitted from the trails to the spade through pivots 3 (Fig. 66) and bearing surfaces a.

In the traveling position, the spades are fastened to the trails by cover plate 6, which has vertical holes to accomodate trail racks 9 (Fig 63) and check 5 (Fig 66) which fasten the spade to the rack pins.

Checks 5 have inscriptions "Open" and "Closed", which indicate the position of the check levers.

The spades have an eye 1 with horizontal openings for fastening locks 43 to the trails (Fig. 63).

For convenience of handling, the spades are provided with handles 4 (Fig. 66).

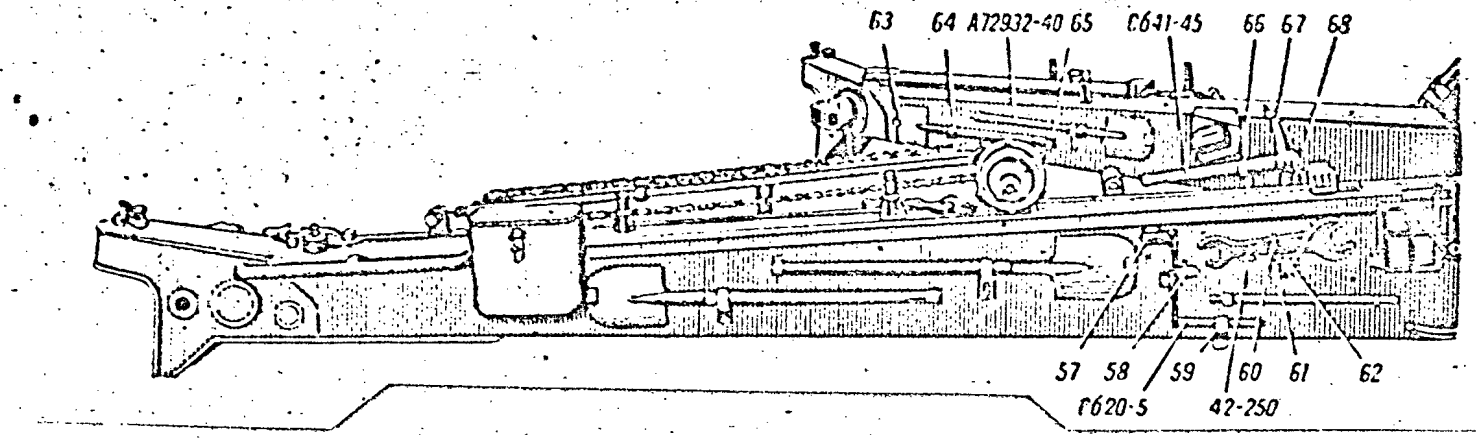


Fig 64. Trails. Attachment of Entrenching Tools

57. brackets (Sb 19-22)
58. support (A51175-3)
59. holder (Sb 19-111)
60. pin (19-206)
61. check with chain (Sb 19-27)
62. plate (19-205)
63. support (19-90)
64. holder (Sb 19-23)
65. support (A52422-87)
66. holder (Sb 19-125)
67. cleat (19-672)
68. holder (Sb 19-22)

Sb 20-5. handle
52-100. wrench
Sb 41-46. pick
A 72932. spade

[113]

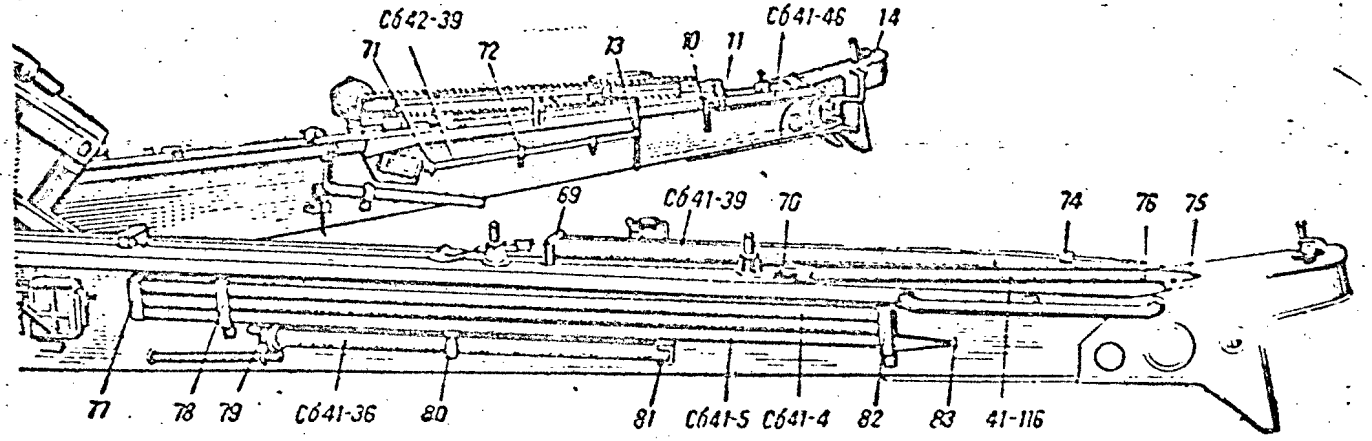


Fig 65. Trails. Attachment of Entrenching Tools

10. screw with tap wrench
11. bracket (Sb 19-125)
14. hammer support (19-675)
69. hand-spike support (19-97)
70. pick support (19-660)
71. recess (19-41)
72. holder (Sb 19-9)
73. recess (19-151)
74. holder (Sb 19-72)
75. holder (Sb 19-106)
76. hand-spike support (19-674)
77. support (19-644)
78. holder (Sb 19-13)
79. punch support (Sb 19-113)
80. holder (Sb 19-15)
81. support (A52422-29)
82. holder (Sb 19-123)
83. rammer-head support (19-675)
41-116. pick
Sb 41-4. rod
Sb 41-5. rammer head
Sb 41-46. hammer
Sb 41-36. punch
Sb 41-39. hand spike

CHAPTER VII

WINCH AND JACKS

36. The Winch

The winch is used to move the barrel from the firing position to travel position, and vice versa. It is installed on the right-trail (see figs 67 and 68).

The winch consists of the following components: housing 24 with gear drive and roller brake; and shaft 8 with suspension rod 10 and chain 9.

Housing 24 is a casting, fixed to the right side of the gun and held in place by means of four bolts 3. The housing contains the gear drive and roller brake.

The gear drive consists of an eccentric cam 25, pinion 21, cover 18, and shaft 23 with gear.

Eccentric cam 25 is mounted on ball bearings 37 and 33.

Gear 21 turns on two ball bearings 22. Shaft 23, with its gear, is mounted on two bushings 30 fixed in housing 24.

On the slotted end of the gear shaft is a chain sprocket 28, held in place by nut 27. The roller brake is mounted in cover 18 and consists of a right brake carrier 45, left brake carrier 39, two slide blocks 41 (fixed by screws 46 to carrier 39), four rollers 42, four ferrules 43 and four springs 44. Plate 16 and washer 38 (attached to the right brake carrier 45 by screws 57), maintain proper alignment of rollers 42.

Winch handle 40 is mounted on the square end of the left brake carrier 39. Detainer 60 keeps the handle in place.

Housing 24 is joined to cover 18 by means of four bolts 35. Two pins 20 prevent mutual rotation of the housing and cover.

Shaft 8 is attached to housing 24 and is fixed in place by means of nut 29.

Fitted onto the shaft is suspension rod 10 with yoke 13, in which is mounted sprocket 14. Spring 4 is placed between the shaft and the yoke and serves to impart tension to chain 9 when the shaft is pushed toward the trail.

On the front part of yoke 13 is a loop 7 used to connect the suspension rod to the shield bracket when operating the winch. The position of loop 7 can be adjusted by screwing it in or out of the yoke and fixing it in the desired position by lock nut 47.

If there is not sufficient slack in the chain to permit adjustment, one link next to the last one may be removed from the chain. In this case, the outer washer 49 of end pin 1 should be mounted on shackle 11.

/116/

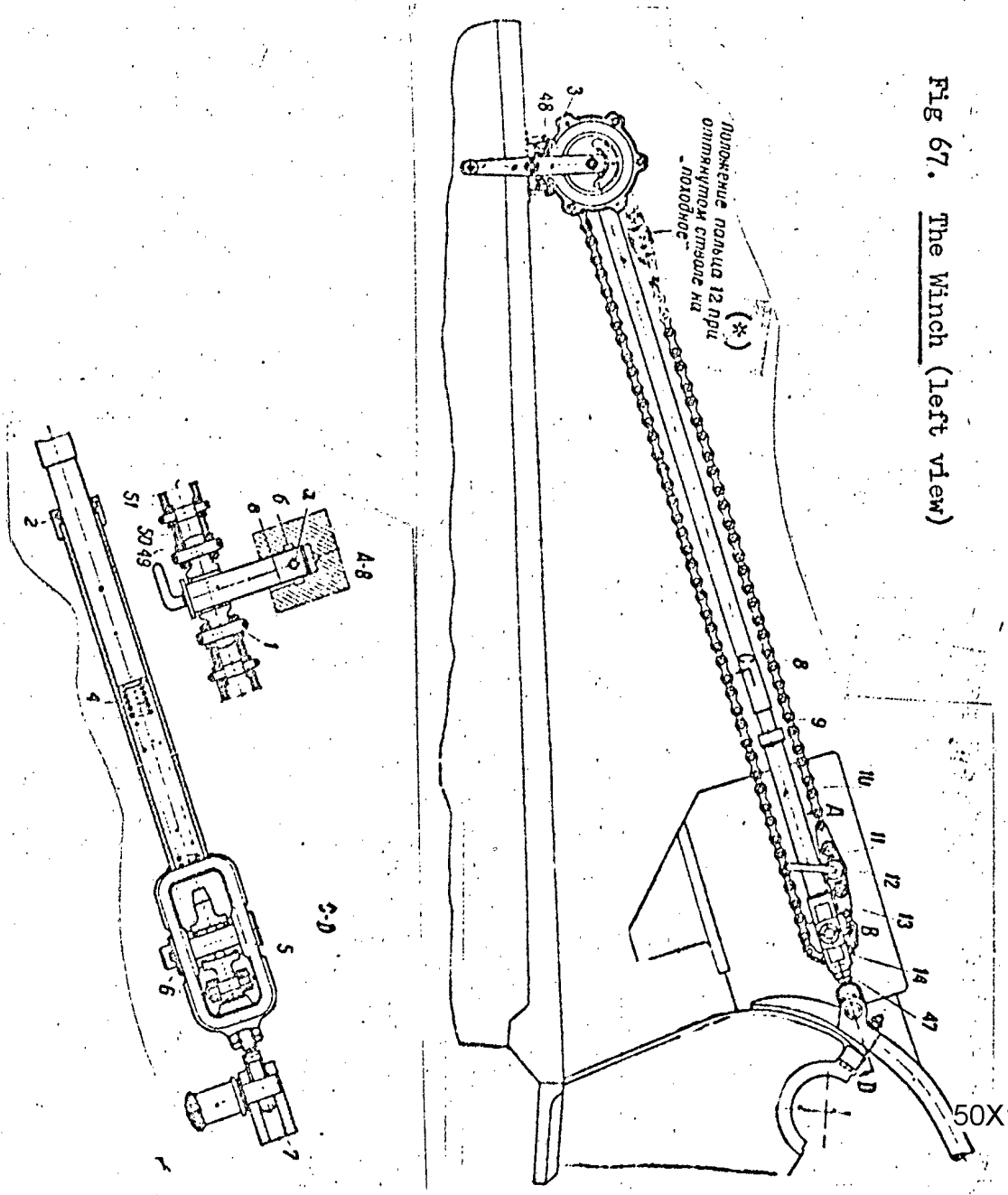


Fig 67. The Winch (left view)

Fig 67. The Winch (left view) /116/
(figure on preceding page)

1--pin (20-57); 2-- packing ring (20-31); 3--semi-finished bolt (20-59); 4--spring (A51230-11); 5--axle (20-41); 6--washer (A51021-11); 7--loop (20-70); 8--shaft (Sb20-1); 9--chain (Sb20-6); 10--suspension rod (Sb20-2); 11--shackle (20-39); 12--pin (20-44); 13--yoke (20-51); 14--sprocket (20-33); 47--lock nut (20-71); 48--lock washer (A51021-48); 49--washer (A51021-4); 50--end plate (20-46); 51--(20-65); a-- pin; b--ring groove; c) groove.

*) Position of pin 12 when barrel is retracted for trave position.

Fig 68. The Winch (cross-section) /117/
(figure on next page)

8--shaft (Sb20-1); 15--bushing (Ab1910-302); 16--plate (20-13) 17--key (A51050-23); 18--cover (20-2); 19-- plate (20-14); 20--cylindrical pin (A51041-33); 21--pinion (20-4); 22--ball bearing No 211; 23--shaft and pinion (20-3); 24--housing (20-1); 25--eccentric cam (20-5); 26--lock washer (A51023-79); 27--round nut (A51970-9); 28--sprocket (20-19); 29--nut (20-17); 30--bushing (A51910-344); 31--round nut (A51970-5); 32--lock washer (A51023-20); 33--ball bearing No 305; 34--ring (20-65); 35--bolt (A51000-16); 36--bushing (20-9); 37--ball bearing No 207; 38--washer (20-18); 39--left brake carrier (20-25); 40--handle (Sb20-5); 41--slide block (20-23); 42--roller (20-24); 43--cap (20-27); 44--spring (20-29); 45--right brake carrier (20-26); 46--screw (A51062-10); 52--screw (A51065-5); 53--screw (A51060-8); 54--shaft (20-62); 55--tube (20-61); 56--nut (20-63); 57--screw (A51060-5); 58--spring (20-53); 59--washer (20-45); 60--detainer (20-55); 61--ring (20-64); 62--lock washer (A51027-5).

*) Displaced for purposes of illustration.

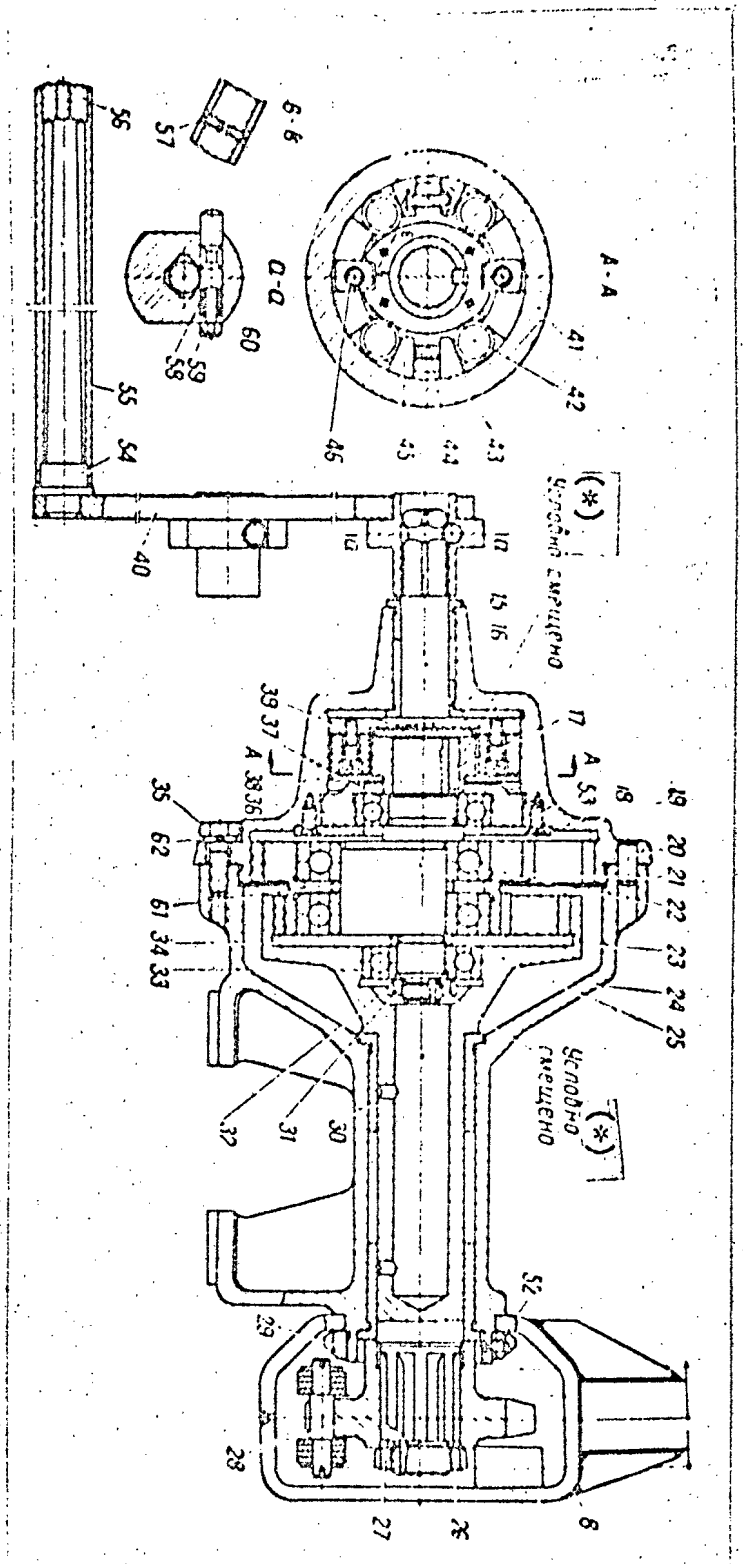


Fig 68. The Winch (cross section)

(legend on preceding page)

Sprocket 28, mounted on shaft 23 with the pinions, and sprocket /118/
14, which is mounted in the yoke of the suspension rod, are connected to each other by chain 9. The chain is provided with shacle 11 and pin 12. The pin connects the winch chain to the barrel when operating the winch.

37. Operation of the Winch

As handle 40 (figures 68 and 69), located on the square end of the shaft of brake carrier 39, is turned, its motion is transmitted to sprocket wheel 28 by way of right brake carrier 45, eccentric cam 25, gear 21, and gear shaft 23. As sprocket 28 turns, the chain moves together with its pin 12 (figure 67), which is connected to the breech of the barrel.

/118/

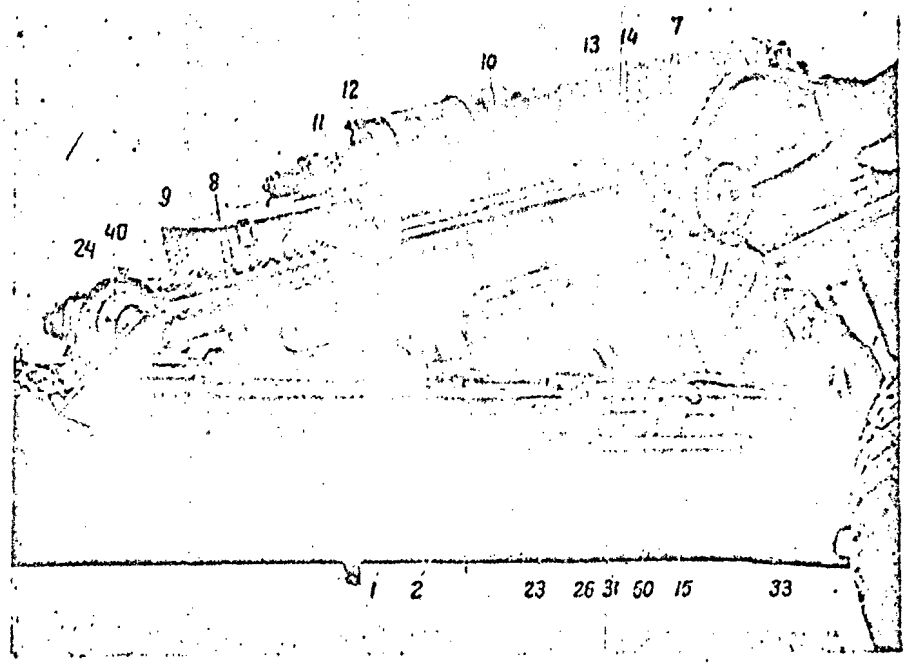


Figure 69. Retracting the Barrel by Means of the Winch and Attaching the Jack

Parts of Winch:

7--loop (20-70); 8--shaft (Sb20-1); 9--chain (Sb20-6); 10--suspension rod (Sb20-2); 11--shackle (20-39); 12--pin (20-44); 13--yoke (20-51); 14--sprocket (20-33); 24--housing (20-1); 40--handle (Sb20-5).

Parts of Trail:

31--catch (19-619); 33--locking device (Sb19-115).

Parts of Jack:

1--handle (Sb24-16); 2--head (24-30); 15--outside cylinder (Sb24-1); 23--box (Sb24-17); 26--nut (24-53); 50--plate (Sb24-9)

Movement of the barrel from the firing to traveling position and back is accomplished depending on the direction of rotation of handle 40 (figures 68 and 69).

To move the barrel into firing position, loop 7 (figures 69 and 67) of the winch shaft must be placed in the locking device of the shield bracket and pin 12 must be pushed into the opening in the breech. Handle 40, set on the long lever, must be turned to the right.

The barrel is advanced as far as it will go against the recoil brake buffer plate and is forced in place by a pressure of from 15 to 30 kg on the winch handle. Pin 12 is removed from the opening in the breech only after the counterrecoil mechanism is connected to the collar of the cradle; otherwise, it may prove impossible to connect the two, and the barrel could roll back on its own. Pin 12 is removed by turning the pin and aligning pin "a" with the groove in the breech opening. /119/

When the barrel is shifted from firing to travel position, the rod should be pushed over to the locking device of the shield bracket, and pin 12 of the chain is aligned with the recess in the breech by turning the winch handle. The pin is then placed in the recess and is locked by key "a" in the annular groove "b" by turning pin 12. By rotating handle 40 to the left, using the short lever, the barrel is brought to the travel position, pin 12 is disconnected, and the winch shaft remains in place.

A roller-type brake prevents accidential rolling of the barrel. It will transmit movement only from the winch handle to the barrel via the chain and makes it impossible for movement to be transmitted in the opposite direction--from the barrel to the handle.

Before the trails are spread, the winch shaft must be pushed toward the trail, once pin 12 has been pulled out, by making fifteen full turns with handle 40.

In so doing, the shaft must be supported by hand so as to keep it from hitting the protruding parts of the trail. If this precaution is not taken, the shaft may be bent.

The brake operates as follows: in transmitting motion from the winch handle, the left brake carrier 39 (fig 68) rotates with slide blocks 41 and deflects rollers 42 with its forks, the gap between the slide blocks and the right brake carrier grooves is taken up, and the right brake carrier begins to rotate. Rotation of the right brake carrier, which is connected by a pin coupling to eccentric cam 25, causes the latter to turn, actuating the sprocket wheel through the gears and shaft.

As motion is transmitted from the sprocket, the gear shaft (through its gears) turns the eccentric cam and, with it, the right brake carrier. When the right brake carrier turns, rollers 42 are wedged between the right carrier and cover 18. Thus, rotation of the right brake carrier and, hence, of the sprocket wheel, becomes impossible.

38. Disassembly and Assembly of the Winch

The winch is diassembled only for purposes of technical inspection, elimination of malfunctions, and lubrication of parts in the winch housing.

Disassembly

(Figures 67 and 68)

1. Snap back the catches on lock washers 48 and, with wrench A52830-5, unscrew bolts 3. Remove the winch from the trail.

2. Remove chain 9 in the following manner:

— turn the winch handle so as to move the shackle with pin 12 to a distance of approximately 400 mm from yoke 13;

— pass a tap wrench over the upper and lower halves of the chain and yoke 13, and, by working the handle of the winch, relax tension on the upper part of the chain;

— remove the cotter pin and remove washer 49 from the side of yoke 13; pull out pin 1 which connects yoke 11 with chain 9;

— using the winch handle, advance suspension rod 10 up to the point where it is relieved from the pressure of spring 4, and separte it from sprocket 14; then separate suspension rod 10 together with spring 4 from shaft 8. /120/

3. To diassemble the suspension rod, proceed as follows:

— remove the key from axle 5, remove washer 6, and use a rod to knock out axle 5;

— remove sprocket 14.

4. Separate shaft 8 from the winch as follows:

— snap back the catches of lock washer 26 and, using wrench A52832-19, unscrew nut 27 as far as it will go toward the yoke;

-- unscrew screw 52 and nut 29, lightly tapping the nut with a hammer and a copper rod;

-- remove shaft 8 with sprocket 28 and nuts 27 and 29.

5. Disassemble the housing of the winch as follows:

-- using wrench A52830-4, unscrew bolts 35 which retain cover 18 and separate the cover together with all its parts from pins 20 (cover 18 is removed by lightly tapping the rim with a hammer and a copper rod; this is to be done uniformly all around the cover to avoid jamming it);

-- remove shaft 23 with the pinion gear.

Any further disassembly is to be done only as part of a general overhaul. The sequence then is as follows:

-- push open the catches holding lock washer 32, unscrew nut 31, and, using a copper rod and lightly tapping it with a hammer, remove lock washer 32, ball bearing 33, ring 34, and pinion gear 21, together with its ball bearings 22. If ball bearings 22 are to be replaced, remove them and ring 61 from the pinion gear 21;

-- unscrew screws 53 holding plate 19 and remove the latter;

-- tap lightly with a hammer on the copper gasket around the square end of brake carrier 39, knock out bushing 36 and ball bearing 37, cam 25, and the roller brake from cover 18. Continue by removing rollers 42, ferrules 43, springs 44, and left brake carrier 39 together with slide blocks 41;

-- remove the right brake carrier 45, unscrew eight screws 57 which retain plate 16 and washer 38, and separate plate 16 and washer 38 from carrier 45;

-- remove cotter pin 17, bushing 36, and ball bearing 37 from cam 25;

-- unscrew screw 46 (only if it is necessary to separate slide blocks 41 from carrier 39) and remove the slide blocks.

(Figures 67 and 68)

1. Assemble cam 25 and the parts which attach directly to it (if these had previously been disassembled). This is done as follows:

50X1-HUM

-- insert left brake carrier 39 together with its slide blocks 41 in cover 18;

-- attach plate 16 by means of four screws 57 to the right brake carrier 45; insert carrier 45 in cover 18 and tighten the screws;

-- place rollers 42, ferrules 43, and springs 44 in the cover; install washer 38 and fix it in place by means of four screws 57; tighten these screws;

-- insert bushing 36 in cover 18;

-- install ball bearing 37 and pin 17 on cam 25 and insert cam 25 into the depression of the right carrier 45; mount plate 19 and fix it in place by means of screws 53; prick-punch the screws;

-- place ball bearing 25, ring 61, pinion 21, a second ball bearing /121/ 22, ring 34, ball bearing 33, and washer 32 on cam 25; then, using a copper rod, tap lightly with a hammer on nut 31, tighten it, and lock it in place with washer 32.

2. Assemble the winch housing as follows:

-- place shaft 23 with its pinion gear on ball bearing 33; install cover 18 together with its parts on housing 24, setting the cover on pins 20, adding spring washers 62, and tightening bolts 35 by means of wrench A52830-4.

3. Install shaft 8 as follows:

-- on shaft 23 with the pinion gear place shaft 8 with nut 29, aprocket 28, washer 26, and nut 27;

-- tapping lightly with a copper rod and hammer, screw on nut 29 and lock it in place by tightening screw 52;

-- use wrench A52832-19 to tighten nut 27 and lock it in place with washer 26.

4. Assemble suspension rod 10 as follows:

-- insert sprocket 14 into yoke 13 of the suspension rod;

-- install axle 5 and washer 6 and lock the axle in place.

5. Install chain 9 as follows:

-- insert spring 4 and retaining ring 2 into suspension rod 10, and place the suspension rod on shaft 8;

--engage the end of the chain on sprockets 28 and 14 by advancing th handle of the winch;

— squeeze the spring to connect both ends of the chain.

To do this, slip the tap wrench through yoke 13 of the suspension rod and through both the upper and lower parts of the chain. Then, by working the winch handle and stretching the chain and compressing the spring, install pin 1 which connects shackle 11 with chain 9. Lock pin 1 in place; then, by working the handle, release the tension in the chain and remove the tap wrench.

6. Place the winch on the trail, position lock washers 48, use wrench A52830-5 to tighten the winch in its position on the stand by means of four bolts 3, and tighten the bolts with washers 48.

7. Regulate the chain tension when pulling back the barrel, as explained in Chapter 12.

39. The Jacks

The hydraulic type jacks are intended for lifting the trails onto the limber and taking the trails from the limber when shifting the gun from firing position to traveling position and vice versa.

In addition, the jacks are used to raise the trails in order to extricate the summer spades from the ground after firing.

The jacks are located on the trails -- one on the right trail and the other on the left.

The two jacks are identical in their construction.

A jack consists of the following basic parts: housing 11 (figure 70), plunger 3, external cylinder 15, rod 16 with piston, box 23, handle 1, and plate 50.

The jack housing contains: plunger 3 with head 2 and connecting rod 33, suction valve A, pressure valve B, and handle 39 with valve and valve seal 34. Box 23 contains valve 40 with filter 42, safety valve V, and test plug 25 which closes the opening for checking the amount of fluid in the jack.

In plunger 3 are: rotating ring 7, collar 8, cap 9 of the plunger, /122/ rotating ring 10, and leather gasket 21 under the lower collar. Cap 9 is screwed onto the plunger and held by pin 6. The upper end of the plunger is hinge-connected to head 2 by pin 31 and is sealed against dirt by gasket 4 placed in baffle 5.

The suction, pressure, and safety valves are identical in d[illegible] 50X1-HUM Each valve consists of a ball 27, spring 28, and valve plug 29.

Valve 34 is welded to handle 39. The valve gasket consists of two rings 35 and ring 36 compressed by pressure nut 38; nut 38 is held in place by lock nut 37.

Cylinder 15 is welded to housing 11 of the jack.

A brass sleeve 14 with seal 13, which guides rod 16 during operation of the jack, is screwed onto the lower end of the cylinder.

The rod and piston assembly consists of rod 16, ring 43, collar 18 with leather gasket 17, and collar ring 19, held in place by screw 20. Handle 48 is welded to the lower end of the rod.

Plate 50 is a welded body reinforced by ribs and represents the support for the jack during operation.

Box 23 of the jack is filled with steol-M to the level of plug 25, which represents a quantity of approximately 1.3 liters.

In order to increase reliability of operation, some jacks are equipped with two pressure valves B (figure 70, cross-section TT, variation II) and a rod with two removable half-rings for the purpose of removing sleeve 14 and seal 13 from the rod.

40. Operation of the Jacks

In the firing and traveling positions of the gun, the jacks are attached to the trails by locks 33 (figure 69).

In order to move the gun from the firing position to the traveling position and vice versa, the jacks are removed from the locks and are tilted in a vertical position; plates 50 are placed under the rods of the jacks.

The jacks operate as follows:

When raising the trails: Close valve 34 (if it is open) by turning handle 39 (figure 70) to the right. This will cross the paths of the flow of fluid from box 23 to the cavity of the cylinder through openings a and b.

Permit air to flow into the jack by opening valve 40 one or two turns.

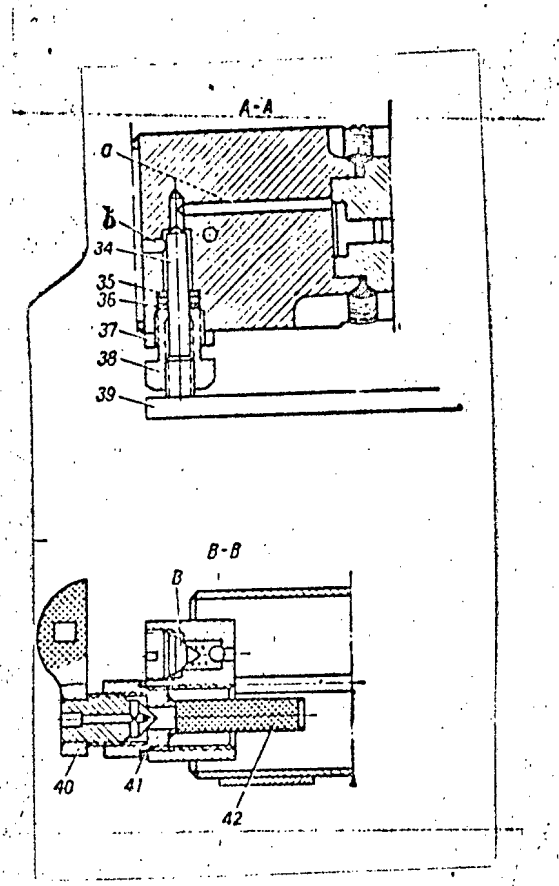
Pump handle 1; this will force fluid from the box of the jack through opening v and suction valve A under the plunger and then through opening g in pressure valve B, opening d, and into the space under the piston of rod 16.

The fluid acts on the rod and piston and pushes them from the cylinder. This raises the trails.

When/lowering the trails. Close valve 40 to prevent the flow of fluid through it. Carefully open valve 34 with handle 39. The liquid will then return from the cylinder through openings a and b to the box. Air is forced from the box through safety valve V when the rod is forced into the cylinder.

When the trails are down, close valve 34 with handle 39. /123/

A detailed procedure for moving the gun from the firing position into the traveling position and vice versa is given in Chapter 15.



(part of) Fig. 70. The Jack (see next two pages)

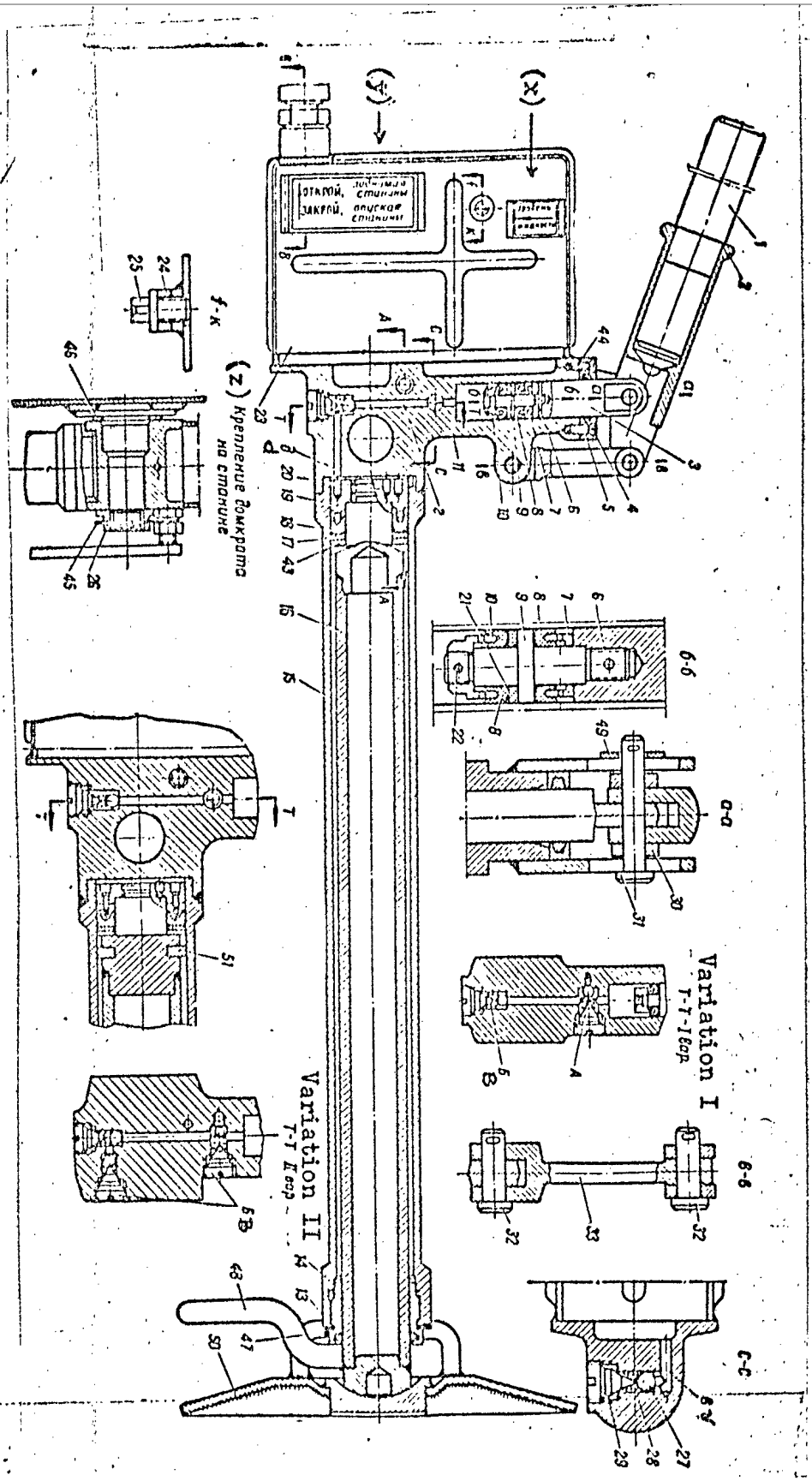


Fig 70. The Jack (cross section) (see preceding two pages)

/123/

Figure 70. The Jack (cross-section). /123/

1-handle (Sb24-16); 2-head (24-30); 3-plunger (24-102); 4-gasket 24-27); 5-baffle (24-28); 6-cylindrical pin (A51041-6); 7-collar ring (24-103); 8-collar (24-104); 9-plunger cap (24-105); 10-collar ring (24-106); 11-jack housing (24-3); 13-seal (24-14); 14-sleeve (24-13); 15-external cylinder (Sb24-1); 16-rod (Sb24-14); 17-gasket (24-112); 18-collar (24-108); 19-collar ring (24-109); 20-screw M4 (A51065-1); 21-gasket (24-113); 22-cotter pin 2 x 20; 23-box (Sb24-17); 24-ring (24-85); 25-plug (24-86); 26-nut (24-53); 27-ball 0 8; 28-conical spring (24-80); 29-plug (24-39); 30-washer (24-31); 31-pin (24-32); 32-axle (A51620-114); 33-connecting rod (24-35); 34-valve (24-62); 35-ring (24-40); 36-ring (24-41); 37-lock nut (24-61); 38-pressure nut (24-60); 39-handle (24-63); 40-valve(Sb24-11); 41-ring seal (24-95); 42-filter (Sb24-10); 43-ring (24-107); 44-screw (A51060-6); 45-cotter pin 4 x 45; 46-washer (24-96);47-lock washer (24-22); 48-handle (24-69); 49-washer (A51020-4); 50-plate (Sb24-9); 51-half-ring (24-115); a and b - openings for passage of fluid; v-opening for flow of fluid from box to plunger (intake period); g and d - openings for flow of liquid to area above piston (pressure period); A - suction valve; B - pressure valve; V - safety valve; x - level of liquid; y - OPEN (raise trails) CLOSE (lower trails); z - attachment of jack to trail.

41. Disassembly and Assembly of the Jack

The jack is disassembled only for purposes of technical inspection and the elimination of malfunctions.

Disassembly

1. Remove the jack from the trail in the following manner:

— free the jack from lock 33 (figure 69) and tilt it in a vertical direction;

— pull out the cotter pin and unscrew nut 26 (figure 69) with wrench A52830-7. Remove the jack from catch 31 on the trail and separate it from the trail.

2. Pour the liquid from the jack in the following manner:

— unscrew valve 40 (Figure 70) and unscrew the cap with filter 42 using wrench A52830-5;

— unscrew plug 25 and valve 40 with the square opening;

— pour the liquid from the jack into a clean vessel.

In removing plug 25 with valve 40 it is permitted to strike the valve with a hammer from opposite sides of the cone.

3. Disassemble valves A, B, and V in the following manner:

— unscrew plug 29;

— remove spring 28 and ball 27.

Since plugs 29 (figure 70) and valves 34 and 40 were matched for proper fit at the plant, make appropriate marks on these parts for future identification before disassembling valves A, B, and V, as well as when unscrewing the valves.

4. Unscrew handle 39 with valve 34, unscrew lock nut 37 and pressure nut 38 with wrench A52830-5, and remove rings 36 and 35 with wrench A52435-21.

5. Remove the rod and piston from the cylinder in the following manner:

—pull out the rod and piston until it stops against sleeve 14;

— unbend lock washer 47 and unscrew sleeve 14 with wrench 42-250;

— remove the rod 16 and piston.

6. Disassemble the rod and piston in the following manner:

— remove screw 20 and, with wrench A72931-10, unscrew collar ring 19;

— remove collar 18, gasket 17, and ring 43. Sleeve 14 and seal 13 are removed only for repair.

7. Remove plunger 3 in the following manner:

— remove the cotter pin, washer 49, and pin 31; remove washer 30;

— remove the cotter pin and pull out axle 32; remove head 2 and connecting rod 33;

— unscrew screws 44 and remove baffle 5 with gasket 4;

— rotate the plunger 90° with a pair of flat pliers, connect its pin 31 to head 2, and, grasping head 2, remove plunger 3.

8. The plunger is disassembled in the following manner:

— remove cotter pin 22 and unscrew collar ring 10 with wrench A52830-2, push out cylindrical pin 6, unscrew cap 9 of the plunger, and remove collar 8 and collar ring 7. Cap 9 is unscrewed from plunger 3 only when replacing upper collar 8. /124/

Assembly

1. Assemble the plunger in the following order:

— place collar 8 and collar ring 7 on plunger cap 9;

— screw on plunger cap 9 and lock it with pin 6;

— place gasket 21 and the second collar 8 on the cap;

— with wrench A52830-2 screw on collar ring 10 and lock it with cotter pin 22.

2. Install the plunger as follows:

— place the assembled plunger in jack housing 11;

— attach baffle 5 with gasket 4 and fasten it with screws 44; tighten the screws. Align connecting rod 33 with head 2 and housing 11; insert axle 32 and the cotter pins. Connect plunger 3 to head 2 with pin 31, having first installed the two washers 30 and washer 49; insert the cotter pin. 50X1-HUM

3. Assemble the rod and piston as follows:

— place ring 43 with gasket 17 and collar 18 on rod 16;

— using wrench A72931-10, screw on the collar ring 19 and lock it with screw 20; tighten the screw.

4. Insert rod 16 with the piston in the external cylinder 15 of the jack as follows:

— place the two half-collars 42-286 in the jack cylinder;

— place the rod and piston in the cylinder and remove the half-collars 42-286; screw on sleeve 14 with wrench 42-250 and lock it with washer 47.

5. Install valve 34 with handle as follows:

— with wrench A52830-5 screw pressure nut 38 and lock nut 37 on the valve; place ring 36 and the two rings 35 on the valve;

— insert valve 34 with its assembled parts in the opening in housing 11 and press on leather washers 35 of the pressure nut 38; secure with lock nut 37.

6. Place valves A and B in the jack housing and valve V in the box, having first inserted balls 27 and springs 28 and fully tightening plug 29; plug 29 in valve V is then unscrewed two turns and punch-locked.

7. Place ring seal 41 on the cap of filter 42 and screw the cap on the filter with wrench A52830-5, compressing ring 41.

8. Pour fluid into the jack as follows:

— pour steol-M through a funnel into the opening of the cap through filter 42 up to the level of the opening for plug 25, which reads "Level of Liquid";

— place ring seal 24 on plug 25; screw in the plug of valve 40 with the square opening, compressing ring seal 24; then screw valve 40 into place (that is, in the cap of filter 42).

50X1-HUM

/125/

Ring seal 24 may be tightened by striking valve 40 with a hammer on opposite sides of the cone.

9. Place the jack on the trail as follows:

— place the jack on the pin of the trail and secure it in the catch on the trail; at the same time, install washers 46 if they have been supplied;

— tighten nut 26 with wrench A52830-7, making sure the jack rotates freely on the pin, and insert the cotter pin.

Remove the jack from the catch on the trail and place it in locking device 33 (figure 69).

CHAPTER 8

WHEELS, WHEEL BRAKE AND ELECTRIC LIGHTING

42. Wheels

The wheels of the gun are 1350x390. Earlier models had wheels 1350x380.

Each wheel consists of a rim 1 with a tire (Fig. 71) and a hub 3 with a brake drum 4.

The rim 1 for the tire consists of two metal disks on which tire a, filled with foam rubber b, is attached tightly. The metal disks are held together by 12 nuts 15 and bolts 5.

The hub 3 with the brake drum is a cast hub to which brake drum 4 is welded. Hub 3 is attached to the tire rim by 12 nuts 14 and bolts 2.

Bearings 8 and 9, by which the wheel rests on journal 65 (Fig 58) of the lower carriage rocker arm, are located in the hub. The wheel is attached to the journal by a washer 12 and a nut 13 (Fig 71).

The bearings in the hub are lubricated through an aperature closed by plug 11. A seal 10 which holds the lubricant in the wheel hub and keeps dirt out of the internal chamber of the hub is mounted near bearing 9.

The hub on the side of bearing 8 is sealed by cap 6 with gasket ring 7. There are lugs 16 on the cap and on the hub for locking the cap with wire.

The brake drum 4, which is welded to the hub, transfers the braking momentum to the wheel during the operation of the wheel brake.

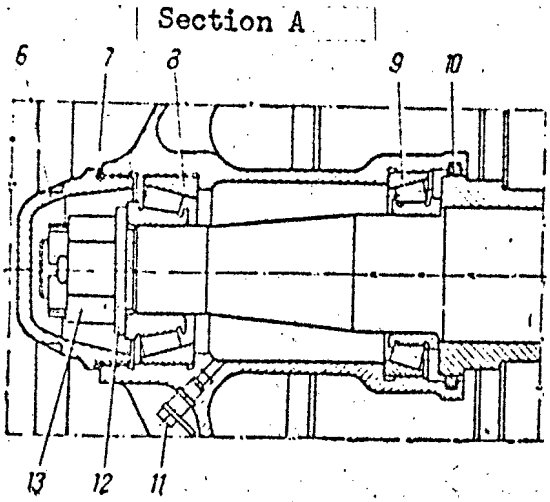
Separating hub 3 from tire rim 1 during field operations is allowed only when changing the wheel.

The procedure for removing and replacing the wheels on the gun is shown in Chapter 12.

43. Wheel Brake

The wheel brake of the shoe type is designed to brake the cannon during travel for sudden stops and to hold it back while going downhill.

The wheel brake has pneumatic control which is activated by the driver of the truck tractor and which operates simultaneously with the brake of the truck tractor. Moreover, there is a hand brake which is activated by a special handle in case of damage to the pneumatic control.



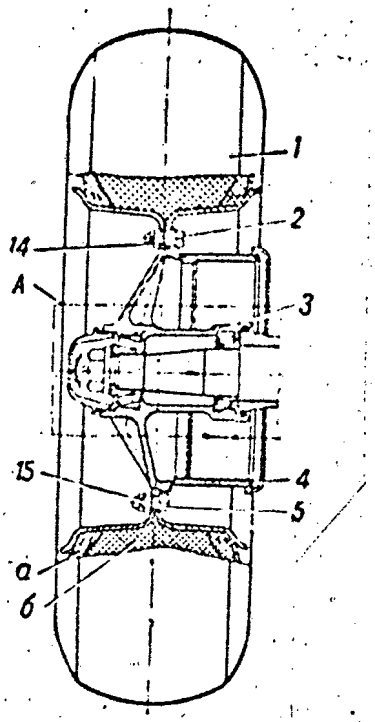
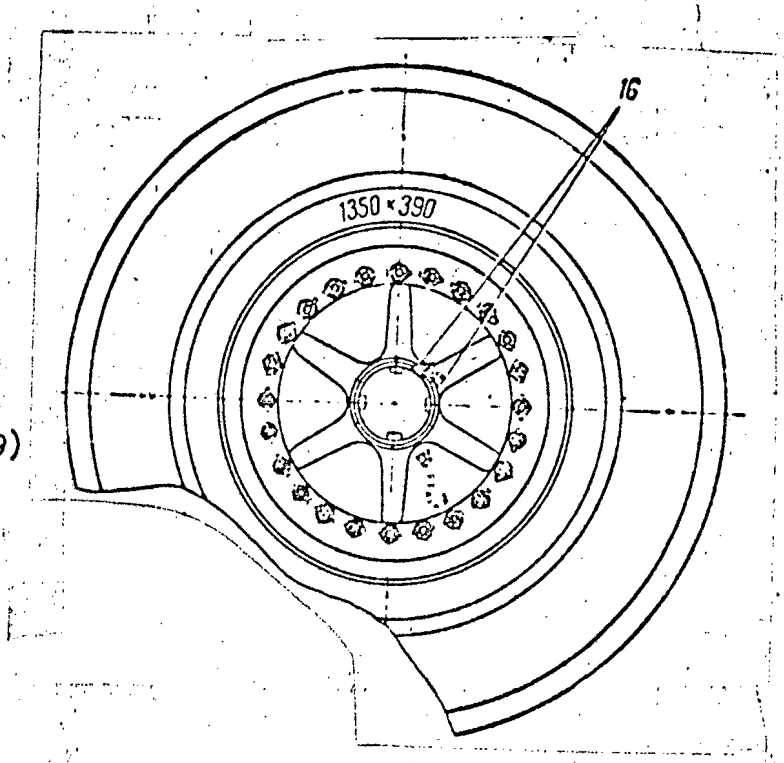


Fig 71: Gun Carriage Wheel [127]

1. tire and rim (Sb25-3)
2. bolt (25-10)
3. hub (25-1A)
4. brake drum (Sb25-1A)
5. bolt (25-18)
6. cap (25-8)
7. gasket ring (25-7)
8. bearing No. 7714
9. bearing No 7518
10. seal (25-5)
11. plug with chain (Sb25-4)
12. washer (18-10)
13. nut (18-11)
14. nut (25-11)
15. nut (25-11)
16. lugs (25-11 and 25-9)

a. rubber tire
b. foam rubber



The wheel brake consists of left disk 16, right disk 8, (Fig 7[illegible]) control valve 11, air reservoir 2, air filter 113, cable 51, rubberized hose 6 and hoses 1, 10, and 12.

50X1-HUM3

Left disk 16 and right disk 8 of the wheel brake are mounted on the lower carriage rocker arm journals 65 (Fig 58) and are prevented from turning by means of keys.

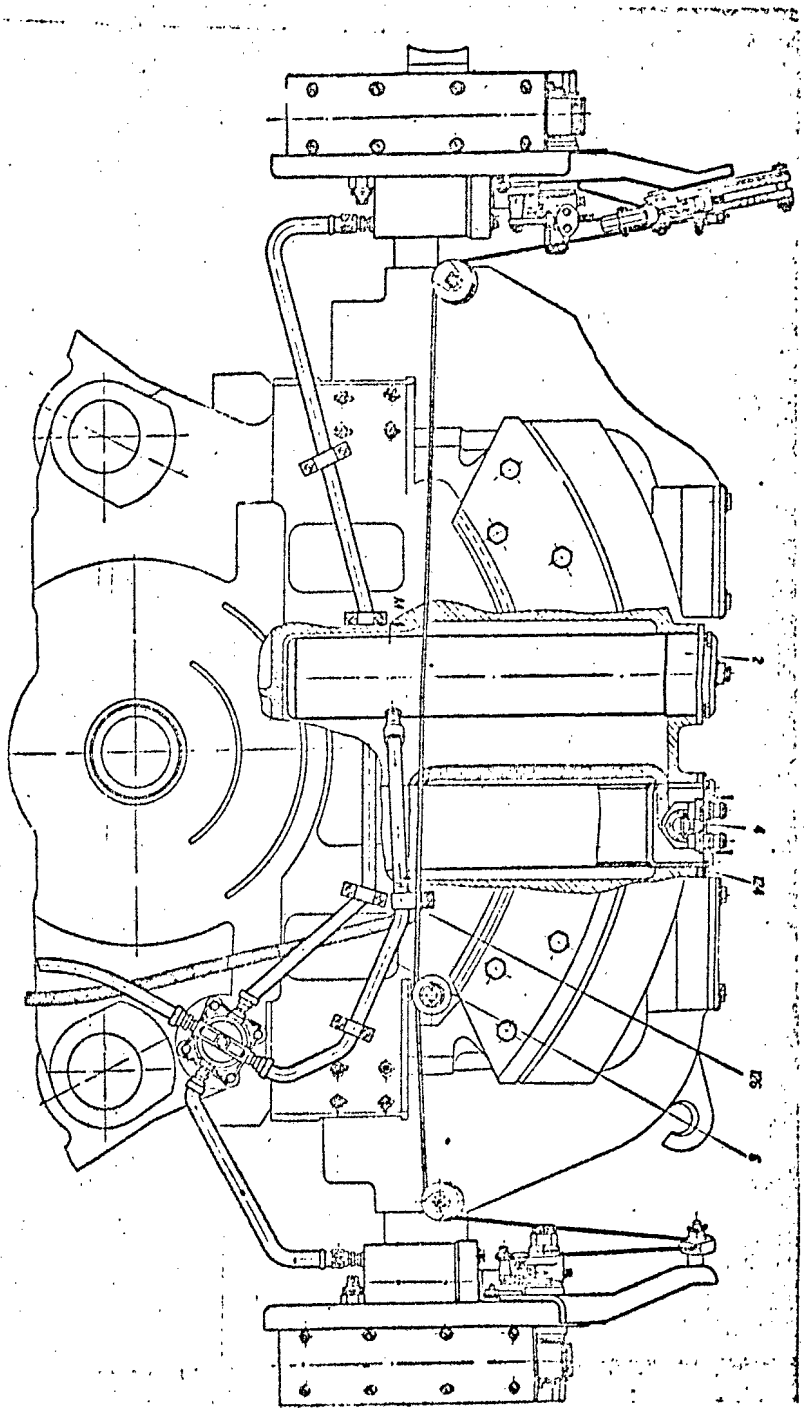


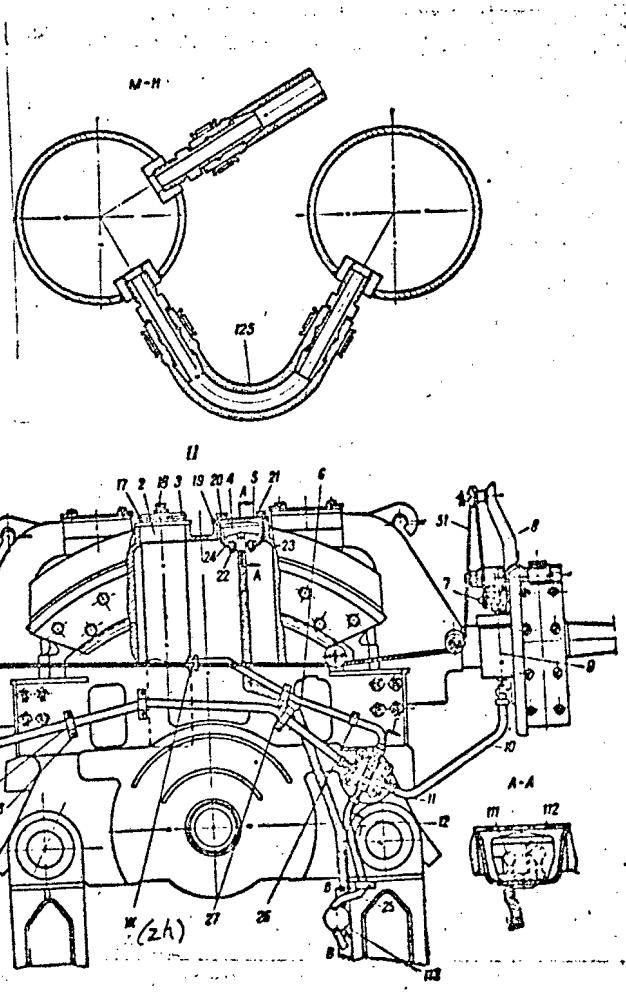
Fig 72. Wheel Brake and Electric Lighting (part 1)

50X1-HUM

Fig 72. Wheel Brake and Electric Lighting

1-hose (cord-reinforced rubber 13, GOST 73-40); 2-air reservoir (Sb26-39A); 3-bolt (A51000-16); 4-rear light (Sb40-1); 5-guard (26-167); 6-hose (cord-reinforced rubber 13, GOST 73-40); 7-washer (A51026-5; 8-right wheel brake disk (Sb26-25); 9-right cylinder (Sb26-37); 10-hose (cord-reinforced rubber 13, GOST 73-40); 11-control valve (Sb26-23); 12-hose (cord-reinforced rubber 13, GOST 73-40); 13-washer (A51021-4); 14-nut (A51011-3); 15-left cylinder (Sb26-36); 16-left wheel brake disk (Sb26-26); 17-spring washer (A51027-5); 18-plug (A5251-28); 19-cup (26-166); 20-bolt (A51000-16); 21-spring washer (A51027-5); 22-pin; 23-nut; 24-spring washer (A51027-3); 25-electrical wiring sheath (26-156); 26-clamp (26-83); 27-bracket (26-105); 28-screw (AA51061-11); 29-hose clamp (26-85); 51-cable (Sb26-16); 111-light bulb; 112-stop-signal light; 113-air filter (Sb26-43); zh-boss; 124-air reservoir (Sb26-27); 125-hose (cord-reinforced rubber 13, GOST 73-40); 126-clip (Sb19-144).

Fig 72. Wheel Brake and Electric Lighting (part 2)



Left disk 16 (Fig. 72) consists of stamped steel disk 97 (Fig. 73) to which is welded bushing 104, bracket 83, pins 110, pegs 103, and rigid ribs on which are installed two brake shoes 93, handle 31 (Fig. 74) with segment gear 36 and lever 38 with left shaft 105 (Fig 73) and cam 86. 50X1-HUM

There are two grooves for keys on bushing 104 to prevent the disk from turning on the rocker arm journal. Two pins 110 and two pegs 103 are used in seating the brake shoes 93. A hole with two bronze bushings in which the left shaft 105 is mounted is located between pins 110.

Located at one end of the left shaft is lever 38 (Fig. 74), which is fastened into the groove by nut 106 (Fig. 73) and washer 107.

Left lug 86, which is held by set screw 101, is inserted into the groove on the other end of the left shaft 105. Cam 86 moves freely along the groove. Lug 86 releases the shoe when braking the cannon.

Furthermore, there are square openings in disk 97 for positioning the left cylinder 15 (Fig. 72), which is attached to disk 97 (Fig. 73) by 3 nuts and bolts 14 (Fig. 72) and washers 13.

Left cylinder 15 (Fig. 72) consists of cylinder 39 (figures 75 and 74), piston rod, spring 44, lid 45, and head 47 of the rod. The piston rod consists of piston 43, collar 42, collar ring 41, and set screw 40. Seal 46 is in lid 45.

The brake shoes are mounted on pins 110 (Fig. 73) and pegs 103 of the left disk 16 (Fig. 72) and are fastened by cover plate 88 (Fig. 73) and washers 92 with cottor pins.

The brake shoe consists of a cast brake shoe housing 93, lining 94, and slide block 87.

Lining 94 is attached to the brake shoe 93 by screws 91 with nuts 90 and spring plates 102. Slide block 87 is attached to the brake shoe by two screws 100.

Eyes i and k with holes to attach springs 89 and 95, which are designed to return the brake shoes to the original position after braking of the cannon, are on the brake shoes.

Pin 96, on which the brake shoes rotate when the brakes are applied, is located between the brake shoes.

Handle 31 with segment gear 36 (Fig. 73 and 74) is mounted on bracket 83 and is used for manual braking of the cannon.

Handle 31 has bushing 108 with an opening for pin 37 by which the handle is attached to bracket 83 of the left disk. 50X1-HUM

Pulleys 56 with guard 55, trigger 30 with connecting rod 50X1-HUM rod 34, spring 35, and catch 52 are mounted on handle 31.

Rod 32 is connected to catch rod 34 by pin 33. Tooth 1, which engages with the gears of segments 36, is on catch 52; in this way handle 31 with pulley 56, is engaged in the necessary position after cable 51 is pulled by hand to brake the cannon. Segment gears 36 are attached to bracket 83 by bolts 99 and nuts 98. Distance tube 109 is located between the segment gears.

Right disk 8 (Fig. 72, 73, 74) is, in structure, similar to left [129] disk 16 and differs only in that the right disk does not have a handle, having instead pulley 56 with guard 55 which are held by a washer and nut. Furthermore, a right cylinder, shaft and cam are mounted in place of left cylinder 15, shaft 105 and cam 86. The inner construction of left cylinder 15 and right cylinder 9 are the same.

Control valve 11 (Fig. 72 and 74) controls the supply of air to the brake cylinders of the wheel brake. The control valve consists of the valve casing and the valve.

In casing 59 (Fig. 74) the valve has an opening to connect with hose 12 (Fig 72) which runs from the prime mover, an opening to connect with pipe 6 which runs to the air reservoir, an opening which is controlled by valve 58 (Fig. 74) and two openings to connect hoses 1 and 10 (Fig. 72) which run to the brake cylinders.

Hoses (cord-reinforced rubber) 1, 10 and 12 connect the valve to the brake cylinders by sleeves 71 (Fig. 74) and collars 70. Moreover, hose 1 (Fig. 72) is attached to the bottom carriage by clamps 29 and screws 28.

Valve casing 59 (Fig. 74) is closed by gasket 79 and nut 72. The valve consists of slide valve 82 with seat 80, collar 81 and shank 60, on the upper part of which is mounted cup 64 and disk 65, ring 66, spring 67, cap 68 and ring 69. Cup 64 is held by washer 63 and nut 62, which is arrested by a cotter pin.

Disk 73 with washers 75 and 76, ring 77 and spring 78 are mounted on the lower part of shank 60. The disk is held by nut 62, which is arrested by a cotter pin.

There are four through slots in the center opening and eight through openings in the side wall of seat 80 for the air to pass from the air reservoir to the braking cylinders when the brakes are applied.

Air reservoir 2 (Fig. 72) creates the air supply for the wheel brake system necessary to brake the cannon. 50X1-HUM

The air reservoir is a cylindrical tank attached to the lower carriage by four bolts 3 with spring washers 17. Threaded boss zh, used to connect pipe 6 to the control valve, is on the side of the air reservoir. There is an opening in the front part of the air reservoir to drain the liquid which has accumulated in the air reservoir. This opening is shut off by plug 18.

Connecting pipe 6 is attached to the lower carriage by clamp 26 and bracket 27 with screws 28.

Air filter 113 (Fig. 72) purifies the air which is fed to the wheel brake assembly of dust and moisture. The air filter consists of casing 116 (Fig. 73), cover 115, bottom 121, and filter 123 with rings 122.

Pressure packing 120 is installed between the cover and the bottom. Casing 116 is a steel cylinder which has outer threads on the upper and lower parts for attaching the cover and the bottom. In the middle part of the casing are two collars for braces 118, which hold the air filter on the right trail of the cannon by two bolts 117.

Cover 115 has pipe 119, with openings for the passage of air which enters the air filter, and two connecting pieces 114 to connect the hoses from the prime mover to the control valve.

50X1-HUM

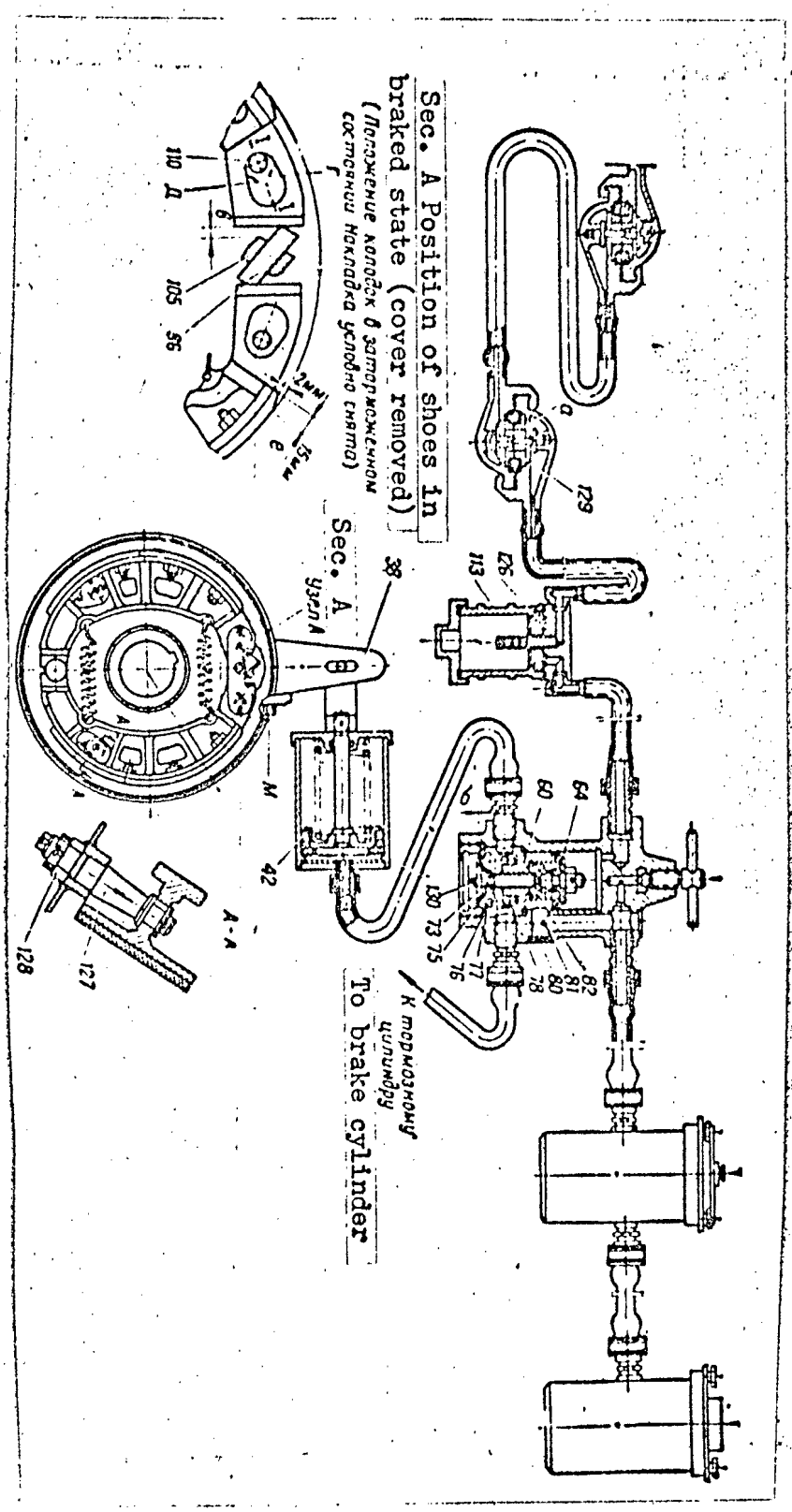


Fig. 73. Wheel Brake (part 1)

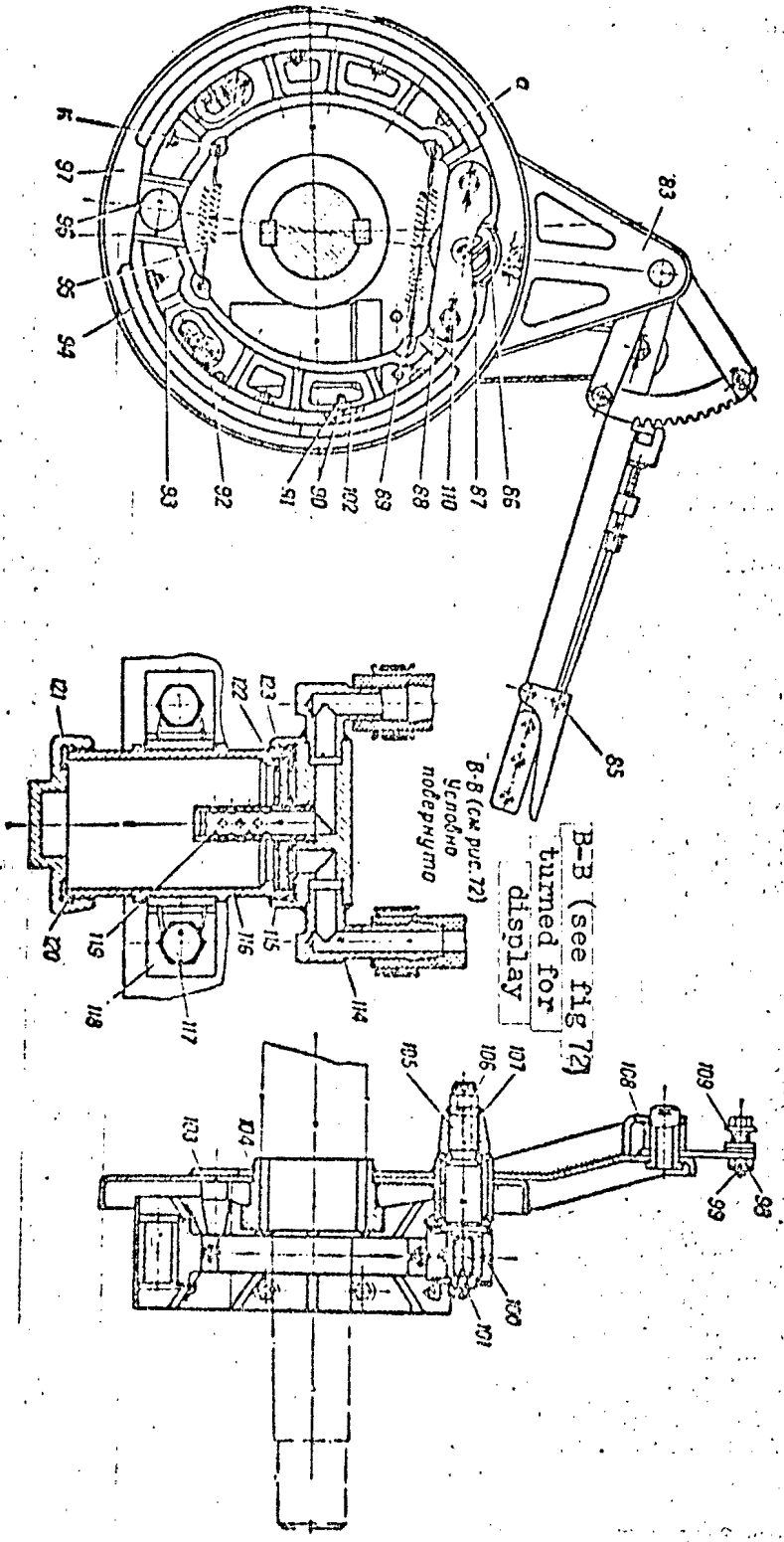


Fig 73. Wheel Brake (part 2)

Figure 73. Wheel Brake

38-right, left lever (Sb26-46, Sb26-45); 42-collar (10-83); 60-shank (26-125A; 64-cup (26-182); 73-disk (26-137A); 75-washer (26-121); 76-washer (26-132); 77-ring (26-127A); 78-spring (26-123A); 80-seat 26-126A); 81-ring (26-131); 82-slide valve (26-124A); 83-left bracket (26-34); 85-pin 8X,X30 (A51620-110); 86-right, left cam (26-65, 26-66); 87-slide block (26-2); 88-cover plate (26-67); 89-spring (26-69); 90-nut M10Sh (A51010-5); 91-screw M10x30 (A51060-17); 92-washer (A51021-7); 93-brake shoe (26-1); 94-brake shoe lining (26-4); 95-spring (26-70); 96-pin (26-26); 97-left disk (26-32); 98-nut M10ShK (A51011-3); 99-bolt (A51000-20); 100-screw M6X15 (A51060-8); 101-screw (A51064-7); 102-spring washer (A51027-5); 103-peg (26-28); 104-bushing (26-33); 105-left, right shaft (26-64A, 26-63A); 106-nut (A51011-8); 107-washer (A51021-11); 108-bushing in lever (26-42); 109-distance tube (26-43); 110-shoe pin (26-29); 113-air filter (Sb26-43); 114-connecting pipe (26-186); 115-cover (Sb26-12); 116-casing (26-187); 117-bolt (A51002-8); 118-brace (26-192); 119-pipe (Sb25-41); 120-gasket (26-191); 121-bottom (26-188); 122-ring (26-189); 123-filter (26-190); i-eye; k-eye; 126-filter (S626-48; 127-eccentric cam (26-202); 128-nut (25-11); 129-cup (A52352-8); 130-nut (A51011-1); m-stem of worm axis; a-sealing surface of cup; b-gap between washer and disk; v-gap between slide block of shoe and edge of shaft; g-upper surface of the oval opening; d-lower surface of the oval opening; e-beveled face. [131]

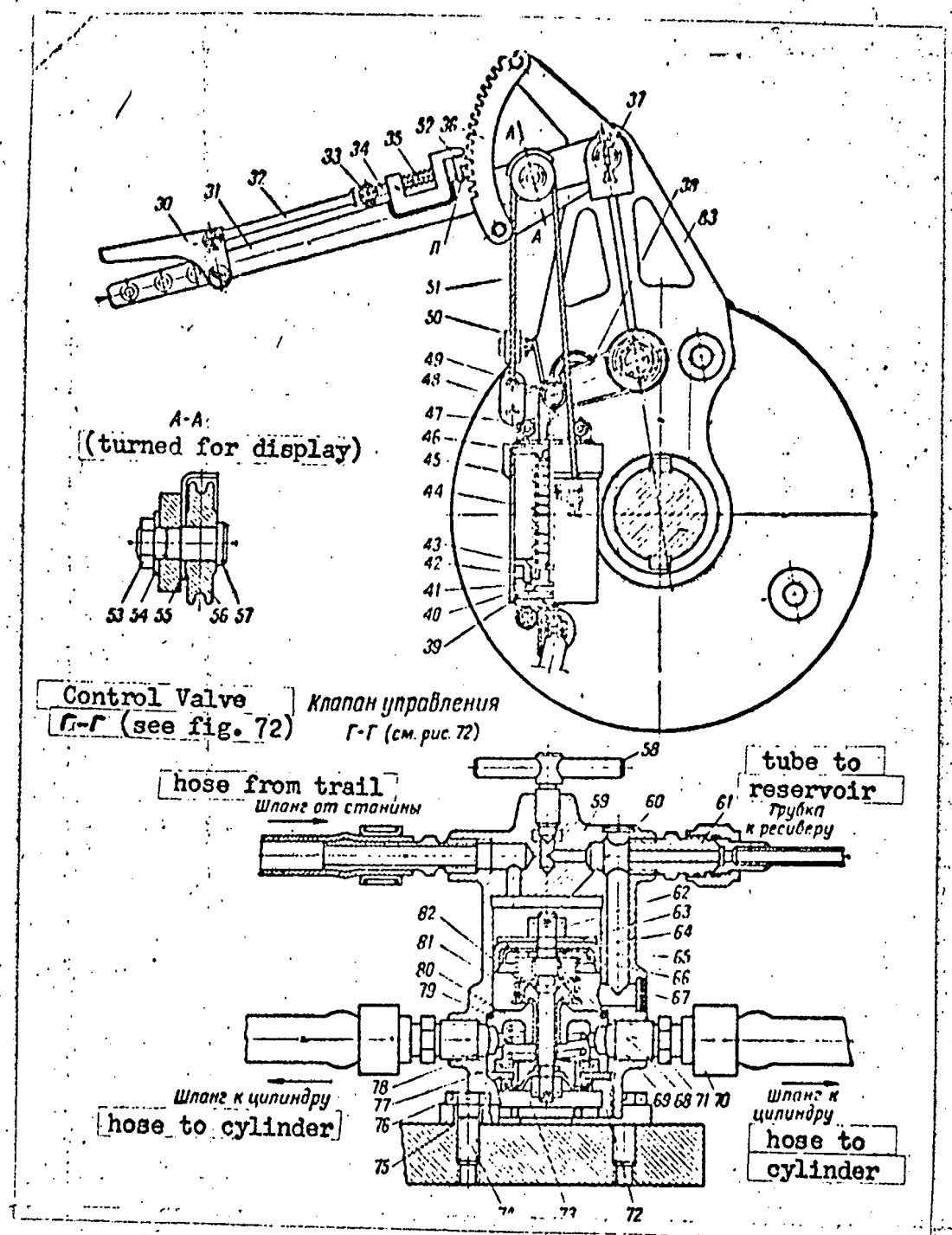


Fig 74. Wheel Brake

Figure 74. Wheel Brake

30-trigger (26-60); 31-handle (Sb26-10); 32-connecting rod (26-56); 33-pin (26-57); 34-catch rod (26-55); 35-spring (26-54); 36-segment gear (26-75); 37-pin (26-61); 38-lever (Sb26-19); 39-cylinder (Sb26-35); 40-screw M6x8 (A51063-7); 41-collar ring (26-172); 42-collar (10-83); 43-piston (Sb26-33); 44-spring (26-171); 45-lid (26-173); 46-seal (26-168); 47-head of rod (26-17); 48-lug (26-18); 49-pin (A51620-65); 50-washer (26-102); 51-cable (Sb26-16); 52-catch (26-53); 53-nut (A51024-46); 55-guard (26-50); 56-pulley (26-30); 57-pin (26-103); 58-valve (Sb26-24); 59-valve casing (Sb26-22); 60-shank (26-125); 61-terminal sleeve (26-175); 62-nut M8ShK (A51011-2); 63-washer (26-134); 64-cup (26-133); 65-disk (26-135); 66-ring (26-129); 67-spring (26-122); 68-cap (26-136); 69-ring (26-130); 70-collar (A71312-9); 71-sleeve (A52264-36); 72-nut (26-144); 73-disk (26;137); 74-bolt M10x25 (A51002-15); 75-washer (26-121); 76-washer (26-132); 77-ring (26-127); 78-spring (26-123); 79-gasket (26-145); 80-seat (26-126); 81-ring (26-131); 82-slide valve (26-124); 83-left bracket (26-34); 1-trigger tooth.

Felt filter 123 purifies the air from the tractor compressor. Ring 122 with holes is for the attachment of filter 123. 50X1-HUM

Cable 51 (Fig. 72) transmits the force to the cams of the brake shoes when the cannon is braked by hand.

It is possible to regulate the length of the cable. Some cannons have an auxiliary air reservoir 124 (Fig. 72) (at the forward end of which is the rear light) to speed up the operation and the response of the air brakes. Connecting tube 6 is replaced by a rubber hose. Air reservoir 2 is connected to the auxiliary air reservoir 124 by hose 125.

In air filter 113 (Fig. 73), felt filter 123 (Fig. 73) is replaced by two metallic grid filters 126. Peg 103 (Fig. 73) is replaced by cam 127 (Fig. 73) to regulate the position of the brake shoes during their assembly in the factory. The cam is fastened by nut 128 and a cotter pin. Nut 128 is welded at two places. The position of the brake shoes is regulated by cam 127 only when changing brake shoes during repairs.

Shafts 105 are replaced by shafts with smaller grooves under lever 38.

Lever 38 (Fig. 74) is replaced by lever 38 (Fig. 73), which makes it possible to control the output of the coupling rod from the brake cylinder by turning collar m with a wrench.

To increase the quick response and reliability of the operation of the control valve, the following parts are changed: spring 78, slide valve 82, shank 60, seat 80, ring 77, disk 73. Leather cup 64 is replaced by a rubber cup.

44. Operation of the Wheel Brake

When the gun is transported, the compressor feeds air continuously under a pressure of 5-6 atm to the gun air system. From the tractor compressor the air passes through hoses on the limber and the right trail of the cannon to air filter 113 (Fig. 72-76). In the air filter the air passes through tube 119 and the felt filter, where it is cleaned of dust and moisture. From the air filter the air passes to the control valve 11 through a hose.

The air, once in the control valve, forces the rim of cup 64 from the wall of casing 59 and goes to the air reservoir through the clearance which has been created.

50X1-HUM

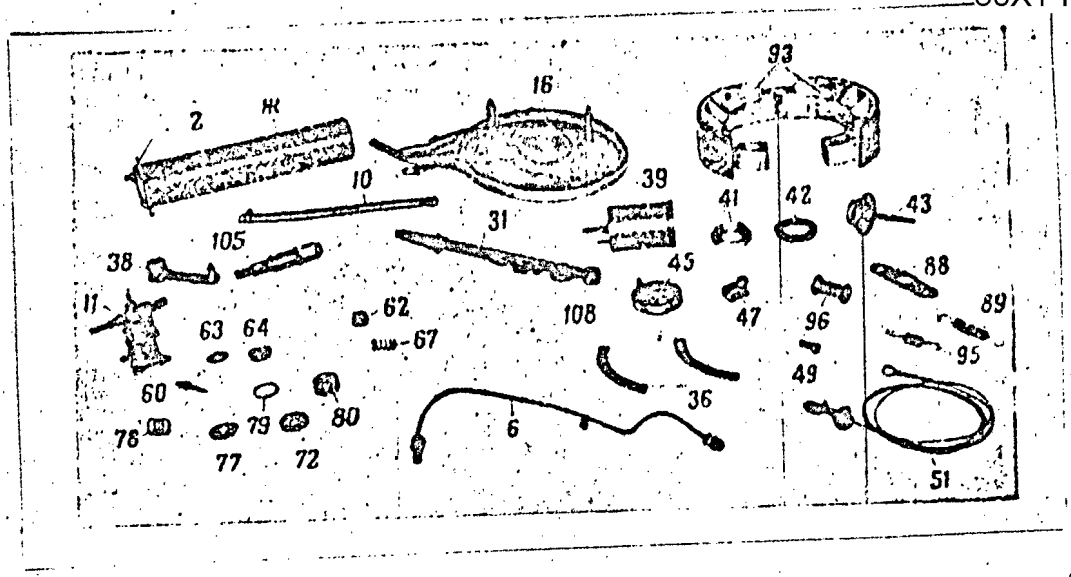


Fig 75. Parts for the Wheel Brake

[134]

2. air reservoir (Sb 26-39)
6. connecting pipe (Sb 26-38)
10. hose (rubber, cord-reinforced, 13, GOST 73-40)
11. control valve (Sb 26-23)
16. left wheel brake disk (Sb 26-26)
31. handle (Sb 26-10)
36. segment gears (26-75)
38. lever (Sb 26-19)
39. cylinder (Sb 26-35)
41. collar ring (26-172)
42. collar (10-83)
43. piston (Sb 26-33)
45. lid (26-173)
47. coupling rod head (26-17)
49. pin (A51620-65)
51. cable (Sb 26-16)
60. shank (26-125)
62. nut M8ShK (A51011-2)
63. washer (26-134)
64. cup (26-133)
67. spring (26-122)
72. nut (26-166)
77. ring (26-127)
78. spring (26-123)
79. gasket (26-145)
80. seat (26-126)
88. cover plate (26-67)
89. spring (26-69)
93. brake shoe (26-1)
95. spring (26-70)
96. pin (26-26)
105. left shaft (26-63)
108. bushing in lever (26-42)

zh. nipple

Pressure in air reservoir 2 increases until it is equal to the air pressure which is arriving from the tractor compressor. The air pressure under and over cup 64 is equalized. But since the area of the cup on which the air pressure acts from above is greater than from below (due to shank 60 and slide valve 82), the resulting force against the cup will work downwards. 50X1-HUM

Shank 60 drops down and slide valve 82 with ring 81 settle on seat 80, sealing chamber b of the valve housing from chamber v. As shank 60 drops, disk 73 which is attached to it drops simultaneously, producing gap g between washer 76 and disk 73; air is transmitted to the right and left brake cylinders through this gap.

Thus, when the piece is not being braked the air pressure in the supply systen and in the air reservoir is 5-6 atmospheres (equal to the air pressure supplied by the compressor of the tractor), and in the brake cylinders, the pressure equals atmospheric pressure. [134]

When the brakes are applied, the pressure in the main air line which connects the tractor to the gun is reduced to atmospheric pressure. In view of the fact that the pressure on cup 64 from the air reservoir becomes greater than from the side of the air supply, cup 64, together with shank 60 and disk 73, begins to rise.

Then, gap g between disk 73 and washer 76 closes, resulting in closing of the brake cylinders to the atmosphere.

To prevent air leaking from chamber b to chamber v before gap g is closed, there is a rubber ring 69 which is tightened by cap 68 and spring 67.

With further movement of shank 60 upward, washer 76 collapses, spring 78 compresses, and gap d between washer 75 and slide valve 82 closes; washer 75 pushes against the end of slide valve 82 and pushes it upward together with ring 81. As a result, a gap is formed between washer 81 and seat 80 through which the air passes (through the 4 grooves and 8 openings in seat 80) from the air reservoir to the brake cylinders.

The air which has entered the brake cylinders causes pistons 43 to move and levers 38 and shafts 105, which are connected to them, to rotate. Cams 86, which are mounted on shafts 105, push apart the brake shoes which are fixed against the brake drums, thereby braking the cannon.

Thus, when braking the cannon, the air in the supply system equals atmospheric pressure, but the air pressure in the air reservoir and in the brake cylinders is 3.5-4 atm (the air pressure in the air reservoir when the brakes are not being applied is 5-6 atm.). Some drop in pressure in the reservoir during braking of the cannon is due to the fact that [illegible] air passes from the air reservoir to the brake cylinders. 50X1-HUM

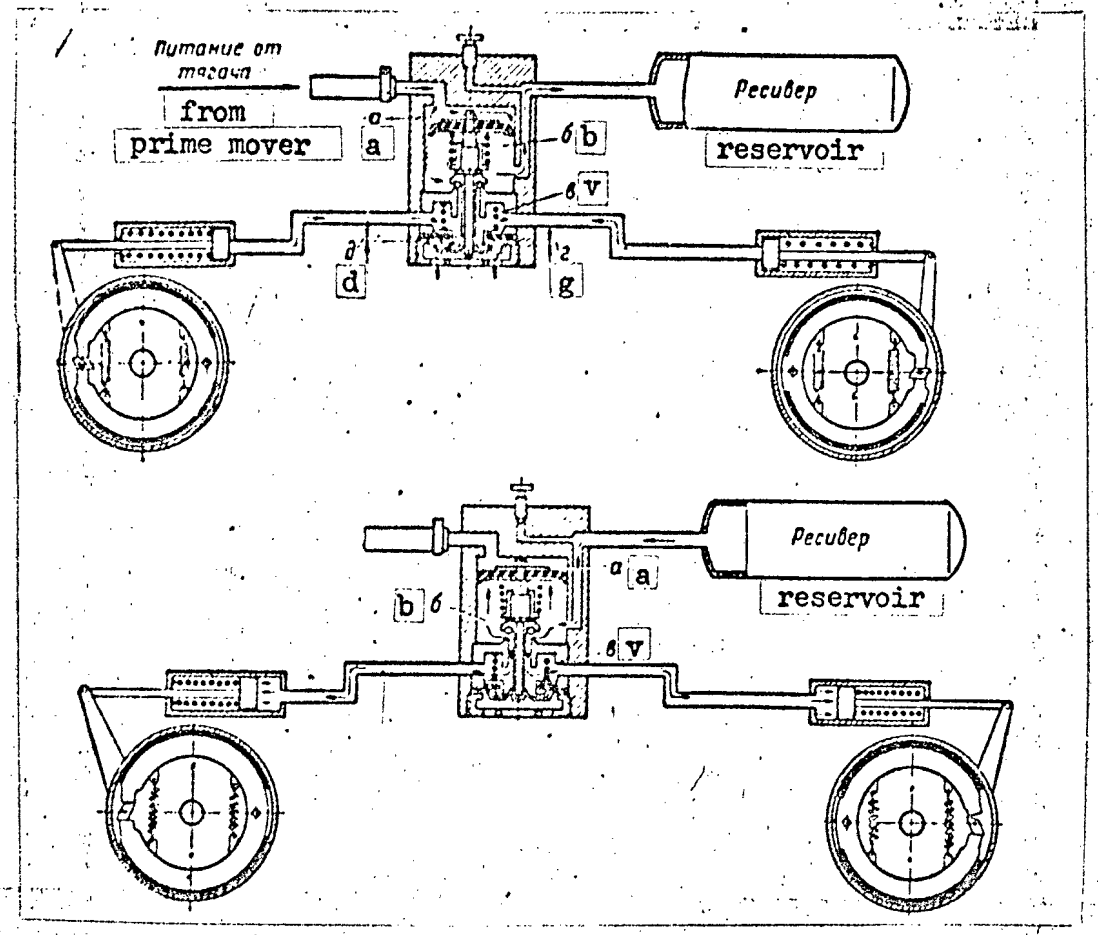


Fig 76. Wheel Brake Operation

a,b, v. chambers

g and d. gaps

After the brakes are released and the pressure in the main air line which connects the tractor to the gun rises to normal (5-6 atm), the air which has entered the control valve forces out the edge of cup 64 and goes to air reservoir 2.

Shank 60 and cup 64 drop, and slide valve 82 and washer 81 rest on seat 80, sealing chamber b of the valve casing from chamber v.

When shank 60 drops, disk 73, attached to it drops simultaneously and produces gap g between washer 76 and disk 73; the air which was under pressure in the right and left brake cylinders goes out through this gap.

The brake cylinder pistons and levers 38 return to their initial position under the effect of springs 89, 95, and 44. The brake shoes are drawn together creating a gap between the brake shoes and the brake drums of the wheel. The brakes of the cannon are released.

When partial braking and not complete braking is required, the air pressure in the supply system is reduced not to atmospheric pressure but to 1-3 atm (depending on the intensity required to brake). Therefore, the control valve functions as follows.

The air pressure in the supply system and in the air reservoir is identical and equal to 5-6 atm up to the time of braking of the cannon. If at the time of braking the air pressure in the supply system is reduced and equals 2 atm, then the pressure on cup 64 from the air reservoir becomes greater than that from the supply system: cup 64, shank 60 and disk 73 began to rise. [136]

In this case gap g between disk 73 and washer 76 first closes and cuts off the connection of the brake cylinders with the air. When shank 60 moves further up, washer 76 collapses, spring 78 compresses, and gap d between washer 75 and slide valve 82 closes; washer 75 pushes against slide valve 82 and pushes it and washer 81 up. This results in a gap being formed between ring 81 and seat 80 through which the air enters into the brake cylinders from the air reservoir. However, at the time of braking, the air pressure in the brake cylinders increases not to 3.5-4 atm, as during complete braking, but to a lesser value, which depends on the air pressure in the supply system. For example, when the air pressure in the supply system is 2 atm, the air pressure in the brake cylinders rises to approximately 1.5 atm.

This takes place as follows:

Shank 60, cup 64, and disk 73 are under the influence of the following forces:

— air pressure in chamber a, which is acting on cup 64, creates a force which is directed downward;

— air pressure in chamber b, which is acting on cup 64, creates a force which is directed upward; 50X1-HUM

— air pressure in chamber v, which is acting on disk 73, and the force of spring 78 create a force which is directed downward if gap g is absent and the pressure in v is greater than atmospheric. This will happen when shank 60 with all the parts mounted on it is in an upper position. When shank 60 is in the lower position, the air pressure in chamber v is the same as the atmospheric pressure; in this case, there are no forces acting downward on disk 73.

During braking of the cannon, until the force which is directed upward is greater than the total of all the forces directed downward, shank 60 with all the parts on it will remain in the upper position. In this case there is an increase in pressure in the brake cylinders due to air entering from the air reservoir.

Simultaneously with the increase in pressure in the brake cylinders there occurs an increase in pressure in chamber v of the control valve and, consequently, an increase in the forces directed downward. When the sum of the forces directed downward becomes greater than the forces directed upward, shank 60 with all its parts drops until the action of spring 78 ceases due to shoulder on nut 72. The slide valve and ring press into the seat, and the flow of air from the reservoir to the brake cylinders ceases.

In this position, the forces directed upward cannct overcome the force of spring 78 and raise the slide valve and ring, while the forces directed downward cannot overcome the force directed upward and, consequently, create a gap g through which the brake cylinders would be connected with the atmosphere. The pressure created in the brake cylinders would be connected with the atmosphere. The pressure created in the brake cylinders depends on the pressure of the air in the supply system. The less the pressure in the supply system, the greater the pressure in the brake cylinders, that is, the stronger will be the braking of the weapon.

When separating the weapon from the prime mover (upon arrival at the firing position or accidental separation of the limber from the prime mover), the weapon will be braked, since a drop in pressure will occur in the air system connecting the weapon with the prime mover. [137]

In order to release the brakes it is necessary to open valve 58 of the control valve, allow air to pass through it from reservoir 2, and again close valve 58.

50X1-HUM

Manual braking of the weapon requires that handle 31 of the wheel brake be pulled toward the operator. When handle 31 moves, cable 51 tightens and turns levers 38 together with shafts 105 and cams 86. Cams 86 separate the brake shoes and brake the weapon. 50X1-HUM

To release the brakes on the weapon it is necessary to squeeze trigger 30 on handle 31 and return the handle to the original position. The action of springs 89, 95, and 44 will then cause levers 38 with shafts 105 and cams 86 and the brake shoes to return to their original positions. The brakes on the weapon will be released.

45. Disassembly and Assembly of the Wheel Brake

Before disassembly of the wheel brake, the wheels must be removed in the order described in chapter 12.

Disassembly of the Wheel Brake

1. Disconnect cable 51 from levers 38 (Fig 74) and handle 31 in the following manner:

— remove the cotter pin and washers 7 (Fig 72) from levers 38 (Fig 74);
— remove the cable from levers 38;
— bend back lock washer 54 and, with wrench A52830-5, remove nut 53 holding the pulley on handle 31, remove lock washer 54, withdraw pin 57 with pulley 56, remove the cotter pins, unscrew the nuts holding the cable to the rocker arms of the lower carriage and the bracket of the right brake disk, and remove the cable.

2. Remove the hoses as follows:

— remove the cotter pins and, with wrench A52830-2, loosen the nuts on the collars of hoses 1, 10, and 12 (Fig 72) connected to the sleeves of the control valve and the air filter;
— remove the hoses from control valve 11 and air filter 113;
— with wrench A52830-4 unscrew the sleeves with their hoses from the brake cylinders;
— unscrew screw 28, remove collars 29, and remove hose 1 from the bottom carriage;
— separate pipe 6 from control valve 11 with wrench A52830-5.

3. Remove the brake shoes as follows:

— remove the cotter pins, cover plate 88 (Fig 73), and washers 92 which hold brake shoes 93;
— remove brake shoes 93 and disconnect them by removing springs 89 and 95. 50X1-HUM

It is forbidden to remove linings 94 from the brake shoes

— remove the cotter pins and, with wrench A52830-6, unscrew nut 106 and take off washers 107; 50X1-HUM [138]

— remove the cotter pins, push out shaft 49 with a screwdriver, and remove levers 38;

— remove shafts 105 (Fig 73) with cams 86;

— remove the cotter pins and, with wrench A52840-23, unscrew nut 14 (figure 72) which holds brake cylinders 9 and 15, remove washers 13, and take out the brake cylinders.

5. The brake cylinders 9 and 15 are disassembled as follows:

— unscrew lid 45 from the cylinder and remove it together with spring 44 and the rod and piston;

— remove the cotter pin, unscrew head 47 of the rod, and remove spring 44.

The rod and piston are disconnected by unscrewing set screw 40 with wrench 42-233, unscrewing collar ring 41, and removing collar 42.

6. Remove handle 31 as follows:

— remove the cotter pin and knock out pin 37 (Fig 74) with a rod;

— remove the cotter pin and, with wrench A52830-4, unscrew the forward nut 98 (Fig 73) of the segment gear and pull out bolt 99;

— remove handle 31 (Fig 74).

7. Handle 31 is disassembled as follows:

— remove the cotter pins and shafts 33 and 85 (Fig 73) which hold trigger 30 and rod 32 (Fig 74);

— remove trigger 30 and 32;

— unscrew catch rod 34 and remove catch 52 and spring 35.

The right disk 8 and left disk 16 (Fig 72) are removed from the rocker arm only for purposes of repair. The disks are removed by lightly tapping around the rim of the disks with a hammer and copper strip.

8. Remove control valve 11 as follows:

— remove the wire and, with wrench A52840-23, unscrew bolts 74 (Fig 74) which hold the control valve to the bottom carriage;

— remove the control valve.

9. The control valve is disassembled as follows: (Fig 72):

— unscrew nut 72 (Fig 74) with wrench A72931-10;

— remove the cotter pin and unscrew the bottom nut on the valve, remove disk 73, and, with wrench A52435-21, remove ring 77 with rubber washer 76; then remove the shank and remaining parts attached 50X1-HUM

— disassemble the valve by removing spring 78, seat 80 with gasket 79, washer 75 with slide valve 82 and rubber ring 91 (it is forbidden to remove the rubber ring 91 from slide valve 82); remove the cotter pin and unscrew

disk 65, spring 67, ring 66, cap 68, rubber ring 69 (ring 69 is rem 50X1-HUM only if it is to be replaced).

Sleeves 61 and 71 may be removed from the valve casing only if they are to be replaced.

10. Remove air reservoir 2 (Fig 72) as follows:

— disconnect pipe 6 from the reservoir with the aid of wrench A52830-5, unscrew the screws in collar 26 and bracket 27, and remove pipe 6;
— unscrew bolts with wrench A52830-4 and remove reservoir 2.

11. Air filter 113 is removed as follows:

— remove the wire and unscrew bolts 117 with wrench A52830-2, remove bracket 118 (Fig 73) and air filter 113 (Fig 72).

12. Disassemble the air filter as follows: [139]

— unscrew cover 115 (Fig 73) and remove it together with ring 122; remove packing 120 and unscrew pipe 119 from the cover only if they are to be replaced;
— remove filter 123 with rings 122;
— unscrew the bottom 121 of the filter together with packing 120.

Assembly of the Wheel Brake

The wheel brake is assembled is the following order:

1. Assemble the air filter as follows:

— place filter 123 with rings 122 in casing 116 (Fig 73);
— screw cover 115 containing packing 120 onto the casing;

2. Place the air filter on the trail screw on bolts 117 with wrench A52930-2, and safety-lock the filter with wire.

3. Install the air reservoir and, with wrench A52830-4, screw on bolts 3 (Fig 72) with spring washers 17; connect pipe 6 to the reservoir with wrench A52830-5.

4. Assemble the control valve as follows:

— place slide valve 82 with ring 81, seat 80 with spring 78, ring 77, and washer 76 on shank 60 (Fig 74), install washer 75 and disk 73, and screw on the bottom nut with wrench A52840-10 and insert the cotter pin;

— place ring 69 (if it has been removed), cap 68, ring 66, spri 50X1-HUM disk 65, cup 64, and washer 63 on the top part of shank 60; screw on the top ut 62 with wrench A52840-10 and insert the cotter pin;

— screw on nut 72 with wrench A72931-10;
— screw down valve 58.

50X1-HUM

5. Place the control valve on the lower carriage, tighten bolts 74 with wrench A52940-23 and safety-lock them with wire.

6. Install the right disk 8 and left disk 16 (Fig 72) on the rocker arms of the bottom carriage (if they have been removed for replacement). The disks are installed by lightly tapping around the edge of the disks with a hammer and copper strip.

7. Assemble handle 31 (Fig 74) as follows:

— install spring 35 and catch 52 and screw on catch rod 34;
— install trigger 30, rod 32, secure them with their pins, and insert cotter pins.

8. Install handle 31, secure it with pin 37 and a cotter pin, install segment gear 36, and secure it with bolts and nuts; secure the nuts with cotter pins.

9. Assemble the brake cylinders as follows:

— place collar 42 on piston 43, screw on collar ring 41 with wrench 42-233, and lock it with screw 40;

— insert the piston and spring 44 into the cylinder;
— screw on cover 45;
— screw on head 47 of the rod and secure it with a cotter pin.

10. Install the brake cylinders as follows: (140)

— place the brake cylinders on the right 8 and left 16 disks (Fig 72), insert washers 13, tighten nuts 14 with wrench A52840-23 and secure them with cotter pins;

— insert shafts 105 with cams 86 (Fig 73);

— install levers 38 and pins 49 (Fig 74); insert cotter pins in the pins.

11. Install the brake shoes as follows:

— place springs 89 and 95 (Fig 73) on the brake shoes and insert pin 96;

— place the brake shoes on the right and left disks, install the coverplates 88 and washers 92, and secure the latter with cotter pins;

— install washers 107, tighten nuts 106 with wrench A52890-8, and secure the nuts with cotter pins.

50X1-HUM

brake cylinders, having first applied red lead or graphite to the sl 50X1-HUM connect the hoses to the control valve and air filter, and tighten the nuts on the collars with wrench A52830-2 and insert cotter pins; connect pipe 6 (Fig 72) to the control valve with wrench A52830-5.

Only graphite lubricant should be applied to the threaded connections of the sleeves and the connections between the hoses and the sleeves.

13. Install the cable as follows:

— place the cable on pulley 56 (Fig 74);
— place pulley 56 on pin 57, insert pin 57 in handle 31, install washer 54, tighten nut 53 with wrench A52830-5, and lock the latter with washer 54;

—attach the cable to the bottom carriage, rocker arms, and the bracket of the brake disk;

— place the ends of the cable on levers 38, install the washers, and secure them with cotter pins.

46. Electrical Lighting

A tail light 4 (Fig 72 and 77) is located on the bottom carriage of the weapon for the purpose of lighting the weapon while traveling.

Light 4 contains two electric bulbs. Bulb 111 is an illuminating bulb which remains lit while the weapon is traveling; bulb 112 is a stop signal bulb and is turned on automatically when braking the weapon to warn those following the weapon.

Light 4 is placed in cup 19 (Fig 72) and is held by two small pins 22 with nuts 23 and spring washers 24.

Light 4 is covered by guard 5 to protect it from damage. Cup 19, with light 4 and guard 5, is attached to the bottom carriage by four bolts 20 and spring washers 21.

The electrical wiring for light 4 is protected by sheathing 25 and is attached to the bottom carriage by bracket 27 and screws 28.

50X1-HUM

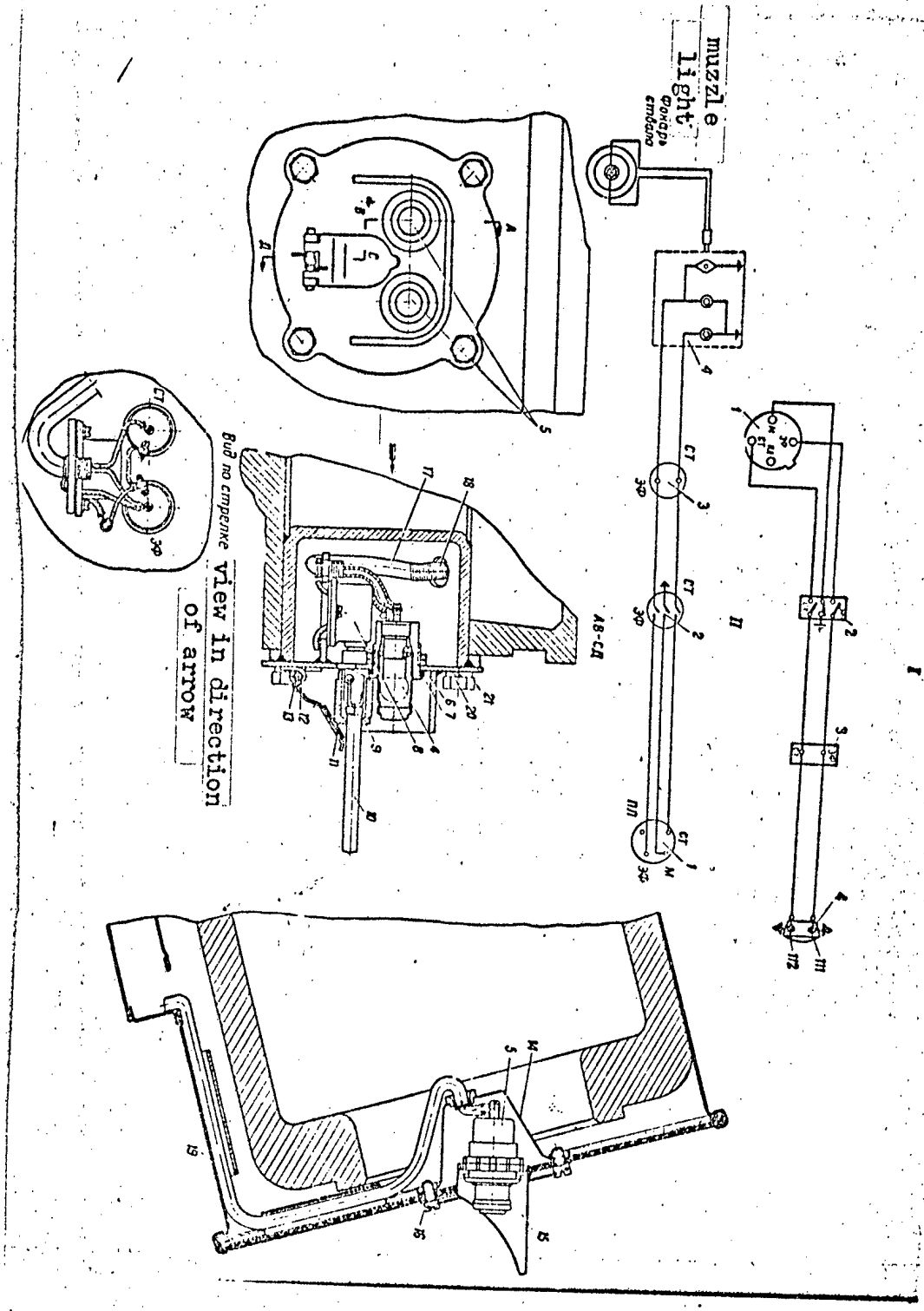


Fig 77. Electrical Lighting Diagram (See next page for caption)

Fig. 77. Electrical Lighting Diagram

1 - plug PS-11, connected to prime mover; 2 - plug connection on trail; 3 - terminal box on trail; 4 - rear light (Sb40-1); 5 - illuminator OSLT-37 with red lens; 6 - base of light (Sb40-3); 7 - washer (40-8); 8 - recertacle ShR-51; 9 - plug type ShV-51; 10, 17, and 19 - conductor (ShRP1 2x1 cable); 11 - cover (40-4); 12 - spring (40-6); 13 - pin (40-19); 14 - inner cup (40-14); 15 - hood (40-16); 16 - screw (A51066-7); 18 - electrical sheathing (26-156); 20 - bolt (A51000-16); 21 - spring washer (A51027-5); 111 - illuminating bulb; 112 - stop-signal bulb

An electrical diagram of the wiring for light 4 on the weapon is given 50X1-HUM in Figure 77.

The light is removed from the weapon in the following order:

— disconnect the wiring from the terminal box on the right trail;
— unscrew bolts 20 with spring washers 21 and remove the guard;
— unscrew the screws holding brackets 27 which secure the wire to the bottom carriage, and remove light 4 with cup 19 and the wires.

The light is installed on the weapon in the following order:

— set light 4 with cup 19 on the bottom carriage;
— cover cup 19 with guard 5 and screw on bolts 20 with spring washers 21 using wrench A52830-4; [141]
— connect the wiring to the terminal box on the right trail and fasten it to the bottom carriage with bracket 27.

If it is necessary to replace a bulb or examine the contacts, the rear light may be removed without disconnecting the wiring from the terminal box on the trail and without removing bracket 27.

Some guns have a unified lighting system installed on the bottom carriage and the muzzle cover (Fig 77, II). The rear light 4 on the bottom carriage has two illuminators 5 with bulbs; the bulb in one illuminator may burn constantly (clearance light), while the other bulb lights automatically when braking the weapon (stop signal). The bulb in the light on the muzzle cover may also burn constantly (clearance).

Rear light 4 is placed in an auxiliary receiver cup. The base of light 6 is held by bolts 20 with spring washers 21, which also hold the auxiliary receiver. Two illuminators 5 with a shock-absorbing gasket 7 and receptacle 8 are attached to the base of light 6. Plug 9 with wire 10 is used to connect the muzzle light to receptacle 8. When the muzzle light is not connected, the opening for plug 9 is closed by a cover 11 with spring 12 and pin 13.

The muzzle light consists of an inner cup 14 and hood 15, to the base of which is attached an illuminator in the same manner as in the rear light. The muzzle light is fastened to the muzzle cover with screws 16 which are safety-locked with wire.

An electrical diagram of the wiring for the lights on the gun is shown in Figure 77.

Sequence for removal of rear light 4:

— unscrew bolts 20 with spring washers 21 and pull out light 50X1-HUM as far as the wires will permit;

— disconnect the wires from the terminals of the illuminators; remove the illuminators, the receptacle, and the spring-hinged cover only if they are to be replaced;

— disconnect wire 17 from the terminal box on the right trail;
— unscrew the screw holding clip 126 (Fig. 72), which secures the wire to the bottom carriage, and remove wire 17 with sheathing 18 (Fig 77).

Sequence for installation of rear light:

— install wire 17 with sheathing 18 and fasten it in clip 126 (Fig. 72) with the screw;

— connect the wire to the terminal box on the right trail;
— connect the wire to the terminals of the illuminator;
— install the rear light and screw in the bolts 20 (Fig. 77) with spring washers 21.

The muzzle light is disassembled by unscrewing screws 16 and disconnecting wire 19 from the terminal of the illuminator. The illuminator is removed only if it is to be replaced. Wire 19 is stored in the pocket of the muzzle cover if there is no need to connect it to the rear light. In order to replace the bulbs in the illuminators it is necessary to remove only the inner cup of the illuminator.

CHAPTER 9

SIGHT ATTACHMENTS

47. General Information

The sight attachments are designed for laying the gun on the target.

The sight attachments consist of a mechanical sight with dial sight PG-1 and an optical sight.

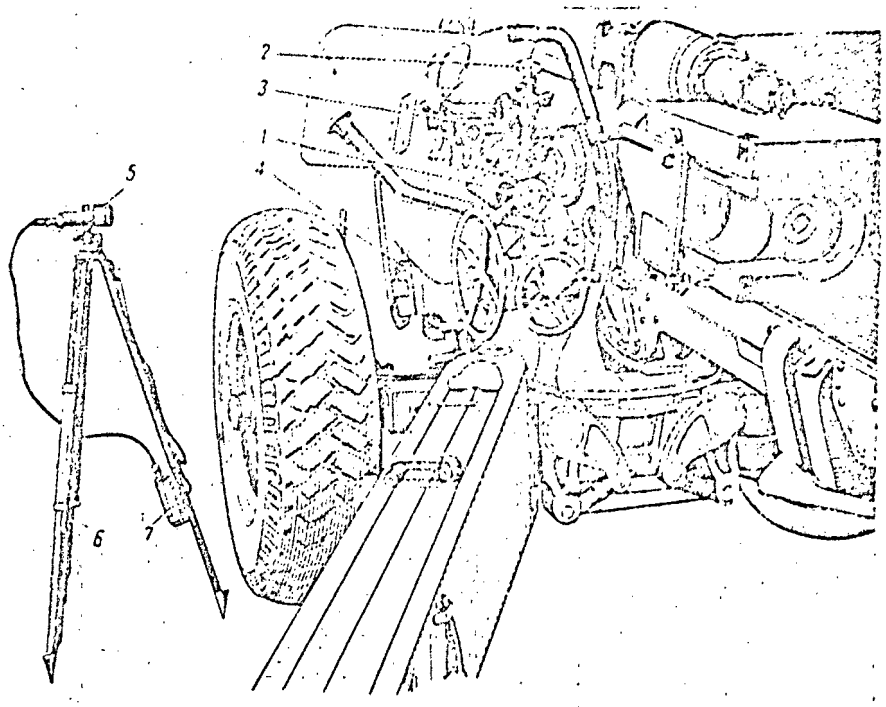


Fig. 78. Location of Sight Attachments on Gun:

1 - mechanical sight S71; 2 - dial sight PG-1; 3 - optical sight OP-2; 4 - illuminating apparatus LUCh-S71M; 5 - collimator K-1; 6 - tripod; 7 - storage battery.

Both sights are attached to the left side of the gun on the cradle (figure 78).

An illuminating apparatus LUCh-S71M is used to illuminate the sights when working under night conditions.

50X1-HUM

The weapon is supplied with a gun collimator K-1 for the purpose of horizontal laying of the gun under conditions of poor visibility and

For ease of setting up a parallel sheaf of fire, the mechanic sight is equipped with an extension of the dial sight socket, which permits circular scanning.

The mechanical sights of the M-46 and M-47 guns differ only in the scales of the range drum and are designated:

S71-35 — for the M-46 gun;
S71-96 — for the M-47 gun.

The optical sights of the M-46 and M-47 guns differ only in their scales and are designated:

OP-4-35 — for the M-46 gun;
OP-4-96 — for the M-47 gun. (Footnote: Sights OP-2-35 (M-46) and OP-2-96 (M-47) may be found on some guns.)

Due to the fact that the sight attachments as well as the gun laying handwheels and firing mechanism are located on one (the left) side of the weapon, laying the gun and firing are carried out by the layer.

48. Mechanical Sight S71-35 (S71-96)

Mechanical sight S71-35 is intended for laying the weapon when firing from concealed positions and with direct fire.

A standard gun dial sight PG-1 is used as the view finder and main scale in the sight.

On the basis of its schematic diagram, the S71-35 sight is one which is dependent upon the weapon and has a rocking bar system of sighting.

Note: The dependence of the sight on the weapon is such that when working with the elevating mechanism of the weapon, the entire sight is deflected in a vertical plane, resulting in a change in the position of the optical axis of the dial sight (the line of sight).

The dependence of the line of sight is seen in the fact that when tangent elevations are made on the sight, the position of the optical axis of the dial sight changes in the vertical plane.

Basic Data on the Sight

Limits in setting tangent elevations	0.00-7.50
Limits in setting angles of sight	+4.00 / -2.00
Limits of cross leveling	±10°

50X1-HUM

50X1-HUM

Value of divisions of coarse tangent elevation scale (up to 7.00) - - - - - - - - - - - - - - - - 1.00

Value of divisions of fine tangent elevation scale - 0-00.5

Value of divisions of coarse angle of sight scale - 1.00

Value of divisions of fine angle of sight scale - 0.01

Design of the Sight

The sight (figures 79 and 80) consists of the following basic mechanisms and parts:

tangent elevation mechanism with range drum;
target angle of sight;
cross-leveling mechanism;
dial sight socket.

50X1-HUM

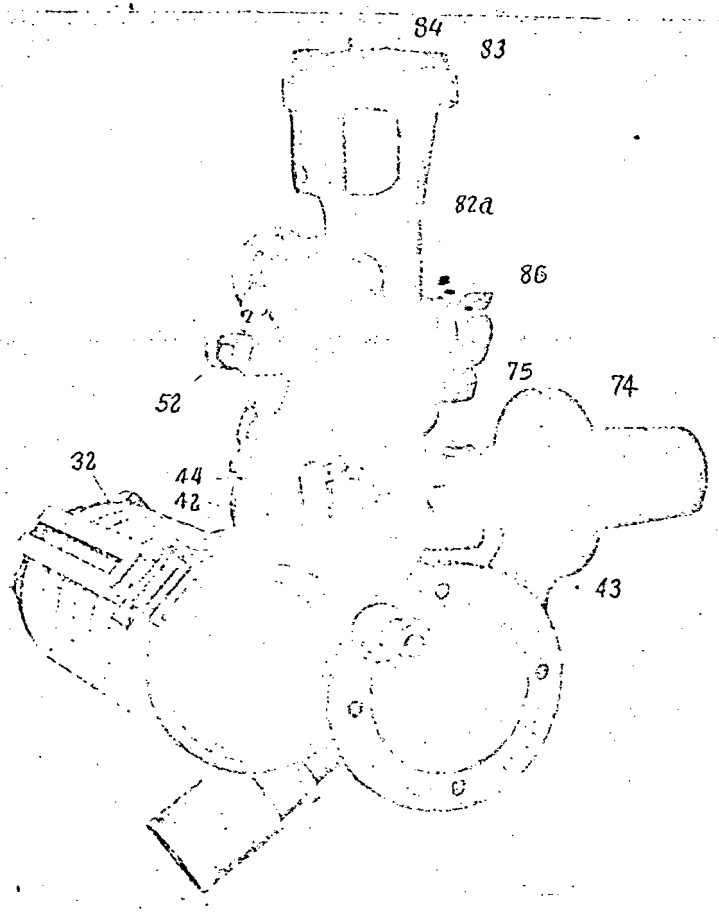


Fig. 79. General View of Sight S-71 (view from pointer's side):
32 - range drum reader; 42 - plate with coarse tangent elevation scale; 43 - reader of fine tangent elevation scale; 44 - reader of coarse tangent elevation scale; 52 - longitudinal level; 74 - fork; 75 - cross level; 82a - window for eyepiece of dial sight; 83 - supporting cone; 84 - [illegible] screw; 86 - clamp handle.

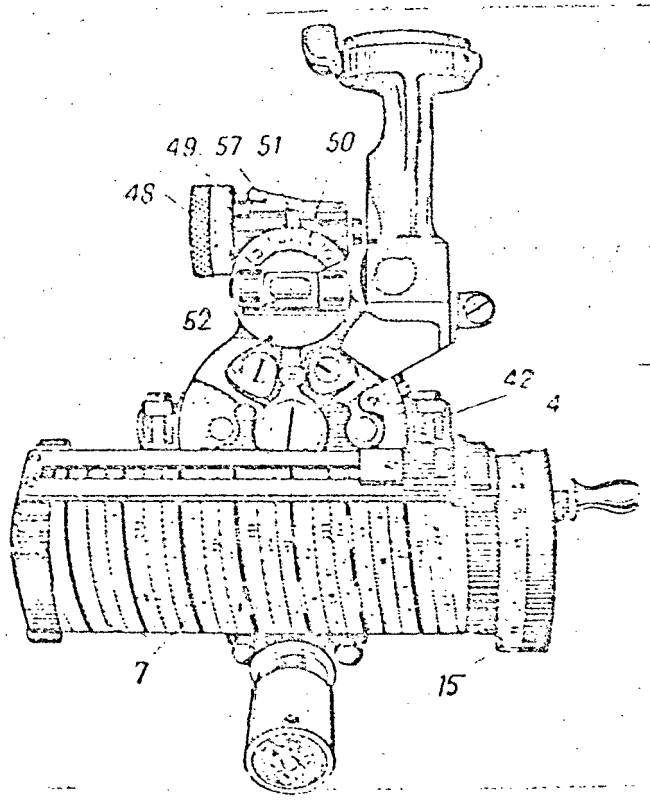


Fig. 80. General View of Sight S-71 (side view):
4 - tangent elevation handwheel; 7 - range drum; 15 - ring with scale of thousandths of tangent elevation; 42 - plate with coarse tangent elevation scale; 48 - angle-of-sight handwheel; 50 - plate with coarse angle-of-sight scale; 51 - reader of coarse angle-of-sight scale; 52 longitudinal level; 57 - reader of fine angle-of sight scale.

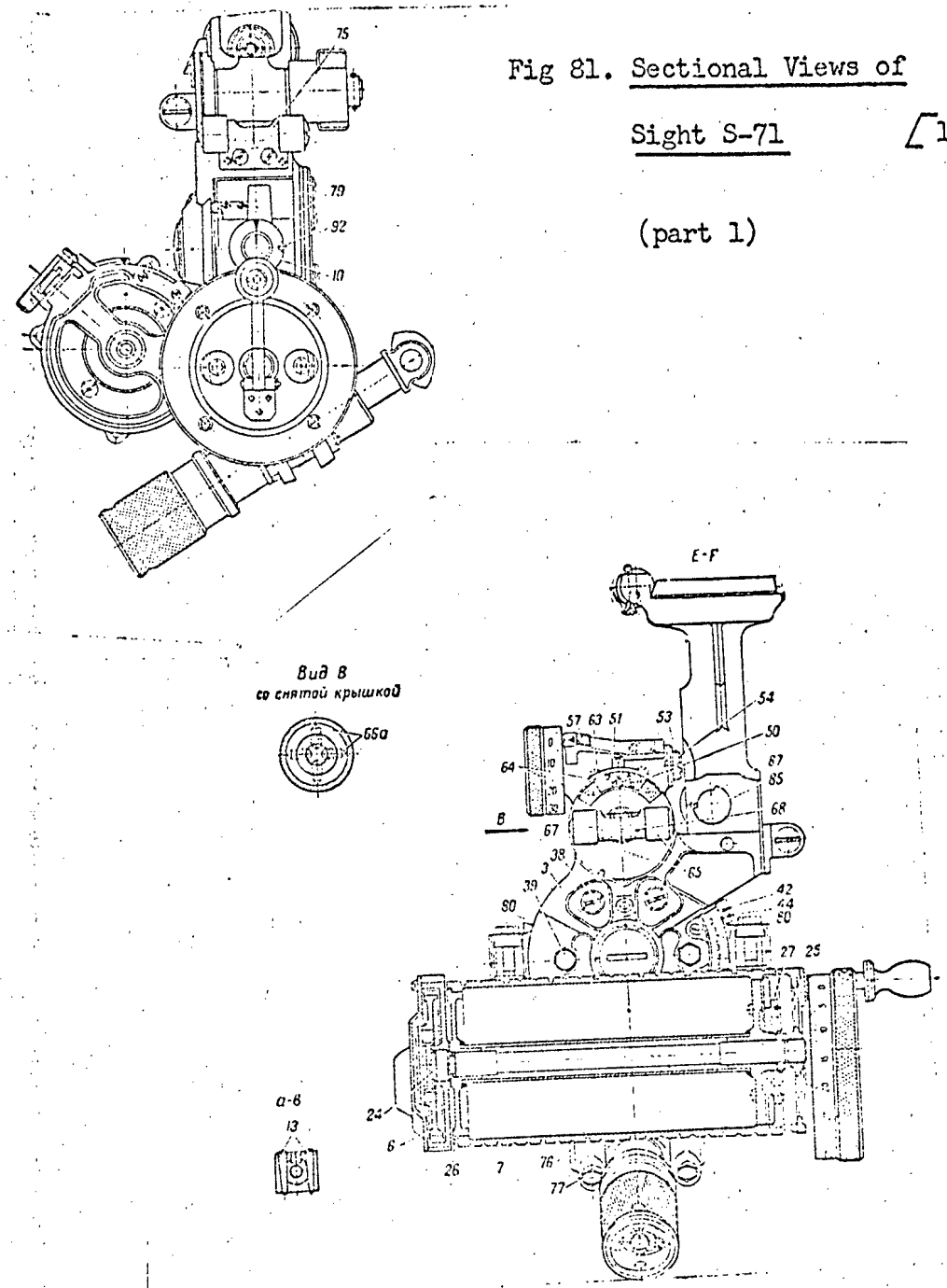


Fig 81. Sectional Views of Sight S-71 [145]

(part 1)

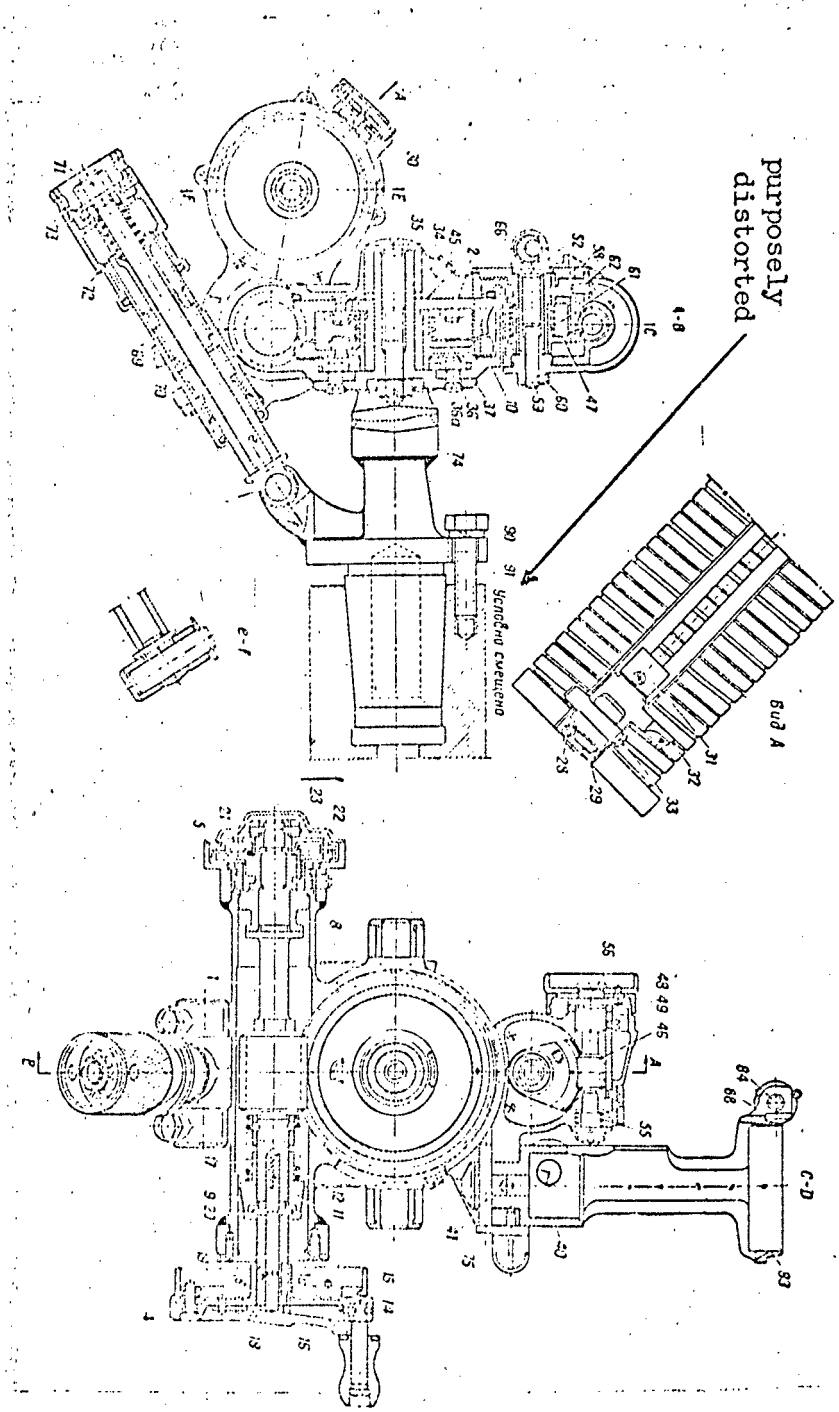


Fig 81. Sectional Views of Sight S-71

(part 2)

Figure 81. Sectional Views of Sight S71

1 - worm; 2 - segment worm gear; 3 - base of dial sight socket; 4 - tangent elevation handwheel; 5 - slotted spur pinion; 6 - spur pinion; 7 - range drum; 8 and 9 - bronze bearings; 10 - sighting gear casing; 11 - cone; 12 - spring; 13 - pins; 14 - clamping ring; 15 - ring with scale in thousandths for tangent elevation; 16 - disconnecting lever; 17 - spring; 18 - plunger; 19 - rod; 20 - pin; 21 - nut; 22 - torsional spring; 23 - cover; 24 - shaft; 25 - pin; 26 - end of cylinder; 27 and 28 - screws; 29 - cleat; 30 - base of reader; 31 - guide; 32 - reader of range drum; 33 - stop; 34 - eccentric shaft; 35 - bolt; 36 - nut; 36a - cotter pin; 37 - torsional spring; 38 - screw; 39 - bolt; 40 - dial sight socket; 41 - pin; 42 - plate with coarse tangent elevation scale; 44 - reader of coarse tangent elevation scale; 45 - oil cup; 46 - worm; 47 - segment worm gear; 48 - angle-of-sight handwheel; 49 - ring with scale in thousandths for angle of sight; 50 - plate with coarse angle of sight scale; 51 - reader of coarse angle-of-sight scale; 52 - longitudinal level; 53 - pin; 54 - nut; 55 - spring; 56 - screw; 57 - reader of fine angle-of-sight scale; 58 - shaft; 59 - bolt; 60 - screw; 61 - torsional spring; 62 - stop; 63 and 64 - screws; 65 - lugs; 66 - level mounting; 66a - adjustment screws of level mounting; 67 - plug; 68 - cover; 69 - split (adjusting) screw; 70 - sleeve; 71 - roller with lug; 72 - spring; 73 - nut; 74 - fork (Sb12-1); 75 - cross level; 76 - bushings; 77 - bolt; 78 - shaft; 79 - bushing; 80 - bolt; 83 - supporting cone; 84 - clamping screw; 85 - shaft of clamp; 87 - pin; 88 - lug; 90 - spring washer (A51027-5); 91 - bolt (A51000-17); 92 - pin.

Tangent Elevation Mechanism

The tangent elevation mechanism is intended for setting tangent elevations on the sight; it consists of the following basic parts: worm gear 1 (figures 81 and 82), segment worm gear 2 with the attached base 3 of the dial sight socket, handwheel 4 for tangent elevation with a ring and scale in thousandths, two spur pinions 5 and 6 (pinion 5 is segmented), and range drum 7 with a reader.

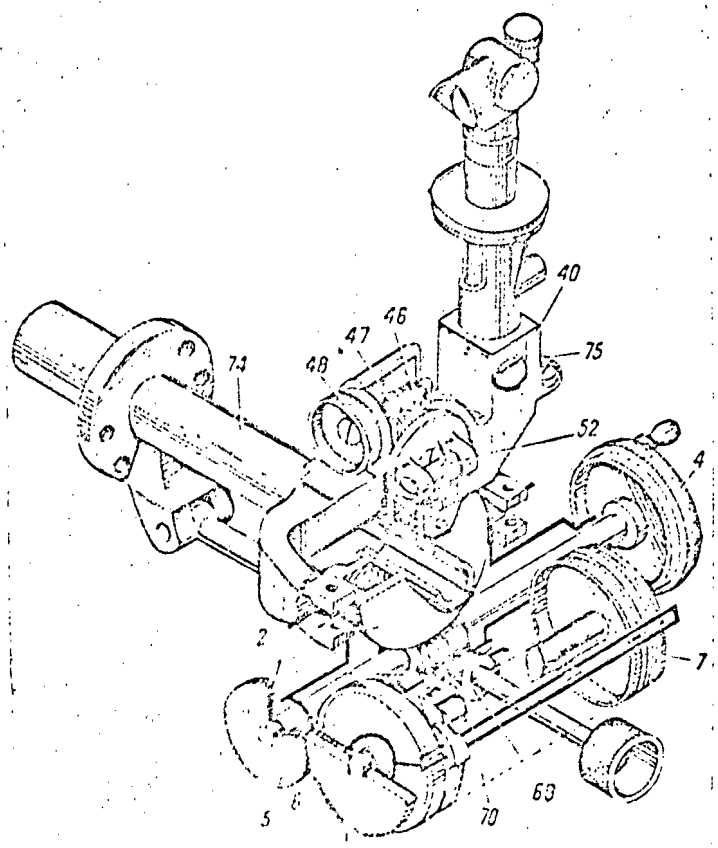


Fig. 82. Functional Diagram of Sight S71:

1 - worm gear; 2 - segment worm gear; 4 - tangent elevation handwheel; 5 - segmented spur pinion; 6 - spur pinion; 7 - range drum; 40 - dial sight socket; 46 - worm gear; 47 - segment worm gear; 48 - angle-of-sight handwheel; 52 - longitudinal level; 69 - split (adjusting) screw; 70 - sleeve; 74 - fork (Sb12-1); 75 - cross level.

Worm gear 1, which is in contact with worm wheel 2, is set in bronze bearings 8 and 9 which are attached to the lug of casing 10. Cone 11, which is capable of moving along the axis of the worm gear, and spring 12 are set on the roller of the worm gear. The spring eliminates free play along the axis of worm gear 1 and constantly

presses cone 11 against the conical surface of bearing 9, thus 50X1-HUM
a frictional force which prevents arbitrary rotation of worm gear 1. Because of this, the established tangent elevation setting will not be disturbed at the time of firing.

On one end of worm gear 1 (at bearing 9) is attached (by means of conical pins 13 and a key) the tangent elevation handwheel 4 with a handle. Ring 15 with a scale in thousandths of tangent elevation is attached to the rim of the handwheel by clamping ring 14 and screws. One division of ring 15 is equal to half of a thousandth; the divisions are marked by numers from 0 to 95 for every 5 thousandths. [146]

Disconnecting lever 16 is attached by a hinge to handwheel 4.

The end of this lever is held against the end of the handle of handwheel 4 by spring 17, which is placed in an opening of worm gear 1. When the handle of handwheel 4 is pushed in, lever 16 pushes plunger 18, which compresses spring 17 by means of rod 19 and presses against cone 11 and releases it from bearing 9 by means of pin 20, which is set in the rod and passes through slots in worm gear 1.

In this position it is possible to freely (without force) turn handwheel 4: that is, to make the necessary tangent elevation settings.

At the other end of worm gear 1 (at bearing 8) is attached, by means of nut 21 and a pin, a slotted spur pinion 5, within which is spring 22. This spring separates both halves of the slotted spur pinion, taking up the free play in the contact of spur pinions 5 and 6, which are enclosed by cover 23. Spur pinion 6 is attached to roller 24. Base 26, to which is attached the range drum 17 by means of screws 27 and a clamping spring, is fastened to this same roller by conical pin 25. On the surface of drum 7 are screw slots, between which are drawn the range scales for different shells.

The scales of the range drums for the ballistics of the M-46 and M-47 guns are shown in figure 83.

Cleat 29, on which the base 30 of the reader moves, is fastened by screws 28 parallel to the axis of the range drum. At the bottom of base 30 are two threaded projections which enter tapped holes on the range drum; at the top of the base is attached guide 31 along which reader 32 moves. At the top of guide 31 are inscriptions which correspond to the names of the scales of the range drum (figure 83).

These inscriptions are used when setting the reader 32. For example, if it is necessary during firing to use the BR (armor-piercing shell) range scale, reader 32 must be shifted along guide 31 until the BR inscription appears in the window of the reader. In this 50X1-HUM
case the graduation line (index) of reader 32 will be located opposite the BR scale of the range drum. The setting of the reader

is fixed by means of a special stop and depressions on the side of guide 31. The number of depressions corresponds to the number of scales on the range drum.

In order to reset reader 32, it is necessary to press the top of the stop 33 and move reader 32 along guide 31 to the required position.

In the central groove of the sighting gear casing 10 is an eccentric shaft 34, attached by screws and nuts, on which is fitted the segment worm gear 2 with attached base 3 of the dial sight socket. Worm gear 2 and base 3 may be rotated freely around shaft 34 and are restrained from axial motion by bolt 35, which is locked by castellated nut 36 and cotter pin 36a.

Segment worm gear 2 consists of two halves (narrow and wide), between which is located spring 37. This spring separates both halves of the worm gear and, at the same time, takes up the free play in the contact between worm 1 and segment worm gear 2. /147/

Base 3, which serves as a housing for the angle-of-sight mechanism and supports the dial sight socket, is attached to the wide half of segment gear 2 by screws 38 and bolts 39. The dial sight socket is placed in the opening of base 3 and is held by pins 41.

Plate 42 with an inscribed coarse tangent elevation scale is attached to base 3 by screws. The divisions on the scale are denoted by numbers from 0 to 7; the last incomplete division (after number 7) is not designated by a number. The value of each division designated by a number corresponds to 100 divisions of the main scale (1.00), while the last division (which is not designated by a number) corresponds to 50 divisions of the main scale (0.50).

Readers 43 and 44 (figure 79) are used to read tangent elevations on the thousandths scales. The graduation mark of reader 43 is used in setting tangent elevations on the fine scale. The graduation mark of reader 44 is used in setting tangent elevations on the coarse scale.

Oil cup 45, which is press-fitted in the top of base 3 of the dial sight socket (figures 81, 82), is intended for lubricating eccentric shaft 34, on which the swinging part of the sight rotates, and worm gear 1.

Operation of the tangent elevation mechanism. Tangent elevation settings are made by turning handwheel 4 (figure 81), whereby it is necessary first to engage cone 11 by pushing on the handle of handwheel 4 along its axis.

When rotating handwheel 4 it is absolutely necessary to disengage cone 11. Failure to disengage the cone may lead to loosening of the handle of the tangent elevation handwheel.

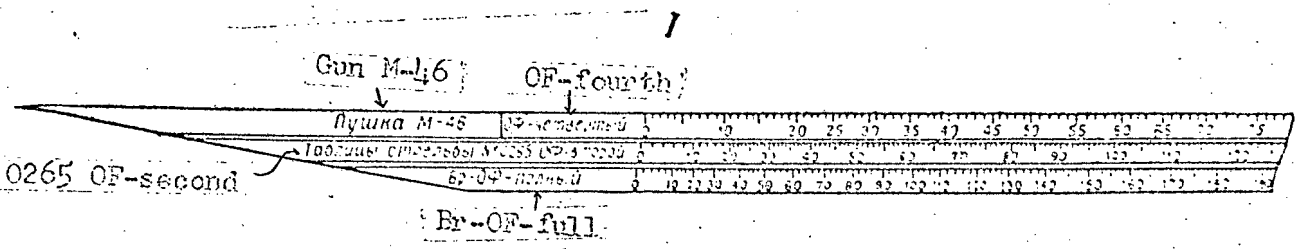
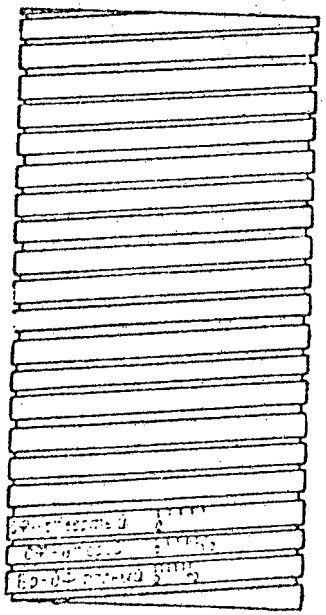


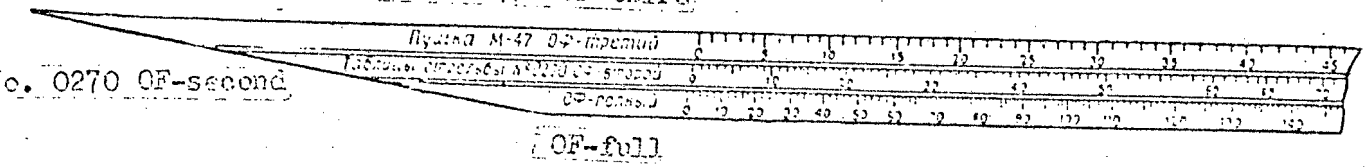
Fig 83. Scales of Range Drums

I. for the M-46 (130-mm) Gun



II

Gun M-47 OF-third

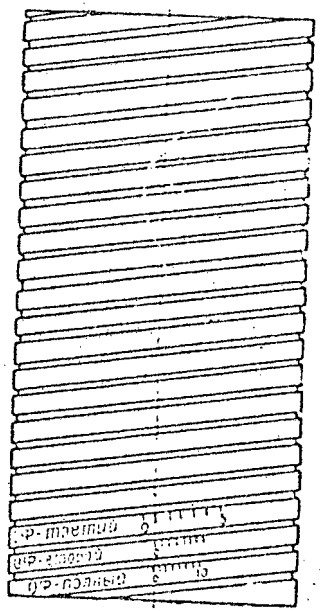


Firing Table No. 0270 OF-second

OF-full

Fig 83. Scales of Range Drums

II. for the M-47 (152-mm) Gun



OF-third

OF-second

OF-full

Segment worm gear 47 consists of two halves with spring 61 placed between the halves. The spring separates both halves of the segment gear and thus takes up the free play in the contact between worm gear 46 and segment worm gear 47.

Rotation of the segment worm gear is limited by two pins attached to its wider half.

When the segment gear is in the furthermost positions, these pins abut against stop 62 of reader 51 and the segment gear is stopped. Stop 62 is fixed to reader 51 which, in turn, is attached by screws 63 to the housing of the angle-of-sight mechanism.

Plate 50 with the coarse angle-of-sight scale is fastened by screws 64 to the base of segment worm gear 47. The divisions on the scale are denoted by numbers from 28 to 34. The even divisions on the scale are marked by short lines and the odd divisions by long lines.

The value of each division corresponds to 100 divisions on the main scale (1.00).

An index mark inscribed on reader 51 is used for reading from this scale.

A setting of 30.00 corresponds to the zero position on the coarse angle-of-sight scale; in this case the index mark on reader 51 will be located opposite the division marked by the number 30.

The mounting 66 of the longitudinal level, in which a glass ampule has been cemented, is placed in the openings of lugs 65. The ampule is filled with a non-freezing liquid (alcohol or ether) and contains a small air bubble; the length of the bubble at a temperature of 20° C is equal to 8 mm.

Reference marks are etched on the glass of the ampule; the air bubble is located between the middle marks when the ampule is in a level horizontal position.

There are four screws 66a at one end of the inside of lug 66 by which the zero position of the mounting and ampule may be regulated (view in the direction of arrow B in figure 81).

Mounting 66 is restrained from axial movement by plugs 67, which are screwed into threaded openings in lugs 65, and is prevented from turning by a pin (the pin, placed in an opening of one of the lugs 65, enters the lower groove in mounting 66). On mounting 66 is a cover 68 which, when rotated, covers or uncovers the glass ampule of the level.

Rotation of handwheel 4 causes rotation of worm gear 1, which, being in contact with segment worm gear 2, turns the latter and, consequently, tilts base 3, together with the dial sight socket and the angle-of-sight mechanism, in a vertical plane.

Simultaneously, rotation of the shaft of worm gear 1 through spur pinions 5 and 6 is transmitted to range drum 7, which, by turning, moves reader 32 along cleat 29.

A reading of the established tangent elevation in divisions is taken from one of the scales of the range drum 7 opposite the graduation mark of reader 32, and a reading in thousandths is taken from the scales of ring 15 and plate 42 opposite the graduation marks of readers 43 and 44 (figure 79).

Angle-of-Sight Mechanism

The angle-of-sight mechanism is used for setting the angle-of-sight (level) on the sight assembly. It consists of the following basic parts: worm gear 46 (figures 81, 82), segment worm gear 47, handwheel 48, ring 49 with a scale in thousandths, plate 50 with a coarse scale, reader 51 with a stop, and longitudinal level 52.

Worm gear 46 is attached in the upper opening of the angle-of-sight mechanism housing by nut 54 and pin 53. Axial free play of the worm gear is restricted by spring 55. Handwheel 48 with a pin is fixed to the worm gear by screw 56; the pin enters a hole in the collar of worm gear 46 and rigidly connects the latter to handwheel 48.

Between the collar of worm gear 46 and handwheel 48 is fixed a ring 49, the surface of which is divided into 100 equal divisions around its circumference. Every tenth division is marked by a number from 0 to 90; the value of each division corresponds therefore to one division of the main scale (0.01). [150]

The zero division of the thousandths-scale ring 49 is fixed by a wedge-shaped projection on reader 57 which enters a groove on the inner surface of ring 49. This groove is located opposite the zero division on the thousandths scale ring 49.

On reader 57 is inscribed an index mark for making readings on the thousandths scale ring 49.

Shaft 58, on which segment worm gear 47 is fitted, is fixed in a side opening of the angle-of-sight mechanism housing. This segment gear is free to rotate around shaft 58 but is restrained from movement by bolt 59 which is held by set screw 60.

Operation of the angle-of-sight mechanism. Target angles 50X1-HUM are set by turning handwheel 48.

Turning of handwheel 48 (figure 82) turns worm gear 46 which, since it is in contact with segment worm gear 47, turns the latter. The position of the segment worm gear and the axis of the longitudinal level 52 are thus changed.

The fixed angle of sight is read from the scales of plate 50 and ring 49 (coarse and fine scales) opposite the marks of readers 51 and 57 (figure 81). [151]

Cross-Leveling Mechanism

The cross-leveling mechanism is intended for setting the sight in a vertical position. It is a screw-type mechanism and consists of the following basic parts: split (adjusting) screw 69 (figures 81 and 82) with handwheel, sleeve 70, roller 71 with lug, spring 72, nut 73, fork 74, and cross level 75.

Sleeve 70 encloses split screw 69 and, with its trunnions, is hinge-connected to the lugs of sight gear casing 10 by means of bushings 76 and bolts 77.

Free play between split screw 69 and sleeve 70 is taken up by spring 72. Roller 71 with a lug, which is hinge-connected to fork 74 by means of shaft 78 and a cotter pin, passes through an opening in split screw 69.

Fork 74 is hinge-connected to sight gear-casing 10.

The hinge connection of these parts is achieved by bushings 79 placed over the trunnions of the gear casing. The lugs of fork 74 are placed on the outside surface of the bushings and are held by bolts 80.

Thus, the cross-leveling mechanism forms a rigid triangle with a hinged connection to the sight gear casing 10, fork 74, and sleeve 70 with split screw 69.

The tapered shaft and flange of fork 74 are designed for attachment of the sight to the weapon by means of four bolts 91 with spring washers 90.

Note: For some weapons the fork has a cylindrical stem.

The vertical position of the sight is determined from the cross level 75, which is attached by screws to base 3 of the dial sight socket. The cross level device is similar in design to the longitudinal level. 50X1-HUM

For correctly setting up the gun on terrain which has no transverse incline, some guns have index marks painted with white paint on the butt end of the rear trunnion (gear casing 10) and the end of bushing 79 (figure 81). Bushing 79 is prevented from turning by pin 92. 50X1-HUM

The weapon is considered set up without transverse inclination if the bubble of cross level 75 is in the middle position when the index marks on the trunion of sighting gear casing 10 and bushing 79 coincide.

The marks are made to coincide by turning the handwheel of the sight cross-leveling mechanism.

Operation of the Cross-Leveling Mechanism

The sight is leveled in the transverse direction by turning the handwheel of split screw 69. By rotating the handwheel, sleeve 70 is screwed onto the screw or is unscrewed: that is, the sleeve accomplishes a forward or backward motion. At the same time, the trunnion (gear casing 10) are rotated, and the sight moves in a transverse direction relative to stationary fork 74. The handwheel of split screw 69 is turned until the bubble in cross level 75 is centered.

Dial Sight Socket

[152]

The dial sight socket 40 (figures 79, 81) is attached by conical pins 41 to base 3. The socket includes: aperture 82a for the eyepiece of the dial sight, supporting cone 83 on which the dial sight sits, clamping screw 84, and a catch which holds the dial sight.

The catch consists of shaft 85 with a spring and handle 86. In the middle part of the shaft, inserted into a side opening of the dial sight socket, is a two-surfaced notch. One surface of this notch serves to engage the hook of the dial sight and the other side serves to push the dial sight upward when removing it from the dial sight socket.

Pin 87, against which the shoulders cut in the collar of the shaft of the catch rest when the shaft is in its extreme positions, is inserted in the dial sight socket to limit the rotation of the catch shaft.

Clamping screw 84 presses a projection on the dial sight into a depression in lug 88 and thus prevents the dial sight from moving in an azimuthal direction. 50X1-HUM

When setting the dial sight in the socket, handle 86 of [redacted] is rotated up to the stop in a clockwise direction. For ease of turning, the handle has two flat holding devices with notches around its outside. 50X1-HUM

Disassembling and Assembling the Sight

Disassembly of the sight under field conditions is permitted only for purposes of correcting a fault in the sight.

Disassembly and assembly of the sight must be carried out by an artillery mechanic (who is very familiar with the construction of the sight) in an equipment repair shop.

After disassembly of the sight, all parts must be carefully wiped clean and each individual part coated with a thin layer of AF-70 lubricant.

Assembly of the sight is carried out in the reverse order of disassembly; therefore, only the disassembly of the sight is described below.

1. With wrench A52830-4, remove the sight from the weapon by unscrewing bolts 91 (figure 81) from the flange and removing spring washers 90; screw two of these bolts into threaded holes in the flange of the fork and, while supporting the sight with one hand, force the shaft of the fork out of the hole in the trunion of the cradle (by screwing in the two bolts).

2. Disassemble the angle-of-sight mechanism as follows:

— unscrew plug 67 from the left side of the longitudinal level; unscrew adjustment screws 66a one or two turns; extract level mounting 66 with the ampule; and remove cover 68; these operations are also performed with the cross level so that the ampules will not be broken;

— knock out the conical pin 53; unscrew nut 54, and remove spring 55;

— remove screws 63 and 64; remove plate 50 and reader 51;

— insert pin A52435-12 (from the spare parts set) into the upper through hole of segment worm gear 47 and unscrew worm gear 46 (the pin prevents one half of segment worm gear 47 from turning relative to the other half when worm gear 46 is removed);

— remove screw 56 and handwheel 48 with ring 49;

— unscrew bolt 59, having first loosened set screw 60; 50X1-HUM

50X1-HUM

— remove the segment worm gear, holding it by hand to prevent it from catching spring 61; while removing pin A52435-12, carefully separate both halves of worm gear 47 and remove spring 61.

[153]

3. The tangent elevation mechanism is disassembled as follows:

— remove screws 28 and cleat 29 with the entire reader assembly from the range drum;

— having removed the screws, remove cover 23;

— knock out conical pin 25 and insert pin A52435-12 into the opening of slotted spur pinion 5;

— while supporting the range drum by hand, remove shaft 24 from spur pinion 6; separate the range drum 7 from the mount 26;

— remove the cotter pin and unscrew nut 21, and remove half of slotted spur pinion 5 and spring 22;

— while holding handwheel 4, unscrew the base of spur pinion 5;

— knock out the conical pins 13, remove handwheel 4 from the key, and pull out plunger 18 from the opening in worm gear 1;

— remove the screws in handwheel 4, ring 15 with the tangent elevation thousandths scale, and the clamping ring 14;

— remove bearing 9, having first unscrewed the screws which hold it; insert the pin in the opening of segment worm gear 2 and unscrew worm gear 1;

— remove cone 11, spring 12, rod 19, and spring 17;

— remove the cotter pin, inscrew nut 36, and remove bolt 35;

— remove the leveling part of the sight; by pulling out the pin, carefully separate both halves of the segment worm gear 2 and remove spring 37.

4. The cross-leveling mechanism is disassembled as follows:

— remove the cotter pin and pull out shaft 78;

— unscrew the lock nuts and bolts 77; remove bushings 76 and separate the split screw 69 and sleeve 70 from the sight;

— remove the cotter pin and unscrew nut 73;

50X1-HUM

50X1-HUM

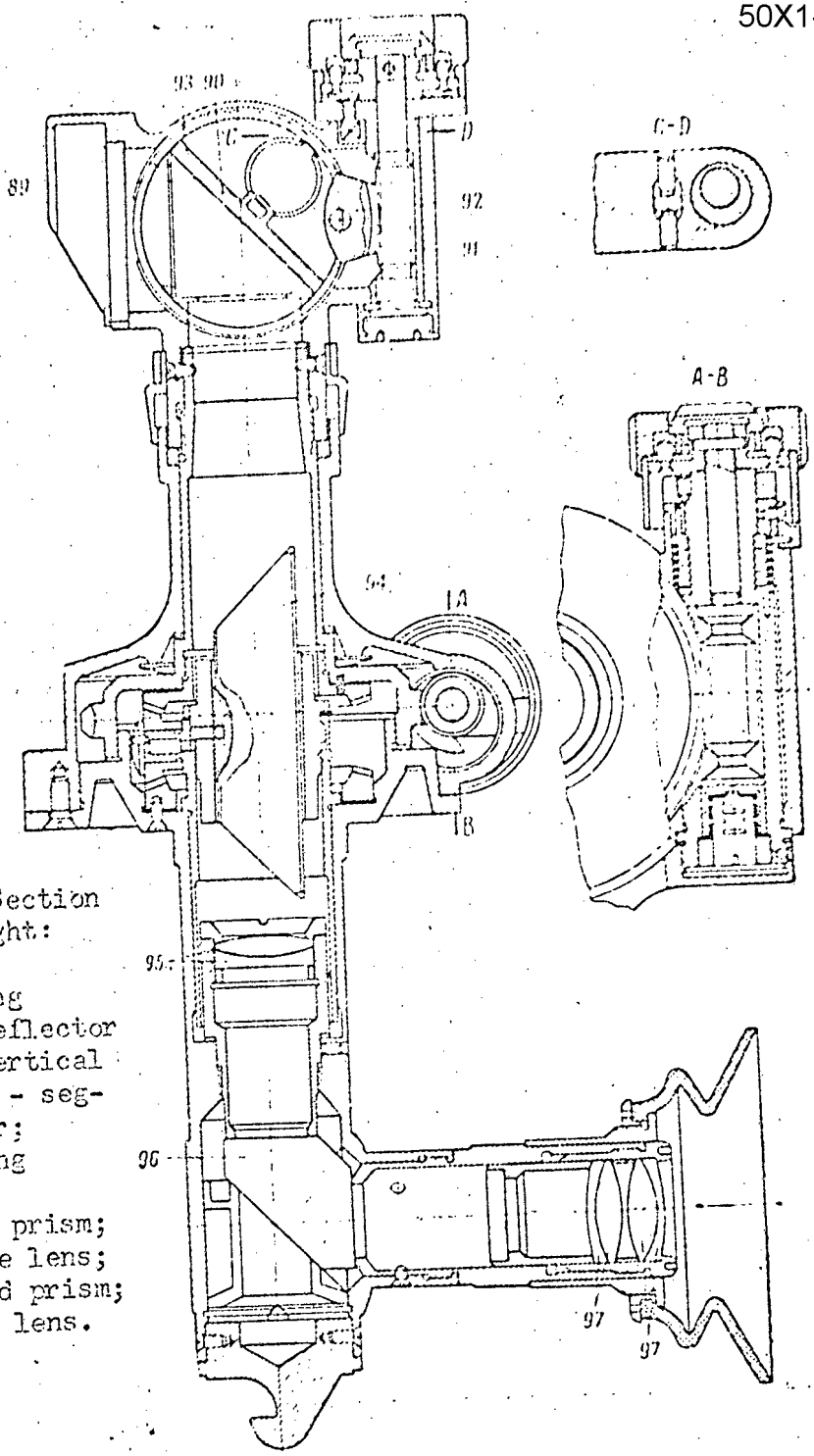


Fig.84.Cross-Section of Dial Sight:

89 - reflecting prism; 90 - reflector mount; 91 - vertical worm gear; 92 - segment worm gear; 93 - reflecting mirror ring; 94 - rotating prism; 95 - objective lens; 96 - truncated prism; 97 - eyepiece lens.

50X1-HUM

— remove spring 72 and roller 71 and unscrew sleeve 70 from split screw 69; 50X1-HUM

— unscrew the lock nuts and bolts 80; remove bushings 79 and separate fork 74 from the sighting gear casing.

49. Dial Sight PG-1

The dial sight (figure 84) is an elbow optical tube containing a sighting head, a stationary casing, and an eyepiece tube.

The sighting head has a reflecting-mirror handwheel with a ring divided into 100 divisions. The value of each division on the ring corresponds to one division on the main scale (0.01). Near the reader of the handwheel are inscribed the words "Vverkh" [up] and "Vniz" [down] and arrows indicating the direction of rotation of the handwheel for moving the optical shaft of the dial sight in a vertical plane.

On the left movable side of the sighting head are inscribed points for the coarse scale of the reflecting mirror (three points each upward and downward from the zero division), each division of which corresponds to 100 divisions on the main scale (1.00). [155]

On the right side of the casing of the sighting head is attached a view finder, which is designed for rapid (coarse) laying of the weapon on the target (the aiming point) as well as for laying the weapon when there is a malfunction in the optical part of the dial sight.

The view finder consists of a square hollow box, on the front part of which are stretched two wire filaments; the back of the box is covered by a plate with a vertical slit.

The front part of the sighting head is covered with protective glass.

A fixed scale divided into 60 divisions with each division having a value of 1.00 is attached by four screws to the bottom of the sighting head. The graduations are marked by lines, and the even graduations are denoted by numbers from 0 to 58. The scale is read by means of a reader on the upper face of the stationary casing of the dial sight.

On the widened part of the stationary casing of the dial sight are a handwheel and a fixed scale. The fixed scale is graduated into 100 divisions marked by lines, and every ten divisions are denoted by numbers from 0 to 90. [156]

50X1-HUM

The value of each division corresponds to 0.01. 50X1-HUM

Below and around the circumference of the wide part of the fixed dial-sight casing is an internal cone for seating the dial sight on the sight socket. The dial sight is held in the socket by means of a flange (on the wide part of the dial sight) and a securing hook (at the bottom). The flange engages the tongue of the socket and the hook engages the clamp shaft.

Perpendicular to the dial sight casing is an eyepiece tube with a side opening for illuminating the cross-hairs at night.

The optical part of the dial sight consists of the objective lens system, the eyepiece lens system, and three prisms.

Within the sighting head is the reflecting mirror prism 89, attached to mount 90.

Rotation of the reflecting mirror handwheel is transmitted to the reflecting prism 89 through vertical worm gear 91, segment worm gear 92, and the reflecting-mirror ring 93, as a result of which the sighting line is deflected upward or downward.

Light rays falling on the reflecting prism are reflected by it to rotating prism 94. Prism 94 rotates around a vertical axis together with reflecting prism 89 but with an angular speed half as great as the latter: that is, when reflecting prism 89 rotates through 90°, prism 94 rotates through only 45°.

Because of the difference in angular speeds, the image of the object obtained is straight (not inclined) regardless of the position of the sighting head of the dial sight.

From rotating prism 94 the light rays pass through the objective lens system 95, through the fixed truncated prism 96, and, after being refracted, pass to the eyepiece lens system 97.

In the field of view of the dial sight is a graticule (figure 85).

The graticule consists of cross lines, a central inverted V, a scale of corrections for line, and a special scale.

The special scale is intended for taking readings with the gun sight collimator; it has 74 divisions corresponding to the vertical zones of the collimator graticule. The divisions to the right of the vertical cross line are designated by letters A, B, C, etc., and the divisions to the left are designated by numbers 1, 2, 3, etc.

50X1-HUM

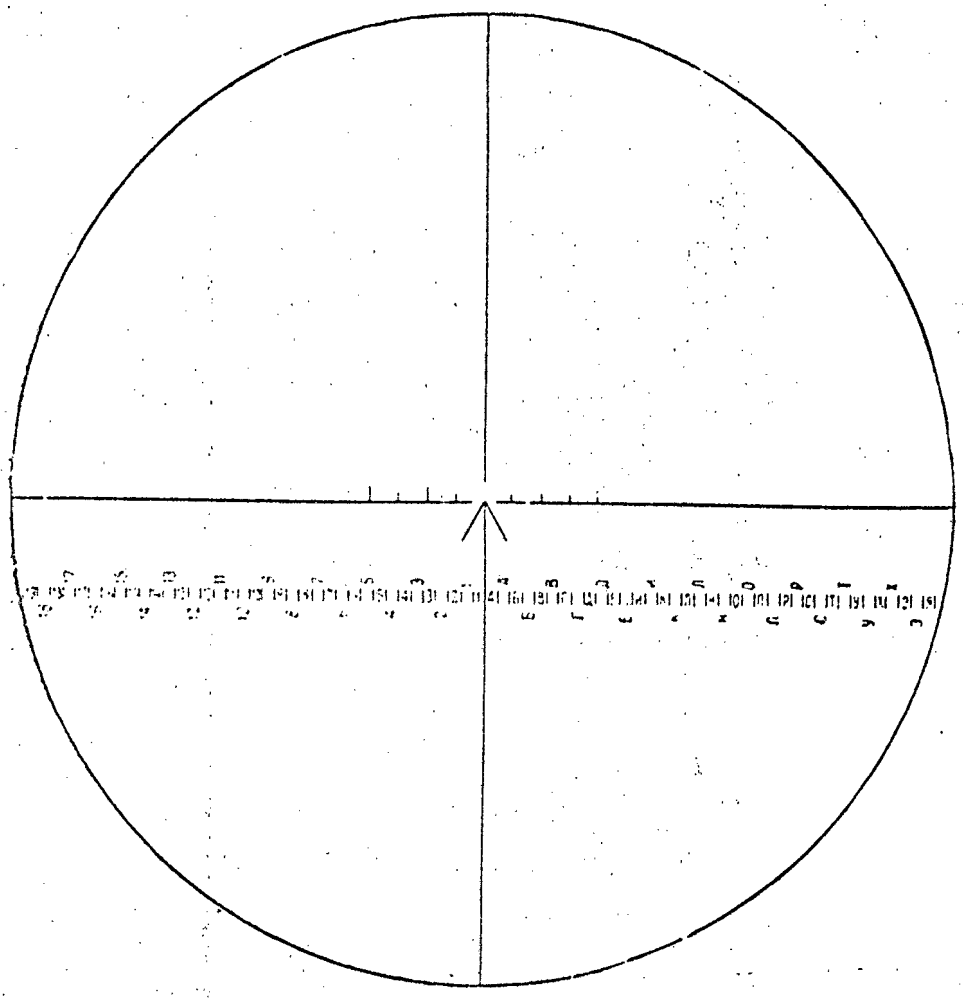


Fig 85. Graticule of Dial (Panoramic) Sight

Removal of the Dial Sight

To remove the dial sight it is necessary to:

— loosen clamping screw 84 (figures 79 and 81) which holds the flange of the dial sight to the tongue of the dial-sight socket;

— holding the stationary casing of the dial sight in the left hand, turn clamp handle 86 as far as it will go in a clockwise direction with the right hand;

— carefully remove the dial sight from the socket (after 50X1-HUM
been slipped from supporting cone 83) without permitting the eyepiece tube to strike the crosspiece of the socket.

Installation of the Dial Sight

To install the dial sight it is necessary to:

— unscrew clamping screw 84 as far as possible;

— holding the dial sight casing with the left hand between the reflecting mirror and the wide part of the casing, carefully insert the (157)
dial sight into the socket, making sure that the eyepiece tube fits into the middle of opening 82a;

— with the right hand turn clamp handle 86 in a clockwise direction as far as possible and hold it in this position;

— continue inserting the dial sight into the socket and set it carefully on the supporting cone 83, making sure that the flange on the dial sight engages the tongue of the socket;

— when the securing hook of the dial sight comes in contact with the two-surfaced groove of clamp shaft 85, carefully lower the handle 86 of the clamp; the dial sight will then seat itself and its cone will come into flush contact with the cone of the dial sight socket;

— tighten the clamping screw 84.

50. Extension of Dial Sight Socket

The dial sight socket extension (figure 86) is intended to facilitate setting up a parallel sheaf and is used in the event that the disposition of the firing position of the battery makes it impossible to set up a parallel sheaf with the aid of an azimuth compass.

The extension increases the total length of the dial sight by 160 mm.

The upper part of the extension has the same design as the dial sight socket, the only difference being the addition of screw 1 and nut 2 for the purpose of adjusting the azimuthal position of the dial sight.

The lower part of the extension is attached to the sight in the same manner as the dial sight.

The extension is stored on a panel in a box.

After the parallel sheaf has been set up, the extension 50X1-HUM
from the sight.

Firing with the extension in place is forbidden, since this may result in maladjustment of breakage of the sight.

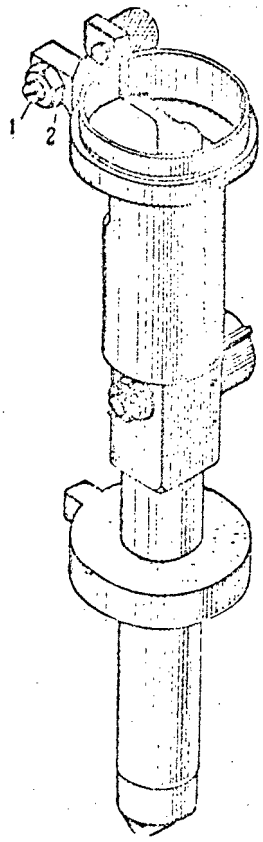


Figure 86. Extension of Dial Sight Socket

1 - screw (A51065-11); 2 - nut (A51010-4)

51. Gun Collimator K-1

Purpose of the Collimator

Gun collimator K-1 (figure 87) is designed for the horizontal laying of the weapon in the absence of natural (distant) aiming points or under conditions of poor visibility — at night, in fog and snowfall, and when blanketing the firing position with smoke.

The collimator is placed close to the weapon (figure 78) and takes the place of a distant aiming point. This makes it possible to select any point for a firing position — undergrowth, forest, the edge of a forest, etc.

Gun dial sight PN-1, which has a special graticule, is u50X1-HUM operating with the graticule.

Each weapon is supplied with one collimator. (158)

Natural light is used when operating with the collimator in the day time, and electrical illumination is used at night or under conditions of poor visibility. A storage battery for illuminating the collimator is part of the gun illumination set LUCh-S71M.

Basic Data for the Collimator

Field of vision — 10°.
Diameter of iris diaphragm — 18 mm.
Recommended separation between collimator and dial sight — 6-8 m.
Number of marks on horizontal axis of collimator graticule — 76.
Value of division on graticule of collimator and special scale of dial sight — 7.8' = 2.2 thous.

Design of the Gun Collimator

Gun collimator K-1 (Fig. 88) consists of the following basic parts: housing, objective, graticule, level, viewfinder, ball pivot, mirror, bracket, socket with electrical conductor and plug, and lens hood.

The optical system of collimator K-1 consists of a multi-lens objective which includes lenses 2, 3, 11, 12, and 19, plate 24, protective glass 41, and mirror 32. The graticule of the collimator is etched on lens 19 and is covered by plate 20.

Housing 1 is in the form of a tube in which the optical parts of the (160) collimator are assembled.

Viewfinder 9, which is used for coarse sighting of the collimator on the dial sight of the weapon, is attached by screws 4 and pins 6 to the front part of the collimator housing. Around the middle part of the housing are cleats; level 13 is attached to the two top cleats. On the bottom cleat is a groove in which is screwed ball pivot 54 which serves to fasten the collimator to the top of the tripod. The ball pivot is held in the groove of the housing by screws 52 and pin 53.

At the rear of the collimator housing is a hinged mirror 32 and bracket 38.

Within the front part of the housing are lenses 2 and 3 of the objective which are cemented together. Lenses 2 and 3 are held in mount 5 by spring ring 7 and threaded ring 10, which is fixed by set screw 8.

50X1-HUM

Mount 5 is screwed into the front part of housing 1 and is held 50X1-HUM
set screw 57.

Mount 17 is screwed into the middle part of the housing; lenses 12 and 11 of the objective are held in this mount by ring 56 and screw 55. Spacing ring 16 is inserted between lenses 12 and 11.

Mount 50, held by set screw 49, and ring 44, held by set screw 26, are screwed into the rear part of the housing. Ring 44 supports collar 27 on the housing. Mount 50 supports mount 18, in which lens 19 and plate 20 (cemented to the lens) are held by ring 51. The collimator graticule is etched on lens 19. Mount 18 is held in mount 50 by ring 21 and screws 22 and 48. Into mount 23, which is screwed into mount 50 and held by a set screw, is inserted frosted glass plate 24; the plate is held by spring 25 and a set screw.

The collimator graticule (figure 89) has 76 graduation marks which represent vertical zones. The zones located in the right half of the graticule are designated by letters A, B, C, etc., and the zones located in the left half are designated by numbers 1, 2, 3, etc.

Level 13 (figure 87) serves to eliminate lateral inclination of the collimator: that is, to set the zones of the collimator graticule in a vertical position. It consists of level ampule 13, ampule mount 14, and protective ring 15. The level is held by a nut in lugs on the housing of the collimator.

The collimator is leveled by rocking the collimator in a sideways direction.

Mirror 32 is used to reflect rays of natural light on the collimator graticule. The mirror is placed in mount 31 and is held by nut 33 and screw 34. Mount 31 is supported by shaft 28 and is attached to it by pin 29. Shaft 28 rotates in the lugs of collar 27. Screw 30 in the lug of mount 31 is used to adjust the friction between the lugs of mount 31 and collar 27 which is necessary to hold the mirror in the necessary position. Collar 27 may be rotated on the housing of the collimator.

When operating with the collimator under conditions of natural illumination, collar 27 is rotated and mount 31 is tilted until the mirror is located in the position which will provide the greatest illumination on the graticule of the collimator.

When using electrical illumination, the mirror is raised and placed in a horizontal position.

Bracket 38 is used to hold socket 37 of bulb 40. Bracket 38 is placed on shaft 47 and is attached to it by pin 46. Shaft 47 rotates in lugs on housing 1. Thumbscrew 45, which is used to hold bracket 38 50X1-HUM
in the required position, is screwed onto shaft 47.

Lamp socket 37 with electrical conductor 36 and plug 35 to supply electrical power from the storage battery to bulb 40. Reflector 39, which is screwed onto socket 37, holds milk-colored protective glass 41 by means of nut 42 and screw 43. 50X1-HUM

When operating the collimator at night or under conditions of poor visibility, socket 37 is raised up until reflector 39 rests against ring 44 and bracket 38 is tightened by thumbscrew 45; plug 35 is then connected to the battery.

Lens hood 59 is placed on the front part of the collimator housing. It is designed to eliminate glare from the sun as well as to protect the outer lens of the objective.

An alkaline storage battery consisting of two series-connected type NKN-10 elements serves as the source of electrical energy for illuminating the graticule of the collimator. The battery is set in a metal box which at night is held by a strap to a leg of the tripod. On the top of the box are a socket for plug 35 (figure 88) and a switch.

When operating the collimator, the storage battery should be used only when necessary. At other times the bulb must be switched off.

The same tripod used for azimuth compass PAB-2 serves for setting up the gun collimator at the firing position.

The ball joint of the collimator is placed in the cup of the tripod and is fastened to it with the aid of a trunnion cap and a clamping screw.

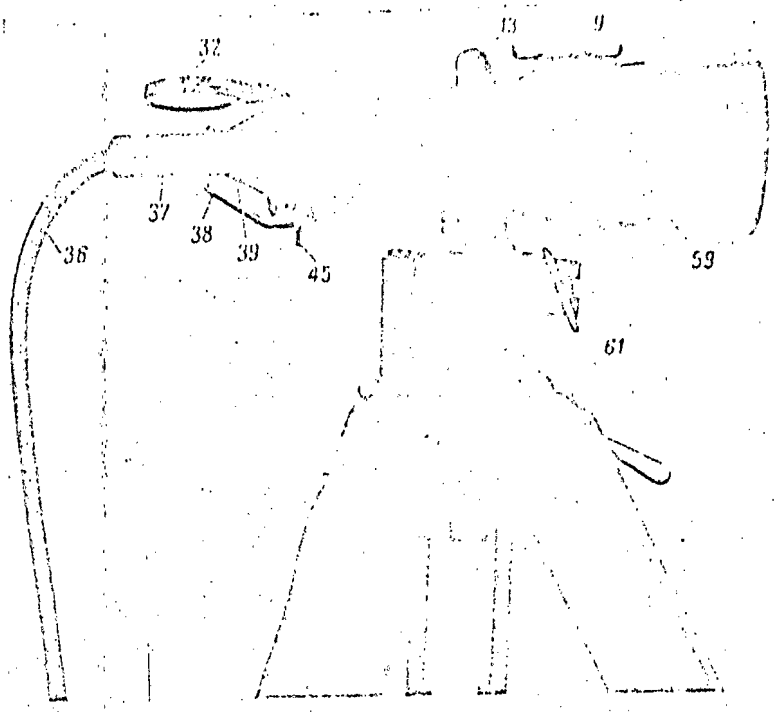
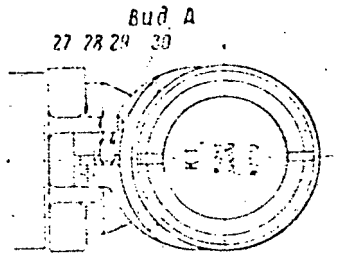


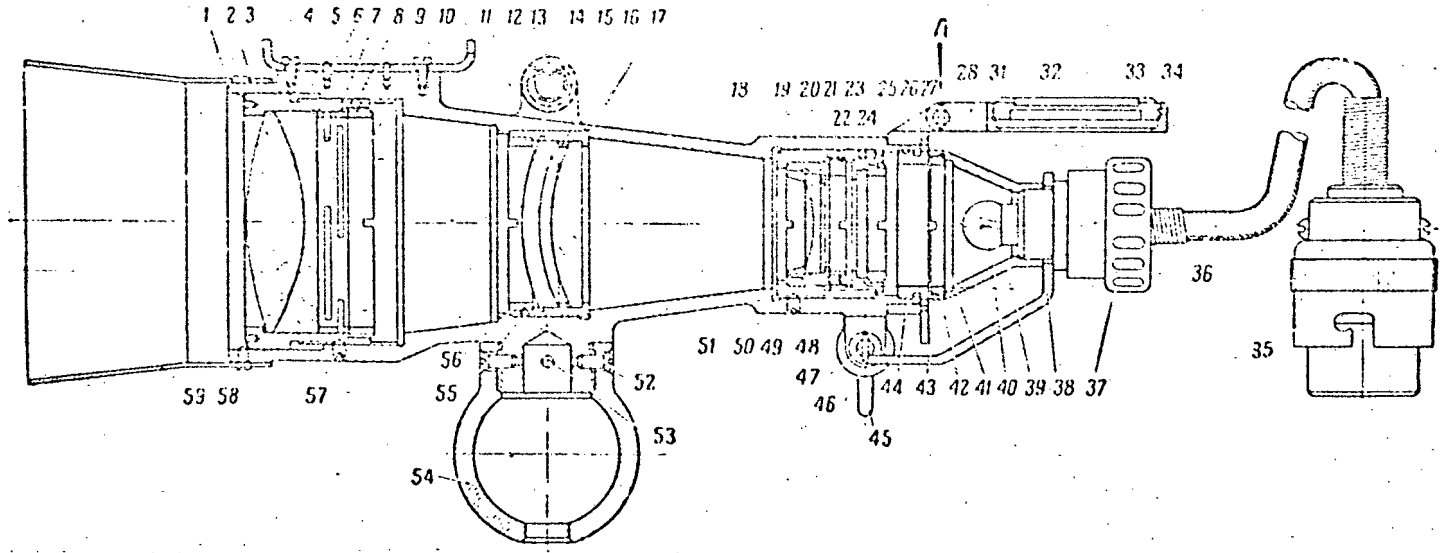
Figure 87. General View of the Gun Collimator:

9 - viewfinder; 13 - level; 32 - mirror; 36 - electrical conductor; 37 - socket; 38 - bracket; 39 - reflector; 45 - thumbscrew; 59 - lens hood; 61 - clamping screw.

Fig 88. Cross-Sectional View of Collimator [159]

1. housing
2,3. lenses
4. screw
5. mount
6. pin
7. spring ring
8. screw
9. viewfinder
10. split ring
11,12. lenses
13. level
14. ampule mount
15. protective ring
16. spacing ring
17. mount
18. mount
19. lens
20. plate
21. ring
22. screw
23. mount
24. plate
25. ring
26. screw
27. collar
28. shaft
29. pin
30. screw
31. mount
32. mirror
33. nut
34 screw
35. plug
36. electrical conductors
37. socket
38 bracket
39. reflector
40. bulb
41. protective glass
42. nut
43. screw
44. ring
45. thumbscrew
46. pin
47. shaft
48,49. screws
50. mount
51. ring
52. screw
53. pin
54. ball joint
55. screw
56. ring
57,58. screws
59. lens hood





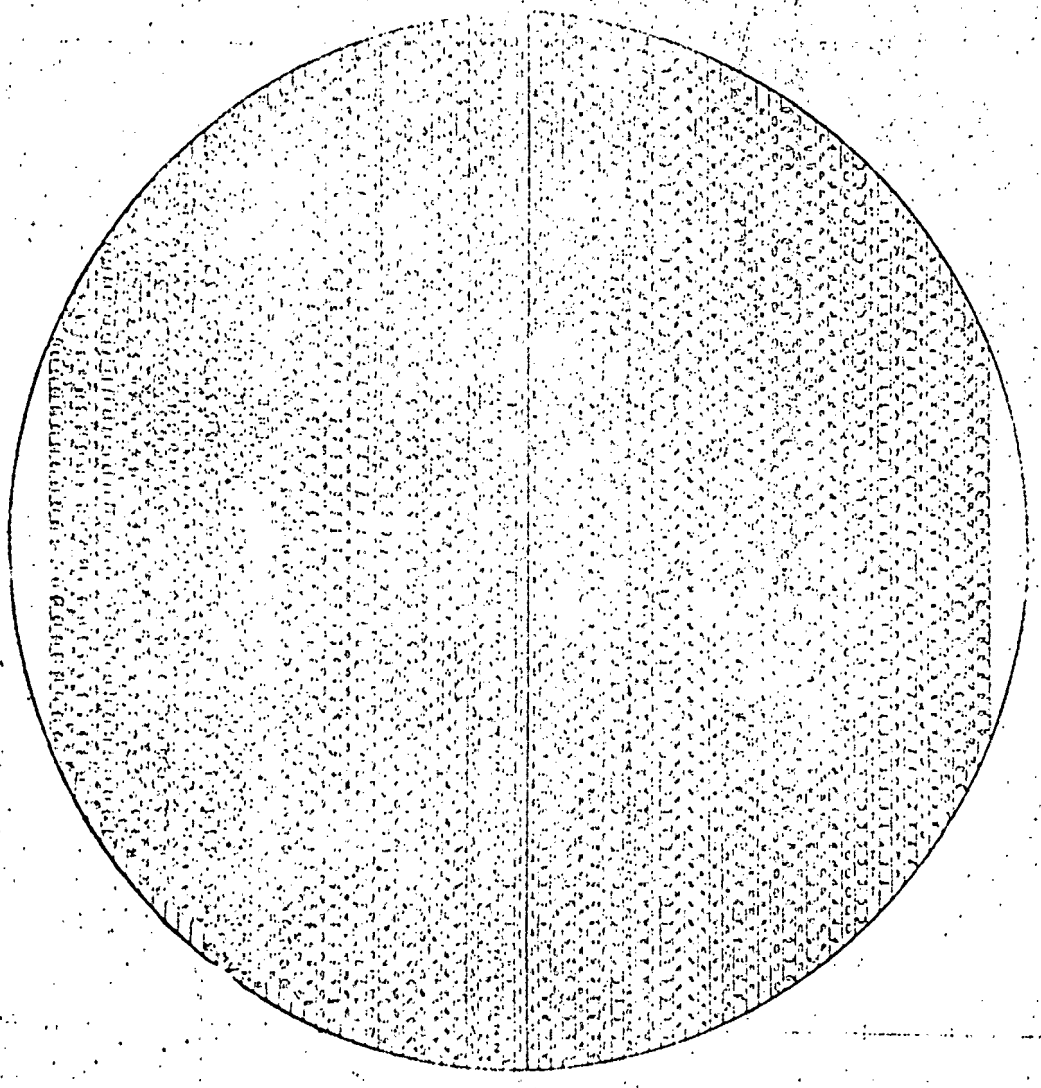


Fig 89. Graticule of the K-1 Collimator

-- raise bracket 38 until reflector 39 rests against the collimator and tighten it in this position with thumbscrew 45;

-- insert the plug into the battery socket and turn on the switch;

-- turn on illumination to the graticule of the dial sight with the aid of the LUCh gun illumination device; if the graticule of the dial sight is not easily visible, it will be necessary to remove the red light filter from the lampholder for the dial sight graticule.

The collimator is taken down and stored in the opposite order.

The collimator tripod must be set up in a stable and secure manner in order that the instrument not be shaken by the wind and the tripod not be subjected to accidental jarring. For this, it is necessary to fully tighten the lower and upper thumbscrews on the tripod. The legs of the tripod should be pushed into the ground, and on rocky ground the legs should be steadied with rocks. When a gun emplacement is used, it is best to set the tripod in a parapet of the emplacement: that is, in a recess which has been dug out with consideration for protection of the collimator by personnel servicing the gun.

The disposition of the collimator as recommended above (to the left rear of the weapon and at a distance of 6-8 m from the dial sight) is the most favorable for operation.

However, if such disposition is not possible, because of local conditions the collimator may be set up at any place (relative to the weapon) where the dial sight is visible, if it is remembered that the maximum separation between the collimator and dial sight is 13 m (2 zones of the collimator graticule are visible) and the minimum separation is 0.3 m (all 76 zones of the collimator graticule are visible). It should also be kept in mind that the collimator has a narrow operating range when it is placed close to the dial sight: that is, the feasibility of using the collimator is decreased when significant changes in the position of the dial sight are made as a result of training the weapon to the right or left within the limits of the horizontal field of fire and as a result of movement of the gun carriage during firing, especially at poorly prepared firing positions.

With large separations between the collimator and the weapon (12-13 m) the image of the collimator graticule, when viewed through the dial sight, becomes too indistinct, although it is possible to use the collimator when significant changes in the position of the dial sight occur.

Operation With the Collimator

After setting up the collimator at the weapon, carry out

ings and laying of the weapon in the following order:

Setting Up the Collimator at the Weapon

The collimator should be set up at the weapon in the following order:

1. Give the weapon an angle of elevation of 18° according to the sight (300 on the thousandths scale of tangent elevation) and, using the training mechanism, set the barrel in a middle position relative to the trails: that is, the barrel should be pointing approximately at the middle of the firing sector.

When elevating the weapon 18° it is absolutely necessary that the bubble in the cross level of the sight be centered by means of the cross-leveling mechanism.

2. Place the collimator tripod to the left rear of the weapon at a distance of 6-8 m from the dial sight of the gun.

3. Remove from the box the collimator with the electrical conductor (figure 87), the bulb socket, and the plug; place the lens hood on the collimator;

4. Fasten the collimator on the tripod in the following manner:

— loosen the clamping screw 61 on the cup of the tripod;

— place the ball joint of the collimator in the tripod cup so that its objective is pointed toward the dial sight, and slightly tighten clamping screw 61;

— using viewfinder 9, aim the collimator more accurately at the protective glass of the sighting head and simultaneously level in the transverse direction with level 13;

— finally, tighten the collimator in the tripod cup with clamping screw 61.

5. When using the collimator in daylight, use mirror 32 to illuminate the graticule of the collimator, placing the mirror so that the rays from the brightest part of the sky are reflected by the mirror on the graticule. (162)

6. When using the collimator at night or under conditions of poor visibility, use electrical illumination as follows:

— remove the storage battery designed for use with the K-1 collimator from the LUCh gun illumination instrument box and attach it to the tripod with the strap used to hold the tripod legs together (figure 78);

— move mirror 32 to the uppermost horizontal position (figure 81);

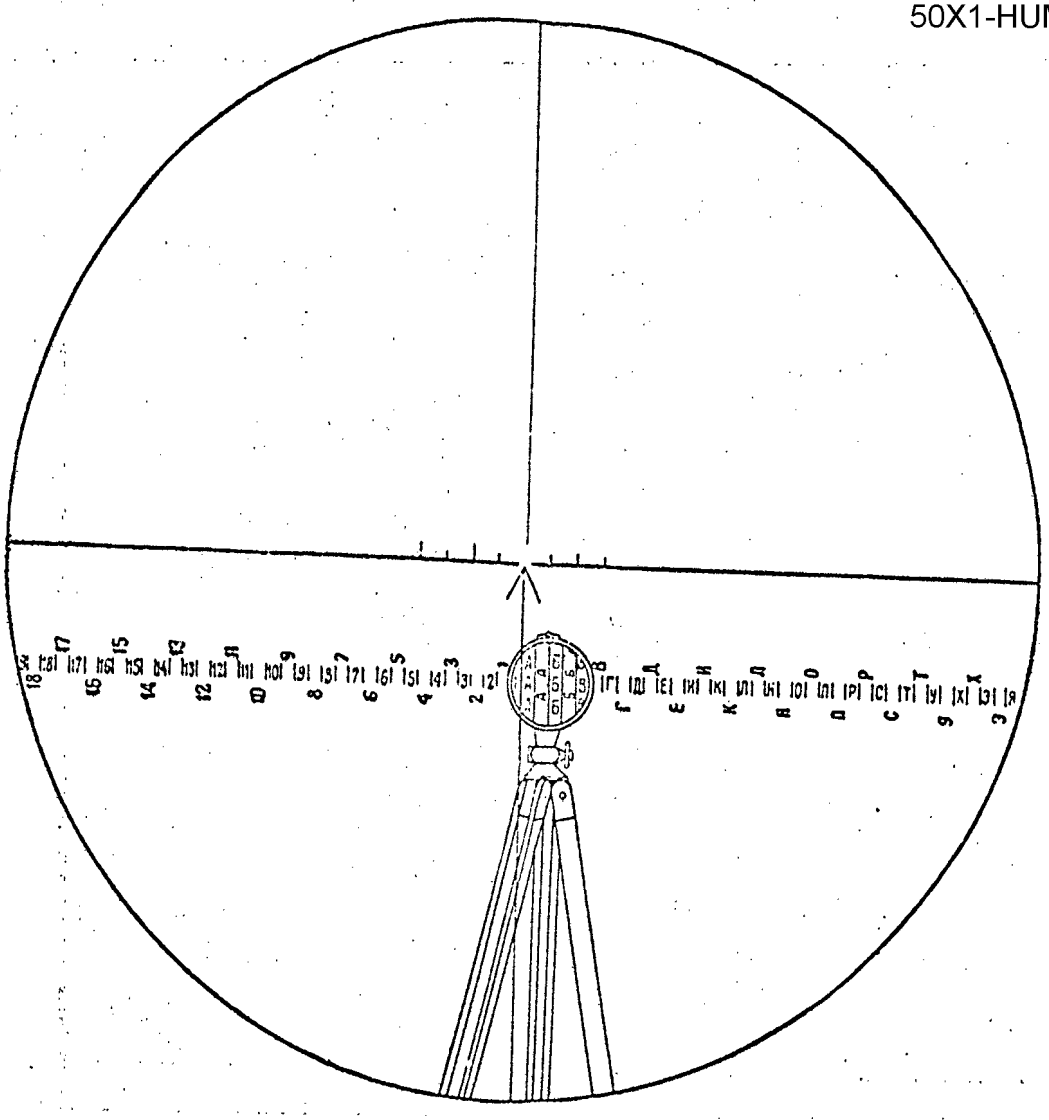


Fig 90. Example of the Alignment of the Special Scale of the Dial (Panoramic) Sight Graticule with the Graticule of the Collimator

1. In order to reference the dial sight of the weapon to the collimator, turn the sighting head of the dial sight and operate the reflecting mirror so as to align the vertical lines of the collimator graticule which are visible through the dial sight with the corresponding lines on the special scale of the dial sight graticule: that is, the lines designated by the same letters or numbers as on the collimator. (163)

Figure 90 shows how to align the lines of the collimator graticule with those of the dial sight graticule. In this figure the collimator, which has been placed approximately 4 m from the dial sight (six zones of the collimator graticule are visible), is seen in the field of view of the dial sight.

After referencing to the collimator, record the azimuth obtained.

2. In order to lay the weapon after changing the azimuth setting or to restore the original setting after firing, lay the cross hairs of the dial sight on the collimator while looking through the dial sight and operating the training mechanism and the reflecting mirror of the dial sight, and align the visible vertical lines of the collimator graticule with the same lines on the special scale of the dial sight graticule.

3. In order to provide good visibility of the collimator graticule during firing, the outer lens of the collimator objective system should be wiped clean periodically (to remove dirt and moisture from the glass).

Care of the Collimator

In caring for the collimator it is necessary to abide by the following basic rules:

— in inclement weather the collimator should be covered with a hood during breaks in firing (figure 91);

— the collimator is transported and stored in the carrying case only (figure 92); during transport, it should be protected against shocks and vibration;

— set up and dismantle the collimator carefully, without subjecting it to shocks;

— always keep the collimator clean. If the collimator is used in rain or snow, the outer metal parts should be wiped dry with a clean rag before it is stored in the case. The outer surfaces of the optical parts of the collimator should be dried with clean flannel (a linen rag), the collimator having first been shaken to remove dust and sand.

Dust and sand should be removed from the optical parts with a small brush or by blowing.

The optical parts should be cleaned with flannel, using a circular motion from the center to the edges.

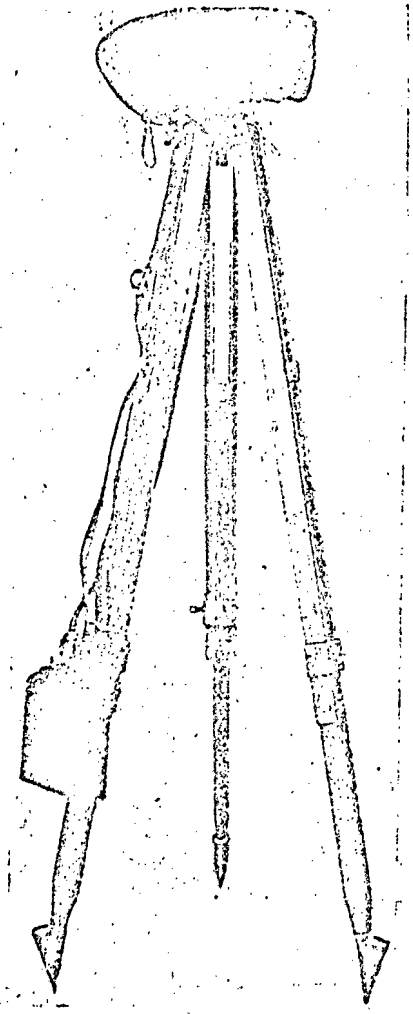


Figure 91. Gun Collimator on Tripod, Covered With Hood

Touching the optical parts with the fingers or an oily or dirty rag is forbidden, since the slightest oil spots will ruin the polished surface of the glass and result in poor image quality. (164)

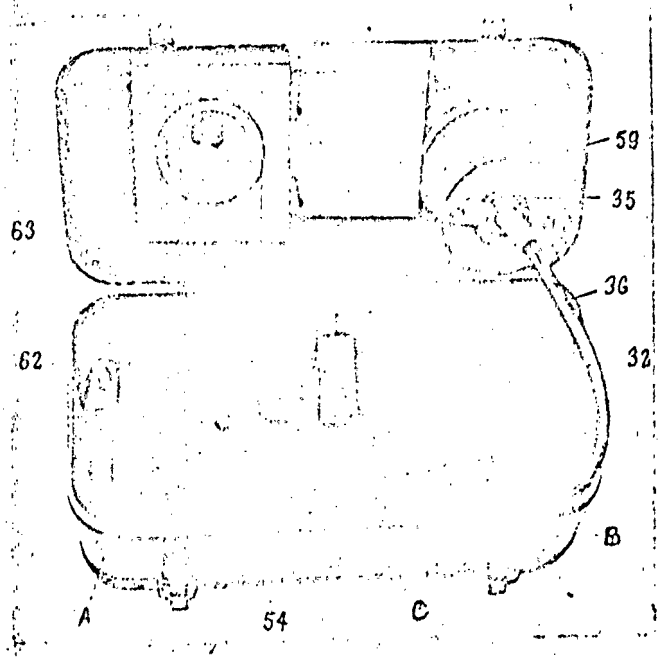


Figure 92. Gun Collimator in Carrying Case: [164]

A - collimator; B - carrying case; C - place for storing spare bulbs; 32 - mirror; 35 - plug; 36 - electrical conductor; 54 - ball joint; 59 - lens hood; 62 - flannel; 63 - spare mirror.

52. Optical Sight OP-4-35 (OP-4-96)

50X1-HUM

Purpose and Basic Data on the Sight

Optical sight OP-4-35 is intended for use with direct fire and has the following optical and design characteristics:

Magnification	5.5^{x}
Field of View	11°
Diameter of Exit Pupil	5.5 mm
Distance Between Exit Pupil and Last Lens of Eyepiece	24.5 mm
Maximum Adjustment of Sight:	
in range	± 10 divisions of fixed scale
in height	± 10 divisions of fixed scale

Construction of the Sight

The OP-4-35 sight (figure 93) consists of the following basic parts: tube, tangent elevation mechanism, height adjustment and range adjustment mechanisms, eyepiece with rubber eye shade, rubber forehead piece, and light filter.

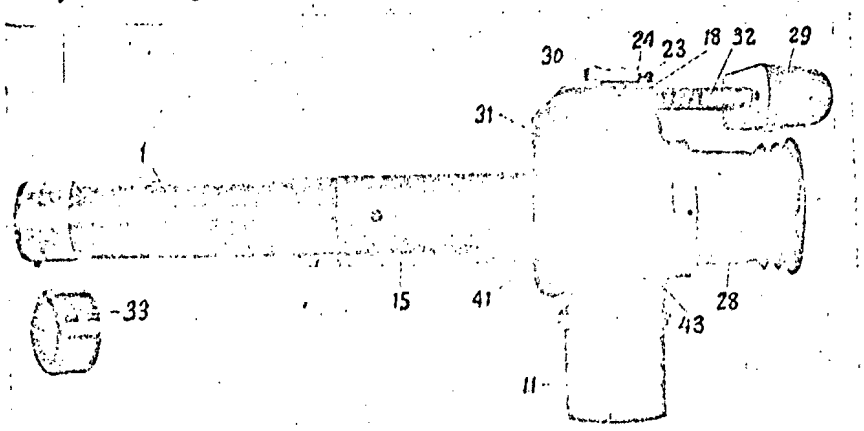


Figure 93. Over all View of Sight OP-4-35:

1 - tube; 11 - handwheel of tangent elevation mechanism; 15 - key; 18 - bracket illuminating bulb holder; 23 - cover; 24 - screw; 28 - rubber eye shade; 29 - rubber forehead piece; 30 - screw for attaching forehead piece; 31 - forehead piece bracket; 32 - forehead piece shaft; 33 - light filter; 41 - screw; 43 - cover. 50X1-HUM

An optical diagram of the sight is shown in figure 94.

The following optical parts of the sight are fixed in tube 1 (figure 95): objective lens 2, condensor 3, and erecting lenses 4 and 5. The objective lens, which consists of two lenses cemented together, provides a reduced and reversed image of observed objects in its focal plane (that is, the top of the object is at the bottom, the right side is toward the left, etc.). The condensor concentrates the light rays along the optical axis, as a result of which the diameter of the parts behind the condensor is reduced in size and the dimensions of the sight have been decreased.

The erecting lenses, consisting of three lenses each, reverse the image made by the objective lens. After the light rays have passed through these lenses, an erect image of the observed object is produced in the focal plane of the eyepiece.

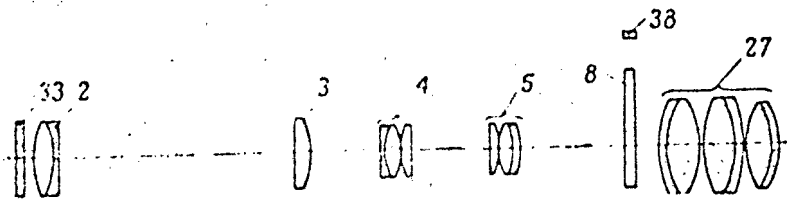


Figure 94. Optical Diagram of the Sight:

2 - objective lenses; 3 - condensor; 4 - first erecting lens; 5 - second erecting lens; 8 - plane-parallel glass plate; 27 - eyepiece; 33 - light filter; 38 - protective glass for illumination of sight scales.

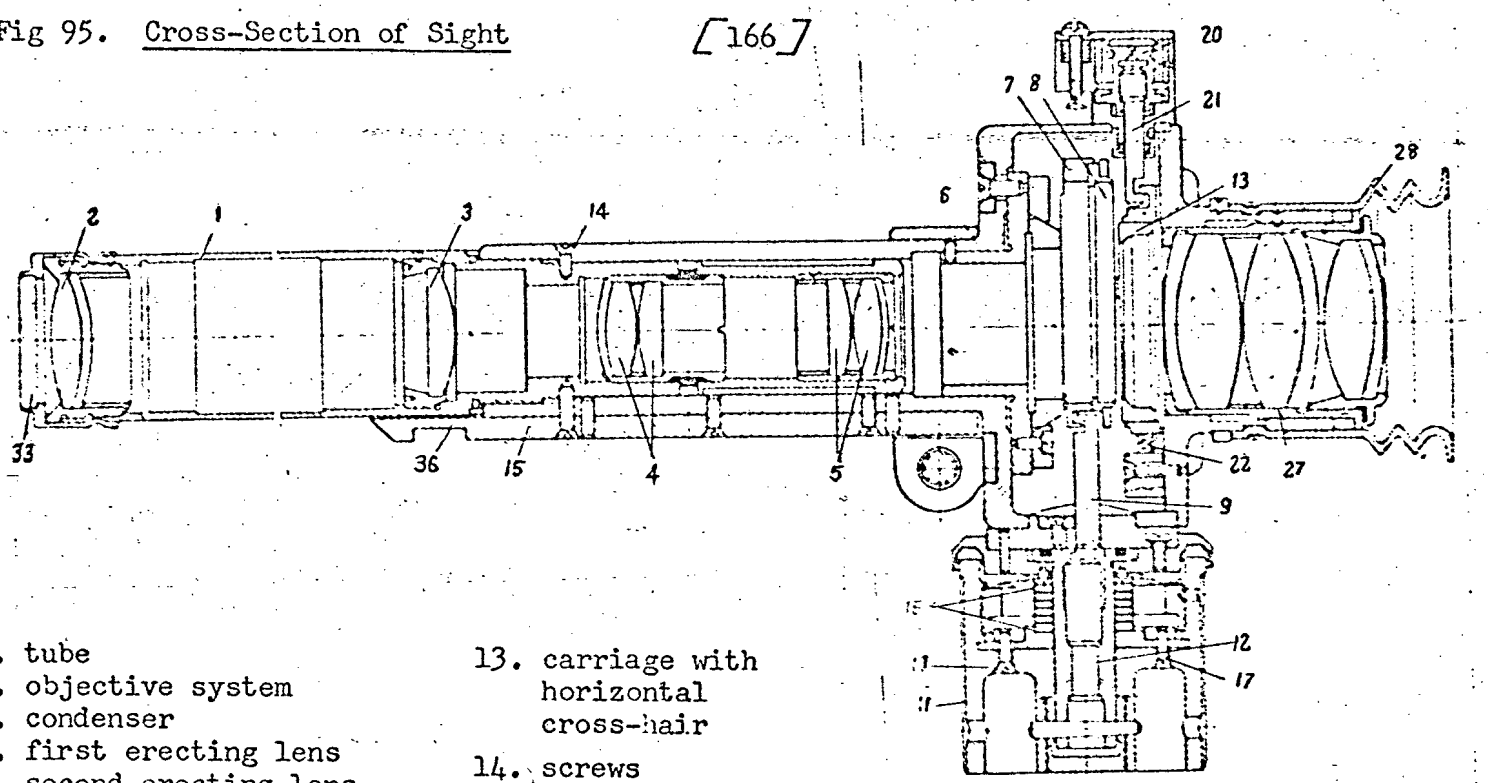
The tangent elevation mechanism consists of the following basic parts: housing 6, carriage 7 with plane-parallel glass plate 8, screw 9, spring 10 (fig. 98) of handwheel 11 (fig. 95) with nut 12, and carriage 13 with horizontal cross-hair.

Range scales and laying marks (symbols) in the form of inverted V marks and vertical lines are inscribed on plane-parallel glass plate 8. The plate is placed in the focal plane of the eyepiece.

Housing 6 is attached to tube 1 by means of a threaded connection and screws 14. Key 15, attached to the cylindrical part of the housing, is used to fix the sight in the bracket on the weapon. [167]

The tangent elevation is set by moving the carriage with the plane-parallel glass plate upward or downward relative to the horizontal cross-hair.

Fig 95. Cross-Section of Sight



1. tube
2. objective system
3. condenser
4. first erecting lens
5. second erecting lens
6. housing of tangent elevation mechanism
7. carriage of plane-parallel glass plate
8. plane-parellel plate
9. screw of tanget elevation mechanism
11. handwheel of tangent elevation mechanism
12. nut
13. carriage with horizontal cross-hair
14. screws
15. key
16. stop washers
17. screws
20. nut of height adjustment mechanism
22. spring of height adjustment mechanism
27. eyepiece
28. rubber eye shade
33. light filter
36. groove in key

50X1-HUM

50X1-HUM

The tangent elevation mechanism operates as follows: 50X1-HUM

Rotation of handwheel 11 causes rotation of nut 12 which moves screw 9 upward or downward.

When handwheel 11 is rotated in one direction, screw 9 descends (is unscrewed from the threads of nut 12) and its L-shaped end pulls down on the catch of carriage 7 with the plane-parallel glass plate 8, compressing spring 10 at the same time (figure 98); when the handwheel is rotated in the opposite direction, screw 9 rises and carriage 7 with the plane-parallel glass plate is moved upward.

Spring 10 (figure 98) constantly applies tension on carriage 7 and takes up the free play between screw 9 (figure 95) and nut 12.

When the carriage with the plane-parallel glass plate is moved downward, the angle of elevation is increased; and when it is moved upward, the angle of elevation is decreased.

Six stop washers 16, linked to each other by projections on their outer surfaces, are set on nut 12 to restrict the movement of the carriage with the plane-parallel glass plate to the limits of the tangent elevation scales. These washers serve to limit the rotation of nut 12 and, consequently, handwheel 11 to six turns.

If the limiting motion of handwheel 11 is not correct (for example, if the zero divisions of the range scales do not reach the horizontal cross-hair), then screws 17 should be loosened and the handwheel turned to the necessary position; in this case washers 16 will not turn. After this, screws 17 are tightened.

On the top of housing 6 is a bracket 18 (figure 93) with lugs having a dovetail cross-section; the lugs are designed to hold a lamp holder and electric bulb for illumination of the range scales and laying marks. The illumination system used with the given weapon serves for illumination of the sight scales.

The height and range adjustment mechanisms are used to align the zero line of sight with the axis of the gun barrel.

The carriage with the horizontal cross-hair is moved upward or downward by means of the height adjustment mechanism, while the carriage with the glass plate is moved to the left or right by means of the range adjustment mechanism.

The height adjustment mechanism is situated on the top part of housing 6 (figure 95) as one looks at the sight when it is in firing position. The range adjustment mechanism is located on the left side of housing 6. 50X1-HUM

Both mechanisms are identical in construction and, therefo 50X1-HUM only the height adjustment mechanism will be described below.

The height adjustment mechanism consists of the following basic parts: housing 9 (figure 96), nut 20, adjusting screw 21, and spring 22 (figure 97).

The housing of the adjustment mechanism, which is screwed onto [168] the housing of the tangent elevation mechanism, has a cover 23 (figure 96) which is held by screw 24.

When screw 24 is loosened, cover 23 is pushed upward by the force of spring 25 and comes out of the cylindrical guide of housing 19. When in this position, cover 23 may be turned to the side and the height of the sight may be adjusted by turning nut 20 with a screwdriver.

When nut 20 of the height adjustment mechanism is turned in one direction, screw 21 descends (is unscrewed from the threads of nut 20) and, by means of its L-shaped end, pulls the catch of the carriage with the horizontal cross-hair downward and compresses spring 22 (figure 97). When nut 20 is turned in the opposite direction, screw 21 is raised and the carriage is moved upward. Spring 22 takes up the free play between screw 21 and nut 20.

When the nut (figure 93) of the range adjustment mechanism is turned, carriage 26 (figure 98), on which is fastened carriage 7 with the plane-parallel glass plate, is moved to the right or the left.

Eyepiece 27 (figures 94 and 95) is used to view the image which is formed by the objective lenses at a wide angle (as through a magnifying glass); therefore, the observer sees a magnified image of the object.

The eyepiece consists of a mount and six lenses, cemented together in pairs, placed in the mount. The eyepiece mount is screwed into the housing of the tangent elevation mechanism and is held by screws. A rubber eye shade 28 (figure 93) is fastened to the rear part of the housing of the tangent elevation mechanism for convenience in observing through the eyepiece.

50X1-HUM

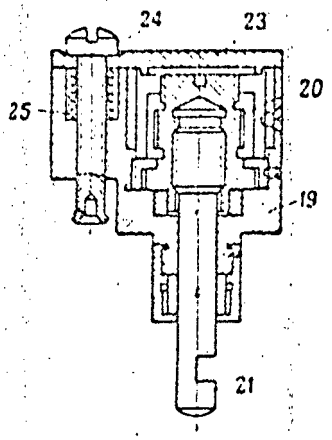


Fig. 96. Height Adjustment Mechanism:
19 - housing; 20 - nut; 21 - adjusting screw; 23 - cover; 24 - screw; 25 - spring.

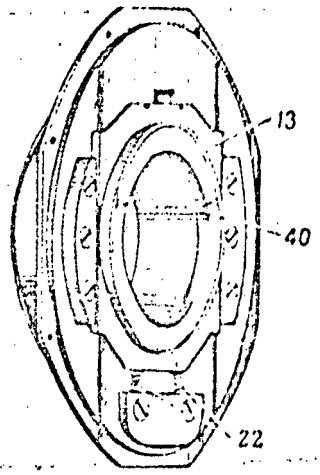


Fig. 97. Housing With Cross-Hair Carriage:
13 - carriage; 22 - spring; 40 - cross-hair.

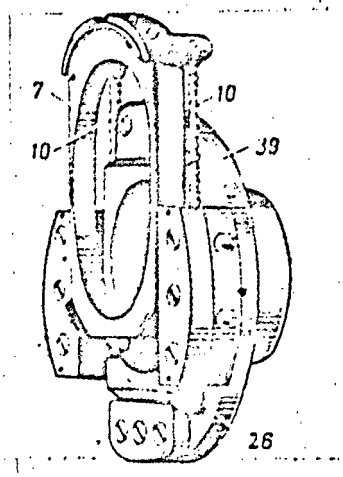


Fig. 98. Carriages of Sight Scales:
7 - carriage with plane-parallel glass plate; 10 - spring; 26 - range adjustment carriage; 39 - base of carriages.

The rubber forehead piece 29 (figure 93) provides convenience in operating the sight by the pointer.

The forehead piece is attached by screw 30 to the guide of bracket 31. The forehead piece may be moved along the axis of the sight in order to align the plane of the output pupil of the sight with the eye of the pointer.

The position of the forehead piece along the axis of the sight [169] may be read from the scale on shaft 32 of the forehead piece. If the pointer already recorded this position on the scale, he may rapidly set the forehead piece in the required position if the setting has been changed.

Light filter 33 (figures 93 and 94) is a metal ring holding a smoked glass plate. The light filter is set in the tube of the sight (in front of the objective) when laying the gun in the direction of the sun or on a brightly illuminated target.

The sight scale. In the field of view of the sight are the range scales and laying marks inscribed on a plane-parallel glass plate (figure 99). In addition, a stationary horizontal cross-hair (reader) 50X1-HUM may be seen in the field of view.

The range scales located on the upper part of the plane-pa 50X1-HUM glass plate are drawn in accordance with the ballistics of the weapon for which the sight was designed and are designated by letters corresponding to the types of sheels used in the given weapon. The divisions on the scales are marked by numbers corresponding to ranges in hectometers (hundreds of meters). Below the range scales are the laying marks drawn in the form of inverted V's and short vertical lines. The large central V serves for sighting without consideration for side corrections, while the side V's and vertical lines are used when sighting with consideration for side corrections.

The distance between the peaks of adjacent V's corresponds to eight divisions of the main scale, and the vertical lines (one large and two small) divide this distance into four equal parts representing two divisions on the main scale.

The laying marks, located on both sides of the large central V, make it possible to determine side corrections for up to 24 divisions of the main scale to the right and left.

The vertical line drawn downward from the top of the central V is intended to facilitate locating the central V and to permit the layer to more easily detect a lateral inclination of the weapon.

Between the top of the central V and the beginning of the vertical line is a gap equal to two divisions on the main scale. This gap may be used as a scale for determining the range to the target if the height of the target is known.

The distances between the short lines on the side correction scale may also be used to determine accurately the range to the target if the length of the target is known.

The scales of sights OP-4-35 for the 130-mm M-46 gun and OP-4-96 for the 152-mm M-47 gun are shown in figure 99.

Sight OP-4-35 has three range scales. To the left is the scale for armor-piercing sheels, designated by the letters BR; the divisions are from 0 to 40.

The value of each division on the BR scale (4,000 m) is 200 m.

To the right is the scale for high-explosive fragmentation sheels with reduced charge, designated by OF-4; the scale has divisions from 0 to 31. The value of each division on the scale (3,100 m) is 100 m.

To the left of the OF-4 scale is a scale for high-explosive fragmentation shells with full charge, designated by the letters 50X1-HUM the scale has divisions from 0 to 80.

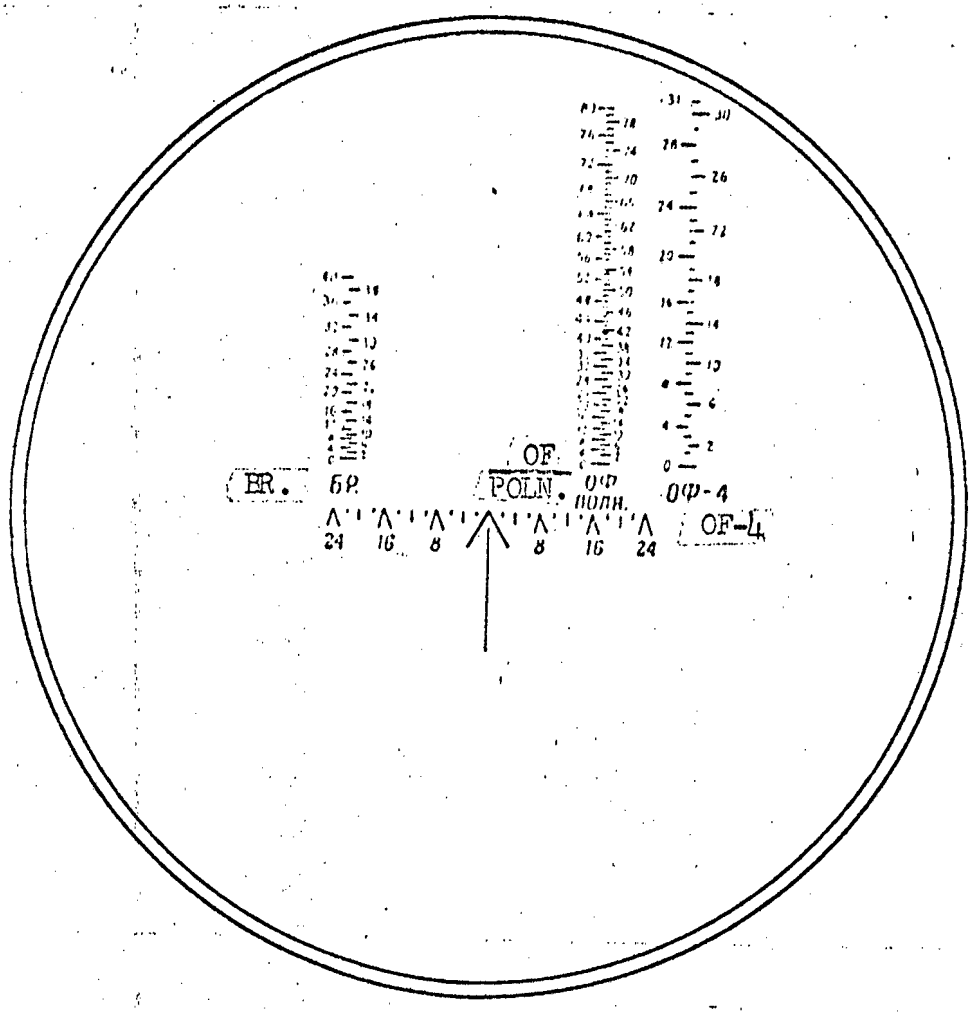


Fig 99. Scales of Sights

(OP-4-35 Sight)

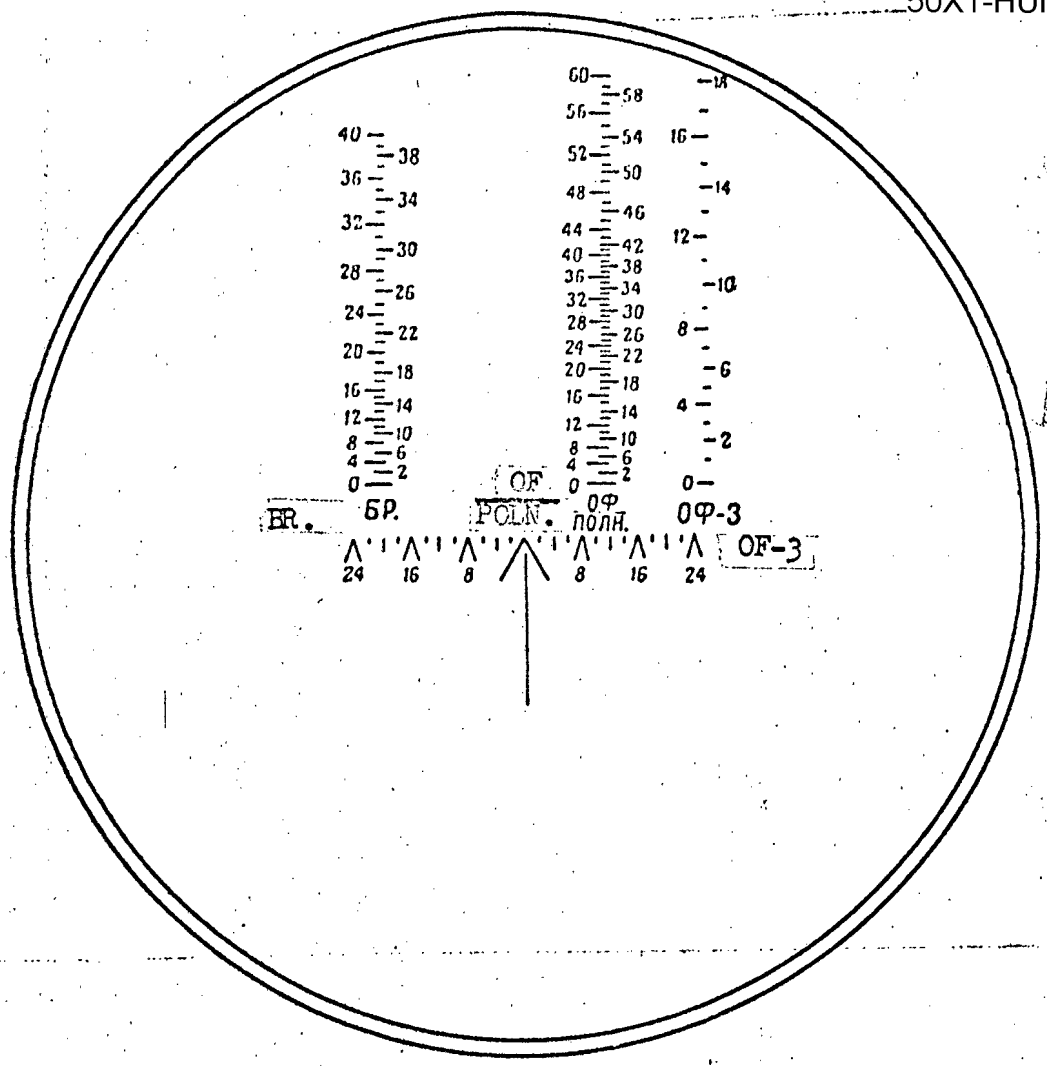


Fig 99. (part 2) Scales of Sights

(OP-4-96 Sight)

The value of the divisions on the $\frac{OF}{POLN}$ scale are:

— from 0 to 40 (4,000 m) = 200 m;
— from 40 to 80 (8,000 m) = 100 m.

Sight OP-4-96 has three range scales whose designations and divisions are shown in figure 99.

Attaching the Sight to the Weapon

Bracket 1 (figure 100) and collar 3 are designed for holding sight OP-4-35 (OP-4-96) on the gun; the bracket is rigidly welded to the cradle of the gun (two bolts 2 are screwed into the bracket at the factory for accessory purposes).

Collar 3 is fastened to bracket 1 with four bolts 5 and two pins 6.

A longitudinal opening with a key-way at the bottom is used to hold the sight in collar 3. A key attached to the tube of the sight is inserted into the keyway and prevents the sight from turning on the collar. [171]

At the bottom of collar 3 (below the keyway) is a laminated spring (attached by two screws 4) which engages a groove in the key of the sight and holds the sight securely in the bracket; screws 4 are locked with wire.

Final attachment of the sight in the collar is made with thumbscrews 10 which hold the sight by clamp jaws and thus fasten the sight to the collar. Cotter pins are placed in the ends of the thumbscrews to prevent them from becoming lost.

Mounting and Removal of the Sight

Before mounting the sight on the weapon it is necessary to make sure that the opening in collar 3 (figure 100) of bracket 1 (where the sight is seated) is clean. If the opening is dirty, it should be wiped out with a clean rag. Take care that the sight is not damaged when mounting it on the weapon. [173]

In order to mount and fasten the sight in the bracket it is necessary to:

— open the clamp jaws of the sight collar, having first loosened the thumbscrews 10;

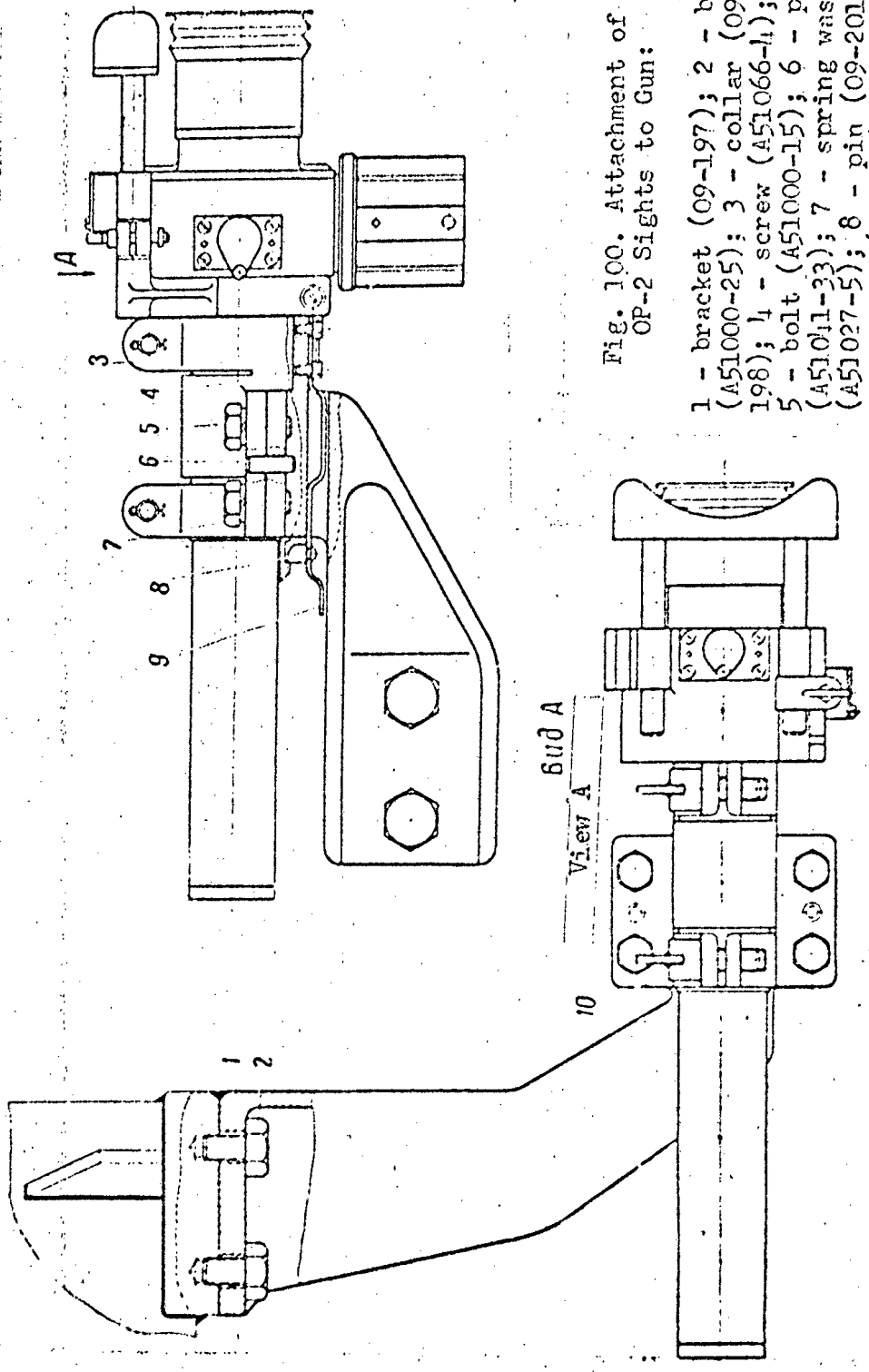


Fig. 100. Attachment of OP-2 Sights to Gun:

1 - bracket (09-197); 2 - bolt (A51000-25); 3 - collar (09-198); 4 - screw (A51066-4); 5 - bolt (A51000-15); 6 - pin (A51041-33); 7 - spring washer (A51027-5); 8 - pin (09-201); 9 - spring (09-202); 10 - thumbscrew (Sb09-37).

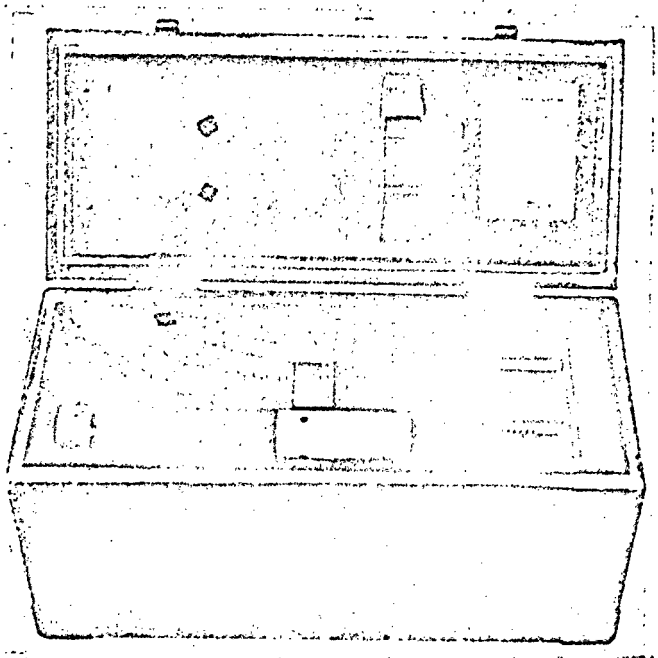
50X1-HUM

— insert the sight (objective toward the front) in the opening of the collar on the bracket so that the key of the sight enters the keyway and pin 8 of spring 9 engages the groove in the key of the sight;

— tighten thumbscrews 10.

In order to remove the sight from the gun it is necessary to loosen thumbscrews 10; this will make it possible to free the sight from the clamp jaws of the sight collar.

Then, with the left hand, press spring 9 so that is pin releases the key on the tube of the sight, and, with the right hand, remove the sight (pushing it carefully) from the collar of the bracket. Place the sight in a carrying case (figure 101), which is then locked with hasps.



[173]

Figure 101. Carrying Case With Sight in Place.

Operating With the Sight

When laying the weapon during direct fire, it is necessary to lay the weapon on the target and to set the angle of elevation on the sight according to the corresponding range scale, depending on the range to the target and the shell to be used.

50X1-HUM

The angles of elevation are set by means of the tangent elevation mechanism handwheel, which moves the range scales into the field of view relative to the horizontal cross-hair. When laying the weapon during direct fire at a stationary target, it is necessary to perform the operations outlined in Paragraph 73. [174]

When laying the weapon in the direction of the sun or against brightly illuminated targets, place the light filter on the tube of the sight (at the end with the objective lenses).

When fire is directed against lighted targets at dusk or night, illumination for the scales of the sight should be turned on. When necessary, sight OP-2 may be used to measure horizontal and vertical angles and to determine the range to the target (approximately).

Measuring horizontal angles. The scale of side corrections is used when measuring horizontal angles.

In order to measure an angle (of not more than 24 divisions on the main scale) between two objects, the following steps should be performed:

— by operating the training and pointing mechanisms of the weapon, lay the peak of the central inverted V on one of the objects;
— count the number of whole divisions (small) on the scale of side corrections from the central V to the second object; if the second object is located between two lines, the percentage of the division should be estimated by eye;
— multiply the total number of whole divisions (small) by 0.02 and add the estimated percentage to the result.

For cases in which the angle between the objects does not fall between the central and extreme V's but does not exceed 48 divisions of the main scale, one of the extreme V's should be layed on one of the objects. If the angle between the objects is greater than 48 divisions of the main scale, the angle should be measured in parts by training the gun.

Measuring vertical angles. When measuring vertical angles, the layer should use the distance (gap) between the top of the central inverted V and the beginning of the vertical line, or one of the divisions of the range scales, the value of which in divisions of the main scale must be determined beforehand. In order to measure an angle using the size of the space between the top of the central V and the beginning of the vertical line, it is necessary to proceed as follows:

— by operating the training and pointing mechanisms of the gun, determine the number of times that the gap between the top of the V and the beginning of the vertical line may be layed out between the two objects subtending the angle being measured;

— multiply this number by 0.02 (the value of the angle corresponding to the distance between the top of the central inverted V and the beginning of the vertical line).

Determining range. The range to the target may be determined with the aid of the sight scales if a dimension of the target (height or length) is known.

In determining range:

— lay the sight on the target (object), whose dimensions are known, and determine the angle subtended by it;
— divide the length of the target (in meters) by the value of the angle (in thousandths) subtended by it, and multiply the quotient by 1,000. The result is the range to the target.

Example: A tank moving along a front subtends an angle of 0.04. Determine the range to the tank if the tank is 5 m long.
Solution: The range to the tank equals

$$D = \frac{5}{4} \cdot 1{,}000 - 1{,}250 \text{ m.}$$

Care of the OP-4-35 (OP-4-96) Sight [175]

The following basic rules should be followed in caring for the sight:

1. The sight is not removed from the gun under combat conditions. This is necessary in order that the gun always be ready for direct firing. When moving, as well as during breaks in firing in bad weather, the sight must be covered with a hood.

2. When moving the gun over long distances under combat or peacetime conditions, as well as in cases where the gun is stored in an artillery park, the sight must be removed from the gun and transported or stored in the carrying case.

3. In mounting the sight on the gun and removing it, care should be observed that the sight does not strike metal objects.

4. Do not use great force when operating the handwheel of the tangent elevation mechanism. If the range scales do not move to their maximum limits, the stop washers for the tangent elevation handwheel should be reset, as described in the section "Operating With the Sight."

5. The housings of the height and range adjustment mechanisms under covers 23 and 43 (figures 93 and 96) must always be packed up to their edges with AP-70 grease, which protects the sight from moisture penetration

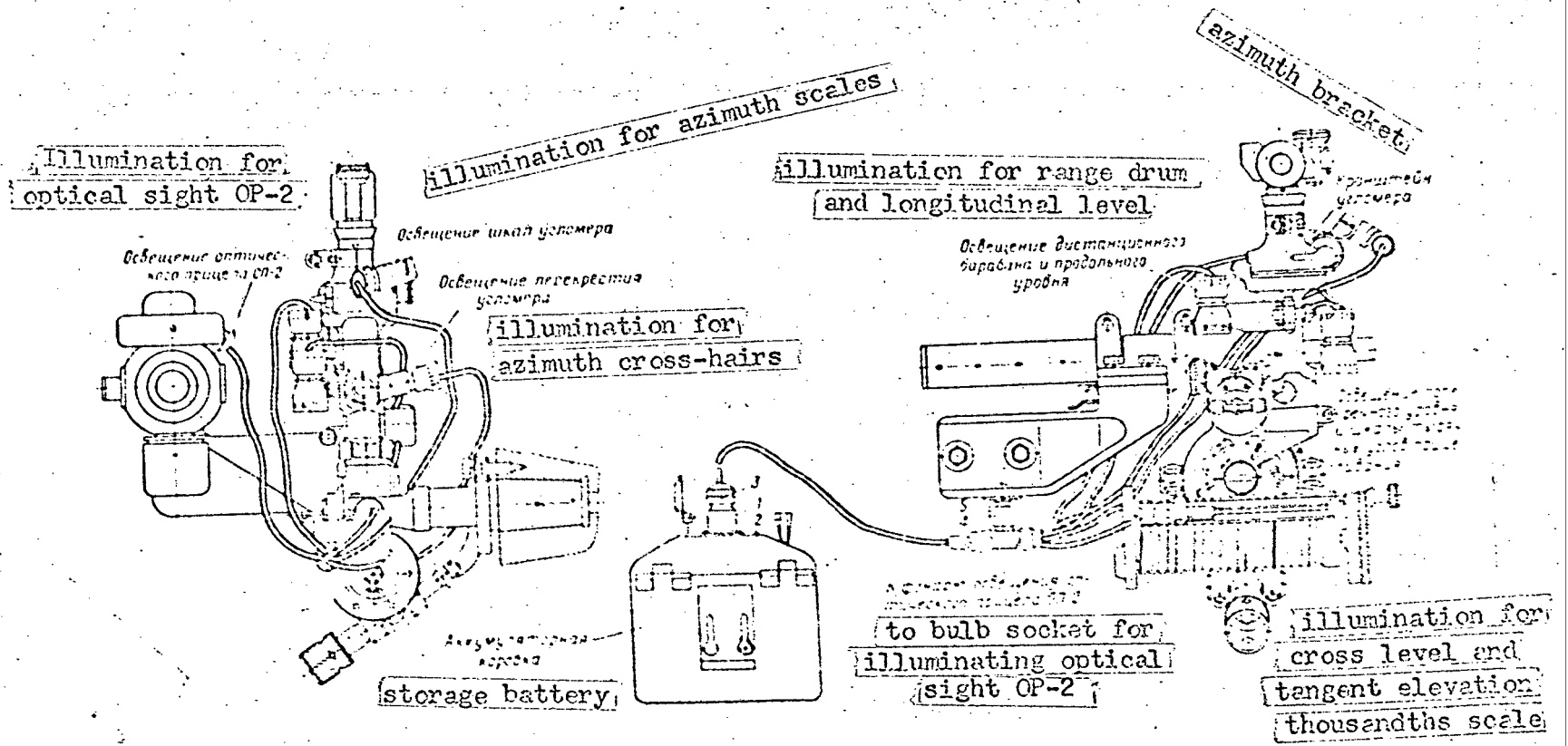


Fig 102. Arrangement of LUCh-S71M Illuminator for Sight Attachments

1. socket 2. switch 3. plug 4. socket 5. socket holder [176]

through these mechanisms. Where AF-70 grease is not available, the housings of the adjustment mechanisms should be packed with gun grease. 50X1-HUM

6. The sight should be kept clean at all times.

If the gun and sight are operated in snow or rain or if they are being moved over dusty roads, the outer metal parts of the sight should be wiped with a clean rag at the earliest possible moment.

The outer optical parts of the sight should be wiped with clean flannel (or a clean linen rag if flannel is not available), the sight having first been shaken to remove dust and sand; sand and dust should be removed (by blowing or with a small brush) before the glass is wiped with a cloth.

The glass should be wiped with the flannel, using a circular motion of the hand from the center to the edges. Touching the optical parts with the fingers or with oily or dirty rags is forbidden, since the presence of even the slightest oily spots will damage the polished surface of the glass and worsen the quality of the image formed by the sight.

53. Illuminating Instrument LUCh-S71M

Instrument LUCh-S71M (figure 102) is designed for illumination of the sights and gun dial sight when firing at dusk or at night, as well as for the illumination of those points which must be visible to the gun captain and the fuse-setter.

Instruments LUCh-S71M consists of four storage batteries and attachments for illuminating the mechanical sight, the optical space sight and dial sight, the gun collimator, attachments for illuminating the operating areas of the gun captain and fuse-setter, and a case for storing the instrument.

The storage battery, which supplies 3.5 volts to the bulbs (flash-light-type bulbs), consists of two series-connected type NkN-10 alkaline elements placed in a metal box with a cover.

On the rear wall of the box is a spring clip which is intended for hooking onto a belt, and at the side walls are buttons for attachment of the box to a shoulder harness. [p 177]

Attached to the cover of the battery box is socket 1 to which plug 3 of the illuminating instrument is connected. Switch 2 is next to the socket.

Two wires pass from the terminals of the battery. One wire is connected to the contact of socket 1 and the other to the contact of switch 2. The second contact of switch 2 is connected to the second contact of socket 1. 50X1-HUM

The battery used for illumination of the mechanical, optical 50X1-HUM
dial sights is attached to the shield of the weapon; the battery used for illuminating the graticule of the collimator is fastened to the collimator tripod; the two other storage batteries are worn by the gun captain and the-fuze-setter.

The attachment for illuminating the mechanical, optical and dial sights consists of an electrical conductor split into five divergent branches.

On the end of the undivided part of the conductor is a plug 3 for connection to socket 1 of the storage battery.

The branched part of the conductor consists of five two-wire terminals which are connected to

— a socket with a bulb for illuminating the cross-hairs of the dial sight;

— a socket with a bulb for illuminating the cross level and the tangent elevation thousandths scale;

— a socket with a bulb for illuminating the range drum and longitudinal level;

— a socket with a bulb for illuminating the azimuth scales of the dial sight;

— a socket with a bulb for illuminating the optical sight.

The socket and bulb used to illuminate the cross-hairs of the dial sight are held in a special clip which, in turn, is fastened by a draw bolt and nut to the eyepiece of the dial sight.

The socket and bulb used to illuminate the azimuth scales of the dial sight are placed in a special bracket which, in turn, is held by a swing bolt and nut to the housing of the dial sight (below the ring of the azimuth scale).

The attachment for illuminating the operating area of the gun captain consists of a conductor, on one end of which is a socket with a bulb and reflector and on the other end of which is a plug for connection to the socket of the storage battery.

The socket has a clip which is used to attach it to the belt.

The attachment for illuminating the operating area of the fuse-setter consists of a conductor and a leather glove which is worn on the left hand of the fuse-setter. 50X1-HUM

On one end of the conductor is a socket and bulb, and on the other end is a plug for connection to the socket of the storage battery. The bulb socket is fastened to a brace sewn into the leather glove.

The attachment for illuminating the gun collimator consists of a conductor on one end of which is a plug for connection to the socket of the storage battery and on the other end of which is a holder; a reflector with protective glass is screwed onto the holder. The holder [178] is attached to the collimator by means of a special bracket.

The carrying case is intended for holding the LUCh-S71M instrument and its accessories and spare parts. The case contains special receptacles, partitions, and springs into which the parts of the instrument fit securely. The instrument is placed into the case in accordance with the instructions attached to the inside of the cover of the case.

The LUCh-S71M instrument is connected to the weapon in the following order:

— remove the detachable bracket from the carrying case, place it on the housing of the dial sight below the azimuth scale ring, and tighten the swing bolt on the clip of the bracket;

— remove the conductors for illuminating the sights and dial sight and place socket 4 in socket holder 5, which is attached to the bracket of the gun cradle by two bolts;

— attach the holders of the five conductors coming from socket 5 to the appropriate locations;

— place the light on the eyepiece tube of the dial sight and tighten it by means of the nut;

— place the battery box in the container on the gun shield and secure it with straps;

— insert plug 3 into socket 1; switch on the voltage when necessary, using switch 2.

* * *

CHAPTER TEN

LIMBER

54. Construction of the Limber

The limber is designed for transportation of the gun. It serves as a front running gear of the gun and is coupled to the tractor by a special collar 11 (Fig 103).

During transportation, the trail ends are placed on the limber frame 56 and fastened to it by a nut 4.

The limber consists of the following main parts: axle 31, frame 56, boom 7, and wheels 57.

To the limber are attached hose 8 with couplers and wire 35 with sockets.

The limber axle 31 is of welded construction and has a box-type cross section. The axle terminates in journals for mounting the limber wheels 57.

The journals 54 have two highly finished surfaces to fit the wheel roller bearings and are threaded for nuts 45 holding the wheel.

The middle part of the axle 31 has a vertical hole for mounting the limber pintle 21. Into the lower part of this hole is fitted a bronze bushing 18, and to the right and left of it are located two brackets 14 for coupling to the limber boom.

On the upper surface of the limber axle housing are located box 30 for holding the spare parts and tools and box 36 for housing the sockets of electric wire 35. Boxes 30 and 36 are fastened by bolts 55 and lock washers. Close to the boxes 30 and 36 are mounted holders 69 (Fig 104) for clamping the hose on the limber.

Also, on the limber axle are located two eyes 61 (Fig 103) with a plate 13 which prevents the boom 7 from moving toward the axle 31 during the uncoupling of the limber from the gun.

The limber frame 56 consists of a base 34 and pintle 21 supported by a spring 20.

The base 34 of the limber frame and the pintle 21 are connected together by a shaft 1 and are secured to the limber axle 31 by a nut 16.

The base 34 of the limber frame is capable of rocking on the horizontal shaft 1 and turning with the pintle 21 on a vertical axis.

When the limber is separated from the gun, the frame base 34 [p 180] is held in a horizontal position by two springs 32.

The base 34 of the limber frame has a horizontal hole fitted with two bronze bushings 59 and 60 which support the base on the shaft 1.

Between the bushings is a recess for the upper part of the pintle 21. On the upper surface of the frame base 34 is located a pivot 33 with a washer 3 and nut 4 for securing the trails to the limber.

The nut 4 is locked in position by a handle 5 with a spring lock. The lock and washer 3 are attached to chains.

Also, on the upper part of the frame base 34 are two checks a and two checks b on which rest the bearing surfaces m and n of the trails

The pintle 21 (Fig 103) has a horizontal hole in its upper part for shaft 1, which connects it with the base 34 of the limber frame. This hole has a slot for a key 2 which keeps the shaft 1 from rotating.

The shaft 1 has a grease cup and ducts for supplying lubricant to the bearing surfaces of the bronze bushings 59 and 60.

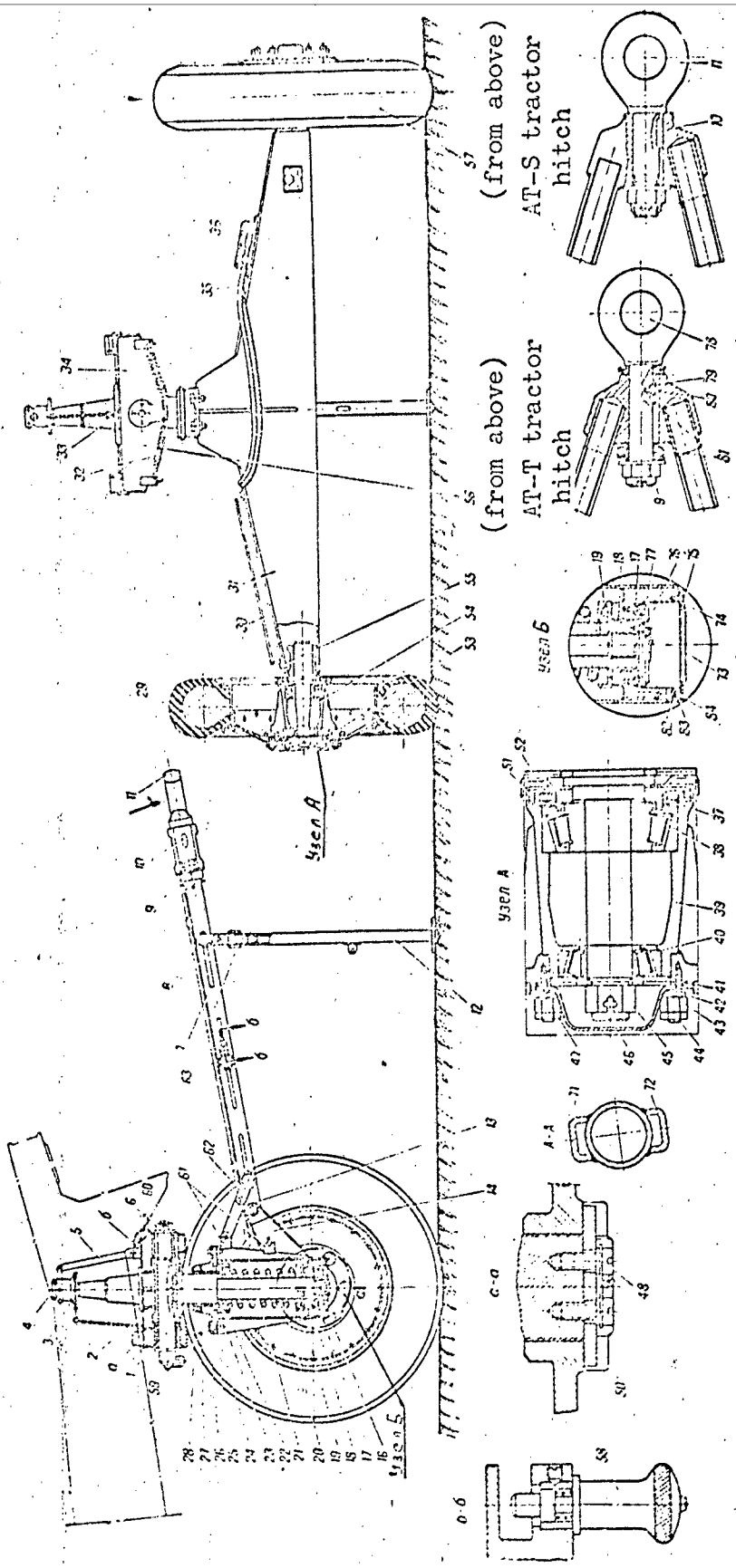
The two surfaces of pintle 21, which rests on the bronze bushings 18 and 26, are highly finished.

The lower part of the pintle 21 is threaded to accomodate the nut 16 which fastens the pintle to the limber axle 31. The nut 16 has a rubber buffer 17 and is held in place by the check 50 and screw 48.

The spring 20 is placed over the pintle 21 and rests on the washer 19. From the top the spring 20 is held in place by the washer 22 with a leather ring 23 and a cover plate 25 attached to the limber axle 31 with four bolts 24 and nuts.

On the top of the cover plate 25 is mounted a rubber buffer 28 with a jacket 27. The cover plate 25 also has a grease cup 70 (Fig 104) for lubricating the bearing surface of the bronze bushing 26 50X1-HUM.

50X1-HUM



[180]

Fig 103. Limber

50X1-HUM

Figure 103. Limber

1 - shaft (Sb46-12)
2 - key (A51050-67)
3 - washer (46-76)
4 - nut (46-77)
5 - handle (Sb46-16V)
6 - nut (46-89)
7 - limber boom (Sb46-10)
8 - hose with couplers (Sb41-32)
9 - nut (46-114)
10 - cutter pin (A51050-222)
11 - coupling collar (46-214)
12 - boom prop (Sb46-7)
13 - plate (46-98)
14 - bracket (Sb46-19)
16 - nut (46-201)
17 - lower buffer (46-73A)
18 - bushing (46-105A)
19 - washer (46-82A)
20 - spring (46-67)
21 - pintle (46-58A)
22 - washer (46-68A)
23 - ring (46-138)
24 - bolt (46-203)
25 - cover plate (46-61A)
26 - bushing (46-62A)
27 - buffer jacket (46-63)
28 - upper buffer (46-64A)
29 - rim and tire (Sb46-4)
30 - box for the gun kit (Sb46-22)
31 - limber axle (Sb46-1A)
32 - spring (26-69)
33 - frame pivot (46-129)
34 - base of the limber frame (Sb46-11)
35 - wire with socket (Sb41-48)
36 - box (Sb46-29)
37 - packing ring (Sb46-28)
38 - roller bearing No 7612
39 - hub (Sb46-3)
40 - roller bearing No 7609
41 - gasket (46- 135)
42 - bolt (A51000-1)
43 - nut (46-19)
44 - nut (46-193)
45 - nut (46-90)
46 - cap (46-91)
47 - lock washer (A51027-3)
48 - screw (A51066-35)
50 - check (46-202)
51 - washer (46-176)
52 - jacket (46-12)
53 - bolt (46-18)
54 - journal (46-8)
55 - bolt (A51000-5)
56 - limber frame (Sb46-17)
57 - limber wheel (Sb46-5)
58 - lock (Sb46-9)
59 - bushing (46-56)
60 - bushing (46-57)
61 - eyes (46-97)
62 - eye (46-40)
63 - ring (46-50)
71 - left channel (46-222)
72 - right channel (46-221)
73 - cover (46-210)
74 - gasket (46-211)
75 - screw (A51060-8)
76 - screw with a flange (46-209)
77 - screw (46-213)
78 - coupling collar (46-300)
79 - key (46-301)
80 - screw (A51060-9)
81 - disk (Belleville)spring (46-302)
82 - plug (46-219)
83 - spring (24-50)
84 - ball 8
a - check
b - check

The limber boom 7 serves to couple the limber to the tractor.

The front part of the boom has a coupling collar 11 which is clamped with a nut 9. A cotter pin 10 keeps the coupling collar from turning.

In the middle part of the boom is a prop 12 with a ring 63 which serves to support the limber boom when the limber is disconnected from the gun. In the travel position, the boom prop 12 is folded back and attached to the limber boom by lock 58.

The limber boom 7 has two eyes by which it is connected to the limber axle 31 with the aid of pins 68 and nuts 67 (Fig 104).

The boom 7(Fig 103) has also a connecting eye 62 with a plate 13 which prevents it from moving toward the axle 31 when the limber is disconnected from the gun.

The boom 7 has two cleats 65 (Fig 104) and two holders 64 for clamping the limber hoses.

During prolonged storage in open lots, the hoses 8 and electric wires 35 should be removed from the limber.

The limber wheels 57 (Fig 103) are fitted over the axle journal 54 with roller bearings 38 and 40 and secured by nuts 45. The wheel journals are protected from dirt by packing rings 37, washers 51, and jackets 52.

The limber wheel consists of a rim 29 and hub 39 with a 34" x 7" tire.

The tire is filled with foam rubber.

The hub 39 is fastened to the rim with six bolts 53 and nuts 43 and 44.

The caps 46 with gaskets 41, which are fastened with four bolts 42 and lock washers, serve to protect the internal cavity from dirt. [p 181]

In some limbers the base 34 of the frame (Fig 103) is reinforced (the 5-mm plate is replaced by an 8-mm plate), and the base of the pivot 33 is turned with its larger side in the direction of travel. The limber boom is reenforced with two channels 71 and 72.

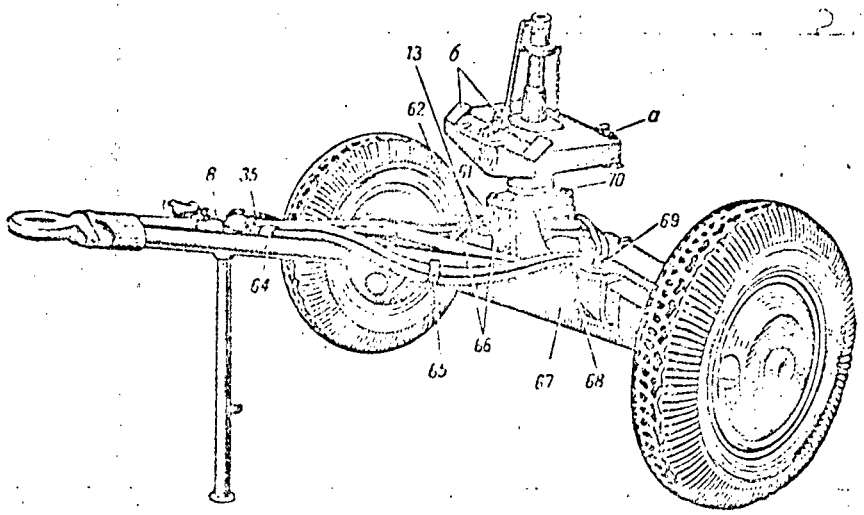


Fig 104. Limber

8 - hose with couplers (Sb41-32); 13 - plate (46-98); 35 - electric wire with socket (Sb41-48); 61 - eyes (46-97); 62 - eye (46-40); 64 - holder (A71312-5); 65 - cleat (46-208); 66 - shaft (46-99); 67 - nut (A51011-8); 68 - pin (46-94); 69 - holder (A71312-5); 70 - grease cup (A72273-6); a - check; b - check.

In this type of limber the handle 5 is also reenforced. To reduce the wear of the pintle bushings, the opening in the lower part of limber axle 31 is closed with a cover 73 and gasket 74. The cover 73 is fastened with screws 75. A screw 76 with a flange fits into the lower end of the pintle 21 and is locked by three screws 77 which are secured with a wire. The lower buffer 17 fits into the annular groove of the lower insert of the limber axle. The cover plate 25 is reenforced. The washers 19 and 22 are modified in such a manner as to increase the bearing surface of the bushings 18 and 26. The upper buffer 28 fits over the pintle 21 and has a membrane for protection of the pintle bushings from dirt. A valve consisting of plug 82, spring 83, and ball 84 serves to drain water and oil.

When the gun is pulled by an artillery tractor AT-T, the coupling collar 11 with cotter pin 10 should be replaced by spring coupling collar 78 with cotter pin 79, the collar being fastened with a screw 80 and springs 81. The replacement of the coupling collar 11 is made

— remove the cotter pin and unscrew the nut 9;

— remove the coupling collar 11 and the cotter pin 10;

— place two springs 81 on the coupling collar 78;

— insert the cotter pin 79 and secure it with screw 80; fit the screw into the slot;

— insert the coupling collar into the hole of the pintle paw of the limber boom;

— place four springs 81 on the protruding end of the coupling collar; [p 182]

— screw on the nut 9 tightly and lock it with a cotter pin.

When the gun is pulled by an artillery tractor AT-S, the spring coupling collar should be replaced by a regular coupling collar 11.

55. Disassembly and Assembly of the Limber

Disassembly

1. Place wooden blocks under the limber axle and remove hoses 8 and electric wires 35 (Fig 104) if they have not already been removed.

2. Disengage the limber boom in the following manner:

— remove the lock and cotter pin of the shaft 66 and remove the plate 13;

— remove the cotter pins and unscrew nut 67 with the wrench A52830-6, and with the aid of a rod knock out pin 68 holding the limber boom;

— remove the limber boom 7 (Fig 103).

3. Remove the wheels in the following manner:

— with wrench A52840-10 unscrew the bolts 42 (Fig 103) which are holding the cap 46; then remove the lock washers, cap 46, and gaskets 41;

— remove the cotter pins and unscrew nuts 45 with wrench A52830-8; screw the cap 42-314 onto the limber axle;

— remove the wheel by hitting the wheel guard with a hammer and prying off the wheel with a crowbar rested against the end of the limber axle; repeat the same procedure with the other wheel.

4. Remove the base of the limber frame in the following manner:

— tilt the base (to reduce the tension of the spring 32) and remove the spring 32 with pliers; now tilt the base in the opposite direction and remove the other spring 32;

— remove the cotter pin and unscrew nut 6 with wrench A52830-8;

— with the aid of a hammer and copper rod knock out the shaft 1 and separate the base 34 of the limber frame from the pintle 21.

5. Remove the pintle 21 in the following manner:

— turn the limber axle 31 until the pintle 21 comes into a horizontal position;

— remove the wire and unscrew screw 48; remove check 50;

— holding the nut 16 with wrench 42-233, unscrew it with the aid of a crowbar 41-116 inserted into the hole of the pintle;

— remove the cotter pins and with the aid of wrench A52830-5 replace the two diametrically opposite bolts 24 connecting the cover plate 25 to the limber axle 31 with bolts 42-228 secure the bolts 42-228 with nuts and remove the other two bolts 24; then carefully loosen the nuts of bolts 42-228 and remove the cover plate 25 from the limber axle 31;

— remove the pintle 21, cover plate 25, washer 22, spring 20, and washer 19.

During the disassembly of the limber it is forbidden to remove the hub 39 from the wheel.

Packing rings 37, washers 51, and jackets 52 may be removed only when it is necessary to replace them.

Prior to installation of the wheels see that the packing rings (Fig 73) are tightly fitted to the inner surface of the washer 51.

1. Replace the pintle 21 in the following manner:

— replace the washer 19, spring 20, washer 22, and cover plate 25;

— with wrench A52830-5, bring cover plate 25 up against the limber axle by tightening the nuts on two bolts 42-228 and compressing the springs;

— place the bolts 24 in the two remaining holes in the cover plate, screw on the nuts with the wrench A52830-5, and insert the other cotter pins;

— replace the bolts 42-228 with the bolts 24 one at a time, screw on the nuts with wrench A52830-5, and insert the cotter pins;

— insert pintle 21, and holding nut 16 with wrench 42-233, screw it on by turning the crowbar 41-116 inserted in the pintle opening;

— replace check 50, secure it with screw 48, and lock it with a wire.

2. Install the base 34 of the limber frame in the following manner:

— place the base on the pintle 21, insert the shaft 1, screw on nut 6 with wrench A52830, and lock;

— incline the base to the right and replace the second spring 32.

3. Mount the wheels in the following manner:

— place them on the axle journals of the limber and remove the cap 42-314; prior to installation, the wheel hubs are filled with grease;

— place the inner race of the bearing 40 with rollers and separator on the journal 54;

— screw nuts 45 on tightly with wrench A52830-8, loosen them 1/6 of a turn (to ensure normal performance of the roller bearings), and lock;

— replace the gaskets 41 and cups 46, and screw in the bolts 42 with spring washers with the aid of wrench A52830-10.

4. Replace the limber boom 7, insert the pins 68 (Fig 104), screw on the nuts 67 with wrench A52830-6, and lock.

5. Replace the air hose 8 and electric wire with socket.

CHAPTER 11

SPARE PARTS, TOOLS, AND ACCESSORIES

56. General Information

The spare parts, tools, and accessories, called ZIP for short, are provided in order to keep the gun in combat readiness.

All ZIP items are found in one of the following:

combat kit;
special tool kit;
repair kit.

The combat kit is divided into a gun kit and a battery kit.

The ZIP gun kit contains spare parts, tools, and accessories which should be with a gun under all service conditions.

The ZIP battery kit contains spare parts, tools, and accessories necessary for preparing a gun for firing, for gun maintenance, and for making small, emergency repairs that can be handled by battery personnel and facilities.

The special tool kit is required for the inspection, testing, and repair of guns by regimental personnel and facilities; is issued at the same time as the guns; and is attached to the artillery workshop of the military unit.

All ZIP kits are issued to troops at the same time as materiel. Replenishment of them as they are used up is the responsibility of the chief of artillery ordinance; they are replenished from the district (krug) supply in accordance with regulations. A general purpose tool kit is issued to the battery artillery mechanic; when none is provided in the TO, the gun is serviced with the general purpose tool kit of the artillery workshop of the military unit.

Spare parts, tool, and accessory kits are stored and shipped in special packing boxes. That portion of the equipment which is required at all times for firing and maintenance is installed directly on the gun.

The presence, working order, and proper custody of spare parts, tools, and accessories must be given the same attention as that given the condition of the gun.

Only special tools and accessories may be used in all work on the disassembly, assembly, adjustment, repair, and maintenance of the gun. Instructions for the use of special tools and accessories are given in the corresponding sections of this Service Manual and in the illustrated ZIP list (Appendix 4), where an indication is given of the

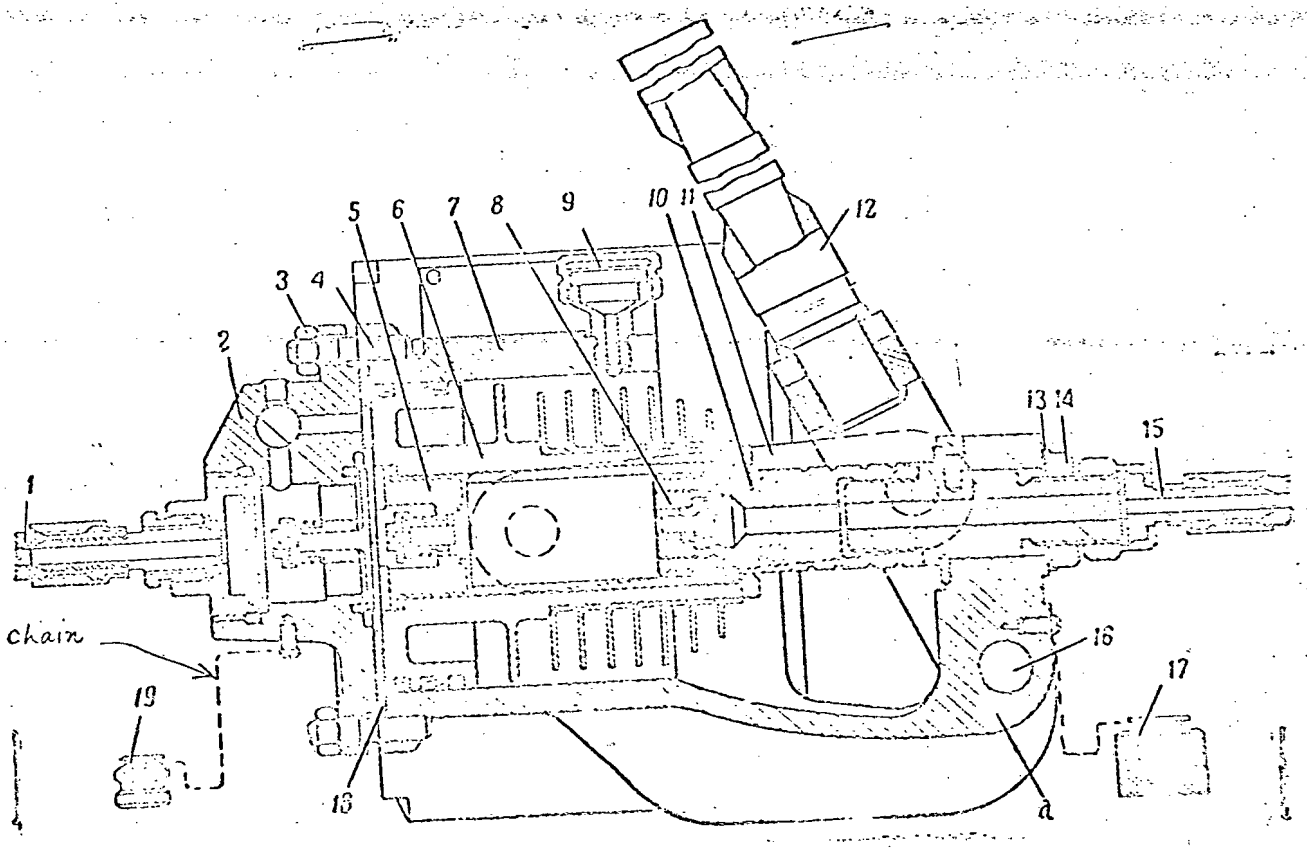


Fig. 105. Hydro-Pneumatic Pump (52-I-035) [186]

1. intake hose (Sb22)
2. housing cover Sb4)
3. nut (A51010-5)
4. stud bolt (220
5. by-pass valve (Sb6)
6. low pressure piston (Sb8)
7. pump housing (Sb5)
8. de[illegible]very vavle (Sb10)
9. grease cup (A52276-23)
10. high pressure piston (Sb11)
11. thrust rod (69)
12. yoke and handle (Sb13, Sb14)
13. lock washer (64)
14. nut (65)
15. connecting hose (Sb21)
16. pin (67)
17. cap (66)
18. packing ring (62)
19. plug (61)

a. support

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

If a part has no special tool, a general purpose tool must be used.

Below is given a description of the hydro-pneumatic pump 52-I-035 and the hand extractor.

57. The Hydro-Pneumatic Pump (52-I-035) and Hand Extractor

The hydro-pneumatic pump 52-I-035 is used to pump air and fluid (steol-M) into the counterrecoil mechanism of the gun, to pump air into the bottle of the equilibrator, and to produce artificial recoil.

Design of the Hydro-Pneumatic Pump

The hydro-pneumatic pump (Fig. 105) consists of the following basic parts: housing 7 with cover 2, low pressure piston 6, high pressure piston 10, yoke with handle 12, hose connection 15, and intake hose 1.

The housing 7 is cast steel. It joins all the parts of the pump. The inside of the housing is machined to the diameter of piston 6 and serves as the low pressure cylinder. The housing has a support a, to which the high pressure piston 10 and the fork with handle 12 are attached.

Cover 2 serves as the bottom of the low pressure cylinder and is attached to the housing by four stud bolts 4 with nuts 3 which are screwed into the head of the pump housing.

A leather packing ring is inserted between the cover and the housing. The housing cover holds the delivery valve, filter, and cock 20 (Fig. 106).

The delivery valve consists of washer 22, which is soldered inside the cover; the valve 21; spring 23; and nut 28, which is locked with cotter pin 26.

Cover 27 is screwed into the center of the threaded housing. In order to provide an airtight seal at the cover, a packing ring 24 is inserted between the steps of the grooved indentation in the housing cover and the face of cover 27. A filter 25 with gauze is installed between cover 27 and packing ring 24. Cover 27 has a threaded receptacle b, into which a clamp nut 72 for holding intake hose 1 is screwed when liquid is being pumped (Fig. 105). When the pump is stored, plug 19, which is attached by a small chain to the housing cover nut, is screwed into the receptacle.

In the boss of the upper part of the housing cover there is a conical opening g (Fig. 106), into which cock 20 fits, and an elbow v for the passage of fluid.

The cock is used to transfer pump operation from air to fluid, or vice versa. The position of the handle of the cock during the pumping of fluid or air is shown by indicators marked "Fluid" or "Air." The cock, when in place in opening g, is held down by spring 31 and locked by nut 30 and its cotter pin 29. When the cock is positioned for pumping fluid or air, its extreme positions are limited by a screw 33 put into the stopper of the cock. [187]

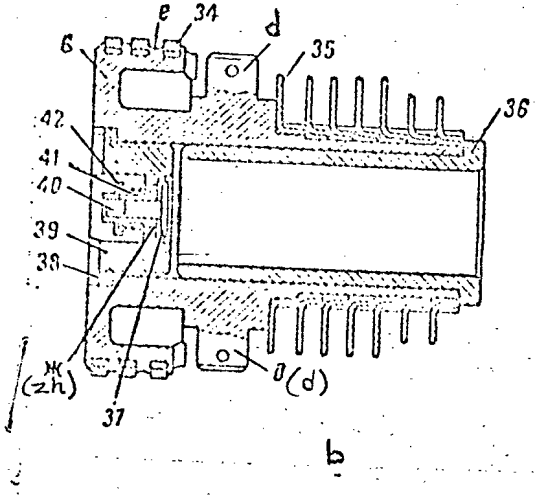
Low pressure piston 6 provides the intial compression of the air. The piston has trunnions b for connection with the thrust rod 11 (Fig. 105), which connects the piston with the yoke 12. The head of piston 6 (Fig. 106) has 4 annular grooves, three of which are occupied by piston rings 34.

The fourth groove e is used to hold lubricant. Seven aluminum bands (fins) 35 are attached to the piston head for the purpose of dissipating the head generated during the operation of the pump. Steel bushing 36 is pressed into the interior cavity of the piston and serves as the high pressure cylinder.

Valve seat 39, together with paronite washer 38, is screwed into the center of the piston. In the bridge of valve seat 39 there is an opening into which the stem of valve 37 fits. Spring 41, which slips over the stem of the valve and is held by nut 42 and cotter pin 40, holds the valve against the seat and overlaps six by-pass openings zh.

Piston 10 (high pressure) screws onto adapter 45, which fits into the opening in the support a for the pump housing (Fig. 105) and is held there by nut 40 with its cotter pin 13. Nut 52 (Fig. 106) of the hose connection 15 is screwed onto the outside of the adapter when air or fluid is being pumped. Cap 17 (Fig. 105) is screwed onto the adapter when the pump is stored. The adapter is kept from turning by pin (Fig. 106), the end of which fits into an indentation in the pump housing. Fiber washer 43 is slipped onto the adapter in order to damp the vibrations produced by the low pressure piston during operation. The outer surface of the piston has eleven grooves, five of which contain piston rings 51; the remaining six are used to retain lubricant.

Inside the cylinder there is a continuous duct i through which air or fluid passes from the high pressure cylinder into the connecting hose. Seat 47 of the delivery valve is screwed into the center of the piston. In the seat there are six ducts k for the passage of air or



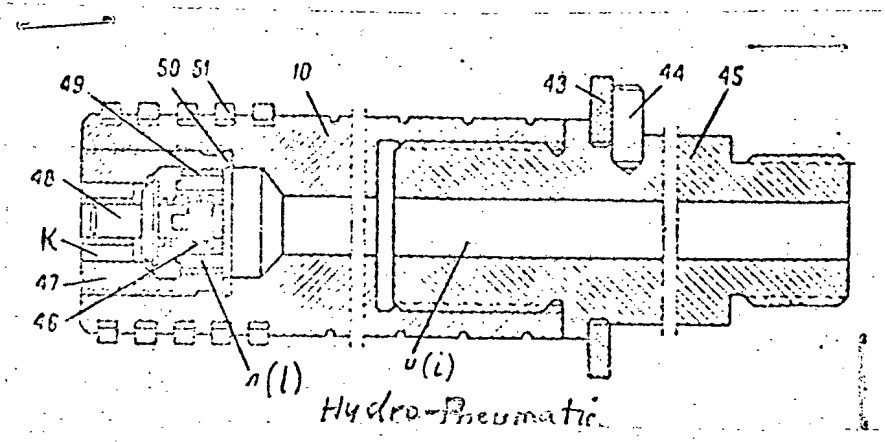


Fig. 106. Parts of Pump (52-I-035)

[188]

2. housing cover (Sb4)
6. low pressure piston (26)
10. high pressure piston (32)
15. connecting hose (Sb21)
20. cock (Sb3)
21. delivery valve (8)
22. washer (2)
23. spring (9)
24. packing ring (77)
25. filter (Sb2)
26. cotter pin (A51040-71)
27. cover (12)
28. valve nut (10)
29. cotter pin (A51010-15)
30. nut (A51011-3)
31. spring (16)
32. washer (15)
33. screw (A51062-5)
34. piston ring (31)
35. alum bands (fins) (28,29,30)
36. bushing (25)
37. by-pass valve (24)
38. paronite washer (27)
39. valve seat (23)
40. pin (A51010-71)
41. spring (9)
42. valve nut (10)
43. fiber washer (38)
44. pin (39)
45. adapter (33)
46. spring (36)
47. valve seat (34)
48. pressure valve (35)
49. barrel (37)
50. leather gasket (41)
51. piston ring (40)
52. special nut (75)
53. gasket (76)
54. adapter (80)
55. nipple (82)
56. sleeve (78)
58. connecting pipe (81)
59. ball (A51650-42)
60. spring (54)
61. stop (55)
62. gasket (56)
63. nipple (48)
64. special nut (51)
65. transfer nipple
66. handle base (45)
67. handle (46)
68. handle head (47)
69. fork (43)
70. trunnion (42)
71. nipple (55)
72. clamp nut (58)
73. sleeve (84)
74. hose (83)
75. connectiong (Sb20)

b. threaded bushing
v. elbow
g. conical opening
d. trunnion
ye. groove
zh. by-pass duct
i. duct
k. duct
l. hole

50X1-HUM

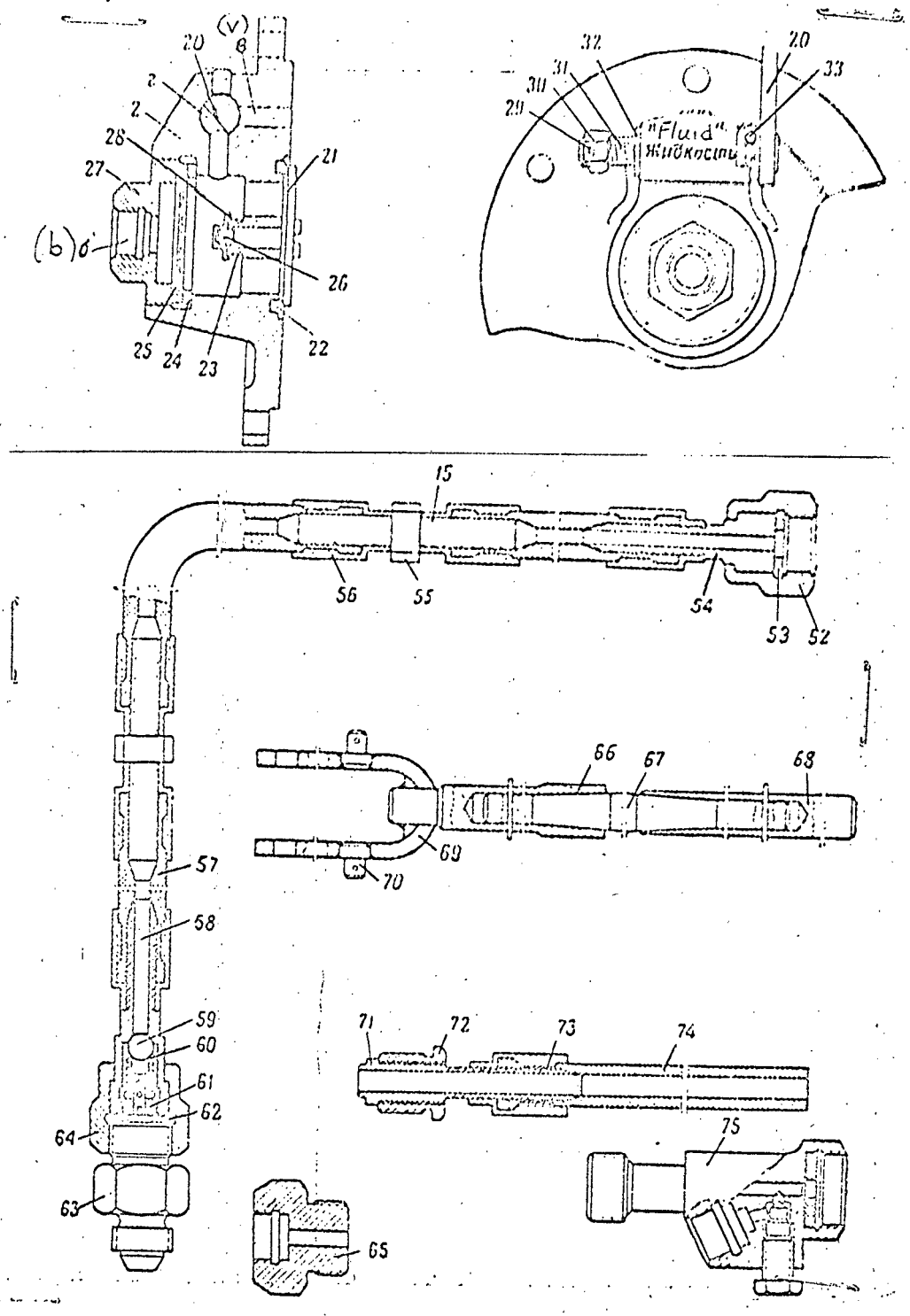


Fig. 106. Parts of the Hydro-Pneumatic Pump (52-I-035) [199]

fluid and one duct for the shaft of valve 48. The beveled part of the valve rests against the machined part of the seat and overlaps the continuous duct k. The valve is held against the seat by spring 46, one end of which rests on the valve nipple; the other end fits into the recess of barrel 49, which is screwed into the seat. The barrel has seven openings l for the passage of air or fluid.

The yoke 12, with handle and thrust rods 11 (Fig. 105), is used to impart a back-and-forth motion to low pressure piston 6. Yoke 12 is attached to the support a of the pump housing by means of pin 16; cotter pins keep pin 16 from falling out. Thrust rods 11 (Fig. 105) fit on the yoke trunnions 70 (Fig. 106) and low pressure piston trunnions d and are held there by cotter pins. The handle base 66 (Fig. 106) is welded to the yoke; the handle 67, together with the handle head 68, fits into the tapered opening in the handle base 66. The handle base, handle, and handle head are secured with cotter pins before the pump is operated.

Hose 15 (Fig. 105) is designed to connect the pump to either the counterrecoil mechanisms or the bottle of the equilibrator and is made up of three rubber hose sections 57 joined together by sleeves 56 and nipples 55. /1907

Adapter 54, with special nut 52 and gasket 53, is attached to one end of the hose by sleeve 56. Nut 52 engages the adapter 45 of the high pressure piston at one end of the connecting hose; at the other end, sleeve 56 joins connecting pipe 58 with special nut 64, gasket 62, and nipple 63.

A valve device consisting of a ball 59, spring 60, and stop 61 is screwed into the inside of connecting pipe 58. For the connecting pipe to be joined to a T-piece, nipple 63 must be removed and special nut 64 screwed onto the connecting pipe, which is then screwed into the T-piece. It is possible to use copper tubing in place of the rubber hose. The assembly of such tubing would be similar to that of the rubber hose.

Intake hose 1 (Fig. 105) is connected to a reservoir from which the fluid is drawn. At one end of the hose, sleeve 73 (Fig. 106) connects nipple 71 to a clamp nut 72 which slips over it. The clamp nut 72 connects the intake hose to the cover of the pump housing. Copper tubing in place of the rubber hose is possible, and such an assembly is the same as for the rubber hose.

The pump kit includes connection 75, which provides artificial recoil.

The hydro-pneumatic pump contains a set of spare parts, tools, and accessories which is stored in special receptacles in the p

packing box.

Operation of the Pump

Preparing the Pump for Operation

The following steps are necessary to prepare the pump for operation:

1. Remove the pump for the packing box and attach it to the right trail.

2. Insert handle 67, together with handle head 68, into the handle base 66 (Fig. 106) and secure with cotter pins.

3. Unscrew cap 17 (Fig. 105) from adapter 45; and plug 19, from housing cover 2.

4. Check the condition of the filter and, if necessary, clean the gauze.

5. Connect the hose 15 to the pump by screwing hose nut 52 (Fig. 106) onto adapter 45.

6. Unscrew nipple 63 from nut 64 and attach the connecting hose to a T-piece.

Tighten gaskets 53 and 62 securely with nuts 52 and 64 to prevent the escape of air at the joints.

It is recommended that five to ten grams of steol-M be added at nut 64 before the hose is connected to the T-piece, in order to lubricate ball 59 and thereby facilitate the operation of the pump.

7. To pump air, set cock 20 at "Air."

8. Check the hermetic state of the connecting hose with a pressure of 40-50 atmospheres by operating the pump without unscrewing the valve of the counterrecoil mechanism. If there is no escape of air at the /191/ connections, unscrew the valve and pump air. If air escapes through the connections, tighten nuts 52 and 64.

9. In order to pump fluid, attach the intake hose 1 to housing cover 2 (Fig. 105) by screwing clamp nut 72 (Fig. 106) into the threaded receptacle of cover 27. The free end of the hose is immersed in a reservoir containing a measured amount of fluid which must be transferred to the counterrecoil mechanism. The cock on the pump is set is at "Fluid."

Before being operated, a pump that has been exposed to f[illegible] 50X1-HUM temperatures must be heated up in order to give the lubricant normal viscosity. This can be done by letting the pump idle a short time on no load, with the cock set at "Air." If extremely low temperatures prevail, the pump must be heated in the room or compartment; if this is not possible, the heat can be produced by flare or torch.

If a pump has been lubricated with gummy lubricant, the latter must be removed by pumping through about one or two liters of gasoline or by rubbing the pistons and cylinder with a clean rag soaked in gasoline; the latter case requires partial stripping of the pump.

Operation as an Air Pump

The pump is operated by two persons moving the handle from the extreme position to the extreme rear position, 20-30 cycles per minute being required to pump air.

When the handle is pumped, the high pressure piston does not move, whereas the low pressure piston, which is connected to the handle yoke by thrust rods, moves back and forth. When the handle is moved, the piston moves out of the housing cover (intake stroke), producing a vacuum inside the low pressure cylinder. Under the effect of atmospheric pressure, the intake valve 21 (Fig. 106) opens, and the low pressure cylinder is filled with air.

At the end of the piston stroke, the flow of air stops, and the intake valve is closed by spring 23. When the piston moves in the opposite direction (compression stroke), the air in the low pressure cylinder is compressed; the compressed air opens up the by-pass valve 37 and enters the high pressure cylinder, where it is further compressed by the remaining piston travel. At this moment, the by-pass valve 37 is closed by the action of the spring and the pressure difference in the cylinders, and the pressure valve 48 opens, allowing the air to flow out of the high pressure cylinder through the continuous duct into the connecting hose, where it forces out the ball 59 and enters the counterrecoil mechanism.

The return of compressed air from the counterrecoil mechanism to the pump is prevented by the ball in the connecting hose.

With subsequent strokes of the low pressure piston, this pumping operation is repeated, and the pressure of the compressed air in the counterrecoil mechanism increases.

50X1-HUM

Operation as a Fluid Pump

Pumping fluid requires 10-15 complete back-and-forth motions of the handle per minute.

When the low pressure piston moves in the direction of the connecting hose, fluid is drawn by atmospheric pressure out of the reservoir and through the intake hose 1 (Fig. 105), forces open the delivery valve, and enters the low pressure cylinder. At the same time, part of the fluid enters the cylinder through the open cock and the elbow in the pump housing cover. [1927]

At the end of the stroke of piston 6 the intake stops and delivery valve 21 (Fig. 106) closes. During the return stroke of the piston the fluid opens by-pass valve 37 and enters the high pressure cylinder.

Excess fluid that does not get into the high pressure cylinder is returned to the reservoir through the elbow in the housing cover. The by-pass valve closes during the return stroke of the piston.

During the following stroke of the low pressure piston, i.e., during the next intake of fluid into the low pressure cylinder, the high pressure piston forces fluid out of the high pressure cylinder, through the pressure valve 48 and into the connecting hose, whence, after forcing the ball valve open, it flows into the counterrecoil cylinder. The fluid cannot flow back out of the counterrecoil cylinder, because it is blocked by the ball 59 in the connecting hose.

This operation is repeated during subsequent pumping cycles.

When fluid stops coming out of the connecting hose, the pump cock must be switched over to "Air" and the pump operated as an air pump until all the fluid remaining in the pump and hose is forced out into the counterrecoil system.

Disassembly, Assembly, Preservation, and Maintenance

Disassembly

The pump is disassembled for technical inspection, lubrication, and repair.

Inspection and lubrication of the bearing surfaces of the pistons and cylinders involve a partial disassembly, which is given below (See 1-4). The steps to be taken in reassembling following partial disassembly are given in 14-17 below (See "Assembling the Pump").

The pump is disassembled as follows:

1. Remove the cotter pins holding the thrust rod 11 (Fig. 105) on the trunnions d (Fig. 106) of the low pressure piston and the yoke trunnions 70.

2. Remove thrust rods 11 (Fig. 105) from the trunnions.

3. Unscrew the six nuts 3 from stud bolts 4 attached to the pump housing cover 2, and remove the cover, together with the leather packing washer.

4. Push the low pressure piston forward the remove it from the pump housing.

The above steps comprise the partial disassembly. Further steps in disassembling the pump are as follows:

5. Unscrew the grease cup 9.

6. Unscrew the small cover 27 (Fig. 106) from the larger pump housing cover 2; remove filter 25 and packing ring 24.

7. Remove the cotter pins and unscrew the nut 28 on the delivery valve; remove spring 23 and delivery valve 21.

8. Remove the cotter pins and unscrew the nut 30 on the cock; remove spring 31, washer 32, and cock 20.

9. Using special wrench Sb34 (from the pump ZIP kit), remove the seat 39 of the by-pass valve.

10. Remove the cotter pins and unscrew nut 42 of the by-pass valve; /1937
remove spring 41 and by-pass valve 37.

11. Remove from low pressure piston 6 three cast iron piston rings 34. In removing the piston rings, be careful not to break them (piston rings should be removed only for replacement).

12. Remove the cotter pins and the pin 16 from support a connecting yoke 12 with the pump housing (Fig. 105); then remove yoke 12.

13. Bend back the edge of lock washer 13 and remove nut 14 from the adapter of high pressure piston 10.

14. Remove the adapter, together with high pressure piston 10, from the input opening of the pump housing.

15. Remove the pressure valve seat 47 (Fig. 106) and the leather gasket 50 from the high pressure cylinder.

16. Remove the barrel 49, spring 46, and pressure valve 48 from the pressure valve seat 47.

17. Remove the five cast iron piston rings 51 from the high pressure piston 10 (piston rings should be removed only for replacement).

18. Disassembly the connecting hose valve as follows:

— remove nipple 63 and leather washer 62 from nut 64;
— use a screw driver to remove valve stop 61; then remove spring 60 and ball 59.

Assembling the Pump

Before assembling the pump, clean and lubricate all the parts with a thin layer of gun grease except the bearing surfaces of the cylinders and pistons; these are lubricated with the graphite in the special tin can in the pump ZIP kit before being put into place.

Assemble the pump as follows:

1. Assembly the connecting hose valve by inserting ball 59 and spring 60 into connecting pipe 58 (Fig. 106) and screwing in stop 61; then screw nipple 63, with the leather washer under it, into nut 64.

2. Slip the five cast iron piston rings 51 over the end of high pressure piston 10, so that the locks (joints) will be at different positions.

3. Insert the pressure valve 48 and spring 46 into the valve seat 47, and screw in barrel 49.

4. Insert gasket 50 into the high pressure piston, and screw in the valve seat and valve.

5. Insert high pressure piston 10 with the adapter 45 into the bracket opening of the pump housing and secure with nut 14 and lock washer 13 (Fig. 105).

6. Insert cock 20 into the intake opening of pump housing cover 2 (Fig. 106) and secure it with nut 30, washer 32, and spring 31; then lock the nut with a cotter pin.

7. Insert delivery valve 21 into the opening of the pump housing cover 2; slip spring 23 onto the extension of the valve seat, and screw nut 28 onto the end of the valve and lock it with a cotter pin.

8. Place gauze and filter 25 (gauze outside) in cover 27 and screw the latter into the pump housing cover 2.

9. Insert by-pass valve 37 into its seat 39; slip spring 41 over the extension of the valve seat, and screw nut 42 onto the end of the valve and lock it with a cotter pin. /194/

10. Screw seat 39, together with the valve, into low pressure piston 6 after placing the paronite washer 38 under the flange of the seat.

11. Slip the three cast iron piston rings over the end of low pressure piston 6, so that the locks (joints) are at different positions from each other.

12. Join the yoke 12 to the support a of the pump housing with pin 16 (Fig. 105) and put cotter pins in the ends of the latter.

13. Screw the grease cup 9 into the pump housing.

14. Lubricate the bearing surfaces of the pistons and cylinders with graphite.

15. Insert low-pressure piston 6 into the pump housing 7. In order to avoid damage to the piston rings, insert the low and high pressure pistons into their respective cylinders by means of the special funnels provided in the pump ZIP kit. To insert the high pressure piston into its cylinder, position the funnel so that the guide on the outside of the piston will enter the groove at the cover of the pump housing, and push the piston — along with its piston rings, already mounted — into the cylinder.

In order to put the high-pressure piston into its cylinder, it is necessary to lay the funnel on the end of bushing 36 (Fig. 106), aligning the inside diameter of the funnel with the inside diameter of the bushing, and push forward the low pressure piston, so that the high pressure piston, with the rings already mounted on it, passes through the funnel and enters the cylinder.

After the high pressure piston has moved into the cylinder, remove the funnel from the piston by releasing the hinge bolt on the funnel and throwing back its clamping ring.

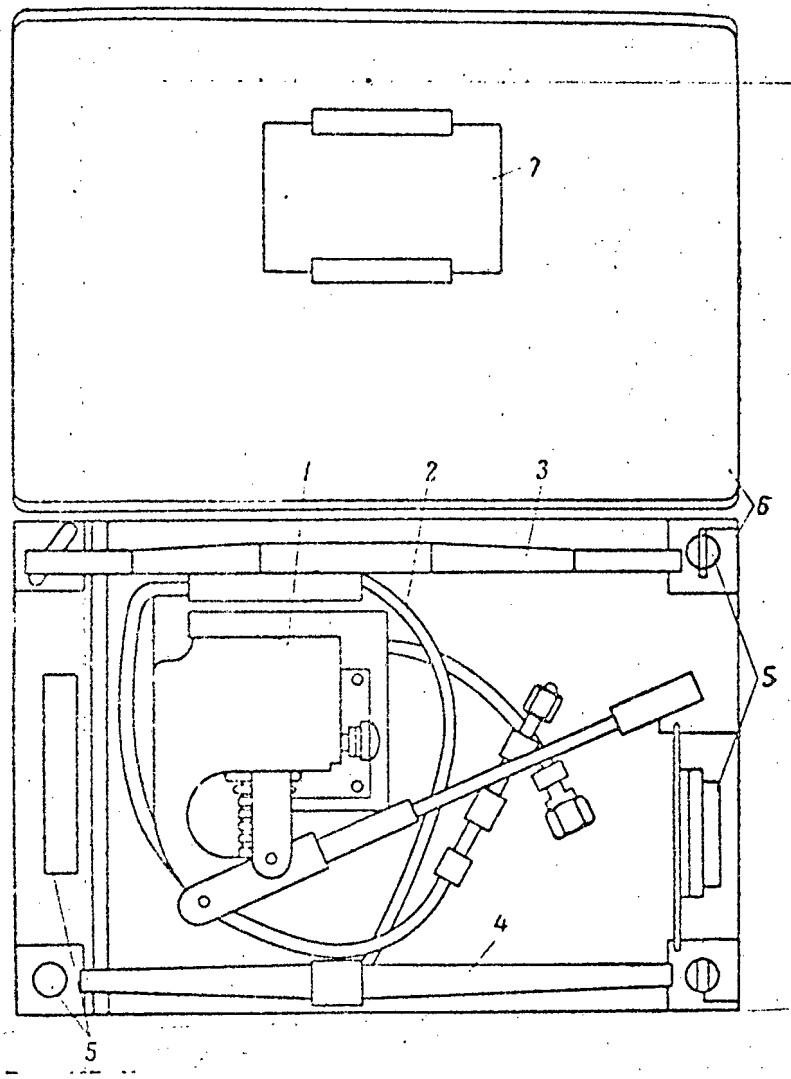


Fig 107. Stowing the Hydro-pneumatic Pump (52-I-035) [1957]

1. pump (52-I-035)
2. hose (Sb 21)
3. handle head (47)
4. handle (46)
5. receptacle for stowing ZIP kit
6. box
7. storage record

16. Insert the packing ring into the recess of pump housing 7 (Fig. 105), and after positioning cover 2, secure the latter with nuts 3 and stud bolts 4 (when positioning the leather washer, be sure that the openings for the cock are aligned).

17. Slip thrust rods 11 (Fig. 105) onto the low-pressure piston trunnions d (Fig. 106) and yoke trunnions 70 and lock them with cotter pins.

When the pump has been assembled, test its operation by pumping air.

Preservation and Maintenance

The hydro-pneumatic pump, together with its ZIP kit, is stored and transported in a special packing box (Fig. 107).

A pump that is in constant use is completely disassembled and reassembled twice a year (during the spring and fall technical inspections of equipment).

When disassembling the pump, clean and lubricate all parts with gun grease except the surfaces of the pistons and cylinders, which are lubricated with a special graphite found in the pump ZIP kit.

To avoid its contamination, store the graphite lubricant in a tightly closed vessel. Besides the disassembling for fall and spring inspections, periodic partial disassembling and lubrication of the bearing surfaces of the pistons and cylinders are also necessary.

When the pump is in operation, the low-pressure piston and cylinder are lubricated by means of the grease cup 9 (Fig. 105) as follows: line up the groove e (Fig. 106) on low pressure piston 6 with the grease cup opening — by putting the piston in the extreme back position — and screw in the grease cup cap one or two turns. /1957

To lubricate the high pressure cylinder and piston, apply the lubricant directly to the protruding surface of the piston; at this time the low pressure piston should be in the extreme forward position; i.e., inside the cover.

Before a pump is surrendered for extended storage, it must be disassembled; all parts, including the surfaces of the pistons and cylinders, must be rid of dirt and old grease, then coated with a thick layer of gun grease; the pump is then reassembled and turned over to storage.

When a pump is kept in storage for a very long period of time, it must be disassembled for inspection not less than once a year.

Before a pump that has been in storage for an extended period can be put back into use, it must be disassembled, the thick coating of gun grease removed, and a thin layer of gun grease (and graphite lubricant in the case of the pistons and cylinders) applied. The pump is then reassembled.

Possible Pump Malfunctions and Methods of Correcting Them

/1967

Malfunction As Air Pump	Reason	Remedy
1. Pump does not produce the pressure given on the rating plate.	1. Cock set on "Fluid." 2. No lubricant on the surfaces of pistons and cylinders.	1. Set cock on "Air." 2. Line up groove e (Fig. 106) with grease cup hole 9 (Fig. 105) and, by turning grease-cup cap one or two turns, lubricant low pressure piston. Place piston 6 in extreme position toward cover 2 and lubricate protruding surface of high pressure piston 10.
	3. Incorrectly posi-positioned or worn piston rings.	3. Partial disassembly of pump and setting of piston ring locks at different positions; if rings are worn, replace with new rings from the ZIP kit.
	4. Valves not seated tightly because of dirt or damage.	4. Disassemble pump and clean and reseat valves on valve seat; then coat with thin layer of gun grease and reassemble pump. If malfunction not corrected, replace valves with new ones

2. Air leak between cover and housing.	Loose nuts on stud bolts holding down housing cover, defective leather washer.	Tighten uniformly; if leak is not stopped, replace leather washer.
3. Leak of air through cock.	Loose cock nut, weak spring, or dirty cock.	Tighten cock nut or replace spring; if leak not stopped, remove cock, clean and grind it, and coat with thin layer of gun grease and reassembly.
4. Air leak through connecting hose.	Special nut loose or gasket damaged.	Tighten special nut; if leak does not stop, replace the gasket.

Malfunction As Fluid Pump	Reason	Remedy
1. After the first stroke, the low pressure piston stops in the extreme position.	Pump cock set on "Air" instead of "Fluid."	Set the pump cock on "Fluid."
2. Leak of fluid out of the cylinders.	Incorrectly positioned or worn piston rings.	Partially disassemble the pump and set the piston rings with their locks (joints) in different positions; if piston rings are worn, replace them with new ones from the ZIP kit.
3. Leak of fluid through connecting hose.	Special nuts are loose, or gaskets are damaged.	Tighten special nuts; if leak does not stop, replace the gaskets.

After using the pump to pump fluid, carefully empty it of all residual fluid by pumping a while with the cock set at "Air." /1977/

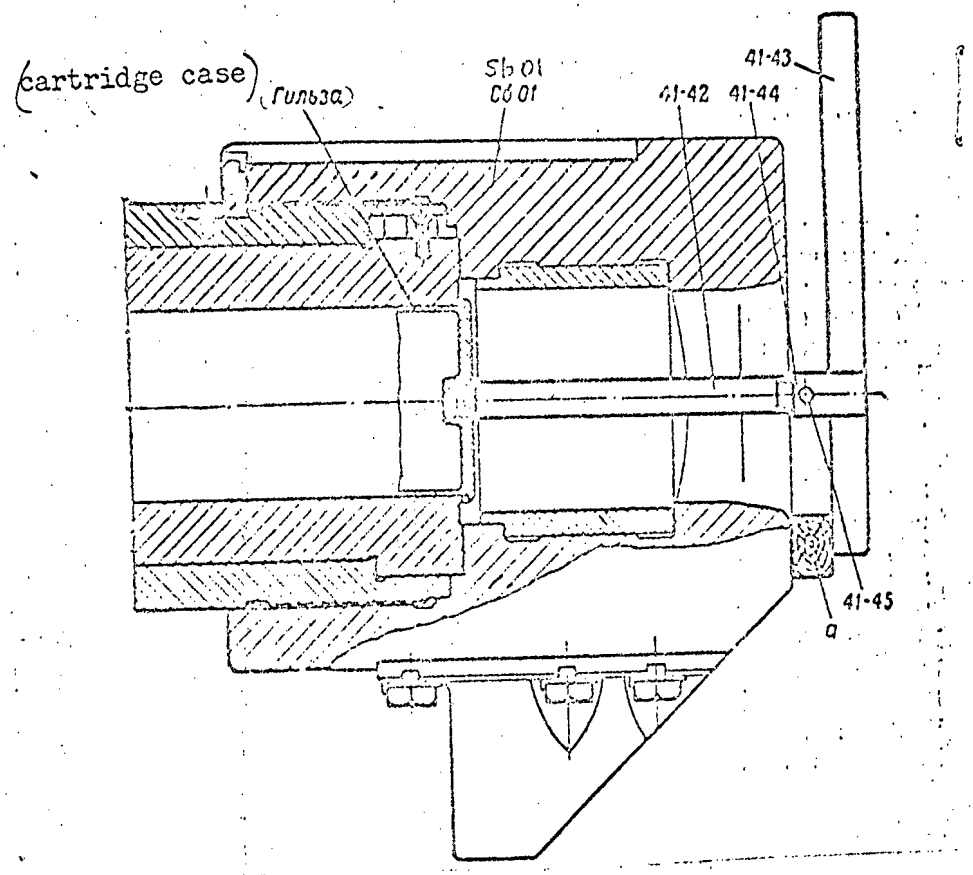


Fig. 108. Arrangement for Removing a Cartridge Case With the Hand Extractor (Sb41-42) [197]

Sb 01. breech
41-42. screw
41-43. handle
41-44. eye
41-45. pin
a wooden block

The Hand Extractor

The hand extractor (Fig. 108) is used to remove a cartridge case from the chamber when it is not expelled by the ordinary method (opening the breech) because of swelling or some other reason.

The hand extractor consists of a bolt 41-42 and handle 41-43. One end of bolt 14-42 is threaded so that it can be screwed into the primer cup hole in the cartridge case; the other end has a hole for attaching on eye 41-44 by means of a pin 41-45. Handle 41-43 of the extractor fits loosely into the eye 41-44, and the cartridge case is extracted from the chamber as follows:

1. Open the breech; if the breach cannot be opened in the usual way, place a block of wood in the loading tray of the breech block and, by hitting it with a hammer and pulling on the breech handle at the same time, open the breech.

2. With wrench A52840-39 (in the box on the limber) remove the primer cup from the cartridge case and replace it with bolt 41-42.

3. Insert handle 41-43 into the eye of the bolt and place wooden block a between the handle and the breech ring (as shown in Fig. 108); by using the handle as a lever, pull the cartridge case out of the chamber.

CHAPTER 12 DISASSEMBLY AND ASSEMBLY OF THE GUN BY LARGE UNITS

50X1-HUM

58. Disassembly of the Gun by Large Units

Prior to disassembly of the gun in large units, it is necessary to put it into firing position (if it is in travel position) and to remove the guards (spades must be detached from the trails).

Complete disassembly of the gun by large units is carried out in the following sequence:

1. Remove the sights.
2. Remove the suspension disengagement pins and the double-arm lever
3. Remove the summer spades and accessories from the trails.
4. Remove the barrel with the breech and recuperator.
5. Disconnect the barrel from the recuperator
6. Remove the shield.
7. Remove the equilibrator
8. Remove the cradle and recoil brake.
9. Remove top carriage with elevating and training mechanisms.
10. Remove the wheels.
11. Remove the wheel brake.
12. Remove the winch.
13. Remove the jacks.
14. Disconnect the trails from the lower carriage.

Removal of the Sights

Removal of the mechanical sight S71-35 (s71-96) is carried out as indicated in Paragraph 48 ("Disassembly and Assembly of the Sight"); and that of the optical sight OP-4-35 (OP-4-96) if it is present, as indicated in Par. 52 ("Mounting and Removal of the Sight").

Removal of the Suspension Disengagement Pins

Removal of the suspension disengagement pins (Fig. 58) is carried out with trails brought together, as follows:

— pull out the cotter pins and, by hammering on a copper rod, force out the shafts 22;

— remove the guards 19 from the firing-position levers 16 and 30, and pull out the suspension disengagement pins 15;

— unscrew the nut 18 with wrench A72931-12 and remove it and thrust rod 20; the ball support of the rod should be removed only in case of necessity.

Removal of the Double-Arm Lever [p 199]

To remove the double-arm lever 32 (Fig. 22), elevate the cradle slightly, remove the lock screw 96 of the double-arm lever pin 95, unscrew the pin and take out the roller of the double-arm lever from the slideway.

50X1-HUM

Removal of the Summer Spades and Accessories from the Trails

1. Turn the spade lock handle to position "Open"; pull out the side lock and turn it to the right; take off the summer spades from the trails.

2. Remove the accessories and entrenching tools.

Removal of the Barrel

The barrel is removed with the aid of a crane or a 3 to 5 ton pulley block.

To remove the barrel with the aid of a crane, proceed as follows:

1. Bring barrel in to horizontal position.
2. Remove the recoil indicator cursor from the cradle in the following manner:

— pull out the cotter pin, unscrew the nut with wrench A52830-2, and remove the screw which holds the recoil indicator;
— remove the recoil indicator.

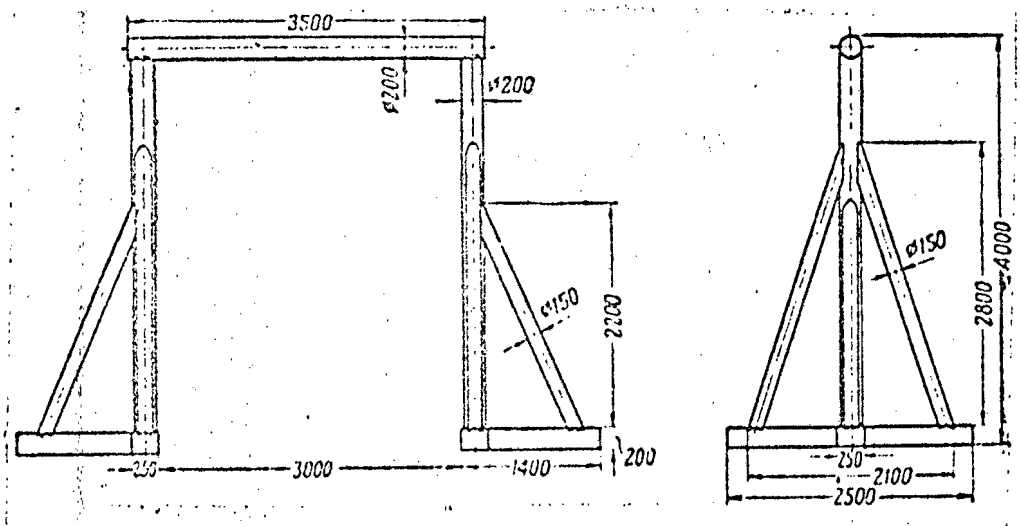


Fig. 109. Trestles for Lifting the Barrel

3. Disconnect the barrel from the recoil brake rod by inserting wrench Sb42-39, with its large jaw up, into the recess for the sliding nut and turning it 1/4 of a turn counterclockwise by pushing the wrench forward.

4. Disconnect the counterrecoil mechanism from the cradle in the following manner:

— shift lever 19 with handle (Fig. 22) from the "Firing" [illegible] into "Travel" position (if shifting is difficult, push the barrel forward with the aid of the winch).

5. Secure a hemp rope or cable near the rear of the front support.

50X1-HUM

Lift the barrel from the cradle and place it on the trestles so that the recoil indicator cursor does not touch the trestles.

Removal of the barrel with the aid of a pulley block requires the following equipment: [p 200]

— a 3-to-5 ton pulley block,
— wooden trestles for the support of the pulley block (Fig. 109),
— a minila rope or chain for attaching the pulley block to the trestles,
— a ring-spliced manila rope or steel-wire cable for lifting the barrel from the carriage.

With this equipment the barrel may be removed under field conditions or at any regular shop where cranes are not available.

When the barrel is removed inside a building, the pulley block can be attached to the ceiling if it sufficiently strong, or it can be attached to a special beam.

When the barrel is removed from the carriage outside of a building, it is necessary to set up a horizontal platform for wooden trestles made at the site. Prior to uncoupling the carriage from the limber, carry out the following operation (Figs. 110 and 111):

1. Recoil the barrel with the aid of a winch; connect the barrel to the recoil brake, and the counterrecoil mechanism to the cradle.

2. Depress the barrel 2-3°, so that the breech will pass freely over the mounting supports for the spades when the barrel is lifted from the cradle.

3. Roll the gun under the trestles so that the pulley hook is over the barrel and somewhat behind the front support.

4. Clean and lubricate the cradle guides.

5. Remove the recoil indicator cursor from the cradle; disconnect the barrel from the recoil brake, and the counterrecoil mechanism from the cradle.

6. Pass a spliced-loop manila rope not over 35 mm in diameter or a steel-wire spliced-loop cable around the barrel, just behind the front support (so that it will pass freely between the barrel and the trunnion collar of the cradle when the barrel is lifted).

7. With the aid of a pulley block, lift the barrel so that six to eight men with sharp jerks could pull the carriage and disengage the barrel supports from the cradle guides; it is permissible to use crowbars to push the barrel from the cradle guides.

50X1-HUM

While removing the barrel, keep the barrel supports parallel to the cradle guides, this is accomplished by keeping the suspended b 50X1-HUM parallel to the cradle guides.

8. After the passage of the muzzle brake through the cradle stirrup, pull the carriage away and set the barrel on wooden blocks.

Removal of the Recuperator Mechanism from the Barrel

1. Remove the jacket 46 from the recuperator mechanism (Fig. 43) in the following manner:

— pull out the cotter pins, unscrew two nuts 22 with wrench A52830-5, and remove bolts 24;
— bend back the lock washers 38 and unscrew two bolts 39 with wrench A52830-5;
— remove the jacket 46 from the recuperator;

2. Remove the recuperator assembly in the following manner:

— pull out the cotter pins and with wrench A52830-6 unscrew nuts 21 from the stubs (Fig. 4) holding the covers 2 and 4 of the front and rear supports of the barrel; then remove the covers with the aid of a screwdriver and hammer;
— remove the recuperator mechanism from the barrel. [p 201]

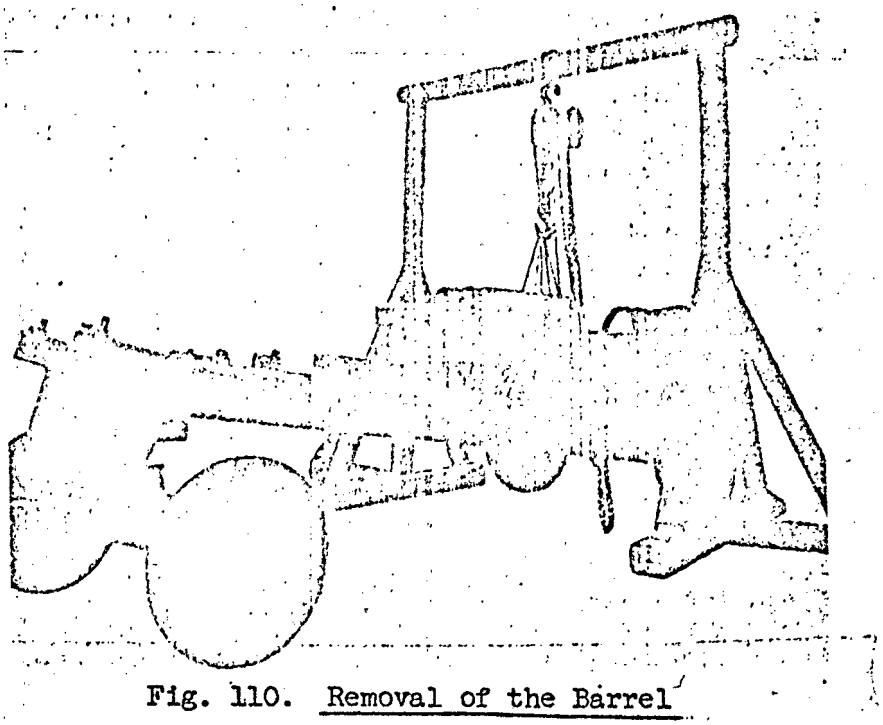


Fig. 110. Removal of the Barrel

50X1-HUM

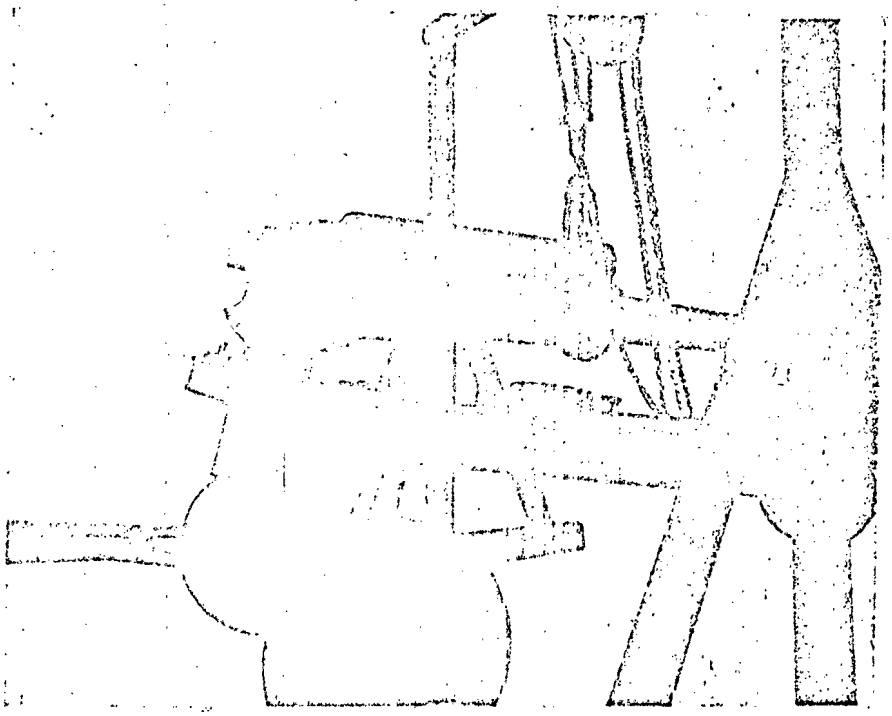


Fig 111. Removal of the Barrel

Removing the Shield (Guard)

Paragraph 22 describes the removal of the guard from the top carriage. /202/

Removing the Equilibrator

The equilibrator is removed from the gun for:

— its own disassembly;
— removal of other parts of the gun.

Remove the equilibrator for its own disassembly as follows:

1. Release the air from the equilibrator:

— open valve 36 (Fig 53) with wrench Sb 42-52;
— use wrench A52830-5 to open plug 10 on the distributor and release the air (Fig 52).

2. Remove the equilibrator cylinders as follows:

— remove the cotter pins and use wrench A52830-2 to remove the

equilibrator mechanism; then remove the jackets;

— with the aid of wrench A52830-5 disconnect the coupling tubes 4 and 6 (Fig. 52) from the distributor 8 and the heads of the ball supports;

— unscrew the nuts with wrench A52830-19, bend back and remove the lock washers, and knock out the shaft 52 with a rod and hammer; remove the trunnions from the cradle brackets and the saddle.

Removal without disassembly of the equilibrator mechanism for the purpose of dismantling other parts of the gun is carried out in the following manner:

1. Set up the cleats 42-4 as follows:

— depress the barrel;
— insert the cleats 42-4 into the openings of bushing 11;
— elevate the barrel so that the piston checks rest on the cleats 42-4.

2. Remove the cylinders of the equilibrator as follows:

— remove the cotter pins with wrench A52830-2 remove the screws which hold the jackets protecting the ball supports of the equilibrator; remove the jackets;
— with wrench A52830-5 disconnect the coupling tubes 4 and 6 (Fig. 52) from the distributor 8 and the heads of the ball supports;
— bend back the ends of the lock washers, unscrew the nuts and remove the lock washers with wrench A52830-19, and knock out the shaft 52 with a rod and hammer; remove the trunnions from the cradle brackets and the top carriage.

3. The tank 1 and distributor 8 (Fig. 52) should be removed only in case of necessity.

Remove the tank in the following manner:

— with the aid of wrench A52830-5 disconnect the tube 3 (Fig. 52) from the tank and the distributor;
— with wrench A52830-4 loosen the nut 46 which holds the band 2 of the tank and remove the tank from the top carriage.

4. To remove the distributor 8, bend back the lock washers and with wrench A52830-5 unscrew bolts 48, which fasten the distributor to the upper carriage; then remove the distributor.

Removal of the Cradle and Recoil Brake

1. Remove the cradle from the upper carriage in the follow: remove the cotter pins and with wrench Sb42-44 unscrew the nuts on the top carriage and remove the trunnion caps.

50X1-HUM

50X1-HUM

Place the cradle in a horizontal position, pass a rope or cable around the cradle brackets supporting the counterbalance, and insert a crowbar through the bracket eyes so as to prevent the cable from slipping; then lift the cradle from the upper carriage. [p 203] 50X1-HUM

2. To remove the gear box, bend back the lock washers (Fig. 22) and unscrew bolts 99 with wrench A52830-4.

3. Remove the recoil brake in the following manner:

— remove the front cover of the cradle by unscrewing nuts 79 (Fig. 22) and nut 107 (Fig. 23) on stubs 80.
— remove the lever 53 with cotter pin 49 (Fig. 25) from the throttle bar;
— unscrew the lock nut with wrench A52830-5 and the screw 105 (Fig. 22) with wrench A52830-4; the screw locks the recoil brake cylinder in the cradle;
— with wrench A52830-160 turn the nut 15 (Fig. 25) of the recoil brake by 90° so that the mark on the recoil brake cylinder coincides with the inscription "Open" on the cradle box;
— remove the wire, take out the screws holding the flat spring 57, and remove the spring;
— remove the recoil brake from the cradle by forcing it through the lower opening in the cradle box with the aid of a crowbar.

Removal of Top Carriage With Elevating and Training Mechanisms

1. Disconnect the lock 15 (Fig. 42) clamping the top carriage in travel position.

2. Remove the front support 13 in the following manner:

— remove, from top carriage, tube 6 (Fig. 52) which connects the cylinders of the equilibrator;
— with wrench A52830-6 unscrew the bolts 17 (Fig. 42) which fasten the front top carriage support, and remove the lock washers 18;
— with the aid of a chisel and hammer remove the front support from the control pins.

3. Remove the pivot in the following manner:

— remove the wire, take out the screws 53 (Fig. 40), and remove the check plate 42;
— with wrench 42-250 rotate the regulating bolt 20 two or three turns (Fig. 42);
— bend back the lock washers and with wrench A52830-5 unscrew the bolts 49 holding the pivot cover 8; remove the cover and gasket 48;
— with wrench A52830-5 remove the screw 27 which locks the nut 6, on the pivot and unscrew the nut with wrench Sb42-7;
— remove the pivot 7 with springs and bearings. 50X1-HUM

4. [illegible]

from the lower carriage by passing a rope or cable under the top carriage brackets 40 (Fig 40), and putting a bar through the trunnion h 50X1-HUM the trunnion caps should be clamped on the top carriage pins before this operation.

The machined surfaces of the top carriage base must be protected from scratches and other damage during the removal of the top carriage.

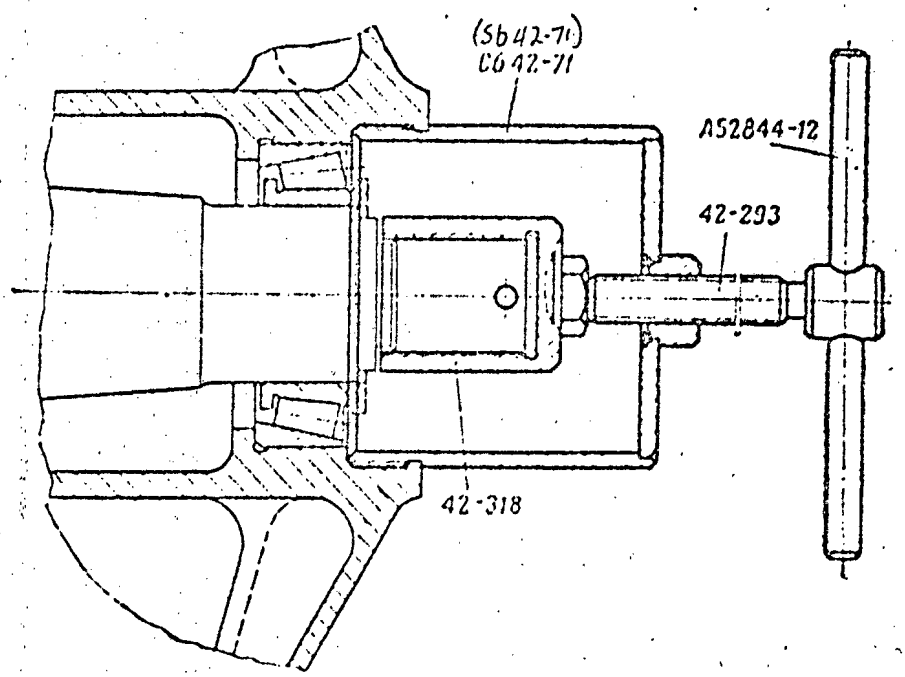
Removal of the Wheels

1. Lift the lower carriage by its hooks and set wooden blocks under it so that the wheels will clear the ground.

2. Remove the wire holding the cap 6 and unscrew the cap (Fig. 71) [p 204] with wrench A52830-24; remove the gasket rings 7.

3. Remove the wheels in the following manner;

— remove the cotter pins, with wrench Sb42-68 unscrew the nuts 13 holding the wheels, and remove the washers 12;
— screw caps 42-318 onto the rockerarm journals;
— assemble the device Sb42-70 (Fig. 112); insert the turning bar A52844-12 into the screw 42-293 of the device by turning the screw, take off the wheels.



50X1-HUM

Fig. 112. Device for Removal of the Carriage Wheels (Sb42-70):

The outer races of the roller bearings 8 and 9 (Fig. 71) should not be removed from the wheels except for replacement. A wheel may be removed from a fully assembled gun. In such a case, place the hydraulic jack from the ZIP under the appropriate rocker arm and raise it until the wheel clears the ground; then remove the wheel as explained above.

50X1-HUM

Removal of the Wheel Brake

Removal of the wheel brake is carried out as indicated in Par. 45. If complete disassembly of the wheel brake is not required, then carry out only the operations indicated in items 1, 2, 3, 4, 8, 10, and 11 of Par. 45.

Removal of the Winch

1. Bend back the lock washers 48 (Fig. 67) and unscrew four bolts 3 with wrench A53830-5.

2. Remove the winch from the trail.

Removal of the Jacks (Fig. 69) [p 205]

1. Remove the cotter pin and unscrew nut 26 with wrench A52830-7,

2. Pull back the lock 33, and remove it by raising the jack.

3. Remove the plate 50 from the trails.

Disconnecting the Trails from the Lower Carriage

1. Disconnect the airhose from the nipple 1 (Fig. 63) of the control valve.

2. Unscrew and remove the terminal block 3.

3. With the aid of wrench A52830-2 unscrew the nuts holding the ends of the electric wire leading to the lights, and disconnect the wire from the contacts.

4. Bend back the lock washers 16 and unscrew bolts 15 with wrench A52830-79; remove the lock washers.

5. Pull back the trails with the aid of a crane or a pulley block, and knock out the bolts 2.

6. Disconnect the trails from the lower carriage.

Note: If complete disassembly of the lower carriage is necessary, the trails should be disconnected only after this has been done.

50X1-HUM

59. Assembly of the Gun

Assembly of the gun is carried out in the following sequence:

1. Connect the trails to the lower carriage.
2. Assemble the lower carriage. 50X1-HUM
3. Replace the wheel brake.
4. Replace the wheels.
5. Replace top carriage, elevating and training mechanisms.
6. Replace the cradle with recoil brake and double-arm lever.
7. Replace the equilibrator.
8. Replace the recuperator on the barrel.
9. Replace the barrel with the breech and recuperator.
10. Replace the suspension disengagement pins.
11. Replace the shield.
12. Replace the jacks and winch.
13. Replace the trail attachments.
14. Replace the sights.

Connection of the Trails to the Lower Carriage (Fig. 63)

1. Place the right trail over the right eye of the lower carriage, drive in the hinge bolt 2, replace the lock washer 16, and screw in the bolt 15 with wrench A52830-79, locking it with the washer.

2. Place the left trail over the left eye of the lower carriage, drive in the hinge bolt 2, replace the lock washer 16, and screw in the bolt 15 with wrench A52830-79, locking it with the washer.

Assembly of the Lower Carriage

The assembly of the lower carriage is explained in Paragraph 34.

Installation of the Wheel Brake

Installation of the wheel brake is explained in Par. 45.

Installation of Wheels (Fig. 71) [p 206]

1. Fill the wheel hubs with grease.

2. Place the inner race of the roller bearing 9 on the rocker arm journal.

3. Put a wheel fitted with the outer races of roller bearings 8 and 9 and with spacers and rollers on the rocker arm journal, replace the inner race of roller bearing 8, slop on a washer 41-85 taken from the ZIP and by screwing on the nut 13 with wrench Sb42-68, bring the wheel into proper position.

4. Unscrew the nut 13, remove washer 41-85, replace washer 12, screw the nut on tightly with wrench Sb42-68, and then loosen it 1/4 of a turn and insert the cotter pin. 50X1-HUM

5. Screw on the cap 6 and gasket 7 with wrench A62832-24.

6. Install the other wheel in a similar manner.

50X1-HUM

7. Lock the caps 6 with wire.

Installation of Top Carriage, Elevating and Training Mechanisms

1. Lubricate the bearing surfaces of the top and lower carriages.

2. Place top carriage, with elevating and training mechanisms, on the lower carriage.

3. Replace the pivot 7 (Fig. 42) in the following manner:

— insert the pivot into the recess on the carriage so that the pin 28 of the pivot will coincide with the groove on the lower carriage;
— screw on the nut 6 with wrench Sb42-7 and lock it with screw 27 and spring washer 51;
— replace the assembled pivot springs;
— replace the pivot cover 8 with gasket 48, screw in the bolts 49 with wrench A52830-5, and secure with lock washers;
— screw the regulating bolt 20 into the cover with wrench 42-250.

Final tightening of the regulating bolt 50 is made on the fully assembled gun after replacement of the barrel and during the adjustment of the clearance between the lower carriage and the top carriage.

4. Replace the front support on the mounting pins 38 (Fig. 40) and with wrench A52830-6 screw in the bolts 17 (Fig. 42) which fasten the front support to the top carriage.

Installation of the Recoil Brake and Cradle

1. Replace the recoil brake in the following manner:

— replace the recoil brake on the cradle;
— bring the mark on the cylinder head of the recoil brake into alignment with the inscription "Open" on the cradle box;
— replace the flat spring 57 (Fig. 25) and fasten it with screws; lock the screws with wire;
— with wrench A52830-160 on nut 15 rotate the recoil brake 90° so that the mark will coincide with the inscription "Closed"; lock the recoil brake with the screw 105 by means of wrench A52830-4 (Fig. 22); secure the screw with a lock nut;
— install the lever 53 with cotter pin 49 as indicated in Par. 18;
— replace the gear box and the front cover 78 of the cradle (Fig. 22) as indicated in Par. 12;

2. Install cradle on top carriage in the following manner: [p 207]

-- lift the cradle with the aid of a pulley block or crane and bring 50X1-HUM the cradle trunnions under the trunnion caps of the top carriage, maintaining contact between the lever and the handle of the interlocking mechanism.

— replace the trunnion caps; with wrench Sb42-44 screw on the nuts holding the trunnion caps on the saddle and insert the cotter 50X1-HUM

Installation of the Double-Arm Lever 82

Installation of the double-arm lever (Fig. 22) is carried out in the following manner:

— bring the cradle to maximum elevation;
— bring the roller of the double-arm lever into the slideway;
— screw the shaft 95 of the double-arm lever into the lug hole on the cradle, lock it with screw 96, and lock the screw. If during this operation the 140-mm spacing between the centers of the lever heads has been changed, readjust it by turning the regulating nut 81 with wrench A52830-5; lock the nut 81 with lock nuts 92 and 93.

Installation of the Equilibrator

1. Install the equilibrator mechanism in the following manner (Fig. 52):

— place the ball supports of the pistons in the receptacles on the saddle and insert the eyes of the outer cylinders into the brackets of the cradle;
— replace the jackets protecting the ball suports, fasten them with screws using wrench A52830-2, and lock them with wire.

If the cylinders are installed with cleats 42-4 (i.e., without letting the air out of the cylinders), then it is necessary to depress the cradle, insert shafts 52 into the eyes, place lock washers on the shafts, screw on the nuts with wrench A52832-19, and secure with lock washers; after this remove the cleats 42-4. Set the cylinders of the equilibrator mechanism in such a position that the plugs 38 (Fig. 53) face the cradle. This allows the maximum angle of elevation of the barrel.

2. Replace the distributor 8 and secure it with bolts 48 by means of wrench A52830-5; fasten the bolts with lock washers.

3. Replace the tank and fasten it with bands 2; tighten the band nuts with wrench A52830-4.

4. Connect the tube 3 to the tank and distributor with wrench A52830-5.

5. Connect the tube 4 to the distributor and to the right column of the equilibrator mechanism with wrench A52830-5; connect the tube 6 to the columns of the equilibrator. The tubes are secured with bands 43 and screws 44.

50X1-HUM

Installing the Recuperator On the Barrel

covers of the front and rear barrel supports, and screw the nuts on to the support stubs with wrench A52830-6, locking them with cotter pins. 50X1-HUM

2. Replace the counterrecoil jacket 56 (Fig. 43) and screw on the bolts 39 with wrench A52830-5, locking them with lock washers. Put nuts 22 on bolts 24 with the same wrench and insert cotter pins into the nuts.

[p 208]

Installing the Barrel, With Breech and Recuperator, On Cradle

Place the barrel on the cradle with the aid of a crane or a 3 to 5 ton pulley block.

If a crane is used, proceed as follows:

1. Secure a manila rope or cable near the rear end of the front support, lift the barrel so that its guides will be on a level with the guides on the cradle, and push the barrel over the cradle.

2. Connect the recoil brake rod to the breech lug, and the recuperator rod to the cutoff-gear actuating collar as follows:

— insert the pointed end of wrench Sb42-39 into the recess of the sliding lock of the breech lug and turn the lock all the way to the right so as to push the stop 30 (Fig. 8) into the recess;
— with the aid of regulating bolt 70 (Fig. 28) and wrench 42-250 (with cap 65 removed), install the recuperator rod in such a manner that the bushing 60 with bracket (Fig. 22) will freely connect with nut 19 of the recuperator rod (Fig. 28) when the lever 19 with handle (Fig. 22) is shifted from the travel position to the firing position; during this operation ensure that the stop of the lever enters the opening of cradle bracket 20 (Fig. 20); attach the cap 65 (Fig. 28) to the cover with bolts 81.

Final adjustment of the connection between the recuperator rod and the collar is made with the aid of bolt 70 after complete assembly of the gun; the description of this operation is given in Par. 60.

3. Replace the recoil indicator, secure it with a screw and nut, and insert a cotter pin into the nut.

Installation of the barrel by means of a pulley block requires equipment indicated in Par. 58 ("Removal of the Barrel").

When the installation of the barrel on the carriage is done outside a building, a horizontal platform is required on which to set up the wooden trestles for the pulley block.

Sequence of Operations During Installation of the Barrel on the Cradle by Means of a Pulley Block

50X1-HUM

1.

the cradle 2-3° by releasing the air from the equilibrator.

50X1-HUM

2. Pass a loop-spliced manila rope or cable around the barrel behind the front support and raise the barrel so that its guides will be on a level with the guides on the cradle.

3. Roll the carriage under the trestles, bring the barrel guides to the cradle guides, and push the barrel over the cradle.

When pushing the barrel, keep the barrel supports and the cradle guides parallel;

4. Connect the barrel with the recoil brake, and the recuperator mechanism with the cradle.

5. Replace the recoil indicator, secure it with a screw and nut, and insert a cotter pin into the nut.

Installation of the Shield

Installation of the two shield pieces on the upper carriage is described in Par. 22.

Installation of the Jacks

[p 209]

1. Install the plate 50 on the trail (Fig. 69)

2. Slip the jack over the trail pin, replace the washers 46 (Fig. 70) and connect the jack catch to the trail catch.

3. With wrench A52830-7 screw on the nut 26 and insert a cotter pin into the nut.

Installation of the Winch

1. Install the winch on the trail (Fig. 67).

2. Replace the lock washers 48; screw in bolts 3 with wrench A52830-5 and lock them with washers.

Installation of Sights

Installation of the mechanical sight S71-35 (S71-96) and optical sight OP-4-35 (OP-4-96) is described in Paragraphs 48 and 52, respectively.

Installation of Suspension Disengagement Pins

Installation of the pins (Fig. 58) is carried out with trails drawn together; as follows:

50X1-HUM

— connect the thrust rods 20 with the suspension disengagement pins 15; screw on nuts 18 with wrench A72931-12 and lock them;

— connect the thrust rods 20 to the trail brackets 24; insert the shafts 22 and lock them. 50X1-HUM

60. Adjustment of the Gun Mechanisms After its Assembly

Adjustment of the Suspension Mechanism

To test the adjustment of the suspension mechanism, roll the gun 5-8m back and forth on the platform.

After this, check the suspension disengagement with trails spread.

When the trails are fully spread, the suspension should disengage if the suspension adjustment has been properly made.

If the trails cannot be fully spread because the suspension disengagement pins fail to enter the rocker arm receptacles, then regulating levers 27 and 39 should be further adjusted (Fig. 58).

With wrench 42-250, lengthen or shorten the screw 47 of the suspension-regulating tie rod to align the pin with the recess in the rocker arm. The threads of the screw should not protrude more than 55 mm. If they do then the corresponding torsion bar should be shifted to the next slot.

After making the suspension adjustment, roll the gun over the platform again and check the disengagement of the suspension.

Adjustment of the Equilibrator [p 210]

Adjustment of the equilibrator is described in Par. 69.

Adjustment of the Recoil Limiter

Adjusting the limiter consists of setting a gap of 140 mm between the centers of levers 82 and 98 (Fig. 22).

This gap should be checked after every overhaul of the gun, cradle, or recoil mechanism, and also after each period of travel and before each firing. The check is made with the gun at its maximum elevation.

Adjustment of the 140-mm gap between the levers 82 and 98 is made with the aid of wrenches A52830-2 and A52830-5.

Adjustment of the Training Mechanism

In a fully assembled gun the upper carriage should rest on the lower carriage at three points: the two rollers and the pivot springs.

If the rollers and pivot springs are properly adjusted, then, with a fully depressed barrel, the clearance between the bearing surfaces of the carriage, measured in front, should be not less than 0.05 mm; and 50X1-HUM

N

with the barrel elevated 45°, the clearance between the bearing surfaces of the carriage, measured from the rear, as well as between the projection of the lower carriage and the grip of the front support, should also be not less than 0.05 mm.

Adjustment of the clearance is made with the aid of a feeler gauge.

If a feeler gauge is not available, the clearance between the top and bottom carriages can be estimated by the amount of force that has to be applied to the handwheel of the training mechanism; this force should not exceed 7 kg. The operation of the training mechanism should be smooth, free of jerking. If the force needed to be applied to the training mechanism is too great (during this test the gun should be placed in a horizontal position), and if the clearance between the top and bottom carriages is insufficient, then the clearance should be readjusted.

The adjustment of the clearance in the front part of the carriage is made by turning the roller nuts 43 (Fig. 40) with wrench 42-250.

The adjustment of the clearance of the carriages is made by turning the pivot bolt 20 (Fig. 42) with wrench 42-250.

After adjustment of the clearance, the nuts 43 (Fig. 40) and regulating bolt 20 should be clamped with plates 41 and 42 and the latter fastened with screws 53 and locked with wire.

To check the performance of the worm-transmission friction clutch of the training mechanism, rotate the handwheel with the lock of the rotating part fixed in travel position and the clearances properly adjusted.

After rotating the handwheel at least five turns, measure the force applied to the wheel after every succeeding half turn. If it is within a range of 30 to 50 kg. the performance of the friction clutch is considered satisfactory.

If the force on the handwheel is less than 30 kg, then it is necessary to tighten the clutch springs. To do this, remove the cotter pin and tighten the upper nut of the worm-gear box with wrench A52830-7; check the force on the handwheel again.

If the force on the handwheel is greater than 50 kg, then it is necessary to loosen the spring by unscrewing the nuts; check the force on the handwheel again. [p 211]

Adjustment of the Elevating Mechanism

Adjustment of the worm-shaft brake of the elevating mechanism is made on assembled gun as follows (Fig. 44):

1. Remove the lock 18 and with wrench Sb42-5 unscrew cover 49 until the roller bearings 44 jam. The action of the elevating mechanism now becomes uneven, and greater effort is required to rotate the handwheel

Now screw in the cover 49 1/12-th of a turn to restore normal resistance of the handwheel and smooth operation of the elevating mechanism; fasten the cover with lock 18.

50X1-HUM

2. With wrench A52830-7 unscrew the nut 52 so that the worm shaft will jam (now it is impossible to rotate the handwheel).

3. Screw in the nut 52 with wrench A52830-7 roughly 1/6 of a turn to restore normal resistance of the handwheel and smooth operation of the elevating mechanism for all angles of elevation; insert a cotter pin into the nut 52.

Adjusting the Connection of the Recuperator Rod With the Nut of the Cutoff-Gear Actuating Collar

This adjustment is made with the trails hooked up to the limber, as follows (Fig. 28):

— remove the cap 65 from the rear cover of the recuperator by unscrewing the bolts 81;

— manipulating the winch, push the barrel forward; now the lever 19 with handle (Fig. 22) of the interlocking mechanism should be in the "Firing" position,

— remove the cover 62 from the cutoff gear by removing screws 61;

— measure the clearance between the bearing surface of the recuperator connecting nut 19 (Fig. 28) and cutoff-gear bushing 60 (Fig. 22) (the clearance is measured with a hook made of 1-2 mm wire); this clearance should be equal to 1-2 mm and is obtained by turning the regulating bolt 70 (Fig. 28) with wrench 42-250; an incorrect clearance may result in an improper connection of the recuperator nut 19 with the cutoff-gear bushing 60 when the gun is switched from the travel to firing position;

-- after the proper clearance has been obtained, check the operation of the interlocking mechanism by shifting the lever 19 with handle (Fig. 22) from the firing to travel position, and vice versa; one man should be able to easily engage the connecting nut 19 (Fig. 28) of the recuperator rod with cutoff-gear bushing 60 (Fig. 22); then the lock of lever with handle (Fig. 22) should enter the openings on the cradle brackets;

-- replace the front cover 62 on the cutoff, and fasten it with screws;

-- replace the cap 65 (Fig. 28) on the rear cover of the recuperator mechanism and fasten it with bolts, using wrench A52830-2; lock the bolts with wire;

[p 212]

-- screw the plug into the hole of the regulating bolt.

Adjustment of the Winch Chain

During its operation, the winch chain may stretch. Opening of loop 7 the (Fig. 67) is aligned with the locks 31 (Fig. 43) and 26 (Fig. 63) by screwing the loop in or out.

50X1-HUM

If there is no margin of adjustment remaining in the loop, then it it nece

end link) in the following manner:

50X1-HUM

— place the lug 12 (Fig. 67) in the breech ring opening and push the barrel all the way forward with the aid of the winch;
— remove the cotter pins and the pin 1 with washers 49;
— remove the wire from both ends of the four chain link pins;
— remove the plates, washers, and pin of one of the links with end plates 50; also remove the outer plates of the two adjacent links;
— connect the end plates 50 with the chain link pin, replace the outer plates of the two links with their washers, and lock the pins with wire;
— join the end plates 50 with the stirrup 11 and the pin 1, replace the washer 49 on the inner side and insert cotter pins into pin 1;
— if it is necessary, regulate the tension of the winch chain by means of loop 7; for this purpose, the loop can be unscrewed to a distance of not more than 34 mm.

After its assembly and adjustment, the gun should be tested for performance:

1. The breech mechanism is tested by opening and closing the breech and releasing the firing pin.

2. The counterrecoil mechanism is checked for fluid in the recoil brake and recuperator, as well as pressure in the recuperator, as indicated in Par. 69.

3. The jacks are checked for fluid and tightness of packing; their performance is tested by lifting and lowering the trails.

4. The sights are tested in accordance with Par. 85.

50X1-HUM

CHAPTER 13

AMMUNITION

61. General Instructions

Rounds described in this Manual and in the Firing Tables are authorized for use in firing the 130-mm M-46 gun and the 152-mm M-47 gun.

The list of rounds given in the Manual may be augmented or changed by order of the Main Rocket-Artillery Administration (GRAU).

A round is defined as that combination of assembled elements required for one firing of the gun.

The M-46 (130-mm) and M-47 (152-mm) guns use separate loading ammunition.

These rounds consist of the following two separately assembled parts, which are loaded, in order, into the chamber of the gun:

- projectile with filler and fuze;
- cartridge case with propellant charge, igniter and boosters.

Projectiles with fuzes screwed into place are designated as armed; those in which dummy fuzes are screwed in are called unarmed.

62. Brief Information on Rounds

The following rounds are used in firing the M-46 (133-mm) and M-47 (152-mm) guns:

M-46 (130-mm) Gun

VOF-482M: full multisection charge, high-explosive fragmentation shell with adapter and nose fuze RGM-2 or V-429.

VOF-482MU: same, but with reduced multisection charge.

VBR-482: with armor-piercing tracer shell and base fuze DBR.

M-47 (152-mm) Gun

VOF-547: full multisection charge, high-explosive fragmentation shell and nose fuze RGM-2 or V-429.

VOF-547U: same, but with reduced multisection charge.

VBR-547B: special charge and armor-piercing tracer shell, blu50X1-HUM with a ballistic cap and base fuze DBR.

VBR-547: special charge and sharp-nosed armor-piercing tracer shell and base fuze MD-7.

VPBR-547: special charge and practice-firing tracer shell.

Table 1 gives general information on rounds.

63. Purpose of Rounds

Rounds with the 130-mm and 152-mm high-explosive fragmentation shells are used:

- for combat with artillery and motor-mechanized enemy units;
- for the annihilation of enemy personnel;
- for the destruction of field-type defensive installations;
- for firing against the enemy rear (railroad junctions, headquarters, troop concentrations).

Rounds with 130-mm and 152-mm armor-piercing tracer shells are used against armored enemy units (heavy and medium tanks, self-propelled guns, armored trains, armored cupolas in fortified areas).

The 152-mm practice-firing tracer shell is used in practical training with direct laying.

When rounds with armor-piercing tracer shells are not available, the high-explosive fragmentation shells may be used against tanks and other armored targets.

64. Design and Function of Rounds and Their Elements

Rounds for the 130-mm and 152-mm guns, M-46 and M-47 consist of:

an armed grenade or projectile;

a cartridge case with propelling charge and primer cup.

Projectiles for the M-46 (130-mm) and M-47 (152-mm) Guns

Shells and projectiles consist of three main parts: the nose (ogival), cylindrical part with bourrelets, and the base, made up of a short cylindrical portion and conical portion (in the form of a truncated cone). 50X1-HUM

The nose is ogival in shape in order to reduce air drag during flight.

The bourrelets on the body center the shell in the tube before firing and provide correct motion of the shell through the tube at the moment of firing.

The rotating bands impart a rotary motion to the projectile, which guarantees stable motion in flight.

The conical base (boattail) of the projectile reduces the turbulence behind the projectile in flight, thus increasing the range.

[p 215]

TABLE 1

M-46	1. 130-mm round, high-explosive, fragmentation shell, full charge	2. 130-mm round, high-explosive fragmentation shell, reduced charge	3. 130-mm round with armor-piercing tracer shell
index:	53-VOF-482M	53-VOF-482-MU	53-BVR-482
wgt, armed projectile:	33.4 kg	33.4 kg	33.4 kg
type fuze and tracer:	RGM-2 or V-429	RGM-2 or V-429	DBR: tracers: 2 No 5; 1 No 7
primer cup:	KV-5	KV-5	KV-5
type of powder:	DG-3 23/1 or NDT-3 23/1	9/7 12/1 Tr	DG-3 23/1 or NDT-3 23/k
approx weight of charge:	12.9	6.54 kg	12.9 kg
muzzle velocity:	930 m/sec	705 m/sec	930 m/sec
powder gas pressure:	not over 3,150 kg/cm^2	not over 2,700 kg/cm^2	not over 3,150 kg/cm^2
number of rounds per box:	1	1	1
weight, round:	59.1 kg	51.8 kg	59.1 kg

50X1-HUM

M-46	1. 130-mm round, high-explosive, fragmentation shell, full charge	2. 130-mm round, high-explosive fragmentation shell, reduced charge	3. 130-mm round with armor-piercing tracer shell:
weight, round plus box:	84.5 kg	77.5 kg	84.5 kg

M-47:	1. 152-mm round, high-explosive fragmentation shell, full charge	2. 152-mm round, high-explosive fragmentation shell, reduced charge	3. 152-mm round, blunt-nose armor-piercing tracer shell, special charge
index:	53-VOF-547	53-VOF-547U	53-VBR-547B
wgt, armed projectile:	43.56 kg	43.56 kg	48.96 kg
type fuze and tracer:	RGM-2 or V-429	RGM-2 or V-429	DBR tracer No 7
primer cup:	KV-5	KV-5	KV-5
type of powder:	DG-3 19/1 or NDT-3 19/1	4/1 12/1 Tr	DG-3 19/1 or NDT-3 19/1
approx weight of charge:	10.9 kg	3.54 kg	10.14 kg
muzzle velocity:	770 m/sec	500 m/sec	700 m/sec
powder gas pressure;	not over 2.350 kg/cm^2	not over 2,350 kg/cm^2	not over 2,350 kg/cm^2
number of rounds per box:	1	1	1
weight of round:	65.6 kg	58.0 kg	70.2 kg
weight, round plus box:	92 kg	84 kg	96 kg

50X1-HUM

Table 1
(cont'd)

M-47:	4. 152-mm round, sharp-nosed armor-piercing tracer shell, and special charge	5. 152-mm round, with practice-firing tracer shell
index:	53-VBR-547	53-VPBR-547
wgt, armed projectile:	48.78 kg	48.78 kg
type fuze and tracer:	MD-7 tracer No 1	tracer No 1
primer cup:	KV-5	KV-5
type of powder:	DG-3 19/1 or NDT-3 19/1	DG-3 19/1 or NDT-3 19/1
approx weight of charge:	10.14 kg	10.14 kg
muzzle velocity:	700 m/sec	700 m/sec
powder gas pressure	-	-
number of rounds per box:	1	1
weight of round:	70.0 kg	70.0 kg
weight, round plus box:	96 kg	96 kg

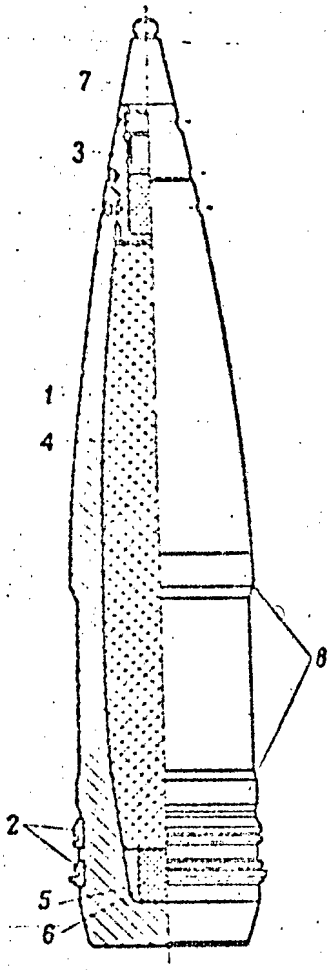


Fig 113. OF-482M 130-mm High-Explosive Fragmentation Shell

1. body
2. rotating bands
3. adapter
4. bursting charge - TNT
5. smoke-flash booster
6. paraffin-ceresin mixture
7. RGM-2 fuze
8. bourrelet

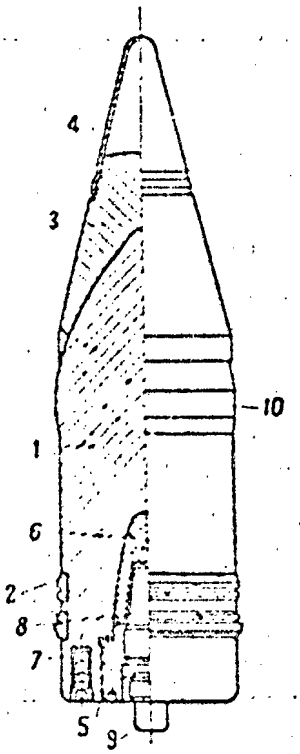


Fig 114. BR-482 130-mm Armor-Piercing Tracer Projectile

1. body
2. rotating bands
3. armor-piercing cap
4. ballistic cap
5. base
6. bursting charge
7. No 5 tracer (two)
8. DBR fuze
9. nut with No 7 tracer in DBR fuze
10. bourrelet

Design Characteristics of the High-Explosive Fragmentation Shells and Armor-Piercing Projectiles

The OF-482M 130-mm high-explosive fragmentation shell (Fig 113) consists of:

- steel body with a chamber under the bursting charge; in the nose there is a threaded hole where the adapter is screwed in under a RGM-2 or V-429 fuze; bourrelets (8) are on the cylindrical part of the shell;

- a bursting charge (4) of TNT;

- a smoke-flash booster (5) which is a pellet placed in the bottom of the shell chamber on a mixture (6) of paraffin and ceresin;

- two rotating bands (2); the lower rotating band has a raised rib to facilitate obturation of the powder gases and thus reduce the erosion of the tube caused by such gases;

- a RGM-2 or V-429 fuze (7).

The 130-mm armor-piercing shell BR-482 (Fig 114) consists of:

- a sharp-nosed steel body;

- a steel armor-piercing cap (3), soldered to the nose section of the body of the projectile; [p 217]

- a pickled steel ballistic cap (4), attached to armor-piercing cap by rolling into special grooves;

- bursting charge (6);

- two rotating bands (2) (same as on the OF-482 and OF-482M high-explosive fragmentation projectiles);

- steel base (5) with threaded fuze hole for DBR fuze.

The body has a chamber under the bursting charge, an opening in the bottom part of the projectile for the purpose of screwing in the threaded base (5). On the cylindrical part of the body of the projectile there is a single bourrelet (10).

Tracer No 7 (in nut 9) is attached to the body of the fuze.

The OF-547 152 mm high-explosive fragmentation shell (Fig [illegible], 50X1-HUM consists of:

- steel body (1) with chamber under bursting charge;

- bursting charge (3);

- copper rotating band (2) with a shoulder for better obturation of the powder gases.

50X1-HUM

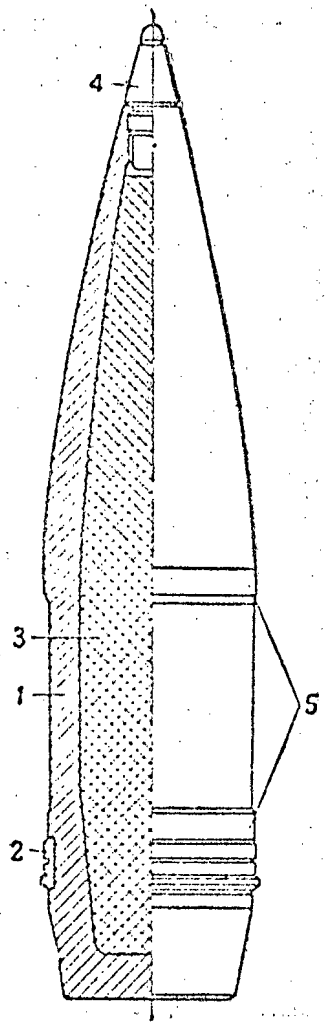


Fig 115. OF-547
152-mm high-explosive
fragmentation shell

1. body
2. rotating band
3. TNT bursting charge
4. RGM-2 fuze
5. bourrelet

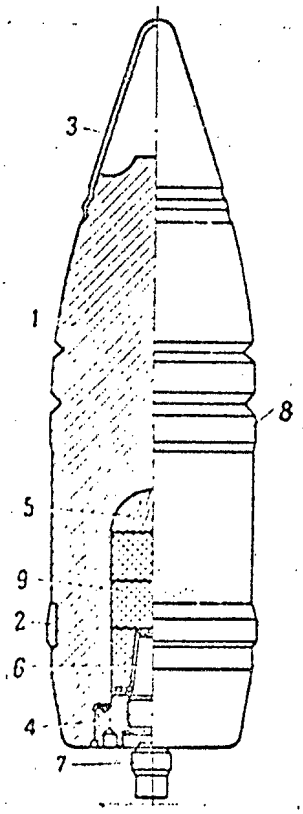


Fig 116. BR-540B 152-mm armor-
piercing tracer shell

1. body
2. rotating band
3. ballistic cap
4. base
5. wooden insert
6. DBR fuze
7. nut with
tracer No 7
in DBR fuze
8. bourrelet
9. burst
charge

In the nose portion of the body of the shell there is a [p 218] threaded hole into which a RGM-2 or V-429 fuze is screwed; top and bottom bourrelets (5) are on the cylindrical part of the shell.

The BR-540B 152-mm armor-piercing tracer shell (fig 116) consists of:

- a steel body (1), blunt-shaped, with chamber under the bursting charge, and a hole in the bottom for screwing in the base;

- a pickled-steel ballistic cap (3) attached to the body by forcing into special grooves;

- bursting charge (9);

- steel base (4) with threaded hole for screwing in a DBR fuze with tracer;

- one copper rotating band (2);

-

- a wooden insert (5).

On the cylindrical part of the body there is one bourrelet (8) and two localizing undercuts, which prevent a splitting of the body at the chamber under the bursting charge (upon impact against armor, the body of projectile is abraded up to the localizing undercuts).

The BR-510 152-mm armor-piercing tracer shell (Fig 117) is similar in design to the BR-540B projectile, except that it is sharp-nosed instead of blunt, has no ballistic cap, and uses the MD-7 fuze instead of the DRB fuze.

The PBR-540 152-mm practice-firing tracer shell is the same size as the sharp-nosed BR-540 armor-piercing tracer shell. The practice-firing shell is solid, has no bursting charge and no fuze; it is made of plain carbon steel.

The tracer is inserted in a seat in the base of the shell body and is kept from falling out by a tracer plug.

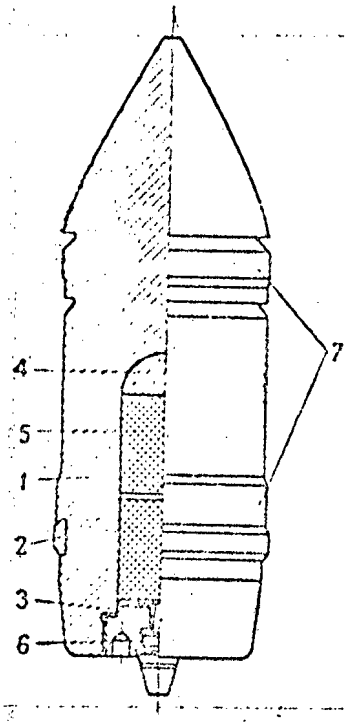


Fig 117. BR-540 152-mm armor-piercing tracer shell

1. body
2. rotating band
3. base
4. wooden insert
5. A-1Kh-2 bursting charge
6. MD-7 fuze
7. bourrelet

Action of High-Explosive Fragmentation Shells

Depending on the design of the fuze employed, the action of shells with the RGM-2 or V-429 fuze can be either high-explosive fragmentation plus ricochet, or high-explosive with delayed action.

Fragmentation firing is done against open targets such as personnel, artillery, etc.

In order that a fragmentation effect be produced, the fuze must be set at "0" and the waterproof cap screwed in.

At this fuze setting, the projectiles burst at the surface, before having time to penetrate very far into the ground, and produce small open craters. When the shell bursts, a great number of fragments attain a high velocity as they fly out in all directions, destroying the targets in the area of the burst.

Firing for blast effect is done against covered positions of the light field type, earth and timber fortifications, wooden structures, machine-gun nests, trenches and the like. [p 219]

The blast effect can be produced without any manipulation of the fuze, since the fuzes are delivered from the factory already set for blast effect.

A ricochet effect is obtained when the projectile bursts in the air after ricocheting at the point of impact.

Ricochet firing with the fuze set at delayed action ("Z" setting and fuze cap not removed) is used to annihilate enemy personnel hidden behind terrain irregularities, in open trenches, in ditches and moats, behind low vertical cover and the like.

To get the ricochet effect, it is necessary that the V-429 or RGM-2 fuze be set at "Z", and that the fuze cap not be screwed off.

Blast effect firing with delayed action is used against more rugged structures such as bridges, blindages, railroad terminals, etc.

When blast effect firing is employed with the fuze set at delayed action, the projectile does not burst immediately upon impact, but after a certain interval of time, during which the projectile has succeeded in penetrating the obstruction.

Maximum blast and fragmentation effects are obtained when, with the fuze set at "Z", and the fuze cap not removed, the projectile penetrates through the obstruction and bursts inside the structure.

The Effect of Armor-Piercing Tracer Shells

Firing armor-piercing tracer shells requires no preliminary manipulation of the fuze before loading, since the MD-7 and DBR fuzes have no settings and are always armed. When the projectile strikes the armor, the fuze functions with delayed action, which is sufficient to allow the projectile to penetrate the armor and burst inside the tank or armored vehicle, inflicting damage to personnel and equipment through the effect of blast and flying fragments. The presence of the tracers in the projectiles facilitates the observation of the projectiles during flight and the aiming of the gun.

The maximum penetration effect is obtained when the projectile strikes perpendicular to the armor or at an angle close to the perpendicular.

The range for firing by direct laying against a target two meters high is 1,170 meters for the 130-mm BR-482 projectile, 860 meters for the 152-mm BR-540B projectile, and 840 meters for the BR-540 projectile.

The penetration of a projectile depends not only on its design, but to a considerable extent also on the terminal velocity of the projectile as it strikes the armor; consequently, armor-piercing tracer projectiles are fired from the 130-mm M-46 gun only with full charge, and from the 152-mm M-47 gun only with the special charge.

The Fuzes

Design and Action of Fuzes During Firing, Flight and Impact

An impact fuze is a combination of mechanisms, instruments and devices designed to produce a detonation of the bursting charge of a projectile upon impact with an obstruction. The RGM-2 and V-429 fuzes are used with high-explosive fragmentation shells, and the DBR and MD-7 fuzes with the armor-piercing tracer shells.

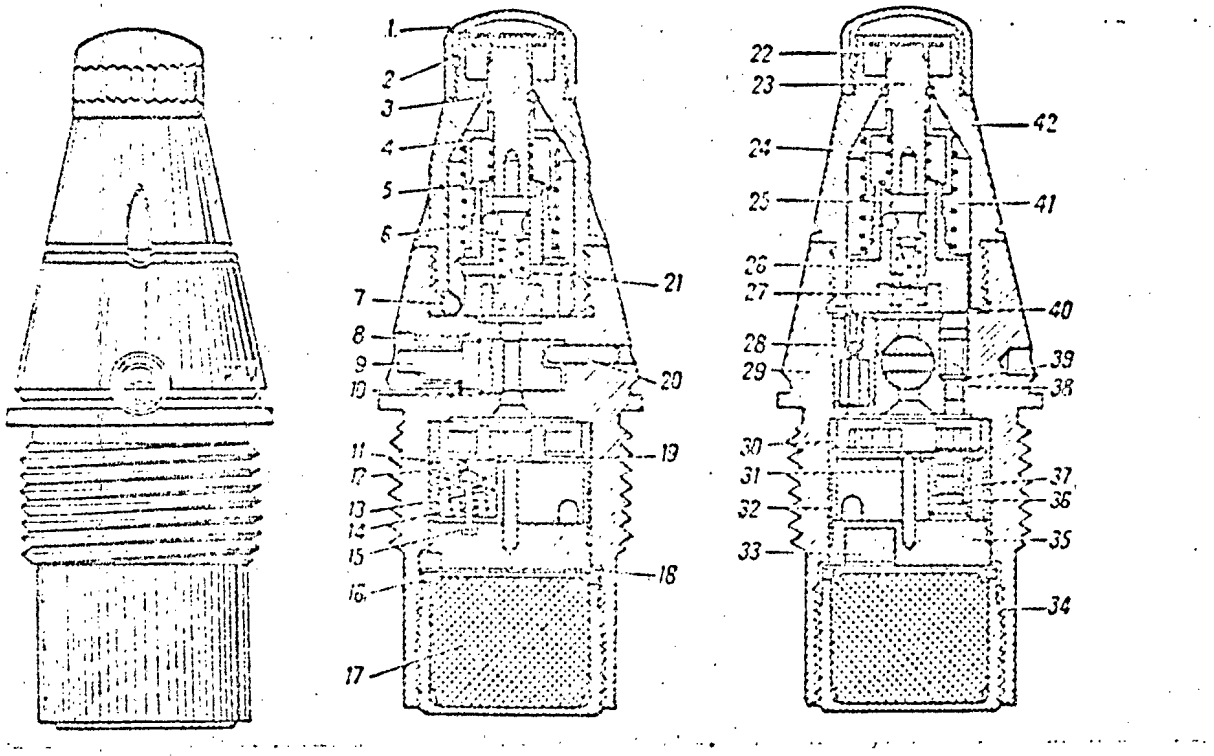


Fig 118. RGM-2 Fuze

1. fuze cap
2. diaphragm
3. keeper ring
4. setback case
5. safety spring
6. safety ball
7. locking ball
8. insert
9. fuze-setting sleeve
10. obturation ring
11. ball
12. setback plug
13. lock spring
14. safety spring
15. lock
16. washer
17. detonator
18. cap
19. cover
20. pin
21. striker spring
22. mushroom
23. plunger pin
24. cocking spring
25. firing pin
26. striker
27. percussion primer
28. plug with delay element
29. body
30. horizontal spring
31. spindle
32. jacket
33. lead charge
34. base plug
35. detonator plug
36. horizontal plug
37. detonating primer
38. plunger
39. arming pin
40. safety clamp
41. safety ring
42. nose

The RGM-2 Fuze

The RGM-2 nose fuze (Fig 118) is a safety-percussion fuze with the following four settings:

- fragmentation (pointer at "0", fuze cap removed);

- blast effect (pointer at "0", fuze cap screwed down);

- blast effect with delayed action and ricochet (pointer at "Z", fuze cap screwed down);

- ricochet (pointer at "Z", fuze cap removed).

The blast effect setting (pointer at "0", fuze cap screwed down) is used when firing against troops.

The marking "RGM-2" is stamped on the body of the fuze.

The RGM-2 fuze consists of an inertial and nondelay percussion mechanism, a delay device with setter and detonator-safe mechanism.

The percussion mechanism, which is both inertial and instantaneous, is in the nose (42) of the fuze. The main parts of the percussion mechanism are the inertial striker (26) with the percussion primer (27) and the instantaneous striker, consisting of the plunger pin (23) and mushroom (22), the firing pin (25) and the keeper ring (3). Balls (6) prevent the striker and firing pin from coming together before the projectile is fired from the gun; these balls are held by a safety ring (41). The safety clamp (40), which fits on the inertial striker (26), is held by claws against the lower face of the fuze nose (42) and prevents the coming together of striker and firing pin while the projectile is in flight.

The striker spring (21) holds the nondelay striker by a needle at a specified distance from the percussion primer after the firing mechanism has been cocked, while the cocking spring (24) holds up the setback case (4) together with the safety ring (41) when the firing mechanism is cocked.

The detonator-safe mechanism guarantees the safe condition of the firing mechanism during the handling of the fuze and during firing and also transmits the explosive impulse to the bursting charge of the projectile.

This mechanism consists of the detonator plug (35), which is rigidly attached to the fuze body (29), and the horizontal plug 36,

which rotates under the effect of the horizontal spring (30) on the axle (31) which is press-fitted into the center hole of the booster plug.

The horizontal plug contains the detonating primer (37) and locking mechanism, which is made up of the lock (15), lock spring (13), the setback plug (12), safety spring (14) and the ball (11).

Lock (15) fits into the socket of the detonator plug (35) and prevents the rotation of the horizontal plug (36) under the effect of spring (30).

Ball (11), which is held by the setback plug (12) and rests against cover (19), keeps lock (15) from disengaging from detonator plug (35) under the effect of the lock spring (13).

With the new position of the horizontal plug, the detonating primer (37) is separated from the detonator (17) by the detonator plug (35). The latter is strong enough so that, if the detonating primer (37) should explode during the handling of the fuze or when the gun is fired, the horizontal (rotating) plug (36) will not produce a detonation of the lead charge (33) and the detonator (17) itself, which is inside the base plug (34), provided the horizontal (rotating) plug is in the new position. [p 222]

An additional safety mechanism is inside the housing of the fuze body. It consists of a plunger (38) and an arming pin (39), which holds the plunger from moving. The plunger (38) prevents the premature detonation of the projectile in front of the muzzle when the fuze is set at "Z" (if the primer (27) ignites when the projectile is in the bore of the gun during firing).

The delaying mechanism consists of the delaying element in plug (28), the fuze-setting sleeve (9) and other parts. The delaying element and fuze-setting sleeve fit inside holes drilled in a transverse housing of the fuze body. The sleeve (9) has a hole which transmits the flash from the percussion primer (27) to the detonating primer (37) when the fuze is set at "0". When the pointer setting is at "Z", the central channel in the housing of the fuze body is closed, and the flash from the percussion primer (27) to the detonating primer (37) can travel only through the delaying element. On the outside face of the sleeve (9) there is a recess for inserting a key, and an arror pointer.

Operation of the Fuze

When the projectile is fired from the gun, the inertial force exerted on the setback case (4) is sufficient to overcome the resistance of spring (5); the setback case (4) compresses spring (5) and, with its extensions, engages safety ring (41), thereby compressing the cocking spring (24).

At the same time, in the locking mechanism of the horizontal (rotating) plug (36), the setback plug (12) compresses the safety spring (14); ball (11) is moved aside, allowing lock (15) to move upward.

The parts of the percussion and locking (safety) mechanisms remain in this position until the projectile has left the gun.

After the projectile has left the gun and the effect of inertia in the percussion mechanism has ceased, the cocking spring (24) lifts the safety ring (41) and the ferrule (4) into the upward position and releases the safety balls (6), which move, under the effect of centrifugal force, out of the firing-pin recess and no longer prevent the coming together of the firing pin and striker (26).

At the same time, in the locking mechanism, spring (13) lifts lock (15) and frees horizontal (rotary) plug (36), which is forced by spring (30) to rotate on its axis until the detonating primer 37 is lined up with the lead charge 33. The cocking of the fuze is completed when the projectile is two to five meters from the muzzle face, and the parts remain in their present positions until the projectile strikes an obstacle.

When the projectile strikes an obstacle, the action of the fuze depends on its setting. A fragmenatation effect is obtained when the fuze setting is at "0" and the fuze cap is removed, which is easily done by screwing it off before loading the gun. When the projectile strikes the target obstacle, the diaphragm (2) is punctured, and the nondelay striker, together with the firing pin (25), is forced against the percussion primer (27). The flash from the percussion primer (27) goes through the hole to the detonating primer (37), the detonation of which passes on to the lead charge (33) and detonator (17), and from there to the bursting charge in the projectile.

A blast effect is obtained with the fuze setting at "0" and the fuze cap not removed. For this, nothing has to be done with the fuze before loading the gun.

When the fuze cap is screwed on, the percussion primer is activated as a result of the striker's moving forward together with the percussion primer until the latter is struck against the firing pin. At the same time, the extensions of the safety clamp (40) straighten out. The flash from the percussion primer moves through the opening in the setting sleeve to the detonating primer, and the subsequent fuze functions are the same as for the fragmentation effect. A blast effect with delayed action is obtained with a fuze setting at "Z" and the fuze cap intact. [p 223]

When the fuze is set for a delayed-action blast effect, the hole is covered by the setting sleeve (9), which causes the flash from the percussion primer to reach the detonating primer via a powder-train delaying element. By the time the powder train has burned, the projectile has penetrated the ground or defense installation, and thus produces a powerful blast effect.

Functioning of the Additional Safety

In the event that the percussion primer (27) goes off at the moment the gun is fired, if the fuze is set at "Z", the arming pin (39) is sheared off, and the plunger (38) drops down, restraining the rotation of the plug (36) into the cocked position, and the detonator primer cap (37) remains isolated from the detonator (17); the flash from the percussion primer does not reach the detonator, and the projectile is not exploded. A fuze failure will result when the projectile strikes the target.

Under normal conditions, the arming pin is strong enough so that it is not sheared off when the gun is fired and the plunger is not activated.

Fuze B-429, according to its use, design and action, is basically similar to the RGM-2 fuze, therefore, it will not be described. In addition, there is a separately published technical manual for the B-429 fuze.

The DBR Fuze

The base fuze DBR (Fig 119) is a percussion fuze with automatic delaying action. The DBR fuze does not have to be set before the projectile is fired. The fuze body is stamped with the marking "DBR".

Design of the DBR Fuze

[p 224]

The DBR consists of an inertial [setback] type percussion mechanism, an automatically regulated delaying mechanism; a detonator mechanism and tracer.

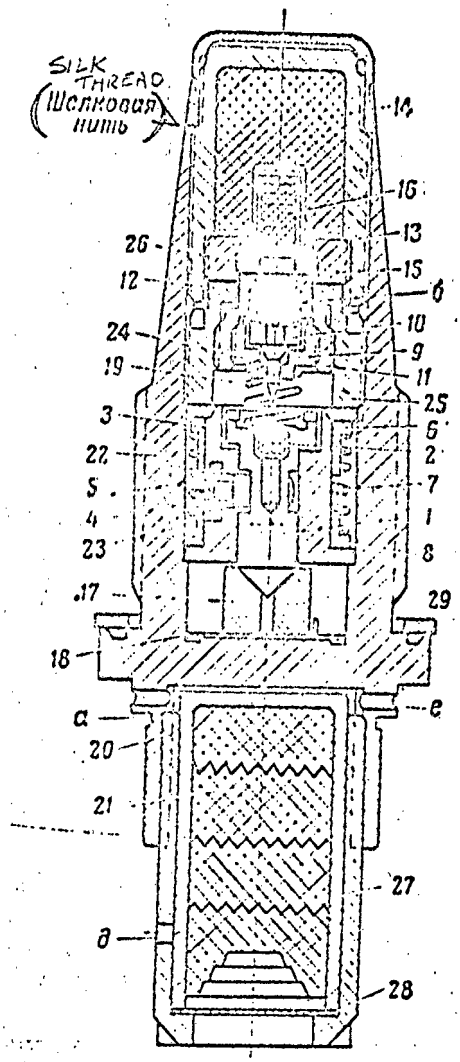


Fig 119. DBR Fuze

1. striker
2. percussion primer
3. striker case
4. three centrifugal plungers
5. three plunger springs
6. upper sleeve
7. spring
8. lower sleeve
9. delay-element plug
10. firing-pin plunger
11. delay-element case
12. plug
13. detonator casing
14. detonator
15. detonating primer plug
16. detonating primer
17. setback separator
18. rigid safety
19. striker spring
20. tracer nut
21. tracer
22. body
23. cup
24. firing pin
25. plug
26. nut
27. tracer case
28. gasket
29. lead washer

a. undercut
b. delay element
d. perforation
e. perforation

The outside of the fuze body (22) has left-hand threads for screwing the fuze into the base of the projectile. Inside the fuze body are the percussion mechanism and the (screwed-in) delaying and detonating mechanisms. The tracer is screwed into a hole in the bottom of the fuze body. The bottom of the fuze body has a special undercut (a), which allows the tracer to separate from the fuze upon impact of projectile against target, which prevents the fuze from exploding out of the base of the projectile.

The inertial type percussion mechanism consists of the striker (1) and the percussion primer (2) which is rolled onto the striker. The striker is inside the striker case (3), where it is held by three centrifugal plungers (4), which are held in the circular recess in the striker by the three plunger springs (5). For convenience in assembling the plungers together with the springs, small cups (23) are used, which are attached to the striker case (3). The striker spring (19) prevents the striker with percussion primer from coming together with the firing pin (24) during the flight of the projectile. Below the striker case is the inertial (setback) separator (17) with a conical hole into which the bottom part of the striker fits. A rigid safety (18) prevents the separator from moving to the side. The percussion mechanism has an upper (6) and lower (8) sleeve, separated by spring (7), to prevent a cocking of the plungers when the projectile is in the gun tube.

The delaying mechanism consists of the delay-element case (11), the firing-pin plunger (10) and firing pin (24), and the delay-element plug (9). Powder is pressed into the delay-element case. The delay-element case (11) is screwed into a plug (12). A copper gasket is placed between the delay-element case (11) and the plug (25), in order to provide correct placement of parts during assembly.

The detonator mechanism consists of the detonator casing (13), containing pressed TNT, the detonator (14) and the detonating primer (16), which fits into a recess in the detonator TNT (14). Its projecting bead fits into a washer inside the detonating primer plug (15). To provide a reliable fit, a gasket is placed in the upper part of the projecting bead of the detonating primer. A cardboard gasket between the detonator TNT and the plug provides a tight fit.

The tracer device consists of the tracer case (27) containing the tracer (21) (material pressed into the case) and the tracer nut (20). A cellulose-base gasket (28), with varnish, is set on the circular recess of the tracer nut in order to protect the tracer material from the effects of moisture. There are four perforations (d) in the tracer nut, which provide a means for the escape of the powder gases that are formed in the gap between the tracer nut and tracer case during firing. There are two similar perforations e in the fuze body for the same purpose.

The lead washer (29) on the flange of the fuze body (22) pr50X1-HUM the escape of gases from the powder charge in the base of the projectiles.

Operation of the Fuze

At the moment of firing: Under the effect of the force of inertia caused by the rapid forward motion of the projectile, the top sleeve (6), by compressing spring (7), sinks to the lower position in contact with the bottom sleeve, thereby preventing the centrifugal plungers (4) from disengaging the striker. The top sleeve remains in this position the entire time the projectile moves through the tube. In case of an accidental slowing-down of the projectile in the tube, the top and bottom sleeves, together with the spring compressed between them, move all the way up into the ring inside the fuze body. In this case, the plungers overlap the lower sleeve. The powder gases burn the cellulose-base gasket (28) and ignite the tracer material in the tracer case. /225/

During the flight of the projectile in the air: When the projectile has left the tube and has traveled about a meter beyond the muzzle face, the effect of the force of inertia on the fuze parts ceases, as a result of which the spring (7) lifts the upper sleeve all the way into the ring. The plungers then, under the effect of the centrifugal force created by the spinning of the projectile, compress springs (5) and move out of the circular recess in the striker. During the flight of the projectile, the combination of striker (1) and percussion primer (2) is kept from contacting the firing pin (24) by the striker spring (19).

The tracer material burns gradually, indicating the path of the projectile in flight.

When the projectile strikes the target obstruction: Under the effect of the inertial force created by the sudden reduction of projectile velocity, the striker (1) compresses spring (19) and breaks the percussion primer (2) against the firing pin (24). Plunger (10) is pressed against the bottom of the cutout in the delay-element case (11), and the gases from the percussion primer penetrate the hole in the delay-element plug and holes in the striker to the powder delay element (b), igniting it.

When the projectile has passed through the armor or becomes lodged in the armor, the effect of the force of inertia on plunger (10) ceases, and the gases of the burning delay element drive back the plunger, the conical end of which closes the hole in the delay-element plug, and the flow of gases into the hollow of the fuze ceases. As a result, the delay element burns rapidly in the closed area; the flash of fire moves on to the detonating primer, then to the detonator and the burst 50X1-HUM charge of the projectile.

When projectiles strike the ground (at ricochet ranges), the setback separator (17) straightens out the lugs of the rigid safety holding it and moves all the way to the side wall of the fuze body, as a result of which the striker (1) comes together with the firing pin, puncturing the percussion primer, which leads to the bursting of the projectile. 50X1-HUM

The MD-7 Fuze

The base fuze MD-7 (Fig 120) is a percussion type fuze with delayed action and consists of the percussion mechanism which works on the inertial principle, the delaying mechanism, the detonator and tracer.

The marking "MD-8" is stamped on the fuze body.

The percussion mechanism consists of the striker (6), with a percussion primer (8) and copper slug (9) attached to it, a lead washer (7) under the striker, a slit setback cylinder (4), a steel firing pin (10) with a hole in its head for passage of the flash, and the striker spring (3).

The delaying mechanism consists of the powder delaying element (12), which is pressed into the cup, the setback separator (11) with a hole through it, and the silk pad pasted to the delay element. The flash of fire from the percussion primer can penetrate to the detonating primer (13) only after the powder train of the delay element has burned out.

The detonating device consists of the detonating primer (13) and the detonator (1), which are inside the detonator casing (2). /226/

50X1-HUM

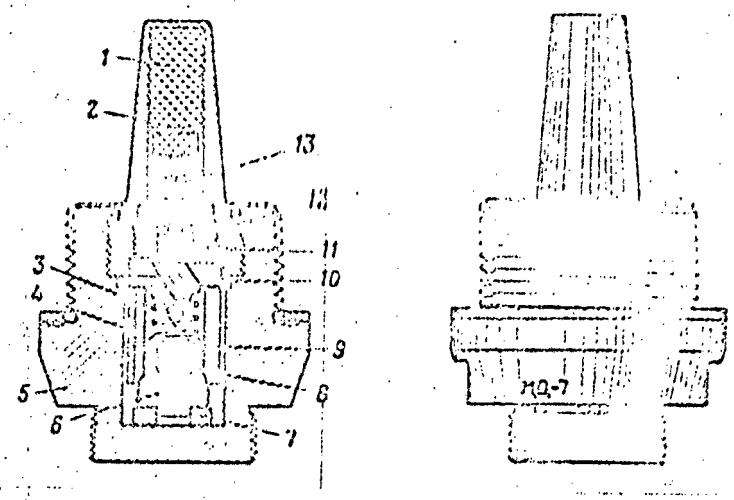


Fig 120. MD-7 Fuze

1. detonator
2. detonator casing
3. striker spring
4. slit setback cylinder
5. fuze body
6. striker
7. lead washer
8. percussion primer
9. copper safety slug
10. firing pin
11. setback separator
12. delay pellet
13. detonating primer

The tracer (not shown on the illustration) consists of the tracer itself and the tracer nut. The tracer is a brass shell into which the tracer material has been pressed; it is covered by a thin celluloid cap.

The tracer is inside the tracer nut, which screws onto the fuze.

Operation of the Fuze

The fuze requires no preparation for firing.

During firing, the slit setback cylinder (4), under the effect of inertia, moves all the way down onto the lead washer (7), opening out somewhat as it moves down, and tightly encompasses the body of the striker (6). The powder gases (from propellent charge) burn through the cellulose-base gasket and ignite the tracer.

During the flight of the projectile the striker is kept from coming into contact with the firing pin by the striker spring (3) and the strong friction of the slit setback cylinder (4) against the wall of the chamber inside the fuze body. 50X1-HUM

The tracer material burns gradually, directly indicating the trajectory of the projectile.

When the projectile strikes an armored target, the striker (6) moves forward as the result of inertia, compressing striker spring (3), and the primer is punctured against the firing pin (10). The flash from the primer ignites the powder train of the delay element. By the time the striker has traveled, the primer has been punctured, and the delay-element powder train has burned, the projectile has penetrated the armor. After the delay-element has burned through, the flame reaches the detonator primer which is ignited and explodes, causing the detonation of the TNT detonator and the bursting of the projectile on the other side of the armor.

The Cartridge Cases /227/

Seamless brass cartridge cases are used for the M-46 (130-mm) and M-47 (152-mm) guns.

The cartridge case serves the following purposes:

- to combine in one piece all the propelling and igniting elements;
- to prevent the escape of powder gases through the breechblock;
- to prevent the erosion of the chamber;
- to protect the propelling charge from atmospheric effects and mechanical damage.

Externally, the parts of the cartridge case are: the neck (the upper cylindrical part); the body (main part, which acts as a shell for the propellent charge); the conical shoulder (the transition from the body to the neck — in 130-mm gun ammunition only); the rim (a rim at the outside edge of the base of the cartridge which stops the motion of the cartridge as it moves into the chamber and ejects it from the chamber after the gun is fired); and the base of the cartridge, in the center of which there is a nipple, and an inside shoulder with a threaded hole into which a primer is screwed.

50X1-HUM

The external dimensions (diameter) of the cartridge are somewhat smaller than those of the chamber, so that the cartridge can be loaded freely and readily ejected after firing. When the gun is fired, the pressure of the expanding powder gases stretches the cartridge, pressing it against the wall of the chamber, closing the gap between cartridge and chamber wall and eliminating the possibility of an escape of powder gases in the direction of the breechblock.

After firing, the deformation of the cartridge being elastic, the cartridge shrinks back to a size smaller than that of the chamber diameter, facilitating the ejection of the cartridge when the breech is opened.

The Powder Charges

The propellent charge imparts to the projectile the required muzzle velocity. The charge consists of a specific amount by weight of a particular make of powder and igniting elements. The charges for the M-46 (130-mm) and M-47 (152-mm) guns are in brass seamless cartridge cases.

The M-46 (130-mm) gun uses, for the high-explosive fragmentation shells, two different propellent charges: a full multisection charge, with the index ZhN-482, in one cartridge and a reduced multisection charge, with the index ZH482U, in another cartridge, one charge being issued to troops for each projectile.

The 130-mm armor-piercing tracer projectile comes with a full charge only.

For firing high-explosive fragmentation projectiles, it is possible to get the first charge from the full charge, and to get the third and fourth charge from the reduced charge by removing equal sections; in the first case, an increment in a bag must be removed, and in the second case equal sections [balancing sections opposite one another].

The M-17 (152-mm) gun, for the high-explosive fragmentation projectile, uses two charges: full multisection charge, with index ZhN-547, in one cartridge case and a reduced multisection charge, index Zh-547U, in a second cartridge. For firing the high-explosive fragmentation projectiles, the first charge can be obtained from the full charge, and the third charge from the reduced charge.

Only special charges are used with the armor-piercing tracer projectiles and practice-firing projectiles.

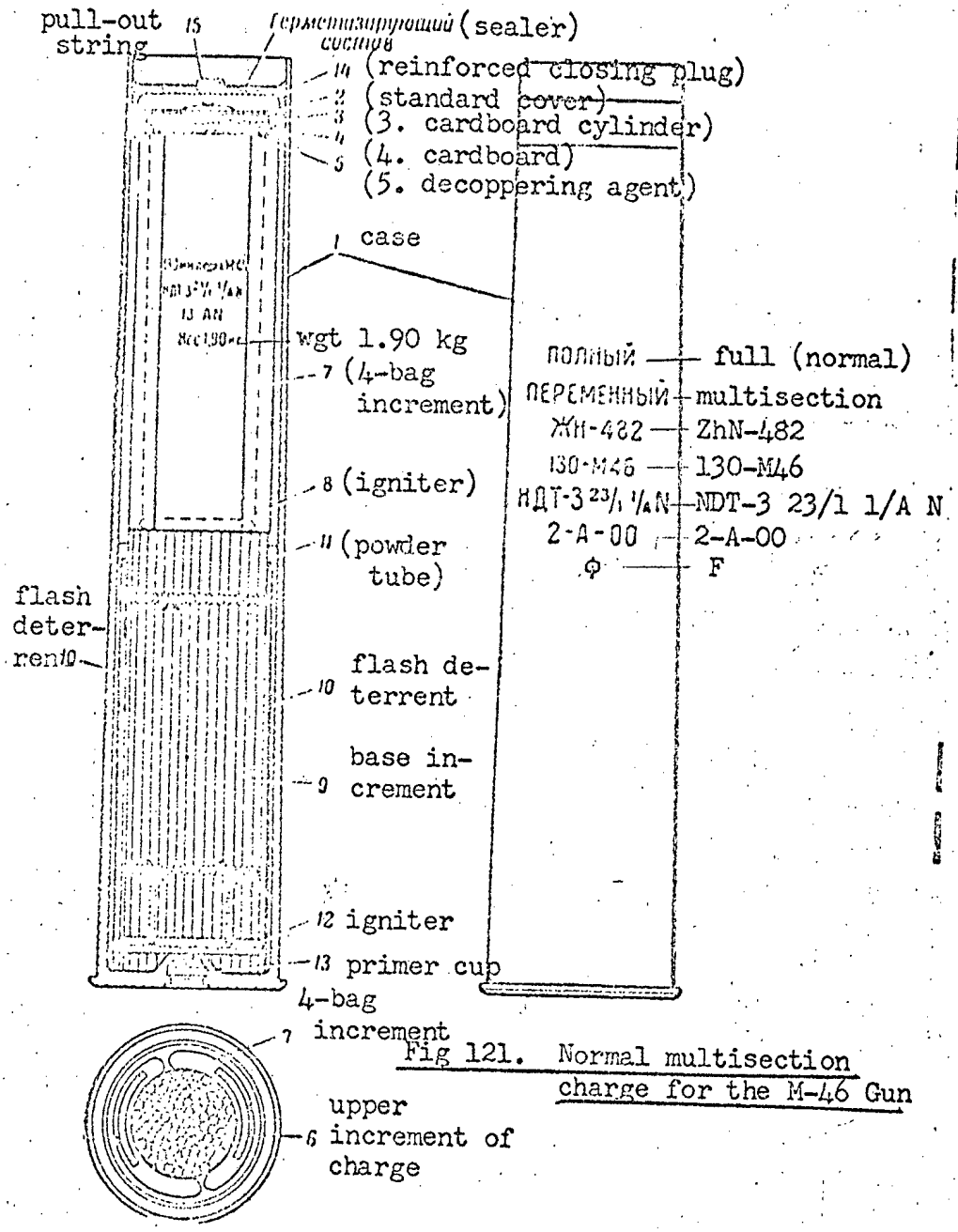


Fig 121. Normal multisection charge for the M-46 Gun

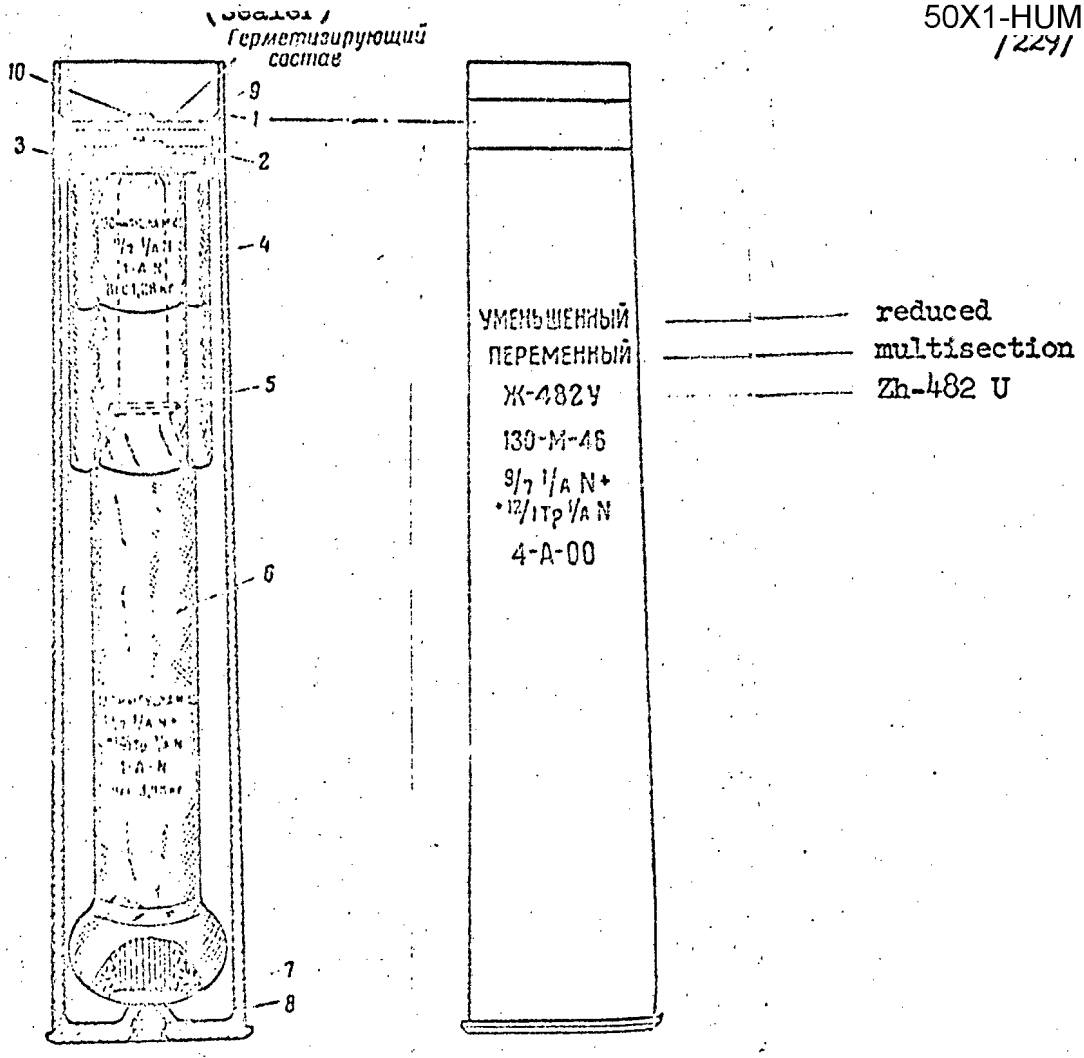


Fig 122. Reduced multisection charge for the M-46 Gun

1. cartridge case
2. standard cover
3. cardboard cylinder
4. equalizing increment
5. decoppering agent
6. main charge packet
7. igniter
8. bottom cup (primer cup)
9. reinforcing cover
10. pull-out string

Design of Charges for the M-46 (130-mm)

Full multisection charge, index ZhN-482 (Fig 121) consists of the base and upper increments (9) and (6) of tubular powder with attached igniters (8) and (12) of black powder, a increment (7) of tubular powder in a bag, and the decoppering agent (5) in the form of a roll of lead wire. Around the lower increment are the powder tubes (11) in random order and the attached flash reducer (10), consisting of sheets of tissue paper coated with a reducer mixture of paraffin, ceresin and petrolatum.

The increment bag has four pockets, each containing one section of the basic reducer and tubular powder. The added increment in the bag is inserted in the cartridge case around the upper center increment.

The powder for all increments is either NDT-3 21/1 nitroglycerin or DG-3 23/1 nitroglycol.

On top of the propellent charge, a cover (4) and a standard cover (2) close the cartridge; in between them is a cardboard cylinder (3). Over the standard cover must be placed a reinforcing cover, over which a special material is poured.

Reduced multisection charge, index Zh-482U, (Fig 122) consists of:

- main packet (6) in a bottle-shaped bag, consisting of an increment of tubular pyroxylin powder 12/1 Tr and ganular pyroxylin powder 9/7 filled in around the increment; /230/

- two equal (balancing) increments in bags (4) containing pyroxylin powder 9/7 which fit over the upper narrow part of the main packet;

- decoppering agent (5) in the form of a coil of lead wire slipped over the upper narrow part of the main packet.

The charge in the case is covered by the cover (4) (Fig 121), a cylinder (3), a normal or standard cover (2) (obturator), and a reinforced cover 9 (Fig 122).

/130/

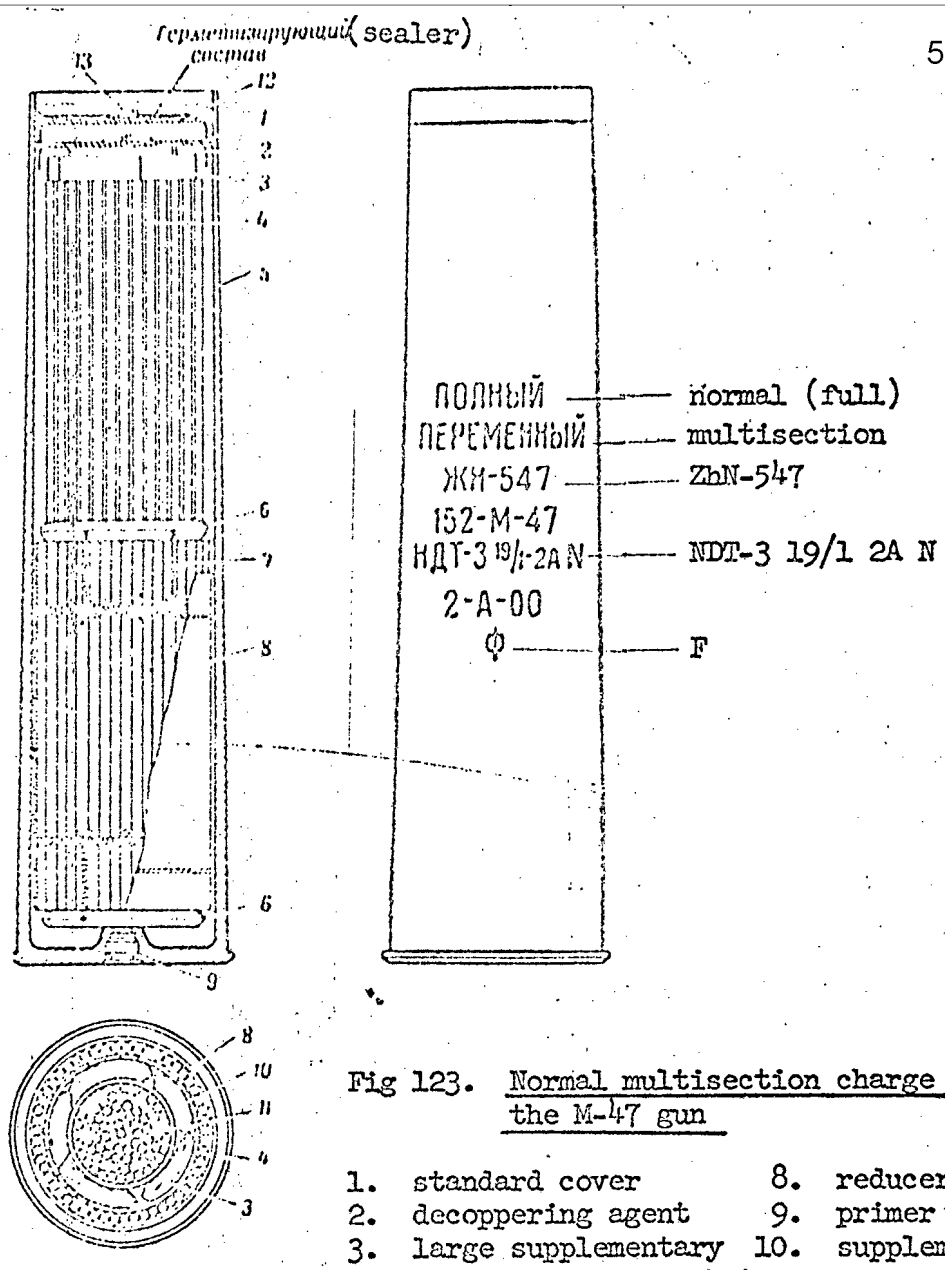


Fig 123. Normal multisection charge for the M-47 gun

1. standard cover
2. decoppering agent
3. large supplementary increment in 3-pocket bag
4. basic reducer
5. case
6. primer
7. lower packet
8. reducer
9. primer cup
10. supplementary increment in 2-pocket red bag
11. center increment
12. reinforcing cover
13. pull-out string

Design of Charges for the M-47 (152-mm gun)

The full multisection charge, index ZhN-547, is a nitroglycerin powder (Fig 123) and consists of:

- a bottom increment, and attached to it, lower and upper igniters (6) and a flash reducer (8) around the increment;
- a central increment (11), resting on the bottom increment;
- a large added increment (3) in a three-pocket bag and the main reducer (4);
- an additional increment (10) in a two-pocket red bag.

The additional increments are put in around the central increment, and the main reducer (4) fits around the additional increments. All increments have tubular, NDT-3 19/1, nitroglycerin powder.

At the top of the charge is a decoppering agent (2) of lead wire. /231/ The charge is closed inside the case by standard cover (1) (obturator) and the reinforcing cover.

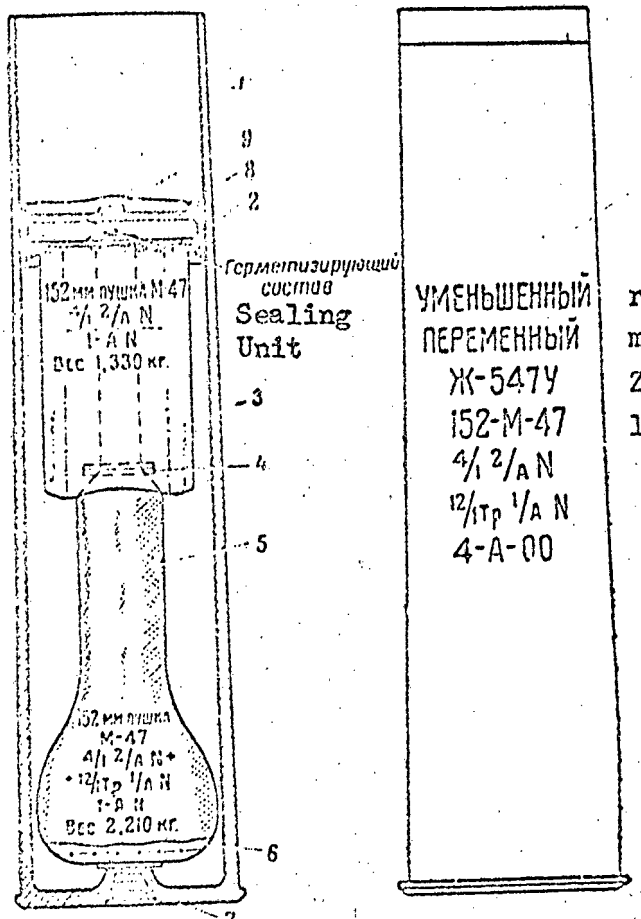
The reduced multisection charge (Fig 124) consists of:

- a main packet (5), bottle shaped, tubular pyroxylin powder 12/1 Tr and granular pyroxylin powder 4/1 in a bag with black powder igniter sewn into the bottom;
- a supplementary increment (3) of granular pyroxylin powder 4/1 in a four-pocket bag, slipped over the narrow part of the main packet;
- a decoppering agent (4) consisting of lead wire slipped over the narrow part of the main packet.

The charge is closed in the cartridge case by a standard cover (2) (obturator) and a reinforcing cover.

/231/

1. case
2. standard cover
3. supplementary increment
4. decoppering agent
5. main packet
6. primer
7. primer cup
8. reinforcing cover
9. pull-out string



reduced multisection
Zh-547 U
152-M-47

Fig 124. Reduced multisection charge for the M-47 gun

Fundamental Data On Charges and Their Preparation /232/ 50X1-HUM

for the M-46 (130-mm) gun

Charge: full (normal)

Projectiles: BR-482 armor-piercing tracer;
OF-482M and OF-482 high-explosive fragmentation

Main charge: lower increment with supplementary tubular powder in random order and flash reducer plus upper central increment in a bag (with four pockets) with basic reducer

Preparation: remove reinforcing cover

Approximate weight: 12.9 kg

Average pressure of powder gases: 3,150 kg/cm^2

Muzzle velocity: 930 meters per second.

Charge: first

Projectiles: high-explosive fragmentation OF-482M, OF-482

Main charge: lower increment with supplementary tubular powder in random order and flash reducer plus upper central increment

Preparation: remove reinforcing cover and supplementary increment in bag (with four pockets)

Approximate weight: 10.9 kg

Average pressure of powder gases: -

Muzzle velocity: 810 m/sec

50X1-HUM

Charge: reduced (second)

Projectiles: high-explosive fragmentation OF-482M and OF-482

Main charge: main packet plus two equal-weight increments

Preparation: remove reinforcing cover

Approximate weight: 6.54 kg

Average pressure of powder gases: 2,700 kg/cm^2

Muzzle velocity: 705 m/sec

Charge: reduced (third)

Projectiles: high-explosive fragmentation OF-482M and OF-482

Main charge: main packet plus one equal-weight increment

Preparation: remove reinforcing cover and one equal-weight increment

Approximate weight: 5.26 kg

Muzzle velocity: 621 m/sec

Charge: reduced (fourth)

Projectiles: high-explosive fragmentation OF-482M and OF-482

Main charge: main packet

Preparation: remove reinforcing cover and two equal-weight increments

Approximate weight: 3.98 kg

Average pressure of powder gases: 1,100 kg/cm^2

Muzzle velocity: 525 m/sec

50X1-HUM

for the M-47 (152-mm) gun /233/

Charge: full (normal)

Projectiles: high-explosive fragmentation OF-547

Main charge: lower increment with igniters and flash reducer plus central increment plus a large supplementary increment with main reducer plus supplementary increment in red bag

Preparation: remove reinforcing cover

Approximate weight: 10.7 kg

Average pressure of powder gases: 2,350 kg/cm^2

Muzzle velocity: 770 m/sec

Charge: first

Projectiles: high-explosive fragmentation OF-547

Main charge: lower increment with igniters and flash reducer plus central increment

Preparation: remove reinforcing cover, supplementary red-bag increment and large supplementary increment with main reducer

Approximate weight: 8.45 kg

Average pressure of powder gases: not less than 1,000 kg/cm^2

Muzzle velocity: 635 m/sec

Charge: special

Projectiles: armor-piercing tracer BR-540B and BR-540 and practice-firing projectile PBR-540

Main charge: lower increment with igniters and reducers plus central increment plus large supplementary increment with main reducer

Preparation: remove reinforcing cover

Approximate weight: 9.84 kg

50X1-HUM

Muzzle velocity: 700 m/sec

Average pressure of powder gases: 2,350 kg/cm^2

Charge: reduced (second)

50X1-HUM

Projectile: high-explosive fragmentation OF-547

Main charge: main packet with igniter plus supplementary increment

Preparation: remove reinforcing cover

Approximate weight: 3.54 kg

Average pressure of powder gases: 2,350 kg/cm^2

Muzzle velocity: 500 m/sec

Charge: reduced (third)

Projectile: high-explosive fragmentation OF-547

Main charge: main packet with igniter

Preparation: remove reinforcing cover and supplementary increment

Approximate weight: 2.21 kg

Average pressure of powder gases: 900 kg/cm^2

Muzzle velocity: 380 m/sec

50X1-HUM

When the first charge for the 130-mm gun (M-46) is being prepared, the decoppering agent, disk, cylinder, and standard cover are put back into the cartridge case. When preparing charges 3 and 4, the cylinder and standard cover are not inserted into the case. When all charges are being prepared for the M-47 (152-mm) gun, the decoppering agent and standard cover are put into the cartridge case as far as they will go. 50X1-HUM

Description of the Auxiliary Components of the Propellent Charge Obturating Devices

An obturating device prevents the possibility of a disturbance of the powder charge during shipping and handling of the rounds and provides a partial obturation of the powder gases during the initial period of motion of the projectile in the tube.

In the charges for the M-46 (130-mm) gun, the obturating device consists of a cardboard disk, a paper cylinder, a cardboard standard cover (obturator) and a cardboard reinforcing cover (Figs 121 and 122).

Full and reduced charges, assembled without the cardboard disk, are available from storage; in these charges, the cylinder is placed between the reinforcing and standard covers.

In charges for the M-47 (152-mm) gun, the obturating device consists of a standard and a reinforcing cover (Figs 123 and 124).

The disk, cylinder and standard cover in 130-mm rounds and the standard cover in the 152-mm rounds provide a compact seating of the charge in the cartridge case and prevent it from dislodging during delivery, handling and loading. A loop of tape (pull-out string) in the center of the disk and in the center of the standard cover is placed there to facilitate the removal of these parts from the case.

The disk, cylinder and standard cover in the 130-mm rounds (full, first and second charges) and the standard cover in the 152-mm rounds (all charges) should always be inside the cartridge case. When charges of the 152-mm rounds are being prepared, the standard cover should always be placed in the cartridge case sideways (edgewise) all the way down tight next to the charge to hold the charge firmly in place. After preparing the charges No 3 and No 4 for the 130-mm M-46 gun, the disk, cylinder and standard cover are not put back into the cartridge case.

The reinforcing cover seals the propellent charge and protects it from atmospheric conditions. The reinforcing cover is inserted into the cartridge case on top of the standard cover, and the sealing compound is poured over the entire surface and along the seam between cover and case. 50X1-HUM

N

When the reinforcing cover is being inserted over the standard cover in the cartridge case, first the loop of tape (pull-out string) should be slipped over it, since it must be used to remove the cover before firing. 50X1-HUM

If supplementary increments need not be removed in preparing a charge, there is no need to remove the reinforcing cover before firing.

Deterrent

The deterrent reduces the erosion of the barrel resulting from the effects of powder gases during firing and, as a consequence, increases its life (main deterrent).

A deterrent is also used to extinguish the flames that might flash back out of the chamber when the breech is opened after firing (flash deterrent or flareback deterrent). /235/

A deterrent consists of a paper backing on which is applied a deterrent compound or mixture made up of ceresin, paraffin and petrolatum.

Decoppering Agent

The decoppering agent is a section of lead wire. It removes the copper formed inside the tube by the deposition of copper from the rotating band.

When the gun is fired, the lead wire melts and deposits in the molten state on the coppered places inside the tube; the powder gases easily remove the alloy of lead and copper.

Means of Igniting the Charges

The bottom-cup primers KV-5(54V027) and KV-5U are used as means of igniting the charges used in the M-46 (130-mm) and M-47 (152-mm) guns.

The KV-5 Bottom Cup

The KV-5 (Fig 125) bottom cup consists of a steel body (1), on the flange face of which are three indentations for a wrench (used to screw the KV-5 bottom cup into the cartridge case), and a brass base plug (2) screwed into the bottom of the body on a mixture of red lead and natural drier. The base plug (2) holds a cup (3) and primer element (4), which is held in place by a brass anvil (5), which is screwed into the base plug. In the upper part of the body of the plug is the obturator-cone (6), made of red copper.

50X1-HUM

/235/

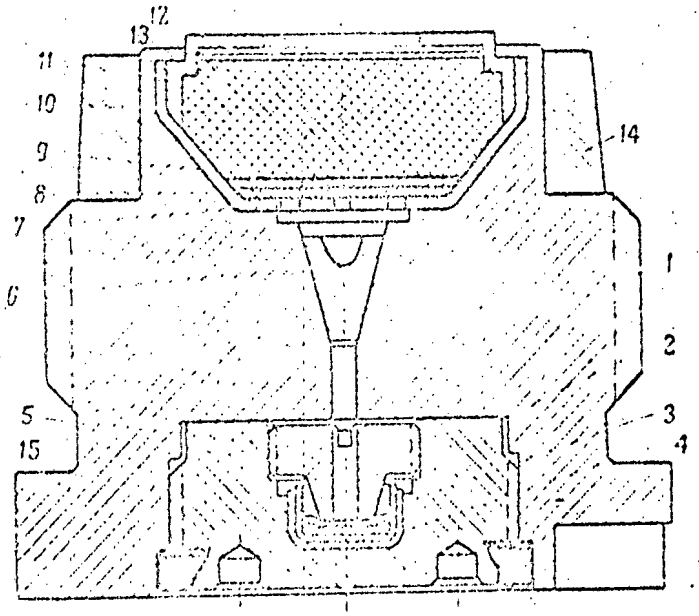


Fig 125. KV-5 Bottom Cup (Primer Cup)

1. body
2. base plug
3. cup
4. primer element
5. anvil
6. obturator cone
7. insert
8. paper cup
9. powder additive
10. petard
11. obturator
12. brass cup
13. parchment cup
14. reinforcing ring
15. lead washer

In the upper part of the plug, beyond the external threads, is an insert (7) with five one-millimeter holes. At the bottom of the insert there is a cup (8) made of tissue paper, and on top of this cup are the powder additive (9) and black powder petard (10). 50X1-HUM /236/

The petard is covered by the copper obturator (11). Between the petard and bottom of the obturator are the brass cup (12) and the parchment cup (13).

The powder petard is outside the external threads; this makes it possible for the bottom cup to be unscrewed and removed from the fuze hole in the cartridge case. For this purpose there is a special reinforcing ring (14), which is pressed on the body of the cup.

Operation of the Bottom Cup KV-5

When the firing pin strikes the bottom of the base plug (2), the primer element (4) explodes against the anvil. The gases generated by the burning primer element raise the obturator cone (6), and the flash ignites the powder additive (9) and the petard (10), both of which, in turn, ignite the powder charge.

The pressure of the powder gases deforms the obturator cone, causing it to press tightly against the hole in the body of the bottom cup, which prevents the possibility of a flareback of powder gases through the base of the bottom cup. The red-copper obturator (11) prevents the flareback of gases between the body of the bottom cup and the fuze hole in the cartridge case.

Normal operation of the bottom cup KV-5 is guaranteed when the base of the cup is not more than 0.3 mm inside the fuze hole in the cartridge case.

In 1955, the design of the KV-5 was improved, and the improved design is now called the KV-5U.

The new KV-5U bottom cup differs from the KV-5 in the design of the igniting elements (primer and anvil) and the design of the obturator.

Packaging of Rounds

The M-46 (130-mm) and M-47 (152-mm) rounds are packed in individual wooden boxes (Figs 126, 127) when received by troop units.

Each box contains one round (cartridge case with charge plus projectile). The projectiles and loaded cartridge cases are held in the boxes by inserts and reinforcing boards, which differ in size and position in the boxes (depending on whether projectile or case is packed in the box). The boxes have covers attached with metal strips 50X1-HUM phonograph-type locks.

The entire box must be kept, since it must be returned to the military warehouse for re-use. 50X1-HUM

Sample markings on boxes and their meanings are given below.

65. Stamping, Stenciling and Marking of Ammunition

Stampings

Rounds and their parts are marked and stamped for recognition.

Stampings are those marks indented in the metal. They consist of combinations of letters, numbers and symbols. Stampings are found on the projectiles, fuzes, cartridge cases and igniting parts.

On the bottom of the body of a high-explosive fragmentation projectile are the number or code of the manufacturing plant, the lot number, year of manufacture of metal bodies, the stamp of the OTK (inspection department) of the factory and stamp of the customer representative (Fig 128).

On the cylindrical part of the projectile is the stamp of the Brinell hardness test, and above it the conventional stamp and the heat number. /238/

The armor-piercing projectiles have the following markings: factory number, heat number and code for year of manufacture on the cylindrical part; the lot number, stamp of factory inspection department and of customer representative on the rotating band; and the number or mark of the factory, heat number, code for year of manufacture, stamp of the inspection department and of customer representative on the base.

On the base of the cartridge case are the lot number, code for year of manufacture, number or code of factory, stamp of inspection department and of customer representative (Fig 128).

On the base of the primer cup or bottom cup are the type of cup, number or code of the machine shop, lot number and code for year of manufacture (Fig 128).

On fuzes the stamped markings are the number or code of the manufacturing plant, lot number, code for year of manufacture and type of fuze (Fig 128).

In the nose fuzes, the stamping is done on the outside lower part of the body cone; on the base fuze with tracer, the stamping is on the lower face of the flange on the body above the thread under the tracer nut. /239/

50X1-HUM

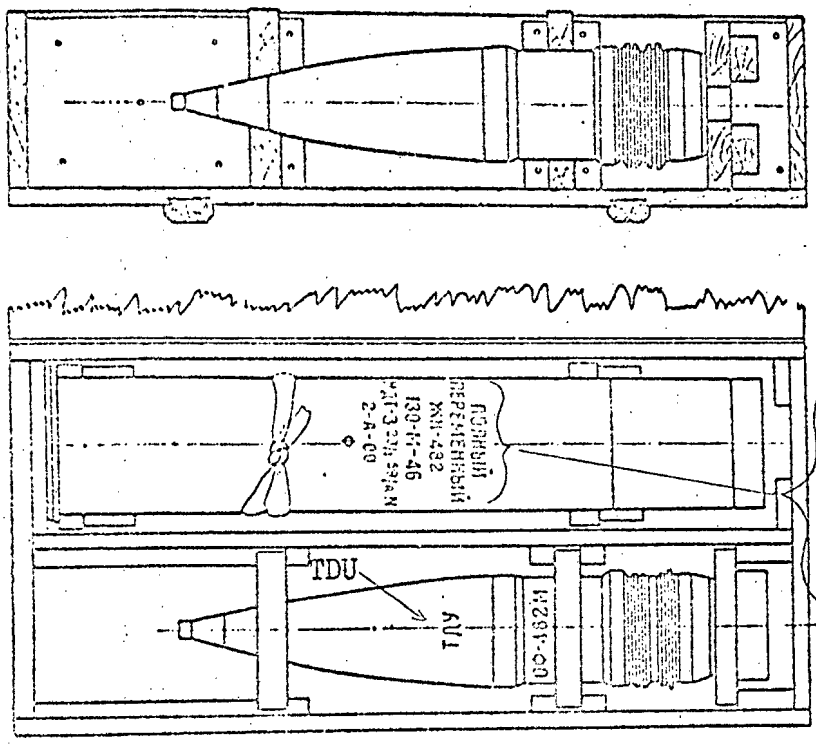


Fig 126. Method of Boxing 130-mm High-Explosive Fragmentation Shell [and cartridge case containing normal charge]

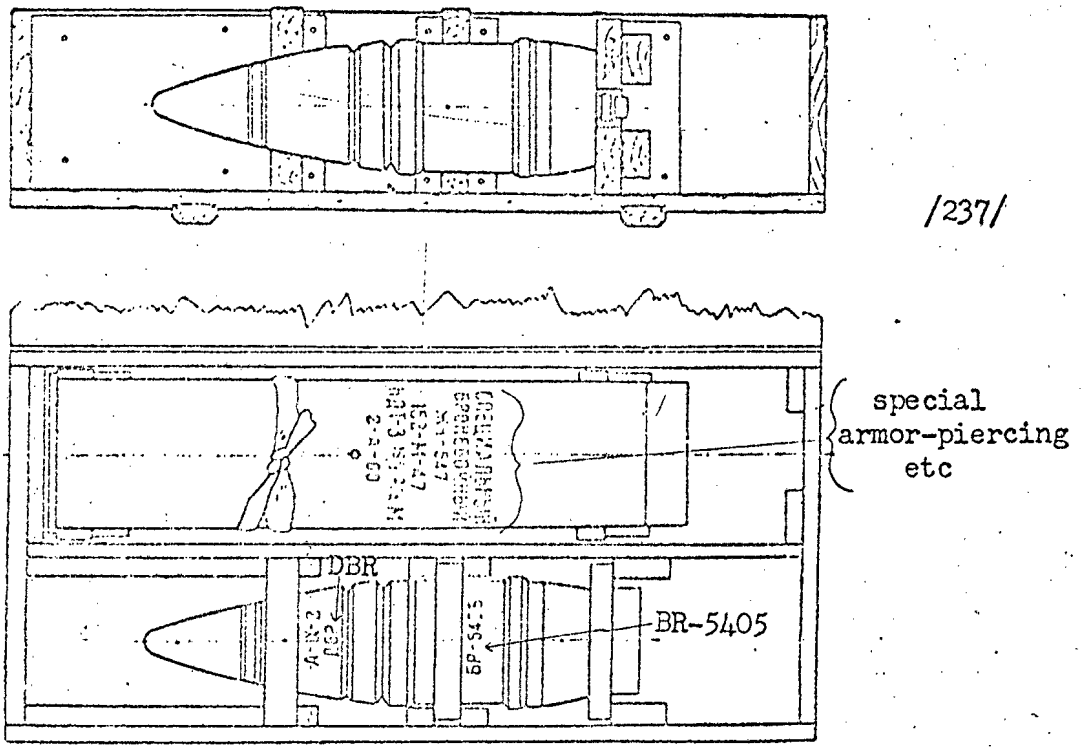


Fig 127. Method of Boxing 152-mm Armor-Piercing Tracer Projectiles
[and cartridge case containing special charge]

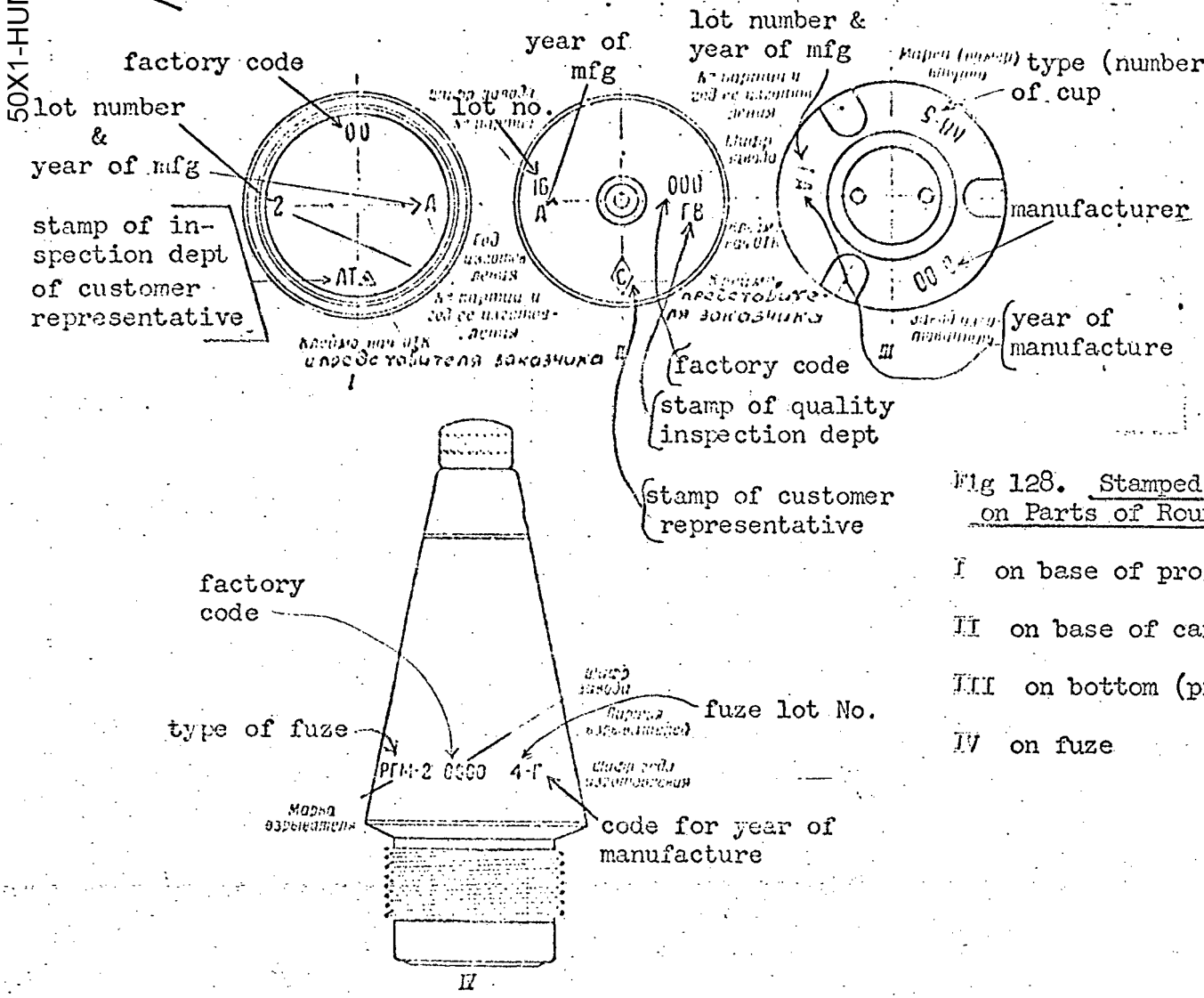


Fig 128. Stamped Markings on Parts of Round

I on base of projectile

II on base of cartridge case

III on bottom (primer) cup

IV on fuze

The shops where ammunition is prepared for use stamp only the high-explosive fragmentation shells in order to indicate the code for the explosive used (emergency double stamping for the case where one stamping might be obliterated). This stamping is on the cylindrical part of the body on the side opposite the marking for the Brinell hardness test.

Ammunition parts also have additional stampings made by the technological inspectors; these stampings are much smaller in size than the ordinary or main stampings.

Markings

Markings are symbols and abbreviated inscriptions marked in red on projectiles, cartridge cases, charges (on powder increments) and on packings.

The marking on the parts of the projectiles and packings are applied at powder factories, shops where ammunition is prepared, military arsenals and military bases.

1. Projectiles are marked as follows:

- on one side, the code of the shop that prepared the ammunition, lot number and code for year of preparation (on the ogive), caliber and symbol for weight of projectile (on cylindrical part);

- on the other side, the code for the explosive for high-explosive fragmentation shells, the code for the explosive and type of fuze for the armor-piercing projectile (on the ogive) and the index of the projectile (on cylindrical part).

2. On the body of the cartridge case containing the charge are the marking indicating the designation of the charge (normal multisection or reduced multisection), abbreviated index of charge, caliber and code of system, type of powder, lot number (numerator), code for year of preparation of the powder (denominator), code of powder factory, lot number, manufacturer's part number for charges, code for year of manufacture of charges and code of deterrent (for charges with deterrents).

3. On the increments or packets of the charge, the marking indicates the designation of the system, type of powder, number (numerator) and code for year of preparation (denominator) of the powder, code of the powder factory, lot number, code for year of manufacture of charges and code for the manufacturing plant, and weight of powder per increment.

4. On a packing box containing a round, the marking indica[illegible] 50X1-HUM

- on the cover of the box, the group symbol for hazard and unloading of freight;

- on the left front of box (for high-explosive fragmentation only) the marking "ok. snar.," which means that the round is in the final form ready for use and that no supplementary elements are required, as well as the type of fuze, factory code, lot number and code for year of manufacture of the fuze, code for year of manufacture and code of military supply depot where rounds were assembled;

- in the center front of box, the caliber of projectile, code of system, type of projectile (high-explosive fragmentation or armor-piercing), number of rounds in box, weight symbol for projectile and weight of box plus round or rounds;

- on the right front of box, designation of charge (normal multisection or reduced multisection), type of powder, lot number, code for year of powder manufacture and code for powder manufacturing plant, lot of rounds, code for year of assemblage and code of arsenal (base) that assembled the rounds; the [Russian] letter "f" (ф) is present, if the charge has a deterrent;

- on left side of box, the type of bottom cup, lot number, factory code and code for year of manufacture of the bottom cup; /240/

- on right side of box, abbreviated index of projectile, code of the facility that prepared the round for use, preparation lot number, code for the year of assembly and code for the ammunition.

On boxes containing armor-piercing tracer projectiles in ready for use form, the code "ОКСИ" (OKSI) [OXY] and the type of fuze are marked below the code for the ammunition.

Samples of the markings on projectiles, cartridge cases, charges and packing boxes are given in Figs 122, 123, 124, 125, 130, 131, 132, 133 and in the diagram given below.

50X1-HUM

50X1-HUM

/240/

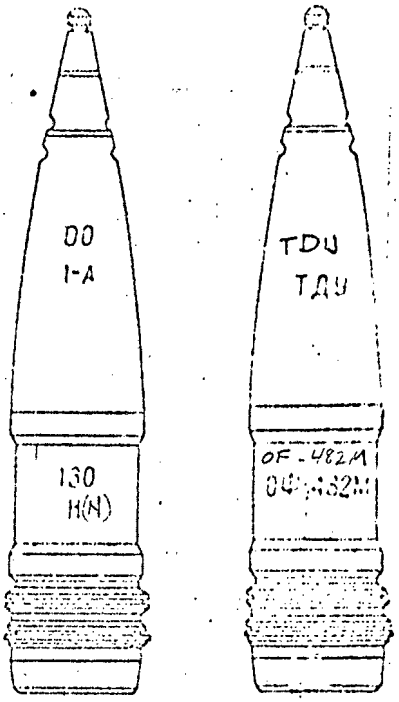


Fig 129. Markings On the 130-mm High-Explosive Fragmentation Shell

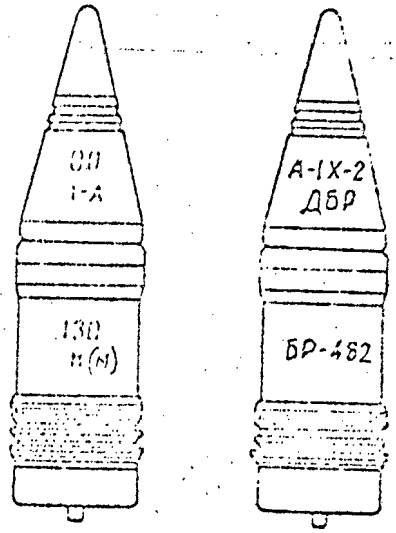
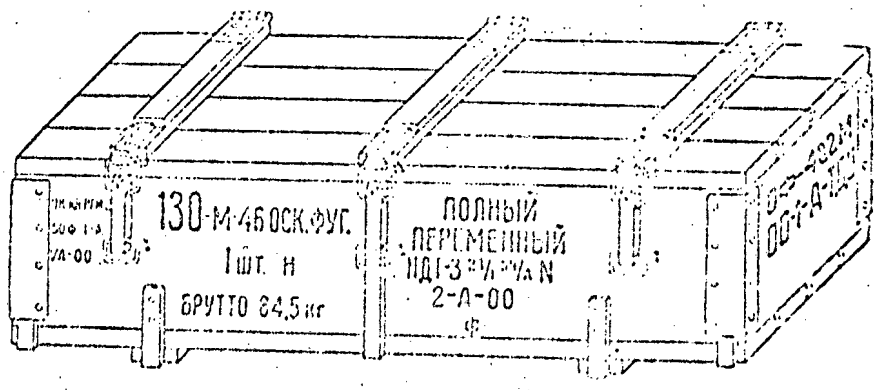


Fig 130. Markings on the 130-mm Armor-Piercing Tracer Projectile

50X1-HUM

No For

50X1-HUM
/241/



0F-482M

— 00-1-TDU

Fig 131. Markings on Box for the 130-mm Round for the M-46 Gun

OK km RGM (fuze)

50 F-I-A

VA-00

130-m-46 OSK.FUG. (high-expl)

1 Sht H (wgt symb) (number or rounds)

brutto 84.5 kg (gross wgt)

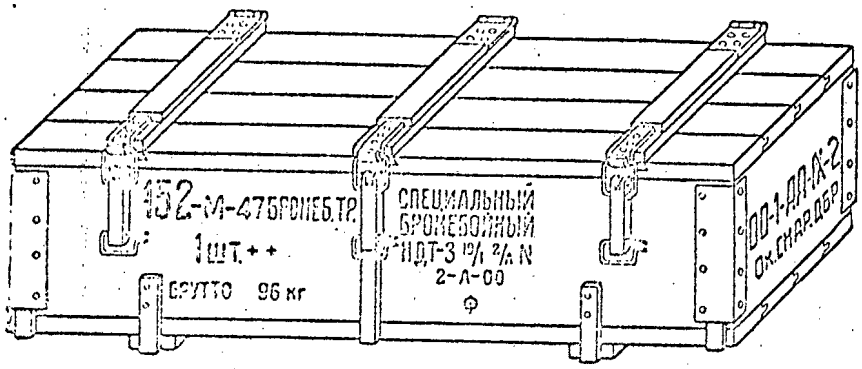
polnyy (full)

peremennyy (multisection)

NDT-3 23/1 59/A N (powder)

2-A-00

f (deterrent)



00-1-AA-IX-2

OK.SNAR. DBR

Fig 132. Markings on Box for the 152-mm Round for the M-47 Gun

152-M-47 broneb.tr. (armor-p. tracer)

1 Sht + +

brutto 96 kg

spetsial'nyy (special)

broneboynyy (armor-piercing)

NDT-3 19/1 2/A N

2-A-00

f

50X1-HUM

/241/

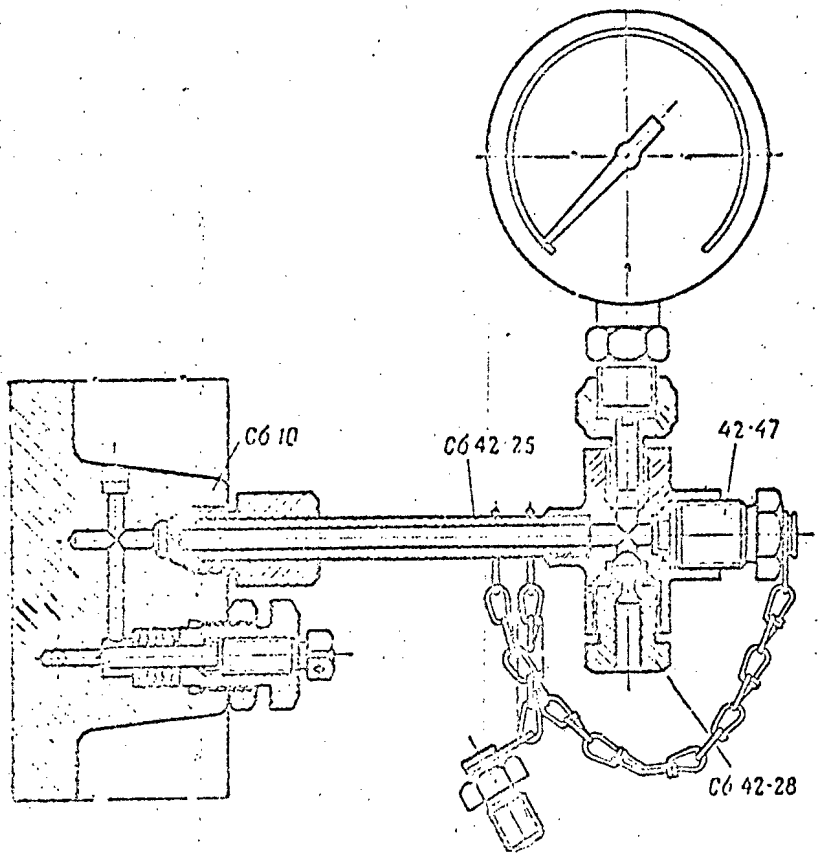


Fig 133. Testing the Pressure in the Counterrecoil System

Sb-10 - counterrecoil system

Sb 42-25 - inflating device plus manometer

Sb 42-28 - plug

42-47 - plug

Place of Marking	Marking	Meaning of Marking
On HE Fragmentation Shells (Fig. 120)		
On one side of the shell body: the nose part	00	00 - number of the supplier (ammunition) plant
	1-A	1 - lot number of the ammunition A - code for the year manufactured
on the cylindrical part	130	130 - caliber of the shell
	11	11 - weight-zone marking
On the other side of the shell body: the nose part	TDU	TDU - code for the explosive
On the cylindrical part	OF-482M	OF-482M abreviated designation of the shell model
On Armor-Piercing Tracer Shells (Fig. 130)		
On one side of the shell body: the nose part	00	00 - number of the supplier (ammunition) plant
	1-A	1 - lot number of the shells A - code for the year manufactured
on the cylindrical part	130	130 - caliber of the shell
	11	11 - weight-zone marking
On the other side of the shell body: the nose part	A-1X-2	A-1X-2 - code for the explosive
On cylindrical part:	DBR BR-482	DBR - type BR-482 - abreviated designation of the shell model

On the Shell Case

50X1-HUM

Full Multisection Charge
(Fig. 123)

On the side surface of the shell/case	"Polnyy peremennyy"	"full (normal) multisection" (designation of the charge)
	ZhN-547	ZhN-547 type of charge
	152-M-47	152-M-47 - caliber and system code with which this charge could be used
	NDT-3 19/1 2AN	NDT-3 19/1 - grade of powder 2 - lot of the powder A - code for the year of manufacturing N - code for the powder plant
	2-A-00	2 - assembly number of the charge A - code for the assembly year 00 - number of depot that assembled the charge
	F	F - code for the deterrent

[243]

Reduced Multisection Charge
(Fig. 122)

On the side of the shell case	"Umen'shennyy peremennyy"	"reduced multisection" (type of charge)
	Zh-482U	Zh-482U - abreviated designation of charge type
	130-M-46	130-M-46 - caliber and code of system with which this charge is used
	9/7 1/A N+	9/7 and 12/1 Tr-grade of powder
	12/1 Tr1/AN	1 = powder lot A - code for the year

50X1-HUM

	4 - A-00	N - code for the powder manufacturing plant 4 - lot number of round A - code for the year of round assembly 00 - number of the depot that assembled the round
On increment or packet	130-mm "Pushka" M-46	Name of the system in which the increment is used in the charge
	9/7 1/A N 1 - A - N	9/7 - grade of powder 1 - powder lot A - code for the year of powder manufacture N - code of the powder manufacturing plant
	Ves 1.28 kg	Weight 1.28 kg - weight of powder in an increment

On the Packing Box

For HE Fragmentation Shells
(Fig. 131)

On the front side	OkSi RGM-2 00-0-1-A V-A-00	130-M-46 Oks. fug. 1 sht N 84.5 kg brutto	polnyy peremennyy NDT-323/1 59/A N 2-A-00 F

Meaning of the Markings

OkSiRGM-2 - HE fragmentation, with fuze PGM-2
00-0 - fuze manufacturing plant
1 - lot of the fuzes
A - code of the year of fuze manufacture
V-A - month and code of the year of final assembly of the round
00 - number of the depot where the round was finally assembled
130 - M - 46 - caliber and code of the system
oks. fug. - HE fragmentation (projectile) [244]
1 sht 11 - number (1) of rounds in the box and weight-zone marking (11)
brutto 84.5 - gross weight of the box with the round
polnyy peremennyy - "full multisection" (type of the charge)
NDT-3 23/1 - grade of the powder
59/A N - lot, code of the year of manufacture and code of the powder plant
2-A-00 - lot, code of the year of round assembly and of assembly (No. of the depot)
F - code for the deterrent

	Marking	Meaning of the Marking
On the Right End side	OF-482M	OF-482M-abbreviated designation of the shell model
	00-1-A-TDU	00 - number or code of the ammunition plant 1 - ammunition lot number A - code for the year of ammunition manufacture TDU - code for the explosive

50X1-HUM

Painting

The body of the 130-mm and 152-mm, HE fragmentation and armor-piercing tracer shells, except for the bourrelet and rotating band, is coated with protective drab-gray paint. The bourrelet and rotating band are coated with varnish. Other parts of the round are not coated.

During war time the rounds are not painted.

Meaning of the Weight Zone Markings

Weight Zone Marking	Deviation of the Charge Weight from Normal
- - - -	Lighter by 2 1/3 to 3%
- - -	" " 1 2/3 to 2 1/3%
- -	" " 1 - 1 2/3%
-	" " 1/3 to 1%
N	" " Lighter or heavier by 1/3% (of normal weight)
+	Heavier by 1/3 to 1%
+ +	" " 1 to 1 2/3%
+ + +	" " 1 2/3 to 2 1/3%
+ + + +	" " 2 1/3 to 3%

The weight zone marking is placed on the cylindrical part of the shell body in black paint and, also, is stamped on the rotating band.

66. Handling of Ammunition at the Firing Position

General Instructions for Handling the Ammunition

50X1-HUM

Prior to Firing

The rounds with HE fragmentation and armor-piercing tracer projectiles should be supplied to the battery in finally assembled form packed in wooden boxes. 50X1-HUM

Unloading of the ammunition boxes should be carried out in a very careful manner. [245]

Throwing boxes from vehicles is strictly forbidden.

Preparation of the ammunition on the firing position involves examining, sorting and readying for loading.

In checking the ammunition by the markings placed on the boxes, assertain the kind of rounds (HE fragmentation, armor-piercing tracer or practice shells) and the type of gun they are intended for.

Make certain that the ammunition does not contain rounds which are not indicated in the firing tables.

Disclosure of ammunition not indicated in the firing tables should be immediately reported to the command.

At the firing position the rounds should be sorted into groups on the basis of their application (HE fragmentation, armor-piercing or practice), on the basis of their charge (full, variable or reduced variable, on the basis of their fuze (if identical rounds are assembled with different fuzes), and on the basis of weight zone marking. To reduce scattering of projectiles during firing, each firing should be carried out with rounds in each group on the basis of their lots.

The round markings prepared for firing are recorded on standard blank forms; behavior of the ammunition during firing is also recorded.

Only by careful sorting of ammunition and proper recording in the blank forms is it possible to identify the lot of rounds which exhibit abnormal behavior.

At the firing position, the ammunition should be stored in dry cellars, ditches or recesses; the bottom row of ammunition boxes should be placed on blocks.

The ammunition dump should be well protected from bullets or fragments of projectiles or bombs.

The rounds ready for firing should be carefully wiped with a rag to remove grease and dirt but without removing the markings; store the rounds either in boxes or on canvas. Setting a shell on its base is strictly forbidden.

The rounds should be protected with canvas from rain, snow, sun or dust. 50X1-HUM

The following rounds should not be fired:

50X1-HUM

-- if fuzes have deep dents and torn diaphragms;

-- rounds without markings, or with shell cases having cracks on their cylindrical part or the base (shell cases with small cracks at their neck may be fired);

-- rounds where the explosive is leaking from an opening under the fuse, with cracks in the shell body, without markings, with torn or highly dented rotating band, with improperly screwed on bases or primer cups.

If some rounds have improperly screwed nose fuzes or primer cups, they should be properly screwed in accordance with instructions on how to bring the round into final firing condition. If such corrections cannot be made on the site, the rounds should be returned to the warehouse.

The primer cup in the 130-mm rounds may be recessed to a depth not exceeding 0.3 mm and not more than 0.5 mm in the 152-mm rounds. [246]

The primer cup should be screwed into the individual rounds at a distance of at lease 30 meters from the ammunition dump.

Disassembling fuzes or repairing their individual parts is strictly forbidden.

During Firing

Each shell should be wiped with a rag prior to loading into a gun so as to prevent soiling the loading chamber and the bore, which might subsequently result in malfunctioning of the gun.

Handle the rounds carefully during firing -- don't drop or hit them.

Prior to firing, see that the muzzle cover is removed, that the bore is free of foreign matter, such as sand, twigs, lubricant, etc. If the bore has some foreign matter, remove it.

Immediately prior to loading, remove the reenforcing cover, unscrew the safety cup and set the fuse. In making up the multisection charge place back into the shell case the standard cover, the cylinder and the disk for No 1 charge of the 130-mm gun (M-46), and place back the standard cover for charges of the 152-mm gun (M-47). In making up charges No 3 and 4 for the 130-mm gun (M-46), do not replace the disk, cylinder and standard cover in the shell case.

In loading the gun, be careful not to hit the nose fuze against the breech, because this may damage the fuze diaphragm.

50X1-HUM

A round that has been dropped or struck against the breech should be set aside; such a round can be used only after inspection and approval by

an artillery mechanic. The ammunition should not be dropped or subjected to impacts.

The shells should be inserted into the gun chamber in such a manner that the greatest effort of pushing will be at the end of the stroke; this will ensure proper seating of the shell base in the breech. If the shell is properly seated, it will not slide back at any elevation of the barrel. Improper seating of the shell may lead to abnormal flight (shearing-off of the rotating band and falling-short of the projectile).

In case of misfire (after two or three releases of the firing pin), the shell should be left for one or two minutes in the gun after which it can be carefully removed with its misfired primer cup; for further firing insert a new shell.

Replacement of the misfired primer cup should be carried out at a distance of at least 30 meters from the place of ammunition storage.

A round should never be kept for more than three minutes in a hot barrel.

The firing should be conducted with the smallest charge needed to attain the desired range; this will prevent the premature wear of the bore. Firing in strong rain with fuzes V-429 or RGM-2 set for fragmentation (the cap is screwed off) is not permitted, because the impact of the fuze with rain drops can cause a premature explosion while the projectile is still in its trajectory.

For this reason, firing in heavy rain should be carried out with caps screwed on.

After Firing. [247]

If the gun is left loaded after firing it can be discharged only by firing. It is forbidden to transport loaded guns. If, after firing, some rounds are left with fuzes from which the caps were removed and with charges from which the reenforcing covers were removed, then screw the caps back on and replace the reenforcing covers. Fill the clearance between the reenforcing cover and shell case with the petrolatum remaining on the cover.

Reset the fuze from "Z" back to setting "0".

Return the projectiles with the shells to the packing boxes.

Put the unused auxiliary charge increments, empty shell cases, fuzes with caps and reenforcing covers into packing boxes and deliver to the ammunition warehouse.

Any irregular behavior of the ammunition or damage to the gun must be reported immediately by the company commanders to the Ammunition Administration.

50X1-HUM

Such a report should include all details on the firing conditions under which the irregular performance of various components of the round was observed, as well as the lot number, year of manufacture, code of the manufacturing plant and other markings on the shell case.

50X1-HUM

COMBAT SERVICE OF THE 130-mm M-46 AND 152-mm M-47 GUNS

CHAPTER 14

PREPARATION OF THE GUN FOR FIRING AND TRAVELING

67. General Instructions

A gun in service must be kept in good working order and in readiness for rapid combat use.

Combat readiness is determined by the presence and reliable attachment of all parts, the working order of all mechanisms, and the presence of prescribed spare parts, tools, and accessories.

Preparation of the gun for firing and traveling comprises:

— examining the gun and checking the operation of the mechanisms;
— checking the counter recoil mechanisms;
— checking the sight attachments.

The gun is inspected and prepared for firing under the supervision of the gun platoon captain. The artillery mechanic and armorer should be present when inspecting and preparing the weapon, as well as when correcting any malfunctions which are noted.

The condition of the material portion of the weapon is the responsibility of the enlisted men, non-commissioned officers, and officers to whom these duties are entrusted.

68. Inspection of the Gun and Limber and Checking the Operation of the Mechanisms

Inspection of the gun and checking the operation of the mechanisms before firing and traveling are carried out in the following sequence:

1. Inspection of the barrel.
2. Inspection of the breech.
3. Inspection of the cradle and counter recoil mechanisms.
4. Inspection of the top carriage, shield assembly of the aiming mechanism, and the equilibrator.
5. Inspection of the bottom carriage, drive parts, trails, jack, and winch.
6. Inspection of the limber.
7. Inspection of the spare parts set, tools, and accessor

Inspection of the Barrel

1. Inspect the outside of the barrel and ascertain that there are no cracks, bulges, or other defects. The outside of the barrel should be clean and well painted in those places where it is attached; [249] the unpainted parts of the barrel should also be clean and without rust; in addition, they should be well oiled.

2. Ascertain that the sliding lock in the breech ring is turned as far as it will go and the safety lock on the block fits into the groove of the sliding lock.

3. Ascertain that the muzzle brake is screwed on as far as it will go and the bolts on it are in place and secured with a wire.

Test the muzzle brake by hand and ascertain that it will not come loose.

4. Wipe the master plane of the barrel with a clean rag and ascertain that there are no nicks, scratches, or rust on it.

5. Remove the breech block and wipe the bore and breech block groove

6. Inspect the bore and ascertain that there are no cracks, bulges, or other defects, as well as dirt, rust, grit, or hard particles which could damage the rifling of the barrel during firing.

7. Inspect the breech block groove and ascertain that it has no defects, nicks, or scratches.

Dismantle the breech, wipe all parts, and inspect them and lubricate them with a thin layer of grease.

Test the breech mechanisms and ascertain that they are in good working order. The operation of the breech mechanisms is checked in the following sequence:

Inspection of the Striker Mechanism

The inspection is made as follows:

— inspect the intermediate cocking lever of the striker spindle, at the same time checking to see that the lever turns freely; the spring should return it to its original position;

— check the emergence of the firing pin with the aid of gauge 42-61 by placing the striker spindle in the central recess of the block and pushing it into the forward position; holding back the striker spindle, measure the emergence of the pin beyond the surface of the block with the gauge; this distance should be from 2.3 to 2.7 mm;

— check the operation of the striker mechanism by putting in place all the parts of the mechanism in the breech block and pressing the cocking lever, causing [the mechanism] to fire; after firing, the parts

should all return to their original positions. The striker mechanism should operate properly and without jamming. 50X1-HUM

For the following checks of the other breech mechanisms, assemble the breech completely and install it in the breech ring.

Inspection of the Locking Mechanism

In a properly operating breech, the movement of the block along the groove in the breech ring, the rotation of the lever, the sliding of the lever pawl in the groove, and the action of all other parts of the locking mechanism should take place smoothly, without appreciable friction between adjacent surfaces.

The force on the lever to open the breech should not exceed 15 kg. The lug on the lever safety lock should completely engage the catch on the breech ring without pressure on the cap from beneath, and the lever should not disengage from the breech ring and open the breech.

The lug on the lever safety lock should disengage easily from the catch on the breech ring by pressure on the cap.

Inspection of the Extractor Mechanism [250]

Open the breech slowly and check to see whether the extractor lugs move back.

During the inspection of the extractor mechanism, check to see whether there are any nicks, scratches, or other damage to the parts.

Inspection of the Safety Device for Premature Firing

The safety device for premature firing must guarantee a reliable linkage of the breech mechanism lever with the breech ring before firing.

The operation of the safety device is considered satisfactory if, at the time the breech is not fully closed (breech mechanism lever not engaged with the breech ring), the breech mechanism lever at once engages the breech ring, and the striker spindle fires (or does not fire) when the firing push rod is pressed.

Inspection of the Inertial Safety Device

The inertial safety device and catch should move in their seats without jamming. When the safety device with the release is pressed. it should remain in the depressed position. 50X1-HUM

The safety catch should go into the groove on the breech ring and should not hinder the opening of the breech block. 50X1-HUM

When the block is shut, the inertial safety device should slip into the notch on the breech ring.

The release of the inertial safety device should ensure the disengagement of the device.

Inspection of the Projectile Retainer

When the breech is closed with the cartridge case seated in the chamber of the barrel, the projectile retainer should pass under the breech-operating cam.

When the breech is closed without the cartridge case, the projectile retainer should be in the upper position. After the retainer is depressed, its spring should cause it to return to the upper position.

Inspection of the Cradle

When inspecting the cradle, check to see whether there are cracks in the trunnion casing and cut-off gear actuating collar of the cradle; also ensure that there is not excessive play between the recoil indicator and its guides. The recoil indicator should move freely but with sufficient resistance to inertia to prevent its movement during firing.

Check to see that the buffer is properly connected to the cradle. The screw holding the buffer should be put in as far as it will go and secured with a lock nut. Verify that the double-armed lever is properly secured.

The double-armed lever should not move out of the groove for the cam guide. The distance between the centers of the tops of the double-armed and upper levers should be equal to 140 mm.

Inspection of the Recoil System

Ensure that the recoil piston rod is properly connected to the barrel and that there is no leakage of liquid. Check the operation of the mechanism for varying the length of recoil — when the barrel is being elevated, the throttling bar should turn easily and smoothly (without jerking).

Note whether the marks on the end of the piston rod and the end of the piston rod nut coincide with those on the buffer. [25]50X1-HUM

Check the amount of liquid in the recoil system as indicated below.

50X1-HUM

Inspection of the Counterrecoil Mechanism

Check the amount of liquid and pressure in the counterrecoil mechanism (the procedure is described in paragraph 69 "Checking the Counterrecoil Mechanisms").

Check for leaks through the packing of the piston rod and piston.

Check that the counterrecoil mechanism is reliably fastened to the barrel and its piston rod is in the yoke of the cradle.

Checking the Elevating Mechanism and Equilibrator

The condition of the elevating and equilibrator mechanisms is checked by operating the elevating mechanism; if the elevating mechanism operates smoothly, both mechanisms are in good working order.

The force on the handwheel must be no greater than 10 kg.

Free play in the handwheel must not exceed 5/8 of a turn of the handwheel.

Inspect the hinges of the elevating mechanism drive and make sure that they are in good working order.

Note whether the drive housings of the elevating mechanism are securely fastened.

Wipe off the driving gear and elevating arc and inspect the teeth for nicks and scratches which might hinder the operation of the mechanism. The elevating mechanism must operate smoothly and without jerking. Lubricate the gear and arc with a uniform layer of gun grease.

Check that the equilibrator mechanism is in adjustment. For this purpose, use the following as a guide.

If the force on the handwheel of the elevating mechanism is great when elevating the gun barrel, the pressure in the equilibrator mechanism is low; if the force is great when lowering the barrel, the pressure is high. Check the pressure in the cylinder; note whether the tubes are properly connected.

Examine the chrome-plated surfaces of the internal cylinders (pistons) of the equilibrator mechanism and be sure that they are in good condition. Lubrication of these surfaces with gun grease is forbidden, since the penetration of viscous gun grease under the rubber collar of 50X1-HUM equilibrator mechanism may cause the collar to separate from the surface of the cylinder and permit leakage of air from the equilibrator mechanism.

The exposed surfaces of the pistons of the equilibrator mechanism may be lubricated with gun grease only when storing the gun outdoors. 50X1-HUM

Inspection of the Traversing Mechanism

Examine the handwheel of the traversing mechanism, the shaft, and the drive couplings and make sure they are in good working order. Check that the housing of the traversing mechanism is securely attached.

Check that the parts of the mechanism move smoothly and that the force required on the handwheel is not too great. This force must be not more than 7 kg when the weapon is on flat ground.

Free play in the handwheel must not exceed 7/8 of a turn of the handwheel. [252]

Make sure there are no defects in the arc of the traversing mechanism and that it is securely fastened.

Inspection of the Top Carriage

Examine the top carriage and note any damage.

Special attention should be devoted to the condition of the reinforcing ribs in checking for cracks. Check the condition of the welded seams.

Check that the clamp rings of the top carriage are tightly fastened.

Make sure that the top carriage is securely attached to the bottom.

Check the bolts holding the tube support and the operation of the stop fastening the top carriage to the bottom; inspect the slide way.

Inspection of the Bottom Carriage, Trails, Wheels, Jack, Winch, and Wheel Brake

During inspection, particular attention should be devoted to the condition of the parts of the suspension, the wheels, and the wheel brake; check that the weapon is securely attached in the traveling position and that the equipments transported with the weapon are firmly attached.

Inspection is carried out in the following order: 50X1-HUM

1. Check how the suspension is disengaged when the trails are spread; and check the engagement of the trail locks in the firing position.

2. Examine the balancers, levers, and other parts of the suspension and make sure they are in good working order.

50X1-HUM

3. Examine the wheels and note whether the tires are in good condition; note whether there is grease in the wheel grease cups.

4. Check that the spread trails are reliably fastened with the tie bolt.

5. Examine the hinged clamps on the trails for the cradle and the supports for the breech ring. Check the engagement and disengagement of the lock on the trail for holding the breech ring.

6. Examine the winch and chain used to move the tube into and out of the traveling position; the winch mechanism must operate smoothly with a force of not more than 25 kg when winching the tube.

7. Check the operation of the jacks and the amount of liquid in them.

8. Examine the spades and check their attachment to the trails.

9. Inspect the accessories which are transported with the gun, and verify their good working order and that they are securely attached to the trails.

10. Check the operation of the pneumatic and manual control of the wheel brake.

Inspection of the Limber

When inspecting the limber it is necessary to determine the condition of its moving parts and to verify that the limber pin is reliably connected to the drawbar of the cradle and the limber device is in good working order.

When inspecting the limber device, make sure that the spring-fitted connecting eye 78 (Fig. 103) used in transporting the weapon behind AT-T prime movers is in place, and when transporting behind AT-S prime movers, the regular connecting eye 11 should be in place.

The inspection is carried out in the following order: [253]

1. Examine the wheels and note whether the tires are in good condition and that there is sufficient grease in the wheels.

2. Check the attachment of the frame to the limber axles.

3. Check the limber device and make sure it is securely 50X1-HUM to the axle of the limber.

4. Check that the lower nut on the limber pintle is secure and that the pneumatic brake hoses and electrical wiring for the lights are in good condition. 50X1-HUM

Inspection of Spare Parts, Tools, and Accessories

When inspecting the spare parts, tools, and accessories, note that all parts are present and in good repair and that they are properly stowed, and safe for storage or transport.

69. Checking the Counterrecoil Devices and Adjusting the Equilibrator

Checking the Counterrecoil Devices

An insufficient or excessive amount of liquid in the recuperator, as well as insufficient or excessive pressure (above the limits noted below) leads to abnormal operation of the counterrecoil devices in general and may lead to a breakdown.

Normally, the recuperator should contain 21.6 ± 1 liters steol-M at an air pressure of 56 ± 2 atm.

If it is found that the liquid and pressure in the counterrecoil mechanism are not within normal limits, this should be corrected.

Determining the Pressure in the Recuperator (Fig. 133)

To determine the pressure in the recuperator it is necessary to:

1. With wrench Sb-42-49, unscrew plug 48 (Fig. 28) of the recuperator filler receptacle.

2. Screw filler device Sb-42-25 into the receptacle.

3. Screw the pressure gage into the opening of the cross piece of the device.

4. Screw plug 42-74 (Fig. 133) into the device in place of cap 42-83 (Fig 36).

5. Give the barrel a maximum angle of depression and open valve 51 (Fig. 36) with wrench Sb-42-49 approximately one half turn.

6. Read the pressure according to the pointer on the scale of the pressure gage. 50X1-HUM

7. Fully close valve 51 with wrench Sb-42-49.

8.

9. Unscrew the device from the recuperator receptacle.

50X1-HUM

10. Create a hydraulic lock, as explained below in the section "Reducing Fluid and Air in the Recuperator."

11. Close the receptacle with the plug.

As a rule, pressure in the recuperator is determined before each firing and periodically every ten days for all weapons stored outdoors. The periodic pressure check is necessary, since pressure loss is possible as a result a leakage of fluid through the packing and piston. When air [254] leaks from the recuperator, the barrel will not be supported by the system and may slide back when elevated, which may result in accidents and damage of material.

Determining the Amount of Fluid in the Recuperator

The amount of fluid in the recuperator may be determined by artificial recoil or by using the inspection hole.

The artificial recoil method is used to determine the amount of fluid in the recuperator after each overhaul of the weapon and each time the amount of fluid is changed in the system.

The inspection hole is used to determine the amount of fluid during the daily check of the fluid level before firing.

Determining the Amount of Fluid in the Recuperator

by the Artificial-Recoil Method

1. Place the hydro-pneumatic pump 52-035 (Fig. 134) on the right trail (in place for the bore brush storage box) and, with wrenches A52830-4 and A52830-5, connect its hose Sb21 to the regulating bolt of the recuperator, having first disconnected nipple 48 and connecting pipe Sb20 (Fig. 135).

2. With wrench A52830-5, screw instrument Sb-42-25 with pressure gage (Fig. 134) for filling the recoil brake with fluid (air) onto the receptacle used in testing the recuperator. Screw plug 42-74 (Fig. 136) onto the instrument in place of cap 42-83 (Fig. 36); give the barrel a maximum angle of depression, and check the pressure in the recuperator with the pressure gage. If necessary, regulate the pressure as indicated below.

3. Fill a clean bucket with steol-M (not less than 6 liters), and place the end of suction hose Sb22 (Fig. 134) in it.

50X1-HUM

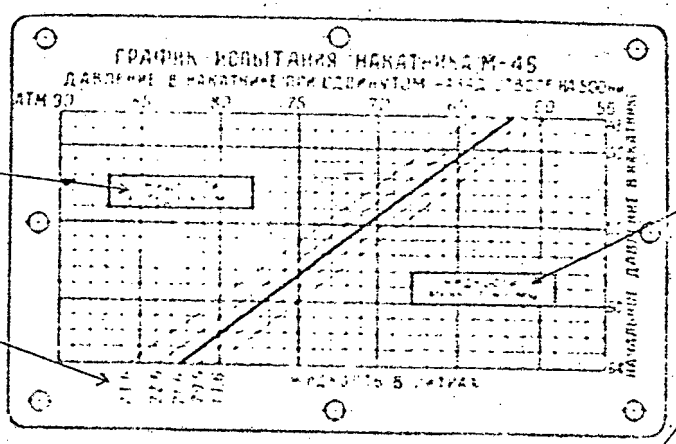
4. Pump the fluid in until the barrel is aligned with the first index mark on the right guide key of the cradle, open the recuperator

Fig 134. Artificial Recoil of the Tube

52-I-035. hydro-pneumatic pump
Sb 42-25. device with manometer for filling recoil brake with fluid (air)
Sb 21. connecting hose
Sb 22. intake hose

Graph for Testing M-46 Recuperator

Pressure in Recuperator When Barrel Backed 500 mm (abscissa)
Initial Pressure in Recuperator (ordinate)



fluid level too high

fluid level too low

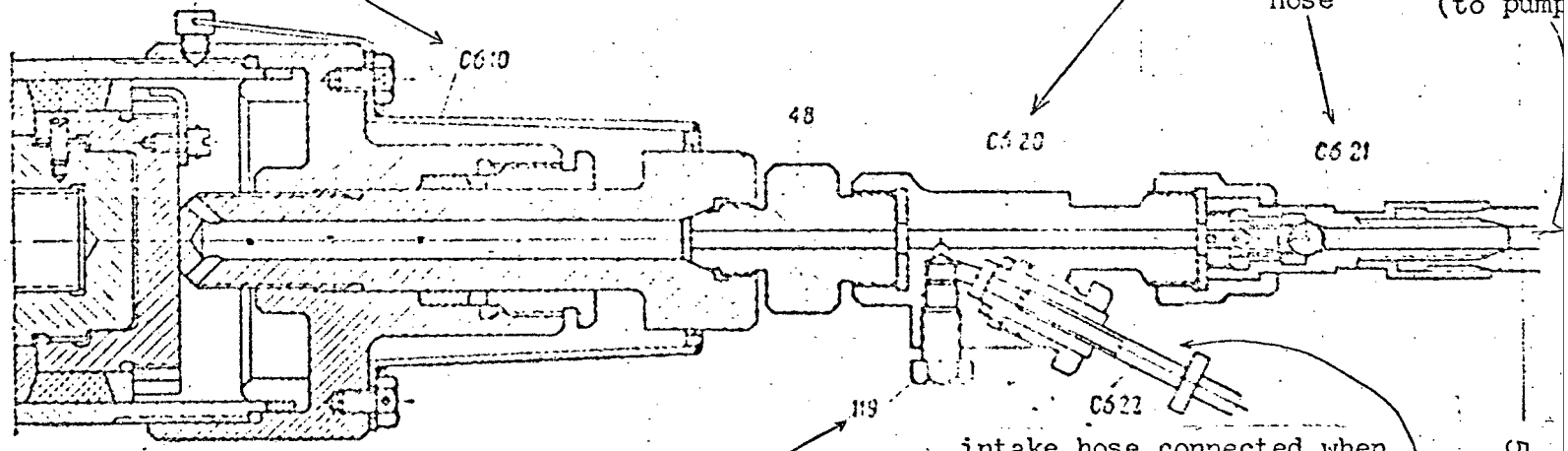
fluid in liters

Sb 10 - recuperator

Sb 20 connecting pipe

Sb 21 connecting hose

(to pump



intake hose connected when fluid withdrawn after artificial recoil (Sb 22-intake hose)

119- plug

50X1-HUM

50X1-HUM

Fig 135. Connection of Pump to Recuperator for Artificial Recoil

(to the second index mark).

50X1-HUM

5. Again open the recuperator valve slightly and read the pressure gage.

6. Determine the amount of fluid in the recuperator from the graph on the right side of the carriage.

The amount of fluid in the recuperator is determined in the following manner:

1. Using the two pressure gage readings, find the point of intersection on the graph of the horizontal line corresponding to the pressure gage reading at the first index mark and the vertical line corresponding to the reading at the second index mark.

2. If the point of intersection is in the middle dark slanting line with the inscription "21.6," then the amount of fluid in the recuperator is normal (21.6 liters). The permissilbe quantity of fluid in the recuperator is 20.6 - 22.6 liters; thus, the point of intersection must be between the slanted lines of the graph designated "20.6" and "22.6."

If the point of intersection is below the slanted line with the inscription "20.6," the fluid level in the recuperator is below normal and fluid must be added; if the point of intersection is above the line with the inscription "22.6," the fluid level in the recuperator is above normal and fluid must be withdrawn.

The outer light slanted lines which are drawn on both sides are auxiliary lines and serve as a scale by which, according to the position of all other lines drawn by hand, it is always possible to determine the true amount of fluid in the recuperator with sufficient accuracy.

3. The closer the point of intersection of the coordinates to the middle slanted line, the more accurately is the recuperator filled.

There is no need to match the point of intersection exactly with the middle line since, for practical purposes, the counterrecoil system will function quite satisfactorily if the point lies between the two lighter lines.

4. Once the amount of fluid has been checked, unscrew intake hose Sb22 (Fig. 134) from the pump and connect it to connecting pipe Sb20 (Fig. 135); unscrew plug 119 one half turn, and drain the fluid from the recuperator into a clean can.

5. Create a hydraulic lock as described below in the section "Reducing Liquid and Air in the Counterrecoil System."

50X1-HUM

it is clean. Care should be taken that foreign particles do not enter the recuperator cylinder.

Determining the Amount of Fluid in the Recuperator by Means of the Inspection Hole

1. Remove the plug which closes the inspection hole.

2. By operating the elevating mechanism, apply to the tipping parts of the gun that angle at which the level of the fluid observed through the inspection hole will be at the level of the index mark in the center of the screen of the inspection hole.

3. Measure the angle of elevation or depression of the barrel by means of the sight or quadrant.

If the amount of fluid in the recuperator is within normal limits (20.6 - 22.6 liters), the barrel should have an angle of depression within the limits of 0° to 70 thousandths.

If it is established that the barrel has an angle of depression greater than 70 thousandths, the fluid in the recuperator is greater than normal, and if the barrel has an angle of elevation greater than 0°, the fluid is less than normal. In this case it will be necessary to carry out a check by the artificial recoil method and, according to the results of this check, bring the amount of fluid to that required.

Addition of Fluid and Air to the Recuperator

1. Unscrew plug 48 from the filler receptacle (Fig. 28) and attach the instrument as explained in the section "Determining the Amount of Fluid in the Recuperator."

2. Close the upper open receptacle of the instrument (under the pressure gage) with the plug.

3. Set up the air hydraulic pump and connect to it hose Sb22 (Fig. 135), without the nipple, and intake hose Sb22.

4. Pour steol-M into a clean can, place the intake hose Sb22 in the can and operate the pump, having first set the valve to Zh (fluid), until the fluid begins to flow from hose Sb21. Then connect hose Sb21 to the filling instrument. Pour off the remaining fluid into a can.

5. Pour the required accurately measured amount of fluid into the can, open the recuperator valve, and transfer the fluid to the recuperator.

6. Close the recuperator valve; disconnect hose Sb21 from the instrument, and drain the remaining fluid from the hose and pump into a

[illegible] connect the pressure gage to the instrument, determine the pressure, and bring it to the required amount. Create a hydraulic lock as described below in the section "Reducing Fluid and Air in the Recuperator." 50X1-HUM

Then remove the filler instrument, close the filler receptacle with the plug, and remove the pump from the trail and store it in the box.

A dry recuperator is filled with fluid in the same manner as when adding additional fluid. Filling the recuperator after overhaul is permitted by directly pouring the fluid into the cylinder before the stuffing box is set in place.

The same pump is used to add air to the recuperator. The only differences are that the pressure gage is connected to the filler instrument, intake hose Sb22 is not attached (but the cap is removed from the pump), and the pump valve is placed on letter B (V) (air).

After this has been done, it is necessary to open the recuperator valve and operate the pump to bring the pressure to normal, which is determined by the pressure gage, and create a hydraulic lock, as described below in the section "Reducing Fluid and Air in the Recuperator."

50X1-HUM

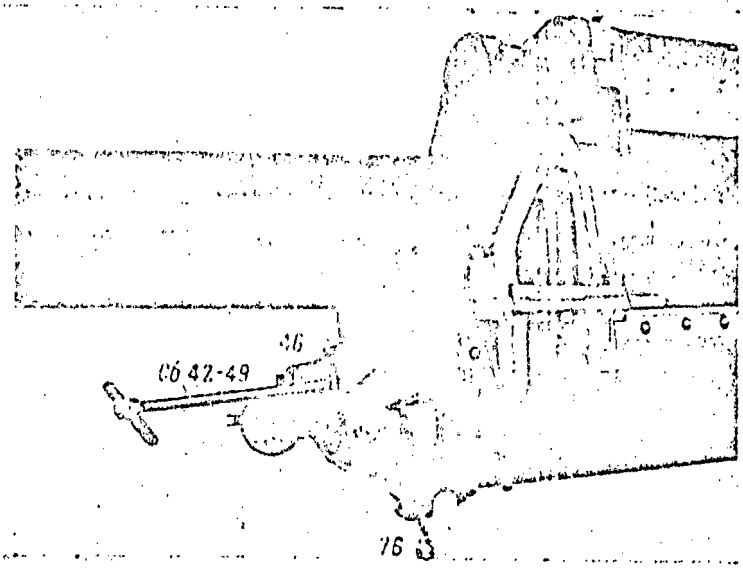


Fig 136. Checking Fluid in Recoil Brake

[259]

Sb 42-49.	wrench
46.	screw (08-72)
76.	plug (Sb 09-35)

Reducing Fluid and Air in the Recuperator

To reduce the fluid in the recuperator, it is necessary to connect the instrument for filling the counterrecoil mechanism with the blind opening under the pressure gage, and to connect to it intake hose Sb22 (in place of cap 42-83), the end of which is placed in the graduated cup.

Then give the barrel an angle of elevation of 6 to 10°, open the recuperator valve and drain off the necessary amount of fluid.

The suction hose is connected in order to avoid a loss of fluid.

If it is necessary to release air in order to reduce the pressure in the recuperator, the pressure gage is attached to the instrument (all openings are closed with the exception of the lower one, which is closed by plug Sb42-28 and this is opened one half turn); the barrel is given a maximum angle of depression; the valve is opened, and the excess air is released. The air should be released in small portions, and the pressure monitored continuously with the pressure gage.

After any operation is performed with the recuperator (determining pressure, decreasing or increasing pressure, etc.), it is necessary to create a hydraulic lock. This is done by giving the barrel an angle of elevation of 6 - 10°, slowly opening the valve so that liquid appears in the filler receptacle, and then rapidly closing the valve.

Determining the Amount of Fluid in the Recoil Brake

To determine the amount of fluid in the recoil brake, it is necessary to:

1. Unscrew plug 76 (Fig 136) with wrench A52830-2, open the lid on the forward cover of the carriage, and give the barrel an angle of elevation of 6° (100 thousandths on the sight).

2. Open the valve with wrench Sb42-49 and unscrew screw 46 from the throttling rod.

3. If fluid does not flow out, the amount of fluid is below normal.

Add fluid to the recoil brake by means of a funnel placed in the opening for screw 46; continue until fluid appears at the edge of the opening in the throttling rod. The amount of fluid in the recoil brake will now be normal (28.7 liters). [259]

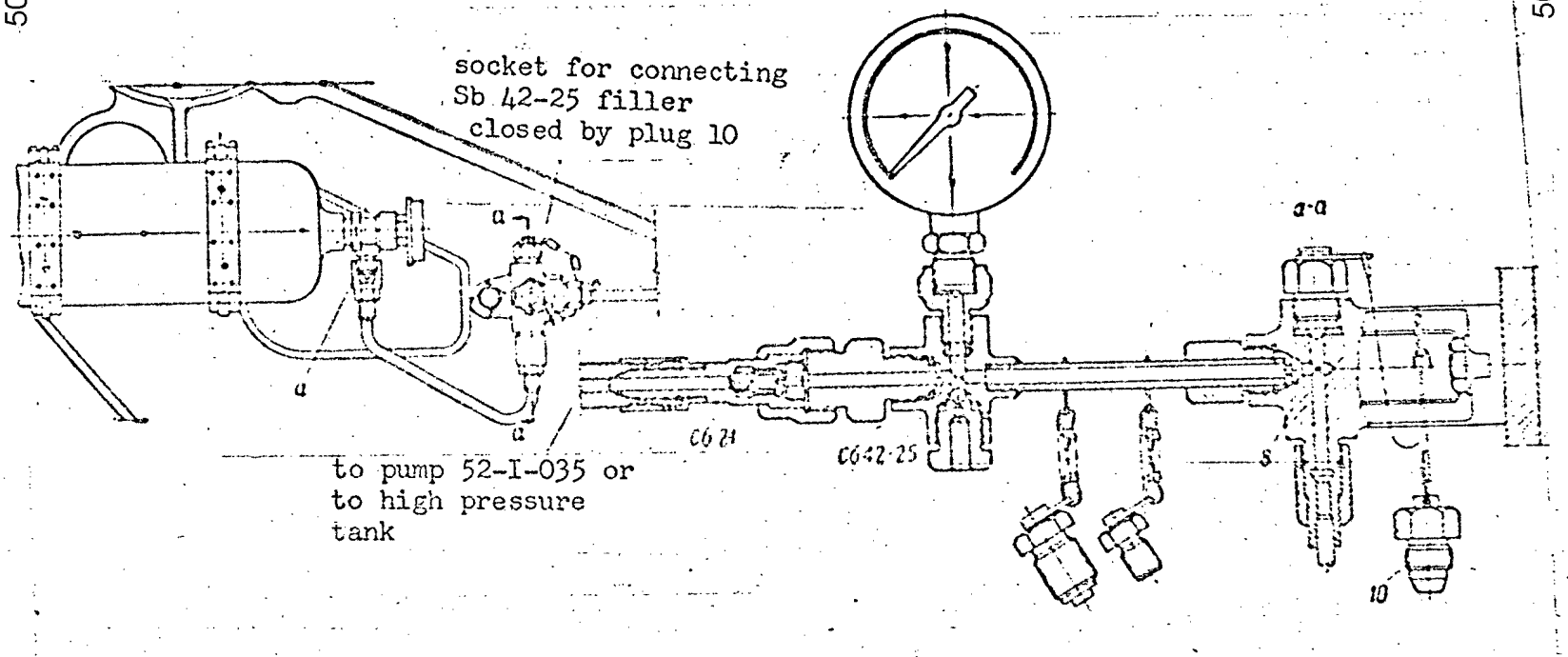


Fig. 137. Filling the Tank With Air

[260]

Sb 42-25. filler instrument with pressure gauge
Sb 21. connecting hose
8. distributor pipe (23-23)
10. plug (Sb 23-17)
a. connecting pipe of air tank

After checking the amount of fluid, screw down tight the valve and screw in the throttling rod, screw in the plug and close the lid on the front cover of the cradle.

Adjustment of the Equilibrator

The tank must always contain compressed air at a pressure sufficient to adjust the equilibrator.

The tank may be filled with compressed air by means of the air hydraulic pump 52-I-035 or from a tank with high pressure.

Use of Hydro-Pneumatic Pump 52-I-035 to Fill the Air Tank

The tank is filled in the following sequence:

— set the pump in the compartment on the right trail (in place of the bore brush box);

— attach connecting hose Sb21 (Fig 137) to the pump and connect its free end to instrument Sb42-25, having first removed nipple 48 (Fig 34);

— screw the conical end of instrument Sb42-25 with the pressure gage into the opening of distributor pipe 8 (Fig 137), having first unscrewed plug 10;

— open the valve of the tank by turning the handwheel and pump in air to a pressure of 60 to 70 atmospheres; close the valve and remove the pump.

Use of a High-Pressure Tank to Fill the Air Tank [261]

The tank is filled in the following manner:

— attach one end of connecting hose Sb21 (Fig 137) to the high-pressure tank and the other end to instrument Sb42-25, having first unscrewed nipple 48 (Fig 34);

— attach the conical end of instrument Sb42-25 (Fig 137) with the pressure gage to the opening in distributor pipe 8, having first unscrewed plug 10;

— open the valve of the tank on the gun and permit air to flow into it from the high-pressure tank;

— close the valves of the tank on the gun and the high-pressure tank and remove instrument Sb42-25.

In order to avoid damaging the pressure gage, do not permit the pressure in the tank of the equilibrator to exceed 120 atmospheres.

Note: If the tank has been removed from the top carriage, it may be filled with air by connecting instrument Sb42-25 directly to nozzle a (Fig 137) of the tank with the aid of connecting pipe Sb42-67 (appendix 4) and connecting one end of hose Sb21 to instrument Sb42-25 and the other to the pump or high-pressure tank.

Adjusting the Equilibrator

Adjustment of the equilibrator involves establishing the correct pressure in its cylinders. The force required on the handwheel of the elevating mechanism is an indication of the proper adjustment of the equilibrator: if it takes considerable force to elevate the barrel, the pressure is insufficient; if depressing the barrel requires considerable force, the pressure is too high. With correct adjustment, the force on the handwheel of the elevating mechanism for all angles of elevation must not exceed 10 kg.

The pressure in the equilibrator is increased by applying air from the tank situated on the right side of the upper carriage. Pressure is regulated in the following manner (Fig 52 and 137):

1. Place the pressure gage in the top receptacle of the distributor pipe, having first unscrewed the top plug with wrench A52830-5.

2. With wrench A52830-5, check that plugs 10 (Fig 138) in the distributor pipe are tightly secured.

3. Open valves 36 (Fig 53) in the right and left pistons of the equilibrator with wrench Sb42-52.

4. Open the valve of the air tank slightly and check the reading of the pressure gage while applying air from the tank to the cylinders of the equilibrator; continue until the same ease of operation of the handwheel of the elevation mechanism is achieved when elevating and depressing the barrel.

When the equilibrator is correctly adjusted, the pressure at the maximum angle of depression should be approximately 44 atmospheres and at the maximum angle of elevation — approximately 25 atmosphere.

These figures are only approximate. The main criterion of adjustment of the mechanism is the force on the handwheel of the elevating mechanism.

The pressure in the equilibrator may be reduced by two methods:

First method. If at the maximum angle of depression the pressure in the equilibrator is greater than the pressure in the tank, the excess air is passed from the equilibrator to the air tank. To accomplish [262] this, place the barrel at the maximum angle of depression, open the valves of the equilibrator, and, by opening the valve of the air tank slightly, pass the air from the equilibrator to the tank until normal operation of the elevating mechanism is achieved both when depressing and elevating the barrel.

Second method. If, when the barrel is fully depressed, the pressure in the equilibrator is less than the pressure in the tank, the excess air is allowed to escape into the atmosphere. This is done by opening the valves of the equilibrator and, by opening slightly plug 10 in the distributor pipe to release the necessary amount of air. The elevating mechanism should then operate normally.

Upon completing the adjustment, unscrew the pressure gauge and return it to its place. Close the plug in the top of the distributor pipe.

If the pressure in the air tank has been reduced to 40 — 44 atmospheres, further adjustment of the equilibrator may be carried out in the following manner:

1. At low temperatures and when the barrel is difficult to elevate, give the tipping parts of the gun an approximate angle of elevation of 10 - 15° and open the valves of both columns and the tank; elevate the barrel by operating the elevating mechanism until normal forces on the handwheel are achieved; close the valves.

2. At high temperatures and when the barrel is difficult to depress, give the tipping parts an angle of depression and pass excess air from the columns to the tank until normal operation of the elevation mechanism is achieved. If there still remains an excess pressure both in the columns and in the air tank, the excess should be released into the atmosphere by opening the valves of the columns.

Fig 138. Checking Pressure in the Equilibrator [262]

10. plug (Sb 23-17)

Such adjustment of the equilibrator mechanism may be maintained without using the pump until the air temperature drops approximately 30°C below the temperature at which air was last released from the columns into the atmosphere.

Adding Fluid to the Columns of the Equilibrator Without Releasing Air From Them [263]

The fluid level in the columns is monitored by means of plug 38 (Fig 53) in the outer cylinders.

If fluid does not spurt out of plug 38 when the latter is opened slightly (while preventing the escape of air), fluid should be added to the appropriate column in the following manner;

— set up air-hydraulic pump 52-I-035 (Fig 134) and connect to it hose Sb21 (without nipple 48) and intake hose Sb22;

— close the top open receptacle of instrument Sb42-25 (receptacle for the pressure gage) with the plug and connect the instrument to distributor pipe 8 (Fig 137);

— pour steol-M into a clean can, insert hose Sb22 (Fig 135), and operate the pump, having first set the valve to "Zh" (fluid), until fluid flows from hose Sb21; then connect the hose to instrument Sb42-25 (Fig 137); pour off the fluid remaining in the can;

— fill the can with 0.2 liter of fluid; open the valve in the column, and transfer the fluid to the column; then close the valve;

— check the level of the fluid in the column;

— disconnect hose Sb21 from instrument Sb42-25, drain the excess fluid into the can, and remove the pump;

— expel the fluid from tubes 3, 4, or 6 (Fig 52) by briefly forcing air alternately from the cylinders and from the tank on the upper carriage (valves should be opened carefully);

— remove instrument Sb42-25 and screw in plug 10.

70. Inspecting and Checking the Sight Attachments

Checking the S71-35 (S71-96) Mechanical Sight

The checking procedure for the mechanical sight is subdivided into partial and complete checking.

Partial checking involves the checking of zero settings of the sight and the zero line of sight.

Partial checks should be made each time the gun has been set up at a firing position or before the gun is moved out for field firing or practice firing if it is known beforehand that there will be insufficient time to check the sight at the firing position.

Complete checking includes partial checking and, in addition, the periodic checks made during technical inspections and after repair.

Periodic checks involve:

— determining the free play in the sight and dial sight mechanisms;

— determining the longitudinal and transverse free play of the sight;

— checking the attachment of the sight to the gun and adjusting the longitudinal and cross levels;

— checking the accuracy of the sight readings with the aid of a quadrant (matching the sight settings with the true elevation angles);

— checking the line of sighting at different angles of elevation (checking the climb of the line of sighting).

Preparing the Gun and Sight Attachments for Testing [264]

Before checking the sight attachments it is necessary to:

— prepare the gun for checking of the sight attachments;

— prepare the sight attachments for checking;

— check the master level.

Preparing the Gun for Checking of the Sight Attachments

Set up the weapon on a solid horizontal surface, spread the trails, remove the cover from the sight, and carefully wipe the control surface on the breech and the upper groove of the dial sight socket with a clean rag.

Make sure that the aiming mechanisms operate easily and smoothly without jerking.

The gun must be positioned so that some object located at least 1,000 m from the gun and suitable for laying on is clearly visible.

Preparing the Sight Attachments for Checking

Examine the sight attachments, clean off the excess lubricant and dust from their exterior surfaces, and see that their mechanisms operate easily and smoothly.

Note whether all parts of the sights are present and in good repair; if such is not the case, correct the part or replace it with a spare part. Check the tightness of the nuts, screws, cotter pins, and rings.

Checking the Master Level

1. Wipe dry the master plane on the gun barrel and the mounting planes of the master level.

2. Position the master level on the plane of the barrel according to the scribe marks inscribed on the master plane.

3. Center the bubble of the master level between the lines by operating the handwheel of the gun-pointing mechanism.

4. Turn the master level 180°, placing it again on the longitudinal index mark on the master plane.

If the bubble of the master level rests exactly in the middle, then the master level is true.

If the bubble of the master level is off center, it will be necessary to correct approximately half the error with the stop screws of the level and the other half of the error with the pointing mechanism of the gun so that the bubble in the level rests in the center (between the marks). Then again turn the master level 180°.

If the bubble of the master level is still not centered, the above operations should be repeated; when the bubble is centered, the level may be considered corrected.

Partial Checking of the Sight

In partial checking, the sight may be considered aligned (when the master plane on the breech and the upper groove of the dial sight socket are in a horizontal position) if the following is true:

— the bubbles of the longitudinal and cross levels are centered with an allowance of 0-00.5; [265]

— the zero divisions on the tangent elevation and angle-of-sight scales and the zero divisions on the range drum coincide with the scribe marks of the readers with an allowance of 0-00.5;

— the line of sighting of the dial sight, with and without the extension, is parallel to the bore axis with an allowance of 0-00.5 when the main scale is set at 30.00 and the reflecting mirror at 0.00.

The order of partial checking is given below.

Checking the Zero Settings of the Sight

1. Using the master level set on the master plane of the breech, bring the gun barrel to a horizontal position.

2. Place the master level on the groove of the dial sight socket parallel to the cross level and, by turning the adjusting screw handwheel of the cross-leveling mechanism, bring the bubble of the master level to the center.

3. Turn the master level 90° in the groove of the dial sight socket and, by turning the handle of the tangent elevation handwheel, bring the bubble of the master level to the center.

4. Center the bubble in the cross level by turning the angle-of-sight handwheel 48 (Fig 81).

As a result of the operations performed above, there should be zero settings on the tangent elevation thousandths scales and the range drum scales, a setting of 30.00 on the angle-of-sight scales, and the bubble in the cross level of the sight should be centered.

If the setting on the angle-of-sight scales is not 30.00, screw 56 (Fig 81) should be unscrewed one or two turns, and the thousandths ring 49 should be turned until the 0 division on its scale is opposite the index mark of reader 57. Screw 56 should then be tightened.

If the zero division on the tangent elevation thousandths scale does not coincide with the index mark of reader 43 (Fig 79), the screws at the end of handwheel 4 (Fig 81) should be loosened one or two turns and ring 15 should be turned until the 0 division on its scale is opposite the index mark of reader 43 (Fig 79). Then tighten the screws on handwheel 4 (Fig 81).

If the zero division on the range drum does not coincide with the index mark of reader 32, screws 27 should be loosened one or two turns, and the range drum should be turned until the 0 division on its scale is opposite the index mark of reader 32. Tighten screws 27.

If the bubble in the cross level is not centered, mount 66 of the cross level should be turned with the aid of adjusting screws 66a until the bubble is centered. Adjusting screws 66a are reached by unscrewing the left (when facing the sight from the rear of the gun) plug 67, which is replaced after the adjustment has been made.

Checking the Zero Line of Sighting

The zero line of sighting is checked against a distant point and by using the cross-hairs on the bore sight. The check is made both with and without the extension.

The zero line of sighting is checked against a distant point in the following manner:

1. Place the dial (panoramic) sight in the dial (paroramic) sight socket and fasten it with clamping screw 84. [266]

2. Glue the cross-hairs to the index marks etched on the muzzle face of the barrel and remove the firing mechanism.

3. Place the sight in a vertical position according to the cross level.

4. Set the tangent elevation thousandths scales at a reading of 0.00.

5. While looking through the striker pin hole and at the center of the cross-hairs on the muzzle face, lay the gun barrel on a point located not less than 1,000 m from the weapon.

6. Turn the handwheels of the main scale and the reflecting mirror of the dial (paroramic) sight until the cross-hairs of the dial sight or the peak of the central inverted V are aligned with the same point on which the gun barrel is layed.

As a result of the above operations, the reading on the main scales of the dial sight should be 30.00 and the reading on the reflecting mirror scales should be 0.00.

In the event that the readings on these scales are off by more than half a thousandth, it will be necessary to loosen the locking nuts of the main scale and reflecting mirror hand-wheel
with the
of the r

No

If it is necessary to shift the position of the ring of the main scale, the screws which hold the ring should be loosened with a screwdriver and the ring turned until division 30 matches the index mark of the reader.

The same procedure should be followed in checking the zero line of sighting with the extension in place. The check is carried out as without the extension. The main scale of the dial sight is set at 30.00.

If the cross-hairs of the dial sight do not coincide with the laying point, the position of the adjusting screw on the extension should be set to provide coincidence with an accuracy of not less than 0.5 thousandth.

The viewing attachment of the dial sight head should be checked at the same time that the main scales of the dial sight are checked.

If the laying point is not visible between the wire and the slit of the viewing box, shift the wire by turning the screws which hold it until the laying point is visible.

Where there is no suitable distant laying point, or if visibility is poor, the zero line of sighting may be checked with a bore sight.

The bore sight is a plywood sheet on which are drawn (according to the coordinates shown in Fig 139) crosses which determine the direction of the zero line of sighting of the sight and the bore axis of the gun. The first cross corresponds to the position of the bore axis. There are three crosses on the left upper corner of the bore sight.

The upper right cross corresponds to the position of the optical axis of dial (panoramic) sight S71-35 (S71-96) with the extension, and the lower right cross corresponds to the position of the optical axis of the same sight without the extension. The lower left cross corresponds to the position of the optical axis of sight OP-4-35 (OP-4-96).

The width of each band of the crosses on the bore sight must be no more than 10 mm.

When checking the zero line of sighting, the bore sight is placed at a distance of not less than 40 m from the gun, perpendicular to the viewing line (the bore axis), and without inclination to either side.

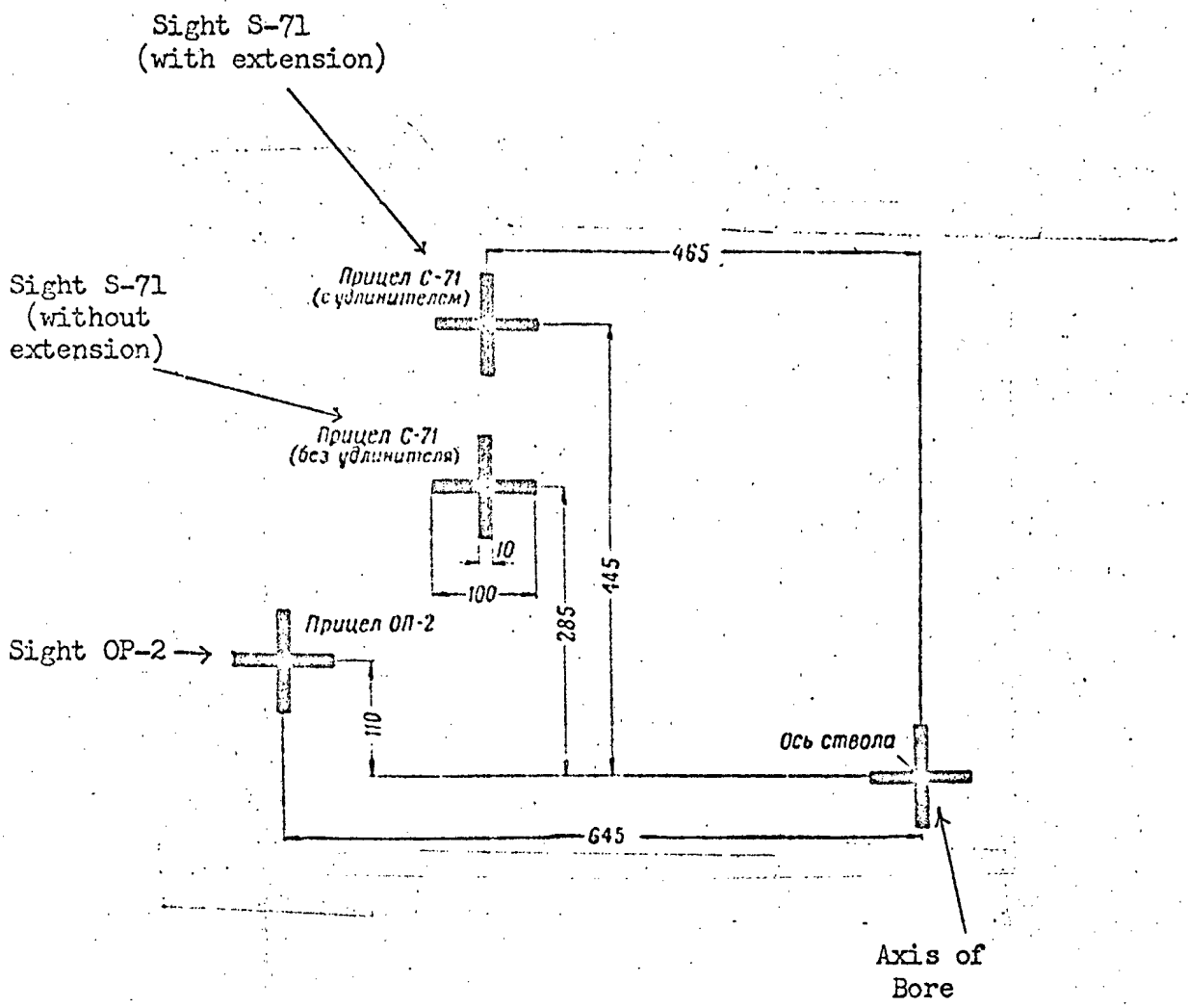


Fig 139. Coordinates (Crosses) for Checking Zero Line of Sighting

When the bore sight is used, the gun must be placed in a horizontal position (without inclination of the axis of the trunnions) according to the master level.

Checking the zero line of sighting on a bore sight with and without the extension is done in the same manner as when laying on a distant point, but in this case the weapon and the dial sight are layed on the appropriate crosses of the bore sight. [267]

Complete checking of the sight attachments is carried out in the sequence given below.

The zero settings and the zero lines of sighting are determined as described in this section (see "Partial Checking of the Sight").

Determining Free Play in the Sight and Dial Sight Mechanisms

To determine free play it is necessary to:

— by turning handwheel 48 (Fig 80 and 81) of the angle-of-sight mechanism in one direction, bring the bubble of the cross level to the middle and take a reading on the angle-of-sight scales;

— turning handwheel 48 in the opposite direction, again bring the bubble of the cross level to the middle and take a reading on the scales.

The difference between the first and second readings will be the amount of free play in the angle-of-sight mechanisms.

Free play is determined two or three times, and the arithmetic average is used as the value.

The amount of free play in the angle-of-sight mechanism must not exceed one thousandth (0.01).

If free play is more than one thousandth, it will be necessary to correct this fault according to the instructions given in the servicing manual, The S71 Mechanical Sight. [268]

Determining Free Play in the Tangent Elevation Mechanism

To determine free play it is necessary to:

— turn the knob of the tangent elevation handwheel 4 (having disconnected cone 11) in one direction, bring the bubble of the cross level to the middle, and take a reading on the tangent elevation thousandths scales;

— turn the knob of handwheel 4 in the same direction to change the setting on the tangent elevation scales by 40-50 thousandths;

— turn the knob of handwheel 4 in the opposite direction, again bringing the bubble of the cross level to the middle, and take a reading on the tangent elevation thousandths scales.

The difference between the first and second readings will be the amount of free play in the tangent elevation mechanism.

Free play is determined two or three times, and the arithmetic average is taken as the value. This value must not exceed one thousandth (0.01).

If the free play is greater than one thousandth, it will be necessary to eliminate the fault according to the instructions given in the service manual The S71 Mechanical Sight.

In addition, the amount of free play should also be determined in the drive of the range drum. This is done by taking a reading on one of the scales of the range drum and, grasping the drum in one hand, turn it first in one direction, release it and take a reading; then turn the drum in the opposite direction and again release it and take a reading. The difference between the two readings on the range drum must not exceed 0-00.5.

This value is read from the tangent elevation thousandths scale.

If the free play exceeds 0-00.5, replace spring 22 (Fig. 81).

Determining Free Play in the Main Scale and Reflecting Mirror of the Dial (Panoramic) Sight

To determine the free play in the main scale of the dial (panoramic) sight it is necessary to:

— place the dial sight in socket 40 (Fig. 81) of the sight and tighten it with clamping screw 84;

— by turning the handwheel of the main scale in one direction, lay the cross-hair or the central inverted V of the dial sight on a point located no closer than 400 m from the gun and read the setting on the main scale;

— turn the handwheel of the main scale in the same direction and change the setting of the main scale by 0.40-0.50;

— turn the handwheel of the main scale in the opposite direction and again match the cross-hair or inverted V with the laying point and take a reading.

The difference between the two settings of the main scale will be the amount of free play in the main scale of the dial sight.

Free play is determined two or three times and the arithmetic average is taken as the value of free play. [269]

Free play in the reflecting mirror of the dial sight is determined in the same manner as in the main scale of the dial sight.

In this case, readings are made on the scales of the reflecting mirror which are moved by turning the reflecting mirror handwheel.

The amount of free play in the main scale and the reflecting mirror must not exceed two thousandths (0.02). If the free play is greater than this, the dial sight should be sent to repair.

Determining the Nonrecoverable Longitudinal and Transverse Play in the Sight

To determine the nonrecoverable longitudinal play in the sight it is necessary to:

— center the bubbles of the longitudinal and cross levels of the sight (using either the sight mechanisms or the gun pointing mechanisms);

— with one hand, push on the dial sight socket with a slight force (7-8 kg) and then release it (in the absence of nonrecoverable longitudinal play in the sight the bubble of the longitudinal level should

return to the middle; if there is play in the sight, the bubble will not return to the middle; in the latter case it will be necessary to determine the position of the bubble relative to the index marks on the ampule);

— pull the dial sight socket towards you using the same amount of force, release it, and again determine the position of the bubble of the longitudinal level relative to the index marks.

The total amount of nonrecoverable longitudinal play in one and the other direction must not exceed one thousandth (0.01). The amount of free play is determined from the index marks of the ampule of the level, each division of which corresponds to an average of three minutes.

Note: The value of one division of the level is the value of the angle at which the ampule must be tilted in order to move the bubble 2 mm; one small division on the ampule, that is, the distance between adjacent long and short lines, is equal to 2 mm.

The nonrecoverable transverse play in the sight is determined in a similar manner with the exception that the sight should be pushed to the right and the left and the play in the sight determined from the cross level.

The nonrecoverable transverse play in the sight must not exceed two thousandths (0.02).

If the longitudinal and transverse nonrecoverable play in the sight exceeds the prescribed maximums, adjustments should be made using the method described in the service manual The S71 Mechanical Sight.

Checking the Attachment of the Sight to the Weapon and Adjusting the Longitudinal and Cross Levels

The attachment of the sight to the weapon is checked in the following sequence:

— bring the gun barrel to a horizontal position in the longitudinal and transverse directions using the master level or quadrant;

— place the master level on the master plane of the sight, which is located on the upper surface of fork 74 (Fig. 81); in this case, movement of the bubble of the master level with respect to its middle position must not exceed ten thousandths (0.10); if the displacement is greater than ten thousandths (0.10), the fastening of the sight to the gun must be adjusted;

[270]

N

— lay the gun barrel (while looking through the striker pin hole and at the center of the cross-hairs on the muzzle face) and the cross-hairs or the peak of the central inverted V of the dial sight on a laying pint which is at least 1,000 meters from the gun;

— by turning the handwheel of the adjusting screw of the cross-leveling mechanism, deflect the sight all the way to the right and then to the left.

If the sight is correctly attached (if the cross-leveling axis of the sight is properly positioned), the line of sighting should not move from the selected laying point by more than two divisions of the main scale (0.02).

The amount of deflection of the line of sighting is determined from the scale of the reflecting mirror and the main scale of the dial sight by again laying the cross-hair or central inverted V on the same laying point.

If the line of sighting is found to be more than two divisions (0.02) off on the main scale, the attachment of the sight to the gun should be adjusted.

The proper adjustment of the longitudinal level is determined in the following order:

— use the master level to bring the barrel of the gun into a horizontal position and center the bubble of the longitudinal level;

— by turning the handwheel of the adjusting screw of the cross-leveling mechanism, deflect the sight all the way to the right and then to the left.

The bubble of the longitudinal level should now be centered. If the bubble is not centered, it must be brought to the middle by turning the side adjusting screws 66a (Fig. 81) of the longitudinal level mount.

Access to adjusting screws 66a of the longitudinal level is obtained by unscrewing plug 67 on the left (looking at the sight from the side of the angle-of-sight coarse scale), which must be replaced after the adjustment has been made.

After this adjustment it is necessary to check the zero settings of the sight.

Adjusting screws 66a are turned with screw driver D125x0.5 which is found in the spare parts kit.

The proper adjustment of the cross level is checked in the following order:

— by turning the handwheel of the adjusting screw of the cross-leveling mechanism to bring the bubble of the cross level to the middle;

— turning the tangent elevation handwheel to an angle of 2.00 while watching the position of the bubble in the cross level; the bubble should not go beyond the last index marks of the ampule.

If the bubble of the cross level goes beyond the last index marks of the ampule, it should be centered by means of the side adjusting screws of the cross level mount.

Access to the adjusting screws of the cross level is obtained by unscrewing plug 67 on the left (looking at the sight in the direction of the gun barrel), which must be replaced after the adjustment has been made.

Checking the Accuracy of the Sight Readings With the Quadrant

The following order should be followed in checking the accuracy of the sight readings with the aid of the quandrant (checking the agreement between the sight settings and the true sighting angles):

— use the master level to set the gun in a horizontal position in the longitudinal and transverse directions (with the axis of the trunnions level); [271]

— set zero readings on the sight (tangent elevation at 0.00, level at 30.00, and the bubbles of the longitudinal and cross levels in the middle);

— give the gun barrel angles of elevation first from 0.00 to 7.00 through every 1.00 in sequence, and then reverse the procedure from 7.00 to 1.00; these angle should be set using the tangent elevation thousandths scales by turning the handwheel of the sight and the handwheel of the elevating mechanism first in the direction of greater angles (a forward direction) and then in the direction of lesser angles (a backward motion).

With the weapon in each of these positions, measure the true angle of elevation with the quandrant and compare it with the angle indicated by the sight.

N

This check should me made in the forward and backward directions three times. The difference between the sight settings and the average of the three measurements made with the quandrant gives the correction for the discrepancy of the angles.

The corrections for the discrepancy of the angles should be recorded in a table which should be used in firing.

Table of Corrections for Discrepancy of Angles of Elevation According to the Sight and the Quandrant

(Example)

Weapon No.	No. of measurements	Setting on Sight Scale (thousandths)							
		0	100	200	300	400	500	600	700
		Quandrant Readings							
130-mm Gun M-46	1	0	100	199	297	398	497	596	694
	2	0	98	200	299	395	496	595	695
	3	0	99	198	298	398	498	597	696
Avg. of three measurements		0	99	199	298	397	497	596	695
Correction for level		0	+1	+1	+2	+3	+3	+4	+5

The maximum difference between the quandrant readings when measuring the same elevation angle in the "forward" and "backward" directions (which represents the free play of the sight together with the weapon) must not exceed two thousandths (0.02).

The checking method described above should also be carried out for the angle-sight mechanism after its repair. In this case, the angle is set according to the angle-of-sight scales.

Checking the Line of Sighting for Difference Angles of Elevation

(Checking the Climb of the Line of Sighting)

The corrections for climb of the line of sighting should be determined after setting up the weapon at the firing position and simultaneously with the checking of the agreement between the sight settings and the true angles of elevation.

The climb of the line of sighting may be checked either with an aiming circle (or theodolite) or a cord and weight (plumb bob).

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Use of the aiming circle (or theodolite) for checking should proceed as follows: [272]

a) Set up the PAB aiming circle (or theodolite) at a distance of 25 to 40 m in front of the muzzle face of the gun; the limb of the aiming circle should be carefully leveled with the spherical level. Glue a vertical cross-hair of the muzzle face (across the cross marks) and remove the striker mechanism from the breech housing.

b) With zero sight settings, aim the vertical cross-hair on the muzzle face of the gun at the monocular of the aiming circle, and aim the vertical line of the graticule in the monocular at the vertical cross-hair on the muzzle face.

Once these vertical lines have been matched, the aiming circle operator must not turn the indicating and orienting knobs.

c) With zero settings on the sight scales and the bubbles of the longitudinal and cross levels centered, aim the dial (panoramic) sight at a distant laying point. The main setting should then be recorded in a table.

d) Set the thousandths scale of the sight at 100 and elevate the gun barrel. The aiming circle operator should note any displacement of the cross-hair on the muzzle face with respect to the vertical line on the graticule of the aiming circle monocular and should order the layer (trainer) to make a deflection shift to one side or the other in order to match the lines (the main scale knob of the PAB should not be touched since this might disturb the previous setting of the aiming circle). When the lines have been matched, center the bubbles of the longitudinal and cross levels (if they are not already centered) and again aim the dial sight at the same laying point. Record the setting in a table.

e) Without moving the aiming circle, carry out the same operations with sight settings of 200, 300, 400, etc. to the maximum angle of elevation.

A check is made two or three times at each setting. Before beginning new measurements (the second and third), the gun should again be layed horizontally according to the aiming circle and the laying point with zero settings on the sight attachments. The results and corrections for climb should be recorded in a table for use during firing.

Table of Azimuth Corrections for Climb of the Line of Sighting

(Example)

Weapon No.	No. of measurement	Setting on Sight Scale (thousandths)							
		0	100	200	300	400	500	600	700
		Azimuth According to Laying Point							
130-mm Gun M-46	1	-	43-17	43-16	43-17	43-19	43-19	43-20	43-21
	2	-	43-15	43-17	43-18	43-18	43-20	43-21	43-23
	3	-	43-16	43-15	43-16	43-20	43-21	43-22	43-22
Avg. of three measurements		-	43-16	43-16	43-17	43-19	43-20	43-21	43-22
Main Scale		43-15	43-15	43-15	43-15	43-16	43-15	43-15	43-15
Correction for climb		-	+1	+1	+2	+4	+5	+6	+7

Use of the plumb bob for checking the climb of the line of sighting should proceed as follows:

— with the master level, bring the gun barrel into a horizontal position in the longitudinal and transverse directions;

— attach cross-hairs to the marks drawn on the muzzle brake and remove the striker mechanism; [273]

— fasten a line and weight (plumb bob) in front of the gun; the length of the line must be such that it is visible through the bore at the maximum angle of elevation;

— place the sight in a vertical position according to the cross level;

— lay the gun barrel on the plumb line (by looking through the striker pin hole and at the cross on the muzzle face), check the position of the bubble in the cross level, line the dial sight on a distant laying point, and record the azimuth;

— elevate the gun barrel to 1.00 and again lay the gun barrel on the plumb line using the training mechanism; check and, if necessary, correct the position of the bubble in the cross level and the alignment of the barrel with the plumb line;

— aim the dial sight on the selected laying point and record the azimuth.

The difference between the first and second azimuth settings is the amount of deviation of the gun axis at an elevation angle of 1.00.

The weapon is checked in this manner at every 100th division of the scale up to the maximum angle of elevation and back. This check is repeated two or three times and the average of the measurements is taken as amount or error (climb of the line of sighting) for each elevation angle.

The error in this case must not exceed three divisions of the main scale (0.03). If the error is greater, the sight must be sent for repair.

Checking with the plumb bob is less convenient than checking with the aiming circle (or theodolite), since the plumb line must be placed at such a great height from the ground and can be easily disturbed by the wind.

This method of checking the climb of the line of sighting may be used during technical inspections of the gun and in checking the gun after repair.

Checking the OP-4-35 (OP-4-96) Optical Sight

For the correct operation of the optical sight, it is necessary that the zero line of sighting be parallel to the axis of the bore both in the vertical as well as horizontal planes.

Note: The zero line of slighting is determined by the apex of the central inverted V in the field of view of the sight when the zero divisions of the scales are aligned with the horizontal cross-hair.

The zero line of sighting must be checked each time the gun is set up at the firing position. In addition, the zero line of sighting is checked in the following situations:

— when placing the sight on the gun, if it was removed (for example, if it has been stored in the carrying case);

— before transporting the gun for combat or practice firing, if it is known that there will not be time to check the zero line of sighting at the firing position;

— if extreme deviations of the shells from the target are detected.

N

The zero line of sighting is checked against a distant point with a bore sight. 50X1-HUM

Checking Against a Distant Point [274]

In order to check the zero line of sighting of the optical sight against a distant point:

1. Select a laying point which is not less than 1,000 meters from the gun. The laying point must have a sharp outline; the top of a smoke stack, the corner of a building, a post, or the trunk of a tree may serve as a laying point.

2. Stretch the cross-hairs across the marks drawn on the muzzle face of the gun barrel.

3. By turning the handwheel of the tangent elevation mechanism, align the zero divisions of the range scales in the field of view of the sight with the horizontal cross-hair.

4. Remove the striker mechanism and, by looking through the striker pin hole and at the center of the cross on the muzzle face, lay the barrel on the laying point.

5. Look through the eyepiece of the sight and determine the position of the apex of the central inverted V relative to the selected laying point.

If the sight is correctly adjusted (Fig. 140), the apex of the central V must coincide with the laying point, and the horizontal cross-hair must pass through the zero divisions of the range scales.

If the apex of the central V is to the left or right of the laying point, the following adjustment should be made:

— having slightly loosened screw 41 (Fig. 93) of the range adjusting mechanism, turn cover 43 to one side;

— while looking through the eyepiece of the sight, use the special key found in the sight carrying case to turn the nut of the range adjusting mechanism until the apex of the central inverted V coincides with the selected laying point;

— close cover 43 of the range adjusting mechanism and tighten screw 41.

If the apex of the central inverted V is above or below the selected laying point, the following adjustment should be made: 50X1-HUM

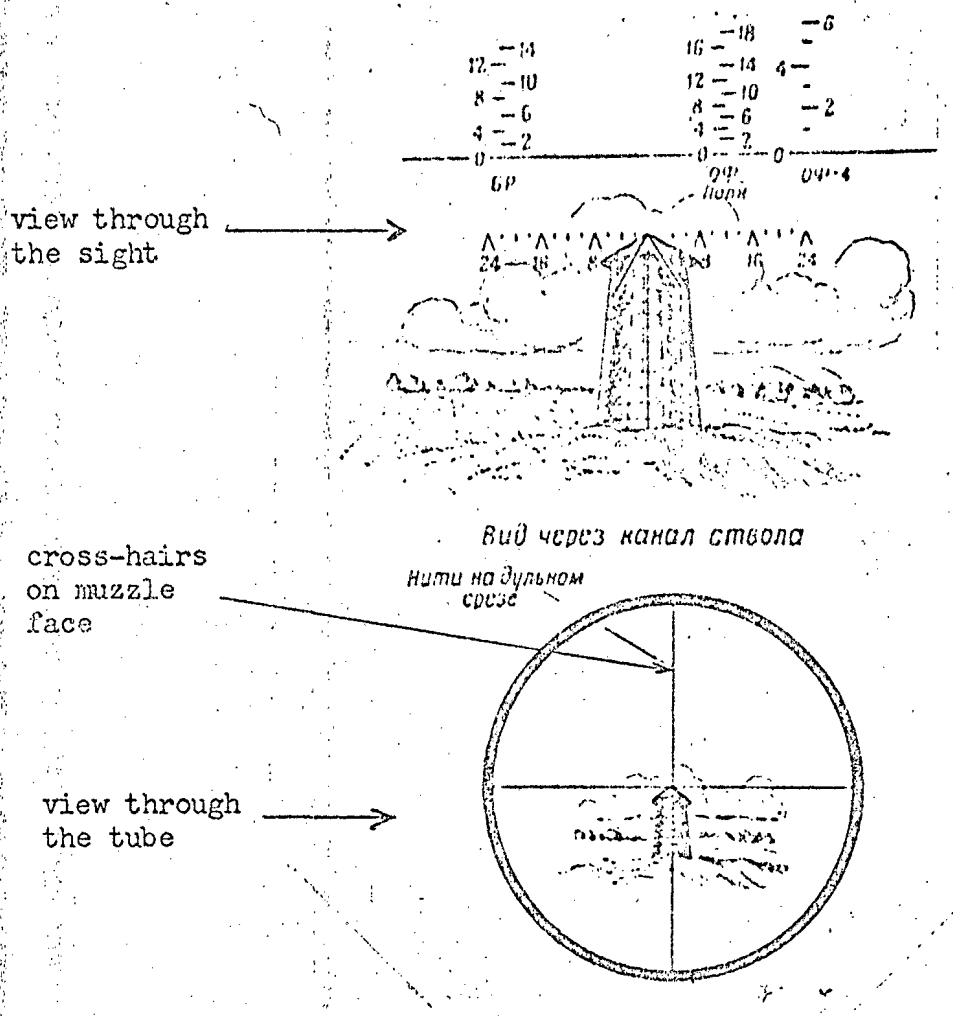


Fig 140. Position of the Range Scales and Apex of the Central Inverted V of a Correctly Adjusted Sight, and Position of the Cross-Hairs On the Muzzle Face [274]

No

— turn the tangent elevation handwheel to align the apex of the central V with the laying point;

— having slightly loosened screw 24 (Fig. 93 and 96) of the height adjusting mechanism, turn cover 23 to one side;

— while looking through the eyepiece of the sight, use the key to turn nut 20 of the height adjusting mechanism until the horizontal cross-hair coincides with the zero divisions of the range scales;

— close cover 23 of the height adjusting mechanism and tighten screw 24.

Upon completing the adjustment of the sight, make sure that the uppermost divisions of the range scales coincide with the horizontal cross-hair when tangent elevation handwheel 11 (Fig. 95) is turned.

If this condition is not met, the stop washers of the tangent elevation handwheel should be shifted in the following manner:

— loosen (by one full turn) the four screws 17 located at the lower end of the tangent elevation handwheel;

— turn the handwheel of the tangent elevation mechanism until the uppermost divisions of the range scales are aligned with the horizontal cross-hair;

— fully tighten the four screws 17 and again check the limits of motion of the range scales.

Checking With the Bore Sight

When the bore sight is used to check the sight, the gun must be set horizontally (without inclination of the turnnion axis). The method of checking the zero line of sighting with the bore sight is the same as when using a distant point, with the exception that the gun barrel is layed on the extreme left cross (Fig. 139).

If the sight is correctly adjusted, the apex of the central inverted V will coincide with the center of the left cross on the bore sight when the sight settings are at zero.

If there is not coincidence, it will be necessary to use the adjusting mechanisms and the tangent elevation mechanism as described above.

When the light filter or protective glass is placed on the sight tube, some deflection of the zero line of sighting will occur. 50X1-HUM deflection is insignificant (not more than one minute) and adjustment of the sight in such cases will not be necessary.

CHAPTER 15

HANDLING THE GUN DURING FIRING AND TRAVELING

71. Changing Gun from Traveling to Firing Position

After arriving in position and turning in the direction of fire, the gun is changed from traveling to firing position: [p 276]

1. Uncouple the prime mover from the limber; disconnect the brake hose and electric lines from the prime mover and lay them on the limber drawbar after having secured the drawbar with cleat 13 (Fig. 104).

Do not remove the trails from the limber when uncoupling the prime mover.

2. Remove the gun cover, breech ring cover with breech lock cover, and sight and trigger mechanism shield protectors. Loosen and release the breech ring tightening devices and fasten them on the trails.

3. Remove the summer spades by switching locks 44 (Fig. 63) from the "Closed" to "Open" position. Pull out lock 43 by the ring and turn it to the right. Then, lifting the spades from above, remove them and place to the side.

4. Release the barrel lock. Remove the covers from the cradle actuating collar. Remove the recoil and counter-recoil rod locks and winch chain key. Insert the winch hook into the breech slot. Remove the winch crank from the trail, attach it to the winch, and roll the barrel forward.

5. Connect the barrel to the recoil mechanism, and the counter-recoil mechanism to the cradle by turning the breech lock counter-clockwise 90° with wrench Sb42-39 (to connect the recoil rod to the barrel).

With one hand release the catch of the lever with handle while simultaneously moving the lever down from the "Travel" to Battery" position with the other hand (to connect the counter-recoil rod with the cradle actuating collar).

6. Take the winch hook out of the breech slot and pull it back. After turning the winch crank 15 revolutions, disconnect the winch key from the upper carriage, and pull it back and fasten it to the trail.

Do not spread the trails unless the winch key is disconnected from them.

Before taking the winch hook out of the breech slot, make sure that the counter-recoil rod nut is connected with the bushing of the cut-off gear actuating collar.

7. Remove the trails from the limber; to do this:

- release the limber frame lever locking limber pintle nut 4 (Fig. 103); unscrew nut 4 several revolutions and remove disc 3; [p 277]

- set the hand brake for the wheels, and open the brake valve and bleed air from the brake cylinder; close the valve;

- place the jack in an operating position on the base plate (in the event of soft ground, put a board or skids under the base plate); operate the jack as shown in Paragraph 40 to lift the trails and remove the limber pintle from the drawbar;

- roll the limber back and put a support under the [limber] shaft; secure the support with a ring [lock];

- close jack valve 40 (Fig. 70) and carefully lower the trails by opening valve 34 with handle 39;

- push the jack piston down, secure the jack and base plate to the trail, and close valve 34.

8. Lower the barrel by operating the elevation handwheel, remove the muzzle brake cover, and throw back the catches supporting the cradle.

9. Disconnect the drawbar and spread the trails as far as possible. Stops 52 (Fig. 58) should engage the trail openings. Attach the summer spades to the tail sections [of the trails].

A jack may be used to facilitate spreading the trails and fastening the summer spades to them, as follows:

- lower the trails to approximately 1.5 meters above the ground and release the drawbar;

- move one trail, without a jack, to the side, but do not lock it in place;

- lower the trail and place a jack at the trail lock;

- move the trail to the support with handspikes (stop 52 must engage the trail opening);

- set up the jack and raise the trail to facilitate attaching the spade;

- attach the spade and secure it with a cap;

- lower the trail until the spade rests on the ground, and set a jack at the trail lock;

- spread the second trail as far as possible (stop 52 must engage the opening on the lower carriage);

- raise the trail with the jack and install the spade;

- remove the jack and secure it to the trail.

10. Unlock the upper carriage from the bottom carriage by pulling stop 15 (Fig. 42) handle up and turning it 90°.

11. Install the panoramic telescope and, if firing at night, the LUCh-S71M illuminating instrument.

12. Mount the zero indicators on the sight and panoramic telescope.

13. Install optical sight OP-4-35 (OP-4-96) on the gun and secure it. If direct laying is required, mount zero indicators on the sight.

14. Check the operation of the recoil indicator after shifting it to the forward position.

15. Secure the tail sections of the trails by digging holes for the spades. When firing on loose or soft soil set the spades on skids 2.5 - 3 meters long and secured with rings.

In the event it is necessary to open fire quickly from an unreadied position, it is permissible to fire without the summer spades in place. [p 278]

Under winter conditions on frozen ground, firing is done with winter spades (instead of the summer replaceable ones). For this purpose, smooth holes are chopped in the ground for the spades, and blocks are placed under the trail box to provide a firm footing. This also prevents the bottom plates of the trail from dragging on the ground.

16. Cover the light reflectors on the shield.

For normal operation of the training mechanism, the firing position of the gun must be located on a flat area if possible.

Laterial tilt of the gun can be checked by a level placed on the machined surface of the bottom carriage or by the cross level of the S71 sight.

On the end of the fork bushing of the sight (same side as elevation angle-handwheel) and on the end of the pivot arm of the tipping parts are graduations. To determine the horizontal position of the lower carriage by the sight cross level, it is necessary to align the graduations with the cross leveling knob and ascertain the tilt of the gun according to the position of the bubble on the sight level.

When the spades are placed in a horizontal plane, a slope of $\pm 3^{\circ}$ under the wheels is permissible.

For stability of the gun on any terrain, the plane on which the wheels rest should not slope more than $\pm 3^{\circ}$ laterally relative to the plane on which the spades rest.

It must be remembered that when the gun is placed on a steep slope, operation of the training mechanism is difficult.

72. Preparing Gun to Fire at Firing Position

Before opening fire it is necessary to:

1. Clean dust and mud from the gun. Wipe the cradle slide thoroughly and swab the bore dry. Clean the arc segment and shaft journal of the elevating mechanism.

Do not fire a gun from whose bore all grease has not been removed, as this can cause barrel swelling.

2. Dismantle the breech as described in Paragraph 10. Wipe and oil all parts. Remove dirt and excess oil from the breech ring guide and the block recess. Assemble the breech block and check the operation of ot and the firing mechanism.

3. Wipe the sight attachments to remove dust, grime, and excess oil with a rag to remove dust, grime, and excess oil.

4. Wipe the columns of the equilibrator mechanism.

5. Check to see that the recoil rod has been correctly and securely connected with the barrel, and the counter-recoil rod with the cradle actuating collar. For this purpose, check the operation of the triggering mechanism and breechblock (the breechblock must open and the fi[illegible] release).

6. Check the fluid level in the recoil mechanism and the pressure in the counter-recoil system, as described in Paragraph 69.

7. Make sure there are no leaks in the recoil mechanism; if leaks are evident, eliminate them by methods given in Paragraph 78. [p 279]

8. Test the operation of the elevating and training mechanisms.

73. Gun Laying

The gun is aimed at the target by two methods: direct laying on the target and indirect laying on an auxiliary point.

Coarse setting on a line can be done by the scale located on the rear plate of the lower carriage.

Direct Laying

Direct laying can be done with optical sight OP-4-35 (OP-4-96) or with mechanical sight S71-35 (S71-96).

For direct laying on a stationary target with the optical sight, it is necessary to:

1. Line up the division on the selected scale with the horizontal cross-hair by looking through the eyepiece of the sight and turning the angle of elevation handwheel according to the commanded elevation (angle of elevation) and projectile.

2. Line up the apex of the inverted "V" of the central angle by means of the training and elevating mechanisms, and commence firing.

When firing at a moving target (taking into account the lead angle), the gun is laid as described above, except that the lead angle is added.

In all other situations when working with the sight, it is necessary to follow the instructions stated in Paragraph 52 of this manual.

Direct laying of the gun with mechanical sight S71-35 (S71-96) is done in the following manner;

- level the sight vertically by turning the leveling screw until the bubble is centered;

- set the deflection and reflector on the scales of the panoramic telescope to 30-00 and 0-00 respectively;

- pressing on the release of the range drum indicator, move the indicator so that the scribe mark will be visible on the scale which is used during firing;

- set the commanded elevation by turning the angle-of-elevation handwheel (if setting is given in mils, then set it on the mil scale);

- by turning the training and elevating mechanisms, align the panoramic telescope cross hairs or the apex of the inverted "V" of the central angle with the target.

To eliminate the effect of sloping cradle trunnion axles, the air bubble of the level must always be centered.

Note: When the target is moving, the lead angle is equal to one tank length or is added to the angle of train. In the first case, the cross hair of the panoramic telescope or the apex of the inverted "V" of the central angle is not laid on the target but on a point incorporating the lead angle. In the second case, the angle of train will differ from 30-00 by the amount of the lead angle.

Indirect Laying

Indirect laying on a target is done with mechanical sight S71-35 (S71-96) in the following order: [p 280]

- level the sight vertically;

- set the deflection of the panoramic telescope according to command;

- set the commanded angle of site (with sight still level) by turning the angle-of-site handwheel;

- set the commanded elevation by turning the angle-of-elevation handwheel (if setting is given in mils, set it on the mil scale);

- center the bubble of the longitudinal level by means of the elevating mechanism;

- by turning the training and reflector handwheels, align the panoramic telescope cross hairs or the apex of the inverted "V" of the central angle with the aiming point;

- check the positions of the bubbles of both levels and, if necessary, correct the laying.

74. Loading and Firing of Gun

1. At the command "Fire," place a shell in the chamber of the barrel so that its after end is seated behind the projectile retainers; ram the shell forward with a ramrod so that its rotating band is firmly wedged into the lands.

Complete seating of the shell increases the accuracy of fire, reduces bore scoring, and prevents rupture of the rotating band.

Ramming of the shell must be done carefully when firing with large angles of elevation, because a badly rammed shell can misfire and, in some cases, cause swelling and even rupture of the barrel.

2. Place a shell with charge in the chamber. Close the breech and commence firing by pulling the firing plunger handle back.

In the event of misfire, try firing 2-3 more times. If nothing happens, wait 1-2 minutes, open the breech, and replace the round.

When loading, pay particular attention to the cleanliness of shells and cases in order to avoid firing delays and mishaps.

75. Firing with Blank Rounds

When firing with blank rounds, observe the following rules:

1. Send blank rounds which are difficult to load or which have a large number of dents to an artillery shop for repair.

2. When blank rounds misfire, use the same procedure as for live rounds.

3. When removing a blank round from the gun, take the following precautionary measures: after opening the breech, remove the cartridge case by hand; do not allow it to fall out of the chamber.

4. If the gun fails to eject the round (caused by a misfire resulting in the round's becoming jammed and impossible to remove, or by [p 281] incomplete seating of the round)remove the round with a manual extractor.

Do not knock out rounds from the muzzle.

5. Before unpacking the next round, inspect the chamber thoroughly for unburned solid particles and remove any that are found.

6. When ramming a blank round, do not apply excessive force, so that the gun can be easily unloaded if there is any difficulty.

7. The rate of firing blank rounds must not exceed that of live rounds.

Any personnel, livestock, or inflammable objects must be at least 200-250 meters from the front of the gun.

8. Do not bend the edges of the cartridge case, and do not force the wadding in.

9. Do not use live charges for blank rounds, and do not use blank rounds for field firing.

76. Observation of Gun During Firing

During firing, there must be constant observation of the operation of the gun's mechanisms to prevent accidents and damage. Pay special attention to the following:

1. During breaks between rounds, elevate the barrel and open the breech to allow the barrel to cool.

If a gun has been loaded and firing delayed for some reason, the shell must be removed from the barrel.

2. To prevent damage to the counter-recoil mechanisms, the length of recoil must not exceed a limiting value of 1,350 mm, as indicated by the word "Stop." When the recoil becomes greater than this limiting value, firing must be stopped immediately and measures taken to determine the cause of the unsatisfactory operation of the counter-recoil mechanisms.

When the cause of abnormal operation cannot be explained, the gun must be sent to a repair shop.

3. After firing the first round, check the spades for firm placement in the ground. If one of the spades is loose, tamp the ground under it or break the ground under the other spade. Examine the ground for rocks under the spades. Rocks must be removed, since they can bend the spades.

When a gun is laid for firing with winter spades, the tail section of the trail parallel to the barrel may have to be raised. In this case, the tail section itself cannot be lowered. In order to lower the trail, it is necessary to bring the barrel to a horizon-

on.

4. When firing the gun with a maximum angle of elevation, make sure that the breech does not strike the ground during barrel recoil. On soft ground put planks under the wheels.

When the short recoil exceeds the permissible limit (815 mm), it is necessary to adjust the recoil limiter mechanism so that the marks representing a distance of 140 mm (Fig. 22) approach to within 3-4 mm of each other and, at the same time, the grooves of the counter rod are overlapped by insert 5 (Fig. 25). [p 282]

If short recoils at maximum angles of elevation and long recoils at small angles of elevation are normal after this, then one of the old marks should be covered up and a new mark put on to maintain the distance of 140 mm.

It should be remembered that bringing the marks too close together during adjustment can, when firing with low angles of elevation, reduce long recoil and bring it below the permissible value (1,150 mm).

5. Make sure that the wheels have been locked by the brake.

6. If gases escape through the cartridge case, cease firing and inspect the bore.

7. Examine the gun carefully upon termination of firing. Lubricate the hot bore with gun grease to soften the carbon deposit. Make sure that the barrel temperature is low enough to avoid burning the swab.

During firing, it is necessary to observe the following precautions:

- the distance between guns must not be less than 20-25 meters to eliminate the blast effect on settings of neighboring guns;

- the area for stacking service rounds must be outside the blast effect zone.

During firing with reduced charges, extra powder removed from the cartridge case must be placed in a box and tightly sealed to prevent ignition by sparks from the barrel.

77. Handling of the Gun in High and Low Temperatures

1. When operating at a low temperature, fire the first 1-2 rounds with reduced charges in order to warm up the barrel and the fluid in the recoil systems.

2. Avoid profuse oiling of the mechanisms, as this can lead to difficult operation and even failure.

This specifically pertains to the firing and trigger mechanisms and to the bearing surfaces of the breechblock.

3. Winter spades are used in winter conditions.

4. When firing at a high temperature, watch for leaks in the recoil and counter-recoil systems. In general, check the condition and operation of the recoil mechanisms (length of recoil, nature of recoil, return to battery, etc.) more often and more thoroughly when firing in extremely hot or cold weather.

78. Possible Malfunctions of Gun Dufing Firing and Methods for Their Corrections

All gun malfunctions detected during firing are corrected by order of the firing platoon commander. Malfunctioning parts of mechanisms are, as a rule, replaced with spare parts.

Possible gun malfunctions during firing and the methods of correction are listed in the following table:

Malfunctions Possible in Firing and Transporting of the Gun, and Methods of Eliminating Them

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
	Malfunctions of Breechblock	
Incomplete or difficult closing of breechblock during loading	1. Nicks on flange and dented cartridge case	1. Remove the cartridge case and replace with a new one.
	2. Nicks on chamber	2. Smooth out nicks.
	3. Heavy oil or nicks on guide block and breech ring	3. Remove excessive oil; carefully smooth out nicks.
	4. Protrusion of primer cup	4. Tighten screw and set cup in farther.
	5. Bent extractor lip	5. Replace the extractor with a new one.
Misfires in triggering firing pin	1. Primer cup set too deep	1. Remove cartridge case; carefully unscrew the primer cup at a distance from the battery.
	2. Heavy oil on, or clogging of, firing mechanism	2. Disassembly the mechanism, clean it, and lubricate it with a thin layer of gun grease.

50X1-HUM

50X1-HUM

Nature of Malfunction	Indications of Causes of Malfunction	Method of Eliminating Malfunction
	3. Broken firing pin	3. Replace with a new firing pin.
	4. Insufficient protrusion of firing pin past the block face	4. Replace the firing pin.
Inertial safety device remains in recessed position after closing of breechblock.	1. The spring of safety device has broken.	1. Replace with a new spring.
	2. The seat of inertial safety device was too heavily lubricated.	2. Take out the inertial safety device and remove excess oil from it and the seat.
After firing, the breechblock opens with difficulty or does not open at all.	1. Expanded cartridge case	1. Let the cartridge case cool off (1-2 minutes) and try to open the breechblock. If it does not open, place a piece of wood on the breechblock loading tray and open the breechblock by hitting the loading tray through the piece of wood (along with pressure on the hand lever). Remove the shell case with the hand extractor.
	2. The cocking lever safety catch did not return to its initial position.	2. Set the cocking lever in the forward position. Open the breech and remove the block. Replace the spring of the tension shaft.

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
	3. The inertial safety device remained in the breech ring notch.	3. Release the safety device with the disengagement lever, and clean it and the seat. When necessary, replace the catch spring.
he trigger mechanism does ot work.	1. The breechblock is not completely closed.	1. Put the bock in place by hand. If this situation occurs again, send the gun to the repair shop.
	2. Defective cartridge case	2. Remove the cartridge case and replace it with a new one.

[p 284]

Note: In case of misfire, try two more times to trigger the firing pin. If it still does not ire, wait 1-2 minutes and then carefully open the breechblock and remove the cartridge case. Take he case away from the battery by hand to a distance of at least 30 meters from the area where the mmunition is kept and replace the faulty primer cup.

Malfunctions of Recoil Mechanisms

eavy Flow of fluid through he packing of the piston od	1. The packing of the buffer piston rod is not securely tightened.	1. Tighten the packing with the winch handle.
	2. The collar is defective.	2. Replace the collar.

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
The escape of fluid through the packing of the recuperator cylinder and the housing of the recuperator packing	The packing housing and the recuperator cylinder are not tight enough.	Tighten the stop screws.
The escape of fluid through the packing of the recuperator buffer rod	1. The packing is not tight enough.	1. Tighten the packing nut.
	2. The collars are defective.	2. Disassemble the packing and replace the collars.
The escape of fluid through the packing of the recuperator piston	The collars are defective.	Disassemble the packing and replace the faulty collars.
The pressure in the recuperator drops although there is no escape of fluid.	There is no hydraulic seal.	Produce a hydraulic seal by elevating the barrel 6-10 degrees; slowly open the valve a slight amount; if fluid squirts out, a hydraulic seal exists.
The short recoil increases at maximum angles of elevation.	1. The throttling bar packing is too tight.	1. Loosen the nut which tightens the throttling bar packing.
	2. Excess play in the mechanism for changing the length of recoil (the throttling bar grooves are not completely overlapped by the bushing)	2. Adjust the mechanism for changing the length of recoil; put one at the center and insert it again maintaining a distance of 140 mm (see Section 76).

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
A short recoil at small of elevation	The mechanism for changing the length of recoil is out of adjustment or has become unbalanced.	Adjust the mechanism in accordance with the instructions in Section 76 .
Long recoil	1. A shortage of fluid in the recoil brake	1. Add fluid.
	2. Piston brake lining is excessively worn.	2. Send brake to repair shop for replacement of lining.
Short counterecoil (with knocking)	1. High pressure in recuperator	1. Reduce pressure to normal.
	2. Large amount of fluid in recuperator	2. Reduce amount of fluid to normal.
	3. Recuperator valve is defective.	3. Repair valve. Replace its spring.
	4. The throttling bar cup is worn.	4. Send the recoil brake to the shop for repair.
	5. The buffer valve is defective.	5. Disassemble the recoil brake and repair the buffer valve. See that the fluid in the recoil brake is clean.
		[p 285]
Sluggish counterrecoil, incomplete counterrecoil	1. Nicks in cradle guides	1. Carefully smooth out nicks.
	2. Not enough fluid in the recuperator	2. Increase amount of fluid to normal.

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
	3. Not enough pressure in recuperator	3. Adjust the pressure.
	4. Friction in the brake and recuperator packing	4. Loosen the packing bolts.
	Malfunctions of Guide Mechanisms	
The elevating mechanism operates with difficulty.	1. Excessive or insuffiecient pressure in the columns of the equilibrator	1. Adjust the pressure in the columns.
	2. Clogged arc segment or main drive gear	2. Remove dirt from the teeth of the arc segment and the drive gear and then lubricate.
	3. Dents on the arc segment and the main drive gear	3. Carefully smooth out the dents.
	4. The gears are clogged.	4. Disassemble the gears; clean and lubricate them.
	5. The worm axle brake is out of adjustment.	5. Adjust the axle brake.
Severe dislodgement of rar[illegible] setting after firing	The axle brake does not work.	Adjust the axle brake.
The [illegible]raining mechanism ope[illegible]ates with difficulty.	1. The gears are clogged or there are dents on the arc segment, worm, and drive gear.	1. Remove the dirt from the gears. Carefully smooth out the the dents.

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
	2. There is not enough clearance between the carriages.	2. Adjust the clearance.
Locking devices difficult to engage when trails are changed to firing position.	1. Clogging of the trail stops and locking devices	1. Remove dirt from the stops and locking devices.
	2. Nicks in the locking devices and the seats	2. Smooth out the nicks.
The sight settings are dislodged in firing.	The sight friction coupling has worn thin or become loose.	Send the sight to the repair shop for elimination of the malfunction.
	Malfunctions of the Equilibrator	
Fluid escapes from the columns.	1. Heavy lubricant 2. Defective collars	1-2. Disassemble packing and wash or replace collars.
The pressure drops although no fluid escapes.	1. The valves are not closed tightly.	1. Close the valves tightly.
	2. There is no fluid in the columns.	2. Put the proper amount of fluid in the columns.
During operation of the elevating mechanism, the clicks in the columns of the equilibrator are too sharp.	No lubricant in the equilibrator bearings	Lubricate the bearings.

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
	Malfunctions of the Jack	[p 286]
The suction valve does not operate.	The crank turns the leverarm without any resistance.	Crank vigorously a number of times. Disassemble and clean the valve.
The pressure valve does not operate.	The crank for operating the jack arbitrarily returns to the stopping device before being stopped.	Same as above
Liquid escapes through the rod or plunger packing.	1. The packing of the collars is defective.	1. Replace the collars.
	2. The collars are pinched by their support ring, as a result of which the packing edge of the collar (the runner) is recessed and does not seal.	2. Install a leather ring of less thickness.
The jack cylinder buckles.	Wheels not braked during raising or lowering of trails.	Put on the hand brake.
The rod handle of the jack is bent.	In raising or lowering the trails the rod handle is placed lengthwise of the trails.	When operating the jack, place the rod handle perpendicular to the trails.
	Malfunctions of the Wheel Brake	
The brakes are not effective enough.	1. The linings of the brake shoes have become oily or have "burned out".	1. Clean the linings with a fine abrasive cloth or paper and wash with gasoline. Also clean the drums with an abrasive cloth or paper and wash with gasoline.

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
	2. Contact between the surface face of the oval aperture of the shoe and the stop pin is made below the aperture.	2. Wear down the lower surface d of the oval aperture of the shoe to depth of 1-2 mm (Figure 73). If the thickness of the lining is less than 7, replace the lining or place a metal sheet of same thickness between the lining and the shoe thickness
	3. Water has fallen on the linings.	3. Operate the brake a number of times.
	4. Air leakage through the collars of the brake cylinders	4. Disassemble the packing.
	5. Air leakage through the collar or washer of the control valve	5. Disassemble the packing.
	6. Low pressure in the main brake line of the gun.	6. Adjust the combination stop-cock or the compressor on the prime mover.
	7. The main brake line is clogged.	7. Disconnect and blow out the air lines.
	8. Too long a stroke of the brake cylinder piston rods	8. Adjust the stroke. On guns with one-piece leverarm 38 (Figure 73) the piston stroke must be 15-35 mm, while with complex lever arms it must be 20-25 mm.

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
		[p 287]
	9. Air leakage through the air lines or fittings	9. Tighten the connections; if cracks are detected in the air line, repair the rubber hoses.
The brakes do not release	1. Contact between the surface of the oval aperture of the shoe and the stop pin is made above the aperture.	1. Hollow out a recess of not more than 0.3 on the upper surface g (Figure 73) of the oval aperture.
	2. There is no clearance v (Figure 73) between the brake-shoe disc and the edge of the cam when the gun is braked.	2. Ensure a clearance of at least 0.3 by trimming off the edge of the camshaft.
The connection of the air-line locks is not hermetically sealed.	1. Deformed and dented sleeves	1. Lubricate the sealing surface of the sleeves. Sleeves which are not airtight replace with new ones.
The cylinder brake piston rod does not return to the initial position.	1. Castellated nut of the camshaft is too tight.	1. Unscrew the nut one-sixth of a revolution.
	2. Adherence of piston collar to the walls of the brake cylinder	2. Lubricate the collar.
	3. The oil in the brake cylinders is not suitable and has thickened during the winter.	3. Thin the oil in the cylinder with mineral oil. Lubricate the piston during overhaul with AF-oil.

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
The brake drums become hot	1. See "Non-return of the cylinder brake rod to the initial position."	
	2. The spring which tightens the brake shoes has broken.	2. Replace the spring.
	3. Slow build-up of pressure in the main "supply" line because of clogging or obstruction of the air line; the air filter has become clogged, oily, or caked.	3. Wash the filter with clean gasoline.
	4. The hand-brake cable is too tight.	4. Loosen the cable.
The gun rolls toward the prime mover in emergency braking	1. See "the brakes are not effective enough."	
	2. Slow decrease of pressure in the main "supply" line	2. Clean and blow out the air line; wash the filter with clean gasoline.
	3. The combination stopcock of the prime mover does not provide enough advance for a pressure decrease in the main "supply" line of the gun before its brakes are engaged.	[p 288] 3. Adjust the advance at least 1.5 atm. It is recommended that the regulating collar on the combination stopcock of the prime mover be set at the position "R" (advanced) providing an advance of 1.5-2 atm.

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
The pneumatic braking system does not work.	1. The hose is broken.	1. Repair or replace the broken hose.
	2. The control valve or air filter is clogged.	2. Remove dust and dirt from the control valve (in the repair shop); clean the air filter.
Malfunctions of the Suspension Mechanism		
The suspension does not release (during separation of the trails the pintles for releasing the suspension do not enter the rocker arm seats).	The suspension mechanism is out of adjustment.	Adjust as indicated in Section 60 ("Setting of the Suspension Mechanism").
Malfunction in Working With the Trails		
The trails do not let down (extreme tightness).	1. Either trail stops or those of the bottom carriage are clogged or jammed in travel position.	1. Smooth out the nicks or remove the dirt from the stops.
	2. There are nicks or metallic slivers on the stops v (Figure 63).	2. Smooth out the nicks and metallic slivers.
	3. Nicks and metallic slivers on the bearing surfaces v of the lever arms 25 and 37 (Figure 58)	3. Smooth out the nicks and slivers.

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
The trails do not separate completely in firing position; the locking devices 52 do not engage (Figure 58).	1. Either the trail stops or those of the bottom carriage are clogged or jammed in firing position.	1. Smooth out the nicks or remove the dirt from the stops.
	2. The locking devices 52 or their seats are jammed.	2. Smooth out the nicks.
	3. The pintles for releasing the suspension do not enter the rocker arm seats.	3. Adjust the suspension.
Stops 17 (Figure 63) come loose when trails connected or disconnected.	Insufficient lubrication or clogging of the link bolt	To lubricate the link bolt on guns having no lubricators, push the bolt out with a jack or by some other means. Smooth out all depressions; lubricate, and insert the link bolt. If there are lubricators, lubricate the link bolt periodically with a grease gun.
Stripping of the threads of the drawbar clamping screw	See "the trails do not let down (extreme tightness)."	

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
		[p 289]
	Malfunctions of the Winch	
The roller brake does not hold.	1. Insufficient clearance between the disc 41 (Figure 68) and the lateral surface of the groove for the right guide	1. Turn in winch for repair.
	2. Too much clearance between the shaft 42 and the surface of the right guide	2. Turn in winch for repair.
	Malfunctions in the Lighting	
The muzzle light or the rear light on the bottom carriage does not go on.	1. The bulb is burned out.	1. Check the bulb and replace if necessary.
	2. The contact of the wire with the terminal has become clogged or is missing.	2. Clean or adjust the contacts of the lights, terminal block, plug of the PS-11 sight.
	Malfunctions of the Interlocking Mechanism for the Recuperator and Stirrup	
The recuperator is not connected with the stirrup bushing	1. Too little clearance between the ends of the connecting nut of the recuperator and the stirrup bushing	1. Adjust as indicated in Section 60 ("Adjusting the Connection of the Recuperator Rod with the Nut of the Cut-off Gear Actuating Collar").
	2. The screws 65 (Figure 25) holding the disc buffer of the recoil brake have become loose.	2. Remove the screws and clean the threads.

Nature of Malfunction	Indications or Causes of Malfunction	Method of Eliminating Malfunction
	On early-model guns, which have a rigid rod locking device 09-27 instead of a leaf spring 57, the following malfunctions can occur: a) The locking device 09-27 is bent when the barrel is partially drawn back without the sliding coupling of the breech lug's being disengaged. b) Incomplete engagement of the locking device 09-27 with the buffer disc during travel	a) Check and repair or replace the rod locking device 09-27. b) Same as above

No

79. Changing the Gun from Firing Position into Traveling Position

To change the gun from the firing position to traveling position:

1. Set the mechanical sight S71-35 (S71-96) in traveling position as follows:

- set the angle-of-sighting mechanism in the traveling position by turning the elevation micrometer drum of this mechanism counterclockwise as far as it will go, i.e., until the base of the dial (panoramic) sight socket rests against the lug on the sighting gear case; [290]

- remove the panoramic display from the sight and place it into its case.

2. Remove the optical sight and the illumination device LUCh-S71M, if they were placed on the gun.

3. With the traversing mechanism, put the barrel in the center, engage the top carriage lock in traveling position, and brake the gun manually.

4. Place the hydraulic jacks in working position and remove the clamp rings which hold the detachable spades in firing position. With the jacks, lift the trail arms until they are completely separated from the spades; release the locks which hold the trails in firing position, remove the jack from under one of the trails and move this trail to the middle or traveling position; place the jack under this trail again and lift the trails; remove the jack from under the second trail and pull this trail next to the first one in the middle.

Release the trails and connect the trail drawbar with a screw.

Pulling the trails together with a lever or hand spike, when the trails are raised on jacks, is prohibited.

5. Put the extension eyes of the trails in traveling position and, using the elevating mechanism, bring the tipping part of the gun to such an elevation angle at which the cradle rests against the extension eyes.

6. Attach the winch to the top carriage; secure to the gun all transporting accessories, place the spades on the trails and secure them with locks by turning them to "locked" position.

Make sure that the loop of the winch rod is properly fastened with the bracket catch of the top carriage (the catch should be in all the way).

7. Using the jack, lift the trails. Place the limber under the tail portion of the trails and lower the trails until the eye of the drawbar fits on the limber pintle; put a washer on, and with the handle tighten the pintle nut and lock it with the same handle. Disconnect the jack and secure it to the trail arm.

In case the jacks are out of order, the trails may be brought together and raised on the limber manually.

8. Pull back the barrel as follows:

- connect the chain of the winch with the breech ring;

- move the barrel a little forward with the winch;

- disconnect the recoil piston rod from the barrel by turning the sliding lock in the breech ring from right to left 90° with key Sb42-39;

- disconnect the recuperator rod from the cut-off gear actuating collar by moving the lever handle from "Firing" position to "Traveling" position;

- using the winch, pull back the barrel until the breech ring comes against the rests on the trails and remove the catch of the winch chain from the recess in the breech ring;

- engage the lock which secures the barrel in traveling position (lock must enter recess on breech ring).

9. Connect the screw couplings to the breech ring and tighten them.

10. Cover the breech end with the breech cover and close the sliding lock with the cap which is connected to the cover, and also, cover the mechanical sight with the sight cover; the cut off-gear actuating collar, nuts of the recoil piston rod and recuperator rod, the shield piece of the trigger mechanism and the arm of the winch chain are covered by the common cover.

11. Release the gun brakes. Open the light reflectors on the shield. Remove from the limber the air brake hoses and the lighting wires and connect them to the tractor and the gun. [291]

12. See that the valve of the wheel brake control is closed (the valve must be closed).

Before connecting the limber with the tractor, disengage the cleat with which the center futchel is rigidly connected to the limber axle. If this is not done, the cleat or the center futchel may break.

The above is the authorized sequence of operations for changing the gun from firing position to traveling position, and vice versa.

However, some operations may be made simultaneously, as for example: centering the barrel, putting away the accessories and opening the light reflectors on the shield, and so forth.

80. Inspection of the Gun Before a March

Before a march, inspect the gun and check the following:

1. Fastening of the gun carriage and limber wheels (the nuts fastening the rim of the wheel to the hub must be tight and locked; the nuts fastening the wheels on the journals of the rocker arms and on the journals of the limber axle must be locked).

2. The condition of the lubricant in the hubs and the secure attachment of the hub caps.

3. The condition of the suspension and the axle parts.

4. The performance of brakes and their linkages (pneumatic and manual), operation of the electric stop lights, and the position of light reflectors on the shield.

5. The condition of the valves.

6. Fastening of the tipping part for a march (cradle on hinged brackets, barrel against barrel stops, breech ring lock engaged, ties securely tightened).

7. The condition and fastening of the accessories and the spades on trails.

8. Fastening of the drawbar with the tightening bolt.

9. Connection of the gun to the limber (check if the washer is placed correctly under the nut of the pin, and see if this nut is tight enough).

10. The connection of the center futchel with the limber axle. and also with the tractor hook. If the tractor has a non-rotatine bushing key on the connection loop of the center futchel should be removed.

11. The secure and correct fastening of the covers.

81. Supervision Over the Gun in March

When the gun is being moved, see that the speed limits for which the gun is designed are observed.

The ground clearance of the gun is 400 mm, and that of the limber - 375 mm. Because of this clearance, it is necessary to move the gun very carefully over roads and terrain on which there are obstacles such as stumps, boulders, and so forth. The speed in such areas must be decreased. The speed must also be decreased when crossing broken terrain (terrains with shallow ditches and slopes). Precautions must also be taken when moving the gun over muddy, slippery and snow-covered roads, because handling of the gun and the tractor under such conditions is difficult.

It is necessary to slow down on turns (especially on sharp curves in winter time), because the gun may skid off the road.

Sudden braking shouldalso be avoided, because it causes the gun to turn against the tractor and jackknife (especially on downgrade). [292]

During short and long stops, check that the wheel hubs, brake drums and cylinders, bushings, etc., are not overheating. If the axle parts are overheating, and/or grease is running out, remove the wheels, inspect the brake shoes, check the brake system, and remove all the defects.

During stops, check the condition of the tires and the parts of the suspension mechanism, and see that the drums are securely connected to the wheels. During the first stops, tighten the wheel nuts of the gun carriage and the limber, and check for secure attachment of the tools and accessories to the trails.

The connection of the gun with the limber and the limber with the tractor may be checked more often (in the gun-to-limber connection, the nut must be tightened as much as possible); the fastening of the tipping part in traveling position, and the fastening of the covers, should be checked intermittently.

Wipe the dust and dirt off the light reflectors, shield, and stop lights often.

82. Temporary Repairs While in Travel

Sometimes, due to lack of time and material, it is necessary to make temporary repairs of damages to the equipment with tools and recources that are available.

Lost cotter pins and pins, in most cases, may be replaced with wire, which is put through the corresponding opening and twisted. If the drawbar is damaged, the gun may be connected to the limber with a wire cable or a chain.

If one or both of the torsion bars break, and they can not be replaced, the traveling may be continued only after the suspension is disengaged. To disengage the suspension, raise the front part of the gun carriage with a jack so that the holes on the rocker arm and the levers coincide; remove the pawl connecting the disengagement pin of the suspension with the trails and insert the pin into the receptacle.

Traveling speeds in this case as well as in the preceding cases should not exceed 5 - 10 km/hr on smooth roads. These temporary repairs must be replaced by permanent ones at the first chance.

83. Inspection of Guns After Prolonged Traveling Under Special Conditions

After traveling, particularly over muddy areas and water barriers or under severe climatic conditions (abrupt changes of temperature, etc.), the gun should be carefully inspected.

The inspection should consist of the following:

1. Remove covers, examine, clean and dry them.

2. Clean the bore and the breechblock, inspect and if necessary oil them; disassemble the breechblock, clean and oil its parts; assemble the breechblock.

3. Clean the outside parts of the gun and the limber with a dry cloth, if necessary wash them with water and wipe dry; oil where necessary.

4. Remove dirt, snow, ice, and such from the trail rests and [293] the front part of the trail, the trail locks, the openings for attaching the spades, the elevating rack and traversing mechanism, the joints, and so forth.

5. If there is time, remove the wheels, examine the hubs, the ball-bearings, and rocker arm journals.

6. Check the suspension.

7. Take whatever measures are necessary to remove water, dirt or dust from all recesses.

8. Check for condition and secure attachment of the accessories.

9. Check the condition of nuts, bolts, pins, cotter pins, expansion rings and locks.

10. Check the limber pin and the center futchel, as well as the trail drawbar.

CHAPTER SIXTEEN

TECHNICAL INSPECTION OF EQUIPMENT AND ELIMINATION OF DEFECTS

84. General Instructions

[294]

The purpose of a technical inspection of equipment is the timely discovery and elimination of defects, as well as the prevention of damage and consequences of incorrect servicing and handling of the equipment.

In military units, a technical inspection is performed by chiefs of the artillery ordnance, artillery mechanics, and officers to whom the equipment is entrusted, as well as by persons appointed to conduct the inspections of the artillery weapons.

In a technical inspection, the equipment is classified as to categories, depending on the degree of wear and character of required repair, in accordance with the instructions on classification of artillery weapons.

Defects and damage discovered during the inspection, no matter how insignificant, must be immediately rectified with the resources available to the military unit. If the equipment is found to be damaged to the extent that it cannot be repaired with the unit's facilities, it must be referred to higher maintanance units.

In addition, this chapter indicates the sequence of a technical inspection of equipment and methods used for correcting frequently occurring malfunctions which may appear in the course of the gun's use and which may be corrected, without the use of special equipment, by the personnel which service the particular equipment.

In all other instances when the equipment is damaged, the repair guide should be used.

A technical inspection of weapons is performed in both the assembled and disassembled states.

An inspection of a weapon in the assembled state determines the condition and operation of the mechanisms and sighting devices, as well as the vertical and horizontal play in such devices.

An inspection of a weapon in the disassembled state determines the condition of all parts and units. Primary attention is given 50X1-HUM assemblies in which a defect was discovered during the inspection [295] of the mechanisms in the assembled state of the weapon.

The repair of discovered defects is carried out in accordance with the instructions on military repair.

Before a technical inspection is begun:

- change the weapon from traveling position to firing position;

- remove the grease from the bore and the breech end of the barrel; flush the bore with kerosene and wipe it dry;

- disassemble the breech, flush its parts with kerosene, and wipe them dry; after lightly greasing all bearing surfaces, assemble the breech and place it back in its position;

- remove dirt and wipe dry all external surfaces of the weapon.

A technical inspection should be conducted in the following sequence:

- inspect all mechanisms and check their operation while the gun is assembled;

- disassemble the gun and check all units in detail.

85. INSPECTION OF GUN IN ASSEMBLED CONDITION

Inspection and Checking of Sighting Devices

1. Prepare the gun for checking the sighting devices as instructed in Section 70.

2. Prepare the sighting devices for checking (see Section 70).

3. Check the gunner's quadrant (see Section 70).

4. See that the sight is firmly secured to the gun; no movement is allowed between the sight and the cradle.

5. See that the elevation scale index is properly attached.

By moving the range indicator along the carriage guide, check to see that the indicator is held in the grooves of the guide, and see that there is no play in the indicator by testing it with the hand. Any looseness of the indicator which interferes with the operation of the sight is not permitted.

6. Check to see that the levels are in good working order. To determine the sensitivity of the air bubble of the side level, bring the bubble to the center between the graduation marks. Change the setting by 0-01. The displacement of the air bubble must be no greater than 1/4 of the length of the bubble itself.

In the same manner, check the cross level by the gunner's quadrant located on the telescope socket.

If the sensitivity of a level is too small or too great, replace the bubble level glass.

Replace the glass also when the graduation marks become worn to the extent that they are difficult to see.

If the bubble housing in the level vial turns, or the vial turns on the base, replace the level or the vial.

7. Determine the play in the sighting and panoramic devices, in the elevation-angle and range drum mechanisms, as well as the play in the azimuth mechanism and the rotating head of the panoramic sight, as instructed in Section 70.

8. Check the zero settings of the sight (see Section 70).

9. Check the vertical play in the panoramic sight. To do this, place the panoramic sight in the socket without securing it with the clamping screw; holding the sight with one hand and lifting and lowering the panoramic sight with the other, test the panoramic sight for play in the socket. There must be none. [296]

Vertical play in the panoramic sight is caused by a defective catch. To check the catch, turn it clockwise all the way and then release it. The spring should cause the catch to return with force to its initial position and tightly press the panoramic sight against the socket cone.

Reasons for a slow return of the catch to its initial position may be:

- friction of the stop screw in the recess of the catch;

- coiling or breaking of the catch spring.

10. Check the horizontal play in the panoramic sight. Place the panoramic sight in the socket and tighten it with the clamping screw; holding the sight by the socket with one hand and turning the sight to the left and right with the other, test the panoramic sight for [illegible] in the socket. There must be none. 50X1-HUM

11. Check the line of sight at the zero setting (see Section 70).

12. Check to see that there is no non-recoverable longitudinal and transverse play in the sight (see Section 70)

13. Check to see that the sight is properly fastened to the gun, and check the adjustment of the levels (see Section 70).

14. Using the gunner's quadrant, check to see if the readings of the gun's sight are correct (see Section 70).

15. Check the line of sight for different elevation angles of the barrel (see Section 70).

16. Check the attachment of the sight's lighting arrangement.

17. Place the telescopic sight OP-4-35 (OP-4-96) on the gun and check to see that it is firmly attached; the sight must not wobble.

18. Perform a visual inspection of the sight. There should be no cracks or corrosion on its outer surface.

19. Looking at the sight (from the eyepiece side), check to see that there is no film, hair, large spots, or other defects on the plane-parallel glass plate (graticule) that may hinder observation, and that the ocular and objective lenses have not become uncemented.

Sights with uncemented lenses, as well as those that have film or other defects on the plane-parallel glass plates which hinder observation, should be sent to a repair shop.

When lenses become uncemented, a "herringbone design" similar to that formed on the glass of windows in winter is seen.

20. Check the operation of the angle of sight mechanism. To check this mechanism, move the range scales into the field of view from zero to maximum by turning handwheel 11 (Figure 93). The range scales must move smoothly, without jerking.

21. Check the operation of the calibrating mechanisms. The mechanisms must allow adjustment of the sight for direction and elevation.

22. Check the lighting of the sight.

A sight should not be disassembled by a military unit, which is authorized to perform, only corrections of defects in the handwheel of the angle of sight mechanisms (tight movements), defects in the socket of the electric bulb, the electric wiring, and the carrying case. Defects should be corrected in a properly equipped repair shop by an artill

If defects in a sight cannot be corrected by the military unit, the sight should be designated for repair.

Inspection of Barrel [297]

Inspection of the barrel is carried out in accordance with the instructions in Section 68.

Checking Operation of Breech Mechanisms

By opening and closing the breech and firing [without ammunition], ascertain that the breech block moves smoothly in the breech ring seat, without jerking or catching; the force on the handle must not exceed 15 kg; and all of the breech mechanisms must operate dependably. A detailed order of checking the breech mechanisms is indicated in Section 68.

Checking Connection of Counterrecoil System.

Pressure and Liquid in Recuperator, and Operation of Interlocking Mechanism of Breech With Buffer

1. Ascertain that the recoil brake rod is properly attached to the barrel; and the recoil cylinder, to the cradle.

If the recoil brake rod is properly attached to the barrel by means of a sliding coupling, the breech can be opened.

If the thrust lock does not turn all the way (through an angle less than 90°), the breech should not open.

Ascertain that the recoil brake is firmly kept from turning in the cradle by a screw with a lock nut located below the cradle.

2. Ascertain that the recuperator is properly attached to the barrel.

The recuperator must be held firmly in the catches by trunnion caps (called "kryshka" on the drawing).

No play is allowed in the cotter pins holding the trunnion caps.

It is more convenient to make this check with the recuperator removed from the barrel.

3. Measure the air pressure in the recuperator; see if the packing in the recuperator is air tight and if its valve is in good working order.

If the pressure is below normal (taking into account the difference in temperatures during the preceding and present tests), the location of the leak must be determined.

4. Examine the peep hole in the recuperator and check for leakage of air or liquid from it, as indicated in Section 19.

Check the accuracy of the peep hole reading in the order indicated in Section 69.

If the results obtained are doubtful, check the quantity of liquid by the method of retraction.

Check of Elevating (Pointing) Mechanism

Check the operation of the elevating mechanism. The mechanism should work smoothly, without jerking, for all angles of elevation. The force on the handwheel required to elevate the gun to angles ranging from $+45^{\circ}$ to $-2^{\circ}30'$ should not exceed 10 kg.

Causes of tight movement of the mechanism can be: control mechanism out of adjustment; wrong kind of oil for the time of year (thick oil in low temperatures); metallic slivers, dents, and nicks on the teeth of the arc segment or shaft of the elevating mechanism; the linkages of the bevel gear transmission and worm gear out of adjustment; parts [298] of the elevating mechanism out of alignment due to wear; mutilated ball bearings, tight and uneven movement of the hinged joints, improper tension on the axial brake; tight movement of the mechanism for varying the amount of recoil.

Check the amount of play in the elevating mechanism. To determine this:

- elevate the tipping parts of the gun to an angle of 10° to 30°;

- turn the handwheel of the elevating mechanism in one particular direction until the play is taken up, note the position of the handwheel, and mark it and the bevel gear box;

- put the gunner's quadrant on the master plane along the longitudinal mark so that the bubble is on the midpoint of the level;

- carefully turn the handwheel in the opposite direction, stopping it at the instant the bubble in the level begins to move, note the position of the handwheel, and put a second mark on it opposite the mark on the bevel gear box.

The angle between the marks on the handwheel indicates the amount of play in the elevation mechanism, which should not exceed 5/8 of a complete turn of the handwheel.

In the event the amount is more than this, it is necessary to check to see if the linkages of the bevel and worm gears are out of adjustment, the hinged joints are worn or not properly connected, etc.

Check of (Traversing) Training Mechanism

Rotating the upper carriage in both directions as far as it will go, check the operation of the training mechanism. The movement should be smooth, without jamming. The force exerted on the handwheel with a smooth motion should not exceed 7 kg. The following can cause tight movement of the training mechanism; insufficient clearance between the upper and lower carriages; metallic slivers and dents on the lower surfaces of the rib of the lower carriage and on the forward clamp; nicks and dents on the teeth of the arc segment and shaft pinion; clogged teeth of the arc segment; tight and uneven movement of the hinged joints; thick oil; mutilated ball bearings; improper linkage or wear of the bevel gear; misalignment of parts due to wear; dents and metallic slivers on the pintle, worm, and worm gear.

Determine the amount of play in the training mechanism by:

- turning the training handwheel in one particular direction, bring the cross hairs of the panoramic sight to the aiming point; note this position and mark the hub of the wheel and the gear box;

- carefully turning the handwheel in the opposite direction, stop it at the instant the cross hairs of the panoramic sight begin to leave the aiming point and put a mark on the wheel opposite the mark on the gear box; the amount of play in the mechanism can be determined from the angle between the marks (it should not exceed 7/8 of a complete turn of the handwheel).

A large amount of play in the training mechanism can be caused by the following:

- bevel gear and worm drive linkages out of adjustment;

- parts worn at the bearing surfaces.

Check of Equilibrator

Check to see if the valve assembly distributor and tubes connecting the tanks, distributor, and cylinders of the equilibrator are in good working order.

Check the quality of liquid in the cylinders. Replace any valves which are not airtight.

Check of Clearance Between Upper and Lower Carriages

The bearing surfaces of the upper and lower carriages must not touch at any elevation angle. A 0.05-mm clearance gauge should pass freely between the bearing surfaces.

If necessary, adjust the pintle and rollers of the upper carriage.

Inspect the travel lock; its spring should hold it in its seat on the lower carriage.

Check of Cradle

The cradle trunnions should be properly attached to the upper carriage, and the nuts securing the trunnion caps to the carriage should be tight and cottered. Loose trunnion caps and cotter pins are not allowed.

Check the movement of the recoil indicator; it should move under a slight pressure of the hand. The contact of the indicator with the guide on the barrel should be not less than 3 mm in a horizontal or vertical direction (check the linkage with the barrel in traveling position).

Check the movement of the push rod; it should operate smoothly, without jamming, and return without fail to its original position.

Check the clearance between the cradle shield and the breech handle; it should be within the limits of 0.5 to 1.5 mm.

If the clearance is found to be outside these limits, an adjustment of the cradle shield, with the aid of a crowbar placed in the breech ring or cradle, is authorized.

Check the clearance between the upper surface of the cradle guides and the lower surface of the breech ring located behind the breech ring guides. If this clearance is less than 0.2 mm, replace the guides.

Check of Non-Recoverable Play in Barrel

Check the horizontal non-recoverable play in the barrel in the following order:

- by means of the elevating and training mechanisms, place the barrel in a horizontal position, midway between the trails;

- apply a force of about 50 kg to the muzzle brake of the barrel, moving the barrel to the right and taking up the play; remove the force and measure the deflection angle on the panoramic sight;

- carry out the same procedure for determining the play in the other (left) direction. [300]

The difference between the angular measurements represents the horizontal play in the barrel; it should not exceed four mils.

Check the vertical non-recoverable play in the following order:

- press down on the muzzle brake with a force of about 125 kg; remove the force and measure the elevation angle with the longitudinal level or the gunner's quadrant placed on the master plane of the barrel;

- press down on the muzzle brake with a force of about 125 kg; remove the force and measure the elevation angle of the barrel.

The difference between the angular measurements represents the vertical non-recoverable play in the barrel; it should not exceed an angle equivalent to a horizontal angle of four mils.

Checking Adjustment of Suspension

While spreading and bringing together the trails, check the action of the suspension. The trails should spread with ease. If the release mechanism for the suspension operates unsatisfactorily, it is necessary to find the cause; to do this, proceed as follows:

- With the trails brought together, roll the gun forward or backward 5-7 meters;

- spread the trails.

If the trails spread normally, then the suspension is properly adjusted.

If one trail cannot be pulled out to the side, or if both trails cannot be spread (as the result of the misalignment of the suspension engagement pin with the recess in the rocker arm), then it is necessary to adjust the suspension. When adjusting the position of the suspension lever arms, make sure that there is sufficient engagement of the tightening screw with its female connection; consequently, the threaded portion of the screw must not extend more than 55 mm out from the female connection. Further adjustment of the suspension is made by placing the torsion bar in the next slot.

The springs of the trail locks for the firing position should cause the locks to engage freely. At the same time, the trails should be spread: i.e., the stops on the trails for the firing position must be in contact with the stops on the lower carriage.

Inspection of Gun for Traveling Position and for Transition From Firing to Traveling Position

Before changing the gun from traveling to firing position, inspect the jacks and check:

- the quantity of liquid in the jacks by opening the drain cocks with the jacks in the vertical position; liquid should appear;

- the hermetic state of the packing of the piston rod and plunger of the jacks (there should be no flow of liquid through the packing; the only escape of liquid past the plunger should be in the form of individual drops);

- the operation of the jacks by raising and lowering the trails.

Inspection of Limber [301]

After placing the trails on the limber, verify that:

- the bearing surfaces of the trails fit tightly against the bearing surfaces of the limber body; there should be no raised portions of metal on the surfaces;

- the connecting link (drawbar) of the trails is properly secured with a limber pintle nut; the nut must be screwed on as far as it will go and secured;

- the connecting link of the trails is properly secured; the drawbar clamp bolt should be firmly attached to the trails.

Inspection of Winch

Inspect the winch; then connect it to the barrel and recoil it by turning the handle.

The force on the handle in recoiling the barrel should not exceed 25 kg.

Retraction and recuperation of the barrel by the winch should be done only with the trails set on the limber.

Do not release the winch handle (allow it to turn by the strain on the winch chain).

Check of Interlocking Mechanism of Recuperator Rod with Firing Mechanism

The mechanism must ensure:

1. In the "traveling" position:

- positioning of the lever lock with the handle in the upper opening of the cradle bracket;

- securing of the bushing and bracket (in the collar) by the lock located on the cut-off gear actuating collar;

- securing of the firing mechanism push rod (impossible to release striker spindle in the "traveling" position and in intermediate position between "firing" and "traveling" positions).

2. In the "Firing" position:

- disconnection of the bushing lock and bracket by means of the arm of the recuperator nut during return of the barrel to the firing position;

- movement of the lever with the handle into the lower position (lever lock should go into the bracket opening on the cradle marked "fire");

- free movement of the firing-mechanism rod.

Maintenance and Check of Wheel Brake

1. Maintenance of the locks on the air brake consists of a periodic removal of dust and dirt and, depending on the season, lubricating the sealing surface a of collar 129 (Fig 73) with a summer or winter oil.

If any deformed or otherwise damaged collars 129 are found during the inspection of the locks, replace them with servicable ones.

2. Maintenance of air filter 113 (Fig 73) consists of a periodic (every 500 km) flushing of felt filter 123 and cleaning of the filter housing (Fig 73) with pure gasoline. After cleaning the filter, dry it and put it back in place. On mechanisms having air filters 126 (Fig 73) with metal screens, the filters should be taken apart at least once a year. [302]

3. Maintenance of control valve 11 (Fig 72) consists of a periodic inspection and check of its operation every 2,000 km, and for guns not having air filters, every 500 km. Basic defects in the control valve are hardening and drying of collar 64 (Fig 73), loss of elasticity (deformation), the appearance of cracks on rubber washer 76, and a defective sealing surface at valve ring 81. These defects are easily detected: the escape of air through gap b between washer 76 and plate 73 (when there is pressure in the main "feed" line and storage tank) indicates the escape of air through valve ring 81; in the braking state (with pressure in the storage tank and reduction of pressure in the "feed"), the escape of air at the "feed" exhaust indicates the escape of air at collar 64, and the escape of air around the side of plate 73 indicates the escape of air past washer 76 or a loose washer 75 of nut 130.

To eliminate the difficulties, take the control valve apart, wash all parts, and replace any that are defective. The escape of air past leather collar 64 can be stopped by cleaning and softening the collar by hand. A hard leather collar should be "tallowed" i.e., immersed for several minutes in a mixture consisting of two parts beef tallow and one part beeswax which has been heated to 60°-70°C. Apply this mixture lightly to the collar when putting it in place in the housing of the control valve.

Collars made of rubber should not be "tallowed"; they should be thoroughly washed in gasoline, and given a light application of AF-70 grease before being put back into place. Defective collars should be replaced with new ones. Washers 76 having cracks or deformations (bent when lying free) should be replaced with new ones. A valve 82 having a ring with a defective sealing surface should be replaced with a new one.

4. The brake cylinders require, first of all, a periodic adjustment of the piston stroke due to the wear of the brake shoe lining. When the piston stroke increases, the braking action slows, causing the gun to "creep up" on the towing vehicle during breaking. Besides this, check to see if the air in the brake cylinders is escaping through collar 42 of the piston.

The piston stroke of a brake cylinder should be 15-35 mm and is adjusted by shifting lever arm 38 to the next slot. Shifting the lever arm one slot results in a difference of 20 mm in the length of stroke.

On [some] guns having a control arm 38 the piston stroke is set at 20 to 25 mm and adjusted by turning stem M on the control arm with wrench A52830-2. During the adjustment, the piston stroke of the brake cylinders must be minimum, but not short enough to cause the drum still to brake when the brake is released.

A basic part of the brake cylinder requiring maintenance is piston collar 42. The most frequent cause of the escape of air and jamming of the piston in the cylinder is the drying of the collar or its sticking to the walls of the cylinder. The escape of air through the opening in which the piston rod moves and, on mechanisms with control arms 38, through the opening in the plug of the filter screwed into the brake cylinder, indicates drying of the piston rod collar. In such cases [303] the piston should be removed and the collar washed. If the collar is made of leather and has hardened to a considerable degree, it should be "tallowed" in the manner indicated above. Such an operation should be carried out also after a long storage of the gun.

Collars made of rubber should not be "tallowed"; they should be thoroughly washed in gasoline and coated with AF-70 grease.

5. Maintenance of the brake shoes consists of a periodic check every 1,000 km of the thickness and condition of the bearing surface of the lining, the point of contact of the oval opening in the shoe with the thrust pin of the plate, and gap v between the sliding block of the shoe and the rib of shaft 105 (Fig 73).

The surface of the brake shoe lining must be clean. Remove dirty and burned areas with a fine abrasive and wash with pure gasoline. The entering facets ye must be restored on both sides, and should be 2 mm deep and 15 mm long. The thickness of the linings must be not less than 7 mm. In the event that at least one lining has a thickness of less than 7mm, all linings of both shoes (on one wheel) should be replaced. The trouble can be corrected also by placing a spacer of even thickness between the linings and the shoes.

Take a set of linings, stamped with a number, from a spare parts kit. Aligning the openings in the linings with the openings in the shoes, attach the linings by means of screws and nuts with spring washers.

Shoes with new linings are fitted to the brake drum by pressing them against the drum and moving them by hand (with the wheel removed). Smooth down protruding ridges with a fine abrasive until not less than 40% of the surface of the lining is in contact with the brake drum. The point of contact of the oval opening with thrust pin 110 (determined by a bright spot) should lie along the axis of the oval opening (on Fig 73). If the bright spot is above or below the axis of the oval opening, it should be removed, maintaining the smoothness and symmetry of the opening. The upper surface g (Fig 73) may be smoothed down to a depth of not more than 0.3 mm. The lower surface d may be smoothed down to a depth of up to 2 mm.

It is permissible to smooth down the rib of shaft 105 in order to maintain a clearance v, which must be not less than 0.3 mm. Before mounting the brake shoes on the plate and putting on the wheel, ensure that:

a) all parts of the brake located in the drum are assembled dry, with all traces of grease removed;

b) all brake shoes have the same serial number (for example: 1-1 for one set, 2-2 for another set);

v) cam 86 and the bearing surface of shaft 105 are greased with a thin layer of lubricant;

g) cams 86 move freely in their grooves, and shaft 105 turns without sticking;

6. Maintenance of the brake drums consists of a uniform smoothing of all drum surfaces and buffing of the bearing surfaces with an abrasive, followed by washing with gasoline, whenever a wheel is removed.

Check of Action of Braking System [304]

Check the hermetic state of the intake system (air line, locks, air filter), for which purpose a pressure of 4.8 to 5.3 atm, controlled by a valve on the towing vehicle, is supplied to the main line of the gun. The hermetic state of the intake system is determined by the time required for the beginning of braking (movement of the brake cylinder pistons) from the instant the valve is turned off.

The hermetic state of the intake system is considered satisfactory if braking still occurs 5 minutes after the valve has been turned off.

Check the hermetic state of the main line of the brake (storage tank, brake cylinder, control valve) by lowering the pressure in the main "feed" line. The line is considered to be satisfactorily air-tight if a complete braking (return stroke of the brake cylinder pistons) still occurs 15 minutes after the air has been exhausted from the intake system.

Check the action of the control valve and brake cylinders by vigorously pumping the brake pedal on the towing vehicle. The brake cylinder pistons should move out and return in the same manner.

Check of Gun's Braking System by Actual Travel

The pressure in the gun's main brake line from the towing vehicle should be 4.8 - 5.3 atmospheres. The control ring at the distributing valve of the towing vehicle should be set in position "R". When an artillery train is moving at a speed of 20 km/hr (with the brakes of the towing vehicle in good condition), the braking distance of the gun should not exceed 12 m on an asphalt or dirt road (making this check on slippery roads is prohibited).

When the gun is fully braked by hand at a speed of 6 to 10 km/hr, the wheels must lock firmly or turn slightly, leaving a clearly defined mark of the tire tread on the ground from the shock of braking.

The hand brake is tested by pulling the hand lever toward oneself and braking the wheels. After this is done, an amount equivalent to 1 or 2 teeth on the arc segment of the wheel brakes should remain on the brake cable. If this is not the case, adjust the length of the cable. If the piston rods do not go completely into the brake cylinders, lever arms 38 (Fig 74) should be placed in the next slot by turning them toward oneself.

Check of Electrical Circuit

A check of the electrical circuit is made in the following order:

- plug one end of an electric cable into the socket on the towing vehicle and connect the other end with the plug on the trail of the gun;

- turn on the rear light of the towing vehicle; at the same time the lower light (illuminating) should go on;

- depress the brake pedal on the towing vehicle; at the same time the upper light (stop light) should go on.

If the lights do not go on, check to see if they and the light circuit on the gun are operating properly; first check to see if the light circuit on the towing vehicle is operating properly.

On early model guns, plug in a light of constant illumination (a stop light is not). [305]

On guns having the light on the muzzle cover, check the wiring in the following order:

- when the cable is plugged into the socket on the towing vehicle and connected to the gun, and the rear light on the towing vehicle is turned on, the muzzle light and the left light on the lower carriage (depending on the motion) should go on;

- when the brake pedal on the towing vehicle is depressed, the right light on the lower carriage should go on.

Inspection of Instruments and Attachments Carried on Gun

Inspect the instruments and attachments carried on the gun and limber; check to see that they are properly secured.

The instruments and attachments should be properly secured to ensure that the vibration of traveling will not cause them to come off or move out of place.

86. INSPECTION OF THE DISMANTLED GUN

Dismantling of the gun is carried out in the following sequence: dismantling of the major parts of the gun in accordance with Section 58 of this Manual; dismantling of the individual parts in the order indicated in corresponding chapters of this Manual.

One should be guided by the following rules in dismantling a gun:

Remove assemblies or components only after it has been ascertained that they are properly connected to the adjoining assemblies or components.

If the mechanisms are in good working order, then a technical inspection of the parts can be made without fully dismantling the mechanisms (for example, remove only the covers from the housings or disconnect certain components and parts).

Unless it is required, disconnecting rigid couplings and removing components requiring fine adjustment, bushings, ball and roll bearings, and co

When dismantling mechanisms, check the connections having a cotter for play; no play is allowed.

Check to see that the springs in the mechanisms are in good working order.

Parts found during an inspection to be generally in poor working order will be removed in the following manner:

Fine parts which are bent. Straighten the part, without heating, on a wooden block to protect it from nicks and dents.

Parts with nicks and dents on their bearing surfaces. Dents which do not weaken a part or affect the operation of a mechanism can be ignored.

If the nicks and dents affect the operation of a mechanism, remove only the raised metal on the damaged portion with a fine file.

Parts with damaged threads. Smooth out the threads with a fine, three-sided file or other fine file.

Parts with stripped threads. Stripped threads are allowed if they do not exceed one fourth of the length of the threads in contact with the opposing threaded surface (excluding the counter-recoil system).

Nuts and bolts with mangled heads. Replace nuts and bolts having mangled heads with spares. If there are no spare nuts and bolts, file down the damaged piece to the next smaller wrench size. [306]

Screws and screwable parts with spread gooves on the heads. File a new groove perpendicular to the old one.

Rusty parts. Dampen the rusty area with kerosene and allow it to remain until the kerosene has loosened the rust, then wipe thoroughly with a rag. Cover the cleaned, dry surface with a uniform layer of grease.

If the kerosene does not remove the rust, powdered charcoal or emery powder with oil can be used.

Emery powder with oil is used only with the permission of the chief of artillery weapons of the military unit. Use emery powder only after coarse particles have been removed. All work using emery powder with oil to remove rust must be done under the immediate supervision of artillery mechanic.

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

It is categorically forbidden in military units to use emery powder with oil for the removal of rust from:

- the bore;
- the machined surface of the barrel;
- the cylinders of the buffer, recuperator, and equilibrator;
- the piston rods of the buffer and recuperator;
- the throttle bar of the buffer.

When any part [of a gun] is repaired in an artillery machine shop, rust may be removed with a chemical solution containing the rust inhibitor "Unikol."

Paint worn off. If the paint has worn off on an important part of the gun, the gun must be completely repainted, after the old paint has first been removed.

If the paint has worn off on local areas, it is permissible to repaint only those areas.

If it is not possible to immediately repaint the affected area, cover it with a generous amount of gun grease.

Inspection of Barrel

The outside of the barrel should be clean and painted (where designated), and the paint should be in good condition. The unpainted areas - the clinometer plane and surfaces adjacent to the breech - should be clean, free of rust, and well oiled.

During an inspection of the outside of the barrel the following unsatisfactory conditions can be discovered:

Paint worn off and rust. To rectify these conditions, take the steps indicated above.

Nicks and dents. If deep gashes are found on the outside of the barrel, check to see if they cause any bulges on the inside. Firing a gun in such a condition is not allowed. Small dents need not be filled in. Any raised metal from a dent on the master plane that might obstruct the placement of the gunner's quadrant should be carefully removed by using a fine file and smoothing with a scraper, without eliminating the dent

Loose muzzle brake. Check to see that the muzzle brake is properly [307] attached. It should be screwed on as far as it will go and secured with bolts. The mark on the muzzle brake should be between the marks on the barrel.

The causes of a loose muzzle brake are: worn threads on the muzzle brake and barrel, loose bolts, worn bolts or worn or stripped threads on the bolt and bolt holes.

A loose muzzle brake is not allowed.

Bulge in the tube. A bulge may be indicated by a dark ring in the bore or by the free passage of a wad through any section of the bore.

An external bulge can be found by eye by seeing if there is a gap between the tube and a ruler held along the tube in the suspected area. When an internal bulge is visible on the outside, the gun is not allowed to fire.

Cracks on the outside of the tube. Cracks on the outside of the tube can be found by eye. In case of doubt, the paint must be removed from the suspected area and a narrow layer of metal chiseled out to a depth of about 0.25 mm.

If there is a crack, the layer will fall in two sections, and a dark streak will be visible along the shiny strip from which the metal has been chiseled. [Guns having] barrels with cracks are not allowed to fire.

Turning of the breech ring and loosening of the recuperator. Check to see whether the breech ring has turned relative to the jacket. If the breech ring is correctly positioned, the cotter grooves on it and the jacket should coincide. The breech ring must not be allowed to turn.

An inspection of the bore may reveal the following unsatisfactory conditions:

Rust. Rust found in the bore should be removed at once. To do this, dampen the affected area thoroughly with kerosene and, after the rust has been loosened, remove it with a rag soaked in kerosene. After the rust has been removed, wipe the bore dry with a rag. If the rag does not remove the rust, use powdered charcoal with oil to remove it. Traces of rust in the form of minute blisters and hollows remaining after cleaning cannot be removed and should not serve as a basis for rejecting the barrel.

Bulges. Bulges can be detected by a dark ring in the bore and also by cleaning.

When there are internal bulges in the tube, check the barrel by dispersion of controlled fire.

If the results of the firing are unsatisfactory, the tube should be replaced.

Cracks in the bore. The existence of a crack can be established by testing the suspected area with an awl driven into the end of a pole. When the awl is moved along a crack, it will stick, but it will move freely along a smooth surface or scratch. Barrels having cracks are not allowed to fire.

Coppering. Coppering is the result of the deposit of copper from the rotating bands of projectiles. The coppering is usually concentrated on the rifling, particularly at the bottom and corners of the grooves; in appearance it resembles coarse blisters or rusty stains. Coppering does not affect a gun's firing and is not removed from a gun in service.

The following measures can be taken to retard the coppering action: [308]

- wipe the bore dry before firing;

- immediately after firing, apply thick layers of grease to the bore until it has cooled;

- 2 to 3 hours after firing, clean the bore thoroughly.

Erosion of the bore. Erosion of the bore results from the high temperatures and pressures present during firing and also from the rush of powder gases between the bore and projectile and from the friction caused by the movement of the projectile through the bore.

Erosion appears first on the forcing cone joining the rifling section of the barrel to the chamber and then in the rifling section, at the beginning of the rifling (in the form of a dark ring). Depending on the state of erosion, the lands begin to wear down, become brittle, and chip off, as a result of which the length of the powder chamber increases.

Small nicks and dents in the chamber. Nicks and dents which do not impede the seating of the cartridge case can be ignored. Significant depressions which impede loading must be thoroughly cleaned out with a very fine file and fine emery paper, under the supervision of an artillery mechanic; then remove only the raised metal. Minor depressions on the forcing cone do not require any attention.

Determination of Erosion in the Bore

The condition of the bore is characterized by the amount of lengthening of the powder chamber, resulting from erosion.

Due to the lengthening of the chamber, the powder gases produced during the firing of the smallest charge may not attain the maximum pressure necessary to arm the fuse; the initial velocity drops, resulting in a decrease of range and an increase in dispersion. The length of the powder chamber is determined by means of a "PZK" tool for measuring the length of the powder chamber.

To determine the length of the chamber, it is necessary to subtract from the measured length of the chamber the length of the chamber of a new barrel, measured at the factory with a PZK tool and entered in a log for the barrel.

If there is no such length entered in the barrel log, then it is assumed on the basis of data found in the Instructions on the Categories of Artillery Weapons and in firing tables for the case of measurement with a PZK instrument.

Inspection of Breech

To inspect the breech it is necessary to verify the presence of all parts and check their condition.

Inspection of Cradle

In inspecting the cradle, special attention should be paid to the cradle cap, trunnions, and trunnion yoke; and they should be checked for cracks. Firing a gun with cracks on the cradle is not allowed.

Check to see whether the elevating arc is properly and firmly attached to the trunnion yoke of the cradle.

Check to see whether there are any dents on the cradle; dents which [309] do not weaken the cradle or impede the action of the recoiling parts are allowable.

Check the rivets on the cradle; they should be tight. The condition of the rivets can be tested by tapping them with a hammer. A rattling sound indicates a loose rivet.

Check to see whether there are metallic slivers on the cradle guides; any slivers should be removed.

Inspection of Counterrecoil Mechanism

Inspection of the counterrecoil mechanism in assembled form. Check to see whether there are any dents on the buffer and recuperator cylinders. If there are, the cylinders should be repaired.

Inspection of the counterrecoil mechanism in dismantled form. Check to see whether there are any cracks or dents on the cylinders and piston rods of the buffer and recuperator. Cylinders with cracks should be replaced; those having small dents should be repaired.

Check to see whether there is any corrosion or flaking on the parts of the buffer and recuperator or whether there is any darkening of the piston rods. See if the throttling valve slides freely along its stem and if it is firmly seated.

See if there are any nicks or dents on the valve in the recuperator; if there are any, smooth them out to ensure a tight seating of the valve.

Check to see if there are broken or badly damaged flanges. Replace any flanges which do not maintain a tight seal. Check the condition of the packing. Replace any that is defective.

Inspection of Top Carriage

When inspecting the upper carriage, check to see whether there are any cracks or dents on it. Cracks on the upper carriage are not allowed. Dents which do not hinder the normal operation of the mechanisms are allowable. The bearing surfaces under the pintle and also under the cradle trunnion must be smooth, without flaking or rust.

Inspection of Equilibrator

Check to see whether there are any dents, flaking, or rust on the surface of the equilibrator cylinders. Cracks, dents, and flaking which hinder their operation are not allowed.

See if there is sufficient liquid in the cylinder. See if the flanges and packing are in good condition, and replace any that are defective. Check the valve assembly for proper operation. Replace valves which do not properly shut off air or liquid.

Inspection of Elevating and Training Mechanisms

Check to see whether there are any cracks, dents, or metallic slivers on the parts. Replace defective parts and smooth off dents and slivers.

Inspection of Lower Carriage, Trail, and Suspension Mechanism

Check carefully for any cracks on the carriage. Cracks on the lower carriage are not allowed.

To inspect the trail, check for cracks in the plates and especially in the welded joints. Cut out any welded sections having cracks, smooth over the cut, and reweld. [310]

Smooth out any dents, metallic slivers, or other minor flaws in the parts of the suspension mechanism.

Inspection of Wheels

Inspect the parts of the wheels and check to see whether they are in good working condition. Replace damaged bearings and packing.

Inspection of Limber

Inspect the parts and remove any having minor faults.

After the gun has been inspected, reassemble it in the order indicated in the description of the parts of a gun and in Sections 59 and 60.

CHAPTER 17

PRESERVATION AND STORAGE OF MATERIEL [311]

87. General Instructions

The reliability and duration of satisfactory performance of materiel depend to a large extent on proper storage, careful maintenance, and constant inspection during both storage and operation, as well as on expert handling, timely cleaning, lubrication, timely repair, and the elimination of defects.

In the use of materiel, the following are prohibited:

— exceeding the established speed;

— loading the gun carriages with objects not found on the list;

— storing cannons in an outdoor parking area in travelling position for more than 3-5 days.

In order to detect damage and defects in a timely manner, materiel must be inspected regularly. The inspection is made at periods established by the Regulations on Internal Service, and it is also obligatory before and after firing and moving.

Materiel which is in constant use must be cleaned after each firing, trip, movement into position, and drill, and also after rain. Materiel which is not in constant operation and which is kept in storage must be cleaned whenever necessary. All guns are further subject to periodic preventive maintenance as established by the commander of troops in accordance with weather conditions.

The gun cannot be cleaned in outdoor parking areas during bad weather (rain snow, etc.)

When rust is detected on the internal parts of dismantled guns, all guns must be completely dismantled and cleaned.

Officers and sergeants to whom the materiel is entrusted are in charge of cleaning and lubricating the materiel. They determine the extent of lubrication necessary, the working order of the parts, the extent and quality of the cleaning done, and the correctness of the lubrication.

Rust cannot be permitted on materiel. Any rust noted should be removed immediately.

The lubricating materials listed below are used to protect the materiel from rust and to ensure operation of the mechanisms.

The lubricant AF-70 is a year-round operational lubricant and is used to lubricate directing mechanisms, breech blocks with semiautomatic mechanisms, and sights.

Gun grease is a preserving lubricant and is used for long-term protection from rust of the bores, mechanisms, and all unpainted metallic parts of the materiel. This lubricant is also used for lubricating guns which are in operation during the summer. In areas with warm winters, where the temperature remains above +10°C it can be used at all times. In such instances, spindle oil AU can be added to the gun grease. [312]

In changing from one type of lubricant to another, carefully remove the old lubricant with kerosene, rub all parts dry with a rag, and lubricate with the new lubricant.

Gun grease is used the year round to lubricate items in depots, but when armaments are sent to troops in winter, the lubricant must be removed completely and replaced with lubricant AF-70.

AU spindle oil is recommended as a light lubricant for gun mechanisms (sight, breechblock, equilibrator cylinders), for lubricating the pump ball valves, and for adding to any lubricants during winter.

Liner lubricant is used to lubricate the adjoining surfaces of the tube, the casing, the breech ring, and the muzzle brake, in order to facilitate insertion and removal of the tube and unscrewing and screwing on of the breech ring and the muzzle brake.

It protects the junctions of the tube, casing, breech ring, and muzzle brake from corrosion.

Liner lubricant does not evaporate or carbonize at high barrel temperatures during intensive firing.

Grease is used to lubricate the running gear and wheel hubs of the guns and limber.

The following materials and implements are used to clean, wash, and wipe materiel.

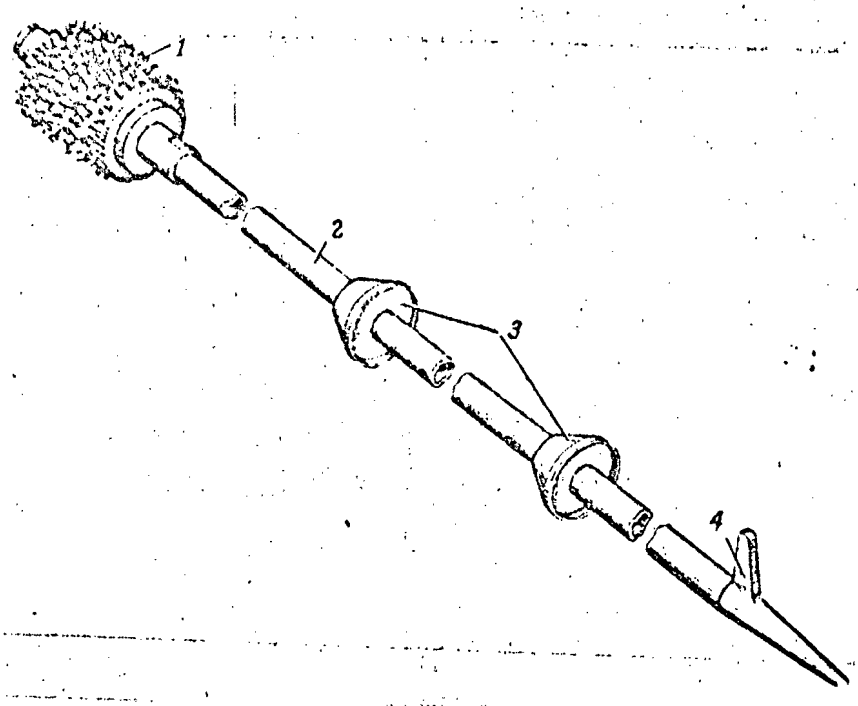


Fig 141. Swab

1. brush with holder (A 72926-26)
2. rod (Sb 41-4)
3. guide collar (Sb 41-7)
4. stop (Sb 41-5)

Solution RChS is used to clean the bores. It is prepared on the spot by dissolving 200 grams of ammonium carbonate and ten grams of bichromate in one liter of water.

Kerosene is used to clean the bores in winter and also to soften and remove lubricant and rust from small parts.

The linen patch is used for final wiping of the cannon bores and also for wiping and lubricating all the small parts.

The coarse cotton patch is used to remove dirt and lubricant from the materiel, shells, and shell cases.

KB-22 paper is used to remove dirt from parts.

Wooden rods are made from hard, non-resinous wood, one-half meter longer than the barrel (70-80 mm in diameter), one rod for each battery.

Wooden wads having a length equal to about twice the caliber of the gun and a diameter of one centimeter less than the caliber of the gun are cut from hard, non-resinous wood. There are two wads per gun. Annular grooves are made on the side surface of the wad so that, when pushed through the bore it does not slip out of the patch which has been twisted onto it.

The combination rammer-and-sponge swab (Fig 141). The eight swabs available in a battery, depending on the types of cleaning and lubrication, are used as follows:

— two are used to wash out the bore with the solution RChs, soap water, or kerosene;

— two are used to lubricate the bore and remove carbon deposits after firing; [313]

— two are used exclusively to lubricate the clean bores with gun grease or lubricant AF-70;

— and there are two spare swabs.

So that the swabs do not become mixed up, they must be distinctively labeled or marked.

All the swabs must be kept clean, and after being used, their brushes must be washed in warm water with soap and then dried.

A set of small rods is used to clean recesses, slots, apertures, and pockets (they are made from dry, hard wood).

Brushes similar to tooth brushes are used to clean the sighting devices and mechanisms.

Wooden scoops are used to apply lubricants (they are made with resources of the unit).

Lubricating material used to lubricate materiel must be clean, without sand, dirt, moisture, or other foreign matter. It must be kept in clean, serviceable, and tightly closed containers. Lubricant taken from a container cannot be put back into the same container.

Sand, lime, brick, files, and various acids cannot be used for cleaning.

88. Cleaning and Lubricating the Barrel and the Breechblock

The barrel and breechblock are cleaned to remove old lubricant, dirt, rust, and gunpowder deposits after firing.

The outer surface of the barrel is cleaned of dirt, powder, and old lubricant with a rag, and if there is large accumulation, it is washed with water and then wiped dry. [314]

While cleaning the outside of the barrel, pay attention to the cleanness of the breechblock seat, clinometer plane and all apertures, recesses, and pockets where water can accumulate.

The slots, recesses, and pockets are cleaned with small rods with tapered ends.

The solution RChS, which also removes copper fouling, is used to clean the bore. The method of preparing the solution RChS and the procedure for cleaning are set forth in the Manual for the Storage and Preservation of Artillery Weapons and Ammunition Among the Troops.

In the absence of the solution RChS, kerosene or soapy water may be used to clean the barrel.

To facilitate cleaning of the bore in this case, it should be liberally lubricated with gun grease (if temperature below 0 degrees C, with lubricant AF-70) on completion of firing, before the barrel becomes cool; the lubricant softens the carbon deposit and thereby facilitates its removal from the bore.

After firing, lubricate the bore with the swab brush used for removing carbon deposits. Attach the swab brush so that the cotter pin does not protrude beyond the sleeve.

To lubricate the bore, apply lubricant on the swab brush thickly with a scoop and then insert the swab from the breech into the bore. Then, after taking hold of the swab shaft and making small strokes forward and back, move the swab along the bore and then slowly pull it out of the bore.

The entire surface of the bore must be equally lubricated.

After 2-3 hours, remove the lubricant from the bore, wash the bore with kerosene or soap water, and wad the barrel as indicated in the Manual for the Storage and Preservation of Artillery Weapons and Ammunition Among the Troops.

After cleaning the bore and chamber, clean out the seat for the breechblock bolt, the recesses, and the seats for the breechblock mechanisms.

Clean the muzzle brake with a rag soaked in kerosene or soapy water, and then rub dry.

Lubricating

After each cleaning, lubricate the bore with a thin, even layer of gun grease as follows: wind a thin, clean rag soaked in grease around the swab brush used only for clean lubricant, or place the lubricant directly on the brush with a wooden scoop, then pass this brush four or five times back and forth from the breech to the muzzle, lubricating the main bore and the chamber. The lubricant is applied in such a way that the entire surface of the bore (especially the corners of the grooves) and the chamber are lubricated. In the winter, the bore is lubricated with lubricant AF-70.

The bore must be lubricated sufficiently but not heavily. The layer of lubricant must be such that a fingerprint can be seen on the lubricated surface of the bore.

Unpainted external parts of the barrel, the clinometer plane, places where paint has worn off, lugs, recesses, seats for the breechblock mechanism, and breechblock parts must, after being cleaned, be rubbed with a rag soaked with lubricant. [315]

After the breechblock is assembled and placed on the gun, rub it again on the outside with a rag soaked with lubricant.

Do not lubricate heavily the breechblock parts and their seats which are on guns being constantly used.

89. Cleaning and Lubricating the Gun Carriage and the Limber

Cleaning

The gun carriage and the limber are lubricated after each firing, march, and training exercise. To clean off dust and dirt, wipe the gun carriage on the outside with a dry rag. If there is a heavy accumulation, remove clots of clinging dirt with wooden scrapers or straw plaits and then wash the gun carriage with water, being careful that the water does not fall inside the mechanisms. Places hard to reach should be cleaned with small, tapered rods wrapped with pads.

Wipe the cradle on the outside with a dry rag. To clean the cradle guide, barrel-holding devices, and breech, recoil the barrel (or clean while in traveling position), and if necessary, remove the barrel.

To remove the old lubricant and dirt from the guides, wash them with kerosene and wipe with clean rag.

During routine cleaning of the carriage, do not disassemble its mechanisms, but just wipe them from the outside. The arc and the shaft gear of the elevating mechanism should be cleaned with a rag wound on a stick.

The sights should be cleaned with brushes or rags wound on sticks. When cleaning the sights, remove all dirt and moisture from the junctions of the parts and from recesses.

To clean the glass of the panoramic sight, optical sight or collimator, blow off the dust and sand from them, slightly fog them with your breath and wipe them with a piece of clean flannel, or a linen rag, using a rotary motion from the center toward the edges. Do not touch the glass with fingers or oily and dirty rags.

Disassembling the carriage or limber mechanisms during cleaning is permitted only if the movements are difficult or if there is some other malfunction. Such mechanisms are generally disassembled twice a year during the complete overhaul of the gun. During each disassembly of the carriage mechanisms, carefully remove the dirt and lubricant, wash all parts in kerosene and wipe them dry.

Remove the mud and dust on the wheel from outside. The wheels are periodically removed from the carriage and limber for examination and cleaning of the hub, journals, roller bearings and packing.

When cleaning the carriage mechanisms and the wheels, be careful not to spill kerosene on the rubber collars, wheel tires or other rubber parts.

The guards should be cleaned of dust and mud and, if necessary, washed in warm water with soap.

Guards wet from rain or from washing should first be dried before they are replaced on the gun.

Lubrication

Lubrication should be done immediately after cleaning.

In the carriage, all sliding or unpainted mechanisms, or those with damaged paint, should be lubricated. The lubricant should be applied directly on the part, or with an oil can or a grease gun. [316]

If the hose end of the grease gun does not have the clamp screw which provides tight coupling between the hose and the grease cup, then it is permissible to remove the grease cup and the hose end, and to screw in the hose tip directly into the tapped hole of the grease cup.

The cradle and barrel guides should be lubricated generously.

The firing mechanism, hinged couplings of mechanisms, bushing with lever, and the cut-off gear actuating collar should be coated with only a thin layer of lubricant. The roller bearings of the cradle trunnions, as well as other ball and roller bearings are lubricated with AF-70.

The wick oilers at the base of the top carriage are filled with AF-70 lubricant.

The roller brakes should be coated with a thin layer of AF-70 lubricant.

The moving parts should be generously lubricated with grease in the process of assembly. Grease is periodically added with the grease gun to the wheel hub through a grease cup (closed with a cap).

The gun and limber wheel-hubs are filled half way with grease.

On the outside, the sights should be wiped with a rag saturated in gun oil, while its mechanism should be lubricated with spindle oil.

The housings of the altitude and direction checking mechanisms of the optical sights should always be filled to the brim with lubricant AF-70 (under the covers). This lubricant prevents the entrance of moisture into the sight.

Rubber parts and painted surfaces should not be lubricated.

Spare parts, tools and accessories should be cleaned, and all the metal parts should be heavily coated with gun grease. The metal files must not be lubricated; they should be wrapped in wax paper; the file handles are painted.

Instructions on lubricating materiel, while in use, are given in Appendix 3.

Note. The rubber gaskets for the lids which cover the sliding lock of the breech lug and the air-hose coupling should be lubricated either with summer or winter type lubricant, depending on the season.

90. Storage of Materiel

The artillery materiel assigned to various units is generally stored either in unheated buildings or under sheds. In the absence of appropriate buildings or sheds, the materiel in use can be stored in open parking areas.

Outdoor parking sites for the storage of materiel should be selected close to their units, on dry level ground and away from the highways, streets or residential buildings.

The parking area should be cleared of stones and debris and then leveled, making a small incline for the drainage of water. A drainage ditch should be dug around the park.

Procedure for storing Materiel

When materiel is stored in buildings or under sheds, the cannons and towing equipment must be placed in such a way that it is easy to examine them and to roll them out during an alert.

The placement of materiel depends on the sizes of buildings and the presence of exits. When materiel of a battion is stored in the building, the exits must be shared by the batteries and

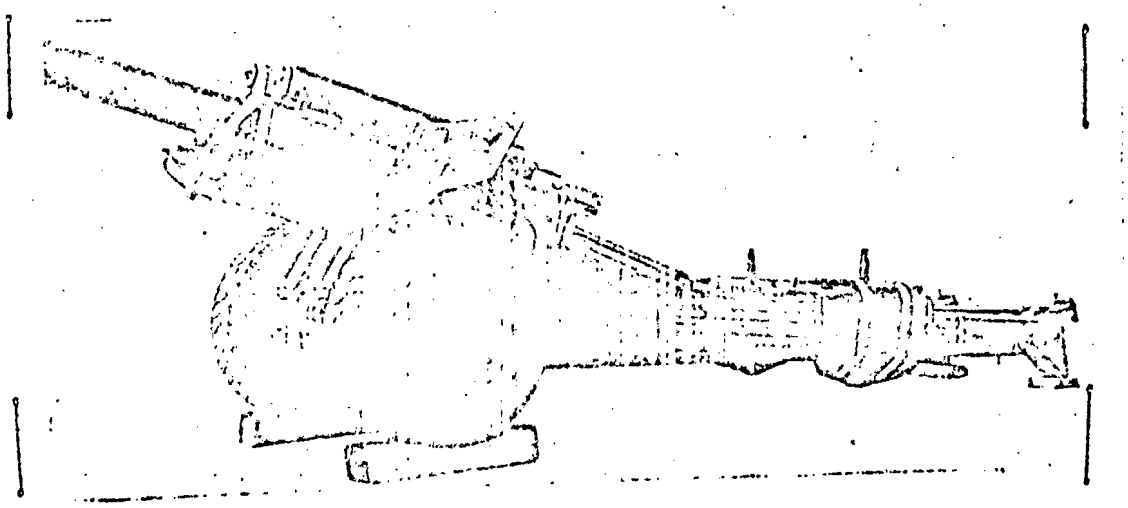


Fig 142. The M-46 (130-mm) Gun Mounted on Wooden Blocks /317/

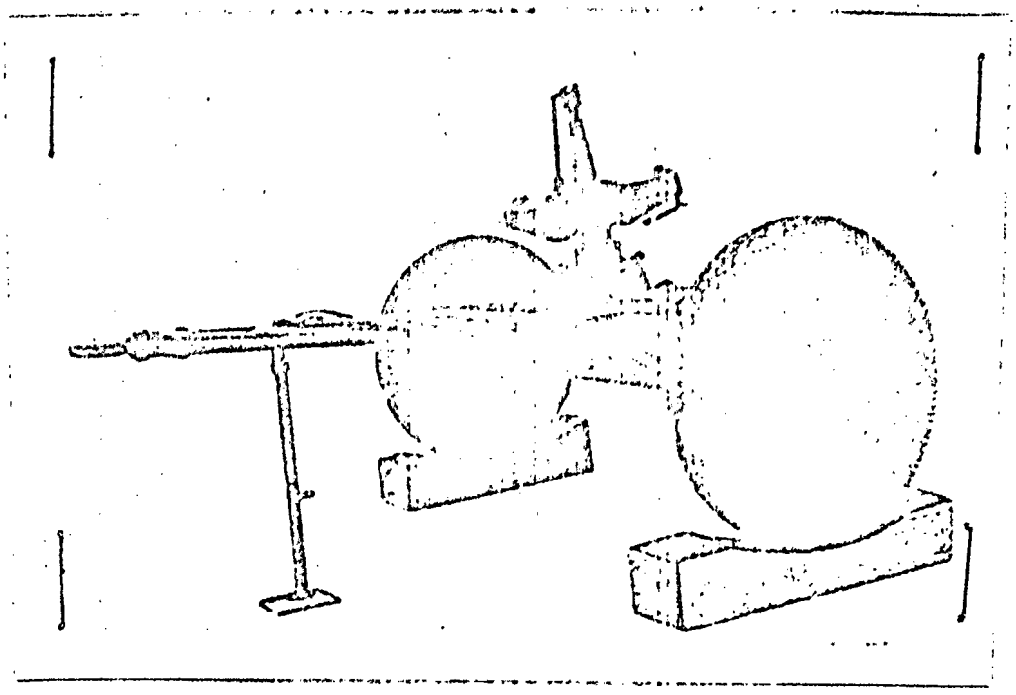


Fig 143. Limber Mounted on Wooden Blocks /318/

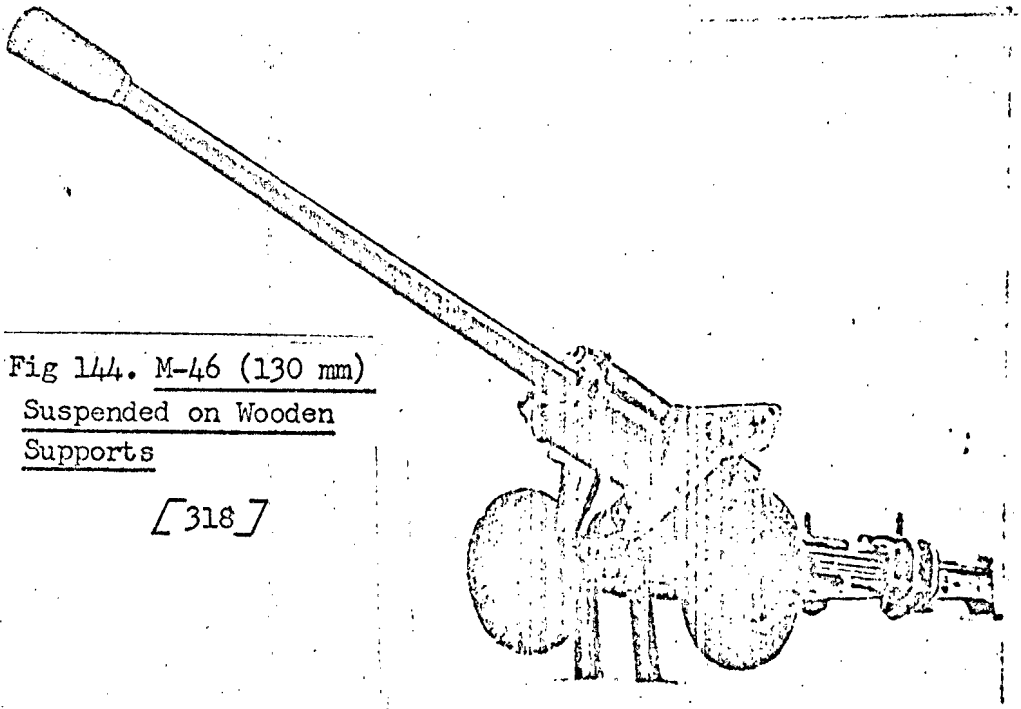


Fig 144. M-46 (130 mm) Suspended on Wooden Supports

[318]

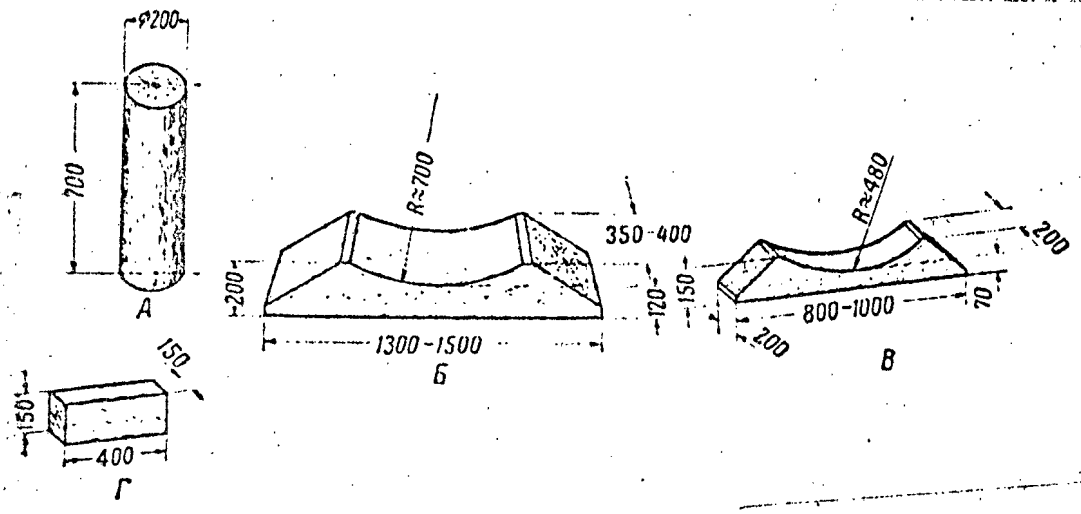


Fig 145. Blocks and Supports For M-46 Gun

[319]

А. support under bottom carriage
Б. block under carriage wheel
В. block under limber wheel
Г. block under winter-trail spade

a specific procedure must be established for using them. This is especially important for quickly rolling out the materiel during an alert or in case of fire.

During storage, the materiel of the reserve is kept separate from the materiel in current use.

For storage, the materiel is placed according to numbers of the batteries, and within the battery, materiel is placed according to numbers of the guns. The limbers are placed behind the guns, and the traction equipment behind the limbers. If the buildings are not big enough for joint storage, the towing equipment is placed in separate buildings.

Lanes at least 0.7 meter wide must be left along the walls of the building. There must also be lanes between the hub caps beside the standing guns and between the guns and the prime movers.

In open parking areas, the materiel is placed further apart to ensure unimpeded work with the guns and easy removal of them from the parking area. The guns are situated in combat order facing the enemy. Behind the limbers are the artillery prime movers which are set by draw hooks to the side of the coupling devices of the limbers.

Procedure for Storage

Materiel in current use and reserve materiel is stored in assembled form, completely provided with all spare parts, tools, and accessories in accordance with the established norms.

Guns in daily use, and their limbers, are mounted on solid wooden blocks with grooves shaped to the wheel circumferences. Small blocks are placed under the ends of the trails (Fig 142).

The center futchel must without fail be connected to the limber axle by a slat, and must be mounted on a hinged pedestal. A small wooden block must be placed under the pedstal (Fig 143). [318]

The trails must be brought together or spread out somewhat [319] (for convenience of inspection) in such a way that the pintles for releasing the suspension do not enter the sockets of the rocker arms. If this is not done, abrasions can develop on the conical portion of the pintles and sockets on the rocker arms.

When arranging materiel under sheds and in open parking areas during the summer, protect the tires of the wheels from the effects 50X1-HUM by any material available.

The wheels should be checked periodically for the correct distribution of grease in them. In winter, avoid blows to the tires at temperatures below minus 30 degrees C.

Guns which are out of operation for more than 2 months are mounted firmly on supports to relieve the weight on the suspension mechanism and wheels (Fig 144). The sizes of the supports are indicated in Figure 145.

The gun is mounted on the supports by means of jacks and it is suspended by two jacks placed under the rocker arms at the hooks. It is raised without slanting the bottom carriage. The supports are mounted under the front part of the bottom carriage behind the rocker-arm caps. In doing this, one must see to it that the supports do not lean against the rocker arms and do not hinder lowering of the wheels or easing of the torsions. After the gun has been mounted on the supports, remove the jacks.

The breechblocks must be closed. There must be a normal amount of fluid in the recoil brake and the recuperator, and the pressure must also be normal in the recuperator.

The caps, plugs, and valves which cover the openings for filling the recoil mechanisms with fluid and air must be screwed on securely, plugged with wire, and sealed.

There must be a normal amount of fluid (steol-M) in the equilibrator, and the air pressure must be within normal limits.

The outer surface of the breech screw of the equilibrator, which comes out of the outer cylinder, must be lubricated with gun grease in the summer and with the AF-70 lubricant in the winter.

The space between the tube and jacket of the barrel must be covered in front with sealing compound or paint to prevent the entry of water and the appearance of rust on the outer surface of the tube and inner surface of the jacket. [320]

If guns in current use are not fired for one month or more, the recoil mechanism rods are taken out and inspected at fixed periods. The rods of the recoil brake and the recuperator can be taken out for inspection in the same way as is done in checking the recuperator by the simulated recoil method.

To prevent rust, the pins of the recoil brake, recuperator, and the operating recuperator cylinder are chrome-plated and the outer surface of the inner tube of the recoil brake is phosphated. With the presence of steol-M, the phosphated surface of this tube can be covered with a 50X1-HUM

thin greenish-black coating which does not influence the operation of the recoil brake and which can easily be removed during overhauling by rubbing the tube with a rag.

The panoramic sight, the optical sight, and the collimator K-1 must be stored in their carrying cases in a clean building in which there must be no batteries, acids, salts, or photochemicals.

Sharp temperature changes, and particularly dampness, are not permitted because they cause film to appear on the optical parts, thereby hindering observance through the panoramic sight, the optical sight, and the collimator.

Coverings must be placed over the muzzle end of the barrel, the sight, and the breech end of the barrel.

Storage of Spare Parts, Tools, and Accessories

Spare parts, tools, and accessories are stored in special carrying cases in the same building in which the guns are placed or in a building provided for them.

The metallic parts must be oiled heavily with gun grease, the canvas and hemp parts must be dried, and the wooden parts must be painted. Glass items and items of non-ferrous metals are not lubricated but merely rubbed to remove dust and dirt. The tools must be sharpened and the files must be wrapped in wax paper.

Storage of Materiel in Camps and During Travel

In camps, the materiel of the artillery is stored in open parking areas. Special attention should be given here to timely cleaning and lubrication, the condition of the paint, and the cleanness and serviceability of the coverings.

When a battery is temporarily at rest during a march, the guns are not disconnected from the prime movers. They are arranged arbitrarily according to local conditions in such a manner as to conceal the materiel from aerial and ground observation by the enemy and to ensure a quick transition to travel or combat order.

91. Regulations for Maintaining the Log

In order to record the qualitative condition of the materiel, the characteristics of its operation, and the nature of repair car50X1-HUM it is necessary to make correctly and in a timely manner the appropriate entries in the gun log, observing the regulations set forth below:

1. The log initially filled in at the plant is an inherent accessory of the gun and must always be transfered with it. [321]

2. The log is kept by entering in its appropriate columns data pertaining to:

— the operation of the gun by parts;

— the nature of repair work done;

— and noted manufacturing and design shortcomings of the gun.

3. All the entries are made in ink, neatly, accurately, and in a timely manner.

4. The data on operation of the gun are entered by the platoon commander and checked by the battery and battalion commanders.

5. Entries on the number of rounds fired and on the mileage are made daily and are totaled each month. The number of rounds for subsequent months are entered as an accumulative total.

6. Data on the length of the powder chamber of the barrel are entered in accordance with the Manual on Categorizing Artillery Weapons.

7. An entry in the table "Overhauling the System and Changing the Fluid" is made when:

— the recoil mechanism is overhauled and the fluid changed; and

— the gun is completely overhauled during a preventive inspection in the unit or during repair at repair agencies.

8. Entries on the nature of the repair done are signed by the appropriate chiefs of ordnance repair shops.

9. Responsibility for the condition, storage, and proper maintenance of the log belongs to the battery commander.

Appendix 1

Parts List of the M-46 130-mm Gun and the M-47 152-mm Gun

Parts	Part Number	
	M-46	M-47
Barrel	01	01
Breech	02	02
Buffer	08	08
Cradle	09	09
Recuperator	10	10
Mechanical Sight	12	12
Upper Carriage	17	17
Lower Carriage	18	18
Trails	19	19
Winch	20	20
Elevating Mechanism	21	21
Traversing Mechanism	22	22
Equilibrator	23	23
Hydraulic Leveling Jack	24	24
Wheel	25	25
Wheel Brake	26	26
Shield	27	27
Accessories	41	41
Tools	42	42
Limber	46	46
Cases	43	43
Covers	45	45

Basic Tactical-Technical Data on the M-46 and M-47

Term	Unit	Values M-46	M-47
A. Ballistic Data			
Muzzle velocity (max)	m/sec	930	770
Max gas pressure	kg/cm^2	3,150	2,350
Max range	m	27,150	20,470
Wt of HE-fragmentation round	kg	33.4	43.56
Charge wt (full)	kg	12.9	10.9
B. Design Data			
Caliber	mm	130	152.4
Barrel length w/o muzzle brake	mm	7,150	6,650
Barrel length w/muzzle brake	mm	7,600	7,170
Grooved length	mm	5,860	5,470
No. of grooves	-	40	48
Pitch of rifling	cal	30	25
Land width	mm	4.2	4.0
[illegible]h	mm	6	5.97
[illegible]k	mm	2.7	1.5
Fluid (steole M) in buffer	liters	28.7	28.7
Recoil:			
a) long	mm	$1,250^{+70}_{-100}$	$1,250^{+70}_{-100}$
b) short	mm	775 ± 40	775 ± 40
c) to stop	mm	1,350	1,350
Fluid (steole M) in recuperator	liters	21.6 ± 1	21.6 ± 1
Initial pressure in recuperator	kg/cm^2	56 ± 2	56 ± 2
Max elevation	deg.	45	45
Max declination	deg.	-2°30'	-2°30'
Traverse	deg.	50	50
Pressure in equilibrator columns			
at: -2°30' declination	kg/cm^2	ca 44	ca 44
45° elevation	kg/cm^2	ca 25	ca 25
Wheel diameter	mm	1,350	1,350
Wheel thickness	mm	390	390
Height of line of fire	mm	1,380	1,380
Height of panoramic sight eyepiece	mm	1,490	1,490
Tread	mm	2,060	2,060
Suspension travel	mm	80	80
C. Weights			
Wt of gun ready to fire	kg	ca 7,700	ca 7,700
Wt of gun in travel	kg	ca 8,450	ca 8,450
Barrel with breech	kg	2,780	2,750
Muzzle			

Term	Unit	Values M-46	Values M-47
Tipping parts	kg	3,880	3,862
Carriage wheel	kg	410	410
Limber w/stowage	kg	ca 650	ca 650
D. Dimensions			[p 324]
Length of gun in travel (barrel extended)	mm	ca 11,730	ca 11,320
Length ready to fire	mm	11,100	10,670
Width in travel	mm	2,450	2,450
Height in travel (along barrel)	mm	2,550	2,500
Clearance at carriage	mm	400	400
Clearance at limber	mm	375	375

Lubrication Guide

Pt. No.	Location	Method	Lubricant	When Applied
1	hinged cradle rests	wood spatula or rag	gun lubricant or AF-70 lubricant (winter, AF-70 only)	when cleaning carriage
2	leveling jack pin	rag	same	same
3	elevating mechanism arc	spatula or rag	"	after march, before firing and training
4	jack detent	rag	"	as for 1
5	equilibrator pistons protruding from cylinders	same	AF-70	pool storage only
6	wheel brake lever pin	same	AF-70	as for 1
7	bore	swab brush with rag (lubricant may be applied directly to brush)	as for 1	after firing, march, and training
8	cradle collar bushing	spatula or rag	AF-70	as for 1
9	cradle guides	same	AF-70	before firing and march, after firing, march and training
10	equilibrator bearings	same	AF-70	at installation, after tech. inspec. [p 328]
11	clamps, pins of sight and cross leveling mechanism	same	AF-70	before firing and training
12	tangent elevation and angle of sight mechanisms	spatula or rag	AF-70	before firing and training
13	stop of lever with handle	same	as for 1	as for 3
14	firing rod and springs	same	spindle oil	same
15	master plane of barrel	rag	as for 1	training, after checking sight gear

Pt. No.	Location	Method	Lubricant	When Applied
16	breech and block housing	rag	AF-70	after firing; march, and training; before firing
17	check	same	AF-70	as for 3
18	winch housing	spatula	AF-70	as for 10
19	winch chain	rag	AF-70	before march, firing, and training
20	winch sprocket axle	spatula or rag	AF-70	same
21	spade pivot	same	AF-70	same
22	pintle	grease gun through plug	AF-70	as for 12
23	elevation mechanism case	spatula	AF-70	as for 10
24	elevation and traverse gear hinges	spatula or rag	AF-70	periodically; as for 19
25	elevation level gear case	same	AF-70	as for 10
26	rocker arm support	same	AF-70	as for 1
27	traverse mechanism arc	same	AF-70	as for 3
28	upper carriage journal boxes	same	AF-70	as for 10
29	traverse worm gear case	spatula	AF-70	as for 10 [p 329]
30	upper carriage stop	same	AF-70	same
31	rocker arm sleeves	grease gun through fitting	AF-70	before march
32	equilibrator supports	spatula	AF-70	at installation
33	lower carriage bearing surface	spatula or rag	AF-70	when replacing duty lubricant
34	wheel bosses	grease gun through hole in boss (unscrew plug)	grease	at least twice a year
35	suspension disconnect spindles	spatula or rag	AF-70	periodically, before march and training
36	upper and lower carriage bearing surfaces	unscrew plug, pour in spindle oil	spindle oil	periodically, as for 19
37	elevating mechanism gear shaft	spatula	AF-70	as for 3

Pt. No.	Location	Method	Lubricant	When Applied
38	stop	spatula	AF-70	as for 3
39	stop	same	AF-70	same
40	couplers for securing breech ring for travel	rag	AF-70	as for 1
41	spade stop	spatula or rag	AF-70	as for 3
42	stop	same	AF-70	same
43	winch stop	same	AF-70	same
44	coupling bolt	same	AF-70	before and after march
45	cross-leveling axle	grease gun through plug	AF-70	before march
46	pintle upper sleeve	same	AF-70	same
47	limber wheel bosses	spatula	grease	at installation
48	stop	spatula or rag	AF-70	as for 3

APPENDIX 3 [325]

INSTRUCTIONS FOR LUBRICATING THE GUN (See Figures 146-148)

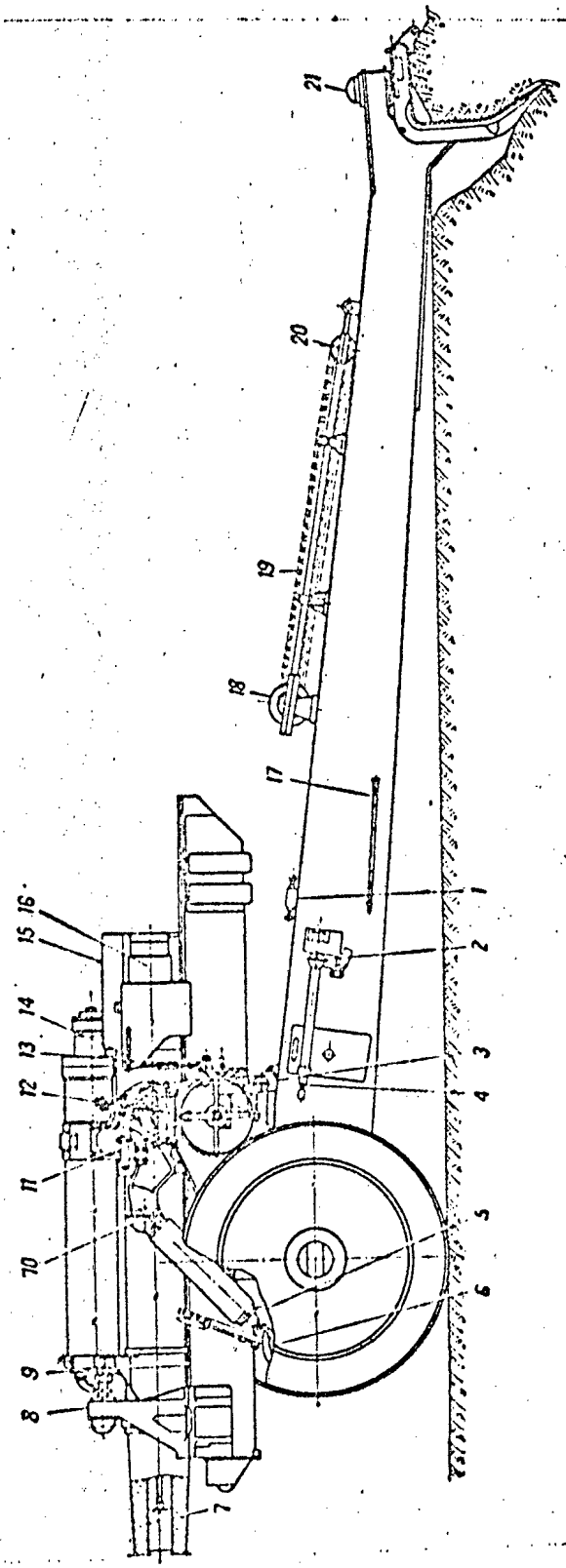
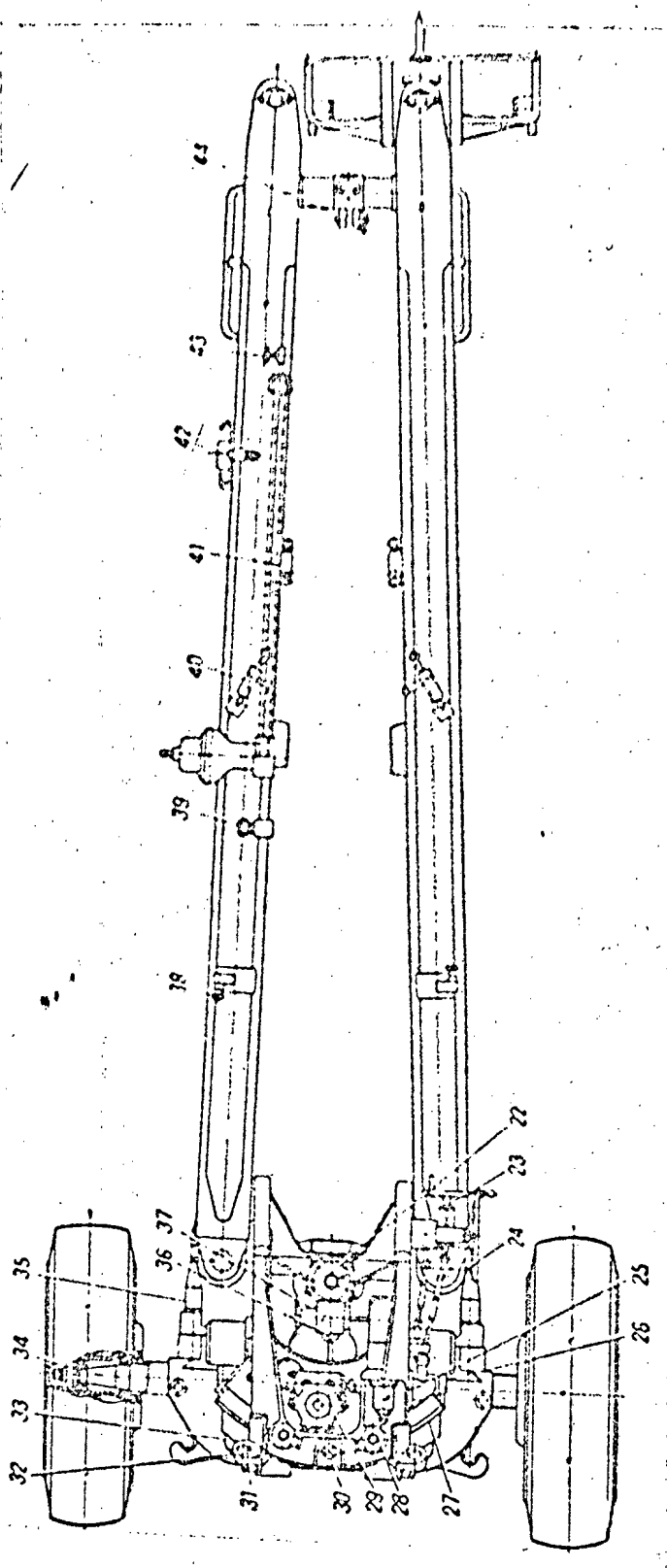


Fig 146. Lubrication Diagram for the Gun (Appendix 3)



[326]

Fig 147. Lubrication Diagram (Appendix 3)

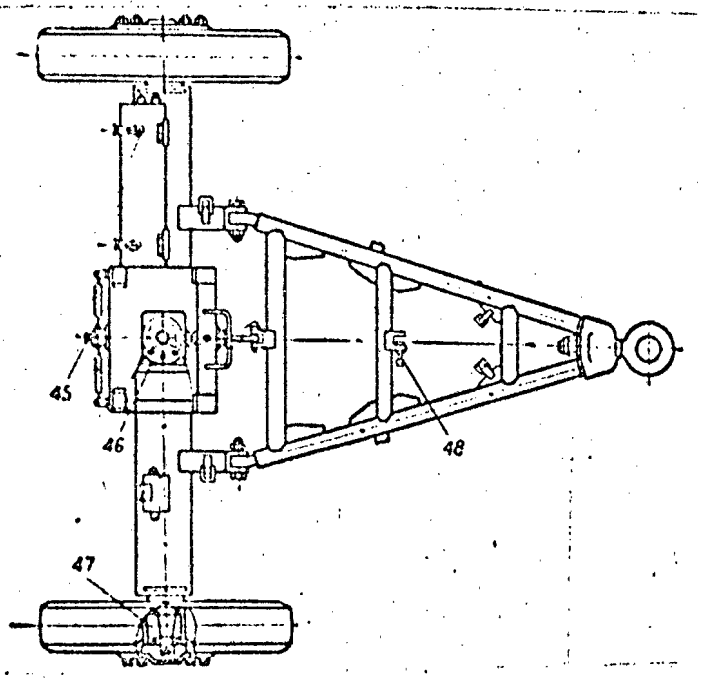


Fig 148. Lubrication Diagram for Limber

(Appendix 3)

ILLUSTRATED GUIDE TO SPARE PARTS, ACCESSORIES AND TOOLS FOR M-46 AND M-47

APPENDIX 4 [p 330]

Column headings:

1. Part or assembly number
2. Nomenclature
3. Cutaway drawing
4. Supplied per
   a. weapon
      (1) amount
      (2) box No.
   b. battery
      (1) amount
      (2) box No.
5. Special tool
   a. amount
   b. box No.
6. Application of tool. Part/assembly No. by group

[Note: Entries below are keyed to part number in column 1. 'Sb' before part number means 'assembly']

Sb02-5
Striker mechanism
Spare parts, Breech gr. 02

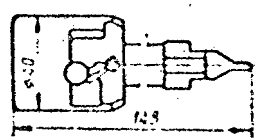
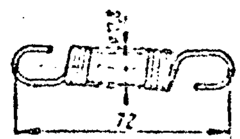
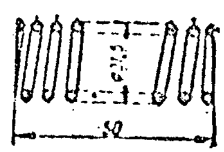
02-19
Spring

02-29
Main spring

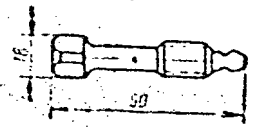
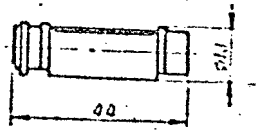
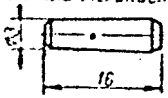
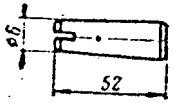
08-48 [p 331]
Valve
Buffer gr. 08

Sb12-10
52Ts012
Holder with bubble cartridge
Sight gr. 12

[330]

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты a. орудийный (1) коли-чество	(2) ящик №	b. батарейный (1) коли-чество	(2) ящик №	5. Специальный инструмент a. коли-чество	b. ящик №	6. Применение инструмента № деталей (сборки) по группам
C602-5	Механизм ударный	Запасные детали Затвор гр.02 	1	1					
02-19	Пружина		1	1	1	1			
02-29	Пружина боевая		1	1					

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: а. орудийный (1) количество	а. орудийный (2) ящик №	b. батарейный (1) количество	b. батарейный (2) ящик №	5. Специальный инструмент: а. количество	5. Специальный инструмент: b. ящик №	6. Применение инструмента. № деталей (сборок) по группам
08-48	Вентиль	Тормоз отката гр. 08 					1	V	
С612-10 / 52-Ц-012	Оправка с ампулой	Прицел гр. 12 			1	I			
А51042-2	Штифт конический 3×15	Подъемный механизм, гр 21 			4	II			
А51043-6	Штифт конический разводной 6×50	Поворотный механизм гр 22 			10	II			

*) Ведомость ориентировочная; номенклатура и количество устанавливается особыми указаниями командования.

[33]

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

A51042-2
Conical pin
Elev. mech. gr. 21

A51043-6
Conical pin, slotted
Trav. mech, gr. 22

*) Information only. Nomenclature and quantity established by special orders of the command.

24-27 [p 332]
Packing (in ammo tray)
Jack gr. 24

24-104
Bushing (in ammo tray)

24-108
Bushing (in ammo tray)

Bulb TN-1;26-28v,5-10w w/base 1 Sh-15-1
Electr. signal gr. 49

Sb41-4
Rod
Accessory
On Weapon

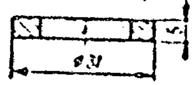
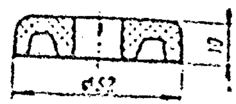
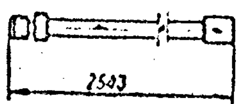
Sb41-5 [p 333]
Marker Pole
On weapon

Sb41-7
Guide disk
On weapon

Sb41-23
Firing lanyard
On weapon

Sb41-24
Extractor
In box on limber

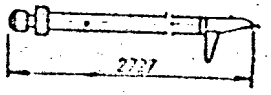
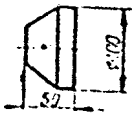
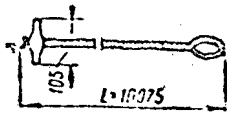
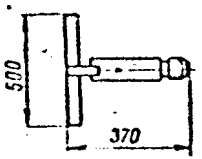
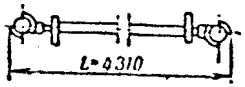
Sb41-32
Hose w/connectors
On limber

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты a. орудийный (1) количество	(2) ящик №	b. батарейный (1) количество	(2) ящик №	5. Специальный инструмент a. количество	b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
24-27	Сальник (в укупорке)	Домкрат гр2а 			4	1			
24-104	Воротник (в укупорке)				4	1			
24-108	Воротник (в укупорке)				4	1			
	Лампочка ТН-1; 26—28 в, 5—10 вт с цоколем 1Ш-15-1	Электросигнал гр40 			8	11			
С641-4	Штанга	Принадлежность 	2	На орудии					[332]

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты a. орудийный (1) количество	(2) ящик №	b. батарейный (1) количество	(2) ящик №	5. Специальный инструмент a. количество	b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
C641-5	Веха		1	На орудии					
C641-7	Шайба направляющая		2	На орудии					
C641-23	Шнур спусковой		1	На орудии					
C641-24	Экстрактор		1	В ящике на передке					
C641-32	Шланг с замками		1	На передке					[333]

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

50X1-HUM

[p 334]

Sb41-36
Rammer
On weapon

Sb41-37
Extender
On weapon

Sb41-39
Hand spike
On weapon

Sb41-45
Pick mattock
On weapon

Sb41-46
Mallet
On weapon

Sb41-48
Cord w/plug
On limber

[p 335]

41-85
Disk for placement of wheel on journal

41-116
Crowbar
On weapon

A72276-13
Oil can

A72926-26
Brush w/holder 140
On weapon
On M-46 only

A72926-30
Brush w/holder 160
On weapon
On M-47 only

[p 336]

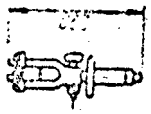
A72950-5
Drop oiler

50X1-HUM

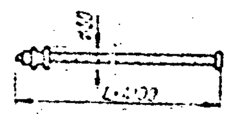
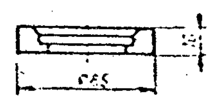
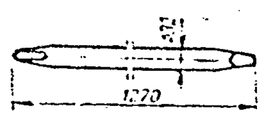
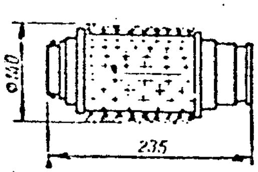
A72950-31
Car 2-liter

50X1-HUM

[334]

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты				5. Специальный инструмент		6. Применение инструмента (сборки) по группам
			а. орудийный		b. батарейный		a. кол-во	b. ящик №	
			(1) кол-во	(2) ящик №	(1) кол-во	(2) ящик №			
С641-36	Прибойник		1	На орудии					
С641-37	Удлинитель		1	На орудии					
С641-39	Гандшпуг		2	На орудии					
С641-45	Киркомотыга		2	На орудии					
С641-46	Кувалда		1	На орудии					

50X1-HUM

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты a. орудийный (1) количество	(2) ящик №	b. батарейный (1) количество	(2) ящик №	5. Специальный инструмент a. количество	b. ящик №	6. Применение инструмен[та] № деталей (сборок) по группам
C641-48	Провод со штепселем		1	На передке					
41-85	Шайба для постановки колеса на шип				2	1			
41-116	Лом		2	На орудии					
A72276-13	Ручная масленка				1	II	1	V	
A72926-26	Щетка с держателем 140		2	На орудии					Комплектуется толь[ко] орудие М-46

[335]

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: а. оружейный (1) кол-во	а. оружейный (2) ящик №	b. батарейный (1) кол-во	b. батарейный (2) ящик №	5. Специальный инструмент: а. кол-во	5. Специальный инструмент: b. ящик №	6. Применение инструмента (№ деталей сборок) со грунтами
A72926-30	Щетка с держателем 160		2	На орудии					Комплектуется только на орудие М-47
A72950-5	Масленка капельная				1	1	1	V	
A72950-31	Кружка на 2 л				1	II	1	II	
A72950-50	Воронка				1	II	1	I	

[336]

A72950-50
Funnel

A72950-51 [p 337]
Funnel

A72957-13
Can for liquids (8 kg)
No container

A72957-16
Can for viscous lubricants (1.5 kg)

Sb91-26
52-p-481
Shovel
On weapon

AMF-8 [p 338]
Lamp, storage battery

52-Yu-034
Lamp, artillery

42-1
Cap on recuperator rod
10-32 rod

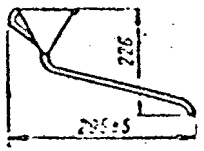
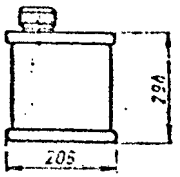
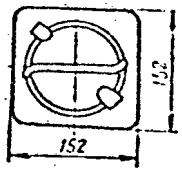
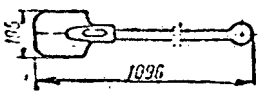
42-2
Funnel
10-75 stuffing box for 10-77. Packing

42-4 [p 339]
Yoke for removing equilibrator
23-6 sleeve

42-61
Template for checking firing pin
Sb02 breech

42-169
Funnel for assembly of buffer
08-2 grease box for 08-4. Packing

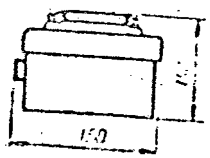
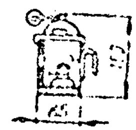
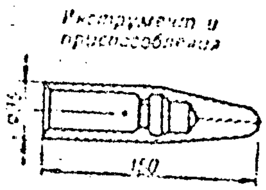
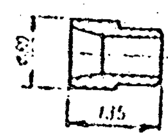
42-171
Funnel for assembly of equilibrator
23-74 packing

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты a. орудийный (1) количество	(2) ящик №	b. батарейный (1) количество	(2) ящик №	5. Специальный инструмент a. количество	b. ящик №	6. Применение инструмента № деталей (сборок) по группам
A72950-51	Воронка				1	I	1	II	
A72957-13	Жестянка для жидкости на 8 кг				1	Без укладки			
A72957-16	Жестянка для густых смазочных материалов на 1,5 кг		2	I			1	IV	
C691-26 / 52-n-481	Лопата саперная		4	На орудии					

337

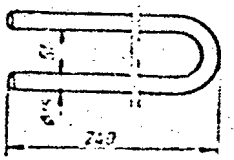
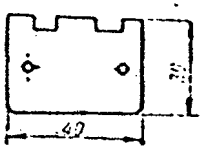
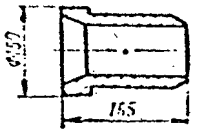
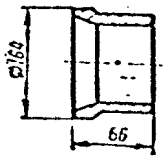
50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: a. орудийный (1) количество	4. a. орудийный (2) ящик №	4. b. батарейный (1) количество	4. b. батарейный (2) ящик №	5. Специальный инструмент: a. количество	5. b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
АМФ-8	Фонарь аккумуляторный				2	II			
52-Ю-034	Фонарь артиллерийский		1	1					
42-1	Колпак на шток накатника						1	II	10-32 шток
42-2	Воронка						1	V	10-75 корпус сальника для 10-77. Воротник

[338]

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: a. орудийный (1) количество	a. орудийный (2) ящик №	b. батарейный (1) количество	b. батарейный (2) ящик №	5. Специальный инструмент: a. количество	5. Специальный инструмент: b. ящик №	6. Применение инструмента (№ деталей (сборок) по группам
42-4	Скоба для снятия уравновешивающего механизма						2	II	23-6 втулка
42-61	Шаблон для проверки выхода бойка ударника				1	1	1	II	C002 затвор
42-169	Воронка для сборки тормоза отката						1	II	08-2 корпус сальн для 08-1. Воротник
42-171	Воронка для сборки уравновешивающего механизма						1	V	23-74 воротник

337

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

50X1-HUM

42-191
Funnel on buffer rod
Sb08-4 rod

[p 340]

42-228
Bolt for Sb46-17
Sb46-17 limber frame

42-233
Wrench
26-172 washer, 08-29 nut, 23-18 disk, 46-201 nut, 10-78 washer

42-250
Wrench 50-60
On weapon
17-53 nut, 17-43 bolt, 18-8 pin, 18-42 nut, 24-16 sleeve, 10-81 nut, 10-120 adjustment bolt

42-286
Half-funnel for 24-108
packing

42-300
Hook for extracting grease seals
08-25 grease box, 10-80 grease box

[p 341]

42-301
Wrench for 10-13
10-13 grease box nut

42-314
Cap
Sb46-1 limber axle

42-318
Cap
Sb18-10, Sb18-11 balancer studs

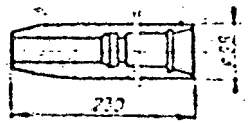
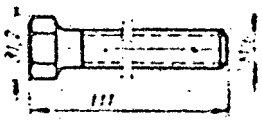
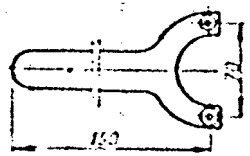
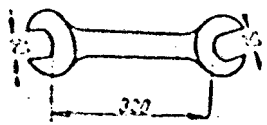
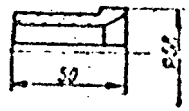
42-322
Wrench for A51970-147
Nut A51970-147 for air line retainers

42-324
Converter
Use specified in Service Manual

[p 342]

42-325
Wrench for 10-135
10-135 bolts for cap Sb10-20

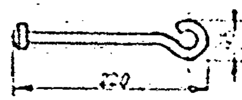
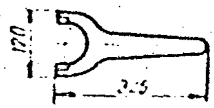
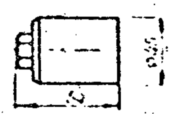
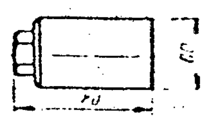
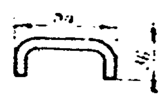
50X1-HUM

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты				5. Специальный инструмент		6. Применение инструмента, №№ деталей (сборок) по группам
			a. орудийный		b. батарейный				
			(1) количество	(2) ящик №	(1) количество	(2) ящик №	a. количество	b. ящик №	
42-191	Воронка на шток тормоза отката						1	I	С003-4 шток
42-228	Болт к С646-17						4	III	С646-17 рама передка
42-233	Ключ						1	II	25-172 кольцо подворотниковое, 08-29 гайка, 25-15 шайба, 45-201 гайка, 19-78 кольцо подворотниковое
42-250	Ключ 50—60		1	На орудии					17-53 гайка нажимная, 17-43 болт, 18-8 шпилька, 18-42 матка стяжки, 24-13 втулка, 19-81 гайка сальника, 19-120 болт регулировочный
42-286	Полуворонка к детали 24-108						2	III	24-108 воротник

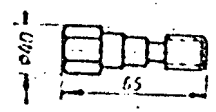
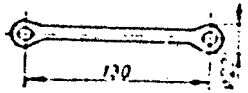
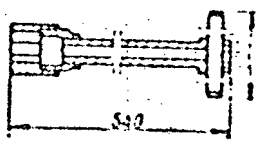
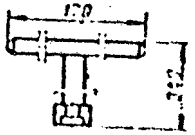
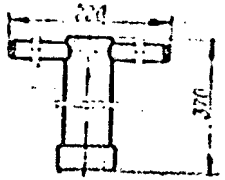
50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

1. № деталь (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: a. орудийный (1) количество	4. a. орудийный (2) ящик №	4. b. батарейный (1) количество	4. b. батарейный (2) ящик №	5. Специальный инструмент: a. количество	5. b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
42-300	Крючок для вынимания сальников						1	II	08-25 сальник, 10-… сальник
42-301	Ключ к детали 10-13						1	III	10-13 гайка сальника
42-314	Колпак				2	II			С646-1 ось передка
42-318	Колпак				1	II	1	V	С618-10, С618-11 шипы балансиров
42-322	Ключ к детали А51970-147				1	II	1	V	Гайка А51970-147 к замкам воздухопровода

[341]

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: a. оружейный – (1) количество	(2) ящик №	b. батарейный (1) количество	(2) ящик №	5. Специальный инструмент: a. количество	b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
42-321	Переводник						1	III	Применение указано в Руководстве службы
42-325	Ключ к детали 10-135				1	II			10-135 болты для крепления колпака С610-20
С642-5	Ключ к деталям 15-11; 21-83						1	II	15-11 гайка, 21-83 крышка
С642-7	Ключ к детали 17-63						1	III	17-63 гайка
С642-8	Прибор к детали 25-11						1	III	25-11 гайка

[342]

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

50X1-HUM

Sb42-5
Wrench for 18-11, 21-83
18-11 nut, 21-83 cover

Sb42-7
Wrench for 17-63
17-63 nut

Sb42-8
Tool for 25-11
25-11 nut

Sb42-9 [p 343]
Tool for 18-32
M24-3.3kg
18-32 torsion bar

Sb42-25
Manometric filler
Manometer
Use specified in Service Manual

Sb42-34
Roller
Use specified in Service Manual

Sb42-39 [p 344]
Wrench for 01-29
On Weapon
01-29 thrust lock

Sb42-44
Wrench
A51011-8 (gr. 17) nut M24 Shk on cap square

Sb42-45
Tool for buffer disassembly
Use specified in Service Manual

Sb42-48
Tool for recuperator disassembly
Use specified in Service Manual

Sb42-49 [p 345]
Wrench 14
08-47 screw, 08-48 valve, 08-72 screw, 10-27 screw, 10-110 plug, 10-57 valve, 17-49 plug 10-58 plug, 09-116 plug, 25-19 plug.

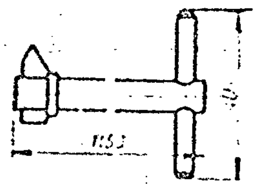
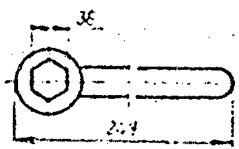
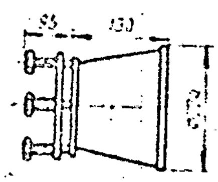
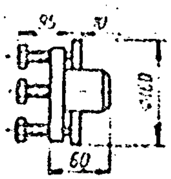
50X1-HUM

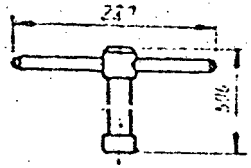
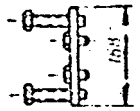
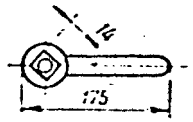
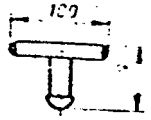
Sb42-50
Tool for extracting 18-101
18-10[illegible] forward bushing

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: а. орудийный (1) Кол. (2) ящик №	4. Войсковые комплекты: б. батарейный (1) Кол. (2) ящик №	5. Специальный инструмент: а. кол.	5. Специальный инструмент: б. ящик №	6. Применение инструмента, № деталей (сборок) по группам
С642-9	Прибор к детали 18-32			1 — 1			18-32 торсион
С642-25	Прибор для наполнения с манометром			1 — 1		III	Применение указано в Руководстве службы
С642-34	Ролик				2	IV	Применение указано в Руководстве службы [343]

50X1-HUM

50X1-HUM

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: a. орудийный (1) количество	(2) ящик №	b. батарейный (1) количество	(2) ящик №	5. Специальный инструмент: a. количество	b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
C642-39	Ключ к детали 01-29		1	На орудии					01-29 сухарный замок
C642-44	Ключ						1	III	А51911-5 (гр. 17) гайка М24 ШК к намётке
C642-45	Прибор для разборки тормоза отката						1	II	Применение указано в Руководстве службы
C642-48	Прибор для разборки накатника						1	V	Применение указано Руководстве службы [344]

1. № детали (сборка)	2. Наименование	3. Эскиз	4. Войсковые комплекты				5. Специальный инструмент		6. Применение инструмента, № деталей (сборок) по группам
			а, оружейный		б, батарейный				
			(1) количество	(2) ящик №	(1) количество	(2) ящик №	а. количество	б. ящик №	
C642-49	Ключ *H*				1	I	1	III	*08-47* винт, *08-48* вентиль, *08-72* винт, *10-27* винт, *10-110* пробка, *10-57* вентиль, *17-49* пробка, *10-58* пробка, *09-116* пробка, *25-19* пробка
C642-50	Прибор для вынимания детали *18-101*				-		1	III	*18-101* передняя втулка
C642-52	Ключ				1	I	1	II	*23-23* пробка, *42-211* болт, *08-47* винт, *10-27* винт
C642-53	Ключ к детали *02-30*		1	В ящике на передке					*02-30* крышка ударника

[345]

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Sb42-52
Wrench
23-23 plug, 42-211 bolt, 08-47 screw, 10-27 screw

Sb42-53
Wrench for 02-30
In box on limber
02-30 striker spindle cover

Sb42-55 [p 346]
Tool for recuperator disassembly
Use specified in Service Manual

Sb42-60
Wrench for 10-100 and 46-209
10-100 nut, 46-209 flanged screw

Sb42-61
Wrench for 08-27
08-27 nut

Sb42-62
Tool for pushing in rod with piston
10-4 operating cylinder

Sb42-66 [p 347]
Fuse cap wrench
In box on limber

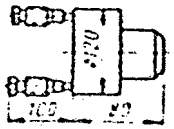
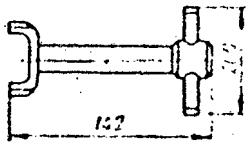
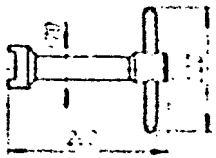
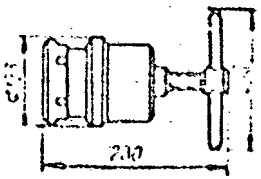
Sb42-67
Stub pipe for tank

Sb42-68
Wrench for 18-11 and 46-90
18-11 nut, 46-90 nut, 46-114 nut

Sb42-69
Wrench for 21-2
21-2 adjusting bushing

Sb42-70
Tool for pulling carriage wheel
Sb25 wheel

A51331-2 [p 348]
Lug
08-69 disk, 10-45 disk

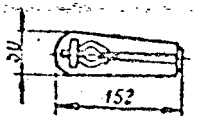
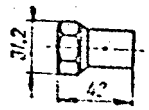
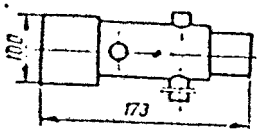
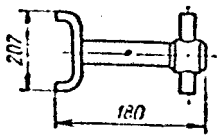
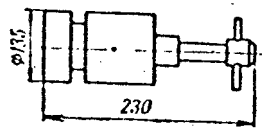
1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты a. оружейный (1) количество	(2) ящик №	b. авторемонтный (1) количество	(2) ящик №	5. Специальный инструмент a. количество	b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
C642-55	Прибор для разборки накатника						1	I	Применение указано Руководстве службы
C642-60	Ключ к детали 19-100 и 46-209						1	III	19-100 гайка, 46-209 винт с фланцем
C642-61	Ключ к детали 08-27						1	III	08-27 гайка
C642-62	Прибор для выталкивания штока с поршнем						1	I	10-4 цилиндр рабочий

[346]

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

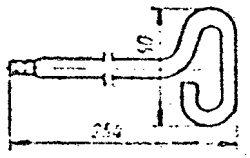
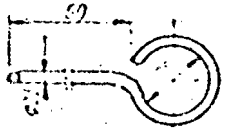
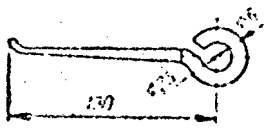
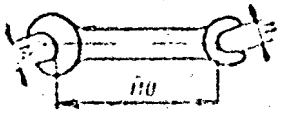
1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты				5. Специальный инструмент		6. Применение инструмента, № деталей (сборок) по группам
			a. оружейный		b. батарейный				
			(1) количество	(2) ящик №	(1) количество	(2) ящик №	a. количество	b. ящик №	
C642-66	Ключ для свинчивания колпачков взрывателей		2	В ящике на передке					
C642-67	Штуцер к баллону				1	1			
C642-68	Ключ к детали *18-11* и *46-90*				1	1			*18-11* гайка, *46-90* гайка, *46-114* гайка
C642-69	Ключ к детали *21-2*				1	1			*21-2* втулка регулировочная
C642-70	Прибор для снятия колеса лафета				1	1			*C625* колесо

[547]

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты a. орудийный (1) количество	(2) ящик №	b. батарейный (1) количество	(2) ящик №	5. Специальный инструмент a. количество	b. ящик №	6. Применение инструмента. № деталей (сборок) по группам
A51331-2	Рым						1	I	03-69 шайба, 10-45 шайба
A52435-12	Шпилька						1	V	К прицелу С71
A52435-21	Крючок		1	В ящике на передке					С612-5 ударный механизм, 10-54 кольцо кожаное, 10-105 кольцо (уплотнения вентилей в С610 и С623)
A52830-2	Ключ 11—14				1	II	1	II	

[548]

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

A52435-12
Stud
For sight S71

A52435-21
Hook
In box on limber
Sb02-5 striker mechanism, 10-54 leather washer, 10-106 valve packing in Sb10 + Sb26.

A52830-2
Wrench 11-14

A52830-4 [p 349]
Wrench 17-19

A52830-5
Wrench 22-27

A52830-6
Wrench 32-36

A52830-7
Wrench 41-46

A52830-8
Wrench 50-55
09-37 bolt, 10-81 grease seal nut, 10-120 adj. bolt, 18-8 stud, 46-59 nut

A52830-79 [p 350]
Wrench 90
21-18 lock nut

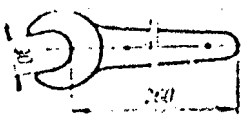
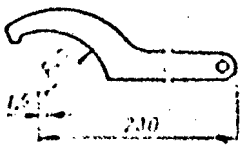
A52832-19
Wrench 45-52
A51970-8 (gr. 21, 22), 23-21 nut, A51970-9 (gr. 20)

A52832-21
Wrench 68-72
08-27 nut, Sb08-8 nut, 10-109 nut

A528-32-22
Wrench 78-85
08-42 nut, 21-84 nut

A52832-24
Wrench 100-110
25-8 cap, 08-31 nut, 20-17 nut, 21-9 nut, 10-114 cover, 10-87 washer

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: а. оружейный (1) количество	(2) ящик №	б. батарейный (1) количество	(2) ящик №	5. Специальный инструмент: а. количество	б. ящик №	6. Применение инструмента, № деталей (сборок) по группам
А52830-4	Ключ 17—19				1	II			
А52830-5	Ключ 22—27				1	II	1	II	
А52830-6	Ключ 32—36				1	II	1	III	
А52830-7	Ключ 41—46						1	I	[349]
А52830-8	Ключ 50—55						1	I	09-37 болт, 10-81 гайка сальника, 10-120 болт регулировочный, 18-8 шпилька, 46-59 гайка

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: а. орудийный (1) количество	а. орудийный (2) ящик №	b. батарейный (1) количество	b. батарейный (2) ящик №	5. Специальный инструмент: а. количество	5. Специальный инструмент: b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
A52830-79	Ключ 90						1	III	21-13 гайка стопорная
A52832-19	Ключ 45—52						1	II	A51870-8 (гр. 21, 22 23-21 гайка, A52870-9 (г 20)
A52832-21	Ключ 68—72						1	II	08-27 гайка, C606-8 га ка, 10-109 гайка
A52832-22	Ключ 78—85						1	II	08-42 гайка, 21-84 г ка [350]
A52832-24	Ключ 100—110						1	II	25-8 колпак, 08-81 г ка, 20-17 гайка, 21-9 г ка, 10-114 крышка, 1 кольцо подшипников

50X1-HUM

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

A52832-26 50X1-HUM [p 351]
Wrench 135-145
08-32 cap nut, 08-7 bushing

A52832-160
Wrench 165-170
08-11 nut, 23-6 bushing

A52840-10
Torque wrench 11x14
For S71 sight and bolts of cap 46-91

A52840-15
Torque wrench
For S71 sight

A52340-23 [p 352]
Wrench
For S71 sight Sb26-36, Sb26-37 (buffer cylinders)

A52840-39
Torque wrench for primer cup

A52840-43
Socket wrench 22
A51000-35 bolt for Sb22-1

A52844-3
Wrench 10.5x200, turning
For S71 sight

A52844-15
Wrench 12.5x175, turning
A52840-43 wrench

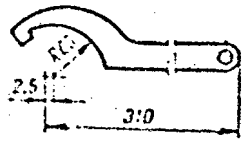
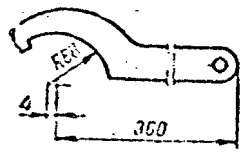
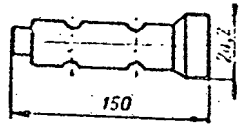
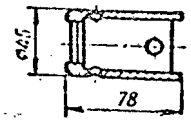
A72277-1 [p 353]
Squirt

A72277-6
Grease gun with hose $\frac{\text{Sb91-24}}{\text{52-p-481}}$

A72577-14
Level UK in case A72906-2

A72930-10
Torque wrench
For S71 sight

50X1-HUM

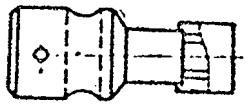
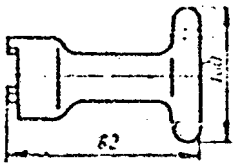
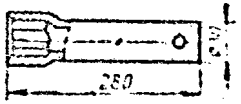
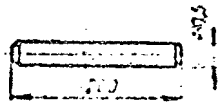
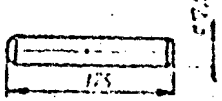
1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: a. организаций (1) количество	a. организаций (2) ящик №	b. батарейный (1) количество	b. батарейный (2) ящик №	5. Специальный инструмент: a. количество	5. Специальный инструмент: b. ящик №	6. Применение инструмент № деталей (сборок) по группам
A52832-26	Ключ 135—145						I	II	08-32 контргайка, 0 втулка
A52832-160	Ключ 165—170						I	I	08-11 гайка, 23-6 втул
A52840-10	Ключ торцовый 11×11						I	V	К прицелу С71 и бол там колпачка 46-91
A52840-15	Ключ торцовый						I	V	К прицелу С71

[351]

50X1-HUM

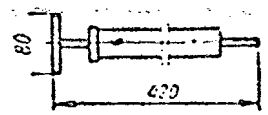
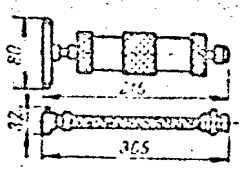
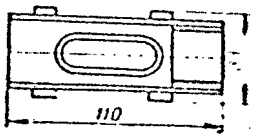
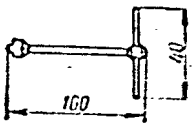
50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты a. орудийный (1) количество	(2) ящик №	b. батарейный (1) количество	(2) ящик №	5. Специальный инструмент a. количество	b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
A52840-23	Ключ						1	V	К прицелу С71 *С626-35* *С626-37* (тормозные цилиндры)
A52840-39	Ключ торцовый для капсюльных втулок				1	II			
A52840-43	Ключ торцовый 22						1	III	*A51000-35* болт к *С622-1*
A52844-3	Вороток 10,5×200						1	I	К прицелу С71
A52844-15	Вороток 12,5×175						1	III	*A52840-43* ключ [352]

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты a. орудийный (1) количество	(2) ящик №	b. батарейный (1) количество	(2) ящик №	5. Специальный инструмент a. количество	b. ящик №	6. Применение инструмента № деталей (сборок) по группам
A72277-1	Шприц				1	1	1	1	
A72277-6	Тавотонабиватель со шлангом $\frac{C691-24}{52-п-451}$				1	1	1	III	
A72577-14	Уровень контрольный УК в пенале A72906-2				1	1	1	III	
A72930-10	Ключ торцовый						1	V	К прицелу С71 [353]

 [p 354]

A72930-45
Fuse wrench
In box on limber

A72930-46
RGM-2-fuse setting wrench
In box on limber

A72931-10
Wrench 40
26-144 nut, 24-109 washer, 10-96 piston

A72931-12
Wrench 48
18-20 nut, 10-101 housing

[p 355]

A72936-1
Screwdriver
For S71 sight

A72936-3
Punch
Tool roll

Screwdriver A200 x 1.0. GOST 5423-54
Tool roll
Tool roll

Screwdriver G125 x 0.5. GOST 5423-54
In box on limber

Adjustable wrench 11-36. GOST 7275-54
Tool roll

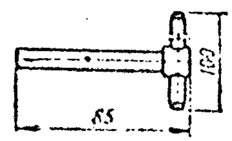
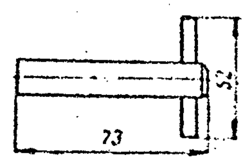
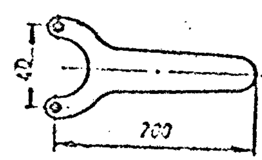
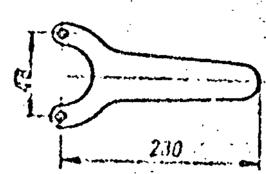
[p 356]

Adjustable Wrench 11-46. GOST 7275-54
Tool roll

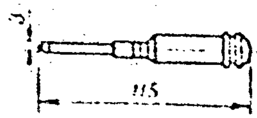
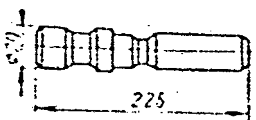
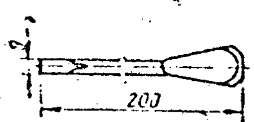
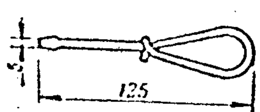
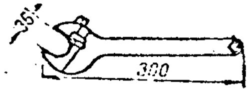
Manometer, type MSA, dia.100 x 120, in box
Use specified in Service Manual

OK 51-B-201
Clinometer in case. GOST 3299-46

52-I-035
Air-hydraulic pump w/spare parts and accessories in case 52-Ya-035
Special case
Special case
Use specified in Service Manual

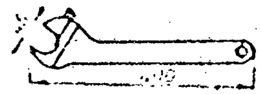
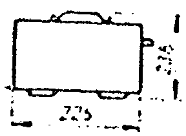
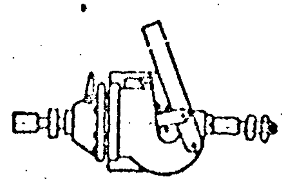
1. № детали (сборки).	2. Наименование.	3. Эскиз	4. Войсковые комплекты				5. Специальный инструмент		6. Применение инструмента № деталей (сборок) по группам
			a. оружейный		b. батарейный				
			(1) количество	(2) ящик №	(1) количество	(2) ящик №	a. количество	b. ящик №	
A72930-15	Ключ к взрывателю		1	В ящике на передке					
A72930-16	Установочный ключ для взрывателя РГМ-2		1	В ящике на передке					
A72931-10	Ключ боковой 40						1	II	25-144 гайка, 24-[illegible] кольцо подворотниково[illegible] 10-95 поршень
A72931-12	Ключ боковой 48						1	II	18-20 гайка, 10-101 ко[illegible] пус [354]

No

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты				5. Специальный инструмент		6. Применение инструмента № деталей (сборок) по группам
			a. орудийный		b. батарейный				
			(1) количество	(2) ящик №	(1) количество	(2) ящик №	a. количество	b. ящик №	
[illegible]-1	Отвертка				1	II			К прицелу С71
А72936-3	Выколотка 20×225				1	1 сверток			
	Отвертка А 200×1,0 ГОСТ 5423—54				1	1 сверток	1	III сверток	
	Отвертка Г 125×0,5 ГОСТ 5423—54		1	В ящике на передке					
	Ключ разводной II-36 ГОСТ 7275—54				1	1 сверток			[355]

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: a. оружейный (1) количество	4. a. оружейный (2) ящик №	4. b. батарейный (1) количество	4. b. батарейный (2) ящик №	5. Специальный инструмент: a. количество	5. b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
	Ключ разводной II-46 ГОСТ 7275—54				1	1 сверток			
	Манометр типа МСА С 100×120 в ящике				1	1	1	V	Применение указано в Руководстве службы
ОК 51-Е-201	Квадрант в ящике ГОСТ 3299-46				1	I	1	III	
52-Н-035	Воздушно-гидравлический насос с ЗИП в ящике 52-Я-035				1	Специальный ящик	1	Специальный ящик	Применение указано в Руководстве службы

[356]

50X1-HUM

No

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

50X1-HUM [p 357]

12-ton automobile-type hydraulic jack
Use specified in Service Manual

205-3919535-B
MAZ
Jack handle

42-326
Wrench for valve plug

220-8604028
MAZ
Valve spring

205-3901563-A
MAZ
Washer

205-3901637-B
MAZ
Gland [p 358]

205-3901646-A
MAZ
Gland

Sb45-1V
Cover on muzzle brake
On weapon
Supplied w/M-46 only

Sb45-3
Cover on stirrup
On weapon

Sb45-6
Cover for rod on carriage
On weapon [p 359]

Sb45-7
Cover for recuperator rod
On weapon

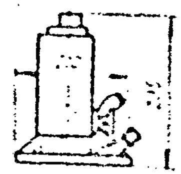
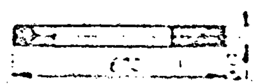
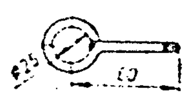
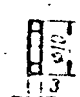
Sb45-8
Cover for buffer rod
On weapon

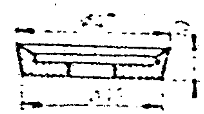
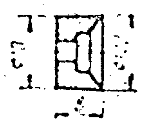
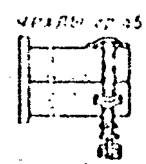
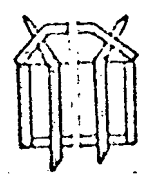
Sb45-9
Roll (cover) for tools for metal work [p 360]

Sb45-10
Cover for S71 sight
On weapon

50X1-HUM

Sb45-11

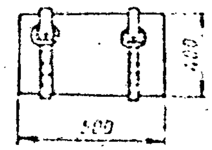
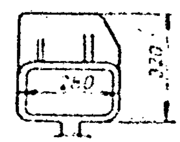
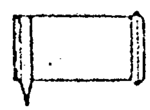
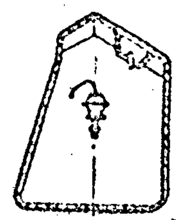
1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: a. орудийный (1) количество	4. a. орудийный (2) ящик №	4. b. батарейный (1) количество	4. b. батарейный (2) ящик №	5. Специальный инструмент: a. количество	5. b. ящик №	6. Применение инструмента № деталей (сборок) по группам
	Домкрат гидравлический автомобильного типа 12-тонный				1	II	1	I	Применение указа[но в] Руководстве служб[ы]
22[illegible]-5 / МАЗ	Рукоятка для качания				1	II	1	I	
42-326	Ключ для пробки клапана				1	II	1	I	
220-8604028 / МАЗ	Пружина клапана				1	II	1	I	
206-3301563-А / МАЗ	Сальник				2	II	2	I	[357]

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: a. орудийный (1) количество	4. a. орудийный (2) ящик №	4. b. батарейный (1) количество	4. b. батарейный (2) ящик №	5. Специальный инструмент: a. количество	5. b. ящик №	6. Применение инструмента, № деталей (сборок) по группам
205-3501037-Б / МАЗ	Манжета				I	II	I	I	
205-3501345-А / МАЗ	Манжета				I	II	I	I	
С645-IВ	Чехол на дульный тормоз		1	На орудии					Комплектуется только орудие М-46
С645-3	Чехол на бугель		1	На орудии					

[358]

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Вобсовые комплекты				5. Специальный инструмент		6. Приспособление инструмента. № деталей (сборок) по группам
			a. оруд.		b. батарейный		a. количество	b. шифр №	
			(1) количество	(2) шифр №	(1) количество	(2) шифр №			
С645-6	Чехол на тягу нижнего станка		2	На орудии					
С645-7	Чехол на шток накатника		1	На орудии					
С645-8	Чехол на шток тормоза отката		1	На орудии					

[359]

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Войсковые комплекты: a. орудийный (1) количество	(2) ящик №	b. батарейный (1) количество	(2) №	5. Специальный инструмент a. количество	b. №	6. Применение инструмента, № деталей (сборок) по группам
C645-9	Сверток под слесарный инструмент				1	1	1	III	
C645-10	Чехол на прицел С71		1	На орудии		—	—		—
C645-11	Чехол на прицел ОП-4		1	На орудии					
C645-12	Чехол на казенник с крышкой C645-21		1	На орудии					[360]

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

Sb45-12
Cap for breech ring w/cover Sb45-21
On weapon

Sb45-13 [p 361]
Gun cover
On weapon

Sb45-14V
Cover for muzzle brake
On weapon
Supplied w/M-47 only

Sb45-18
Cover for firing panel
On weapon

Sb45-19
Cover for winch rod
On weapon

Sb43-1 [p 362]
Case No. 1, weapon complement

Sb43-4
Case No. 1, battery complement

Sb43-8
Case No. 2, battery complement

Sb43-15
Case No. 1, special tools

Sb43-19
Case No. 2, special tools

Sb43-22
Case No. 3, special tools

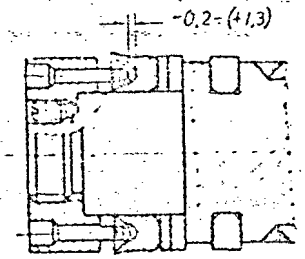
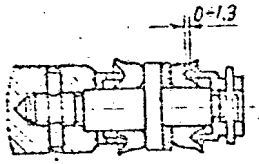
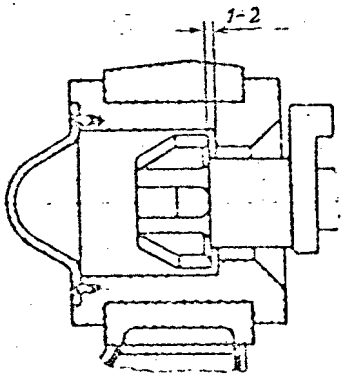
Sb43-26
Case No. 4, special tools

Sb43-28
Case No. 5, special tools

1. № детали (сборки)	2. Наименование	3. Эскиз	4. Ремонтные комплекты a. орудийный (1) количество	(2) ящик №	b. батарейный (1) количество	(2) ящик №	5. Специальный инструмент a. количество	b. ящик №	6. Применяемые инструменты, № деталей (сборок) по прусскам
C645-13	Чехол общего покрытия		1	На орудии					
C645-14B	Чехол на дульный тормоз		1	На орудии					Комплектуется только орудие №47
C645-18	Чехол на щиток спуска		1	На орудии					
C645-19	Чехол на штангу лебедки		1	На орудии					[361]

1. № детали чеберки	2. Наименование	3. Эскиз	4. Войсковые комплекты a. орудийный (1) количество	4. a. орудийный (2) ящик №	4. b. батарейный (1) количество	4. b. батарейный (2) ящик №	5. Специальный инструмент a. количество	5. b. ящик №	6. Применение инструмента. № деталей набора к орудиям
C643-1	Ящик № 1 орудийный комплект				1				
C643-4	Ящик № 1 батарейный комплект				1			—	
C643-5	Ящик № 2 батарейный комплект								
C643-15	Ящик № 1 специальный инструмент						1		
C643-19	Ящик № 2 специальный инструмент						1		
C643-22	Ящик № 3 специальный инструмент						1		
C643-26	Ящик № 4 специальный инструмент						1		
C643-28	Ящик № 5 специальный инструмент						1		[362]

APPENDIX 5. BASIC TOLERANCES ADJUSTABLE DURING ASSEMBLY AND USE OF M-46 and M-47

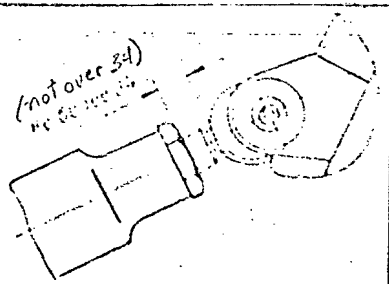
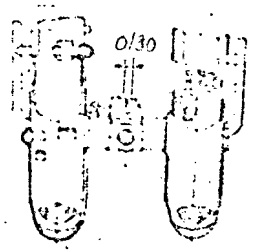
Tolerance Nomenclature	Tolerance in mm	Cutaway Drawing	Method of Adjustment, or Service Manual Reference
space between collar and washer of leveling-jack piston rod	-0.2 -+1.3		If collar becomes distorted, leading to crimping of edge and leakage, replace leather washer with a thinner one. [363]
space between collar and washer of leveling-jack plunger	0 - 1.3		same
space between bearing faces of connecting nut of the recuperator and bushing of cutoff-gear actuating collar	1 - 2		Recuperator adjusting bolt installed with barrel in extreme forward position, drawn forward by winch (15-30 kg applied to lever), which insures 1-2-mm tolerance between bearing faces. (See 60, "Adjusting Connection of Recuperator Rod With Cutoff-Gear Actuating Collar" [364]

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

space between bearing surfaces of top and bottom carriages, measured from front at angle of depression; spaces between bearing surfaces of carriages, measured from behind, and between projection on bottom carriage and detent of forward catch, at 45° elev.	not less than 0.05		adjusted by compressing or extending springs of rollers and pintle (see "Adjustment of Traversing Mechanism")
total clearances a for ball bearings of elevation mechanism worm-gear shaft	not over 0.15		Back off nut 53 until worm shaft jams; then tighten 1/12 turn (see "Adjustment of Elevating Mechanism").
clearance b between faces of brake disk and elevating mechanism worm-shaft nut	not more than 0.3		Back off nut 52 until worm shaft locks; then tighten 1/6 turn (see "Adjustment of Elevating Mechanism").
roller bearing clearances on carriage and limber wheels	not more than 0.3		Tighten wheel retaining nut all the way; then back it off 1/6 turn.
protrusion of threaded part of screw 47 of the coupling	not over 55		Adjusted to ensure entry of suspension-release pin into rocker-arm socket; with increased screw protrusion, torsion bar moved to next slot (see "Adjustment of Suspension Mechanism").

No Fo

interval between holes on levers 82 and 98 (See Fig 22)	140		Check and adjust at 40-45° barrel elevation (see "Adjustment of Recoil Limiter Mechanism").
protrusion of threaded part of winch-rod loop	not over 34		Adjusted for chain tension; if no thread showing, remove one chain link (see "Adjustment of Winch-Bar Chain").
runout of rods on brake cylinders	15-35 (for non-adjustable lever) 20-25 (for adjustable)		Non-adjustable-lever runout provided by setting lever to next slot in shaft; adjustable-lever runout by turning stem "M" on lever 38 (Fig 73,d) [367]
clearance between drawbar lugs with trail arms not coupled, and with trail arms in traveling position (under pull)	0 - 30		If clearance large, trip supports or rests v (Fig 63); if no R25 on rest v, insert it; trim beads on support surfaces v of levers 37 and 25 (Fig 58).

50X1-HUM

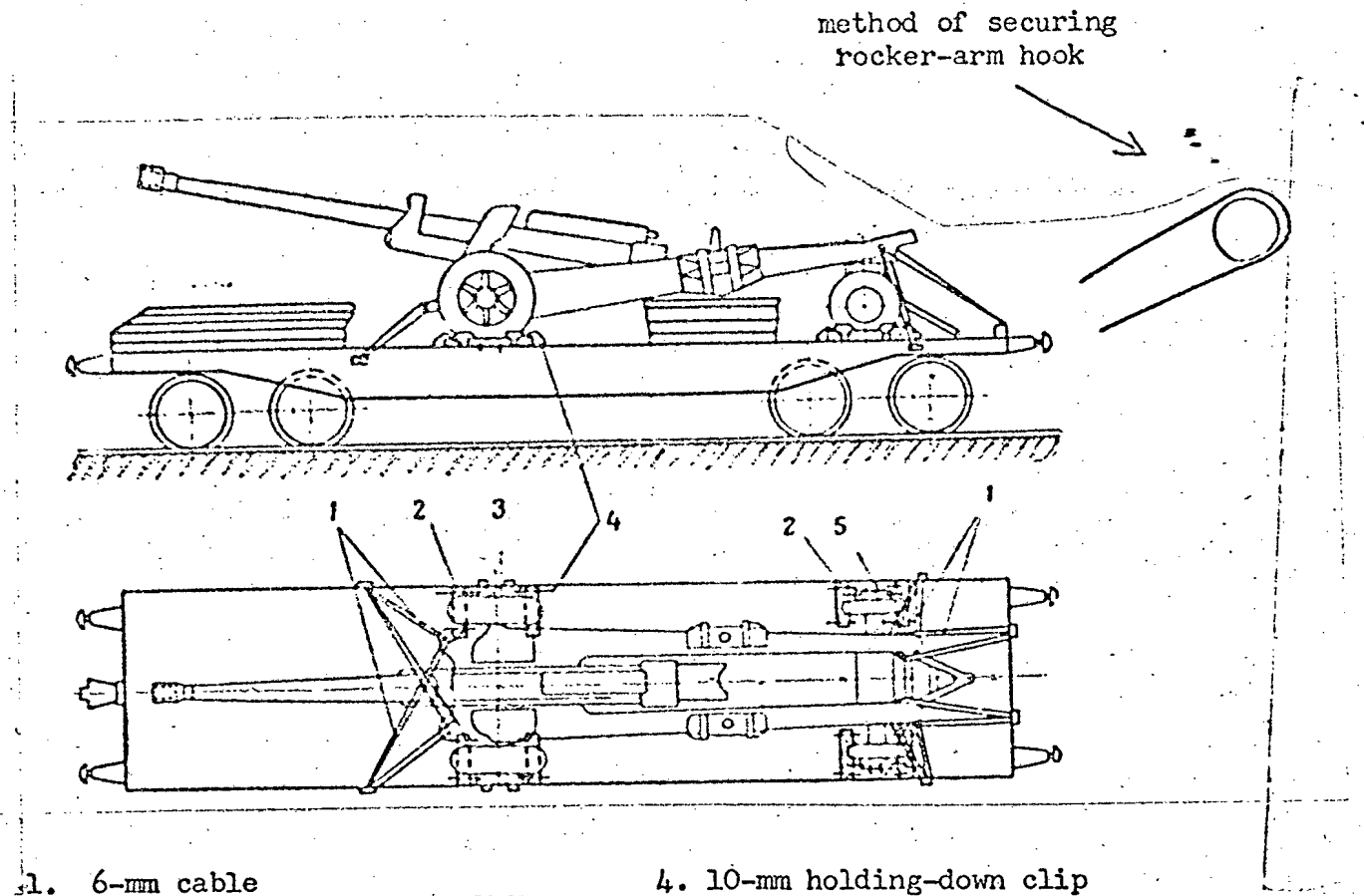
Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7

[273]

projection of retainer 42 from opening of plunger 5 with recuperator-to-firing mechanism coupler in "fire" position	not over 0.5		Set adjusting nut 46 so that, in fire position, plunger 5 will move freely; with holder 33 protruding from opening in gib 20 and raised up about 0.5, movement of plunger 5 should be impossible (see "Assembly of Recuperator-to-Firing Mechanism Coupler")
clearance between gasket 39 (Fig 28) and viewing glass of inspection eyepiece of recuperator	0.5 - 1.5		Provided during assembly of inspection eyepiece by choice of gaskets 42

No Fo

Fig. 149. Method of Securing the Weapon On a Flatcar



1. 6-mm cable
2. block 200 x 200 x 750 [mm]
3. block 100 x 100 x 750 [mm]
4. 10-mm holding-down clip
5. beam 200 x 200 x 500 [mm]

50X1-HUM

Declassified in Part - Sanitized Copy Approved for Release 2013/09/24 : CIA-RDP80T00246A031200160001-7